Aircraft Engine Particulate Matter Emission Standards

Response to Comments

United States Environmental Protection Agency

Aircraft Engine Particulate Matter Emission Standards

Response to Comments

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

EPA United States Environmental Protection Agency

EPA-420-R-22-033
November 2022

Table of Contents

Table of Commenters and Docket Documents

Aircraft Engine Particulate Matter Emission Standards: EPA-HQ-OAR-2019-0660

Organization	Organization Type	Commenter(s)	Comment Document(s)
Aerospace Industries Association (AIA)	Aircraft/Aircraft Engine Manufacturers or Designers	Mark Sudol	EPA-HQ-OAR-2019-0660-0178.html EPA-HQ-OAR-2019-0660-0150.html EPA-HQ-OAR-2019-0660-0150-A1.docx EPA-HQ-OAR-2019-0660-0178-A1.pdf
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)	Commercial Airlines and Airline Associations	Tim A. Pohle and Capt. Frank Pizzonia	EPA-HQ-OAR-2019-0660-0192-A1.pdf EPA-HQ-OAR-2019-0660-0192.html
Airport Impact Relief, Inc. (AIR, Inc.)	Environmental Non-governmental Organizations	Gail Miller	EPA-HQ-OAR-2019-0660-0175-A1.pdf EPA-HQ-OAR-2019-0660-0175.html
Anderson, Gillian	Private Citizens	Gillian Anderson	EPA-HQ-OAR-2019-0660-0197.html
Anonymous Public Comment - 1	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0132.html
Anonymous Public Comment - 10	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0163.html
Anonymous Public Comment - 11	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0166.html
Anonymous Public Comment - 12	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0167.html
Anonymous Public Comment - 13	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0179.html
Anonymous Public Comment - 14	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0186.html
Anonymous Public Comment - 15	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0187.html

Anonymous Public Comment - 2	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0133.html
Anonymous Public Comment - 3	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0137.html
Anonymous Public Comment - 4	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0138.html
Anonymous Public Comment - 5	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0140.html
Anonymous Public Comment - 6	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0141.html
Anonymous Public Comment - 7	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0142.html
Anonymous Public Comment - 8	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0156.html
Anonymous Public Comment - 9	Private Citizens	N/A	EPA-HQ-OAR-2019-0660-0162.html
Aviation-Impacted Communities Alliance (AICA)	Environmental Non-governmental Organizations	Darlene Yaplee and Cindy Christiansen	EPA-HQ-OAR-2019-0660-0159-A1.pdf EPA-HQ-OAR-2019-0660-0159.html EPA-HQ-OAR-2019-0660-0201.html
B, Nick	Private Citizens	Nick B	EPA-HQ-OAR-2019-0660-0146.html
Barnes, Miki	Private Citizens	Miki Barnes	EPA-HQ-OAR-2019-0660-0200.html
Baseman, Debra	Private Citizens	Debra Baseman, MD	EPA-HQ-OAR-2019-0660-0152-A1.pdf EPA-HQ-OAR-2019-0660-0152.html
Batra, Neelesh	Private Citizens	Neelesh Batra	EPA-HQ-OAR-2019-0660-0198.html
Beacon Hill Council of Seattle (BHC)	State and Local Governments and Organizations	Maria Batayola	EPA-HQ-OAR-2019-0660-0176.html

			EPA-HQ-OAR-2019-0660-0176-A1.docx
Bettenccourt, Jacob	Private Citizens	Jacob Bettenccourt	EPA-HQ-OAR-2019-0660-0188.html
Boeing Company (Boeing)	Aircraft/Aircraft Engine Manufacturers or Designers	Mildred Troegeler	EPA-HQ-OAR-2019-0660-0180-A1.pdf EPA-HQ-OAR-2019-0660-0180.html
BOS Fair Skies	Environmental Non-governmental Organizations	CL Christiansen	EPA-HQ-OAR-2019-0660-0199.html
Bucko, Jacob	Private Citizens	Jacob Bucko	EPA-HQ-OAR-2019-0660-0145.html
California Air Resources Board (CARB)	State and Local Governments and Organizations	Heather Arias	EPA-HQ-OAR-2019-0660-0206.html EPA-HQ-OAR-2019-0660-0206-A1.pdf
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin	State and Local Governments and Organizations	Rob Bonta et al.	EPA-HQ-OAR-2019-0660-0203-A3.pdf EPA-HQ-OAR-2019-0660-0203-A1.pdf EPA-HQ-OAR-2019-0660-0203-A6.pdf EPA-HQ-OAR-2019-0660-0203-A2.pdf EPA-HQ-OAR-2019-0660-0203-A7.pdf EPA-HQ-OAR-2019-0660-0203.html EPA-HQ-OAR-2019-0660-0203-A12.pdf EPA-HQ-OAR-2019-0660-0203-A15.pdf EPA-HQ-OAR-2019-0660-0203-A14.pdf EPA-HQ-OAR-2019-0660-0203-A8.pdf EPA-HQ-OAR-2019-0660-0203-A11.pdf EPA-HQ-OAR-2019-0660-

			0203-A13.pdf EPA-HQ-OAR-2019-0660-0203-A4.pdf EPA-HQ-OAR-2019-0660-0203-A9.pdf EPA-HQ-OAR-2019-0660-0203-A5.pdf EPA-HQ-OAR-2019-0660-0203-A10.pdf
Center for Biological Diversity and Friends of the Earth	Environmental Non-governmental Organizations	Kylah Staley, Liz Jones and Hallie Templeton	EPA-HQ-OAR-2019-0660-0189-A7.pdf EPA-HQ-OAR-2019-0660-0190-A2.pdf EPA-HQ-OAR-2019-0660-0189-A19.pdf EPA-HQ-OAR-2019-0660-0190-A14.pdf EPA-HQ-OAR-2019-0660-0190-A4.pdf EPA-HQ-OAR-2019-0660-0190-A17.pdf EPA-HQ-OAR-2019-0660-0189-A12.pdf EPA-HQ-OAR-2019-0660-0190-A11.pdf EPA-HQ-OAR-2019-0660-0190-A6.pdf EPA-HQ-OAR-2019-0660-0189-A13.pdf EPA-HQ-OAR-2019-0660-0190-A13.pdf EPA-HQ-OAR-2019-0660-0189.html EPA-HQ-OAR-2019-0660-0190-A15.pdf EPA-HQ-OAR-2019-0660-0189-A9.pdf EPA-HQ-OAR-2019-0660-0190-A16.pdf EPA-HQ-OAR-2019-0660-0189-A16.pdf EPA-HQ-OAR-2019-0660-0190-A12.pdf

			EPA-HQ-OAR-2019-0660-0189-A4.pdf EPA-HQ-OAR-2019-0660-0189-A14.pdf EPA-HQ-OAR-2019-0660-0190-A10.pdf EPA-HQ-OAR-2019-0660-0190-A3.pdf EPA-HQ-OAR-2019-0660-0189-A5.pdf EPA-HQ-OAR-2019-0660-0190-A8.pdf EPA-HQ-OAR-2019-0660-0190-A9.pdf EPA-HQ-OAR-2019-0660-0189-A18.pdf EPA-HQ-OAR-2019-0660-0190-A7.pdf EPA-HQ-OAR-2019-0660-0190-A1.pdf EPA-HQ-OAR-2019-0660-0189-A3.pdf EPA-HQ-OAR-2019-0660-0189-A6.pdf EPA-HQ-OAR-2019-0660-0190-A5.pdf EPA-HQ-OAR-2019-0660-0189-A11.pdf EPA-HQ-OAR-2019-0660-0189-A1.pdf EPA-HQ-OAR-2019-0660-0189-A15.pdf EPA-HQ-OAR-2019-0660-0189-A8.pdf EPA-HQ-OAR-2019-0660-0189-A20.pdf EPA-HQ-OAR-2019-0660-0190.html EPA-HQ-OAR-2019-0660-0189-A2.pdf EPA-HQ-OAR-2019-0660-0189-A17.pdf

			EPA-HQ-OAR-2019-0660-0189-A10.pdf
Center for Biological Diversity et al.	Environmental Non-governmental Organizations	N/A	EPA-HQ-OAR-2019-0660-0185-A1.pdf EPA-HQ-OAR-2019-0660-0185.html
Clark, Mitchell	Private Citizens	Mitchell Clark	EPA-HQ-OAR-2019-0660-0139.html
Environmental Defense Fund (EDF)	Environmental Non-governmental Organizations	Dr. Pedro Piris-Cabezas	EPA-HQ-OAR-2019-0660-0207-A1.pdf EPA-HQ-OAR-2019-0660-0207.html
General Aviation Manufacturers Association (GAMA)	Aircraft/Aircraft Engine Manufacturers or Designers	Marc Ehudin	EPA-HQ-OAR-2019-0660-0205.html EPA-HQ-OAR-2019-0660-0205-A1.pdf
General Electric Company (GE)	Aircraft/Aircraft Engine Manufacturers or Designers	Thaddeus Driscoll	EPA-HQ-OAR-2019-0660-0183-A1.pdf EPA-HQ-OAR-2019-0660-0183.html
Gibbons, Laura	Private Citizens	Laura Gibbons	EPA-HQ-OAR-2019-0660-0164.html
Growth Energy	Fuels Industry	Chris Bliley	EPA-HQ-OAR-2019-0660-0204.html EPA-HQ-OAR-2019-0660-0204-A1.pdf
Hahnel, Tanya	Private Citizens	Tanya Hahnel	EPA-HQ-OAR-2019-0660-0196.html
Hazard, Thomas	Private Citizens	Thomas Hazard	EPA-HQ-OAR-2019-0660-0135.html
Huang, Wen-Yen	Private Citizens	Wen-Yen Huang	EPA-HQ-OAR-2019-0660-0149.html
Ilabdfara, Rasanjali	Private Citizens	Rasanjali Ilabdara	EPA-HQ-OAR-2019-0660-0170.html

Institute for Policy Integrity at New York University School of Law (Policy Integrity)	Non-governmental Institutes and Foundations (other than Environmental)	Meredith Hankins, Jenna Pearlson and Tanya Shahjanian	EPA-HQ-OAR-2019-0660-0182.html EPA-HQ-OAR-2019-0660-0182-A1.pdf
Layog, Joshua	Private Citizens	Joshua Layog	EPA-HQ-OAR-2019-0660-0144.html
Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)	Environmental Non-governmental Organizations	N/A	EPA-HQ-OAR-2019-0660-0194-A1.pdf EPA-HQ-OAR-2019-0660-0194.html
National Association of Clean Air Agencies (NACAA)	State and Local Governments and Organizations	Eric C. White and Tracy R. Babbidge	EPA-HQ-OAR-2019-0660-0177-A1.pdf EPA-HQ-OAR-2019-0660-0177.html
Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way	State and Local Governments and Organizations	Ryan Calkins et al.	EPA-HQ-OAR-2019-0660-0174-A1.pdf EPA-HQ-OAR-2019-0660-0174.html
Preston, Richard	Private Citizens	Richard Preston	EPA-HQ-OAR-2019-0660-0158.html
Ramirez, Oscar Flores	Private Citizens	Oscar Flores Ranirez	EPA-HQ-OAR-2019-0660-0169.html EPA-HQ-OAR-2019-0660-0169-A1.pdf
Render, Jason	Private Citizens	Jason Render	EPA-HQ-OAR-2019-0660-0202.html
Rojas, Angell	Private Citizens	Angell Rojas	EPA-HQ-OAR-2019-0660-0168.html EPA-HQ-OAR-2019-0660-0168-A1.docx
Rose, Jillian	Private Citizens	Jillian Rose	EPA-HQ-OAR-2019-0660-0195.html
Rosetta Advisory Services, Brussels	Other Companies/Industries	Bill Hemmings	EPA-HQ-OAR-2019-0660-0181.html

			EPA-HQ-OAR-2019-0660-0181-A1.pdf
Senate of Pennsylvania, 10th Senatorial District	State and Local Governments and Organizations	Steve Santarsiero	EPA-HQ-OAR-2019-0660-0157-A1.pdf EPA-HQ-OAR-2019-0660-0157.html
Service Employees International Union (SEIU)	Non-governmental Institutes and Foundations (other than Environmental)	Mary Kay Henry	EPA-HQ-OAR-2019-0660-0191-A1.pdf EPA-HQ-OAR-2019-0660-0191.html
Sierra Club	Environmental Non-governmental Organizations	Vera Pardee	EPA-HQ-OAR-2019-0660-0184-A1.pdf EPA-HQ-OAR-2019-0660-0184.html
Simons-Wilson, Alex	Private Citizens	Alex Simons-Wilson	EPA-HQ-OAR-2019-0660-0147.html
South Coast Air Quality Management District (South Coast AQMD)	State and Local Governments and Organizations	Sarah Rees	EPA-HQ-OAR-2019-0660-0151-A1.docx EPA-HQ-OAR-2019-0660-0151.html EPA-HQ-OAR-2019-0660-0210-A1.pdf EPA-HQ-OAR-2019-0660-0210.pdf
Storey, William	Private Citizens	William Storey	EPA-HQ-OAR-2019-0660-0143.html
Vasquez, Miguel	Private Citizens	Miguel Vasquez	EPA-HQ-OAR-2019-0660-0165-A1.docx EPA-HQ-OAR-2019-0660-0165.html
Ventura, Paula	Private Citizens	Paula Ventura	EPA-HQ-OAR-2019-0660-0136.html
Wagner, Debi	Private Citizens	Debi Wagner	EPA-HQ-OAR-2019-0660-0153-A1.docx EPA-HQ-OAR-2019-0660-0153.html

Wilson, Charles	Private Citizens	Charles Wilson	EPA-HQ-OAR-2019-0660-0148.html EPA-HQ-OAR-2019-0660-0148-A1.pdf
Zamore, Wig	Private Citizens	Wig Zamore	EPA-HQ-OAR-2019-0660-0193-A1.pdf EPA-HQ-OAR-2019-0660-0193-A2.pdf EPA-HQ-OAR-2019-0660-0193.html EPA-HQ-OAR-2019-0660-0193-A3.pdf

The EPA has made every effort to ensure comments and comment excerpts are presented in this document verbatim. However, every original comment is available in the docket for the rulemaking action and is the most accurate reflection of its contents. When individual comments raise multiple issues addressed in different sections of this document, they may be split up and/or repeated in whole or in part below. Footnotes associated with an individual comment letter follow all excerpts from the comment letter presented in each section.

References to the docket for this rulemaking refer to docket EPA–HQ–OAR–2019-0660.

1. General Comments

1.1 General Support

Organizations Included in this Section

Aerospace Industries Association (AIA)
Airlines for America (A4A)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Anonymous Public Comment - 1
Anonymous Public Comment - 2
Anonymous Public Comment - 3
Anonymous Public Comment - 5
Anonymous Public Comment - 6
Anonymous Public Comment - 7
Anonymous Public Comment – 9
Anonymous Public Comment - 10
Anonymous Public Comment - 12
Anonymous Public Comment - 13
Anonymous Public Comment - 14
Anonymous Public Comment - 15
Bettenccourt, Jacob
Boeing Company (Boeing)
General Electric Company (GE)
Huang, Wen-Yen
Hudda, Neelakshi
Ilabdfara, Rasanjali
Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way
Ramirez, Oscar Flores
Render, Jason
Rojas, Angell
Rose, Jillian
Senate of Pennsylvania, 10th Senatorial District
Simons-Wilson, Alex
Storey, William
Vasquez, Miguel
Ventura, Paula

Organization: *Aerospace Industries Association (AIA)*

AIA is strongly supportive of the EPA's proposal to adopt emissions standards and test procedures for aircraft engines based on the International Civil Aviation Organization (ICAO) non-volatile particulate matter (nvPM) standards agreed to at the tenth and eleventh meeting of the Committee on Aviation Environmental Protection (CAEP) – CAEP/10 and CAEP/11, respectively. [EPA-HQ-OAR-2019-0660-0178-A1 p.1]

AIA welcomes the EPA's proposal to introduce domestic regulations consistent with the ICAO nvPM standards which will help both to reduce the environmental impacts of aviation and to maintain the competitiveness of U.S. aircraft manufacturers. [EPA-HQ-OAR-2019-0660-0178-A1, p.7]

Organization: *Airlines for America (A4A)*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 46.]

We appreciate this opportunity to testify in strong support of EPA's proposed adoption of internationally agreed particulate matter standards for new aircraft engines and urge the Agency to finalize its proposal consistent with the law.

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 49.]

First, A4A and our members remain committed to limiting and reducing impacts on local air quality and view the proposed PM aircraft emission standards as an important contributor to those efforts.

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 50.]

A4A and our members remain committed to limiting and reducing our emissions, including PM emissions. We strongly support the proposed rules as an important part of that commitment and urge the Agency to finalize its proposal consistent with the law.

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

A4A was pleased to testify at EPA's February 17, 2022, public hearing in strong support of the Proposed Rule, and we are equally pleased to provide these written comments explaining in more detail the reasons for our strong support of EPA's proposal to incorporate the ICAO Aircraft Engine PM Standards into U.S. law. [EPA-HQ-OAR-2019-0660-0192-A1, p.1]

Organization: *Anonymous Public Comment - 1*

While I think this regulation is needed, especially because regulations similar to this were passed in international forums almost 5 years ago, but for the sake of the American public, there should be more clarification on what exactly these regulations are. [EPA-HQ-OAR-2019-0660-0132, p.1]

Organization: *Anonymous Public Comment - 2*

While I think this regulation is needed, especially because regulations similar to this were passed in international forums almost 5 years ago, but for the sake of the American public, there should be more clarification on what exactly these regulations are. [EPA-HQ-OAR-2019-0660-0133, p.1]

Organization: *Anonymous Public Comment - 3*

While Aviation is one of the smaller contributors to CO2 emissions and air pollution in general this proposed rule plays a key part in returning the us to an international leader of environmental protection. The regulations being adopted are the same regulations that the UN follows and that the FDA helped to create. While slightly stricter regulations would be better in the long run the toll covid-19 took on airlines and air plane manufactures makes these standards quite acceptable for now. Aligning our regulations with the UN will in the future help place pressure on the UN to increase their standards when the time comes to increase ours. [EPA-HQ-OAR-2019-0660-0137, p.1]

Organization: *Anonymous Public Comment - 5*

I believe that the proposition to regulate PM emissions from jet airplanes is an overdue necessity. Given that United Airlines have already adopted this practice and has seen success since doing so, I don't see any objections. Additionally, having such a well-known company set the example would trigger a chain reaction and help other companies and organizations to see the importance as well. Ultimately, we want the net amount of PM emissions to plummet, and I believe that incorporating this practice would be a good step in doing so. [EPA-HQ-OAR-2019-0660-0140, p.1]

Organization: *Anonymous Public Comment - 6*

Air pollution standards are crucial to the state of our atmosphere. It is important to create efficient standards for air quality and jet engines that produce large amounts of air pollution (high PPM [parts per million]). It is critical to target specific entities that ruin air quality and essential to maintain a good condition for the air. Individuals need to understand the detrimental effects of jet engines on air quality and need to be informed about the changes and standards that need to be made. This proposed rule is a reliable strategy to prevent the worsen of our air quality and give a better perspective of the detrimental effects of specific jet engines. [EPA-HQ-OAR-2019-0660-0141, p.1]

Organization: *Anonymous Public Comment - 7*

Air pollution standards are crucial to the state of our atmosphere. It is important to create efficient standards for air quality and jet engines that produce large amounts of air pollution (high PPM [parts per million]). It is critical to target specific entities that ruin air quality and essential to maintain a good condition for the air. Individuals need to understand the detrimental effects of jet engines on air quality and need to be informed about the changes and standards that need to be made. This proposed rule is a reliable strategy to prevent the worsen of our air quality and give a better perspective of the detrimental effects of specific jet engines. [EPA-HQ-OAR-2019-0660-0142, p.1]

Organization: *Anonymous Public Comment - 9*

The environment is our home and it is essential that we maintain and protect it. Under your proposed rule, stricter emissions standards and regulations will be necessary for certain aircraft engines, I agree with this rule in that it is vital that we keep up with modern-day technological advances and continue to maintain strict laws for these massive pollution outputs. Having a uniform standard set would keep things simple and easier to follow as well, and I think that by passing this law, you will be doing your part in helping protect and save our environment. Thank you for your time and I look forward to what other protections you will continue to provide for our home. [EPA-HQ-OAR-2019-0660-0162, p.1]

Organization: *Anonymous Public Comment - 10*

The environment is our home, and it is necessary and essential that we protect and maintain it. Under your proposed rule, stricter standards and regulations would be enacted regarding emissions from

newer jet airplanes. I think that it is important that we continue to update our standards as modern-day technology continues to advance, and that by passing this rule, you would be helping do your part in helping protect the environment from these major pollutants. You also propose that this would bring about a more uniform standard amongst aviation regulations, and I think this would help streamline the process and be more simple and easy to follow. Thank you for your time, and I look forward to seeing what other protections you will continue to develop. [EPA-HQ-OAR-2019-0660-0163, p.1]

Organization: *Anonymous Public Comment - 12*

I support the proposed rule about the particulate matter emission standards and test procedures applicable to certain classes of engines because it would help the new engines create less pollution. Since most people rely on air travel something must be done to protect everyone's help and not have so much pollution going on. Now that today's technology is more advanced more engines will continue to be made there could be something added to the engine to help with climate change and have the emission level where it requires it to be. With this being solved it can help reduce the number of health issues and air pollution. [EPA-HQ-OAR-2019-0660-0167, p.1]

Organization: *Anonymous Public Comment - 13*

This is a class assignment where I am learning to use the Regulations.gov website. I chose this Proposed Rule for comment because I support how it balances both environmental justice as well as the interests of US aircraft engine manufacturers and consumers. On the one hand, while hopefully these standards will incentivize greater production of newer engines that have lower levels of emissions, they would also help the manufacturers be more competitive at the global aviation scale. I look forward to further steps taken towards such a balance of modernization and environmental sustainability. [EPA-HQ-OAR-2019-0660-0179, p.1]

Organization: *Anonymous Public Comment - 14*

I am commenting on this Proposed Rule by the Environmental Protection Agency as a class assignment. I chose this rule because as a student, I am very concerned about climate change and emissions from man-made equipment, such as airplanes. Knowing that the EPA, as well as the UN, are involved in the creation and research of this rule gives me confidence that this rule is well researched and will have only positive effects on our environment. I do not have any data to provide, but I know that any step in regulating pollution is a step in the right direction. [EPA-HQ-OAR-2019-0660-0186, p.1]

Organization: *Anonymous Public Comment - 15*

This is a class assignment where I am learning to use the Regulations.gov website. I selected this proposed rule because I have close connections to environmental nonprofits that advocate for updated policies such as this. I support the updated regulations and would love to see them be pushed even further in the future. [EPA-HQ-OAR-2019-0660-0187, p.1]

This enhanced regulation is a crucial first step, but I hope it is only the first step. [EPA-HQ-OAR-2019-0660-0187, p.1]

Organization: *Bettenccourt, Jacob*

As a student who lives within a close radius of Boston Logan Airport, controlling air pollution from aircraft is a topic that has a direct impact on me, as well as my family. This legislation is a step in the right direction to ensure standardized emission standards and improve the control of emissions from aircraft. Standardization with the ICAO regulations will create an environment that will aid in the long-

term protection of human health from PM emissions. I once again state my support for this proposed rule as well as standardizing emission standards to improve methods and regulations to control PM emissions. [EPA-HQ-OAR-2019-0660-0188, p.1] [[This comment can also be found in section 2.1 of the comment summary]]

Organization: *Boeing Company (Boeing)*

Boeing commends EPA's proposal to implement the emissions standards that follow the International Civil Aviation Organization approved non-volatile Particulate Matter concentration, mass, number, and test procedure to replace the existing smoke number standard. [EPA-HQ-OAR-2019-0660-0180-A1, p.1]

Organization: *General Electric Company (GE)*

GE commends EPA's proposal to adopt non-volatile Particulate Matter ("nvPM") emission standards and test procedures for aircraft engines that follow the standards adopted by the International Civil Aviation Organization ("ICAO"). The nvPM emissions standards were agreed to in 2019 at the eleventh meeting of the Committee on Aviation Environmental Protection ("CAEP"). GE believes that the proposal will protect U.S. jobs and strengthen the American aviation industry by ensuring the worldwide acceptance of GE/CFM engines, and that EPA should finalize the rule promptly. The proposal satisfies the Clean Air Act's ("CAA") requirements, is consistent with the precedent for establishing aircraft emission standards in collaboration with ICAO and is supported by the administrative record for this rulemaking. GE believes that EPA's proposal will protect the environment, while also providing the regulatory, market, and cost certainty that GE and other U.S. aviation companies need to continue leading the global aviation industry. [EPA-HQ-OAR-2019-0660-0183-A1, pp.3-4]

III. Conclusion

GE commends EPA for its leadership with this proposed rule and appreciates the opportunity to provide the comments above. EPA's nvPM emission standards for aircraft are a major step forward for protecting the environment and supporting sustainable growth of commercial aviation and the U.S. economy. [EPA-HQ-OAR-2019-0660-0183-A1, p.8]

Organization: *Huang, Wen-Yen*

I believe this regulation should be passed as global warming has started to aggravate. Air pollution from aircraft engines is one of the main sources of air pollution, especially in the airport area. [EPA-HQ-OAR-2019-0660-0149, p.1]

The passage of this regulation could not only improve the air quality but also uniform the regulations and standards around the world. [EPA-HQ-OAR-2019-0660-0149, p.1]

Organization: *Hudda, Neelakshi*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 32.]

With much appreciation for this opportunity to testify, I would like to begin by recognizing that this proposed rule is well written and is based on sound science. The engine test data and new standards are clearly shown, and the testing and certification process is also clearly detailed. Further, the proposal affirms the environmental justice aspects, which is also commendable.

Organization: *Ilabdfara, Rasanjali*

Those impacted by these regulations will be everyone, specific personal includes, pilots, airport facilities, engineers, farmers, and many others. Positive outcomes of such testing could lead to innovations of new engines and creating new jobs. Other benefits include lowering the risk of acid rain. With positives, there is the possibility of issues that could arise later on. Issues such as travel limitations and how repairing will work for aircraft that don't meet expectations. This also brings up questions about rates of flying and how that would be handled as regulations grow. [EPA-HQ-OAR-2019-0660-0170, p.1]

Overall, I am in support of having regulations for aviation engines. There is some risk with the condition of engines currently, but if we can change and improve these machines so they are better for humans and the environment it should be enforced. [EPA-HQ-OAR-2019-0660-0170, p.1]

Organization: *Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way*

We strongly support the EPA's proposed new standards, but also welcome the opportunity for additional progress, partnership, and investment to truly reduce emissions near airport communities. [EPA-HQ-OAR-2019-0660-0174-A1, p.2]

Keeping emissions from increasing is certainly an important first step, and we understand your conclusion that "adopting the ICAO PM standards in place of more stringent standards is appropriate in part because international uniformity and regulatory certainty are important elements of these proposed standards" and that "[i]t is appropriate to gain experience from the implementation of these nvPM standards before considering whether to adopt more stringent nvPM mass and/or number standards, or whether another approach to PM regulation would better address the health risks of PM emissions from aircraft engines." However, we would be remiss to not take this opportunity to discuss potential next steps. [EPA-HQ-OAR-2019-0660-0174-A1, p.2]

In summary, we believe that the EPA's proposed standards and testing procedures related to aircraft engine PM emissions are a "yes, and" proposition: "yes" in that we support aligning with ICAO standards as an important first step; "and" in that there are many additional opportunities for progress that EPA, FAA, and the Biden Administration can lead on, in order to truly reduce aircraft emissions. Furthermore, we believe a focus on SAF, UFPs and equity are three of the key driving factors in determining next steps. [EPA-HQ-OAR-2019-0660-0174-A1, p.3]

Organization: *Ramirez, Oscar Flores*

After reading and doing my research on this subject, I conclude that the EPA should consider and pass the proposal to switch the types of engines being used in current aircraft to lessen the harsh emission by them. The emissions these engines are emitting into the air have been causing major problems to our environment as a whole and as well as our health. [EPA-HQ-OAR-2019-0660-0169-A1, p.1]

Please I am asking that my letter is considered because this problem is crucial in living a healthy and safe life. We are still at a point where we can help change this problem for the better, helping the fight to stop climate change. Many other countries have already started the process of switching to more "environmentally friendly" engines that will help diminish climate change. If the EPA does not pass this proposal and aircraft engines continue to emit this highly toxic emission our environment and people's health will continue to be affected negatively. [EPA-HQ-OAR-2019-0660-0169-A1, p.1]

Organization: *Render, Jason*

I am currently reaching out as part of a class assignment where we are learning how to us the Regulations.gov website. I chose this NPRM because the effects of air pollution and emissions from aircraft engines is a very large contributor to the environment issues we observe today. As Americans are urged to reduce their carbon footprint within everyday life, the emissions from large aircrafts as well as actions by large corporations completed erase the positive effects of this national push against global warming and environmental harms. We must address air pollution at a larger level within our environmental harm analysis, instead of shifting focus to the micro level within households. This law would allow for air pollution safety standards to be enacted for aircraft engines, which would bring accountability to aircraft organizations within their building processes. We must create a world and environmental climate that can be sustained for generations to come and this law is an essential piece as world leaders seek to decrease air pollution and reverse some of the detrimental effects of climate change which we are already experiencing. [EPA-HQ-OAR-2019-0660-0202, p.1]

Organization: *Rojas, Angell*

The Environmental Protection Agency (EPA) will propose an action that will help reduce emission standards with classes of civil jet airplanes. I support the following action: Control of Air Pollution from aircraft engines by using emission standards and test procedures. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

It's important that the EPA acknowledges that we need cleaner air, and a good step towards this is to change the standards for PM emissions so aircraft companies are considering that we need to take every step possible to ensure cleaner air. A little goes a long way. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

Organization: *Rose, Jillian*

I am writing this comment as part of a class assignment in which I am learning how to use the Regulation.gov website. I chose this notice of proposed rule-making because I believe that large emitters of pollutants to the atmosphere, such as civil subsonic jet airplanes, must be regulated to stay within agreed upon emission standards in order to comply with engine standards such as those adopted by the United Nations' International Civil Aviation Organization (ICAO) and the Clean Air Act. As detailed, it seems that this proposed rule would be nothing but beneficial, as the adoption of the standards into US law would cap aircraft engine PM levels, align US domestic standards with the ICAO standards for achieving the highest practicable degree of uniformity in aviation regulations, and ensure that the US meets its treaty obligations under the Chicago Convention. [EPA-HQ-OAR-2019-0660-0195, p.1]

Organization: *Senate of Pennsylvania, 10th Senatorial District*

I am writing to voice my support for Particulate Matter (PM) standards being applied to aviation emissions. A significant number of my constituents in Bucks County Pennsylvania reside in the flight landing path of Trenton-Mercer Airport in New Jersey and as such they are exposed to increased exposure to air pollution from aircraft engines. Failure to properly regulate, implement, and enforce safe emission standards and testing procedures will likely cause irreversible damage to both the environment and the health of the community in my state Senate District and beyond. [EPA-HQ-OAR-2019-0660-0157-A1, p.1]

To preserve the health of the community, and our environment, I fully support applying Particulate Matter (PM) standards to aviation emissions. Failure to further regulate air pollution from aircraft engines will continue to harm public health. [EPA-HQ-OAR-2019-0660-0157-A1, p.1]

Organization: *Simons-Wilson, Alex*

I support the EPA's proposal in emission standards and test procedures applicable to engines rated output of greater than 26.7 Kilonewtons to replace the existing standards of aircraft engines. [EPA-HQ-OAR-2019-0660-0147, p.1]

Organization: *Storey, William*

Given the large amount particulate matter that is generated from large jet engines, it is incredibly necessary to implement effective regulations and testing procedures regarding their amount of particulate matter jet engines release into the atmosphere. We are at the point in technological advancement, that we can have efficient and powerful engine that does not create a large amount of particulate matter. Implementing this regulation would accelerate new and current engine design allowing for even greater advancements in the aviation field. If this regulation is not put into place, then the integrity of the air we breathe is at risk and people that live in high air traffic area near large airports like Atlanta and Los Angeles who have a right to clean air will suffer as a result. [EPA-HQ-OAR-2019-0660-0143, p.1]

These regulations and procedures would pave the way for cleaner and safer air quality as well as more efficient and environmentally friendly jet engines, thus, it must be put into action. [EPA-HQ-OAR-2019-0660-0143, p.1]

Organization: *Vasquez, Miguel*

I'm writing this letter in support of the proposed rule by the EPA to update the United States emissions standards and test procedures for aircraft. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

Organization: *Ventura, Paula*

When it comes to controlling air pollution from aircraft engines, I believe this proposed regulation on their emission standards and testing procedures should be acknowledged and passed. [EPA-HQ-OAR-2019-0660-0136, p.1]

I also think setting new emission standards and testing procedures for aircrafts will provide environmental justice to those who live around major airports in America. I understand this struggle from living in NYC and knowing the amount of air traffic that comes through each day from not one, or two, but THREE major airports. Regulating the emissions released by these aircraft is part of the duty the Clean Air Act is intended to do by protecting public health and welfare. I am not in extremely close proximity to Newark, LaGuardia or JFK airports, but I am close enough to know that those who are, are also at higher risk of health problems caused by air pollution such as asthma, respiratory infections or even lung cancer. [EPA-HQ-OAR-2019-0660-0136, p.1]

Overall, it is important for the EPA to acknowledge that the Clean Air Act needs to be adapted to the changes experienced over time in society. If we want our country to stay on the same page as the rest of the world, work together in fighting climate change, and keep the Clean Air Act doing what it was intended to do by protecting public health and the environment, then there is no reason why this proposition should not be passed. [EPA-HQ-OAR-2019-0660-0136, p.1]

EPA Response to Comments in Section 1.1

The EPA acknowledges all these comments expressing general support for the proposed rule, which we are finalizing with small modifications as described in the Preamble to the final rulemaking. In cases

where commenters raise additional issues, we include and respond to those issues in the Preamble to the final rulemaking or in the appropriate sections below.

1.2 General Opposition

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Anderson, Gillian
Anonymous Public Comment - 15
Barnes, Miki
Batra, Neelesh
Beacon Hill Council of Seattle (BHC)
BOS Fair Skies
Center for Biological Diversity
Center for Biological Diversity et al.
Environmental Defense Fund (EDF)
Hahnel, Tanya
Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)
Wagner, Debi

Organization: *Airport Impact Relief, Inc. (AIR, Inc.)*

The data in the NPRM indicate that there is a considerable variation in the margin by which medium and large output engines meet the proposed rule. In the mid-thrust range constituting the engines used on most large commercial airplanes, the data shown in the NPEM at figure IV-1 and figure IV-2 indicate that there is a difference of approximately a factor of two in the margin of compliance. If a new rule is adopted at this time it will greatly decrease the chances that another EPA regulation of aircraft engine PM will be undertaken for many years, thus locking in lack of meaningful improvement in aircraft PM emissions. [EPA-HQ-OAR-2019-0660-0175-A1, p.1-2]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

1) Withdrawing the NPRM until such time as EPA can produce a rule that remedies the defects noted in our comments. [EPA-HQ-OAR-2019-0660-0175-A1, p.6]

Organization: *Anderson, Gillian*

I support the comments submitted by Air Inc. They are well-substantiated and I hope the EPA will take them VERY seriously. Thank you. Gillian B. Anderson, resident of East Boston, MA right near the airport. [EPA-HQ-OAR-2019-0660-0197, p.1] [[This comment can also be found in section 6.6]]

Organization: *Anonymous Public Comment - 15*

Individuals living in close proximity to airports are [entitled] to their right to clean air and a safe environment, and it is disappointing to know that the negative impacts of these emissions have not been addressed with greater urgency. [EPA-HQ-OAR-2019-0660-0187, p.1]

Organization: *Barnes, Miki*

I am writing to state my support for the comments submitted by AIRPORT IMPACT RELIEF (AIR INC) on Monday 3/28/22 on the proposed EPA rule: “Control of Air Pollution from Aircraft Engines: Emissions Standards and Test Procedures." [EPA-HQ-OAR-2019-0660-0200, p.1]

Organization: *Batra, Neelesh*

I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: *Beacon Hill Council of Seattle (BHC)*

EPA must rise to the challenge of writing rules that align with the White House Council on Environmental Quality and the White House Environmental Justice Advisory Committee entities that it hosts; worthy of President Joe Biden's climate, environmental justice, and health vision. [EPA-HQ-OAR-2019-0660-0176-A1, p.2] [[This comment is repeated in section 11.5]]

Organization: *BOS Fair Skies*

This NPRM should be withdrawn until the EPA can produce a rule that remedies the defects noted in AIR INC's submitted comments as well as its subsequent procedural recommendations. [EPA-HQ-OAR-2019-0660-0199, p.1]

Organization: *Center for Biological Diversity*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 18-19.]

Since taking office, President Biden has vowed to usher in a clean energy revolution and to put environmental justice concerns front and center. Not only does EPA's proposed PM rule fail to meet those goals. It doesn't even take them seriously. The proposed rule is wholly inadequate on a number of levels, and EPA should withdraw it and replace it with one that actually reduces air pollution.

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 21-22.]

This is the second do-nothing airplane rule the Biden Administration has supported. EPA must reverse this trend of embracing weak, industry-developed standards and, instead, follow its Clean Air Act obligations to set limits that will reduce harmful pollution from aircraft. The Center calls on EPA to replace the proposed rule with one that will advance environmental justice and demonstrate international leadership on this important issue.

Organization: *Center for Biological Diversity et al.*

On behalf of our members and supporters, we write to urge the Environmental Protection Agency ("EPA") to withdraw and replace the proposed rule for aircraft engine particulate matter, 87 Fed. Reg. 6,324 ("Proposed Rule"). [EPA-HQ-OAR-2019-0660-0185-A1,p.1]

The Proposed Rule is woefully inadequate: EPA admits that it will not reduce emissions or improve air quality at all.[1] [EPA-HQ-OAR-2019-0660-0185-A1, p.1]

This is the second "do-nothing" airplane rule the Biden administration has supported. EPA must reverse this trend of embracing weak, industry-developed standards and instead follow its Clean Air Act obligations to set limits that reduce harmful pollution from aircraft.[3] We call on EPA to replace the Proposed Rule with one that will advance environmental justice and demonstrate international leadership. [EPA-HQ-OAR-2019-0660-0185-A1, p.1]

The undersigned organizations agree that EPA must immediately and significantly reduce particulate emissions from the aviation sector. We urge you to withdraw this Proposed Rule and commit to one that will reduce pollution. [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

When President Biden entered office, he acknowledged that federal government leadership and innovation is essential to protect public health and the environment; he pledged to be guided by science and to advance environmental justice.[13] The White House specifically identified the do-nothing aircraft greenhouse gas emissions rule as one to be reviewed in light of the new administration's focus on improving public health and tackling the climate crisis. Yet EPA has not followed through. The administration recently reversed course and opted to defend the aircraft greenhouse gas emissions rule. Now, it is proposing a similar ICAO-following, do-nothing rule for particulate matter. We urge EPA to get serious about airplane emissions and finally utilize the most effective tool in its possession: its regulatory power to set standards that reduce pollution fleetwide. [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

---

[1] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6,324, 6,327, 6,336 (Feb. 3, 2022) (to be codified at 40 C.F.R. pts. 87, 1030, 1031).

[3] 42 U.S.C. § 7401.

[13] White House, Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (Jan. 20, 2021), https://www.whitehouse.gov/briefing-room/presidentialactions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/.

Organization: *Environmental Defense Fund*

II. New evidence since 2016 on PM2.5 contribution to contrail formation and resulting GHG warming requires consideration by EPA as a co-benefit to PM2.5 reduction — justifying more stringent requirements. [EPA-HQ-OAR-2019-0660-0207-A1, pp.6]

Organization: *Hahnel, Tanya*

These EPA guidelines must not be adopted! The EPA must produce a rule that remedies the defects noted in Air Inc.'s detailed comment letter. Those comments are submitted on behalf of an Environmental Justice community that has been fighting the effects of fine particulate matter for half a century. Their comments deserve to be adopted into the EPA's approach to this issue. [EPA-HQ-OAR-2019-0660-0196, p.1] [[This comment can also be found in section 6.6 of the comment summary]]

Organization: *Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)*

I am writing to urge the EPA to replace its proposed rule on regulating airplane emissions with one that protects people and the planet from harmful pollution by reducing particulate matter ("PM") from airplanes. [EPA-HQ-OAR-2019-0660-0194-A1, p.1]

The EPA's proposal, as it is currently written, does nothing to reduce emissions and protect people from deadly PM pollution. I urge the agency to rewrite this rule and regulate airplane emissions while considering the health and environmental justice impacts of PM pollution. [EPA-HQ-OAR-2019-0660-0194-A1, p.1]

Organization: *Wagner, Debi*

I have previously submitted formal public comments on January 17th but I do not see them among comment letters received on the site. I am resubmitting these comments attached below but would also like to add that after listening to public comment on the EPA hearing held February 17, three things stand out. First, industry is supportive of this new rule. This makes sense since the new rule changes

almost nothing for one of the greatest pollution generating industries on the planet. Second, communities, agencies, academics and concerned groups/citizens are generally opposed to this new rule. This also makes sense because the existing condition in airport environments is very bad for public health. Lastly, EPA has a duty to protect public health and the environment first and foremost. This rule streamlines the process for manufacturers across nations and has nothing in common with EPA, its mandate or the Clean Air Act. Its purpose is only to serve industry. EPA should be on the side of communities, academics, agencies and concerned groups/citizens. But more importantly, EPA should be investigating why the health of people living in airport communities is so poor. [EPA-HQ-OAR-2019-0660-0153, p.1] [[Part of this comment is repeated in section 6.4.]]

And EPA should be diligently working on strengthening the existing standards and adding a new rulemaking for ultrafine particulate. [EPA-HQ-OAR-2019-0660-0153, p.1]

EPA Response to Comments in Section 1.2

The EPA acknowledges all these comments expressing general opposition to the proposed rule. Commenters offered different reasons for opposing the rule including views that the standards should be more stringent and that they do not sufficiently address environmental justice concerns. The EPA's general reasons for finalizing the proposed standards, and response to the request to withdraw the proposal, are described in the Preamble to the final rulemaking in Section IV.F.2. In cases where commenters raise additional issues and specific points above, we include and respond to those issues and points in the appropriate sections below.

For the comment on the consideration of co-benefits to PM2.5 reduction, there are no expected emissions benefits, or expected co-benefits, associated with this rulemaking. Consequently, without the rule's resulting in PM 2.5 emissions reductions, and the absence of administrative record evidence evaluating the degree of benefits of any such reductions, it is premature and may not be analytically possible for the EPA to evaluate the co-benefits of possibly related reductions of contrail formation or climate change that could result from PM 2.5 emissions reductions from aircraft engines.

2. Comments Related to Aligning the Domestic PM Standards with ICAO PM Standards

2.1 Support for Aligning Domestic PM Standards with ICAO PM Standards

Organizations Included in this Section

Aerospace Industries Association (AIA)
Airlines for America (A4A)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Bettenccourt, Jacob
General Aviation Manufacturers Association (GAMA)
General Electric Company (GE)
Hazard, Thomas
Huang, Wen-Yen
Ventura, Paula

Organization: *Aerospace Industries Association (AIA)*

As the representative of the American aerospace manufacturing industry, AIA wants to ensure that the U.S. has a framework consistent with the internationally approved ICAO approach that will allow our members to continue to design environmental improvements into aircraft and aircraft engines. As U.S. manufacturers build aircraft and aircraft engines that will be sold and used all over the world, harmonization with ICAO rules is important for ensuring that the intended environmental benefit of these rules is realized – and the competitiveness of the U.S. A&D [Aerospace and Defense] industry and the health of the international aviation system is maintained. When airlines make decisions about the aircraft they purchase, a key consideration is the assurance that an aircraft will meet the required standard to be allowed to operate in all of an airline's jurisdiction – which outside of the U.S. will be demonstrated by compliance with the ICAO nvPM standards. Without implementing domestic regulations in place from the EPA, the FAA are unable to certify an aircraft as meeting the ICAO nvPM standards and U.S. manufacturers would be at a serious competitive disadvantage to those based elsewhere. [EPA-HQ-OAR-2019-0660-0178-A1, p.3]

Given the importance of having equivalent domestic rules to ICAO's nvPM standards in place, AIA is pleased that the EPA intends to continue with its established approach of adopting ICAO emissions standards into domestic law under Section 231 of the Clean Air Act. AIA also welcomes the EPA's intention to adopt rules that are equivalent in scope, stringency, and timing to the ICAO nvPM standards. [EPA-HQ-OAR-2019-0660-0178-A1, p.4]

Organization: *Airlines for America (A4A)*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 49-50.] [[This comment is repeated in sections 2.4 and 11.1]]

A4A strongly supports the proposal to adopt the aircraft PM certification standards as agreed by the International Civil Aviation Organization -- ICAO. The ICAO process for setting aircraft standards is rigorous and ensures they are technically sound. Further, the ICAO criteria for adopting such standards align with the criteria under Section 231 of the U.S. Clean Air Act. Even more critically, the standards will ensure that aviation safety is maintained even as environmental progress is ensured.

As acknowledged in the proposal, it is critical to the competitiveness of the U.S. aircraft and aircraft engine manufacturers that the U.S. follow these international standards which, in turn, improve airlines' ability to acquire U.S.-manufactured aircraft and help foster competitive market prices. Experts from the USEPA and Federal Aviation Administration played leading roles in the ICAO process leading to the adoption of the PM standard. A4A participated as an observer. These efforts ensured that ICAO's PM standard incorporated all of these critical features and -- so that it could be adopted into U.S. law. [[This comment is repeated in sections 2.4, 8.1, and 11.1]]

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

Perhaps most critically, the adoption into U.S. law of aircraft engine PM standards that are equivalent to the ICAO Aircraft Engine PM Standards will ensure that aviation safety is maintained even as environmental progress continues. [EPA-HQ-OAR-2019-0660-0192-A1, p.1] [[This comment is repeated in section 11.1]]

We also are mindful of the importance of this rulemaking to the continued vitality and competitiveness of U.S. aircraft engine manufacturers. As was the case with the ICAO carbon dioxide (CO2) aircraft standards, which EPA adopted into U.S. law through a final rule published on January 11, 2021,[5] adopting the ICAO Aircraft Engine PM Standards into U.S. law will ensure U.S.-manufactured aircraft engines are available to aircraft manufacturers and U.S. airlines, while fostering global competition and enabling our airlines to acquire aircraft and aircraft engines at market-driven, competitive prices. Especially given that, as the Agency itself notes, the ICAO standards "have been or are being adopted by other ICAO member states that certify aircraft engines,"[6] the Agency needs to act to put U.S. aircraft engine manufacturers on the same footing as their foreign counterparts. [EPA-HQ-OAR-2019-0660-0192-A1, p.2] [[This comment is repeated in section 8.1.]]

1. A4A AND ALPA STRONGLY SUPPORT INCORPORATION OF THE ICAO AIRCRAFT ENGINE PM STANDARDS INTO U.S. LAW

A4A and ALPA very strongly support the proposal to adopt the ICAO Aircraft Engine PM Standards into U.S. law for several reasons. [EPA-HQ-OAR-2019-0660-0192-A1, p.5]

A. Adoption into U.S. Law of PM Emissions Standards that are Equivalent to the ICAO Aircraft Engine PM Standards is Consistent with the Authority Conferred on EPA by Section 231 of the CAA

The ICAO Aircraft Engine PM Standards clearly meet the criteria for adoption of aircraft engine standards set out in section 231 of the CAA. As EPA highlights in the preamble to the Proposed Rule, the ICAO Aircraft Engine PM Standards resulted from an intense, multi-year effort within ICAO to assess aircraft engine technologies, develop the metrics for evaluating PM emissions, and agree on the applicability, timing, and stringency of the standards. The technical grounding for the standards was established through many meetings of the ICAO/CAEP. Upon recommendation of the standards by CAEP in 2016 and 2019, the ICAO Council reviewed and voted to adopt the standards in 2017 and 2020. The ICAO Aircraft Engine PM Standards were formally adopted into ICAO's Standards and Recommended Practices ("SARPs") and are codified in Annex 16, Volume II of the Chicago Convention. [EPA-HQ-OAR-2019-0660-0192-A1, p.5]

As a result, there is no doubt that the ICAO Aircraft Engine PM Standards (and associated test procedures) are technically sound.15 In addition, there is no doubt that the standards are consistent with the Terms of Reference ("TOR") for CAEP, which provide that such standards must be technologically feasible, economically reasonable, environmentally beneficial, and balanced against interdependencies (aircraft noise and competing emission reductions of other pollutants, such as NOx).[16] [EPA-HQ-OAR-2019-0660-0192-A1, p.6]

Critically, the CAEP TOR align well with the criteria EPA must follow pursuant to CAA section 231, and ICAO's assessment of each element of the TOR is directly related to the decisions EPA must make when adopting aircraft engine emission standards. Section 231(b) requires any engine emissions standard to allow sufficient lead time "to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period." Due to the rigorous performance criteria required of aircraft dictated by safety imperatives and the need to match aircraft mission capability to demand, the process involved in designing, certifying, and building new aircraft and aircraft engines is inherently lengthy. In addition, section 231(a)(2)(B)(ii) expressly prohibits changes in

engine emission standards that "would significantly increase noise and adversely affect safety."[17] [EPA-HQ-OAR-2019-0660-0192-A1, p.6]

Also particularly relevant here is that, as EPA explains in the preamble, ICAO/CAEP evaluates "technological feasibility" using the Technological Readiness Level ("TRL") scale and deems technologies that have attained TRL8 (defined as the "actual system completed and 'flight qualified' through test and demonstration") to be "technologically feasible."[18] Use of TRL8 to evaluate "technological feasibility" thus ensures emissions standards reflect what aircraft technologies can safely deliver, rather than hypothetical "technology forcing" standards that could pose a potential threat to air safety. [EPA-HQ-OAR-2019-0660-0192-A1, p.6] [[This comment can also be found in sections 8.2 and 11.1 of the comment summary]]

EPA affirms the "long-established ICAO/CAEP terms of reference were taken into account when deciding the international PM standards, principal among these being technical feasibility."19 Given the close relationship between the criteria it must follow under CAA section 231 and the ICAO/CAEP TOR, it is clear that the comprehensive technical and economic data and analyses developed by CAEP to support its standards are more than sufficient to support the adoption of those standards into U.S. law. [EPA-HQ-OAR-2019-0660-0192-A1, p.6] [[This comment is also in section 11.1]]

B. Significant Policy Reasons Support EPA's Expeditious Adoption of Aircraft Engine PM Standards that are Equivalent to the ICAO Aircraft Engine PM Standards

The adoption of aircraft engine PM emissions standards that are equivalent to the ICAO Aircraft Engine PM Standards will advance the goals of the Chicago Convention and the United States' continued leadership role within ICAO/CAEP to achieve important environmental objectives. The Chicago Convention is intended to ensure that "international civil aviation may be developed in a safe and orderly manner" and promote global harmonization and international aviation commerce and growth, through collaboration among its Member States aimed at "securing the highest practicable degree of uniformity in regulations, standards, procedures and organization in relation to aircraft . . . ."[20] ICAO's adoption of the ICAO Aircraft Engine PM Standards represents a consensus reached among its 193 Member States consistent with the ideals memorialized in the Chicago Convention after exhaustive analysis and deliberation. The result is a strong standard that will achieve PM emissions reductions and support U.S. policies to address aviation emissions consistent with maintaining the "highest practicable degree of uniformity" in international requirements. This uniformity is vital given that the nature of international aviation, where U.S. aircraft enter the airspace of and operate at airports in other countries hundreds of times per day. Aircraft and the international airspace system simply could not function if aircraft and aircraft engines were subject to disparate regulatory requirements and standards. [EPA-HQ-OAR-2019-0660-0192-A1, p.7]

As such, we have long supported and actively participated together with EPA and FAA in the standard-setting process of ICAO's CAEP "to help establish international emission standards and related requirements, which individual member States adopt into domestic law and regulations."[21] As EPA rightly affirms, "[h]istorically . . .international emissions standards have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings under CAA section 231 to establish domestic standards that are" consistent with ICAO's standards.22 As we have previously expressed, we believe the Agency should not go beyond ICAO standards as a general matter,[23] and consistent with longstanding U.S. policy, regulation of PM emissions should comport with the Chicago Convention and reflect

international consensus developed through ICAO. We emphatically agree with EPA's decision here to "continue [its] historical rulemaking approach" and adopt aircraft engine PM emissions standards that are equivalent to international consensus as reflected in the ICAO Aircraft Engine PM Standards.[24] [EPA-HQ-OAR-2019-0660-0192-A1, p.7]

We also emphatically agree that the adoption of aircraft engine PM standards that are equivalent to the ICAO standards is critically important to the competitiveness of U.S. aircraft and aircraft engine manufacturers. EPA is correct to highlight that adoption of aircraft engine PM standards equivalent to the ICAO Aircraft Engine PM Standards will ensure U.S. aircraft and aircraft engine manufacturers are able to obtain FAA certification of their products, in turn ensuring that these products will be accepted in the world marketplace. This will remove the potential for U.S. manufacturers to be at a competitive disadvantage with foreign aircraft and engine manufactures with better or more favorable access to foreign certificating authorities. We also agree with EPA's observation that "compliance with the international standards (via U.S. type certification) is a critical consideration in aircraft manufacturer and airlines' purchasing decisions."[25] As noted above, adopting the ICAO Aircraft Engine PM Standards into U.S. law will ensure U.S.-manufactured aircraft and aircraft engines are available to U.S. airlines, while fostering global competition and enabling our airlines to acquire aircraft and aircraft engines at market-driven, competitive prices. This is critical to the continued competitiveness of U.S. airlines across the globe and helps ensure that we will have access to the advanced aircraft and aircraft engines we will need to attain our environmental goals and fulfill our commitments to address climate change. It also helps preserve the vitality of the U.S. aircraft and aircraft engine manufacturing sector, which not only is a very large component of our country's exports but is supported by a vast ecosystem of smaller businesses, manufacturers and service providers that employ thousands in their own right. Of course, economic and social factors like these take on even greater significance in the current economic downturn brought on by the COVID-19 pandemic. [EPA-HQ-OAR-2019-0660-0192-A1, pp.7-8] [[This comment is repeated in 8.1.]]

---

[5] See 86 Fed. Reg. 2136 (Jan. 11, 2021).

[6] 87 Fed. Reg. at 6326, 6337.

[15] As EPA notes, CAEP provided a summary of its analysis and findings regarding the PM standards in ICAO, 2019: Report of the Eleventh Meeting, Montreal, 4-15 February 2019, Committee on Aviation Environmental Protection, Document 10126, CAEP/11.

[16] The CAEP TOR are available at https://www.icao.int/environmental-protection/Pages/Caep.aspx#ToR.

[17] CAA section 231(c) creates an additional mechanism to ensure aircraft engine emission standards are not inconsistent with the imperative to maintain air safety, providing that any requirements promulgated pursuant to section 231 "shall not apply" if the Secretary of Transportation makes a finding that the regulation "would create a hazard to aircraft safety" and the President disapproves the requirement after public notice and comment.

[18] 87 Fed. Reg at 6347-48.

[19] Id. at 6347

[20] Convention on International Civil Aviation ("Chicago Convention"), Preamble and Article 37, available at https://www.icao.int/publications/Documents/7300_9ed.pdf.

[21] 87 Fed. Reg. at 6330.

[22] Id.

[23] See Joint A4A-ALPA Comments on Docket ID No. EPA-HQ-OAR-2014-0828, at 42-44 (Aug. 31, 2015), available at https://www.regulations.gov/comment/EPA-HQ-OAR-2014-0828-0747.

[24] 87 Fed. Reg. at 6330.

[25] Id. at 6347.

Organization: *Bettenccourt, Jacob*

As a student who lives within a close radius of Boston Logan Airport, controlling air pollution from aircraft is a topic that has a direct impact on me, as well as my family. This legislation is a step in the right direction to ensure standardized emission standards and improve the control of emissions from aircraft. Standardization with the ICAO regulations will create an environment that will aid in the long-term protection of human health from PM emissions. I once again state my support for this proposed rule as well as standardizing emission standards to improve methods and regulations to control PM emissions. [EPA-HQ-OAR-2019-0660-0188, p.1] [[This comment can also be found in section 1.1 of the comment summary]]

Organization: *General Aviation Manufacturers Association (GAMA)*

In order to maintain the primacy of international aviation environmental standards and ensure that U.S. manufacturers remain competitive in the global marketplace, GAMA supports this proposed rule and urges EPA to finalize the rulemaking process in an expeditious manner. [EPA-HQ-OAR-2019-0660-0205-A1, p.1]

Organization: *General Electric Company (GE)*

A. nvPM emissions standards that follow the standards adopted by ICAO are critical to ensure the preeminence of the U.S. aviation industry

Consistency with the ICAO nvPM emissions standards is critical to ensure the preeminence of the U.S. aviation industry. The proposed nvPM standards, if adopted, would ensure the acceptance of GE/CFM engines by countries and airlines around the world. Further, harmonization with ICAO's international standards ensures that all the world's manufacturers meet the same standards. Without this harmonization, countries may ban the use of any airplane within their airspace that is not certified to meet ICAO standards. Also, if EPA adopted no standards or standards inconsistent with ICAO's standards, U.S. aircraft engine manufacturers could be forced to seek a PM emissions certification from a foreign aviation certification authority to market their products for international operation, rather than from the Federal Aviation Administration ("FAA"). This would disrupt business and disadvantage U.S. firms. [EPA-HQ-OAR-2019-0660-0183-A1, p.4] [[This comment is repeated in section 8.1.]]

An inconsistent regulatory environment also would likely result in global market distortions. Efficient, safe, and effective airline operations rely on global harmonization. Furthermore, the ability of airlines to seek lease or loan financing in support of their accelerated adoption of new aircraft technology will rely on the ability of financial partners to deploy and finance aircraft where they are most beneficial to airlines globally, without regulatory discrimination by political jurisdictions. [EPA-HQ-OAR-2019-0660-0183-A1, p.4] [[This comment is repeated in section 8.1.]]

D. More stringent nvPM standards are not appropriate and would potentially violate the CAA

The CAA does not require EPA to "technology force" at the risk of flight safety. Section 231(a)(2)(B) of the CAA requires EPA to refrain from changing aircraft emission standards if such a change would adversely affect safety. To maintain the trust and confidence of the flying public, it is imperative that EPA not adopt standards that could in any way be perceived as sacrificing aviation safety. The perception of the flying public matters, and EPA should endeavor to avoid any erosion of public confidence in the safety of aviation. This objective is best achieved by EPA remaining aligned with the ICAO analytical criteria of technical feasibility, environmental benefit, cost effectiveness, and impacts of interdependencies, which have helped ensure the continuation of aviation's impressive safety record and environmental performance. [EPA-HQ-OAR-2019-0660-0183-A1, p.7]

Organization: *Hazard, Thomas*

The use of commercial air travel has increased, though the strictness of the environmental air pollution standards have not kept up with its popularity. I would agree with the proposed rule because it begins to modernize the pollution output allowed by new civil subsonic jet engines. Everyone uses air travel, and many cannot live without it due to contributing factors, such as family, health, or professional necessity. This proposed rule touches on several arguments on why emission levels should be set to the international levels, such as environmental and ecosystem protection, health, and environmental justice. [EPA-HQ-OAR-2019-0660-0135, p.1]

Organization: *Huang, Wen-Yen*

The standards and test procedures within this proposed regulation are equivalent to ICAO standards. Setting the same standards is important for the United States as it helps keep up with the times and the world to further reduce air pollution. [EPA-HQ-OAR-2019-0660-0149, p.1]

Organization: *Ventura, Paula*

Given the information provided on what this proposition will entail, and what is at stake, it is extremely crucial that it gets passed if we want our country to stay on the same page as the rest of the world regarding aircraft emission standards. I think the arguments supplied by this regulation at hand are extremely valid and must be addressed. Since this will be part of a new standard set by the UN's ICAO, the rest of the world will be functioning in correlation with the new standards, and the US needs to remain in the best position it can be for its aircraft manufacturers in a competitive global marketplace. [EPA-HQ-OAR-2019-0660-0136, p.1]

EPA Response to Comments in Section 2.1

For the EPA's response to comments supportive of aligning with the international aircraft engine PM standards adopted by ICAO in 2017 and 2020, see Section IV.F.1 of the Preamble to the final rulemaking. Also, for further discussion on aligning with the ICAO standards see Preamble Section I.B.2 of the final rulemaking and the introductory paragraphs of Preamble Section IV of the final rulemaking. In cases where commenters raise additional issues and specific points above, we include and respond to those issues and points in the appropriate sections below.

2.2 Comments Related to the Effective Date

Organizations Included in this Section

Aerospace Industries Association (AIA)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)

Anonymous Public Comment - 4
General Aviation Manufacturers Association (GAMA)
General Electric Company (GE)
Hazard, Thomas

Organization: *Aerospace Industries Association (AIA)*

The impact of a scenario in which the U.S. fails to adopt equivalent domestic rules to the ICAO nvPM standards in a timely fashion could jeopardize sales of U.S. aircraft and aircraft engines to the effect of tens of billions of dollars. This could have catastrophic impacts on the future strength and competitiveness of the U.S. A&D [Aerospace and Defense] sector, especially in conjunction with the unprecedented downturn in activity that the sector has recently faced as a result of the COVID-19 pandemic. As our industry contributed 920,000 direct jobs, a further 1.28 million jobs throughout the shared A&D supply chain and a positive trade balance of $79 billion in 2019, this would also be extremely detrimental to the prosperity and national security of the United States.[7] [EPA-HQ-OAR-2019-0660-0178-A1, pp.3-4] [[This comment is repeated in section 8.1.]]

Need for timely implementation of final nvPM rules

U.S. aircraft engine manufacturers must demonstrate compliance with these standards in order for engines to be certified for use outside of the United States. Airline customers require regulatory certainty that their aircraft and engine combinations will be able to operate in their jurisdictions. Therefore, demonstrating compliance with these standards is necessary from a competitive standpoint. While the ICAO CAEP/11 nvPM standards do not take effect internationally until 2023, U.S. manufacturers and their customers (who must make aircraft purchasing decisions several years out) may be disadvantaged by uncertainty about whether or how the EPA's standards will be implemented. Furthermore, many foreign agencies require validation of this standard prior to new aircraft or spare engine delivery within their jurisdiction. The validation process is a time and resource intensive process that take 6-12 months to complete and can only happen after FAA certification is complete. Timely implementation of the ICAO standards is important for the U.S. A&D sector and the American economy. Past experience with implementation of CAEP standards into U.S. regulations suggest that the NPRM process should have commenced at least 2 years prior to the implementation date (i.e., first quarter of 2021). Given the novelty of these standards, especially for nvPM number emissions, implementation may be more complicated than for previous CAEP standards. This is a further reason to accelerate the regulatory process. [EPA-HQ-OAR-2019-0660-0178-A1, pp.7-8]

The ICAO CAEP/10 nvPM standard that went into effect internationally on January 1, 2020 was not implemented in the U.S. as new regulation in the CFR, but as a reporting requirement which resulted in a discrepancy with other ICAO member states. U.S. manufacturers had to expend additional resources to coordinate reciprocity with the regulators in these other states. As such, AIA applauds EPA for proposing the implementation of the CAEP/10 nvPM standard along with the CAEP/11 nvPM standards in the CFR. [EPA-HQ-OAR-2019-0660-0178-A1, p.7]

AIA urges EPA to finalize adoption of the ICAO nvPM emission standards promptly. EPA action is required to afford the FAA sufficient time to promulgate their nvPM certification regulations and U.S. aircraft engine manufacturers sufficient time to perform the lengthy and expensive steps that will be required to demonstrate compliance with the ICAO nvPM standard for all aircraft engines that will be in-

production in 2023. From a certification standpoint, rulemaking must be completed by both the EPA and the FAA to begin the certification process in the U.S. [EPA-HQ-OAR-2019-0660-0178-A1, p.7]

AIA strongly urges the EPA to finalize these rules as soon as possible to allow the required time for FAA to undertake its certification rulemaking and for manufacturers to certify and validate aircraft engine nvPM levels before January 2023. [EPA-HQ-OAR-2019-0660-0178-A1, p.7]

---

[7] Aerospace Industry Association (2020), Facts and Figures: Aerospace and Defense

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

Accordingly, we urge EPA to finalize the Proposed Rule as expeditiously as possible. [EPA-HQ-OAR-2019-0660-0192-A1, p.2]

The COVID-19 pandemic also underscores the need to act as expeditiously as possible to approve the adoption of aircraft engine PM emissions standards that are equivalent to the ICAO Aircraft Engine PM Standards. Again, as indicated above, EPA itself notes, "other ICAO member states that certify aircraft engines" have already adopted the ICAO Aircraft Engine PM Standards.[26] Accordingly, the Agency needs to act to put U.S. aircraft and aircraft engine manufacturers, as well as U.S. carriers and other entities that rely on these manufacturers to maintain and modernize their fleets, on the same footing as their foreign counterparts. [EPA-HQ-OAR-2019-0660-0192-A1, p.8]

CONCLUSION

Again, A4A and ALPA appreciate the opportunity to comment, and strongly urge EPA to act as expeditiously as possible to finalize aircraft engine PM emissions standards by adopting into U.S. law standards that are equivalent to the ICAO Aircraft Engine PM Standards. [EPA-HQ-OAR-2019-0660-0192-A1, p.12]

---

[26] Id. at 6326, 6337.

Organization: *Anonymous Public Comment - 4*

I believe that this is a highly important regulation that needs to be put into place as soon as possible. [EPA-HQ-OAR-2019-0660-0138, p.1]

Organization: *General Aviation Manufacturers Association (GAMA)*

In order to maintain the primacy of international aviation environmental standards and ensure that U.S. manufacturers remain competitive in the global marketplace, GAMA supports this proposed rule and urges EPA to finalize the rulemaking process in an expeditious manner. [EPA-HQ-OAR-2019-0660-0205-A1, p.1] [[This comment can also be found in section 2.1 of the comment summary]]

It is important for the EPA to finalize this process expeditiously so that the FAA can promulgate its regulations as required by law and provide manufacturers with the necessary lead time to demonstrate compliance. [EPA-HQ-OAR-2019-0660-0205-A1, p.2]

Organization: *General Electric Company (GE)*

GE urges EPA to finalize the standards promptly to allow the FAA to incorporate these standards into its certification requirements

The ICAO nvPM standards for new and in-production aircraft engines will take effect on January 1, 2023. GE urges EPA to promptly finalize this proposed ICAO-equivalent standard as soon as possible. Timely implementation is important for the U.S. aviation industry and the U.S. economy. GE notes that after the EPA rule is finalized, the FAA must then promulgate its final nvPM regulations, all by the end of 2022, in order to provide U.S. aircraft manufacturers the time to perform the extensive steps that will be required to demonstrate compliance with the ICAO-equivalent nvPM standards for all aircraft that will be in production in 2023. Without timely implementation of both EPA and FAA rules, timely engine shipments may be put at risk. By promptly adopting the ICAO-equivalent standards, EPA can avoid costly disruptions and provide the regulatory certainty the U.S. aviation industry needs to protect jobs and invest domestically. [EPA-HQ-OAR-2019-0660-0183-A1, p.4]

Organization: *Hazard, Thomas*

The rule, if it is to be passed, will be implemented for all engines with an output force of 26.7 kilonewtons, produced after January 1st, 2023. I do not agree with the proposed rule on every account, however. The main point of worry I have is that the timeline is extremely short. It would be difficult for aircraft engine designers and producers to design changes in engines so that they would meet the required emission levels. How many corners would have to be cut to produce engines that comply with these emission standards. I think the only part that should be altered would be to set emission standards every year, each lower than the last. This would allow for more time to be allocated to research and design on safer engines. [EPA-HQ-OAR-2019-0660-0135, p.1]

EPA Response to Comments in Section 2.2

The EPA agrees that timely adoption of these standards is important. Additional information about the EPA's consideration of timing may be found in the Preamble to the final rulemaking in the introductory paragraphs of Section IV, Section IV.F.2, and the introductory paragraphs of Section VI.

The EPA recognizes the commenters' concern that emission standards must be developed with sufficient lead time so that manufacturers can develop safe means to comply with the standards. The EPA's assessment of the rule's impact on safety is in Section VI.D of the Preamble to the final rulemaking.

The EPA disagrees with the comment that there is insufficient time for manufacturers to comply with the standards by the effective date. The in-production engine standards that will go into effect on this date are set at emission levels where all in-production engines meet these standards to prevent backsliding of aircraft engine PM emissions. The new type design standards, that go into effect on the same date, will only apply to aircraft engines that apply for a new type design certificate with the FAA after this date. For new type design engines, the 2020 ICAO PM mass and number standards are set at more stringent emission levels compared to the PM mass and number standards for in-production engines, but nearly all in-production engines meet these new type design standards. In addition, in-production engines will not be required to meet these new type design standards. Only new type design engines will need to comply with the new type design standards. The EPA projects that all new type design engines entering into service into the future will meet these PM mass and number standards.

2.3 Criticisms of EPA's PM Standards

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Aviation-Impacted Communities Alliance (AICA)
Barnes, Miki
Batra, Neelesh
Beacon Hill Council of Seattle (BHC)
Bucko, Jacob
California Air Resources Board (CARB)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Environmental Defense Fund (EDF)
Gibbons, Laura
Institute for Policy Integrity at New York University School of Law (Policy Integrity)
Kroeker, Anne
National Association of Clean Air Agencies (NACAA)
Rosetta Advisory Services, Brussels
Service Employees International Union (SEIU)
Sierra Club
South Coast Air Quality Management District (South Coast AQMD)
Wagner, Debi
Vasquez, Miguel

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

This NPRM proposes a regulation intended to replace the long standing ICAO smoke number standard, which is already incorporated into US regulations (40 CFR Part 87). The NPRM clearly states that the proposed rule is equivalent to the existing smoke standard and will not require any engine manufacturer to modify any engine that is currently in production or is planned for new production in the future.[1] It also states that this rule will not reduce pollution below that which is allowable under the current smoke standard. The sole reason for the new rule appears to be a desire to comply with the new ICAO PM standards adopted in 2017 and 2020, foster international harmonization, and protect the international competitive capability of US airplane and engine manufacturers. However, the data in the NPRM indicates that there is a considerable variation in the margin by which medium and large output engines meet the proposed rule. In the mid-thrust range constituting the engines used on most large commercial airplanes, the data shown in the NPRM at figure IV-1 and figure IV-2 indicate that there is a difference of approximately a factor of two in the margin of compliance. If a new rule is adopted at this time it will greatly decrease the chances that another EPA regulation of aircraft engine PM will be undertaken for many years, thus locking in lack of meaningful improvement in aircraft PM emissions. [EPA-HQ-OAR-2019-0660-0175-A1, p.1]

The NPRM in Section IV, Details for the Proposed Rule, discusses the rationale for the proposed in-production engine emission limits for both the particulate number and mass.[4] We agree with those

limits for in-production engines. However, the data in those figures indicates that there is a considerable variation in the margin by which medium and large output current production engines meet the proposed rule. In the mid-thrust range constituting the engines used on most large commercial airplanes, the data indicate that there is a difference of approximately a factor of two in the margin of compliance. This is not unexpected since the technology variation across in-production engines is substantial. Although the NPRM doesn't provide the level of detail that is likely contained in the CAEP FESG analysis, it is reasonable that some of the older in-production engines in the graphed data entered into service in the mid to late 1980's. Therefore, we believe that it is not reasonable to set a new engine for which an initial type certification application is submitted to the FAA on or after January 1, 2023 meet the proposed anti-backsliding standard that is determined by engines with almost 40 year-old technology. Such a new-production, anti-backsliding standard should be set at a level that reflects, at least, the technical emissions performance that has been demonstrated as achievable by recent current production engines. [EPA-HQ-OAR-2019-0660-0175-A1, pp.4-5]

The NPRM notes that EPA is conducting a demographic analysis, not being conducted as part of this rulemaking, to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity. EPA's June 2016 "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" states that EPA strives to answer three broad questions, one of which is: "Is there evidence of potential EJ concerns for the regulatory option(s) under consideration? Specifically, how are the pollutant(s) and its effects distributed for the regulatory options under consideration?" The use of the traditional LTO volume for assessing and regulating these nvPM emissions may not adequately protect EJ and other communities living in close proximity to the airport because are not distributed uniformly throughout the LTO volume, but are significantly concentrated close to the airport. [EPA-HQ-OAR-2019-0660-0175-A1, p.5] [[This comment can also be found in sections 6.6 and 7.1 of the comment summary.]]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

1) Withdrawing the NPRM until such time as EPA can produce a rule that remedies the defects noted in our comments.

2) File a difference with ICAO to continue use of the existing US regulation based on the ICAO smoke number standard, which the NPRM states provides an equivalent level of protection to the proposed rule.

3) Commence the development of a PM regulation for new production that reflects the significantly reduced PM emissions of contemporary engines, and is fully compliant with the EJ and public participation requirements as well as the Administrative Procedure Act, the relevant Executive Orders on EJ, and OMB Circular A-4. [EPA-HQ-OAR-2019-0660-0175-A1, p.6] [[Part of this comment can also be found in sections 2.5, 11.2, 11.4, and 11.5 of the comment summary]]

---

[1] This is similar to the recent EPA regulation on CO2 emissions that did not require any aircraft currently in production to do anything to reduce its CO2 pollution in order to comply, and required only one potential future aircraft (a possible derivative of the Airbus A380) to do anything to comply with the rule. Airbus has discontinued production of the A380 and is highly unlikely to ever bring it back into production.

[4] fig. IV-1 and fig. IV-2, for nvPM mass and number standards compared to in-production LTO engine emission rates.

Organization: *Aviation-Impacted Communities Alliance (AICA)*

We request EPA to not align with ICAO on the PM10 & PM2.5 aircraft engine standard. This presents a risk that residents impacted by airport operations will not be equally or sufficiently represented when seeking access to their right to a healthful environment through local, state and federal oversight. [EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[The comment can also be found in sections 2.4 and 11.2]]

More stringently regulate CO2 and disregard ICAO recommendations and strengthen all US standards. [EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[This comment can also be found in section 13 of the comment summary]]

Organization: *Barnes, Miki*

I am writing to state my support for the comments submitted by AIRPORT IMPACT RELIEF (AIR INC) on Monday 3/28/22 on the proposed EPA rule: “Control of Air Pollution from Aircraft Engines: Emissions Standards and Test Procedures." [EPA-HQ-OAR-2019-0660-0200, p.1]

Organization: *Batra, Neelesh*

I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: *Beacon Hill Council of Seattle (BHC)*

First of all, we appreciate the United States’ need to align its Emission Standards and Test Procedures with the International Civil Aviation Standards Organization (ICAO). However, the proposed rule is meaningless to us because it:

1. Only regulates new planes, not aircraft already in operation, and even then, requires little if anything beyond what airplane manufacturers are already doing,

2. Discusses at length ultrafine particles, but does not propose a regulation, and

3. It explicitly says that EPA does not anticipate that the rule will improve air quality for those who live near airports (see below quotes), but they are conducting a “demographic analysis” to “inform potential future actions" [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[Portions of this comment are repeated in sections 3.2 and 6.6]]

“…while newer aircraft engines typically have significantly lower emissions than existing aircraft engines, the proposed standards in this action are technology following in order to align with ICAO’s standards and are not expected to, in and of themselves, result in further reductions in PM from these engines. Therefore, we do not anticipate an improvement in air quality for those who live near airports where these aircraft operate.” (Underlined for emphasis. See p. 6327 of the proposed rule.) [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[This comment is repeated in section 6.6]]

“…the proposed in production standards for both PM mass and PM number are levels that all aircraft engines in production currently meet in order to align with ICAO’s standards. Thus, the proposed standards are not expected to result in emission reductions, beyond the business-as usual fleet turnover that would occur absent of the proposed standards. Therefore, we do not anticipate an improvement in air quality for those who live near airports where these aircraft operate.” (Underlined for emphasis. See

p. 6336 of the proposed rule.) [EPA-HQ-OAR-2019-0660-0176-A1, pp.1-2] [[This comment is repeated in section 6.6]]

Organization: *Bucko, Jacob*

My main concern is why we are trying just now to enact policy that has already been adopted on an international level through ICAO, especially if the EPA was involved in the process to pass those standards? These standards are 5 years old at this point and with recent studies that show we are way past the point we initially thought we were in regards to climate change, why adopt this policy, instead of making a more comprehensive bill that goes further than the ICAO bill? This would inspire more innovation for greener aircraft in one of the most technologically advanced nations in the world, which is what we should strive for. I do support this rule and would like to see it enacted but I am hoping for more initiative from the EPA rather than just catching up to the rest of the world. We should not have our planet destroyed for the profits and comfort of lobbyist and billionaires. I am disappointed that we are behind in the first place. [EPA-HQ-OAR-2019-0660-0145, p.1]

Organization: *California Air Resources Board (CARB)*

California and the nation need real limits on aviation emissions and effective ways to cut this pollution yet, as this letter explains, EPA's Proposal misses an opportunity. EPA has the authority to regulate any air pollutant emissions from aircraft engines that cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare.[1] We use this letter to urge EPA to use its authority to reduce particulate emissions beyond what is currently proposed for aircraft engines to protect human health. [EPA-HQ-OAR-2019-0660-0206-A1, p.1]

EPA acknowledges the health and environmental effects of particulate matter (PM) in its Proposal.[2] Nonetheless, EPA has proposed a standard that, on its own admission, does nothing to cut PM pollution from aircraft, even though the agency acknowledges that this pollution is dangerous. EPA's Proposal does nothing to protect public health and the environment beyond the International Civil Aviation Organization (ICAO) technology-following standard. The Clean Air Act preempts state regulation of aircraft emissions that is not identical to federal standards, so California needs EPA to control these emissions.[3] We urge EPA to reconsider this Proposal and take the opportunity to incorporate requirements described in this letter that will achieve much-needed reductions. [EPA-HQ-OAR-2019-0660-0206-A1, p.1]

The public health, environmental, economic, and social impacts from uncontrolled aircraft PM emissions necessitate real and effective control of these emissions. Instead, through this Proposed Standard, EPA intends to codify an approach that is projected to achieve absolutely no additional reductions in PM. Many areas in California are currently classified as "nonattainment" under the National Ambient Air Quality Standards (NAAQS) for PM.[7] California has four areas that do not meet the 12 micrograms per cubic meter (ug/m3) annual PM2.5 standard. These areas include the South Coast Basin and the San Joaquin Valley, which also has the most challenging PM2.5 problem in the U.S. Reducing directly emitted PM2.5 from combustion, such as from aircraft, is critical to improving PM2.5 air quality. Moreover, on March 18, 2022, the Clean Air Scientific Advisory Committee sent a letter to EPA recommending that science supported strengthening the annual PM2.5 NAAQS from 12 ug/m3 to between 8 and 10 ug/m3, further underscoring the necessity of meaningful reductions in aircraft PM2.5 emissions. According to CARB's California Emissions Projection Analysis Model (CEPAM)[8] emission modeling tool (CEPAM 2019 v1.03 – Standard Emission Tool), aircraft are estimated to emit 8.4 tons per day of PM2.5.[9] As a

comparison, in California, all on-road sources contribute 4.4 tons of PM2.5 per day and heavy and medium-duty trucks contribute 2.1 tons of PM2.5 per day.[10] Californians urgently need federal action on aircraft emissions among other federally-regulated sources. [EPA-HQ-OAR-2019-0660-0206-A1, p.3]

In Figure 2 below, the top 19 aircraft visiting California airports in 201916 were compared by PM emission rates. The grey area represents the number of operations, with the Boeing 777-200 Series on the left being the most common with about 9,000 operations. The orange bars represent the average PM value for the engines installed in that aircraft.[17] The horizontal red line represents the PM values for the Boeing 787 Dreamliner, the cleanest and tenth most common aircraft. If all flights were replaced with the cleanest aircraft, PM emissions could be reduced by 67 percent. [EPA-HQ-OAR-2019-0660-0206-A1, p.6] [[See Docket Number EPA-HQ-OAR-2019-0660-0206-A1, p.6 for Figure 2.]]

If the cleanest aircraft were used in California, such as the Boeing 787-10 Dreamliner, PM emissions in South Coast would decrease from 0.731 tons per day to 0.241 tons per day.[18] [EPA-HQ-OAR-2019-0660-0206-A1, p.6]

Please note that these reductions would not require new or risky technologies, but simply choosing to use the cleanest commercial options already available. [EPA-HQ-OAR-2019-0660-0206-A1, p.7]

In Figure 3 below (pulled directly from the Proposal),[19] the proposed standard for PM (by rated output in kilonewton (kN)) is shown for in-production aircraft. The cleaner aircraft in the previous example (the Boeing 787 Dreamliner using the General Electric GEnx-1B engines) is shown in the red circle, with PM emissions well under 200 µg/m3 of exhaust. Meanwhile, the standard at that rated thrust would be 4,000 µg/m3 or over 20 times higher than the cleanest available option. The thin red square shows that there are commercially available, in-production engines with low-PM values at both low and high thrust values, meaning there are cleaner options for aircraft of different sizes and operations in production. The proposed standard neither requires nor even encourages the production and use of these cleaner engine options. [EPA-HQ-OAR-2019-0660-0206-A1, p.7] [[See Docket Number EPA-HQ-OAR-2019-0660-0206-A1, p.7 for Figure 3.]]

IX. Conclusion

EPA has an opportunity to provide additional and necessary PM reductions from aircraft, which only the federal government can regulate. The Proposed Standard must consider all options described above. Simply copying ICAO's technology-following rules will not achieve the magnitude of emissions reductions that are urgently needed to protect public health. [EPA-HQ-OAR-2019-0660-0206-A1, p.14]

We urge EPA to take this opportunity to pursue meaningful emission standards to reduce real-world emissions in California's communities and around the country. We look forward to assisting EPA in any way, including technology assessments, health risk analysis, emissions inventory, and data analysis. CARB staff is committed to supporting EPA in efforts to reduce emissions from the aviation sector. California urgently needs meaningful actions by our federal partners to ensure that all people in all areas of our State can breathe clean air. [EPA-HQ-OAR-2019-0660-0206-A1, p.14]

---

[1] Clean Air Act sec. 231, 42 U.S.C. § 7571(a)(2)(A).

[2] Control of Air Pollution From Aircraft Engines: Emission Standards and Test Procedures, Proposed Rule, 87 Fed. Reg. 6324 (Feb. 3, 2022).

[3] Clean Air Act sec. 233, 42 U.S.C. § 7573.

[7] Air Quality Planning and Science Division, CARB, Area Designations for National Ambient Air Quality Standards PM2.5, updated October 2018, available at https://www.arb.ca.gov/desig/adm/2018/fed_pm25.pdf?_ga=2.244634114.669552627.1644859691-927191194.1614915013.

[8] CARB, Criteria Pollutant Emission Inventory Data, available at https://ww2.arb.ca.gov/criteria-pollutant-emission-inventory-data.

[9] CARB, CEPAM2019v1.03 - Standard Emission Tool, available at https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool.

[10] CEPAM: CALIFORNIA 2019 OZONE SIP BASELINE EMISSION PROJECTION

[16] FAA, Terminal Area Forecast (TAF), updated March 2022, available at https://www.faa.gov/data_research/aviation/taf/.

[17] EASA, ICAO Aircraft Engine Emissions Databank, available at https://www.easa.europa.eu/domains/environment/icao-aircraft-engine-emissions-databank.

[18] CARB, CEPAM 2019 v 1.03 - PM2.5 tpd, available at https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool, applied 67 percent reduction to the projected 2022 PM2.5 emissions in South Coast.

[19] EPA, Control of Air Pollution From Aircraft Engines: Emission Standards and Test Procedures, available at https://www.govinfo.gov/content/pkg/FR-2022-02-03/pdf/2022-01150.pdf.

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

The Proposed Rule understates its severe environmental justice impacts,[1] fails to examine feasible and cost-effective reductions far beyond those achieved by the proposed standards, and elevates an ill-defined, non-statutory interest in "international harmonization" above EPA's core statutory obligation to protect the public health and welfare against dangerous aircraft pollution. Because the rule as proposed is unlawful, arbitrary, and capricious, the Commenting States urge EPA to issue a revised Notice of Proposed Rulemaking that adequately addresses these core concerns. [EPA-HQ-OAR-2019-0660-0203-A1, p.4]

First, as explained in Section II, the health and environmental effects of particulate matter (PM) emissions from aircraft—and their disproportionate impact on environmental justice communities that live, work, and go to school near airports—necessitate prompt action to reduce PM emissions from aircraft. [EPA-HQ-OAR-2019-0660-0203-A1, p.4] [[Section II of this comment is presented and addressed in Sections 6 and 11]]

The substantive standards that EPA proposes to adopt—the 2017 and 2020 PM standards developed by the International Civil Aviation Organization (ICAO)—are far less stringent than what existing engine technologies already achieve and would result in no PM reductions at all compared to current levels. In fact, EPA apparently has not even considered any standard of emission control that would reduce PM,

even though the record it has compiled shows how aircraft PM emissions endanger public health and welfare and disproportionately burden environmental justice communities. [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5]

Accordingly, the Commenting States request that EPA rescind the Proposed Rule and issue a revised Notice of Proposed Rulemaking that assesses all of the environmental justice implications of aircraft emissions, evaluates the full range of feasible options for effective emissions control, and proposes emission standards that actually reduce dangerous PM emissions from aircraft. [EPA-HQ-OAR-2019-0660-0203-A1, p.5]

Second, EPA has not offered any evidence or even reason to believe that zero-benefit standards are necessary for the U.S. aviation industry to "remain competitive in the global marketplace." Id. Again, EPA's reasoning makes sense only insofar as it justifies adopting PM standards no less stringent than ICAO's: if the United States did not do so, it "would not be able to certify aircraft engines to the PM standards" and aircraft engine manufacturers might be forced to seek foreign certifications to market and sell their products. Id. [Id. at 6337. Environmental Protection Agency's (EPA) proposed standards for particulate matter emissions from aircraft, titled Control of Air Pollution from Airplanes and Airplane Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6324 (Feb. 3, 2022) ("Proposed Rule")] But EPA offers no evidence that if the United States certified to more stringent standards, manufacturers would need to seek foreign certification, or would face any other competitive disadvantage.[62] And ultimately, EPA's mission is to protect the public against dangerous pollution from aircraft (and other sources), not to protect the competitiveness of U.S. aircraft engine manufacturing. While EPA must take into account the impact of its regulations on industry, any consideration of harm to industry must be based on actual evidence and must be weighed against the very real, concrete harms to public health and the environment acknowledged in the Proposed Rule. [EPA-HQ-OAR-2019-0660-0203-A1, pp.22-23]

Third, the Proposed Rule has no actual anti-backsliding benefits, since most in-production engines perform far better than any of the ICAO PM Standards. Id. at 6338-41 (Figures IV-1 to IV-3) [Id. at 6338-41. (Figures IV-1 to IV-3) Environmental Protection Agency's (EPA) proposed standards for particulate matter emissions from aircraft, titled Control of Air Pollution from Airplanes and Airplane Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6324 (Feb. 3, 2022) ("Proposed Rule")]. Manufacturers thus have considerable room to backslide on PM emissions even while complying with the Proposed Rule. Thus, the Proposed Rule fails to "capture the technological advances made in the control of emissions" or "reflect[] the current state of technology," and its purported anti-backsliding benefits are illusory. Id. at 6337. [Id. at 6337. Environmental Protection Agency's (EPA) proposed standards for particulate matter emissions from aircraft, titled Control of Air Pollution from Airplanes and Airplane Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6324 (Feb. 3, 2022) ("Proposed Rule")] [EPA-HQ-OAR-2019-0660-0203-A1, p.23]

Fourth, EPA argues vaguely that it should "gain experience from the implementation of these [PM] standards before considering whether to adopt more stringent [PM] mass and/or number standards" but does not explain what this means, or why such experience is needed. Id. There is no question the PM standards are technologically feasible. Id. at 6347-49. The test and measurement procedures are sufficiently well defined for EPA to apply them to industry with less than a year of lead time. Id. at 6325 (proposing Jan. 1, 2023 compliance date for PM standards). If EPA intends to use any element of

uncertainty about the feasibility of the proposed PM standards to counterbalance the overwhelming health, environmental, and technical evidence favoring protective standards, it must identify that uncertainty and explain how more experience could resolve it. [EPA-HQ-OAR-2019-0660-0203-A1, p.23]

Fifth, and finally, EPA claims that limiting its consideration to the ICAO PM Standards would have benefits for future international cooperation on aircraft emission standards because, "[h]aving invested significant effort to develop these standards and obtain international consensus for ICAO to adopt these standards, a decision by the United States to deviate from them might well undermine future efforts by the United States to seek international consensus on aircraft emissions standards." Id. at 6337. [Id. at 6337. Environmental Protection Agency's (EPA) proposed standards for particulate matter emissions from aircraft, titled Control of Air Pollution from Airplanes and Airplane Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6324 (Feb. 3, 2022) ("Proposed Rule")] Again, this rationale is a sound basis for adopting at least the ICAO PM Standards, but EPA offers no reason why exceeding such standards would undermine future efforts. To the contrary, more stringent domestic standards enhance the United States' credibility in negotiations for tighter ICAO standards, since they demonstrate such standards' feasibility, their effectiveness on a major part of the global aviation industry, and U.S. leadership on reducing harmful aviation emissions. [EPA-HQ-OAR-2019-0660-0203-A1, pp.23-24]

For the foregoing reasons, the Commenting States request that EPA rescind the Notice and initiate a proper Section 231 rulemaking. That rulemaking must be based on the full range of technologically feasible control technologies and other measures for aircraft PM emissions, and must result in reductions that address the significant impacts on environmental justice communities nationwide. [EPA-HQ-OAR-2019-0660-0203-A1 p.28]

---

[1] Environmental justice is defined by EPA as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin or income with respect to development, implementation, and enforcement of environmental laws, regulations and policies." EPA, EPA-300-B-1-6004, EJ 2020 ACTION AGENDA: THE U.S. EPA'S ENVIRONMENTAL JUSTICE STRATEGIC PLAN FOR 2016-2020, at 1 (Oct. 2016) [hereinafter EJ 2020 ACTION AGENDA]. For the purpose of this comment, the term "environmental justice community" refers to a community of color or community experiencing high rates of poverty that is overburdened by environmental pollution, and the accompanying harms and risks from exposure to that pollution, because of past or current unfair treatment.

[62] In a statement reported by Reuters, explaining why EPA decided not to revisit the 2021 aircraft greenhouse gas rule, an EPA official suggested tightening aircraft standards beyond ICAO's stringency would be a "Pyrrhic victory" if the aviation industry "avoided complying by certifying their engines via other governments." D. Shepardson, "U.S. EPA will not rewrite airplane emissions rules finalized under Trump," Reuters (Nov. 15, 2021), https://www.reuters.com/business/environment/us-epa-will-not-rewrite-airplane-emissions-rules-finalized-under-trump-2021-11-15/. To the extent EPA intends to rely on any such rationale, it is obligated to give clearer notice of it than the Proposed Rule does, and to offer evidence to support the rationale beyond speculation. Given that the Proposed Rule identifies certain costs that engine manufacturers would face in seeking foreign certification and the potential delays and lack of resources faced by foreign certifying authorities, 87 Fed. Reg. at 6337, it is far from certain that manufacturers would choose this route and evade compliance with standards that are demonstrably feasible and cost-effective.

Organization: *Center for Biological Diversity*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 19.]

To begin, the rule does nothing at all to improve air quality, even though this is the ultimate purpose of the Clean Air Act and one of the primary missions of EPA. Instead, it simply adopted the standards of the International Civil Aviation Organization, or ICAO, which were written in collaboration with industry groups. ICAO standards intentionally lag behind current pollution control technologies, and they allow emissions to rise as air traffic increases. Technology already exists to cut PM pollution from planes, and not only did EPA not require such technologies to be used. It did not even undertake any analysis of those options.

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 20-21.]

By setting a rule that will govern many years into the future, EPA is essentially throwing in the towel when it comes to improving PM emissions in future years. The rule refuses to reduce particulate emissions from new planes beyond what manufacturers are already doing, and it does not regulate in-service planes. ICAO also estimates that airplane traffic levels will rebound quickly following the COVID-19 pandemic and more than double in the coming decades. This means emissions are likely to increase even further as time goes on, and this rule makes no effort to counteract that trend.

Organization: *Center for Biological Diversity and Friends of the Earth*

EPA has rubberstamped international standards that intentionally lag behind current pollution control technologies, making no effort to study alternatives that would decrease emissions. [EPA-HQ-OAR-2019-0660-0189-A1, p.1] [[The comment is repeated in section 11.1]]

Furthermore, EPA mischaracterizes the proposed standards as "anti-backsliding." EPA states that the ICAO standards would "prevent aircraft engine PM levels from increasing beyond their current levels."[82] It doesn't make sense for EPA to assume that future in-production engines will suddenly be higher emitting and generate more pollution than engines in-service today so as to lead to backsliding. With all in-production engines already meeting the proposed emission limits for in-production engines and most meeting the limits for new engines, and with many airplane engines meeting the recommended standards for new planes and new types of planes by a "considerable margin," no backsliding could reasonably occur.[83] The proposed standards cannot be touted as "anti-backsliding" when current conditions would not change absent these standards. [EPA-HQ-OAR-2019-0660-0189-A1, p.10]

Another reason why the proposed standards cannot be characterized as "anti-backsliding" is because they do not consider the anticipated increase in air traffic that will cause an increase in emissions. The narrow application of the proposed standards to aircraft engines does not account for the cumulative impact of increased air traffic. [EPA-HQ-OAR-2019-0660-0189-A1, p.10]

At a minimum, EPA should set standards that reduce emissions using readily-available technology. The Proposal acknowledges that all in-production engines already meet the proposed emission limits for in-production engines and most meet the limits for new engines.[98] In other words, technology that reduces more emissions than the proposed standards is already widely available and in commercial use. By

setting standards that the vast majority of in-production engines already meet, EPA could presumably reduce emissions from new planes with little cost. [EPA-HQ-OAR-2019-0660-0189-A1, p.13]

In addition to setting standards based on available engine technology, EPA has both the authority and the obligation to consider strong, technology-forcing standards that go further. [EPA-HQ-OAR-2019-0660-0189-A1, p.13]

C. Standards should decrease emissions over time and should be technology forcing.

EPA has also previously discussed the option of creating "a declining fleet average emissions program," which would consider efficiency gains from improved "engine, aircraft and operational greenhouse gas control[s]."[118] This type of emissions program is critical for actually decreasing emissions over time. EPA admits that there will be no emission reductions from the proposed rule.[119] Worse, because the standards apply to emissions at individual engines, the rule will do nothing to curb emissions that will continue to rise with increased passenger and cargo traffic. To abate emissions, EPA needs to set a cap across the sector. [EPA-HQ-OAR-2019-0660-0189-A1, p.16]

That fleetwide emissions cap should decrease over time to encourage retirement of the most polluting aircraft and continue to push technological innovation. Congress intended the Clean Air Act to be a technology-forcing statute. The statute itself provides that standards should take effect "after such period as [EPA] finds necessary . . . to permit the development . . . of the requisite technology."[120] Thus, as EPA explained in its first rulemaking under Section 231, "the standards set by EPA may reflect technology which may reasonably be obtained within a given time frame but which is not yet available."[121] EPA in 2005 again confirmed its authority to implement a "technology-forcing standard," and the agency need not "demonstrate that a [necessary] technology is currently available universally or over a broad range of aircraft" to require implementation of its standards, so long as "sufficient lead time" is provided.[122] EPA should have analyzed what suite of technologies are available now, and what technologies could become readily deployed in the coming years. [EPA-HQ-OAR-2019-0660-0189-A1, p.16]

VII. EPA Should Replace the Proposal with a Rule that Complies with Section 231 and Basic Requirements of the Administrative Procedure Act.

The Proposal violates Section 231 of the Clean Air Act because it fails to reduce particulate matter emissions from aircraft when cost-effective technology is available to safely do so. EPA did not even consider the statutory factors laid out in Section 231 and made no attempt to look at any alternative. Instead, it relied on factors outside the statute. Adoption of ICAO's emission standards was the purpose of the regulation, and the description of those standards was the entirety of the agency's analysis. The flaws in this approach cannot be remedied in a final rule. EPA must therefore replace the Proposal with one that meets its duties under the Clean Air Act to reduce emissions from aircraft and protect the public health and welfare. [EPA-HQ-OAR-2019-0660-0189-A1, p.17]

---

[82] 87 Fed. Reg. at 6,326.

[83] Id. at 6,338, 6,339, 6,341, 6,348.

[98] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures Proposed Rule, 87 Fed. Reg. 6,324, 6,338, 6,339, 6,341 (Feb. 3, 2022).

[118] Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,472-73 (July 30, 2008). Section 231's language is similar to that in Section 202, under which EPA has historically employed a fleet-wide averaging approach to regulate of emissions from new motor vehicles. The D.C. Circuit has upheld this approach as lawful, emphasizing the "absence of any clear evidence that Congress intended to prohibit averaging" under section 202 and the strong policy arguments for adopting this approach. See NRDC v. Thomas, 805 F.2d 410, 425 (D.C. Cir. 1986).

[119] 87 Fed. Reg. at 6,347.

[120] 42 U.S.C. § 7571(b) (1990).

[121] Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. at 19,089.

[122] Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. at 69,676 ("forward-looking language" of section 231 does not preclude EPA from setting a technology-forcing standard, and "the Agency is not limited in identifying what is 'technologically feasible' as what is already technologically achieved").

Organization: *Center for Biological Diversity et al.*

Instead, it simply adopted the standards of the International Civil Aviation Organization ("ICAO"), which were written in collaboration with industry groups. ICAO's standards intentionally lag behind current pollution control technologies,[2] and they allow emissions to rise as traffic increases. [EPA-HQ-OAR-2019-0660-0185-A1, p.1]

---

[2] Id. at 6,349.

The harmful impacts of particle pollution fall most heavily on communities of color and low-income communities that disproportionately live near airports. These communities often already bear the brunt of climate change impacts and compounding air pollution from nearby industry and roadways. The Proposed Rule does not reduce particulate emissions from new planes beyond what manufacturers are already doing and does not regulate in-service planes.[9] ICAO and aviation industry groups also estimate that airplane traffic levels will rebound quickly following the COVID-19 pandemic and more than triple in the coming decades.[10] This means emissions are likely to increase with rising traffic, and the rule makes no effort to counteract this trend. With this Proposed Rule, EPA allows for further human suffering in already overburdened communities. [EPA-HQ-OAR-2019-0660-0185-A1, p.2] [[This comment is repeated in 6.6]]

---

[9] 87 Fed. Reg. at 6,347 (particulate matter standards are "technology-following").

[10] International Civil Aviation Organization, ICAO global environmental trends – Present and future aircraft noise and emissions, A40-WP/54 (2019), https://www.icao.int/Meetings/A40/Documents/WP/wp_054_en.pdf; International Air Transport Association and Tourism Economics, Air Passenger Forecasts: Potential Paths for

Recovery into the Medium- and Long-run (2020), https://resources.oxfordeconomics.com/hubfs/Webinar%20presentations/Air-Passenger-Forecasts-potential-pathsfor-recovery-into-medium-and-long-run.pdf.

Organization: *Environmental Defense Fund (EDF)*

However, the scope of the PM emission standards and test procedures proposed by EPA is constrained to combustor technologies and their main goal is to replace the existing smoke standard for aircraft, a standard from 1981. [EPA-HQ-OAR-2019-0660-0207-A1, p.2]

In spite of four decades of technological improvements and growing awareness of ultrafine PM impacts on public health, the proposed standards will not reduce the impact of nvPM beyond business as usual. Indeed, the maximum nvPM mass concentration was developed based on a statistical relationship between nvPM mass concentration and the smoke number to ensure that if an engine passes the 1981 smoke number standard, by design of the regulatory level chosen by the International Civil Aviation Organization (ICAO), it should also pass the mass concentration limit. [EPA-HQ-OAR-2019-0660-0207-A1, p.2]

The only benefit from the proposed rule comes from the nvPM mass and number standard for engines produced on or after January 1, 2023, as it represents an anti-backsliding provision that will avoid, e.g., potential trade-offs with NOx emissions that result in an increase in nvPM emissions in the future. [EPA-HQ-OAR-2019-0660-0207-A1, p.2]

To date, no aircraft gas turbine engine has been designed to lower PM emissions.[9] Instead, new technologies (lean-burn and advanced rich-burn combustors) directed to reducing NOx appear to also offer significant reductions in nvPM mass and number compared to most other in-service engines.[10] These potentially significant reductions will be achieved by all new aircraft manufactured on or after January 1, 2023, but, as noted in the proposed rule, the standards in question are not expected to, in and of themselves, result in further reductions in PM from these engines. Furthermore, the proposed rule is not intended to have an impact on the nvPM emissions from the legacy aircraft without lean-burn and advanced rich-burn combustors. [EPA-HQ-OAR-2019-0660-0207-A1, pp.2-3]

EPA has the statutory authority to adopt a much more stringent nvPM emissions standard. Thus, EPA must act swiftly to control emissions from airplane engines by setting standards and test procedures as required in Section 231 of the Clean Air Act (CAA). We urge EPA to adopt a much more protective standard to achieve real benefits and actually address the danger posed to public health and welfare by air pollution form aircraft engine emissions. [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

However, these additional analyses will not change the need to act now to protect vulnerable communities and thereby address the disproportionally high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities as well as the economic challenges of such impacts. [EPA-HQ-OAR-2019-0660-0207-A1, p.5] [[Additional portions of this comment are addressed in sections 6.6 and 11.5]]

Moreover, it is essential to set stringent standards to drive new technologies to reduce total emissions and warming pollution including from nvPM, which the current proposed standards are too weak to do. [EPA-HQ-OAR-2019-0660-0207-A1, p.7]

---

[9] Jacob and Rindlisbacher, 2019, (op. cit.)

[10] ICAO, 2019, Independent Expert Integrated Technology Goals Assessment and Review for Engines and Aircraft (DOC 10127). Manual. Available at https://store.icao.int/en/independent-expert-integrated-technology-goals-assessment-andreview-for-engines-and-aircraft-english-printed

V. EPA must set stringent standards in order to drive development of long-lived capital stock

Aircraft, like power plants, have lifecycles measured in decades. Immediately prior to the disruption of the Covid-19 pandemic, U.S. airlines were expected to invest in over 9,000 new aircraft, and globally airlines were expected to invest in over 44,000 new aircraft in the coming years.[82] Rapid action to set stringent standards for these long-lived investments is critical. The resources required to design a new jet engine are considerable – historically, up to a decade and investments in the billions have been needed.[83] As EPA proceeds with its rulemaking, it is essential to set stringent standards to drive new technologies to reduce emissions and drive new technologies in an industry characterized by long-lived capital stock. [EPA-HQ-OAR-2019-0660-0207-A1, p.12]

VI. Conclusion

EPA is not only empowered, but also required under the law to promulgate standards to address the polluting effects of aircraft engine emissions. EPA must ensure that its standards are protective and designed to avert aviation's harmful air quality impacts; incentivizing necessary technological innovation, and catalyzing emissions reductions demanded by science and the interests of equity. EPA must act swiftly to control pollution from airplane engines by setting emission standards and test procedures as required by section 231 of the CAA. We urge EPA to work with FAA to strengthen the proposed rule so as to effectively address the danger posed to public health and welfare by air pollution from aircraft engine emissions, and to consider the risks to the aviation sector and to the American people posed by climate change. Particularly in this time of crisis, the United States aviation industry and the country as a whole needs stringent standards that will actually address the public health and climate crisis we are facing. Meeting this challenge, and utilizing the flexibility designed into the CAA, will enable EPA to meet its statutory requirements, protect people of color and low-income populations who are disproportionately affected by aviation pollution, and spur the creation of many good jobs in the process. [EPA-HQ-OAR-2019-0660-0207-A1, pp. 12-13]

---

[82] Boeing, Commercial Market Outlook, 2019-2038, available at https://www.boeing.com/commercial/market/commercial-market-outlook/#/interactive-forecast (last visited Sept. 11, 2020).

[83] *See* 80 Fed. Reg. 37792, n.211.

Organization: Gibbons, Laura

So why aren't you making a regulation that would reduce emissions? How is that consistent with EPA policy for Environmental Justice or for not adversely affecting safety? [EPA-HQ-OAR-2019-0660-0164, p.1]

Any regulations you make must reduce harm to airport communities, including damage from ultrafine particles. Adopting ICAO standards which would keep the per-plane emissions the same is a net increase

in harm, given the yearly increase in flights. [EPA-HQ-OAR-2019-0660-0164, p.1] [[A portion of this comment is repeated in section 6.2.]]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*
EPA's proposal would impose standards that have no effect on emissions and require no technological improvements; instead, it would adopt international standards that themselves are "technology-following" and can already be met by all in-production engines.[3] [EPA-HQ-OAR-2019-0660-0182-A1, p.1]

In the Proposed Rule, EPA seeks to "match" particulate matter standards set by the International Civil Aviation Organization ("ICAO")[9] and proposes standards that are "equivalent in scope, stringency, and effective date" as those set by ICAO. EPA claims that harmonizing with ICAO is necessary to provide international uniformity and regulatory certainty, and that deviation from the ICAO standards would undermine future efforts to obtain international consensus.[10] Rather than seeking to reduce emissions or balance other relevant factors related to "public health or welfare" as EPA is required to do,[11] ICAO "seeks to capture the technological advances made in the control of emissions through the adoption of anti-backsliding standards reflecting the current state of technology."[12] Thus, the harmonized standards EPA proposes to adopt are "technology-following"; that is, the standards can already be met by all in-production engines.[13] In its discussion adopting ICAO's standards, EPA does not consider other relevant factors, such as the public health benefits from reducing PM emissions from aircraft or the technological feasibility of methods to reduce PM emissions. Nor does it consider the evidence of foreign reciprocity driven by strong domestic climate policies.[14] [EPA-HQ-OAR-2019-0660-0182-A1, p.2]

EPA should evaluate a full suite of regulatory alternatives, including more stringent standards that would reduce emissions. Rather than simply deferring to an international body's technology-following standards, EPA should exercise its broad discretion under the Clean Air Act to consider technology-forcing standards. EPA should then presumptively adopt the alternative that maximizes societal net benefits. [EPA-HQ-OAR-2019-0660-0182-A1, p.1]

"… EPA fails to consider any policy that will "appropriately benefit . . . disadvantaged, vulnerable, or marginalized communities," since it merely proposes technology-following international standards without considering any emission-reducing alternatives.[33] [EPA-HQ-OAR-2019-0660-0182-A1, p.4]

---

[3] 87 Fed. Reg. at 6349.

[9] 87 Fed. Reg. at 6325–26..

[10] *Id*. at 6337.

[11] 42 U.S.C. § 7571(a)(2)(A).

[12] 87 Fed. Reg. at 6326.

[13] *Id*. at 6349.

[14] See, e.g., Trevor Houser & Kate Larsen, Rhodium Grp., Calculating the Climate Reciprocity Ratio for the U.S. (2021), https://perma.cc/7MJ8-DN23 (conservatively estimating that for every ton the United States pledged to reduce, other countries had collectively pledged to reduce 6.1–6.8 tons in return); see also Exec. Order No 13,990 § 6(d) ("Our domestic efforts must go hand in hand with U.S. diplomatic engagement. Because most greenhouse gas emissions originate beyond our borders, such engagement is more necessary and urgent than ever. The United

States must be in a position to exercise vigorous climate leadership in order to achieve a significant increase in global climate action and put the world on a sustainable climate pathway.").

[33] Memorandum on Modernizing Regulatory Review, supra note 29, § 2(b)(ii).

Organization: *Kroeker, Anne*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 56-57.]

Going with the standard low-level international standard for engines in the future really doesn't address the issues that also Debi Wagner underscored and many of the others have that we already have.

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA supports EPA adoption of more stringent federal PM standards to address aircraft emissions of PM; however, simply adopting the technology-following ICAO standards, as EPA proposes, would fall far short of what is necessary and feasible. [EPA-HQ-OAR-2019-0660-0177-A1, p.1]

The proposed standards, while more stringent than those that currently exist, would do nothing to improve air quality and protect public health. [EPA-HQ-OAR-2019-0660-0177-A1, p.1]

EPA is not limited to merely adopting the ICAO PM standards and should instead adopt technology-forcing, rather than technology-following, PM emission standards that will result in meaningful and effective reductions in aircraft PM emissions that will be more protective of public health and welfare. State and local air agencies depend on EPA to demonstrate this leadership because they do not have authority to directly regulate aircraft emissions beyond standards adopted by EPA. [EPA-HQ-OAR-2019-0660-0177-A1, p.1]

I. The Proposed Standards Fall Short of What Is Necessary and Feasible

There is a clear and significant need to support additional PM2.5 emission reductions in the U.S. and this proposed aircraft rule provides an opportunity to help address that need. However, in its NPRM, EPA sacrifices this opportunity and, instead, proposes to conduct little more than an administrative exercise to codify the technology-following ICAO standards, which EPA admits in the NPRM are not intended, nor expected, to produce any emission reductions beyond business-as-usual (BAU) fleet turnover that would occur anyway, without the proposed standards.[2] [EPA-HQ-OAR-2019-0660-0177-A1, pp.1-2]

They would not address the persistent national problem of nonattainment of the National Ambient Air Quality Standards (NAAQS) for PM nor would they alleviate disproportionate environmental burdens that continue to be placed on vulnerable communities. [EPA-HQ-OAR-2019-0660-0177-A1, p.1]

Today, tens of millions of people continue to live in areas of the country that fail to attain the current daily and annual PM NAAQS. [EPA-HQ-OAR-2019-0660-0177-A1, p.2]

EPA must also adopt more stringent aircraft PM standards to remain faithful to the Administration's, and President Biden's in particular, environmental justice mission and commitments.[4] [EPA-HQ-OAR-2019-0660-0177-A1, p.2] [[This comment can also be found in section 11.5 of the comment summary]]

There is already overwhelming evidence to support EPA adopting more protective, technology-forcing federal standards and policies now and the agency must appropriately respond. [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

III. NACAA's Recommendations

First, to achieve the necessary reductions from the aircraft targeted by this proposal, EPA should adopt federal PM emission standards for new type aircraft designs and in-use production models that are more stringent than ICAO's BAU standards – that are technology forcing rather than technology following – to ensure adequate and appropriate regulation of airplane PM emissions that will yield critically needed reductions in PM and cleaner air. This is especially important considering the long operational life of modern aircraft. [EPA-HQ-OAR-2019-0660-0177-A1, p.4]

---

[2] Id. at 6,347: "Due to the technology-following nature of the PM standards, the proposed in-production and new type standards would not result in emission reductions below current levels of engine emissions. The proposed in-production standards for both PM mass and PM number, which would be set at levels where all in-production engines meet the standards, would not affect any in-production engines . . . .Thus, the proposed standards are not expected to produce any emission reductions, beyond the business-as-usual fleet turn over that would occur absent of the proposed standards. The EPA projects that all future new type engines would meet the proposed new type standards. There are a few in-production engines that do not meet the proposed new type standards, but since in-production engines would not be subject to these new type standards, engine manufacturers would not be required to make any improvements to these engines to meet the standards. Therefore, there would be no emission reductions from the proposed new type standards."

[4] *See for example*, President Biden's "Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" (EO 13990, January 20, 2021) and "Executive Order on Tackling the Climate Crisis at Home and Abroad" (EO 14008, January 27, 2021).

Organization: *Rosetta Advisory Services, Brussels*

The EPA is to be congratulated for openly recognizing that after a decade's work instigated and promoted by USG, adopting into US domestic law ICAO NvPM jet engine standards "are not expected to produce any emission reductions, beyond the business-as-usual fleet turn over that would occur absent of the proposed standards"…[that] "all future new type engines would meet the proposed new type standards"... "therefore, we do not anticipate an improvement in air quality for those who live near airports where these aircraft operate"…[and] "these proposed standards would impose no additional burden on manufacturers". This is possibly the first time ever that the USG has acknowledged in public what we all already know; that ICAO environmental standards have no impact whatsoever on reducing emissions – other than to possibly prevent backsliding – nor on the business-as-usual technical activities of the aviation industry. [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

Both the NvPM and aircraft CO2 EPA dockets raised and dismissed the option of implementing less stringent or no standards in US law – because US manufacturers would then need to certify in other jurisdictions - and at considerable additional cost - in order to operate internationally. The EPA dockets also looked at "going beyond" ICAO standards in US domestic law – but dismissed doing so in favour of "international uniformity and regulatory certainty". In Europe, the 2018 revamp of the Basic Regulation governing aircraft certification via EASA – the EU's FAA equivalent – reconfirmed in law the extraordinary prohibition on the EU "going beyond" emission stringencies already agreed at ICAO. This EU prohibition serves as a de facto defender of "do nothing" emission standards and likely deters moves for greater ambition elsewhere - the practical impact of the US acting unilaterally to "go beyond," would

be to impose more onerous and costly emission standards solely on US aircraft operating domestically. US manufactured aircraft/engines could operate freely internationally through recourse to EASA or other regulatory bodies certified to the inferior minimum ICAO standards. ICAO environmental standards which EASA adopts automatically are of course also subject to the de facto prior blessing of the global aircraft manufacturing duopoly. [EPA-HQ-OAR-2019-0660-0181-A1, p.2]

Organization: *Service Employees International Union (SEIU)*

SEIU files this comment because our members who work at and live near airports are directly impacted by particulate matter emissions from aircraft and pollution in general from airports. Our members and their communities will have to live with the emissions allowed by the Agency's rule for years to come. In proposing a rule that fails to meaningfully restrict emissions on new engines and takes no action on the emissions of engines already in service, the EPA's proposed rule is insufficient to protect the public health and does not live up to the mandates set forth for EPA in statute and Executive Orders. While we appreciate the EPA taking on this issue, we call on the Agency to correct these deficiencies before finalizing the rule. [EPA-HQ-OAR-2019-0660-0191-A1, p.2] [[This comment is repeated in sections 3.2, 6.6, and 11.5]]

II. The Proposed Rule Will Not Reduce Emissions

Our most significant concern with the rule as proposed is that it will have no actual impact on particulate matter emissions from aircraft engines. As the Agency states in the documentation accompanying the proposed rule, the EPA's standards are "technology following" and "would not reduce aircraft PM emissions below current levels."[13] [EPA-HQ-OAR-2019-0660-0191-A1, pp.3-4]

The agency further states that all aircraft engines in production currently meet the "in production" standards, and that therefore the proposed rules are not expected to result in emission reductions beyond "business-as-usual fleet turnover that would occur absent of the proposed standards." As a result, no improvement in air quality is expected.[14] [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

The stricter, "new type" standards are also predicted to have no impact. While these standards do not apply to engines already in production, the standards are lax enough that many in-production engines already meet the "new type" standard.[15] For those engines that don't meet the new type standard, most have newer replacement models that do. Again, the EPA expects the new type standard would not result in any emission reductions.[16] [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

While harmonization with the International Civil Aviation Organization standard and the prevention of backsliding may be reasonable goals, the EPA is missing an opportunity to lead by creating a technology-forcing standard that will protect the health of airport workers and those who live near airports by reducing emissions. [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

V. EPA Should Propose a Technology-Forcing Rule with Application to In-Service Engines

For all of the reasons outlined above, the standard as proposed is insufficient and fails to protect airport workers and the largely low-income and communities of color near airports. While we appreciate the EPA for taking on this important issue, stronger standards are necessary. [EPA-HQ-OAR-2019-0660-0191-A1, p.5]

[13] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures; 87 Fed. Reg. 6324, 6329 (February 3, 2022).

[14] *Id*. at 6336.

[15] *Id*. at 6347.

[16] *Id*.

Organization: Sierra Club

Section 231 of the Clean Air Act, 42 U.S.C. § 7571, requires EPA to set standards to reduce emissions of dangerous pollutants from aircraft.[1] Congress's purpose in enacting the Clean Air Act was to promote "pollution prevention," which it defined as the "reduction or elimination, through any measure, of the amount of pollutants produced or created at the source."[2] Because aircraft emit vast quantities of particulate matter that harm public health and welfare, EPA must act to reduce this pollutant to mitigate the harms it causes. Yet, even though the agency reports on technology that could reduce PM emissions by up to 25 percent over the status quo, its proposed rule leaves emissions unabated and fails even to consider whether they can be reduced. The Proposal is all but silent about the need to do so and what damage the failure to take action does to public health and welfare. [EPA-HQ-OAR-2019-0660-0184-A1, p.1]

Instead, EPA proposes to adopt, wholesale, PM emission standards and test procedures set by the International Civil Aviation Organization ("ICAO"). ICAO intentionally designed them to be technology-following, leaving emissions unabated, and imposing no new costs or obligations of any kind on industry. This decision jettisons EPA's duties under Section 231 of the Clean Air Act, substituting the agency's own, extra-statutory policy choices that have no statutory support and that, as EPA applies them, nullify the Clean Air Act's purpose. For these reasons, the Proposal is unlawful, arbitrary and capricious. EPA must replace the Proposal and commence its congressionally-mandated task of analyzing how to bring down PM emissions from aircraft. [EPA-HQ-OAR-2019-0660-0184-A1, p.1]

The instant Proposal is EPA's first rulemaking concerning aircraft PM emissions since the 1980s—but even though the enormous harm done by PM emissions is now much more thoroughly understood, the Proposal turns away from any attempt to reduce them. [EPA-HQ-OAR-2019-0660-0184-A1, p. 4]

As EPA states repeatedly, ICAO's PM standards are "intentionally" technology following, do not result in any PM emission reductions, and impose no costs. E.g., id at 6349. EPA also admits that it does not anticipate the standards to result in the "improvement in air quality" for those living in the vicinity of airports. Id. at 6336. The agency notes that this result is an intended feature—not a defect—of the ICAO standards it proposes to adopt: because CAEP's definition of technical feasibility is "technology demonstrated to be safe and airworthy and available for application over a sufficient range of newly certified aircraft," id. at 6329, "[t]his interpretation resulted in all previous ICAO emission standards . . . being anti-backsliding standards (i.e., the standards would not reduce aircraft PM emissions below current levels of engine emissions), which are technology following." Id. Notably, even the "anti-backsliding" rationale is unsupported: as aircraft manufacturers tout slight but continual business-as-usual efficiency improvements, the assumption that intentionally technology-following standards would have any anti-backsliding effects has no reasonable basis. In short, ICAO's PM standards are set at a level

that all new-type and in-production airplane engines already meet, do not reduce emissions, and place no burdens on manufacturers. E.g., id.; id. at 6336. EPA now proposes to make these ineffective standards its own. [EPA-HQ-OAR-2019-0660-0184-A1, p.5]

The agency claims that it considered "the importance of both controlling PM emissions and international harmonization of aviation requirements" when "evaluating whether to propose more stringent standards." 87 Fed. Reg. at 6326 (emphasis added), 6337. But that is not so. Though EPA devotes several pages of the Proposal to what appears to be a paraphrasing of some of Section 231's factors, id. at 6347-49, this purported "consideration" is no more than a post hoc explanation of the result EPA has already decided it must achieve – a rule without any effect. EPA did not consider, let alone analyze, what more could be done. [EPA-HQ-OAR-2019-0660-0184-A1, p.9]

Emission harm reduction. In a subheading entitled "Projected Reductions in PM Emissions," id. at 6347, EPA simply states that there will be none because the Proposal is technology-following and all covered aircraft already meet it. EPA does not relate emission harms to the Proposal or Section 231's statutory purpose – other than to acknowledge that emissions will be left unabated. Id. at 6348. [EPA-HQ-OAR-2019-0660-0184-A1, p.9] [[This comment can also be found in sections 7.2 and 11.1 of the comment summary]]

Time needed to develop and apply the requisite emission reduction technology, noise, and safety. Having selected the adoption of ICAO's do-nothing standards as its regulatory goal, EPA never mentions these factors at all. EPA clearly saw no need to do so, as it had already set its own regulatory goal: adopt standards that prompt no action and change nothing. [EPA-HQ-OAR-2019-0660-0184-A1, p.10]

Whatever discretion EPA has in adopting aircraft emissions standards, it does not encompass a rule that skips the congressionally mandated analysis under Section 231 entirely. The Proposal is patently unreasonable and contrary to law. [EPA-HQ-OAR-2019-0660-0184-A1, p.10]

C. The Proposal did not adequately explain its reasoning and relies on factors Congress did not intend to be considered.

In articulating the purpose of the Proposal, EPA stated that the Proposal was developed to harmonize international aviation standards and shield manufacturers from the competitive disadvantage of not being able to obtain automatic airworthiness certification if ICAO's minimum standards were not adopted. 87 Fed. Reg. at 6326. But international standard harmonization and beneficence to industry are not among the relevant factors Congress identified in Section 231 for setting emissions limits, yet these are the only factors EPA relies on to justify the Proposal. That is improper.[41] [EPA-HQ-OAR-2019-0660-0184-A1, p.12]

And even if concern for the success of international emissions reductions could legitimately be EPA's central objective, cf. *Massachusetts v. EPA*, 549 U.S. 497, 534, refusing to consider whether emissions from U.S. planes can be reduced would be arbitrary and capricious: U.S.-departing flights are by far the largest contributor to global aviation pollution. Further, EPA did not explain why more stringent standards would not in fact advantage manufacturers by decreasing fuel costs and thus increasing profit margins, while ushering in the modernization and emissions reduction that will allow the industry to evolve. [EPA-HQ-OAR-2019-0660-0184-A1, pp.12-13]

Here, EPA argued that incorporation of ICAO standards into U.S. law was an appropriate first step because it is switching to ICAO PM measurements and testing procedures that differ from those EPA used in its last aircraft PM regulations, and it would be "appropriate" to "gain experience from implementation" of these definitions "before considering whether to adopt more stringent regulations." 87 Fed. Reg. at 6337. But EPA would gain exactly the same experience regardless of the stringency of its regulations—should concerns arise (and EPA identifies none and instead deems the new measurements and testing appropriate), they would manifest themselves in the same manner. The proffered explanation is arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0184-A1, p.15]

This failure to consider any alternatives that actually fulfill the emissions-reduction purpose of Section 231 puts on full display EPA's refusal to consider the most important aspect of the problem before the agency: the need to protect public health and welfare from the harm done by PM emissions. The decision to make "international harmonization" its polestar unlawfully precluded consideration of alternatives consonant with the forward-looking, preventative approach demanded by Section 231 and the Clean Air Act. Because the agency entirely failed to consider "important aspect[s] of the problem," its action was arbitrary and capricious.[53] [EPA-HQ-OAR-2019-0660-0184-A1, p.15]

V. EPA Should Replace the Proposal with a Rule that Complies with Section 231 and Basic Requirements of the Administrative Procedure Act.

The Proposal violates Section 231 of the Clean Air Act as it does not even consider how to reduce harmful PM emissions from aircraft. The failure to consider the statutory factors laid out in Section 231, over-reliance on factors outside of and applied to undermine the statute, the failure to analyze the costs and benefits of any alternative, and the refusal to analyze any alternative based on evidence concerning them before the agency are also arbitrary and capricious. These flaws cannot be remedied in a final rule. Instead, EPA must replace the Proposal with one that meets its duties under the Clean Air Act. The final regulations should employ strong mechanisms to reduce emissions from aircraft and protect the public health and welfare, and EPA must consider the full panoply of available measures, including declining fleetwide emissions averages and operational and design improvements. [EPA-HQ-OAR-2019-0660-0184-A1, p.18] [[A portion of this comment is repeated in section 10.]]

---

[1] 42 U.S.C. § 7571.

[2] 42 U.S.C. § 7401(a)(3) (emphasis added).

[41] *State Farm*, 463 U.S. at 43 (An agency rule is arbitrary and capricious "if the agency has relied on factors which Congress has not intended it to consider.").

[53] State Farm, 463 U.S. at 43.

Organization: *South Coast Air Quality Management District (South Coast AQMD)*

While air quality has dramatically improved over the years, the region still exceeds state and federal public health standards, experiences some of the worst air pollution in the nation, and is home to two-thirds of California's environmental justice population. The annual toll of continued non-attainment in our region is estimated at 1,600 premature deaths, 27,000 asthma attacks, and 200,000 days absent from school and work.[1] [EPA-HQ-OAR-2019-0660-0210-A1, p.1] [[This comment can also be found in section 8.6 of the comment summary]]

Attaining federal ozone standards in our region presents a substantial challenge. We are classified as an "extreme" nonattainment area for the 1997, 2008 and 2015 8-hour ozone standards. Our current design value is over 60% higher than the 2015 ozone standard. Nitrogen oxides (NOx) is the key pollutant controlling ozone formation in our atmosphere and mobile sources account for over 80% of the NOx in our region. Emissions from aircraft are a significant contributor – we are home to five major commercial airports, including Los Angeles International Airport, the second busiest airport in the country. Indeed, aircraft emissions are projected to increase in our region. In 2037 – the year we must meet the 2015 ozone standard – we estimate that aircraft emissions will account for 13% of overall NOx in the area, growing from 5% today. This level of emissions from aircraft will make up more than 45% of our region's NOx carrying capacity.[2] This growth in emissions contribution, coupled with the fact that we need an 83% reduction in NOx emissions over current levels to meet the standard, makes the daunting challenge of attainment insurmountable without significant federal action. [EPA-HQ-OAR-2019-0660-0210-A1, pp.1-2]

With this context, we are disappointed in the level of stringency of the proposed rule. We understand that the purpose of this rule is to harmonize and align PM standards for aircraft engine emissions with those established by the International Civil Aviation Organization (ICAO). While more stringent standards are welcome news, this proposed rule is "technology following" and is therefore not expected to result in further reductions from these engines. We are therefore concerned that there is a missed opportunity for EPA to switch to a "technology forcing" approach to further reduce emissions coupled with rigorous testing of new technology to ensure public safety. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

We note also that the proposed rule includes more stringent emission standards for new type design engines compared to in-production engines. However, EPA acknowledges that there are only a few in-production engines that do not currently meet the new type design standard. Given this, we believe that EPA should hold in-production engines to the same standard as new type design engines. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

To conclude, the South Coast AQMD cannot attain the federal clean air standards, and the health and safety of the more than 17 million residents in our region cannot be adequately protected without significant emission reductions from commercial aircraft. EPA is in a unique position to introduce regulations that ensure aviation safety while providing a healthy environment for communities adjacent to commercial airports and, more broadly, for the South Coast region. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

---

[1] South Coast AQMD, Final Socioeconomic Report for the 2016 Air Quality Management Plan (https://www.aqmd.gov/docs/default-source/clean-air-plans/socioeconomic-analysis/final/sociofinal_030817.pdf)

[2] The carrying capacity is the level of allowable NOx emissions in our region while still meeting federal ozone standards.

Organization: *Vasquez, Miguel*

This proposal is to get the United States standards on particulate matter like those of the ICAO (UN's International Civil Aviation Organization) (Control of Air Pollution from Aircraft Engines, 2022). These updates on the standards and testing will allow higher control on particulate matter emissions, there

will be international uniformity, and allow US designers and manufacturers to stay in the global market. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

The international standards are a good start for the United States to become a leading power in controlling air pollution. It would benefit both human health and environmental health. But the United States shouldn't just put its sight on equaling those standards and tests put by the ICAO and go beyond. Pushing American companies to become the leading force to cleaner and better aircraft engines. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

Control of air pollution from aircraft engines: emission standards and test procedures, 87 FR 6324 (Proposed February 3, 2022) (to be codified at 40 C.F.R. pts. 87, 1030, 1031). https://www.federalregister.gov/documents/2022/02/03/2022-01150/control-of-air-pollution-from-aircraft-engines-emission-standards-and-test-procedures

Organization: Wagner, Debi

The rulemaking states in part that EPA wishes to align new aircraft engine PM emissions with ICAO standards to; 1) create international uniformity for engine manufacturers, 2) change the type of reporting from smoke number to mass; 3) set a date for implementation. However, the new rule on page 11 makes it clear the new standard will not improve air quality for communities around airports, implying this is not a reduction of PM 10 and 2.5 from existing impact and states below:

"As described in Section V.C, while newer aircraft engines typically have significantly lower emissions than existing aircraft engines, the proposed standards in this action are technology-following in order to align with ICAO's standards and are not expected to, in and of themselves, result in further reductions in PM from these engines. Therefore, we do not anticipate an improvement in air quality for those who live near airports where these aircraft operate." [EPA-HQ-OAR-2019-0660-0153-A1, p.1]

The statement that newer aircraft engines typically have significantly lower emissions than existing may be misleading. Newer from when? Aircraft can stay in operation for 30 plus years. Significant is not defined. Are you referring to the high-bypass, high ratio engines from the 80's, early 90's designed to reduce CO which dramatically increased NOx? Are you focusing on any reduction but ignoring the increases? Are you referring to specific emissions, or a single phase of the LTO? These kind of statements ignore the fact that the fuel is the primary element responsible for the emissions and that Jet A fuel use has continued to climb globally. More jets and more fuel use equals more emissions to the environment. Nobody is providing data to show specific reductions that can be verified. Maybe it is larger capacity planes and you are considering fuel use per passenger mile? As engines have become larger, some individual emissions may have been static but since use of fuel increases so do some emissions. Have particulate been reduced? By how much? Is it possible that if PM 10 and PM 2.5 have been reduced, that the higher bypass, high flame engines in turn caused a greater emissions of ultrafine particulate (UFP)? [EPA-HQ-OAR-2019-0660-0153-A1, p.1]

The rulemaking also says that this regulation would not increase aircraft engine PM levels above current levels. This is misleading. Although the certification of new engines will stay at the proposed level, adding more aircraft at an airport, meaning more fuel use, will increase overall PM to the environment

around airports. Since the rule does not improve air quality, air quality, absent serious interventions, will worsen with usual added operations and older engines. [EPA-HQ-OAR-2019-0660-0153-A1, p.1]

The rulemaking does not seem to affect any existing engines or those being manufactured except one. There is no verification the existing condition for particulate levels for the environment around an airport is compliant or healthful. The idea, which could be true, that it might be bad now, but it won't get worse is not reassuring. Why waste time on rulemaking that will not fulfill EPA's primary responsibility to protect the environment? [EPA-HQ-OAR-2019-0660-0153-A1, p.1]

Recommendations:

Do not align with ICAO on the PM 10 and PM 2.5 aircraft engine standard. There is a risk that citizens impacted by airport operations will not be equally represented when trying to obtain access to their right to a healthful environment through local, state and federal oversight [EPA-HQ-OAR-2019-0660-0153-A1, p.3]

More stringently regulate CO2 and disregard ICAO recommendations and strengthen all US standards. [EPA-HQ-OAR-2019-0660-0153-A1, p.4] [[This comment can also be found in section 2.3 of the comment summary]]

EPA's Response to Comments in Section 2.3

The EPA's reasons for adopting the PM standards as proposed are explained in the Preamble to the final rulemaking. For the EPA's response to comments on considering alternative levels of stringency in proposing standards, see Section IV.F.2 of the Preamble. Also, for further discussion on this subject see Preamble Section I.B.2 and the introductory paragraphs of Preamble Section IV. Also, see Section I.C of the Preamble for information on the EPA's current and intended future work on aircraft engine PM standards.

In regard to comments on minorities and disadvantaged communities (or environmental justice communities) being disproportionately impacted by airport pollution and the adverse health effects associated with exposure to PM2.5, including ultrafine particles, see the EPA responses in section 6 below.

Comments on alternative PM controls or alternative methods to regulating PM emissions and volatile PM are addressed by the EPA in section 10 below.

Other topics raised by these comments are addressed elsewhere in the Preamble to the final rulemaking or in this document. For example, for comments on regulating in-service aircraft engines, see section the EPA response in section 3.2 of this document.

Comments related to regulating pollutants or chemicals that are not particulate matter are outside the scope of this rulemaking. However, the modification to 40 CFR Part 1030 to clarify the applicability of the EPA's airplane GHG standards cover all jet airplanes with an MTOM greater than 5,700 kg is within scope. The proposal did not reexamine or reopen the endangerment finding for greenhouse gases from aircraft, 81 FR 54421 (Aug. 15, 2016), or the first greenhouse gas standards for airplanes and airplane engines, 86 FR 2136 (Jan. 11, 2021), so comments on those topics are beyond the scope of this rulemaking.

In response to the comment that the EPA did not describe why more stringent PM standards would not advantage manufacturers by decreasing fuel costs, the EPA notes first that this aircraft engine PM standards rule does not impede manufacturers from purchasing the most fuel-efficient engines. The rulemaking has no impact on airplane or aircraft engine fuel costs. It is not clear that more stringent PM standards would necessarily reduce fuel burn or fuel costs. We note that other factors than engine design (e.g., airframe technologies) can also contribute to fuel burn and fuel costs. Further effort would be needed to investigate the potential interrelationships between PM emission reductions (and potentially even PM emission increases) and fuel burn.

2.4 Comments on ICAO/CAEP Procedure

Organizations Included in this Section

Aerospace Industries Association (AIA)
Airlines for America (A4A)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Airport Impact Relief, Inc. (AIR, Inc.)
Aviation-Impacted Communities Alliance (AICA)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
General Aviation Manufacturers Association (GAMA)
General Electric Company (GE)
Wagner, Debi

Organization: Aerospace Industries Association (AIA)

The ICAO standards – which were negotiated by the EPA and the FAA with technical input from AIA member companies – were carefully selected after many years of robust analysis within CAEP to deliver the continuous environmental improvement with considerations for current technological feasibility and economic reasonableness. [EPA-HQ-OAR-2019-0660-0178-A1, p.4]

Organization: Airlines for America (A4A)

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 49-50.] [[This comment is repeated in sections 2.1, 8.1 and 11.1]]

Second, A4A strongly supports the proposal to adopt the aircraft PM certification standards as agreed by the International Civil Aviation Organization -- ICAO. The ICAO process for setting aircraft standards is rigorous and ensures they are technically sound. Further, the ICAO criteria for adopting such standards align with the criteria under Section 231 of the U.S. Clean Air Act. Even more critically, the standards will ensure that aviation safety is maintained even as environmental progress is ensured.

As acknowledged in the proposal, it is critical to the competitiveness of the U.S. aircraft and aircraft engine manufacturers that the U.S. follow these international standards which, in turn, improve airlines' ability to acquire U.S.-manufactured aircraft and help foster competitive market prices. Experts from the USEPA and Federal Aviation Administration played leading roles in the ICAO process leading to the adoption of the PM standard. A4A participated as an observer. These efforts ensured that ICAO's PM standard incorporated all of these critical features and -- so that it could be adopted into U.S. law.

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

Importantly, the U.S. government plays a leading role within ICAO, and its leadership within CAEP is particularly strong. The FAA serves as the U.S. representative to CAEP (also referred to as the "CAEP Member"), with EPA functioning as an advisor to FAA "on aviation emissions, technology, and environmental policy matters" throughout the CAEP process.[13] As EPA recounts, both the FAA and EPA worked over a 10-year period "from 2009 to 2019 within the ICAO/CAEP standard setting process on the development of" the ICAO Aircraft Engine PM Standards.[14] Indeed, both the FAA and EPA served as leaders of key technical working groups and task groups, as CAEP worked to collect data and complete comprehensive technical and economic analyses to inform the development of the standards. In addition, EPA often contributed technical analyses and data for CAEP's consideration. A4A was privileged to be included on the IATA delegation, which serves as an "observer" to CAEP. ALPA also participated as an observer as part of the International Federation of Air Line Pilots' Associations. As observers, A4A and ALPA were able to provide input into the process and – like EPA and FAA – devoted many, many hours and resources to the effort. Other organizations representing industry stakeholders and NGOs also served as observers and contributed data and analyses. In the end, with the FAA and EPA playing key leading roles, it was only after dozens of in-person meetings and many more teleconferences in which hundreds of formal analytical papers authored by aviation experts from government, industry and environmental organizations were painstakingly considered, that CAEP agreed to the ICAO Aircraft Engine PM Standards. [EPA-HQ-OAR-2019-0660-0192-A1, p.5]

---

[13] 87 Fed. Reg at 6328.

[14] Id. at 6330.

Organization: *Airport Impact Relief, Inc. (AIR, Inc.)*

ENVIRONMENTAL JUSTICE AND PUBLIC PARTICIPATION IN THE RULEMAKING

In the executive summary of the NPRM (Section I, B, 3) EPA defines environmental justice as "the fair treatment and meaningful involvement (emphasis added) of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies". Section III, Particulate Matter Impacts on Air Quality and Health, further expands on this responsibility in the section on Environmental Justice (Section III.G, footnote 72) noting that: Meaningful involvement occurs when "(1) potentially affected populations have an appropriate opportunity to participate in decisions about a proposed activity [e.g., rulemaking] that will affect their environment and/or health; (2) the public's contribution can influence [the EPA's rulemaking] decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) [the EPA will] seek out and facilitate the involvement of those potentially affected"[2] [EPA-HQ-OAR-2019-0660-0175-A1, p.2] [[This comment can also be found in section 11.5 of the comment summary]]

The EPA's decision to adopt the particulate standards for airplane engines created by the Committee on Aviation Environmental Protection (CAEP) of the International Civil Aviation Organization (ICAO) effectively foreclosed the opportunity for environmental justice communities to participate with meaningful involvement in the development of the proposed rule. [EPA-HQ-OAR-2019-0660-0175-A1, p.2] [[This comment can also be found in section 11.5 of the comment summary]]

CAEP conducts its work program through 11 working groups, consisting of 31 member state delegations led by the various state's Civil Aviation Authorities (FAA in the case of the US delegation), six observer states, and 15 international non-governmental organizations representing airlines, airports, aircraft and engine manufacturers, an international pilot's union association, and several other aviation industry lobbying groups. The CAEP work program typically spans three years per cycle to produce a new noise or air pollution standard, and the work program is conducted by the 11 working groups in series of multiple individual meetings held in cities throughout the world. The meetings are not open to the public, their work product is considered private, and their key reports, even when included in the EPA rulemaking docket, are not publicly available due to claimed copyright restrictions.[3] This means that the public and the EJ communities affected by the rule have been effectively precluded from participating in, or reviewing, any of the critical considerations leading up to the adoption of the standards. The fact that EPA publishes the conclusions of the CAEP standards as its own proposed rule does not satisfy the requirements of the Administrative Procedure Act, the two Executive Orders on Environmental Justice, or the requirements of the Office of Management and the Budget Circular A-4 guidance to Federal agencies on the development of regulatory analysis. As the NPRM notes, section 231(a)(2)(A) of the Clean Air Act (CAA) directs the Administrator of EPA to, "from time to time, propose aircraft engine emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonably be anticipated to endanger public health or welfare". A plain reading of that language requires the EPA to make the necessary determination of the need for and level of emissions control that are required, not to delegate that responsibility to CAEP. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[This comment can also be found in sections 11.2, 11.4, and 11.5 of the comment summary]]

---

[3] The CAEP Finance and Economics Study Group report contains key data and conclusions on forecast global aviation activity, costs of the proposed standards being considered, the rationale for choosing whether to pursue a technology forcing or an anti-backsliding standard, and the cost effectiveness of the candidate standards. The document is listed in the Docket as "Unavailable - Copyrighted".

Organization: Aviation-Impacted Communities Alliance (AICA)

We request EPA to not align with ICAO on the PM10 & PM2.5 aircraft engine standard. This presents a risk that residents impacted by airport operations will not be equally or sufficiently represented when seeking access to their right to a healthful environment through local, state and federal oversight. [EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[This comment can also be found in sections 2.3, 11.2, and 11.5 of the comment summary]]

We are concerned about the lack of public participation due to closed door meetings, disproportionate impact on often disadvantaged populations in proximity to airports, and also that ensuring global competitiveness on behalf of manufacturer's is not a requirement. [EPA-HQ-OAR-2019-0660-0201, p.1] [[This comment can also be found in sections 11.2 and 11.5 of the comment summary.]]

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

An independent EPA review is all the more critical because ICAO's policy window is explicitly narrower than the Clean Air Act's. ICAO is not an environmental protection body like EPA—not even CAEP is

charged with protecting the public health and welfare. ICAO limits its consideration to "technology-following" options, while EPA considers both technology-forcing and technology-following regulations. 87 Fed. Reg. at 6327, 6347-48. If EPA were to adopt only what ICAO adopts, or consider only what ICAO considers, it would fail to exercise the discretion Congress gave it and fail its mandate to reduce pollution to the full extent practicable and necessary. Moreover, ICAO shares none of the important democratic checks on policymaking that EPA has: it is not democratically accountable, nor bound by rational decision-making on a record, nor open and transparent to the public. Were EPA to continue its apparent commitment to never exceeding ICAO standards in stringency, no matter how grave the harm to public health and welfare, and no matter how feasible, safe, and cost-effective the means of doing so, it would severely compromise the mandate Congress gave it in Section 231. [EPA-HQ-OAR-2019-0660-0203-A1, p.22]

Organization: General Aviation Manufacturers Association (GAMA)

As an international organization, GAMA is most concerned with ensuring the international harmonization of emission standards in aviation. International environmental standards for aviation have long been set by the International Civil Aviation Organization (ICAO), then implemented by national authorities including, in the U.S., by EPA and FAA. This proposed rule would adopt the emission standards and test procedures for aircraft engines that follow the standards adopted by ICAO in 2017 and 2020. [EPA-HQ-OAR-2019-0660-0205-A1, p.2]

Organization: General Electric Company (GE)

3. The proposed standards are consistent with EPA's precedent of collaboration with ICAO

EPA and FAA have long worked within the standard-setting process of ICAO's CAEP to help establish international emission standards and related requirements, which Member States adopt into domestic law and regulations. Historically, under this approach, international emission standards are first adopted by ICAO, and subsequently EPA has initiated rulemakings under CAA Section 231[14] to create domestic standards that are at least as stringent as ICAO's standards. Here, EPA collaborated with FAA and CAEP on ICAO's 2017 and 2020 adoption of the international standards to regulate nvPM emissions from airplanes. [EPA-HQ-OAR-2019-0660-0183-A1, p.6]

In this proposed rulemaking, EPA continues the long collaboration effort with ICAO and CAEP. EPA's adoption of ICAO-equivalent standards under CAA section 231 rulemakings extends back multiple decades. In 1997, EPA, in consultation with FAA, adopted ICAO NOx and CO requirements for gas turbine (turbofan and turbojet) engines.[15] In 2005, EPA, in consultation with FAA, adopted ICAO NOx standards for gas turbine engines.[16] In 2012, EPA, in consultation with FAA, adopted ICAO NOx standards for gas turbine engines.[17] And, in 2021, EPA, in consultation with FAA, adopted ICAO CO_2 standards.[18] With respect to particulate matter emissions, EPA first revised its "smoke number" standards and test procedures to align with ICAO's in 1982,[19] and then in 1984,[20] 1997,[21] 2005[22] and 2012.[23] Thus, this proposed rulemaking adopting ICAO-equivalent nvPM emissions standards in place of the smoke number standards to limit particulate matter emissions from aircraft engines adheres to longstanding EPA precedent. [EPA-HQ-OAR-2019-0660-0183-A1, pp.6-7]

---

[14] 42 U.S.C. § 7571.

[15] 62 Fed. Reg. 25,356 (May 8, 1997).

[16] 70 Fed. Reg. 69,664 (Nov. 17, 2005).

[17] 77 Fed. Reg. 36,342 (June 18, 2012).

[18] 86 Fed. Reg. 2,136 (Jan. 11, 2021).

[19] 47 Fed. Reg. 58,462 (Dec. 30, 1982).

[20] 49 Fed. Reg. 31,873 (Aug. 9, 1984).

[21] 62 Fed. Reg. 25,356 (May 8, 1997).

[22] 70 Fed. Reg. 69,664 (Nov. 17, 2005)

[23] 77 Fed. Reg. 36,342 (June 18, 2012).

Organization: *Wagner, Debi*

ICAO is not a representative body. EPA deferred CO2 emission endangerment finding rulemaking to ICAO only to wait years for a rule which does nothing to reduce CO2 from aircraft until at least 2028. By 2028, the aviation industry could still have higher emitting engines for another 30 years due to grandfathering. Because these rules are deferred to an international body, the US citizens may lose their opportunity to address these issues with their own representatives or through local laws. Citizens are least interested in streamlining processes for industry and most interested in their own air quality. Does this kind of deferral by EPA fit into its mandate to protect the environment in the US? [EPA-HQ-OAR-2019-0660-0153-A1, p.2]

Outsourcing this to an international body that has little representation for US interests and almost no representation from local communities experiencing the brunt of the impacts is inappropriate. [EPA-HQ-OAR-2019-0660-0153-A1, p.2]

EPA Response to Comments in Section 2.4

EPA responds to many of these comments in Sections IV.F.1 and IV.F.2 of the Preamble to the final rulemaking; the topic of public participation in the EPA's rulemaking is further addressed in section 11.2 below.

In regard to the comments suggesting that the ICAO standards negotiation process forecloses the opportunity of environmental justice communities to meaningfully participate in the development of international standards, we refer to two different groups that provide an opportunity for these communities to participate in establishing international aircraft engine emission standards. First, as described in Section IV.F.2 of the Preamble to the final rulemaking, the U.S. Interagency Group on International Aviation (IGIA) facilitates coordinated recommendations to the Secretary of State on issues pertaining to international aviation (and ICAO/CAEP), and the FAA is the chair of IGIA. Representatives of domestic states, non-governmental organizations, and industry have participated, and continue to participate, in IGIA to provide input for U.S. positions on international emission standards as they are being developed at ICAO/CAEP. Also, the International Coalition for Sustainable Aviation (ICSA) is an international environmental non-governmental organization that has observer status at ICAO (Further details about ICSA are located at https://www.icsa-aviation.org/.) Observers may participate without a vote in the deliberations of ICAO. Thus, observers can express their viewpoints during ICAO deliberations or meetings and this forum was available to environmental justice communities as well. See, the document Report of the Eleventh Meeting, Montreal, 4-15 February 2019, Committee on

Aviation Environmental Protection, Document 10126, CAEP11. (This report is found on page 27 of the English Edition of the ICAO Products and Services 2022 Catalog and is copyright protected: Order No. 10126. For assistance with viewing copyrighted documents in the docket, please refer to page 6324 of the Preamble to the proposed rulemaking, under *Docket*.) ICSA's attendance at this meeting as an Observer organization is described on page ii-9 of the report. The documentation of ICSA's offer to provide resources to the CAEP/11 Working Group 3 - Emissions Technical - Work Program is described on page ii-18 of the report.

Comments related to regulating pollutants or chemicals that are not particulate matter are outside the scope of this rulemaking. However, the modification to 40 CFR Part 1030 to clarify the applicability of the EPA's airplane GHG standards cover all jet airplanes with an MTOM greater than 5,700 kg is within scope. The proposal did not reexamine or reopen the endangerment finding for greenhouse gases from aircraft, 81 FR 54421 (Aug. 15, 2016), or the first greenhouse gas standards for airplanes and airplane engines, 86 FR 2136 (Jan. 11, 2021), so comments on those topics are beyond the scope of this rulemaking.

2.5 Chicago Convention and Domestic Rulemaking

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Environmental Defense Fund (EDF)
General Electric Company (GE)
National Association of Clean Air Agencies (NACAA)
Sierra Club
Wagner, Debi

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

As the NPRM notes, section 231(a)(2)(A) of the Clean Air Act (CAA) directs the Administrator of EPA to, "from time to time, propose aircraft engine emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonably be anticipated to endanger public health or welfare". A plain reading of that language requires the EPA to make the necessary determination of the need for and level of emissions control that are required, not to delegate that responsibility to CAEP. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[This comment can also be found in sections 2.4, 11.1, and 11.2 of the comment summary]]

Although EPA has participated in the development of noise and air pollution standards for aircraft through the CAEP process for years, that historic practice does not relieve them of the requirement to develop their own independent standards in this rulemaking. Federal courts have increasingly held that Agencies may not outsource the preparation of environmental documents and rules to others but must perform the critical analyses and decision-making internally. [EPA-HQ-OAR-2019-0660-0175-A1, p.3]

The NPRM, in Section II.B discusses the role of the United States in international aircraft agreements. This extensive discussion strongly implies that, unless EPA adopts the CAEP PM standards as written, it will be in violation of its treaty obligations to ICAO, that American engine manufacturers will experience a competitive commercial disadvantage. This discussion is continued in greater detail in section IV (Details for the Proposed Rule). [EPA-HQ-OAR-2019-0660-0175-A1 p.3]

While we agree that there is considerable value from international harmonization, the EPA seems to place undue emphasis on the assumed disadvantage that American manufacturers would have if the U.S. does not adopt standards that are at least as stringent as the ICAO standards for PM emissions. The NPRM argues that

"… these proposed standards would also allow U.S. manufacturers of covered aircraft engines to remain competitive in the global marketplace." and "In the absence of U.S. standards implementing the ICAO aircraft engine PM emission standards, the U.S. would not be able to certify aircraft engines to the PM standards. In this case, U.S. civil aircraft engine manufacturers could be forced to seek PM emissions certification from an aviation certification authority of another country in order to market and operate their aircraft engines internationally." [EPA-HQ-OAR-2019-0660-0175-A1, p.3]

THE ROLE OF DIFFERENCES IN COMPLIANCE WITH ICAO STANDARDS

The NPRM discussion of the value from international harmonization and the need to adhere to ICAO standards notes in Section II.A that:

"The Chicago Convention also recognizes that member States may adopt national standards that are more or less stringent than those agreed upon by ICAO or standards that are different in character or that comply with the ICAO standards by other means. Any member State that finds it impracticable to comply in all respects with any international standard or procedure, or that determines it is necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, is required to give notification to ICAO of the differences between its own practice and that established by the international standard." [EPA-HQ-OAR-2019-0660-0175-A1, p.4]

That discussion of the filing of differences is superficial and does not convey the extent to which the filing of differences is regularly used to comply with ICAO standards. ICAO requires any differences between a state's regulations and the ICAO standards to be described in a document called an Airman's Information Publication (AIP). The current US AIP published by FAA on December 2, 2021 lists approximately 1460 instances where the US regulations are different from those of ICAO standards, 33 of those differences apply to ICAO Annex 16 where environmental standards like this proposed rule are codified. Despite those numerous cases where US regulations are different than ICAO standards, foreign acceptance of US certificated engines and aircraft has not been impaired. [EPA-HQ-OAR-2019-0660-0175-A1, p.4]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

1) Withdrawing the NPRM until such time as EPA can produce a rule that remedies the defects noted in our comments.

2) File a difference with ICAO to continue use of the existing US regulation based on the ICAO smoke number standard, which the NPRM states provides an equivalent level of protection to the proposed rule.

3) Commence the development of a PM regulation for new production that reflects the significantly reduced PM emissions of contemporary engines, and is fully compliant with the EJ and public participation requirements as well as the Administrative Procedure Act, the relevant Executive Orders on EJ, and OMB Circular A-4. [EPA-HQ-OAR-2019-0660-0175-A1, p.6] [[Parts of this comment can also be found in sections 2.3, 11.2, 11.4, and 11.5 of this document.]]

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

First, "uniformity in international aviation regulations and standards" is not a goal of the Clean Air Act. Indeed, in the context here, it actively undermines the Clean Air Act's purposes. It is unlawful and arbitrary to substitute this uniformity goal for the factors Congress actually specified in Section 231. *See Indep. U.S. Tanker Owners Comm. V. Dole*, 809 F.2d 847, 854 (D.C. Cir. 1987) (EPA "is not free to substitute new goals in place of the statutory objectives without explaining how these actions are consistent with [its] authority under the statute."). An agency may not simply rubber-stamp international standards in lieu of its mandate in the name of "harmonization." *Natural Res. Def. Council v. EPA*, 808 F.3d 556, 570 (2d. Cir. 2015) (EPA's adoption of International Maritime Organization's (IMO) standards for certain discharges was arbitrary, where EPA failed to explain "why standards higher than the IMO Standard should not be used given available technology"); *see also U.S. Telecomm Ass'n v. FCC*, 359 F.3d 554, 565-66 (D.C. Cir. 2004) ("[D]elegation to outside entities increases the risk that these parties will not share the agency's 'national vision and perspective,' . . . and thus may pursue goals inconsistent with those of the agency and the underlying statutory scheme."). [EPA-HQ-OAR-2019-0660-0203-A1, pp.21-22] [[This comment is repeated in section 11.1]]

C. The United States' obligations under the Chicago Convention do not excuse EPA's failure to protect the United States from dangerous pollution

The Chicago Convention does not restrict EPA's authority under the Clean Air Act to regulate PM emissions from U.S. aircraft; nor does it replace EPA's responsibility under the Clean Air Act to protect the public from dangerous pollution. Nonetheless, EPA proposes to ignore its own scientific and technical record and adopt PM emission standards with zero environmental and public health benefits, based solely on a vaguely defined interest in "international harmonization." 87 Fed. Reg. at 6326. EPA explains this harmonization interest as uniformity in regulation, protecting U.S. manufacturers' competitiveness abroad, preventing backsliding, gaining experience with the new mass, numerical, and mass concentration metrics, and building international consensus. Id. at 6337. But none of these interests hold up on examination, and none counter the compelling need for aggressive action by EPA to curb aircraft PM emissions pursuant to its duty under the Clean Air Act. [EPA-HQ-OAR-2019-0660-0203-A1, p.21]

Nor does EPA's uniformity interest make sense on the record. Although the Chicago Convention obligates the United States to adopt PM standards "at least as stringent" as ICAO's, id. at 6337, it explicitly recognizes that member nations may adopt standards that are more stringent than the "minimum standards" agreed upon by ICAO—the Convention requires only that they notify the ICAO of

their decisions. Chicago Convention, arts. 33, 38; see also 87 Fed. Reg. at 6328. All of the Proposed Rule's justifications for "uniformity" apply only to meeting this global regulatory "floor," not to EPA's decision to treat ICAO standards as a regulatory "ceiling" as well. Thus, PM standards that meet or exceed ICAO's "ensure[] that passengers and the public can expect similar levels of protection for safety and human health and the environment regardless of manufacturer, airline, or point of origin of a flight" and "help ensure … acceptance of U.S. manufactured engines worldwide." Id. at 6337. But EPA identifies no reason why PM standards that exceed ICAO's would not also serve these interests. EPA certainly cannot mean that U.S. passengers and the public should be limited to the "levels of protection for safety and human health and the environment" that only the worst-performing fleets in the world can achieve—yet that is exactly the limitation the Proposed Rule enforces. [EPA-HQ-OAR-2019-0660-0203-A1, p.22]

Organization: *Center for Biological Diversity and Friends of the Earth*

The Proposal correctly notes that, in addition to developing standards that meet the requirements of Section 231, the U.S. must adopt standards that are at least as strict as those adopted by ICAO for planes that are certified in the U.S. to operate abroad without additional certification.[77] It also correctly observes that Chicago Convention member states may adopt more stringent standards than the ones set by the ICAO.[78] But EPA goes on to say that adopting the international standards instead of more stringent standards is proper given the importance of "international uniformity and regulatory certainty,"[79] and that to "deviate from them might well undermine future efforts by the United States to seek international consensus on aircraft emissions."[80] EPA provides no legitimate basis for these assertions. EPA does not explain why setting stricter standards would "undermine" future efforts. All members of the Chicago Convention know that adoption of stricter standards is possible, and many of them have in fact adopted stricter standards.[81] Given that international negotiations are driven by pledges from participating countries to reduce their fair share of emissions, it is more plausible that setting stricter standards would improve rather than hinder future cooperation. Regardless, EPA's primary concern about harmonization to the lowest-common-denominator international standards is a policy one, which EPA cannot assign more weight than its statutory obligations under the Clean Air Act to set health-protective standards. [EPA-HQ-OAR-2019-0660-0189-A1, pp.9-10]

---

[76] 87 Fed. Reg. at 6,326.

[77] Id.

[78] Id. at 6,328.

[79] Id. at 6,337.

[80] Id.

[81] Dempsey, Paul Stephen, Compliance & Enforcement in International Law: Achieving Global Uniformity in Aviation Safety, 30 N.C. J. Int'l L. & Com. Reg. 1, 17 n.65 (2004) ("[A]s of 2000, 55 states had notified ICAO of the differences between their domestic laws and Annex 1."); Peterson, Mark Edward, The UAV and the Current and Future Regulatory Construct for Integration Into the National Airspace System, 71 J. Air L. & Com. 521, 559 n.197 (2006) ("A review of the filed differences [pursuant to Article 38] reveals that most deal with differences in terminology or involve more stringent practices.").

Organization: *Environmental Defense Fund (EDF)*

Moreover, the Chicago Convention on International Civil Aviation, to which the United States is a Party, specifically recognizes that Member States may adopt standards more stringent than those negotiated in ICAO. Article 33 of the Chicago Convention provides that ICAO Member States shall recognize certificates of airworthiness,37 which, pursuant to several federal regulations, specifically include certification that the aircraft has met applicable exhaust emissions standards.[38] The Chicago Convention states, in Article 33, that Member States shall recognize airworthiness certificates of other Member States "provided that the requirements under which such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be established from time to time."[39] Thus, the Convention expressly affirms that its Member States may adopt requirements more stringent than the minimum standards of ICAO. EPA is empowered and required by the CAA to promulgate emission standards applicable to any air pollutant, emitted from aircraft engines, which contribute to "air pollution which may reasonably be anticipated to endanger public health or welfare."[40] While ICAO standards thus serve as a floor below which EPA cannot go, and the Chicago Convention authorizes its Member States to apply more stringent standards, EPA remains empowered to promulgate standards stricter than those adopted by ICAO. [EPA-HQ-OAR-2019-0660-0207-A1, p.6]

---

[37] Certificates of airworthiness are required for all aircraft flying between the United States and other countries. See Chicago Convention at Article 31: "Certificates of airworthiness. Every aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued or rendered valid by the State in which it is registered." ICAO, 2006 (op. cit.)

[38] See 14 CFR §§ 21.183(g), 34.21(d), 34.23(a), 34.3(o).

[39] ICAO, 2006 (op. cit.)

[40] 42 U.S.C. § 7571(a)(2)(A).

Organization: *General Electric Company*

C. EPA's proposal to adopt ICAO-equivalent nvPM emission standards is consistent with the law, precedent, and the administrative record

The proposed standards comply with the statutory requirements of the Clean Air Act (the "CAA") and treaty obligations. The standards continue the long collaborative tradition between EPA and ICAO. They also are well supported by an extensive administrative record. [EPA-HQ-OAR-2019-0660-0183-A1, p.4] [[This comment is repeated in section 11.3]]

2. The proposed standards would fulfill U.S. treaty commitments

EPA's proposal to adopt ICAO-equivalent standards under CAA Section 231 is consistent with the 1944 Convention on International Civil Aviation (also known as the Chicago Convention). The purpose of the Chicago Convention is to foster global cooperation and promote an atmosphere where international civil aviation could be developed in a safe and orderly manner, while being operated soundly and economically. [EPA-HQ-OAR-2019-0660-0183-A1, p.5]

This purpose is reflected in more detail in Articles 37 and 38 of the Chicago Convention. Article 37 makes clear that ICAO Member States should strive to achieve "the highest practicable degree of uniformity,"

thereby avoiding a hodgepodge of regulation. Article 38 provides for exceptions to this norm while providing context for the circumstances of a Member State's decision to deviate from an ICAO standard. The net effect of Articles 37 and 38 of the Chicago Convention is to pledge a strong preference toward uniform international standards absent exceptional circumstances that might warrant a Member State's deviation. Furthermore, because Article 33 of the Chicago Convention requires that each contracting State must recognize as valid the certification of aircraft by another contracting State issued pursuant to requirements equal to or above the ICAO minimum standards, any deviation by the United States making its standards more stringent that the ICAO standards would not apply to foreign-certified aircraft with ICAO-compliant engines, and would thus impose a clear competitive disadvantage to U.S. manufacturers. [EPA-HQ-OAR-2019-0660-0183-A1, p.6]

EPA previously noted the connection between the Chicago Convention and CAA's Section 231 in a 2012 rulemaking, when the Agency stated that adopting standards identical to ICAO standards provided, "a means by which the United States can meet its obligations under the Chicago Convention and ensure that engine manufacturers maintain worldwide acceptability of their products.[12] In that same rulemaking, EPA recognized that even if it set tighter standards than required by ICAO, foreign air carriers would only be required to comply with the ICAO standards (or their own nations' more stringent standards).[13] [EPA-HQ-OAR-2019-0660-0183-A1, p.6]

Here, EPA's proposal satisfies the obligations of the Chicago Convention. By proposing standards consistent with the ICAO nvPM standards, EPA is ensuring compliance with U.S. treaty commitments. Additionally, this harmonization allows U.S. manufacturers to remain competitive in the international market and ensures a level playing field. [EPA-HQ-OAR-2019-0660-0183-A1, p.6]

---

[12] 77 Fed. Reg. 36,342, 36,379 (June 18, 2012).

[13] Id. at 36,345

Organization: *National Association of Clean Air Agencies (NACAA)*

Nor does ICAO preempt member States from going beyond the Organization's standards, which are a floor, not a ceiling. As EPA has noted, "ICAO is a United Nations (UN) specialized agency, established in 1944 by the Convention on International Civil Aviation (Chicago Convention), 'in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically' . . . In the interest of global harmonization and international air commerce, the Chicago Convention urges its member States to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures and organization. The Chicago Convention also recognizes that member States may adopt standards that are more stringent than those agreed upon by ICAO [emphasis added]."[10] Such more stringent U.S. standards do not in any way interfere with the stated intent of the U.S. to simultaneously prevent aircraft engine PM levels from increasing beyond their current levels, align U.S. domestic standards with the ICAO standards for international harmonization, help the U.S. meet its treaty obligations under the Chicago Convention and allow U.S. manufacturers of covered aircraft engines to remain competitive in the global marketplace.[7] [EPA-HQ-OAR-2019-0660-0177-A1, pp.3-4]

[10] 81 Fed. Reg. 54,528 (August 15, 2016) – https://www.govinfo.gov/content/pkg/FR-2016-08-15/pdf/2016-18399.pdf

[11] Supra note 1, at 6,337

Organization: Sierra Club

B. The International Civil Aviation Organization's CO2 Standards

The 1944 Convention on International Civil Aviation, known as the Chicago Convention, established rules governing airspace, aircraft registration, and the safety and sustainability of international air travel. It also created the International Civil Aviation Organization ("ICAO"), a UN specialized agency, to manage the administration and governance of the Chicago Convention and to establish standards and recommended policies for the civil aviation sector. [EPA-HQ-OAR-2019-0660-0184-A1, p.4]

While ICAO seeks to reach consensus on aircraft standards, the Chicago Convention does not commit ICAO members to a single set of standards. On the contrary, "it is expected that States will adopt their own airworthiness standards, and it is anticipated that some states may adopt standards that are more stringent than those agreed upon by ICAO."[20] A state that does so need only notify ICAO of this choice.[21] Because the Convention expressly allows member states the freedom and flexibility to establish national standards more stringent than ICAO standards, strong U.S. standards do not interfere with the United States' participation in ICAO or in any way run counter to the Convention's or ICAO's governing provisions. [EPA-HQ-OAR-2019-0660-0184-A1, p.4 and 5]

In 1993, ICAO created the Committee on Aviation Environmental Protection ("CAEP") to develop and recommend standards related to air pollution and noise. Unlike EPA, neither ICAO nor CAEP has a mandate to protect public health and welfare from the effects of aircraft air pollution. Instead, ICAO member nations and industry form a consensus on standards all member nations can meet.[22] [EPA-HQ-OAR-2019-0660-0184-A1, p.5]

In 2016 and 2019, ICAO's technical committee, CAEP, agreed to three international airplane PM emission standards: (1) maximum PM mass standards, (2) maximum PM number standards, and (3) maximum mass concentration standards, which ICAO adopted in 2017 and 2020. 87 Fed. Reg. at 6329. The maximum PM mass concentration standards apply to in-production engines[23] as of January 1, 2020, and the PM mass and number standards apply to both new-type[24] and in-production engines as of January 1, 2023. Id. [EPA-HQ-OAR-2019-0660-0184-A1, p.5]

Lacking any legal basis for its Proposal, EPA looks to U.S. treaty obligations under the Chicago Convention to adopt emissions standards "at least as stringent" as ICAO's. 87 Fed. Reg. at 6328. But these obligations on their face do not supplant or even restrict EPA's duties under Section 231, as they freely permit any member state to deviate from ICAO standards as long as the minimum international benchmark is met.[33] Id. at 6328 (the Chicago Convention permits member states to deviate from ICAO standards "to ensure that international commerce is not unreasonably constrained"). Even assuming arguendo that the Convention did somehow intend to limit EPA's authority, any such effort would be ineffective. As the Supreme Court has found, international regulations do not, as a matter of law, supplant EPA's health-protective mandates under the Clean Air Act. *Massachusetts v. EPA*, 549 U.S. 497,

534 (2007) (EPA's interest in promoting international negotiations to foster efforts to control emissions does not authorize "the refusal to execute domestic law"). [EPA-HQ-OAR-2019-0660-0184-A1, pp.8-9]

The Proposal correctly noted that not adopting standards at least as stringent as ICAO's would cause manufacturers to have to seek certification of their planes through other means to operate abroad. 87 Fed. Reg. at 6326. And it argued that adopting ICAO standards helps to "reduce barriers in the global aviation market, benefiting both U.S. aircraft engine manufacturers and consumers." Id. But EPA's desire to avoid certification problems for manufacturers is a straw man argument: no one claims that EPA should not adopt standards that also satisfy ICAO's minimum requirements, and neither the Chicago Convention nor ICAO prohibit EPA from issuing more stringent standards.[42] EPA provided no reasonable explanation for its apparent belief that exceeding ICAO standards would be detrimental to manufacturers or consumers. [EPA-HQ-OAR-2019-0660-0184-A1, pp.12]

And even if concern for the success of international emissions reductions could legitimately be EPA's central objective, cf. *Massachusetts v. EPA*, 549 U.S. 497, 534, refusing to consider whether emissions from U.S. planes can be reduced would be arbitrary and capricious: U.S.-departing flights are by far the largest contributor to global aviation pollution. [EPA-HQ-OAR-2019-0660-0184-A1, pp.12-13]

D. The Chicago Convention is not a barrier to adoption of standards that protect public health and welfare.

EPA's emphasis on promoting international harmonization seems to suggest that the U.S.'s treaty obligations are a barrier to setting the standards necessary to curb PM emissions. They are not. The United States has the sovereign power under international law to regulate activities within its jurisdiction that have an adverse effect on its citizens.[45] [EPA-HQ-OAR-2019-0660-0184-A1, p.13]

Under the Chicago Convention, EPA has jurisdiction over both U.S. registered aircraft and foreign aircraft operating in U.S. airspace.[46] Article 38 of the Chicago Convention explicitly authorizes the U.S. to depart from international standards and procedures and adopt stricter ones for these aircraft if the U.S. "deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard," requiring only notice to ICAO regarding the differences between the state and international standards. Chicago Convention, supra note 17, at art. 38. [EPA-HQ-OAR-2019-0660-0184-A1, pp.13-14]

Indeed, the U.S. has opted in the past to adopt standards that are stricter than ICAO's.[47] For example, the U.S. phased out noisy in-service aircraft on a quicker timeframe than ICAO did.[48] In making the decision to embrace a more stringent standard, the United States noted that "aviation noise management is crucial to the continued increase in airport capacity" and "use of quieter aircraft" could alleviate "community noise concerns."[49] Notably, the U.S. chose to expedite the phase-out of noisier aircraft even though the Government Accountability Office estimated at the time that airlines' compliance costs ranged from $2.1 to $4.6 billion in 1990 dollars,[50] and airline industry groups estimated the cost to be much higher.[51] [EPA-HQ-OAR-2019-0660-0184-A1, p.14]

EPA has also previously agreed that it can set more protective emissions standards under the Chicago Convention. In an aviation nitrogen oxides rulemaking in 2005, the Agency stated:

The Chicago Convention does not require all Contracting States to adopt identical airworthiness standards. Although the Convention urges a high degree of uniformity, it is expected that States will

adopt their own airworthiness standards, and it is anticipated that some states may adopt standards that are more stringent than those agreed upon by ICAO.[52] [EPA-HQ-OAR-2019-0660-0184-A1, pp.14-15]

---

[20] Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664, 69,667 n.11 (Nov. 17, 2005); 87 Fed. Reg. at 6328 (ICAO has environmental "goals" but under the Chicago Convention, "to ensure that international commerce is not unreasonably constrained," member states may deviate from ICAO standards as long as their domestic standards are "at least as stringent" as ICAO's); see also Convention on International Civil Aviation, Ninth Edition at art. 33 (2006), https://www.icao.int/publications/Documents/7300_cons.pdf [hereinafter "Chicago Convention"].

[21] Chicago Convention, supra note 17, at art. 38.

[22] Id. at art. 37 (the Convention seeks "the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation.").

[23] "In-production" refers to "newly-manufactured or built after the effective date of the regulations—and already certificated to pre-existing rules." Control of Air Pollution From Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures, 85 Fed. Reg. 51,556. 51,566 n.79.

[24] New type designs" include "[a]irplane types for which original certification is applied for (to the FAA) on or after the compliance date of a rule, and which have never been manufactured prior to the compliance date of a rule." *Id*. at 51,566.

[33] EPA also claims manufactures would suffer a "competitive disadvantage" from lack of adoption of ICAO's standards because of potential delay and inconvenience while seeking certifications by means other than the automatic ICAO process. Id. at 6347. But this is a red herring. No one disputes that aircraft PM emissions should be regulated at least at the minimum floor ICAO sets.

[42] To the extent that EPA is basing its decision to align its standard with ICAO's on the false belief that it cannot adopt more stringent standards under its international treaty obligations, the Proposal is subject to vacatur for legal error if finalized. See Prill v. NLRB, 755 F.2d 941, 947-48 (D.C. Cir. 1985) ("[a]n agency decision cannot be sustained, however, where it is based not on the agency's own judgment but on an erroneous view of the law. For it is a fundamental principle of law that 'an administrative order cannot be upheld unless the grounds upon which the agency acted in exercising its powers were those upon which its action can be sustained'") (citing SEC v. Chenery Corp., 318 U.S. 80, 95 (1943)).

[45] Restatement (Third) of The Foreign Relations Law of the United States § 402 (1987) (stating that "[A] state has jurisdiction to prescribe law with respect to . . . conduct that, wholly or in substantial part, takes place within its territory." International law recognizes links of territoriality and nationality as justifying the exercise of State jurisdiction.); see also Am. Soc'y Int'l L., "Jurisdictional, Preliminary, and Procedural Concerns," in Benchbook on International Law § II.A (Diane Marie Amann ed., 2014), available at https://www.asil.org/sites/default/files/benchbook/ASIL_Benchbook_Complete.pdf; see generally The Case of the S.S. Lotus (Fr. v. Turk.), 1927 P.C.I.J. (ser. A) No. 10, at 18 (1927) (discussion of territorial jurisdiction in international law including a statement that "jurisdiction is certainly territorial").

[46] Chicago Convention, supra note 17, at chs. II-III (establishing the rights and privileges afforded to contracting states in relation to aircraft operating within their borders). Article 17 of the Chicago Convention establishes that "[a]ircraft have the nationality of the State in which they are registered." Therefore, all U.S. registered aircraft have

U.S. nationality. EPA' greenhouse gas endangerment findings explicitly considered the impact of emissions aircraft flying domestically in the United States and aircraft flying internationally that have a departure point in the U.S., on the basis that these are the emissions "assigned" to the United States under the IPCC Guidelines for National Greenhouse Gas Inventories. 81 Fed. Reg. at 54,465, 54,470 n.265. In its 2008 ANPRM, EPA also indicated that a declining fleet average GHG emission standard "could cover all domestic operations and international departures of domestic airlines." 73 Fed. Reg. at 44,472-73 (emphasis added). Article 11 of the Chicago Convention also establishes that "the laws and regulations of a contracting State relating to . . . the operation and navigation of such aircraft while within its territory, shall be applied to the aircraft of all contracting States without distinction as to nationality, and shall be complied with by such aircraft upon entering or departing from or while within the territory of that State." Foreign-flagged aircraft can be made subject to operational and economic controls to reduce emissions so long as the controls are imposed in a non-discriminatory manner.

[47] See Federal Aviation Administration, Interagency Comments on Proposed NPRM at 1 (May 15, 2020), available at https://downloads.regulations.gov/EPA-HQ-OAR-2018-0276-0038/attachment_1.pdf ("While we strive to make sure our aviation regulations are in line with ICAO standards per Article 37, we sometimes decide not to follow the ICAO standard and instead opt to file a difference per Article 38"); Id. at 14 ("Our treaty obligations do allow for us to file a difference if we opt not to follow an ICAO standard, so there is no obligation to follow ICAO standards."); Paul Stephen Dempsey, Compliance & Enforcement in International Law: Achieving Global Uniformity in Aviation Safety, 30 N.C. J. INT'L L. & COM. REG. 1, 17 n.65 (2004) ("[A]s of 2000, 55 states had notified ICAO of the differences between their domestic laws and Annex 1."); Mark Edward Peterson, The UAV and the Current and Future Regulatory Construct for Integration Into the National Airspace System, 71 J. AIR L. & COM. 521, 559 n.197 (2006) ("A review of the filed differences [pursuant to Article 38] reveals that most deal with differences in terminology or involve more stringent practices.").

[48] U.S. General Accounting Office, GAO-01-1053, Aviation and the Environment: Transition to Quieter Aircraft Occurred as Planned, but Concerns about Noise Persist (Sept. 2001), available at https://www.gao.gov/assets/240/232737.pdf [hereinafter "USGAO 2001"]; 49 U.S.C. § 47528(a); International Civil Aviation Organization, GIACC/3-IP/1, Agenda Item 2: Review of aviation emissions related activities within ICAO and internationally Parallels between Noise and CO2 Environmental Goals at ¶ 2.2 (July 1, 2009), available at https://www.icao.int/environmental-protection/GIACC/Giacc-/Giacc3_ip01_en.pdf (deadline that is 15 months after deadline set out in the United States' Aircraft Noise and Capacity Act of 1990).

[49] 49 U.S.C. § 47521; see also USGAO 2001, supra note 46, at 9.

[50] USGAO 2001, supra note 46, at 11.

[51] Id. (Air Transport Association of America, Inc. estimated airlines' transition costs at $175 billion).

[52] 70 Fed. Reg. at 69,667.

Organization: Wagner, Debi

I will admit I am not completely familiar with the 1944 Chicago Convention EPA refers to but it hardly seems likely this wartime treaty can be applied to today's discussion. It has nothing to do with the environmental protection passed a few decades later or EPA's role in those laws. In my recollection of past discussion of the Chicago Convention, it applied to making sure that civilian aircraft would have the ability to bypass fixed international borders and not be shot down. This convention has been applied to everything from FAA airspace control to quashing lawsuits citing international commerce clause. EPA

has no role in working with or for the industry to help uniform their process, protect international interests or interpret old treaties, but rather are funded by US taxpayers for the sole responsibility to assure compliance with only our domestic environmental protection laws. [EPA-HQ-OAR-2019-0660-0153-A1, p.2]

EPA Response to Comments in Section 2.5

The EPA responds to many of these comments in Sections IV.F.1 and IV.F.2 of the Preamble to the final rulemaking.

The EPA's work at ICAO and CAEP is described in detail in the Preamble to the final rulemaking in Section II.C and further discussed in Section IV.F.2. The EPA's judgment that the PM standards finalized in this action are "appropriate" is based on EPA's own independent judgment, as elaborated upon in the Preamble to the final rulemaking, including in Sections IV.F.2 and VI.E. While EPA considered the ICAO process, negotiations, and standards in exercising the agency's judgment, EPA in no way abdicated its statutory responsibilities under CAA section 231 to ICAO.

Contrary to some commenters' characterization, *Massachusetts v. EPA* does not foreclose EPA's consideration of international dynamics and the unique market considerations for aircraft. *Massachusetts v. EPA*, 549 U.S. 497 (2007). The Supreme Court in *Massachusetts* concluded that the EPA could not justify its failure to determine whether greenhouse gases from vehicles contributed to endangering air pollution on the basis that doing so "might impair the President's ability to negotiate with key developing nations to reduce emissions." 549 U.S. at 533 (internal quotation marks removed). But in *Massachusetts*, the EPA had not taken action to "execute domestic law[]." *Id.* at 534. Here, EPA is executing domestic law in promulgating standards, and the D.C. Circuit has already affirmed that the EPA may weigh international harmonization as a consideration in the context of setting aircraft engine standards. *NACAA*, 489 F.3d at 1230. Likewise, *Massachusetts* did not conclude that international negotiations could not bear on regulatory judgments about the appropriate pace or stringency of domestic standards under the CAA, only that they were not relevant to the prerequisite *scientific* question of "whether greenhouse gas emissions contribute to climate change." *Id.* at 533-34. The EPA did not reopen or reexamine its endangerment finding for PM aircraft emissions in this rulemaking.

In any case, the assertion in *Massachusetts* that international negotiations would be negatively impacted by EPA action was based on conceptual concerns. *See* 68 FR 52922, 52931 (Sept. 8, 2003) ("Unilateral EPA regulation of motor vehicle [greenhouse gas] emissions could also weaken U.S. efforts to persuade key developing countries to reduce the [greenhouse gas] intensity of their economies."). In this rulemaking, the connection between the EPA's domestic and international positions is neither speculative nor abstract. ICAO standards have a direct bearing on the U.S. aviation industry, impacting the design, manufacture, and operation of U.S. planes See 87 FR 6324, 6347. Meanwhile, ICAO negotiations run actively on consecutive three-year cycles, with meetings to set and update standards held at the end of each cycle (an environment in which domestic regulatory decisions have immediate relevance to ongoing negotiations). See 87 FR 6324, 6328 n.17. The EPA reasonably considered the direct and immediate relevance of ICAO standards and the international standard-setting process when weighing whether to adopt or deviate from the latest ICAO PM standards.

The EPA views one commenter's reference to *U.S. Telecomm Ass'n v. FCC*, 359 F.3d 554 (D.C. Cir. 2004) as misplaced. In that case, the D.C. Circuit found that the Federal Communications Commission

unlawfully subdelegated certain determinations and tasks to State commissions to complete. *Id.* at 564. The court held that although "federal agency officials may subdelegate their decision-making authority to subordinates absent evidence of contrary congressional intent, they may not subdelegate to outside entities—private or sovereign—absent affirmative evidence of authority to do so." *Id.* at 566. However, the EPA did not "subdelegate" the task of promulgating aircraft engine PM standards in the United States to ICAO or any other outside entity. Although the members of ICAO first took action to agree upon international PM standards, those standards had no immediate and direct effect in any member nation. The EPA, not ICAO or any other outside entity, then followed the statutory requirements of CAA section 231 in independently assessing and determining the PM standards to be appropriate for the United States and making them binding and enforceable here in the first instance. The EPA, not ICAO or any other outside entity, conducted a notice and comment rulemaking pursuant to the requirements of CAA section 307(d). Additional details on the EPA rulemaking process are provided in the Preamble to the final rulemaking and in the response in section 11.2 of this document.

The relationship between the ability for Member States to file differences at ICAO and international harmonization was raised in comments. One commenter suggested that because some countries have filed differences from ICAO in regard to Annex 1 and "Article 38" in the past, the EPA need not adopt PM standards at the same level of stringency as ICAO to support international harmonization. (The EPA notes that Annex 1 concerns personnel licensing and is not related to stringency of aircraft emission standards. With regard to the commenter's reference to "Article 38," it is possible that the commenter was referencing Article 38 to Annex 16, Volume II, which covers agreements relating to environmental standards as well as other matters such as safety and air traffic management.) The EPA does not dispute that Member States may deviate from ICAO in certain circumstances or that Member States have filed differences at ICAO for various reasons. However, differences from ICAO air pollution emission standards are the exception, not the norm, and the existence of this safety valve and the relatively modest use of it in the past by Member States does not support the commenter's position, which appears to be either that international harmonization is not an important consideration and/or it is not served by the U.S. aligning with ICAO. The EPA is not aware of any Member State filing a difference at ICAO for the ICAO PM standards. Based on the EPA's lengthy experience in negotiating emission standards within ICAO/CAEP and the unique nature of the aircraft industry, in the EPA's view international harmonization of aircraft regulations is an important consideration in this rulemaking and that adopting domestic PM standards that match ICAO's PM standards will promote international harmonization and avoid any unnecessary risk of impairing U.S. manufacturers' competitiveness.

For the comment suggesting that the EPA withdraw the proposed rule and file a difference with ICAO to continue using the existing smoke number standard, the commenter seems to believe that the existing smoke number standards have equivalent control as the nvPM mass and number standards. However, this assumption is incorrect and seems to be based on a misunderstanding. The nvPM mass concentration standard was developed by ICAO to provide, through a nvPM mass measurement, the equivalent smoke opacity or visibility control as afforded by the existing smoke number standard for the covered aircraft engines. However, as described earlier in section 4.2 of this document, the nvPM mass and number standards are the first nvPM emission standards for aircraft to move beyond controlling visibility, which is the purpose of both the smoke and nvPM mass concentration standards. The nvPM mass and number standards are based on data from direct measurements of aircraft engines and the

technology available to control these emissions. Thus, the existing smoke number standard does relate to providing equivalent control as the nvPM mass and nvPM standards.

In addition, the EPA's regulation of aircraft engine PM emissions is an ongoing and long-term effort. See Section I.C of the Preamble for information on the EPA's current and intended future work on aircraft engine PM standards.

For comments on environmental justice (EJ) and related executive orders, see the responses in sections 6.6 and 11.5 of this document. In regard to comments on the Administrative Procedure Act, see the responses in sections 11.1, 11.2, and 11.5 of this document. For the comments on Executive Order 12866 and OMB Circular A-4, see section 11.4 of this document.

3. Applicability of EPA's PM Standards

3.1 General Comments

Organizations Included in this Section

Aerospace Industries Association (AIA)
Anonymous Public Comment – 11
Huang, Wen-Yen

Organization: Aerospace Industries Association (AIA)

Regarding Section I. General Information, A. Does this action apply to me? - we suggest clarifying the text to include 26.7 kN for supersonic engines. A suggested text for this section is:

This proposed action would affect companies that design and or manufacture civil subsonic jet aircraft engines with a rated output of greater than 26.7 kN and those that design and or manufacturer civil jet engines for use on supersonic airplanes to include engines with a rated thrust at or below 26.7 kN. These affected entities include the following: [EPA-HQ-OAR-2019-0660-0178-A1, p.5]

Organization: Anonymous Public Comment - 11

I support part of the proposed rule. I support the acknowledgment of particulate matter; however, I don't not support the limitation of acknowledgment on certain classes of engines. All aircrafts engines should be included in particulate matter emission standards and test procedures. [EPA-HQ-OAR-2019-0660-0166, p.1]

Organization: Huang, Wen-Yen

I was wondering if there is any compensation or penalty for those who do and do not follow the rule. [EPA-HQ-OAR-2019-0660-0149, p.1]

EPA Response to Comments in Section 3.1

The EPA agrees with AIA that many manufacturers design and/or manufacture aircraft engines and that making a clarification would be appropriate. The EPA will revise the rulemaking text in Section I.A accordingly.

The other AIA suggested text edit in Section I.A related to the engines on supersonic aircraft is helpful for clarity, but to meet the objective of this comment the EPA will instead revise the text by moving the words, *"for use on supersonic airplanes,"* to later in the sentence as follows: *"… ~~for use on supersonic airplanes~~ with a rated output at or below 26.7 kN for use on supersonic airplanes."*

The EPA recognizes support for the EPA proposal from the anonymous commenter. Also, the EPA acknowledges the concerns of PM emissions from aircraft engines. Larger commercial aircraft use most of the jet fuel in the U.S., and the engines that this rule applies to, aircraft engines with thrust greater than 26.7 kN, are installed on these aircraft. (See, U.S. EPA (2022) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020. U.S. Environmental Protection Agency, EPA 430-R-22-003. https://www.epa.gov/ghgemissions/draft-inventory-us-greenhouse-gas-emissionsand-sinks-1990-2020, last accessed September 14, 2022). By focusing these PM standards on such engines, the vast majority of the commercial operations and most of the fuel burn and PM emissions from aviation, will ultimately be addressed. (See, U.S. EPA, Cook, R. Memorandum to Docket EPA–HQ–OAR–2019-0660, June 14, 2022, "Estimation of 2017 Emissions Contributions of Turbine Aircraft >26.7 kN to NOx and PM2.5 as a Percentage of All Mobile PM2.5 for the Counties and MSAs in Which the Airport Resides, 25 Largest Carrier Operations – Final Rule.") (See also, 2017 National Emissions Inventory: Aviation Component, Eastern Research Group, Inc., June 25, 2020, EPA Contract No. EP-C-17-011, Work Order No. 2-19.)

The EPA anticipates that the PM standards finalized by the EPA will be enforced by the FAA in the same manner as all other aircraft engine emissions standards. The FAA evaluates compliance with standards during certification. If an engine is unable to meet the emissions standard(s) then the FAA will not issue the engine type certificate or air worthiness certificate. The EPA did not propose compensation or penalties related to FAA enforcement and the topic is beyond the scope of this rulemaking; questions on that topic should be directed to the FAA.

3.2 In-Service

Organizations Included in this Section

B, Nick
Beacon Hill Council of Seattle (BHC)
California Air Resources Board (CARB)
Center for Biological Diversity
Center for Biological Diversity and Friends of the Earth
National Association of Clean Air Agencies (NACAA)
Service Employees International Union
Sierra Club
Wagner, Debi

Organization: B, Nick

I would also like to encourage the EPA to expand these regulations to also include PM emission reductions on existing airline engines, and not just new builds after 2023. With modern engines being able to run for 20 years or more with regular maintenance, aircraft manufactured prior to these emission regulations could still be in the air in 2040 and beyond. [EPA-HQ-OAR-2019-0660-0146, p.1]

Organization: Beacon Hill Council of Seattle (BHC)

First of all, we appreciate the United States' need to align its Emission Standards and Test Procedures with the International Civil Aviation Standards Organization (ICAO). However, the proposed rule is meaningless to us because it:

1. Only regulates new planes, not aircraft already in operation, and even then, requires little if anything beyond what airplane manufacturers are already doing[.] [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[This comment is repeated in section 2.3]]

Organization: *California Air Resources Board (CARB)*

We ask EPA to require the newest and cleanest aircraft engines and emissions-reducing technologies to all in-service, in-production, and new type design engines. Since aircraft have average service lives of 25 to 27 years,[15] excluding in-service engines in the Proposed Standard leaves a large number of emissions unregulated. [EPA-HQ-OAR-2019-0660-0206-A1, pp.5]

---

[15] U.S. Dept. of Transportation, Bureau of Transportation Statistics, Average Age of Aircraft 2019, available at https://www.bts.gov/average-age-aircraft-2019; D. Forsberg, "Aircraft Retirement And Storage Trends," Aviation Report (2015), available at https://aviation.report/Resources/Whitepapers/c7ca1e8f-fd11-4a96-9500-85609082abf7_whitepaper%201.pdf.

Organization: *Center for Biological Diversity*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 21.]

EPA needs to withdraw and reconsider this rule and, instead, adopt one that sets technology-forcing standards that apply across the airplane fleet instead of to individual engines. The standards should: number one, cover aircraft in operation, not just new aircraft; number two, reduce emissions through airplane designs and operational improvements in addition to engine technologies; and three, include a ratchet mechanism to reduce total emissions over time. Strong technology-forcing standards will drive needed changes and create good, family-sustaining jobs in the aviation sector. [[This comment is repeated in section 10.]]

Organization: *Center for Biological Diversity and Friends of the Earth*

A. Standards should apply to new and existing aircraft.

In contrast to other mobile source provisions that limit standard-setting authority to "new" engines and vehicles, Section 231 does not distinguish between new and existing sources. Section 231 instead authorizes EPA to establish emission standards for "any class or classes of aircraft engines."[100] EPA is therefore empowered to regulate emissions from both new and existing aircraft. In fact, EPA has previously interpreted Section 231 to allow regulation of existing aircraft. In 1973 EPA included retrofit standards for in-use aircraft engines.[101] In 2008, EPA referred to its ability to regulate "previously certified engines" and to setting standards based on fleet average performance.[102] And in 2015, EPA again reiterated its understanding that Section 231 authorizes regulation of existing aircraft.[103] [EPA-HQ-OAR-2019-0660-0189-A1, pp.13-14]

EPA has not explained why it has abandoned the option of regulating all classes of aircraft, including in-service aircraft. Regulation of in-service aircraft is especially important because aircraft and aircraft engines operate for about 25 to 30 years.[104] Applying in-production particulate matter standards to in-service aircraft, and requiring additional improvements over time, could promote early retirement of less efficient models.[105] Studies show that this is one of the most effective means of reducing aircraft emissions.[106] [EPA-HQ-OAR-2019-0660-0189-A1, p.14]

[100] 42 U.S.C. § 7571(a)(2)(A) (1990); compare section 7571(a)(2)(A), with section 7521(a)(1) (authorizing emission standards for "any class or classes of new motor vehicles or new motor vehicle engines"). "Where Congress includes particular language in one section of a statute but omits it in another section of the same Act, it is generally presumed that Congress acts intentionally and purposely in the disparate inclusion or exclusion." Bates v. United States, 522 U.S. 23, 29-30 (1997) (internal quotations and citations omitted).

[101] Control of Air Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,088, 19,089 (July 17, 1973).

[102] Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,472 (July 30, 2008).

[103] Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare and Advance Notice of Proposed Rulemaking, 80 Fed. Reg. 37,758, 37,791 n.203 (July 1, 2015) (citing fuel venting and smoke number standards that applied to in-use aircraft and noting that "unlike the EPA's authority to promulgate emission standards for motor vehicles under CAA section 202(a) or for nonroad engines and vehicles under section 213(a), section 231 of the CAA does not restrict the EPA's authority to set standards for only new aircraft.").

[104] Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,471 (July 30, 2008).

[105] Such phase-out regulations could be modeled on FAA's regulations to phase out the loudest civil turbojet aircraft. See Adoption of Statutory Prohibition on the Operation of Jets Weighing 75,000 Pounds or Less That Are Not Stage 3 Noise Compliant, 78 Fed. Reg. 39,576 (July 2, 2013) (prohibiting the operation of jet airplanes with a maximum weight of 75,000 pounds or less in the contiguous United States after December 31, 2015, unless they meet Stage 3 noise levels).

[106] See Grampella, Mattia et al., The Impact of Technology Progress on Aviation Noise and Emissions, 103 Transp. Res. A: Pol'y and Prac. 525 (2017) (2017 study analyzing local emissions reductions from incremental technical progress [improvements in existing aircraft type] and substantial innovation [the production of new-type aircraft], finding that deploying a one-year younger aircraft/engine combination results in a 1% decrease in local emissions; on a per-passenger basis, local emissions are reduced by 24% the introduction of a new aircraft model).

Organization: *National Association of Clean Air Agencies (NACAA)*

EPA should also adopt technology-forcing emission standards for in-service aircraft engines; we cannot afford to wait for BAU fleet turnover. [EPA-HQ-OAR-2019-0660-0177-A1, p.4]

Organization: *Service Employees International Union (SEIU)*

SEIU files this comment because our members who work at and live near airports are directly impacted by particulate matter emissions from aircraft and pollution in general from airports. Our members and their communities will have to live with the emissions allowed by the Agency's rule for years to come. In proposing a rule that fails to meaningfully restrict emissions on new engines and takes no action on the emissions of engines already in service, the EPA's proposed rule is insufficient to protect the public health and does not live up to the mandates set forth for EPA in statute and Executive Orders. While we appreciate the EPA taking on this issue, we call on the Agency to correct these deficiencies before finalizing the rule. [EPA-HQ-OAR-2019-0660-0191-A1, p.2] [[This comment is repeated in sections 2.3, 6.6, and 11.5]]

III. The Proposed Rule Will Not Apply to In-Service Engines

Another key deficiency in the rule as proposed is that it does not apply to any engines that are currently in service.[17] With the lifespan of commercial airliners measured in decades, older engines that do not meet either even the lower in-production standard can continue to operate for many years without any requirements.[18] [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

In order to protect public health and ensure that all aircraft are operating under the same standard, the EPA should update the standard to apply to engines already in service. [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

V. EPA Should Propose a Technology-Forcing Rule with Application to In-Service Engines [EPA-HQ-OAR-2019-0660-0191-A1, p.5]

---

[17] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures; 87 Fed. Reg. 6324, 6337 (February 3, 2022).

[18] See American Airlines U.S. Securities and Exchange Commission Form 10-K (Feb. 22, 2022), available at https://americanairlines.gcs-web.corn/static-fi les/debS 8cec-bf67-4 I 8f-a0f0-022 fb7 5939fc; see also United Airlines Form 10-K (Feb. 18, 2022) available at https://ir.united.corn/static-files/599411 b0-fa33-4 l 03-80ba-cb8203f923a2.

Organization: Sierra Club

F. The Proposal did not consider any of the technologies and methods available to reduce emissions.

In contrast to other mobile source provisions that limit standard-setting authority to "new" engines and vehicles, Section 231 does not distinguish between new and existing sources. Section 231 instead authorizes EPA to establish emission standards for "any class or classes of aircraft engines."[54] Thus, EPA is empowered to regulate emissions from both new and existing aircraft. In fact, EPA has always interpreted Section 231 in this way. The emissions controls EPA first adopted in 1973 included retrofit standards for in-use aircraft engines.[55] In 2008, in connection with aircraft greenhouse gas emissions, EPA referred to its ability to regulate "previously certified engines" and to setting standards based on fleet average performance.[56] In 2015, EPA again reiterated its understanding that Section 231 authorizes regulation of existing aircraft.[57] [EPA-HQ-OAR-2019-0660-0184-A1, pp.15-16]

EPA has not explained why it has abandoned these approaches. EPA should consider implementing regulations that apply to the most polluting aircraft, regardless of their status as existing or new.[58] At a minimum, EPA must consider applying its standards to all classes of aircraft, including in-service aircraft in addition to all new-in production aircraft and new designs, and provide a reasonable explanation for any decision not to regulate them.[59] [EPA-HQ-OAR-2019-0660-0184-A1 p.16]

---

[54] 42 U.S.C. § 7571(a)(2)(A) (1990); compare section 7571(a)(2)(A), with section 7521(a)(1) (authorizing emission standards for "any class or classes of new motor vehicles or new motor vehicle engines"). "Where Congress includes particular language in one section of a statute but omits it in another section of the same Act, it is generally presumed that Congress acts intentionally and purposely in the disparate inclusion or exclusion." Bates v. United States, 522 U.S. 23, 29-30 (1997) (internal quotations and citations omitted).

[55] 38 Fed. Reg. at 19,089.

[56] 73 Fed. Reg. at 44,472.

[57] 80 Fed. Reg. at 37,791 n.203 (citing fuel venting and smoke number standards that applied to in-use aircraft and noting that "unlike the EPA's authority to promulgate emission standards for motor vehicles under CAA section 202(a) or for nonroad engines and vehicles under section 213(a), section 231 of the CAA does not restrict the EPA's authority to set standards for only new aircraft.").

[58] Such phase-out regulations could be modeled on FAA's regulations to phase out the loudest civil turbojet aircraft. See Adoption of Statutory Prohibition on the Operation of Jets Weighing 75,000 Pounds or Less That Are Not Stage 3 Noise Compliant, 78 Fed. Reg. 39,576 (July 2, 2013) (prohibiting the operation of jet airplanes with a maximum weight of 75,000 pounds or less in the contiguous United States after December 31, 2015, unless they meet Stage 3 noise levels).

[59] See, e.g., State Farm, 463 U.S. at 47-49 (reaffirming that "an agency must cogently explain why it has exercised its discretion in a given manner").

Organization: *Wagner, Debi*

There are several primary problems, among others, with new aircraft engine certification; 1) certification never considers the thousands of older, dirtier engines operating daily at a single facility and does not go the extra step of limiting that use; 2) giving a false impression that EPA is assuring compliance with the Clean Air Act/NAAQS for areas where the engines operate and deferral to the industry/local agencies limitations; 3) the disconnect between certification and modeling, or monitoring and enforcement. [EPA-HQ-OAR-2019-0660-0153-A1, p.2] [[This comment is repeated in 7.1.]]

EPA Response to Comments in Section 3.2

Although the EPA agrees with commenters that the CAA gives EPA the authority to regulate in-service aircraft engines and that this could be an effective means to reduce emissions, the EPA did not propose, and is not finalizing, any in-service standards, so comments on this topic are beyond the scope of this rulemaking. The standards proposed and adopted by the EPA are certification standards for newly built engines. Likewise, the testing, compliance, and certification procedures are all based around newly built engines as well. This means that once the engine type is certificated by the FAA, all future engines built under that type certificate will be required to meet the standards. Additionally, since these are the first standards to directly measure nvPM mass and nvPM number manufacturers are still working to determine the best way to ensure future engines comply with the standards.

Unfortunately, the consideration or development of standards for in-service aircraft engines would not be as straightforward as applying the in-production standards to in-service airplanes. In-service standards would raise new and unique questions that would require substantial effort before the EPA would be able to promulgate in-service standards. A new test procedure would need to be developed for use on in-service airplanes (or for engine emissions on in-service airplanes), new measurement data would need to be gathered to determine emission rates for older (in-service) engines, deterioration rates and recovery rates after engine rebuilds would need to be evaluated, the appropriate regulated entity would need to be determined (e.g., aircraft engine manufacturer or airlines), along with conducting technical and economic analysis (including evaluating approaches such as requiring additional improvements for in-service aircraft engines over time and the impact of these approaches to the operational fleet). The EPA does not, at this time, have sufficient record of information to evaluate whether to propose future standards reflecting standards for in-service, nor did commenters provide such supporting information in their comments.

The EPA continues to believe that the appropriate approach at this time is to adopt PM standards that match the scope of the ICAO standards by the international effective date, an action that we believe is well justified by the information provided in this final rule.

In addition, the comments requesting that the in-production engine standards could be extended to in-service aircraft engines are insufficient for the EPA to consider as a proposal. These general requests do not address the above issue of an insufficient record of information, including how in-service engines might be tested, what technologies might be available for retrofitting, or characterize costs or impacts to airlines and the public.

For the comments about the EPA's mention of the regulation of in-service engines in its July 30, 2008 and July 1, 2015 Advance Notice of Proposed Rulemakings (ANPRM's), the EPA notes that in the July 30, 2008 ANPRM the EPA adopted no policy direction on the regulations of GHG from aircraft or aircraft engines. 73 FR 44354 (July 30, 2008). In the July 1, 2015 ANPRM, the EPA expressed at that time we were only soliciting public comment and were not proposing or imposing any regulatory requirements. 80 FR 37758, 37790 (July 1, 2015). For related responses, see sections 10 and 11.3 of this document.

3.3 Exemptions and Exceptions

Organizations Included in this Section

Aerospace Industries Association (AIA)

Organization: Aerospace Industries Association (AIA)

Regarding Section 40 CFR 1031.20, AIA suggests incorporating this section into the preceding exemptions section 1031.15 and discontinuing use of the "exceptions" terminology. Instead, the provisions for spares should be characterized as "unlimited exemptions." This would make the terminology consistent with that of the ICAO Environmental Technical Manual (ETM). [EPA-HQ-OAR-2019-0660-0178-A1, p.5]

EPA Response to Comments in Section 3.3

The EPA acknowledges that this terminology is different than the terminology ICAO uses in its Environmental Technical Manual. However, this terminology is well established by both the EPA and FAA in existing regulations. Further, there are material differences between exceptions and exemptions that are important.

Exemptions are a public process (a list of requests for exemption received by the FAA is routinely published in the Federal Register), and an applicant has to apply to the FAA and justify why they should not need to comply with the standard. The primary criterion is whether an exemption will be in the public interest. These applications for exemptions are examined on a case-by-case basis, and historically they have never been "unlimited."

Exceptions allow aircraft engines to be produced that do not meet the standards without manufacturers being required to apply to the FAA. Thus, exceptions, which are currently limited to spare engines, could be considered "automatic."

Trying to combine the terminology of an automatic process with a process where FAA approval has to be sought will be confusing and could lead to complications in the certification process.

4. Test and Measurement Procedures

4.1 PM Emissions Metric

Organizations Included in this Section

Center for Biological Diversity and Friends of the Earth
Hudda, Neelakshi
Sierra Club

Organization: *Center for Biological Diversity and Friends of the Earth*

The Proposal is arbitrary and capricious because EPA does not consider the costs and benefits of the reduction of other harmful aircraft emissions.

The Proposal also fails to consider the particularly harmful and significant effects of volatile PM. The combustion of aircraft fuel creates emissions of volatile and involatile PM, which both cause well-recognized harm to human health and the environment. EPA takes into account only nonvolatile PM "[b]ecause of the difficulty in measuring volatile PM, which is formed in the engine's exhaust plume and is significantly influenced by ambient conditions."[72] But standards that increase aircraft fuel efficiency also decrease fuel use, and thus would reduce the emissions of both types of particulate matter. In addition, ICAO has stated that volatile particulate emissions are dependent on controls related to "gaseous emission certification and the fuel composition (e.g., sulfur content)."[73] Standards that incorporate these controls could also address both types of particulate matter.[74] EPA failed to consider these costs and benefits of its Proposal, rendering its rule arbitrary and capricious.[75] [EPA-HQ-OAR-2019-0660-0189-A3, p.9]

---

[72] 87 Fed Reg. at 6,331.

[73] Rindlisbacher, Theo & S. Daniel Jacob, New Particulate Matter Standard for Aircraft Gas Turbine Engines, ICAO Environmental Report (2016) https://www.icao.int/environmentalprotection/Documents/EnvironmentalReports/2016/ENVReport2016_pg85-88.pdf at 1.

[74] See infra at footnotes 112-113.

[75] State Farm, 463 U.S. at 43; Michigan v. EPA, 576 U.S. 743, 753 (2015) (explaining that "reasonable regulation ordinarily requires paying attention to the advantages and the disadvantages of agency decisions").

Organization: *Hudda, Neelakshi*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 33-34.]

My second comment pertains to the following sentence on page 6337. I quote, "It is appropriate to gain experience from the implementation of these non-volatile standards before considering whether to adopt more stringent non-volatile PM mass and/or number standards, or whether another approach to PM regulation would better address the health risks of PM emissions from aircraft engines." I want to focus on the following idea embedded in that sentence: "Experience is required to evaluate the success of this proposed rule." It is a perfectly reasonable stance, but no detail is offered on what metrics would be gathered for evaluation during the experience period nor the duration of the experience period

specified. For example, would monitoring air quality in near-airport communities and tracking the changes be an appropriate criteria of success? The last phrase of the sentence mentions health risks. What approach would be taken to quantify changes in risk that would determine if this non-volatile PM standard was successful or if more stringent standards or another approach is required?

In summary, this proposed rule discusses non-volatile PM emissions standard clearly. [EPA-HQ-OAR-2019-0660-0160, pp. 34.]

Organization: Sierra Club

EPA also quantifies the percentage of PM contained in engine emissions based on (admittedly) imprecise capture and testing procedures, and limited only to non-volatile PM. Id. at 6630. [EPA-HQ-OAR-2019-0660-0184-A1, p.2]

EPA Response to Comments in Section 4.1

Legal topics raised by commenters are addressed in section 11.

It is unclear what the commenter is specifically referring to or what they mean by "imprecise" because 6630 is not a page on which this Federal Register notice was published, and the EPA did not use that word in the proposal.

Perhaps the commenter used "imprecise" to mean that the test procedure would not be a correct method to use certification measurements to assess local air quality impacts. However, the concept was recognized in the proposed rule and is the reason that the EPA led much of the development work for the loss correction procedure to estimate engine exit emissions measurements (87 FR 6324, 6345) and ICAO adopted this loss correction as a reporting requirement (Id. at 6344-6345). As described in Section V.A.2 of the Preamble to the final rulemaking, the PM test procedures specify a sampling line that can be up to 35 meters long, and this length results in significant particle loss in the measurement system relative to the engine exit. To assess the emissions contribution of aircraft engines for inventory and modeling purposes, and subsequently assessing human health and environmental effects, it is necessary to know the emissions rate at the engine exit. Thus, the measured PM mass and PM number values must be corrected for system losses to determine the engine exit emissions rate.

Alternatively, perhaps the commenter is referring to this EPA recognition that a large amount of the particles will be lost in the sampling (Id. at 6342). In the context that the sampling line could be up to 35 meters long, as described above, the measurement of PM from aircraft engines is very different and much more difficult to measure than from other sources. Aircraft engine exhaust is much hotter, and it leaves the engine at much higher velocities compared to exhaust from ground vehicles. These conditions lead to a host of measurement challenges, such as where to place the equipment so it is not damaged (due to vibrations or excess heat), how to cool the measurement sample to a temperature where instruments can measure it, and how to ensure the exhaust emissions sampled is a representative measurement. The PM measurement procedures adopted by ICAO serve as a consistent and comparable measure of nvPM produced by aircraft engines because all engines are measured in the same manner and at the same point in the sampling system. This measurement procedure will allow manufacturers to evaluate how nvPM changes as they develop new technologies and will allow regulators around the world to consistently compare and evaluate nvPM emissions to ensure technologies reduce emissions over time (Id. at 6337).

For responses to comments on volatile PM or total PM, please refer sections III, IV, and V of the Preamble to the final rulemaking and sections 4.2 and 10 here in this response to comments document.

4.2 Test Procedure

Organizations Included in this Section

Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Environmental Defense Fund (EDF)
Ilabdfara, Rasanjali
Sierra Club

Organization: Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)

2. A4A AND ALPA ALSO SUPPORT INCORPORATION OF THE ICAO TEST AND MEASUREMENT PROCEDURES INTO U.S. LAW

In addition to proposing to adopt into U.S. law the ICAO Aircraft Engine PM Standards, EPA is proposing to incorporate "the emission test and measurement procedures adopted by ICAO."[29] As EPA states, these procedures, which "were produced in conjunction with the Society of Automotive Engineers (SAE) E-31 Aircraft Exhaust Emissions Measurement Committee," include "measurement system specifications and requirements, instrument specifications and calibration requirements, fuel specifications, and corrections for fuel composition, dilution, and thermophoretic losses in the collection part of the sampling system."[30] As with the ICAO Aircraft Engine PM Standards, A4A and ALPA support the incorporation of the ICAO testing and measurement procedures into U.S. law. This would be accomplished through the Proposed Rule's incorporation by reference provision, proposed section 1031.210, as well as proposed section 1031.140. [EPA-HQ-OAR-2019-0660-0192-A1, p.10]

While we are supportive of these proposed regulatory provisions, it must be emphasized that the FAA has exclusive authority over the composition and chemical or physical properties of the test fuel. Federal law has long provided as follows:

The Administrator of the [FAA] shall prescribe-

(1) standards for the composition or chemical or physical properties of an aircraft fuel or fuel additive to control or eliminate aircraft emissions the Administrator of the [EPA] decides under section 231 of the Clean Air Act (42 U.S.C. 7571) endanger the public health or welfare; and (2) regulations providing for carrying out and enforcing those standards.[31] [EPA-HQ-OAR-2019-0660-0192-A1, pp.10-11]

Congress added this provision to the Federal Aviation Act of 1958 via the Clean Air Amendments of 1970, and courts have long held that the Federal Aviation Act of 1958 creates a "uniform and exclusive system of federal regulation" of aircraft that preempts state and local regulation.[32] This recognizes the critical importance of ensuring aircraft operations are not subject to a patchwork of state and local laws, as well as the critical importance that maintaining the integrity of aviation fuel has to maintaining the safety of aircraft operations. Quite simply, Congress recognized the need to ensure the FAA had sole and exclusive authority to regulate aviation fuels. [EPA-HQ-OAR-2019-0660-0192-A1, p.11]

In another context, EPA has correctly acknowledged that the FAA has exclusive authority over the composition and properties of aviation fuel. In a 2012 response to a rulemaking petition requesting that

EPA address the lead content of fuel used in piston engine general aviation aircraft, the Agency explained as follows:

EPA has no direct authority on setting . . . aviation fuel specifications by regulation. Rather, FAA has authority to prescribe standards for the composition or chemical or physical properties of aircraft fuels to control or eliminate aircraft emissions. 49 U.S.C. 44714. . . . [W]hile EPA has an interest in environmentally compatible fuels, our direct role here is limited to setting an engine emission standard under [CAA] section 231 that can be met, within appropriate lead time, with the development and application of requisite technology, giving appropriate consideration to the cost of compliance and to safety and noise factors.[33] [EPA-HQ-OAR-2019-0660-0192-A1,p.11]

Proposed subsection 1031.140(b) would require the use of "a test fuel meeting the specifications described in ICAO Appendix 4," and further stipulates that "[t]he test fuel must not have additives whose purpose is to suppress smoke, such as organometallic compounds." A4A and ALPA support this proposed regulatory language. However, we respectfully request the Agency to expressly affirm that in accordance with 49 U.S.C. § 44714, FAA has exclusive authority over the composition and properties of aviation fuel, and that proposed section 1031.140 applies only to the testing of aircraft engines for purposes of establishing the engines meet the PM emissions standards and does not and cannot be interpreted to apply to the fuel used to operate aircraft. Further, proposed subsection 1031.140(b) dictates the use of a test fuel that meets "the specifications described in ICAO Appendix 4," specifications that have been approved by FAA in its capacity "as the representative (member) of the United States" to ICAO/CAEP, with EPA serving an advisory role.[34] As such, the testing specifications have been approved in the first instance by FAA, the federal agency with exclusive authority to do so. [EPA-HQ-OAR-2019-0660-0192-A1, pp.11-12]

---

[29] Id. at 6342.

[30] Id.

[31] See 49 U.S.C. § 44714 ("Aviation fuel standards").

[32] See Burbank v. Lockheed Air Terminal, Inc., 411 U.S. 624, 639 (1973); see also American Airlines v. Department of Transp., 202 F.3d 788, 801 (5th Cir. 2000) (aviation regulation is an area where "[f]ederal control is intensive and exclusive") (quoting Northwest Airlines, Inc. v. Minnesota, 322 U.S. 292, 303 (1944)).

[33] See EPA, Memorandum in Response to Petition Regarding Lead Emissions from General Aviation Aircraft Piston-Engines, at 16 (July 18, 2012) (footnote omitted) (emphasis added), available at https://www.epa.gov/sites/default/files/2016-09/documents/ltr-response-av-ld-petition.pdf.

[34] 87 Fed. Reg. at 6328.

Organization: *Ilabdfara, Rasanjali*

In regards to this situation, I am in support of emissions testing on air travel engines. Overall, air pollution has been a big issue and has caused problems for human health as well as environmental health. It is reported that aviation pollution contributes to 2.5% of global CO2 emissions. However, if we look from a different angle, we see that aviation emissions contribute to other pollutants, such as the decrease of ozone(O3) and methane(CH4). Now with travel becoming open, it is important to take action to help control our emission rates. [EPA-HQ-OAR-2019-0660-0170, p.1]

Organization: *Sierra Club*

In addition, EPA's wholesale adoption of ICAO's testing procedures is arbitrary and capricious. EPA limits itself to ICAO's regulation of only non-volatile PM, even though volatile PM emissions cause serious health risks, and even though EPA acknowledges that ICAO's testing procedures do not fully capture these emissions. 87 Fed. Reg. at 6630. But EPA makes no effort to explore alternative capture and testing procedures, and also does not explain why it had not undertaken that work. EPA thus failed to address an important aspect of the problem before it. [EPA-HQ-OAR-2019-0660-0184-A1, p.13]

EPA Responses to Comments in Section 4.2

The EPA notes AIA's support of the migration of the test fuel provisions from 40 CFR part 87 to the new 40 CFR part 1031. (87 FR 6349, February 3, 2022). In the Preamble to the proposed rule, the EPA explained the intention of the proposed migration (and associated restructuring) of 40 CFR part 87 to a new 40 CFR part 1031. The EPA also noted that, with the exception of some proposed revisions to specific provisions detailed in the NPRM, the intention was to migrate the existing provisions of 40 CFR part 87 to the new part and restructure them in such a way that the regulatory provisions themselves remain unchanged. Further, the EPA did not open for comment, or reexamine, any specific aspect of the proposed regulatory migration that was not explicitly mentioned in the NPRM as a proposed change to the meaning of the regulatory text. Thus, comments regarding the substance of 40 CFR 1031.140(b), which is identical to the former 40 CFR 87.60(b), will not be addressed as they are outside the scope of this action.

Another commenter correctly asserted that we limited the scope of the analysis to engine combustor technologies and did not consider other means by which emissions may be limited. However, they then incorrectly assert that EPA's *"main goal is to replace the existing smoke standard for aircraft, a standard from 1981"*. Although the nvPM mass concentration standard is replacing the existing smoke standard for some engines, the nvPM mass and number standards serve a different purpose. The nvPM mass and number standards are the first PM emission standards for aircraft to move beyond controlling visibility, which is the purpose of both the smoke and nvPM mass concentration standards. The nvPM mass and number standards are based on data from direct measurements of aircraft engines and the technology available to control these emissions.

For the reasons noted elsewhere in this document, potential impacts of aviation on ozone and methane are out of scope of this rule.

Commenters suggest that EPA's limitation of the rulemaking to cover only the non-volatile component of PM is arbitrary and capricious. In Section III of the Preamble to the final rulemaking, the EPA discusses the health risks of volatile PM, and in Section V of the Preamble to the final rulemaking we include an estimate of volatile PM in the inventory. Volatile PM or total PM is not a matter that the EPA has ignored or neglected to account for in this rulemaking.

In general, legal topics raised by commenters are responded to in the Preamble to the final rulemaking in Section IV.F.1 and IV.F.2 or in section 11 of this document. As discussed in Section IV of the Preamble to the final rulemaking and above in section 4.1, only non-volatile PM is present at the engine exit. This is because the conditions at the engine exit are too hot to allow the formation of volatile PM. As the hot exhaust cools and mixes with the environment volatile PM is formed, it means that volatile emissions are significantly impacted by the local environment and after measurements are taken. The size of

aircraft engines makes measuring in completely controlled environments very challenging or impractical. This means that measurements are dependent on the location, season, and even time of day they are taken. The result of this is that it is very challenging to develop a consistent, repeatable, and comparable measurement procedure. Acknowledging these challenges ICAO and SAE focused initial work on the non-volatile component of PM where a consistent and repeatable measurement could be developed more easily. Also, see Section I.C of the Preamble to the final rulemaking for information on the EPA's current and intended future work on aircraft engine PM standards.

5. Annual Reporting Requirements

Organizations Included in this Section

California Air Resources Board (CARB)
Wagner, Debi

Organization: California Air Resources Board (CARB)

V. EPA Should Require More Robust Reporting and Consumer Demand Programs Based on Emission Profiles

EPA should require robust reporting for all in-service, in production, and new type engines. In December 2018, EPA issued an information collection request (ICR) that matches the PM reporting requirements adopted from ICAO's Committee on Aviation Environmental Protection (CAEP) tenth meeting (CAEP/10).[26] CAEP/10 adopted a reporting requirement where aircraft engine manufacturers were required to provide PM mass concentration, PM mass, and PM number emissions data—and other related parameters—by January 1, 2020, for in-production engines. EPA should strengthen these reporting requirements for all aircraft engines whether in-service, in production, or new type. Reporting should be on-going and include future new type engines. It is imperative to have robust reporting and inventory in order to make sound policy decisions and determine accurate emissions and potential emission reductions. Excluding in-service engines in the Proposed Standard omits a large portion of emissions and does not enable a comprehensive inventory. In addition, comprehensive reporting and inventory is critical to assess the emissions impact on EJ communities surrounding airports and is necessary to establish baseline emissions and quantify future reductions. [EPA-HQ-OAR-2019-0660-0206-A1, p.9]

---

[26] 83 Fed. Reg. 44,621, August 31, 2018. U.S. EPA, Aircraft Engines—Supplemental Information Related to Exhaust Emissions (Renewal), OMB Control Number 2060–0680, ICR Reference # 201809–2060–08, December 17, 2018.

Organization: Wagner, Debi

The public believes EPA is protecting our air quality but because the industry is allowed to only rarely publish their own impacts, without any mandate on oversight/scrutiny, there is no assurance of environmental protection. Most of these self regulated reports paint a rosy picture of the airport air quality while independently produced reports say the opposite. Most people are unaware these industry produced reports are primarily estimated or modeled impact analysis using a complex system not subject to checks and balances on data input or results. In other words, the public must take the

word of the industry. It takes years, money and experience to investigate these issues that EPA, not the public, should be responsible for. [EPA-HQ-OAR-2019-0660-0153-A1, pp.2-3]

Use the PM mass to study, document and publish information that can be made clear to the public and local agencies about the potential impact and area of impact from PM 10 and PM 2.5 to local air quality around the nation's busiest airports considering the combined use of thousands of aircraft engines per day. (When this was done independently by the State Department of Ecology in 1991, before PM 2.5 was adopted, and before PM 10 was eliminated from the model, violations of the NAAQS PM 10 short and long term standard were discovered in the communities around the airport) [EPA-HQ-OAR-2019-0660-0153-A1, p.4]

EPA Response to Comments in Section 5

The EPA notes that its current engine emissions reporting program, which is being incorporated into the CFR through this action, already includes robust reporting requirements for any engines produced in a given calendar year and which are subject to the EPA's emissions standards. Thus, the existing reporting program, which was expanded in 2018 to include reporting of PM, already covers in-production and new type design engines. As a result, the EPA has actual gaseous emissions (NO_x, HC, and CO), smoke and PM data for engine types which were in production after 2018 and will continue to receive such data for new type designs going forward. The EPA also has access to gaseous and smoke emissions data for almost all in-service engines given that gaseous emissions and smoke standards for aircraft engines have been in place for decades. Thus, a request to include in-service engines in the reporting program is effectively a request to require PM testing of in-service engines.

The EPA believes that requiring the reporting of PM emissions from in-service engines is neither needed nor appropriate at this time. The EPA has provisions allowing it to require manufacturer-run testing of in-service vehicles and engine for various highway land-based nonroad and marine sectors and could do the same for aircraft engines in the future. See, for example, 40 CFR part 1048, subpart E. However, this response specifically addresses the issues raised by the commenters regarding improved emissions estimates and making sound policy decisions. The comment requesting the EPA establish a consumer demand program is addressed in Section 10 of this document.

Data submitted under the existing reporting requirement, which the EPA is simply incorporating into the CFR with this action, is used for two main purposes. First, the data is used to understand trends in technology and emissions behavior to be used to inform future standards setting efforts. Second, the data is used to develop and improve emissions inventories. As noted above, the existing reporting program already covers in-production and future new type engine designs. Thus, only the reporting of emissions data from in-service engines is being addressed here in this response to comments. The EPA is not currently considering emissions standards for in-service engines. Thus, requiring measured emissions data to be reported for in-service engines would serve no purpose from that perspective. Should the EPA ever consider requirements for in-service engines, it may reconsider this position at that time. Regarding potential improvements to emissions inventories, the EPA does not believe that the modest improvement to inventories that would result from the inclusion of in-service engines in the reporting program would justify the burden of such a change to the reporting program, as discussed in the following paragraphs.

The EPA uses the First Order Approximation version 4.0 (FOA4) method of estimating PM emissions, along with measured smoke data, for modeling PM emissions for out-of-production engine models for which there is not measured PM data. The FOA4 PM estimation methodology is based on a correlation between smoke and PM developed using actual measured smoke and PM from a number of engine types of varying technology levels. This methodology was originally developed under CAEP under the name SCOPE11. (See, Agarwal, Akshat & Speth, Raymond & Fritz, Thibaud & Jacob, S. & Rindlisbacher, Theo & Iovinelli, Ralph & Owen, Bethan & Miake-Lye, Richard & Sabnis, Jayant & Barrett, Steven. (2019). SCOPE11 Method for Estimating Aircraft Black Carbon Mass and Particle Number Emissions. Environmental Science & Technology. 53. 10.1021/acs.est.8b04060.) It was subsequently incorporated into ICAO's Doc 9889 Airport Air Quality Manuel as FOA4. It is a well-documented PM estimation methodology that is suitable for use in cases where actual PM measurement data are unavailable and is sufficient for EPA's emissions inventory purposes related to in-service but out-of-production engine type designs.

The consideration of a requirement to report actual PM test data from out-of-production but in-service engines raises logistical questions regarding such a program's scope and burden. Initially, one would have to determine which entity would be subject to the reporting requirement. While the existing engine reporting program applies to engine manufacturers, it is not clear that this would work well for older, out-of-production engine types for which a manufacturer no longer provides support. In such cases it would seem to fall to the aircraft operators to work together to assure that all in-service engine types are tested, and the data reported to the EPA. The logistics of such a program would be daunting. Further, a reporting requirement would be especially burdensome in cases where there are very few examples of an older engine type still in service. Finally, the cost of such a program would likely be prohibitive. For the existing reporting requirement related to current in-production engine type designs (and future new type engine designs), the cost of emissions testing and providing the resulting data is generally considered to be part of the overall burden of achieving airworthiness certification from the FAA. As such, the burden associated with the current EPA reporting requirement is largely related merely to the submission of the previously collected test data rather than performing the actual emissions measurements. Such would not be the case for PM data from in-service engines, and PM testing for one engine can typically cost a half million dollars. In addition, there would be costs associated with identifying, removing and transporting an engine for the testing.

The EPA believes it has the authority to develop and implement a reporting requirement for emissions data from in-service engines. However, it does not believe that the modest improvement to emissions inventories from such a program would justify the logistical difficulties and burden it would impose in light of the availability of a reasonable PM estimation methodology in FOA4.

6. Particulate Matter Impacts on Air Quality

6.1 General Comments

Organizations Included in this Section

Environmental Defense Fund (EDF)
Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)

Organization: *Environmental Defense Fund (EDF)*

We also request that all the sources cited herein form part of EPA's Record of Decision. [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

Organization: *Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)*

PM pollution is harmful to human health and the environment – contributing to thousands of deaths every year. [EPA-HQ-OAR-2019-0660-0194-A1, p.1]

EPA Response to Comments in Section 6.1

EPA agrees with commenters that exposure to PM pollution generally causes adverse health effects. In setting the standards today, EPA has considered the health impacts of PM and other factors as described in the preamble. EPA's assessment of the health impacts of PM are set forth in Section III.B of the Preamble to the final rulemaking and section 6.2 of this document.

As for the request from Environmental Defense Fund (EDF) for the EPA to include all of its cited sources in our "Record of Decision," the EPA has included in the docket and administrative record for this rulemaking all studies which commenters submitted to EPA as well as any other studies that EPA itself relied upon or considered. The agency, however, is not bound to include in the docket or the administrative record all studies that a commenter merely cites in its comments and does not actually provide to the agency. Where commenters want the agency to read and consider a study, it is commenters' obligation to provide a copy of that study to the agency.

In any event, the EPA took a look at all the sources cited by EDF. The docket contains 18 of the 32 scientific studies cited by EDF (EDF citation numbers 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32). Four of the other sources (2, 5, 6, 7) cited by EDF are not relevant to PM air quality and health and one, Health Effects Institute (HEI) Report number 211, was not included because it was a PM health effects reference published after the most recent U.S. EPA Integrated Science Assessment for Particulate Matter (PM ISA) and supplement (12). While the HEI report was published after the literature cutoff date for the ISA supplement, numerous peer reviewed papers that comprise the report were evaluated and included as part of the evidence base presented in the ISA and ISA Supplement. EDF appears to rely on the HEI Report to argue that the PM NAAQS are not sufficiently protective. However, the adequacy of the NAAQS is beyond the scope of this proceeding. EPA is reconsidering the PM NAAQS separately from this action (https://www.epa.gov/newsreleases/epa-reexamine-health-standards-harmful-soot-previous-administration-left-unchanged). Several of EDF's sources reference the topic of jet fuel (67, 68, 70, 71, 80), which is beyond the scope of this rulemaking, as explained in Section 10 of this document. Other references identified by EDF were not considered by the EPA because as a general matter we do not include non-peer reviewed work in our literature reviews (23, 27, 42).

6.2 Health Effects of PM

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Anonymous Public Comment – 4
Anonymous Public Comment - 11
Aviation-Impacted Communities Alliance (AICA)
Barnes, Miki
Baseman, Debra
Batra, Neelesh
California Air Resources Board (CARB)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Environmental Defense Fund
Gibbons, Laura
Hudda, Neelakshi
Ilabdfara, Rasanjali
Ramirez, Oscar Flores
Senate of Pennsylvania, 10th Senatorial District
Sierra Club
South Coast Air Quality Management District
Vasquez, Miguel
Zamore, Wig

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

The NPRM is woefully inadequate in its treatment of the costs of adopting this proposed rule. It merely states that, since there is no cost to the aviation industry, there are no costs to be considered. There is substantial evidence presented in section III.B of the NPRM that confirms the health risks of PM emissions are substantial.

"Scientific studies show exposure to ambient PM is associated with a broad range of health effects. These health effects are discussed in detail in the Integrated Science Assessment for Particulate Matter (PM ISA), which was finalized in December 2019.[36] The PM ISA concludes that human exposures to ambient PM2.5 are associated with a number of adverse health effects and characterizes the weight of evidence for broad health categories (e.g., cardiovascular effects, respiratory effects, etc.).[37] The PM ISA additionally notes that stratified analyses (i.e., analyses that directly compare PM- related health effects across groups) provide strong evidence for racial and ethnic differences in PM2.5 exposures and in PM2.5-related health risk. As described in Section III.D, concentrations of PM increase with proximity to an airport. Further, studies described in Section III.G report that many communities in close proximity to airports are disproportionately represented by people of color and low- income populations." [EPA-HQ-OAR-2019-0660-0175-A1, pp.5-6]

These health risks have costs that are well documented in the literature, including the costs of premature death, loss of income, medical expenses, and other health-related costs. In considering only the costs to the aviation industry, the NPRM fails to adequately evaluate the costs of this proposal to the public and to EJ communities. [EPA-HQ-OAR-2019-0660-0175-A1, pp.6]

Organization: *Anonymous Public Comment - 4*

The regulations for car emissions have only been around for the last 20 years or so, and have steadily improved overtime to create a commuter environment that breathes a lot better than their counterparts did in the 20th century. We've learned about the health and environmental impacts of auto emission and regulated it, and it's time to do our due diligence for airplane emission as well. We know so little about the impacts of the particulate matter created by airplanes other than it's bad for the atmosphere, and the fact that people living near the airports present a mire of illnesses likely caused by the planes. It's best to take the prospective regulatory approach now rather than reflect on how hindsight is 20/20 once many people and the environment have suffered from currently unknown effects. [EPA-HQ-OAR-2019-0660-0138, p.1]

Organization: *Anonymous Public Comment - 11*

It has been concluded that aircraft jet engines produce carbon dioxide (CO2), water vapor (H2O), nitrogen oxides (NO2), carbon monoxide (CO), oxides of sulfur (SO2), unburned or partially combusted hydrocarbons (also known as volatile organic compounds (VOCs), particulates, and other trace compounds. These particles are being released into the air causing two issues which are an increase of greenhouse gases and health issue for American citizens. [EPA-HQ-OAR-2019-0660-0166, p.1] [[This comment is repeated in section 13]]

The second issue is the health issue that could result in Americans being affected by pollution particles from aircraft engines. Some of health issues include premature death in people with a heart or lung disease, nonfatal heart attacks, irregular heartbeats, aggravated asthma, decrease in lung function, and increased respiratory symptoms (irritation of the airways and/ or coughing or difficulty breathing). [EPA-HQ-OAR-2019-0660-0166, p.1]

Organization: *Aviation-Impacted Communities Alliance (AICA)*

The harmful nature of unregulated aviation emissions is a serious threat to the health of residents on the ground. Extensive evidence is available which underscores that aviation emissions must be regulated. Regulating PM10 & PM2.5 for future engine production is a long overdue starting point, but it is insufficient. Ultra-fine particles (PM0.1) and ultra-UFP (10-20 nm) must be incorporated into air quality and emissions standards. Mobile air monitoring, particularly for down-wind communities and environmental justice communities must become standard. The FAA needs to refocus their priorities from safety and efficiency to a balance between prioritizing the safety and health of both travelers in the air and residents on the ground. Although ultra-fine particles (PM0.1) and ultra-UFP (10-20 nm) are invisible, they are causing harm, which will result in significant suffering and escalating health care costs. [EPA-HQ-OAR-2019-0660-0159-A1, p.1]I ask that the EPA strengthen US environmental protection by developing a UFP standard. [EPA-HQ-OAR-2019-0660-0159-A1, p.1]

Organization: *Barnes, Miki*

I am writing to state my support for the comments submitted by AIRPORT IMPACT RELIEF (AIR INC) on Monday 3/28/22 on the proposed EPA rule: “Control of Air Pollution from Aircraft Engines: Emissions Standards and Test Procedures." [EPA-HQ-OAR-2019-0660-0200, p.1]

Organization: *Baseman, Debra*

It is imperative that stringent Particulate Matter (PM) standards be applied to aviation emissions. This should include not only PM10 and PM2.5 but ultrafine PM0.1 as well. In the past several years, there has been an explosion of literature regarding the specific properties of aviation emissions and their harms to public health. Our wealth of knowledge has grown at the same time the FAA has sought to maximize airspace capacity and utilization, through Airspace redesign, implementation of NEXTGEN, increased use of General Aviation airports and the upcoming DataComm technology. The concerns of scientists, public health officials and residents on the ground have been ignored. The detrimental impact of poorly regulated aviation emissions is a brewing environmental and public health crisis that must be addressed by utilizing the most current scientific knowledge. [EPA-HQ-OAR-2019-0660-0152-A1, p.1]

PUBLIC HEALTH

As a medical doctor, I am overwhelmed and alarmed by mounting environmental toxicology data implicating serious harm related to airplane emissions. We have known for a long time about the significant harms to human health of poor ambient air quality and Traffic Related Air Pollution (TRAP). Extensive correlation has been demonstrated in diverse illnesses, impacting all segments of the population. Air quality related illnesses include adult malignant brain tumors, lung inflammation, childhood asthma & non-smoking COPD, Heart Attacks, poor cognition, Sudden Infant Death Syndrome (SIDS), Neonatal ICU admissions and Preterm delivery. [EPA-HQ-OAR-2019-0660-0152-A1, p.2]

Traffic Related Air Pollution (TRAP) is related to potentially dangerous pregnancy complications such as Preeclampsia and Gestational Hypertension; this is particularly alarming given the Maternal Mortality crisis occurring nationwide. A well-designed study documented airport delays and taxiing time to an increased incidence of hospitalizations for asthma and heart attacks. [EPA-HQ-OAR-2019-0660-0152-A1, p.2]

Data is now emerging regarding the specific risk of UFPs and u-UFPs. These miniscule pollutants pose a unique risk to health because their microscopic size allows passage across tissue barriers, including the difficult to permeate blood-brain barrier. Recent NIH studies have demonstrated UFP PM0.1 exposure related to childhood cancer, adult brain tumors, asthma, heart attacks, mental health issues, including teen ER visits for anxiety and suicidal ideation, [EPA-HQ-OAR-2019-0660-0152-A1, p.2]

Of urgent significance is the recent study specifically linking preterm delivery to aviation emissions. Babies and children may be particularly susceptible to UFP & u-UFP pollution because they accumulate UFPs at higher relative concentrations than adults. Emerging data validates the ability of UFPs to cross tissue barriers, including the placenta, and cause adverse birth outcomes and life-long disease. Most surprising are studies showing that childhood asthma is related to prenatal in-utero UFP exposure, indicating that these particles are causing lung inflammation before a baby even takes their first breast. In addition to the suffering these illnesses will cause, the public health costs will be astronomical. One health impact assessment evaluated the projected costs associated with PM2.5 related asthma alone; the predictions are staggering. [EPA-HQ-OAR-2019-0660-0152-A1, pp.2-3]

AIRPLANE PARTICULATE MATTER EMISSIONS

Until relatively recently, studies regarding Traffic Related Air Pollution (TRAP) used fixed, stationary air quality monitors, which failed to account for downwind effects. Additionally, the smallest Particulate Matter investigated was PM 2.5 [Particulate Matter with diameter <2.5 micrometers (µm)]. Ultrafine Particles (UFP) with a diameter <0.1µm [100 nanometers (nm)], known as PM0.1, or the specific contribution of aviation-origin emissions had been overlooked. [EPA-HQ-OAR-2019-0660-0152-A1, p.1]

The ability to utilize mobile air quality monitors led to a 2014 groundbreaking study demonstrating that particulate matter from airplane emissions spread 10 miles outside of the flight path. Specifically, pollutants measured 4-5 fold at 6 miles downwind and persisted 2-fold at 10 miles downwind. The authors of the study concluded that air traffic exhaust was the "same general magnitude as the entire urban freeway network" occurring overhead, raining down on residents. Their findings "indicated that the air quality impact areas of major airports may have been seriously underestimated". [EPA-HQ-OAR-2019-0660-0152-A1, p.1]

Mobile air quality monitors were also instrumental in delineating the specific emissions profile of aviation vs. road traffic exhaust in the impeccable MOV-UP Study, published in December 2019. The researchers were able to identify a fingerprint of UFP specifically emitted by planes: particles significantly smaller than even PM0.1. These aviation emission particles measure 10-20 nm and were coined ultra-UFP (u-UFP). This miniscule size is important in that they are inadequately measured by current governmental air quality monitoring and can cross tissue barriers , causing significant disease, as is outlined below. [EPA-HQ-OAR-2019-0660-0152-A1, p.1]

The MOV- UP researchers further discovered that the aviation u-UFPs' nanoparticle size, coupled with the velocity with which they are thrust from jet engines, allows for much further spread than heavier ground vehicle emissions, which fall to the surface a relatively short distance from roadways. The velocity with which u-UFPs travel prevents adherence to other particles, allowing the u-UFPs to reach the earth unchanged in size, preserving the ability of u-UFPs to cause significant harm. Related studies have shown that the size and velocity allow for concentration indoors and that aviation u-UFP and NO2 concentrations in homes were comparable to or exceeded near-road regulatory monitors. This same report also demonstrated the inadequacy of stationary air quality monitors to accurately estimate residential exposures; this finding has been supported by other studies.. [EPA-HQ-OAR-2019-0660-0152-A1, pp.1-2]

Recent studies support the hypothesis that aviation emission PM contains metallic compounds. This has been demonstrated both with direct studies of exhaust as well as examination of soil contamination near airports. The ongoing Mov-Up Part 2: "The Characterization of Urban Nanoparticles" will help to further delineate this issue. The health harms of metal exposure are well known and are growing.

CONCLUSION

The toxic nature of unregulated aviation emissions is a threat to the health of residents on the ground. There is a significant and rapidly expanding body of evidence that aviation emissions must be regulated. Regulating PM10 & PM2.5 for future engine production is a long overdue starting point, but it is insufficient. Ultra-fine particles (PM0.1) and ultra-UFP (10-20 nm) must be incorporated into air quality and emissions standards. Mobile air monitoring, particularly for down-wind communities and

environmental justice communities must become standard. The FAA needs to refocus their priorities from unfettered growth to a balance between prioritizing the safety of both travelers in the air and residents on the ground. Although ultra-fine particles (PM0.1) and ultra-UFP (10-20 nm) are invisible, they are causing significant harm, which will result in significant suffering and escalating health care costs. [EPA-HQ-OAR-2019-0660-0152-A1, p.3]

Organization: *Batra, Neelesh*

I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: *California Air Resources Board (CARB)*

Particulate matter (PM) causes health, environmental, and air quality effects. Several serious adverse health impacts have been associated with exposure to PM2.5. For PM2.5, short-term exposures (up to 24-hour duration) have been associated with premature mortality, increased hospital admissions for heart or lung issues, acute and chronic bronchitis, asthma attacks, emergency room visits, and respiratory symptoms. In response to these known health impacts, EPA and other public health agencies recommend restricting outdoor activity on days with high PM levels, preventing children from playing outside. These adverse health effects have been reported primarily in infants, children, and older adults with preexisting heart or lung diseases. In addition, according to the World Health Organization's (WHO) Global Burden of Disease Project,[11] PM2.5 is associated with the greatest proportion of adverse health effects related to air pollution worldwide, more than any other common pollutant. [EPA-HQ-OAR-2019-0660-0206-A1, pp.3-4]

---

[11] The Lancet, Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013, updated September 11, 2015, available at https://www.thelancet.com/action/showPdf?pii=S0140-6736%2815%2900128-2.

Organization: *California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin*

A. Particulate matter from aircraft

Particulate matter pollution is a mixture of substances suspended in air as small liquid and/or solid particles.[3] Particles range in size from those smaller than 1 nanometer to over 100 micrometers (µm) in diameter.[4] Atmospheric particles are divided and grouped in classes based on their diameters. "Generally, the three broad classes of particles include ultrafine particles (UFPs, generally considered as particulates with a diameter less than or equal to 0.1 µm . . .), 'fine' particles (PM2.5; particles with a nominal mean aerodynamic diameter less than or equal to 2.5 µm) and 'thoracic' particles (PM10; particles with a nominal mean aerodynamic diameter less than or equal to 10 µm)." 87 Fed. Reg. at 6330. [EPA-HQ-OAR-2019-0660-0203-A1, p.6]

PM pollution from aircraft is primarily UFP and PM2.5. Initially, the bulk of PM emissions released by airplanes are in the ultrafine range.[5] Over the span of a few hours to days, most of the UFP released converts into PM2.5 by coalescing with other materials in the atmosphere.[6] Another significant component of UFP will evaporate or diffuse onto surfaces it comes into contact with.[7] As a result, UFP has a typical atmospheric residence time that is measured in terms of hours or a few days.[8] Because of

these properties, UFP concentrations are highly localized and disperse much less as compared to PM2.5.[9] [EPA-HQ-OAR-2019-0660-0203-A1, p.6]

PM2.5 emissions from aircraft, like other PM2.5, will remain in the atmosphere until it is formed into cloud droplets and rained out, falls to the ground due to gravity, or diffuses to surfaces on contact.[10] As a result of these processes, PM2.5 has a typical atmospheric residence time that is measured in weeks.[11] Because of these physical properties, PM2.5 will tend to the follow the wind and transport over greater distances than UFP.[12] [EPA-HQ-OAR-2019-0660-0203-A1, p.6]

In addition to its unique physical characteristics, PM released from aircraft is chemically distinct from other sources of PM pollution. Specifically, "jet engine emissions have physiochemical properties similar to diesel exhaust particles."[13] The study EPA cites further explains that emissions from aircraft consist of high numbers of soot particles with associated polycyclic aromatic hydrocarbons (PAHs), and metals. [14] The PAHs released from aircraft can be released as gas or as particles. 87 Fed. Reg. 6335. [EPA-HQ-OAR-2019-0660-0203-A1, pp.6-7]

Studies also consistently show that PM emissions from aircraft, especially UFP, are concentrated around airports. Id. at 6332. A 2015 report cited by EPA concluded that "existing studies indicate that ultrafine particle concentrations are highly elevated at an airport (i.e., near a runway) with particle counts that can be orders of magnitude higher than background with some persistence many meters downwind (e.g. 600 m)." Id. Another study performed at Seattle-Tacoma International Airport, and cited by EPA, found that higher levels of UFP remained concentrated near the airport, and impacted an area larger than near-roadway sites. Id. The studies EPA cites have also found that UFP from aircraft infiltrate residences and remain concentrated near and downwind from airports. Id. [EPA-HQ-OAR-2019-0660-0203-A1, p.7]

B. Public health and environmental impacts of aircraft PM

The health and environmental impacts of PM are well established and widely acknowledged. EPA first established National Ambient Air Quality Standards (NAAQS) for PM in 1971.[15] Since then, EPA has tightened the PM NAAQS in 1987,[16] 1997,[17] 2006,[18] and 2012.[19] In 2020, EPA issued a final rule to retain the PM NAAQS standards set in 2012.[20] However, EPA initiated a reconsideration of its 2020 decision "because available scientific evidence and technical information indicate that the current [2012] standards may not be adequate to protect public health and welfare, as required by the Clean Air Act."[21] [EPA-HQ-OAR-2019-0660-0203-A1, p.7]

Based on this deep body of scientific evidence, EPA's Proposed Rule acknowledges that human exposures to ambient PM2.5 are associated with numerous adverse health effects. 87 Fed. Reg. at 6331. EPA concluded that long-term and short-term exposure to PM2.5 has a causal effect on increased mortality and decreased cardiovascular health and is likely to have a causal effect on decreased respiratory health. Id. Further, EPA's 2019 review of the science has found that long-term exposure to PM2.5 is likely to have a causal relationship to negative nervous system effects and cancer effects. Id. The evidence is also suggestive of a causal relationship between PM2.5 exposure and a host of other negative health impacts, including male and female reproductive and developmental effects (i.e., fertility, pregnancy, and birth outcomes) from long-term exposure, metabolic effects from long-term and short-term exposure, and nervous system effects from short-term exposure. Id. EPA's Proposed Rule further discusses the specific health effects of PM emissions from aircraft. One study cited by EPA

found that every year, nearly 14,000 premature deaths across the globe are attributable to PM2.5 exposure. Id. Occupational exposure studies indicate that airport workers are especially vulnerable to these health impacts, especially ground workers chronically exposed to LTO operations.[22] [EPA-HQ-OAR-2019-0660-0203-A1, p.8]

Exposure to UFP is also linked to adverse health effects. EPA's 2019 Integrated Science Assessment for Particulate Matter concluded that the evidence is suggestive of, but insufficient to infer, a causal relationship between short-term exposure and negative respiratory and cardiovascular effects, and also between long-term and short-term exposure and nervous system effects.[23] In the specific context of the Proposed Rule, EPA itself discusses several studies that have found a link between UFP from aircraft and negative health effects. One study cited by EPA concluded that UFP emissions from aircraft contribute to pre-term births, independent of noise and traffic-related air exposures. 87 Fed. Reg. at 6332.[24] [EPA-HQ-OAR-2019-0660-0203-A1, p.8]

There is also evidence that suggests that exposure to UFP is more hazardous than exposure to PM2.5. This is because inhaled UFP are able to penetrate deeper into the respiratory tract.[25] In addition, because of their high ratio of surface area to size, UFPs can transport a variety of toxins causing tissue and cell injury.[26] Further, because of the high concentration of black carbon and PAHs in aircraft exhaust, these emissions are more likely to pose acute and chronic health problems such as respiratory problems, acute bronchitis, heart problems, lung cancer, aggravation of preexisting heart and lung disease, and asthma. EPA categorizes most PAHs as type 2A or 2B human carcinogens.[27] [EPA-HQ-OAR-2019-0660-0203-A1, pp.8-9]

---

[3] EPA, EPA/600/R-19/188, INTEGRATED SCIENCE ASSESSMENT FOR PARTICULATE MATTER (Dec. 2019) (hereinafter 2019 PM ISA).

[4] A nanometer is 10-9 meters and a micrometer is three orders of magnitude larger, at 10-6 meters.

[5] 2019 PM ISA at 2-4.

[6] Id. at 2-4, 2-94, 3-7.

[7] Id.

[8] Id. at 2-5, Table 2-1.

[9] Id. at 2-4.

[10] Id. at 2-5, Table 2-1.

[11] Id.

[12] Id. at 2-4, 3-8.

[13] 87 Fed. Reg. 6333.

[14] K. Bendtsen, A Review of Health Effects Associated With Exposure to Jet Engine Emissions In And Around Airports, Environmental Health 2021 20:10, at 3, https://ehjournal.biomedcentral.com/track/pdf/10.1186/s12940-020-00690-y.pdf (hereinafter Jet Engine Emissions In And Around Airports).

[15] Title 42-Public Health, Chapter IV-Environmental Protection Agency, Part 410 National Primary and Secondary Ambient Air Quality Standards, 36 Fed. Reg. 8186 (Final Rule Apr. 30, 1971).

[16] Revisions to National Ambient Air Quality Standards for Particulate Matter, 52 Fed. Reg. 24,634 (Final Rule Jul. 1, 1997).

[17] National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38652 (Final Rule Jul. 18, 1997).

[18] National Ambient Air Quality Standards for Particulate Matter, 71 Fed. Reg. 61,144 (Final Rule Oct. 17, 2006).

[19] National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3086 (Final Rule Jan. 15, 2013).

[20] Review of the National Ambient Air Quality Standards for Particulate Matter, 85 Fed. Reg. 82,684 (Final Rule Dec. 18, 2020).

[21] Press Release, EPA, EPA to Reexamine Health Standards for Harmful Soot that Previous Administration Left Unchanged (June 10, 2021).

[22] Jet Engine Emissions In And Around Airports, supra note 14.

[23] 2019 PM ISA, ES-9 – ES11, Table ES-1.

[24] The Proposed Rule describes these findings as being related to "emissions from aircraft." However, the underlying study makes clear that these health effects were found to be connected to exposure specifically to UFP from aircraft. S. Wing, et al., Preterm Birth Among Infants Exposed to In Utero Ultrafine Particles From Aircraft Emissions, Environmental Health Perspectives, 128(4), 047002-4 (Apr. 2020) ("We found in utero exposures to jet-specific UFP emissions . . . to be associated with increased odds of PTB among mothers living within 15 km of LAX.").

[25] M. Ubaid, et al., Pollution Characteristics, Mechanisms of Toxicity and Health Effects of the Ultrafine Particles in the Indoor Environment: Current Status and Future Perspectives, Critical Reviews in Environmental Science and Technology, Vol. 52, No. 3, 436-473, 438 (2022), https://doi.org/10.1080/10643389.2020.1831359 (attached as Exhibit 1).

[26] Id.

[27] M. Ubaid, et al., Emission Sources and Full Spectrum of Health Impacts of Black Carbon Associated Polycyclic Aromatic Hydrocarbons (PAHs) in Urban Environment: A Review, Critical Reviews in Environmental Science and Technology, Vol. 51, No. 9, 857-96, 859 (2021), https://doi.org/10.1080/10643389.2020.1738854 (attached as Exhibit 2).

Organization: Center for Biological Diversity and Friends of the Earth

Particulate matter ("PM") pollution from burning fossil fuels, including aviation fuels, is a leading contributor to global mortality. Fine particulate pollution—defined as particles 2.5 micrometers and smaller ("PM2.5")—from fuel combustion causes one in five premature deaths worldwide, including 355,000 premature deaths in the United States in 2018.[4] [EPA-HQ-OAR-2019-0660-0189-A1, pp.1-2]

As EPA notes in its August 23, 2021 memo to the docket, a "large body" of scientific evidence shows that particulate matter pollution is linked to a broad range of short- and longterm health effects.[5] Due to its small size, PM2.5 enters people's lungs and bloodstream, leading to respiratory and cardiovascular problems that can lead to death.[6] [EPA-HQ-OAR-2019-0660-0189-A1, p.2]

Short-term exposure to PM2.5 increases emergency hospital visits, asthma, and chronic obstructive pulmonary disease.[7] Long-term exposure to PM2.5 is linked to asthma, decline in lung function, and

cardiovascular and respiratory mortality.[8] Recent studies also connect long-term PM2.5 exposure to nervous system effects, such as declines in brain volume and cognition.[9] Fine particulate matter pollution also harms the environment. It affects the climate by altering cloud processes, atmospheric circulation, and the hydrologic cycle.[10] It can also lead to acidification of terrestrial and aquatic ecosystems and to inhibition of photosynthesis and plant growth.[11] [EPA-HQ-OAR-2019-0660-0189-A1, p.2]

As the scientific and public health community continue to document the extreme health and environmental consequences of fine particulate matter pollution, there is growing recognition that the benefits of reducing exposure justify stricter pollution limits. For example, EPA's independent advisory scientific committee recently endorsed lowering national annual exposure limits for fine particle pollution due to its health costs.[12] [EPA-HQ-OAR-2019-0660-0189-A1, p.2]

---

[4] Vohra, Karn et al., Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem, 195 Environmental Research 110754 (2021),

https://www.sciencedirect.com/science/article/abs/pii/S0013935121000487.

[5] Cook, Rich, U.S. EPA, Memorandum re: health and environmental effects of non-GHG pollutants emitted by turbine engine aircraft at 2-3 (Aug. 23. 2021) [hereinafter Memorandum].

[6] U.S. EPA, Criteria Air Pollutants, https://www.epa.gov/criteria-air-pollutants (last visited Feb. 24, 2022); U.S. EPA, Health and Environmental Effects of Particulate Matter, https://www.epa.gov/pm-pollution/health-andenvironmental-effects-particulate-matter-pm (last visited Feb. 24, 2022).

[7] Memorandum at 3.

[8] Id. at 4.

[9] Id.

[10] U.S. EPA, Integrated Science Assessment for Particulate Matter at 13-2 (2019) [hereinafter 2019 ISA].

[11] U.S. EPA, Integrated Science Assessment for Oxides of Nitrogen, Oxides and Sulfur and Particulate Matter – Ecological Criteria IS-99 (2020).

[12] Reilly, Sean, EPA science advisers unanimously back tighter soot limits, E&E News, Mar. 4, 2022, https://www.eenews.net/articles/epa-science-advisers-unanimously-back-tighter-soot-limits/.

Organization: Center for Biological Diversity et al.

The Proposed Rule is EPA's first attempt to set particulate matter standards for planes since the early 1980s, when EPA finalized "smoke standards" focused on improving visibility. In the nearly-forty years since those standards were enacted, scientific studies have produced mountains of evidence documenting that the fine particle pollution generated by fossil fuel combustion is deadly and environmentally destructive. For example, EPA's independent advisory scientific committee recently endorsed lowering national annual exposure limits for fine particle pollution in recognition of its health costs.[4] [EPA-HQ-OAR-2019-0660-0185-A1, pp.1-2]

[4] Reilly, Sean, EPA science advisers unanimously back tighter soot limits, E&E News (Mar. 4, 2022), https://www.eenews.net/articles/epa-science-advisers-unanimously-back-tighter-soot-limits/.

Organization: *Environmental Defense Fund*

EPA's Integrated Science Assessment of PM released December 201911 concluded that human exposures to ambient PM2.5 are associated with a number of adverse health effects and that stratified analyses provide strong evidence for racial and ethnic differences in PM2.5 exposures and related health risk. As noted in the proposed rule, there is "causal relationship" between long- and short- term exposures to PM2.5 and mortality and cardiovascular effects; "likely causal relationship" between long- and short- term PM2.5 exposures and respiratory effects, nervous system effects and cancer. A recent U.S. study by the Health Effects Institute reported health effects of long-term exposure to low levels of ambient pollution below current National Ambient Air Quality Standards.[12] [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

Jet engine emissions consist of volatile organic compounds, NOx, SOx, low molecular weight polycyclic aromatic hydrocarbons (PAH), PM and metals all of which have well established toxicity profiles and associated with adverse health outcomes. [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

[12] Dominici F, A. Zanobetti, J. Schwartz, D. Braun, B. Sabath, X. Wu, 2022, Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution: Implementation of Causal Inference Methods. Research Report.

Organization: *Gibbons, Laura*

Any regulations you make must reduce harm to airport communities, including damage from ultrafine particles. Adopting ICAO standards which would keep the per-plane emissions the same is a net increase in harm, given the yearly increase in flights. [EPA-HQ-OAR-2019-0660-0164, p.1] [[This comment is repeated in section 2.3]]

Organization: *Hudda, Neelakshi*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 34.]

My third point pertains to the volatile fraction of the particulate matter emissions which are not addressed by this proposed rule. The case made about the complexity of characterizing volatile PM in this proposal is reasonable. Nonetheless, the elevated ultra-fine concentrations that likely are mostly composed of volatile particulate matter in communities downwind of the airports would remain unaddressed by this proposed rule. Evidence is growing for the association of ultra-fine particles with adverse health effects and also for association of specifically aviation-generated ultra-fine particles with adverse health effects. The proposed rule is not expected to reduce ultra-fine concentrations or associated health risks in near-airport communities.

And lastly, the proposed rule leaves important volatile particulate matter exposures and health risks unaddressed.

Organization: *Ilabdfara, Rasanjali*

Such pollution also leads to effects on human health. Smog, and overall carbon dioxide, lead to toxic and polluted air that humans breathe in. This polluted air becomes toxic to our lungs and causes serious health issues. Some concerns include the risk of asthma, lung cancer, infections, and more. Ozone interference leads to consequences such as skin cancer, immune deficiencies, an overall effect on the food chain, and many more. [EPA-HQ-OAR-2019-0660-0170, p.1]

Organization: *Ramirez, Oscar Flores*

Another reason why the EPA should pass the proposal is that the emissions are as well affecting our health. Because of what is being released by the engines over time it has degraded our air quality, exposing us to short and long-term health complications and in some cases death. According to National Geographic, they state " health effects from air pollution include heart disease, lung cancer, and respiratory diseases such as emphysema. Air pollution can also cause long-term damage to people's nerves, brain, kidneys, liver, and other organs. Some scientists suspect air pollutants cause birth defects"(Rutledge, 2012). More health complications will continue to arise if emissions levels are not lowered, causing more people to get sick and possibly die. [EPA-HQ-OAR-2019-0660-0169-A1, pp.1-2]

Rutledge, K. (2012, October 9). Air Pollution. National Geographic Society. Retrieved March 28, 2022, from https://www.nationalgeographic.org/encyclopedia/air-pollution/#:~:text=Long%2Dterm%20health%20effects%20from,air%20pollutants%20cause%20birth%20defects.

Organization: *Senate of Pennsylvania, 10th Senatorial District*

Given the number of routine daily flights across the country and the known health implications caused by poor air quality, we must take this pollution problem seriously. [EPA-HQ-OAR-2019-0660-0157-A1, p.1]

Organization: *Sierra Club*

The Proposal briefly summarizes the numerous harms particulate matter inflicts on public health and welfare and the environment. The docket contains numerous scientific articles documenting this incontrovertible harm in detail, including EPA's latest Integrated Science Assessment for Particulate Matter, finalized in December 2019.[3] These deadly health effects include premature mortality, respiratory disease, damage to the nervous system, ill effects on reproduction and fertility, pregnancy and birth outcomes, and adverse metabolic effects. Proposal, 87 Fed. Reg. at 6331. [EPA-HQ-OAR-2019-0660-0184-A1, p.2]

In short, EPA presents a vast array of well-documented and critical harms Congress has sought to reduce for decades. [EPA-HQ-OAR-2019-0660-0184-A1, p.2] [[This comment can also be found in section 6.3 of the comment summary]]

---

[3] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, 2019). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–19/188, 2019.

Organization: *South Coast Air Quality Management District (South Coast AQMD)*

While air quality has dramatically improved over the years, the region still exceeds state and federal public health standards, experiences some of the worst air pollution in the nation, and is home to two-

thirds of California's environmental justice population. The annual toll of continued non-attainment in our region is estimated at 1,600 premature deaths, 27,000 asthma attacks, and 200,000 days absent from school and work.[2] [EPA-HQ-OAR-2019-0660-0210-A1, p.1] [[This comment can also be found in section 2.3 of the comment summary]]

---

[2] South Coast AQMD, Final Socioeconomic Report for the 2016 Air Quality Management Plan (https://www.aqmd.gov/docs/default-source/clean-air-plans/socioeconomic-analysis/final/sociofinal_030817.pdf)

Organization: *Vasquez, Miguel*

This ruling will be beneficial to the health of consumers and the communities that experience high aircraft traffic. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

The key benefit of the proposal is the control of particulate matter, which can cause health issues to those who are exposed to them. Particulate matter is both solid particles and liquid droplets which are minuscule and are released into the air, they can be harmful to the lungs and shorten life spans (Miller, G. T., & Spoolman, S., 2019). Some of the known health problems known to be caused by the particulate matter are premature death, nonfatal heart attacks, aggravated asthma, and decreased lung function (Particulate Matter (PM) Pollution, 2022). Particulates are extremely small and go deep within your body, like your lungs and even your bloodstream. There are "16,000 premature deaths per year globally to global aviation emissions, with 87 percent attributed to PM" (Control of Air Pollution from Aircraft Engines, 2022). This proposal should be passed as it brings benefits to both consumers and those communities around heavy air traffic. The health of individuals should be a priority and be put above the economic impact. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

Miller, G. T., & Spoolman, S. (2019) Environmental science. Cengage.

Particulate matter (PM) pollution: health and environmental effects of particulate matter (PM), (Date accessed March 9, 2022). EPA. https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

Control of air pollution from aircraft engines: emission standards and test procedures, 87 FR 6324 (Proposed February 3, 2022) (to be codified at 40 C.F.R. pts. 87, 1030, 1031). https://www.federalregister.gov/documents/2022/02/03/2022-01150/control-of-air-pollution-from-aircraft-engines-emission-standards-and-test-procedures

Organization: *Zamore, Wig*

I do believe that we must move more aggressively to research transport UFP and noise, to tie these to NLRP3 inflammasome biology, and to relate both to those who are most affected - our environmental justice communities. Those populations are currently unprotected notwithstanding very large health effects. [EPA-HQ-OAR-2019-0660-0193-A3, p.1]

Our research has not, to date, been as well designed or as well informed in the relationships between inflammasome biology and primary transport pollution as is necessary to provide insight and health protection. The human cost of these oversights is staggering. It demands our attention and best efforts. [EPA-HQ-OAR-2019-0660-0193, p.1]

EPA Response to Comments in Section 6.2

EPA acknowledges commenters' concerns on the health impacts of particulate matter. Health effects of particulate matter are discussed in Section III of the Preamble to the final rulemaking as well as a memorandum to the docket. Cook, Rich, U.S. EPA, Memorandum to Docket EPA-HQ-OAR-2019-0660, "Health and environmental effects of non-GHG pollutants emitted by turbine engine aircraft – final rule version" (Aug. 11. 2022). The EPA considered the adverse health effects associated with exposure to particulate matter, as well as elevated levels found near airports, in this rulemaking. EPA's evaluation of the public health risks of PM are based on our earlier work in the 2019 ISA, the 2022 ISA Supplement, and the 2022 Policy Assessment. (U. S. EPA. 2019. Integrated Science Assessment for Particulate Matter. Report No. EPA/600/R-18/179. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534; U. S. EPA. 2022. Supplement to the 2019 Integrated Science Assessment for Particulate Matter. Report No. EPA/600/R-22/028. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=354490; U. S. EPA. 2022. Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. Report No. EPA-452/R-22-004. https://www.epa.gov/system/files/documents/2022-05/Final%20Policy%20Assessment%20for%20the%20Reconsideration%20of%20the%20PM%20NAAQS_May2022_0.pdf).

For the EPA's general response to comments on adopting more stringent standards compared to the international aircraft engine PM standards adopted by ICAO, see the response in Section IV.F.2 of the Preamble to the final rulemaking. Also, for further discussion on consideration of more stringent standards see Preamble Section I.B.2 of the final rulemaking and the introductory paragraphs of Preamble Section IV of the final rulemaking.

6.3 Environmental Effects of PM

Organizations Included in this Section

Baseman, Deborah
Bettenccourt, Jacob
Palosaari, Kent
Ramirez, Oscar Flores
Rojas, Angell
Senate of Pennsylvania, 10th Senatorial District
Sierra Club
Vasquez, Miguel
Wagner, Debi
Wilson, Charles

Organization: Baseman, Deborah

The effect of plane emission pollutants is not limited to air quality; air emissions will land on soil and run-off into water. This was demonstrated with aviation emitted organophosphates that were discovered in the water, soil and vegetation near a medium sized airport. [EPA-HQ-OAR-2019-0660-0152-A1, p.2]

Organization: Bettenccourt, Jacob

Within the past decade air traffic has increased dramatically, with this increase there has been a significant increase in different emissions with one of the critical emissions being particulate matter

(Hime, et al. 2018). With this increase in particulate matter, there has also been an increasing emphasis on the need to control emissions from moving sources including air transportation. The air transportation section targeted in this proposed rulemaking makes up only a small percentage of these PM emissions although this source of PM emissions is unique (Oxner, 2020). Particulate matter from airplane emissions is different from other producers of particulate matter because emissions from aircraft are distributed in 3-D space and can distribute over a larger area both horizontally and vertically (Unal, et al. 2005). [EPA-HQ-OAR-2019-0660-0188, p.1]

Hime, N. J., Marks, G. B., & Cowie, C. T. (2018). A comparison of the health effects of ambient particulate matter air pollution from five emission sources. International journal of environmental research and public health, 15(6), 1206.

Unal, A., Hu, Y., Chang, M. E., Odman, M. T., & Russell, A. G. (2005). Airport related emissions and impacts on air quality: Application to the Atlanta International Airport. Atmospheric Environment, 39(32), 5787-5798.

Oxner, R. (2020, December 28). U.S. implementing 1st-ever airplane emission rules; critics say they're ineffective. NPR. Retrieved March 27, 2022, from https://www.npr.org/2020/12/28/950863508/u-simplementing-1st-ever-airplane-emission-rules-critics-say-theyre-ineffective Massachusetts Department of Public Health . (2014). Logan Airport Health Study - Massachusetts. www.mass.gov. Retrieved March 28, 2022, from https://www.mass.gov/doc/logan-airport-health-studyappendices-english/download

Organization: *Palosaari, Kent*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 52-53.]

And one last point is when we reduce -- there are times when the pollution level is not as high in the air, but it is going into the soil to a point where we cannot grow our fruits and vegetables, we cannot play in our backyards because it's a toxic environment. So as we proceed with any kind of regulation, we need to be highly aware that communities need more than just a slight reduction inclusion. We need a radical change in terms of the number of toxins in our environment.

Organization: *Ramirez, Oscar Flores*

One reason the EPA should acknowledge and pass this proposal is that the emissions are dramatically affecting our environment. Aircraft emissions are a major factor in why climate change has worsened over the years. The process of burning jet fuel releases greenhouse gasses that cause things like global warming, rising sea levels, acid rain, and depletion of the ozone layer. In an article by the Center for Biological Diversity, they explain “Greenhouse gas emissions from the aviation sector are a substantial contributor to global warming. If the aviation industry were a country, it would place sixth in emissions, between Japan and Germany. Left unchecked global aviation will generate an estimated 43 metric gigatons of carbon dioxide emissions through 2050” (Perkinson). [EPA-HQ-OAR-2019-0660-0169-A1, p.1]

Perkinson, N. (n.d.). Airplane Emissions. Retrieved March 28, 2022, from https://www.biologicaldiversity.org/programs/climate_law_institute/transportation_and_global_warming/airplane_emissions/

Organization: *Rojas, Angell*

The last seven years have been recorded to be the warmest, showing how serious and fast global warming is happening. What contributes towards global warming? Human activity. The use of airplanes over the years has made air pollution a bigger issue, as air travels accounts for 2.5% of global carbon emissions. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

If this proposition gets passed, it will satisfy many groups who are passionate about ending air pollution and those who contribute to ending climate change and global warming. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

Organization: *Senate of Pennsylvania, 10th Senatorial District*

Particulate Matter (PM) emissions, a mixture of tiny liquid and solid particulates, originate from a variety of sources, most notably, from the process of combustion, e.g., aircraft engines. These tiny particulates are generated throughout the duration of the flight and are not limited to the flight path. According to recent studies, the emissions have been identified as far as 10 miles outside of the flight path, with strong winds contributing to the spread. These particles have a negative impact on our air, soil, and water. The spread of all particulates, even ultrafine particulates, should be considered and should not be underestimated. [EPA-HQ-OAR-2019-0660-0157-A1,p.1]

Organization: *Sierra Club*

Environmental effects include visibility degradation in national parks and urban areas, damage to plants and ecosystems, and harm to materials and soils from PM deposition. Damages from the deposition of metallic and organic constituents of PM include interference with the metabolic processes of plant foliage, alteration of soil biogeochemistry and microbiology, plant and animal growth and reproduction, and contribution to total metal loading resulting in bioaccumulation and biomagnification and metal corrosion. Id.[4] [EPA-HQ-OAR-2019-0660-0184-A1, p.2]

In short, EPA presents a vast array of well-documented and critical harms Congress has sought to reduce for decades. [EPA-HQ-OAR-2019-0660-0184-A1, p.2] [[This comment can also be found in section 6.2 of the comment summary]]

---

[4] See also Ioannis Manisalidis et al., Environmental and Health Impacts of Air Pollution: A Review, 8 FRONTIERS IN PUBLIC HEALTH 14 (Feb. 20, 2020), available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7044178/#[hereinafter "Manisalidis 2020"].

Organization: *Vasquez, Miguel*

Another factor that cannot be ignored, is that the proposed rule will also have a positive impact on the environment. Particulate matter is a form of air pollution, which is a big contributor to the destruction of ecosystems and their diversity. Air pollution can increase the atmospheric temperature which in the long term can lead to ecosystem change (Miller, G. T., 2019). At this moment scientists estimate that 17% of species could face extinction (Miller, G. T., 2019). The changes being proposed are not only going to be beneficial to human health but also for environmental health. This type of pollution also has a global impact by reducing the United States emissions we are also [contributing] to a cleaner Earth. [EPA-HQ-OAR-2019-0660-0165-A1, p.1]

Miller, G. T., & Spoolman, S. (2019) Environmental science. Cengage.

Organization: *Wilson, Charles*

We are already witnessing some effects of Climate Change, and likely to see many more. If the proposed rules are treated as recommendations, and if exceptions are permitted, then the greenhouse gas goals will not be reached. Increases in air travel, though slowed by the coronavirus pandemic further complicate the emissions problem. [EPA-HQ-OAR-2019-0660-0148-A1, p.1]

EPA Response to Comments in Section 6.3

Commenters point out the environmental effects of aircraft emissions of PM, such as visibility and deposition impacts. The EPA's view of environmental effects of PM are discussed in Section III of the Preamble to the final rulemaking as well as a memorandum to the docket. See, Cook, Rich, U.S. EPA, Memorandum to Docket EPA-HQ-OAR-2019-0660, "Health and environmental effects of non-GHG pollutants emitted by turbine engine aircraft – final rule version" (Aug. 11. 2022).

For the reasons expressed elsewhere in this document, comments about impacts of greenhouse gases emitted from aircraft are beyond the scope of this rulemaking.

6.4 Near-Source Impacts of Aircraft Emissions

Organizations Included in this Section

Aviation-Impacted Communities Alliance (AICA)
Beacon Hill Council of Seattle (BHC)
Bettenccourt, Jacob
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Environmental Defense Fund (EDF)
National Association of Clean Air Agencies (NACAA)
Palosaari, Kent
Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way
Preston, Richard
Rojas, Angell
Service Employees International Union (SEIU)
Simon Alex Wilson
Sierra Club
South Coast Air Quality Management District (South Coast AQMD)
Wagner, Debi
Wilson, Charles

Organization: *Aviation-Impacted Communities Alliance (AICA)*

Use the PM mass to study to clearly and objectively disclose to the public and local agencies about the potential impact and area of impact from PM10 & PM2.5 to local air quality around the nation's Core 30 airports. Note: an independent State Department of Ecology study in 1991, before PM2.5 was adopted, and before PM10 was eliminated from the model, uncovered violations of the NAAQS PM 10 short-term and long-term standard in the communities around the airport. [EPA-HQ-OAR-2019-0660-0159-A1,p.1]

Organization: *Beacon Hill Council of Seattle (BHC)*

We need proposed rules that require interventions that decrease, mitigate and/or stop, the current harmful aircraft emissions on our communities, as well as regulate ultrafine particles. SeaTac International Airport flight operations numbered 450,000 before the COVID pandemic. It is critical that EPA thinks in an integrated environmental, health and climate justice approach with a strong sense of urgency and immediacy, in concert within the current 9-year climate countdown window before climate change is irreversible. [EPA-HQ-OAR-2019-0660-0176-A1 p.2]

Organization: *Bettenccourt, Jacob*

This proposed legislation is especially important for those who live near airports that are exposed to the increasing level of aircraft PM emissions. PM emissions have been linked to health issues in the public such as respiratory and cardiovascular effects (Shandilya and Khare, 2012). It is also keen to note the Logan Airport Health Study from the Massachusetts Department of Public Health performed in 2014 concluded that "children in the high exposure area were estimated to have three to four times the likelihood of this respiratory outcome compared with children in the low exposure area" (Massachusetts Department of Public Health, 2014). This may only affect a small percentage of people but to those of us who are affected, this is a matter of long-term health. This proposed rule is one of the ways to obtain another layer of protection from PM emissions. [EPA-HQ-OAR-2019-0660-0188, p.1]

Shandilya, K. K., & Khare, M. (2012). Particulate matter: sources, emission rates and health effects. Advances in environmental research, 23, 265-322.

Organization: *California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin*

While the Proposed Rule acknowledges significant evidence that these communities are inequitably impacted by aircraft PM pollution, EPA understates the environmental justice impacts of this pollution. There is inadequate monitoring data of PM levels in communities near airports, and EPA's county-level analysis does not adequately capture the highly localized impacts of aircraft PM emissions on airport-adjacent communities. [EPA-HQ-OAR-2019-0660-0203-A1, p.4] [[This comment is repeated in section 6.6]]

E. Aircraft PM pollution impacts on neighboring communities is likely underestimated

The impact of PM pollution from aircraft on environmental justice communities is likely underestimated for several reasons. First, there is insufficient monitoring. EPA acknowledges it has not required the creation of an ambient air monitoring network for UFP and as such "there is limited information on UFP exposures within the U.S."[39] Further, the nearest PM2.5 NAAQS monitor is often too far or not in the right location to register aircraft emissions. For example, the PM2.5 monitor closest to LAX is

approximately 12 miles away, the PM2.5 monitor closest to SFO is over 10 miles away, and the PM2.5 monitor closest to OAK is nearly 3.5 miles away.[40] While there is a PM2.5 monitor about 2 miles away from Ontario International Airport, it is located due south of the airport and would only detect aircraft emissions on the rare occasion (only 3.9 months in any given year) when the wind is blowing from the north.[41] [EPA-HQ-OAR-2019-0660-0203-A1, pp.11-12]

Second, though there are some uncertainties regarding the health effects of UFP exposure, the evidence discussed above suggests that exposure to UFP, especially from aircraft, is likely more harmful than exposure to PM2.5. In short, in the Proposed Rule EPA likely underestimates the impacts of aircraft PM on communities with environmental justice concerns. [EPA-HQ-OAR-2019-0660-0203-A1, p.12]

Organization: *Center for Biological Diversity*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 19-20.]

Second, this rule condones further human suffering in communities already struggling with the burdens of air pollution. In the nearly 40 years since EPA last set PM standards, scientists have produced mountains of evidence documenting that fine particle pollution generated by fossil fuel combustion is deadly and environmentally destructive. Increased PM from aviation pours salt on the wounds of communities that live near airports, many of which are the same communities of color and low-income communities the President has vowed to prioritize. Concentrations of ultra-fine particles can be four or more times higher in areas surrounding airports, and in some regions, like Los Angeles, airplane traffic has grown to be as significant a contributor to elevated particle pollution as the entire urban freeway network. Studies show that residents living near airports are more likely to be admitted to the hospital for asthma, have higher incidences of cancer and cardiopulmonary disease, and are more likely to die prematurely. One study in 2015 estimated that premature deaths due to fine particle emissions from aviation number nearly 14,000 per year globally.

Organization: *Center for Biological Diversity and Friends of the Earth*

A. Aviation PM emissions are especially harmful to health and the environment

Aircraft emissions significantly contribute to ambient PM2.5 pollution, especially in areas with large commercial airports.[13] Premature deaths due to aviation emissions number about 16,000 per year globally, with PM2.5 responsible for 87% of those deaths.[14] In North America alone, 1,500 premature deaths per year have been attributed to aviation emissions, with 650 or 43% of those deaths attributable to landing and takeoff emissions.[15] [EPA-HQ-OAR-2019-0660-0189-A1, pp.2-3]

Studies centered around busy airports have linked aircraft and health impacts. A study that focused on three New York Airports found that residents living within 5 miles of these airports were at increased risk of hospital admissions for respiratory illnesses relative to those living farther than 5 miles away.[16] A report prepared by various Washington State government agencies similarly determined that there were significantly higher rates of lung cancer, oral and pharyngeal cancer; deaths from lung cancer and chronic obstructive pulmonary disease; and hospital admissions for asthma, pneumonia, and influenza within one-three miles of the Seattle- Tacoma Airport as compared to the rest of King County and to Washington State.[17] [EPA-HQ-OAR-2019-0660-0189-A1, p.3]

In another study, focused on the area surrounding Los Angeles International Airport, exposure to ultrafine particles was linked to increased instances of preterm birth.[18] There is growing evidence that the ultrafine PM aircraft generates is especially harmful—ultrafine PM's properties of larger surface area per unit mass and potent cell penetration leads to even more adverse health impacts than PM2.5.[19] Outdoor ultrafine particle number concentrations ("PNC") are elevated in areas around commercial airports.[20] One study found concentrations of ultrafine particles to be four or more times higher in areas surrounding airports.[21] And research reveals that this aviation-related ultrafine PNC penetrates indoors and contributes to higher PNC indoors.[22] [EPA-HQ-OAR-2019-0660-0189-A1, p.3]

The harmful impacts of particle pollution fall most heavily on communities of color and low-income communities that disproportionately live near airports. For example, in California, communities within 10 miles of international airports are disproportionately low-income and people of color, exposing them to above-average airport-associated air pollutants.[23] These communities often already bear the brunt of climate change impacts and compounding air pollution from nearby industry and roadways.[24] [EPA-HQ-OAR-2019-0660-0189-A1, p.3]

---

[13] Proposed Rule Control Air Pollution from Aircraft Engines: Emission Standards and Test Procedures, 87 Fed. Reg. at 6,333.

[14] Yim, S.H.L. et al., Global, regional and local health impacts of civil aviation emissions, 10 Env't Res. L. 034001 (2015) (of 16,000 total premature deaths from PM2.5 and ozone, 87% were attributable to PM2.5).

[15] Id.

[16] Lin, S. et al., Residential proximity to large airports and potential health impacts in New York State, 81 Int Arch Occup Environ Health 797 (2008).

[17] Osaki, C. & J. Finkbonner, Final Report State Board of Health Priority: Environmental Justice (2001).

[18] Wing, S. E. et al., Preterm birth among infants exposed to in utero ultrafine particles from aircraft emissions, 128 Environmental Health Perspectives (2020).

[19] Li, N. et al., Ultrafine particulate pollutants induce oxidative stress and mitochondrial damage, 111 Environmental Health Perspectives 455 (2003); Oberdörster, G. et al., Translocation of inhaled ultrafine particles to the brain, 16 Inhalation Toxicology 437 (2004).

[20] 87 Fed. Reg. at 6,333.

[21] Hudda, N. et al., Impacts of aviation emissions on near-airport residential air quality, 54 Environmental Science & Technology 8580 (2020); Shirmohammadi, F. et al., Emission rates of particle number, mass and black carbon by the Los Angeles International Airport (LAX) and its impact on air quality in Los Angeles, 151 Atmospheric Environment 82 (2017).

[22] 87 Fed. Reg. at 6,332.

[23] Corey, Richard, California Air Resources Board, Comments re: Proposed Rulemaking for Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures; 85 Fed. Reg. 51,556, August 20, 2020, to Administrator Andrew Wheeler, U.S. EPA (October 19, 2020).

[24] See, e.g., American Lung Association, Disparities in the impact of air pollution (updated April 20, 2020), https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities; Carlson, A., The Clean Air Act's blind spot: Microclimates and hotspot pollution, 65 UCLA Law Review 1036 (2018).

Organization: Center for Biological Diversity et al.

It does nothing for communities near airports that are bombarded every day with particulate pollution that can lead to cardiovascular disease, respiratory issues, and higher rates of death. [EPA-HQ-OAR-2019-0660-0185-A1,p.1]

Concentrations of ultrafine particles can be four or more times higher in areas surrounding airports.[5] [EPA-HQ-OAR-2019-0660-0185-A1, p.2]

The small particles infiltrate homes, schools, and other gathering places where they are inhaled, pass into people's lungs, and move into their bloodstream to be carried throughout the body. Studies show that residents living near airports are more likely to be admitted to the hospital for asthma, have higher incidences of cancer and cardiopulmonary disease, and are more likely to die prematurely.[7] One study in 2015 estimated that premature deaths due to fine particle emissions from aviation number nearly 14,000 per year globally.[8] [EPA-HQ-OAR-2019-0660-0185-A1, p.2]

---

[5] Hudda, N. et al., Impacts of aviation emissions on near-airport residential air quality, 54 Environmental Science & Technology 8580 (2020); Shirmohammadi, F. et al., Emission rates of particle number, mass and black carbon by the Los Angeles International Airport (LAX) and its impact on air quality in Los Angeles, 151 Atmospheric Environment 82 (2017).

[7] Lin, S. et al., Residential proximity to large airports and potential health impacts in New York State, 81 Int. Arch. Occup. Environ. Health 797 (2008); Osaki, C. and Finkbonner, J., Final Report State Board of Health Priority: Environmental Justice (2001).

[8] Yim, S.H.L. et al., Global, regional and local health impacts of civil aviation emissions, 10 Envtl Research Letters 034001 (2015) (87% of 16,000 total premature deaths per year are attributable to fine particle pollution).

Organization: Environmental Defense Fund (EDF)

Particulate matter (PM) emissions from aviation have a significant impact on (1) the regional air quality and public health in the vicinity of airports, as captured in the proposed rule, but also (2) the climate.2 EPA should therefore appropriately consider the impacts of non-volatile PM (nvPM) in setting its aircraft standards. Fuel-related emissions from landing and take-off operations disproportionately affect local communities as well as workers within the airport envelope; these effects arise from the impact of aviation's fuel-related emissions on local air quality. In making its decision on level of protection, EPA must weigh the health and environmental benefits for these communities and workers, as well as the benefits of improved regional air quality and appropriately consider the benefits of avoided climate damages. [EPA-HQ-OAR-2019-0660-0207-A1, p.1]

I. EPA's nvPM proposed rulemaking manifestly fails to reduce aviation PM2.5 emissions necessary to avoid premature deaths and adverse health impacts which fall disproportionately on disadvantaged communities and people of color living near airports.

As EPA's own analysis in the proposed rule indicates, the proposed standard will not drive emissions down beyond what is already expected. It simply embodies what the industry has already baked in.

Given the environmental and social impacts associated with nvPM emissions, we respectfully urge EPA to adopt stronger final standards that would reduce emissions beyond the business-as-usual fleet turnover that would occur absent of the proposed standards, i.e, delivering inter alia no improvement in air quality for those who live near airports. [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

EPA's Integrated Science Assessment of PM released December 201911 concluded that human exposures to ambient PM2.5 are associated with a number of adverse health effects and that stratified analyses provide strong evidence for racial and ethnic differences in PM2.5 exposures and related health risk. As noted in the proposed rule, there is "causal relationship" between long- and short- term exposures to PM2.5 and mortality and cardiovascular effects; "likely causal relationship" between long- and short- term PM2.5 exposures and respiratory effects, nervous system effects and cancer. A recent U.S. study by the Health Effects Institute reported health effects of long-term exposure to low levels of ambient pollution below current National Ambient Air Quality Standards.[12] [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

Jet engine emissions consist of volatile organic compounds, NOx, SOx, low molecular weight polycyclic aromatic hydrocarbons (PAH), PM and metals all of which have well established toxicity profiles and associated with adverse health outcomes. [EPA-HQ-OAR-2019-0660-0207-A1, p.3]

Aviation-attributable PM2.5 and O3 emissions from commercial aviation has been estimated to be responsible for approximately 16,000 premature mortalities each year globally[13] and within those, 1,250 premature deaths due to full-flight aviation-attributable PM2.5 exposure within 20 km of airports in North America.[14] [EPA-HQ-OAR-2019-0660-0207-A1, pp.3-4]

Additionally, aviation particle size distribution has been reported to be different from traditional PM2.5, with more ultrafine particles (UFPs, particles which are less than 100 nanometers in diameter) and extremely fine PM2.5 emissions.[15] These penetrate deep into the lungs and even cross into the blood stream. Communities living in proximity to airports are exposed to elevated levels of UFPs[16,17,18] and are at risk of adverse effects.[19,20,21] [EPA-HQ-OAR-2019-0660-0207-A1, p.4]

In addition to the contributions to regional air quality, the impacts on public health are an important concern for exposed airport workers and neighbors, including those that live downwind. Proximity to running jet engines or to an airport is associated with increased risk of disease, hospital admissions and self-reported lung symptoms.[22] Study carried out by Massachusetts Department of Public Health in 2014, found that children living in communities surrounding Logan International Airport had respiratory effects indicative of undiagnosed asthma (i.e., probable asthma); children in the high airport air pollution exposure area were estimated to have three to four times the likelihood of this respiratory outcome compared with children in the low exposure area.[23] Another study assessed the impact of UFP exposure on communities that resided within 10 miles of the Los Angeles airport and found that that exposure to aircraft-related UFPs was associated with preterm births and the odds of preterm births increased with greater exposure levels.[24] [EPA-HQ-OAR-2019-0660-0207-A1, p.4]

---

[2] D.S. Lee et al, 2020, "The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018", Atmospheric Environment September 3, 2020. Available at:

https://www.sciencedirect.com/science/article/pii/S1352310203056 89?via%3Dihub (last accessed April 1, 2022)

[11] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, 2019). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–19/188, 2019.

[12] Dominici F, A. Zanobetti, J. Schwartz, D. Braun, B. Sabath, X. Wu, 2022, Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution: Implementation of Causal Inference Methods. Research Report 211. Boston, MA:Health Effects Institute.

[13] Grobler C., P.J C., P.J. Wolfe, K. Dasadhikari, I.C. Dedoussi, F. Allroggen, R.L. Speth, S.D. Eastham, A. Agarwal, M.D. Staples, J. Sabnis, S.R.H. Barrett, 2019, Marginal climate and air quality costs of aviation emissions, Environ. Res. Lett., 14 (2019), p. 114031, 10.1088/1748-9326/ab4942.

[14] Yim S.H.L., G.L. Lee, I.H. Lee, F. Allroggen, A. Ashok, F. Caiazzo, S.D. Eastham, R. Malina, S.R.H. Barret, 2015, Global, regional and local helth impacts of civil aviation emissions, Environmental Research Letters 10 034001.

[15] Stacey, B. 2019. Measurement of ultrafine particles at airports: A review. Atmos. Environ. 198: 463–477. https://www.sciencedirect.com/science/ article/pii/S1352231018307313.

[16] Hsu HH, G. Adamkiewicz, E.A. Houseman, D. Zarubiak, J.D. Spengler, J.I. Levy, 2012, Contributions of aircraft arrivals and departures to ultrafine particle counts near Los Angeles International Airport, Science of the Total Environment. 2013;444:347–355. doi:10.1016/j.scitotenv.2012.12.010

[17] Masiol M, P.K. Hopke, H.D. Felton et al., 2017, Analysis of major air pollutants and submicron particles in New York City and Long Island, Atmospheric Environment. 2017;148:203–214. doi:10.1016/j.atmosenv.2016.10.043

[18] Hudda N, T. Gould, K. Hartin, T. Larson T , S.A. Fruin, 2014, Emissions from an international airport increase particle number concentrations 4-fold at 10 km downwind, Environmental Science and Technology. 2014;48(12):6628–6635. doi:10.1021/es5001566

[19] Hudda, N., et al. "Aviation-related impacts on ultrafine particle number concentrations outside and inside residences near an airport." Environmental science & technology 52.4 (2018): 1765-1772.

[20] Westerdahl, D. et al. "The Los Angeles International Airport as a source of ultrafine particles and other pollutants to nearby communities." Atmospheric Environment 42.13 (2008): 3143-3155.

[21] Lammers A., et al. "Effects of short-term exposures to ultrafine particles near an airport in healthy subjects." Environment international 141 (2020): 105779.

[22] Bendtsen, K. M., E. Bengtsen, A. Saber, U. Vogel, 2021, A review of health effects associated with exposure to jet engine emissions in and around airports, Environ. Health 20:10. https://doi.org/10.1186/s12940-020-00690-y.

[23] Massachusetts Department of Public Health, Bureau of Environmental Health. Logan Airport Health Study. May 2014. https://www.mass.gov/doc/logan-airport-health-study-english-0/download Accessed 04/03/2022

[24] Wing S.E., T.V. Larson, N. Hudda, S. Boonyarattaphan, S. Fruin, B. Ritz, 2020, Preterm birth among infants exposed to in utero ultrafine particles from aircraft emissions, Environmental Health Perspectives. 2020;128(4):11–12. doi:10.1289/EHP5732

Organization: National Association of Clean Air Agencies (NACAA)

EPA also cites various studies that conclude, among other things, that PM concentrations increase with proximity to an airport; air pollution can disproportionately impact sensitive subpopulations near airports; the relationship between minority population percentages and aircraft PM was found to grow stronger as concentrations increased; minorities and low-income populations are disproportionately represented in many communities in close proximity to airports; and over time, the presence of marginalized groups residing in close proximity to hub airports, has increased.[7] It is also noteworthy that

the community of workers at airports, particularly in jobs with the greatest and most prolonged exposure to aircraft emissions, also comprises minority and low-income populations. [EPA-HQ-OAR-2019-0660-0177-A1, pp.2-3]

EPA states in the NPRM that it is conducting "a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity." The agency notes that the results "could help inform additional policies to reduce pollution in communities living in close proximity to airports."[8] [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

NACAA acknowledges this demographic analysis and supports EPA's continuation of it. However, there is no need for EPA to wait until it completes this analysis to take additional action. [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

III. NACAA's Recommendations

Finally, in addition to adopting more protective emission standards, EPA should consider additional policies to reduce emissions near and minimize impacts to overburdened communities nearby airports. [EPA-HQ-OAR-2019-0660-0177-A1, p.4] [[This comment also appears in sections 6.6 and 10]]

---

[7]. 87 Fed. Reg. 6,324(February 3, 2022)–https://www.govinfo.gov/content/pkg/FR-2022-02-03/pdf/2022-01150.pdf at 6.336

[8] Id.

Organization: *Palosaari, Kent*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 51-52.]

Up until recently, I was a resident next to Sea-Tac Airport here in Washington, one of the fastest growing airports in the Nation.

I started to notice that there was a lot of health issues both personally and in the neighborhood, so I took it upon myself to work with different organizations to gather PM information around the airport. Typically, we found that if we just used, like, the OSHA amount for PM 2.5., we are typically two to three times higher than what was acceptable for chronic exposure. With COVID, interestingly enough, there was a reduction of flying, and when it got down to about 20 -- 25 percent of what was normal, the PM level was acceptable at that point. When we're talking about regulation, the ability to reduce it to a level that's livable means drastic regulating or reducing compared to what's being proposed currently.

Organization: *Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way*

Overall, we appreciate the collaboration between the EPA and the Federal Aviation Administration (FAA) on the development of these standards, and we believe strongly that the EPA can and should play a larger role in supporting airport communities. For example, U.S. Representative Adam Smith, whose Congressional district includes SEA and many of the nearby cities, recently introduced H.R.6050 – the Aviation Noise and Emissions Mitigation Act – which would allow the EPA to take a more active role in both research and mitigation of aircraft noise and emissions in near-airport communities. We welcome

other initiatives that might also be applicable, such as the recent EPA grant announcement of funding for enhanced air quality monitoring for communities or funding to improve filtration systems in near-airport public schools. [EPA-HQ-OAR-2019-0660-0174-A1, p.2]

In terms of UFPs, we appreciate the detailed review that your proposal includes of the wide range of existing and ongoing research on this topic; in particular, we note that you included a reference to the recent University of Washington study that "found higher levels of ultrafine PM near the airport, and an impacted area larger than at near-roadway sites." However, much more can be done on this topic, particularly at the federal level. As your proposal notes: "[m]ore research is needed linking particle size distributions to specific airport activities, and proximity to airports, characterizing relationships between different pollutants, evaluating long-term impacts, and improving our understanding of health effects." [EPA-HQ-OAR-2019-0660-0174-A1, p.2]

We appreciate the work of U.S. Representative Smith on this front also, with his introduction of H.R.4068 – the Protecting Airport Communities from Particle Emissions Act – which would further these efforts. [EPA-HQ-OAR-2019-0660-0174-A1, p.3]

Organization: *Preston, Richard*

I am writing comments regarding this legislation because there is a significant increase in air traffic in my community and the FAA and local airport authority (Trenton-Mercer County Airport) are not even considering the aircraft emissions in their environmental analysis. Since the FAA has relinquished any pretense of concerns about air pollution, the prospect that the EPA would provide new measures and enforcement is encouraging. As more and more planes fly directly over our houses, the health of people in our community is directly affected by particulate emissions from these aircraft. Having regulations on the particle emissions addresses an important part of the pollution problem, but it needs to be expanded to include ultrafine particulates in the legislation. Ultrafine particles have been shown to have serious health consequences and can transport miles from where they are emitted. I encourage the EPA to begin monitoring these emissions in the vicinity of airports even for existing aircraft to baseline the magnitude of the problem. The FAA cannot be counted on to advocate for community health and it is appropriate that the EPA carry out this mission to protect citizens on the ground and not just the flying public. I encourage passage of the legislation and ask that the EPA pick up the monitoring problem as well for the sake of those communities living near airports. [EPA-HQ-OAR-2019-0660-0158, p.1]

Organization: *Rojas, Angell*

This action could possibly help promote cleaner air for citizens, especially those who live closer to airports. Those who are living closer to areas where aircraft are present are most likely to develop sicknesses such as lung cancer, asthma, and other respiratory issues. Aircraft engines emit gases such as carbon dioxide, water vapor, nitrogen oxides or carbon monoxide that are harmful to living beings and the environment. Regulating the particulate matter (PM) emission standards and test procedures could lower these levels of harmful gases in the air. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

Organization: *Service Employees International Union (SEIU)*

I. Particulate Matter Exposure Leads to Negative Health Outcomes for Airport Workers and Near Airport Communities

It is crucial that the EPA revise its proposed standards because of the documented health impacts of exposure to particulate matter emissions, which put airport workers and those who live in communities

surrounding airports at risk. These health impacts are not in dispute, and in fact, the EPA cites these impacts as a basis for the proposed rules. The Agency has concluded that there is a causal relationship between both long- and short-term exposure to PM2.5 and mortality and cardiovascular effects, as well as a "likely to be causal relationship" with respiratory effects. Further, the EPA cited recent studies that provide evidence supporting a "likely to be causal relationship" between long-term PM2.5 exposure, and cancer. The EPA also notes evidence suggesting reproductive and developmental effects, metabolic effects, and nervous system effects.2 [EPA-HQ-OAR-2019-0660-0191-A1, p.2]

While literature specifically studying the impacts of this exposure on airport workers appears to be scarce,[3] a study on exposure of airport workers to ultrafine particles ("UFP") found particularly high levels of exposure for baggage handlers and intermediate exposure for catering drivers, cleaning staff, and airside security.[4] [EPA-HQ-OAR-2019-0660-0191-A1, p.2]

The impact of airport pollution on local communities is both better studied, and acknowledged by the EPA. A 2019 study (cited in the proposed rule) found that over 65,000 California students are exposed to between one to six hours per day of airport pollution during the academic year.[5] A study from the University of Southern California linked UFP pollution from Los Angeles International Airport with acute effects on individuals with asthma.[6] A study by the Dutch public health agency RIVM in communities near Schipol airport tied short-term reductions in lung function to higher UFP exposure, and noted that children with existing respiratory complaints "suffer more and use more medication".[7] An analysis of pediatric emergency room admissions by zip code in Arizona found the largest number of children admitted for asthma-related care lived in a zip code just north of Sky Harbor International Airport.[8] [EPA-HQ-OAR-2019-0660-0191-A1, pp.2-3]

The effects of airport pollution could be very far-reaching, impacting neighborhoods up to I 0 miles away.[9] Researchers estimate that aviation-related PM2.5 and ozone emissions cause an estimated 16,000 premature deaths worldwide every year. [10] [EPA-HQ-OAR-2019-0660-0191-A1, p.3]

---

[2] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures; 87 Fed. Reg. 6324, 6331 (February 3, 2022).

[3] Merzenich, Hiltrud et al. "Air Pollution and Airport Apron \Yorkers: A Neglected Occupational Setting in Epidemiological Research," International Journal of Hygiene and Environmental Health (January 2021) available at https://pubmed.ncbi.nlm.nih.gov/33113483/.

[4] Moller, Karina Lauenborg et al. "Occupational Exposure to Ultrafine Particles Among Airport Employees--Combining Personal Monitoring and Global Positioning System," PLOS One (September 9, 2014) available at https://journals.plos.org/plosone/article?id-10.13 71/journal.pone.0 I 06671.

[5] Henry, R.C., Mohan, S., Yazdani, S. "Estimating Potential Air Quality Impact of Airports on Children Attending the Surrounding Schools," Atmospheric Environment, 212 (September I, 20l9) available at https://www.sciencedirect.com/science/article/abs/pii/S 1352231019303516.

[6] Habre, Rima ct al. "Shott-term Effects of Airport-Associated Ultrafine Particle Exposure on Lung Function and Inflammation in Adults with Asthma," Environment International, 118 (September 2018) available at https://www.sciencedirect.com/science/artiele/pii/SO 160412018301211.

[7] Rijksinstituut voor Volksgezondheid en Milieu, "Ultrafine Particles in the Vicinity of Schiphol Airport Affect Health," (June 27, 2019) https://www.rivm.nl/en/news/ultrafine-particles-in-vicinity-of-schiphol-airport-affecthealth.

[8] Armstrong, Alejandra, "Children Living in Lower-Income Areas are More Susceptible to Asthma," Cronkite News, Arizona PBS (April 29, 2016) https://eronkitenews.azpbs.org/2016/04/29/children-living-in-lower-incomeare-more-susceptible-to-asthma/.

[9] Weikel, Dan and Tony Barboza, "Planes' Exhaust Could Be Harming Communities Up To 10 Miles From LAX," Los Angeles Times (May 29, 2014) https://www.latimes.com/local/la-me-0529-lax-pollution-20140529-story.html

[10] Steve H L Yim et al 2015 Environ. Res. Lett. 10 034001,available at https://iopscience.iop.org/article/10.1088/1748-9326/10/3/034001.

Organization: *Sierra Club*

The agency frankly acknowledges that airport activity adversely affects air quality in the vicinity of airports with especially disastrous effects disproportionately inflicted on sensitive subpopulations, raising profound environmental justice concerns. According to EPA, some 16,000 premature deaths occur per year globally as a result of aviation emissions, with 86 percent attributable to PM2.5. Proposal at 6332. A third of these deaths occur in areas within 20 kilometers of an airport, and 210 were recorded in the continental United States. Id. EPA drastically understates the matter when it concludes that PM emissions in the vicinity of airports "are an important public health concern." Id. [EPA-HQ-OAR-2019-0660-0184-A1, p.2]

Organization: *Simons-Wilson, Alex*

Regardless, the reduction in emissions will greatly improve the health of communities situated around airport environments. Multiple studies have shown an increase in mortality rate and an increase in cardiovascular diseases likely resulting in living in the vicinity of airports. [EPA-HQ-OAR-2019-0660-0147, p.1]

Organization: *South Coast Air Quality Management District (South Coast AQMD)*

As a final note, airports are frequently surrounded by disadvantaged communities. EPA should consider policies that achieve surplus emission reductions and minimize impacts to these overly burdened communities. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

Organization: *Wagner, Debi*

But more importantly, EPA should be investigating why the health of people living in airport communities is so poor. [EPA-HQ-OAR-2019-0660-0153, p.1]

Recommendations:

Apply environmental laws fairly and equitably. Acknowledging vulnerable populations exist around airports, admitting they are subject to a disproportionate impact, acknowledging they may be experiencing additional health disparities from PM 10, PM 2.5 and UFP and then creating a rule that does not help them at all seems contrary to NEPA and EPA. Knowing the above while deferring to local agencies who steer far clear of airport environments for monitoring and enforcement is irresponsible. It is no secret and should not be considered new information to EPA that airports produce tremendous amounts of toxic and criteria pollution, (Sea-Tac produced the highest facility emissions in the state of WA in 2017 at 13,000 plus tons per year) that populations around airports experience health effects

from these emissions whether combined with other known sources or not, and that these people have the least ability to protect themselves from or inform themselves of the dangers. [EPA-HQ-OAR-2019-0660-0153-A1, p.4]

Organization: Wilson, Charles

The proposed standards apply to commercial and freight aircraft and the larger business jets. However, small aircraft contribute to climate change as well and have an important effect on communities near airports. Aircraft noise and local air pollution put some communities in a "sacrifice zone". [EPA-HQ-OAR-2019-0660-0148-A1, p.1]

EPA Response to Comments in Section 6.4

The EPA agrees that there are near-source impacts of airport activity and discusses them at length in the Preamble to the final rulemaking. The EPA conducted a systematic literature of air quality impacts, and other researchers recently published the results of a review of health effects. See, Riley, K., Cook, R., Carr, E., Manning, B. 2021. A Systematic Review of The Impact of Commercial Aircraft Activity on Air Quality Near Airports. City and Environment Interactions, 100066; and Bendtsen, K. M., Bengtsen, E., Saber, A., Vogel, U. 2021. A review of health effects associated with exposure to jet engine emissions in and around airports. Environ. Health 20:10. These reviews are available in the docket. Furthermore, the conclusions of EPA's Integrated Science Assessment for PM apply to ultrafine PM as a subclass of $PM_{2.5}$.

For responses to comments about the stringency of the standards, see the response to comments in Section IV.F.2 of the Preamble to the final rulemaking. For comments on alternatives, see section 10 of this document.

EPA actions under the Clean Air Act are not subject to obligations under NEPA, see 15 U.S.C. section 793(c)(1), so comments on that topic are outside the scope of this action.

Additionally, comments requesting additional research and monitoring are out of the scope of this action. In this action, the EPA did not propose additional research and monitoring. As stated in the Preamble to the proposed rulemaking, "Although not being conducted as part of this rulemaking, EPA is conducting a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity." 87 FR 6324, 6336 (Feb. 3, 2022). In sections I.B.3, III.G, and VIII.J of the Preamble to the final rulemaking the EPA describes the demographic analysis it is planning which continues to be a separate effort from this rulemaking. It should be noted that the EPA provides a variety of funding opportunities to address environmental justice concerns (https://www.epa.gov/environmentaljustice/environmental-justice-grants-funding-and-technical-assistance). Funding is also available for enhanced air quality monitoring under the American Rescue Plan (https://www.epa.gov/arp/enhanced-air-quality-monitoring-funding-under-arp).

6.5 Contribution of Aircraft Emissions to PM

Organizations Included in this Section

California Air Resources Board (CARB)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.

National Association of Clean Air Agencies (NACAA)
Sierra Club
Wagner, Debi

Organization: *California Air Resources Board (CARB)*

California, in particular, experiences the burden of aircraft emissions largely because of the high volume of passenger and cargo air traffic in our State. California is home to two of the nation's ten busiest airports by passengers and three of the 11 busiest by cargo weight.[4] According to 2019 Federal Aviation Administration (FAA) data, the State's total commercial passenger trips represented 12.9 percent of U.S. commercial passengers, and airports in the State handled 11.1 percent of all U.S. cargo.[5] [EPA-HQ-OAR-2019-0660-0206-A1, p.2]

Figure 1 highlights the projected particulate matter (particles less than 2.5 microns) (PM2.5) contribution from aircraft as it compares to the total mobile source contribution. In 2032, aircraft are projected to contribute 19 percent of the total mobile source PM2.5 emissions in the State. In addition, as seen in Figure 1, total PM2.5 contributions from all mobile sources are decreasing while the contribution from aircraft increases. The decrease in total mobile source emissions is due to tightening standards from categories like on-road cars and trucks. [EPA-HQ-OAR-2019-0660-0206-A1, p.2] [[See Docket Number EPA-HQ-OAR-2019-0660-0206-A1, p.2 for Figure 1.]]

As these other mobile sources continue to decrease their emissions, aircraft will continue to contribute more and more to the total emissions. [EPA-HQ-OAR-2019-0660-0206-A1, p.3]

---

[4] FAA, Passenger Boarding (Enplanement) and All-Cargo Data for U.S. Airports, updated Sept 29, 2020, available at https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/ (ranking Los Angeles International as #2 and San Francisco International as #7 by passengers, and Los Angeles International as #5, Ontario International as #10, and Metropolitan Oakland International as #11 by cargo weight).

[5] Ibid. California's airports processed 120,652,743 of 935,693,377 calendar year 2019 enplanements and 20,151,532,213 of 181,574,937,105 calendar year 2019 landed pounds at U.S. airports.

Organization: *California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin*

F. EPA's county-level analysis does not adequately capture the impacts of aircraft PM pollution on neighboring communities

EPA's analysis of the contribution of aircraft emissions to ambient PM levels is methodologically flawed, leading to the Proposed Rule understating the impacts of aircraft PM emissions on environmental justice communities. PM2.5 and UFP emissions should be assessed at the urban and neighborhood scales.[42] EPA instead analyzed the contribution of aircraft emissions over larger regional areas. 87 Fed. Reg. 6333. The urban scale refers to citywide conditions with dimensions on the order of 4 to 50 km. Id. The neighborhood scale refers to an area of a city with dimensions on the order of 0.5 to 4 km.[43] Because PM2.5 and UFP is usually emitted from numerous sources within a given area, and because PM2.5 and UFP concentrations can decrease steeply with distance from sources, considerable variation in PM2.5

and UFP concentrations can occur over relatively short distances.[44] [EPA-HQ-OAR-2019-0660-0203-A1, p.12]

Despite recognizing the appropriate scale for analyzing PM2.5 emissions is at the urban or neighborhood scale due to the highly localized nature PM2.5 emissions from aircraft, EPA assessed emissions at the Metropolitan Statistical Area (MSA) Level and the county level. Specifically, EPA estimated the proportion of PM2.5 emissions attributable to the 25 busiest airports in the United States in relation to the total mobile source emissions for the MSA and county each of those airports is located in. 87 Fed. Reg. 6333. MSAs are large sprawling areas delineated by the U.S. Office of Management and Budget to include both a city and its surrounding communities that have a high degree of integration with the city.[45] Examples of some of these areas include the "New York-Newark-Jersey City, NY-NJ-PA MSA," the "Los Angeles-Long Beach-Anaheim, CA MSA," and the "Chicago-Naperville-Elgin, IL-IN-WI MSA." These MSAs cover areas of 8,936 km2, 12,561 km2, and 18,633 km2 respectively. Examples of some of the counties used in EPA's analysis include Queens County, NY, Los Angeles County, CA, and Cook and DuPage Counties, IL (collectively). These counties cover areas of 460 km2, 12,310 km2, and 5,104.6 km2. These areas are orders of magnitude larger than the urban and neighborhood scale that would be appropriate for analyzing the impacts of aircraft emissions. Accordingly, analysis of PM2.5 emissions at the MSA or county level is not a meaningful exercise for measuring impacts of aircraft PM emissions on air quality. Instead, it drastically and misleadingly underestimates the impact of aircraft PM emissions on air quality in neighborhoods or communities directly near or downwind from major airports. Therefore, this evaluation of the impact of aircraft PM emissions on the neighborhoods and communities impacted by these emissions is potentially misleading, especially in instances where an airport is located in a large county or MSA. [EPA-HQ-OAR-2019-0660-0203-A1, pp.12-13]

---

[42] 2019 PM ISA, at 2-44.

[43] Id.

[44] Id.

[45] 2020 Standards for Delineating Core Based Statistical Areas, 86 Fed. Reg. 37,770, 37,778 (Notice of Decision July 16, 2021).

Organization: *Center for Biological Diversity and Friends of the Earth*

B. Aviation PM emissions will increase as air traffic increases, especially near large airports

Globally, air traffic is expected to increase by 3.3 times by 2045.[25] The International Civil Aviation Organization ("ICAO") anticipates that this increase in air traffic will increase aircraft-related PM emissions. In 2015, PM emissions were approximately 1,243 tonnes.[26] ICAO estimated in 2019 that PM emissions would increase to 3,572 tonnes by 2045.[27] Although the global COVID-19 pandemic has depressed air traffic since ICAO made its predictions about future growth in 2019, international air travel and tourism associations do not anticipate a longterm reduction in air travel.[28] In fact, North American air travel is recovering at a faster rate than other regions.[29] [EPA-HQ-OAR-2019-0660-0189-A1, p.4]

Because aircraft PM pollution is most associated with take-off and landing operations,[30] areas around airports will see the largest increases in PM pollution from increased air traffic. In some regions like Los Angeles, airplane traffic has grown to be as significant a contributor to elevated particle pollution as the

entire urban freeway network.[31] Increasing traffic also will make it harder for regional air quality districts with large airports to meet air quality standards.[32] For example, the South Coast Air Basin, which covers Los Angeles, Orange, Riverside, and San Bernadino counties and has over 12 million residents, already has elevated levels of PM2.5 and is classified as in nonattainment.[33] As long as air traffic continues to increase toward and beyond pre-pandemic levels, regional air quality districts may struggle to reach attainment status even as they take measures to reduce particulate pollution from other sources within their jurisdiction. [EPA-HQ-OAR-2019-0660-0189-A1, p.4]

---

[25] International Civil Aviation Organization, ICAO Global Environmental Trends –Present and Future Aircraft Noise and Emissions, A40-WP/54 at 2 (May 7, 2019), https://www.icao.int/Meetings/A40/Documents/WP/wp_054_en.pdf.

[26] Id. at A-4.

[27] Id.

[28] International Air Transport Association and Tourism Economics, Air Passenger Forecasts: Potential Paths for Recovery into the Medium- and Long-run (2020),

https://resources.oxfordeconomics.com/hubfs/Webinar%20presentations/Air-Passenger-Forecasts-potential-pathsfor-recovery-into-medium-and-long-run.pdf.

[29] International Civil Aviation Organization, 2021 global air passenger totals show improvement from 2020, but still only half pre-pandemic levels, ICAO Newsroom, Jan. 17, 2021, https://www.icao.int/Newsroom/Pages/2021-globalair-passenger-totals-show-improvement.aspx.

[30] 87 Fed. Reg. at 6,345.

[31] Hudda, N. et al., Emissions from an international airport increase particle number concentrations 4-fold at 10 km downwind, 48 Environmental Science & Technology 6628 (2014).

[32] U.S. EPA, Clean Air Act (CAA) and Federal Facilities, https://www.epa.gov/enforcement/clean-air-act-caa-andfederal-facilities (a region of the U.S. is categorized as "non-attainment" when it does not meet the required air quality standards under the Clean Air Act).

[33] Corey, Richard, California Air Resources Board, Comments re: Proposed Rulemaking for Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures; 85 Fed. Reg. 51556 August 20, 2020, to Administrator Andrew Wheeler, U.S. EPA (October 19, 2020); South Coast Air Quality Management District, 2016 Air Quality Management Plan, Appendix II Current Air Quality (March 2017), https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-qualitymanagement-plan/final-2016-aqmp/appendix-ii.pdf?sfvrsn=4.

Organization: *Center for Biological Diversity et al.*

And in some regions, like Los Angeles, airplane traffic has grown to be as significant a contributor to elevated particle pollution as the entire urban freeway network.[6] [EPA-HQ-OAR-2019-0660-0185-A1, p.2]

---

[6] Hudda, N. et al., Emissions from an international airport increase particle number concentrations 4-fold at 10 km downwind, 48 Environmental Science & Technology 6628 (2014).

Organization: *National Association of Clean Air Agencies (NACAA)*

In the NPRM, EPA highlights the aircraft PM2.5 emissions inventory as a percent of all mobile source PM2.5 at both the county and Metropolitan Statistical Area levels for the 25 U.S. airports with the greatest commercial aircraft operations. As depicted, at the county level, aircraft PM2.5 emissions are responsible for as much as 14 percent of mobile PM2.5.[6] [EPA-HQ-OAR-2019-0660-0177-A1, p.2]

Aircraft are a major source of PM emissions, contributing to various NAAQS-related, climate and toxic air pollution problems and causing detrimental public health and welfare impacts. [EPA-HQ-OAR-2019-0660-0177-A1, p.2]

---

[6] *Id*. at 6,334

Organization: *Sierra Club*

B. PM emissions from aviation are growing steeply.

Aviation is one of the fastest-growing sources of harmful emissions.[5] For example, aviation greenhouse emissions increased by 44 percent over the last ten years (an approximate indication of PM emission growth as well), as passenger and cargo traffic expansion far outpaced business-as-usual efficiency improvements.[6] The United States is by far the largest aviation polluter, far outpacing China, which is ranked second in the world for its aircraft emissions.[7] The U.S. aviation sector clearly bears a disproportionate share of responsibility for aircraft PM emissions domestically as well as globally. A U.S. failure even to consider how to mitigate them is inexcusable. [EPA-HQ-OAR-2019-0660-0184-A1, p.3]

---

[5] Brandon Graver et al., CO2 emissions from commercial aviation, 2018at 1-2 (Int'l Council on Clean Transp. Sept. 2019), available at https://theicct.org/sites/default/files/publications/ICCT_CO2-commercl-aviation-2018_20190918.pdf

[6] Xinyi Zheng & Dan Rutherford, *Fuel burn of new commercial jet aircraft: 1960 to 2019* at 1 (Int'l Council on Clean Transp. Sept. 2020), available at https://theicct.org/publications/fuel-burn-new-comm-aircraft-1960-2019-sept2020 [hereinafter "Zheng 2020"].

[7] See Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare and Advance Notice of Proposed Rulemaking, 80 Fed. Reg. 37,758, 37,788 (July 1, 2015).

Organization: *Wagner, Debi*

Two examples of the consequences of lack of oversight, monitoring and enforcement:

A recent EIR approved for LAX expansion included projected air quality violations. The local air quality management district allowed these to fit within the budgeted emissions for the area. So even though emissions spread out over a region may fall within a budget, this process completely ignored the local impact to public health. Because agencies are allowed to shuffle the data to meet industry desires, local communities are put at risk. EPA should never be allowing delegation to local air management districts where public health is put at risk. [EPA-HQ-OAR-2019-0660-0153-A1, p.3]

In 1996, Sea-Tac Airport was in the process of adding another runway. The EIS for this project included modeled existing air quality impacts and what could be expected for the future. These figures were

compared to a scenario with or without the project. In the aircraft category there was an unusually low particulate from aircraft when compared to previous estimates. The process to obtain the input data into the model used to estimate particulate impacts was difficult, costly and time consuming. It involved purchasing a dozen or so floppy discs from FAA which needed the capacity of Microsoft itself to open and view. To my surprise, I found that all particulate defaults in the model for all commercial jet aircraft operations at Sea-Tac at the time and projected into the future had been set to zero. After repeated requests to FAA, I finally received an answer that all previous data had been found to be inaccurate sometime between 1993 and 1995 and removed from the model but that the consultant had the ability to override the defaults and input data. With no reliable data available, the consultant chose to leave it blank. I notified EPA region 10 and despite their knowledge the air quality estimates could not be relied upon for compliance with the NAAQS now or in the future, they proceeded to approve the EIS. From a recent King County Health Department report, we have learned that the health disparities in these same communities are significantly higher than average for the county and become higher closer to the airport. [EPA-HQ-OAR-2019-0660-0153-A1, p.3.

EPA Response to Comments in Section 6.5

One commenter stated that the EPA's analysis of the contribution of the aircraft engines addressed by this rule to overall mobile source emissions was fundamentally flawed, because it did not address emissions at the urban or neighborhood scale, and thus underestimated impacts on environmental justice communities. The analysis EPA provided in the proposed rulemaking was only intended to verify that the aircraft engines covered by this rule (and the aircraft these engines are installed on) significantly contribute to PM in counties and metropolitan statistical areas where airports are located. For that reason, it only included evaluation of aircraft PM contribution estimates at the urban scale (metropolitan statistical areas) and not at the neighborhood scale.

Another commenter stated that environmental impact statements for airport expansions do not adequately address air quality impacts. EPA's rulemaking is not regulating airport expansion and therefore, this issue is beyond the scope of this rule. In addition, EPA actions under the Clean Air Act are not subject to obligations under NEPA, see 15 U.S.C. section 793(c)(1).

Other commenters pointed out the likelihood that aircraft emissions are likely to increase in the future along with aircraft activity. The purpose of our emissions analysis was to verify that the aircraft engines covered by this rule emit PM in counties and metropolitan statistical areas where airports are located. Increases in aircraft activity will simply confirm this verification.

6.6 Environmental Justice

Organizations Included in this Section

Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Airport Impact Relief, Inc. (AIR, Inc.)
Anderson, Gillian
Anonymous Public Comment - 15
Aviation-Impacted Communities Alliance (AICA)
B, Nick
Barnes, Miki
Batra, Neelesh
Beacon Hill Council of Seattle (BHC)

California Air Resources Board (CARB)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Clark, Mitchell
Environmental Defense Fund (EDF)
Gibbons, Laura
Hahnel, Tanya
Institute for Policy Integrity at New York University School of Law (Policy Integrity)
Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)
National Association of Clean Air Agencies (NACAA)
Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way
Rose, Jillian
Service Employees International Union (SEIU)
Wagner, Debi

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*
In addition, the proposed EPA Aircraft Engine PM Standards will bring important environmental benefits, including potentially contributing to the improvement of air quality at and around airports where EPA notes "studies have reported . . . many communities . . . are disproportionately represented by minorities and low-income populations."[4] [EPA-HQ-OAR-2019-0660-0192-A1, pp.1-2]

---

[4] Id. at 6336. As discussed further below, we disagree with EPA's conclusion that the proposed EPA Aircraft Engine PM Standards "are not expected to result in emission reductions, beyond the business-as-usual fleet turnover that would occur absent . . . the proposed standards." Id.

Organization: *Airport Impact Relief, Inc. (AIR, Inc.)*
The NPRM notes that EPA is conducting a demographic analysis, not being conducted as part of this rulemaking, to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity. EPA's June 2016 "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" states that EPA strives to answer three broad questions, one of which is: "Is there evidence of potential EJ concerns for the regulatory option(s) under consideration? Specifically, how are the pollutant(s) and its effects distributed for the regulatory options under consideration?" The use of the traditional LTO volume for assessing and regulating these nvPM emissions may not adequately protect EJ and other communities living in close proximity to the airport because are not distributed uniformly throughout the LTO volume, but are significantly concentrated close to the airport. [EPA-HQ-OAR-2019-0660-0175-A1, p.5] [[This comment also appears in sections 2.3 and 7.1.]]

Organization: *Anderson, Gillian*
I support the comments submitted by Air Inc. They are well-substantiated and I hope the EPA will take them VERY seriously. Thank you. Gillian B. Anderson, resident of East Boston, MA right near the airport. [EPA-HQ-OAR-2019-0660-0197, p.1] [[This comment can also be found in section 1.2]]

Organization: *Anonymous Public Comment - 15*
Individuals living in close proximity to airports are entailed to their right to clean air and a safe environment, and it is disappointing to know that the negative impacts of these emissions have not been addressed with greater urgency. [EPA-HQ-OAR-2019-0660-0187, p.1]

Organization: *Aviation-Impacted Communities Alliance (AICA)*
Apply environmental laws fairly and equitably. Vulnerable populations near airports should not be subjected to disproportionate impacts and additional health disparities from PM10 & PM2.5, and UFP. These people have the least ability to protect themselves from or inform themselves of the dangers. [EPA-HQ-OAR-2019-0660-0159-A1, p.1]

Organization: *B, Nick*
I wanted to take a moment to applaud the EPA's efforts to help curb harmful PM emissions, but also to address the issues of environmental justice. The EPA will be able to best address the full scope of issues, such as airline emissions, by acknowledging how the systems we live in and interact with are built in such a way that negatively impacts and burdens BIPOC [black and indigenous people of color]. It's a great step forward to see the EPA tie the effects of racial housing disparities and income segregation to an increased risk of exposure to airline pollution. [EPA-HQ-OAR-2019-0660-0146, p.1]

Organization: *Barnes, Miki*
I am writing to state my support for the comments submitted by AIRPORT IMPACT RELIEF (AIR INC) on Monday 3/28/22 on the proposed EPA rule: “Control of Air Pollution from Aircraft Engines: Emissions Standards and Test Procedures." [EPA-HQ-OAR-2019-0660-0200, p.1]

Organization: *Batra, Neelesh*
I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: *Beacon Hill Council of Seattle (BHC)*
First of all, we appreciate the United States’ need to align its Emission Standards and Test Procedures with the International Civil Aviation Standards Organization (ICAO). However, the proposed rule is meaningless to us because it:

3. It explicitly says that EPA does not anticipate that the rule will improve air quality for those who live near airports (see below quotes), but they are conducting a “demographic analysis” to “inform potential future actions" [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[Portions of this comment are repeated in sections 2.3, 3.2 and 10]]

“…while newer aircraft engines typically have significantly lower emissions than existing aircraft engines, the proposed standards in this action are technology following in order to align with ICAO’s standards and are not expected to, in and of themselves, result in further reductions in PM from these engines. Therefore, we do not anticipate an improvement in air quality for those who live near airports where these aircraft operate.” (Underlined for emphasis. See 6327 of the proposed rule.) [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[This comment is repeated in section 2.3.]]

“…the proposed in production standards for both PM mass and PM number are levels that all aircraft engines in production currently meet in order to align with ICAO’s standards. Thus, the proposed standards are not expected to result in emission reductions, beyond the business-as usual fleet turnover that would occur absent of the proposed standards. Therefore, we do not anticipate an improvement in

air quality for those who live near airports where these aircraft operate." (Underlined for emphasis. See 6336 of the proposed rule.) [EPA-HQ-OAR-2019-0660-0176-A1, pp.1-2] [[This comment is repeated in section 2.3.]]

When one looks at aircraft impacted communities near the SeaTac International Airport and under flight paths, we number 419,761 with 64.4% people of color/mixed race, 29% immigrants and refugees, vulnerable 22% children/youth and 12% elders. Near airport communities include Burien, Des Moines, Federal Way, Normandy Park, Renton, SeaTac, and Tukwila. Our communities under flight paths include Beacon Hill, Georgetown, Duwamish, White Center, and Chinatown ID. We are environmental justice (EJ) communities. The COVID pandemic demonstrated faster and harder impacts on our vulnerable EJ communities. [EPA-HQ-OAR-2019-0660-0176-A1, p.2]

As a community under the flight path, north Beacon Hill experiences aircraft every 90-180 seconds and the rest of the neighborhood experiences aircraft as frequently as 180 seconds with 70% of the aircraft headed towards Seattle Tacoma International Airport for landing. Our Beacon Hill community have 40,601 residents with 73% people of color and 40.2% immigrants and refugees. Beacon Hill, as other communities under the flight paths are not eligible for any mitigation. We collectively say: "As we hear it, we breathe it." [EPA-HQ-OAR-2019-0660-0176-A1, p.2]

The health profile of residents within 10 miles of SeaTac International Airport reflects similar health concerns in the proposed rule. https://app.leg.wa.gov/ReportsToTheLegislature/Home/GetPDF?fileName=Community%20Health%20and%20Airport%20Operations%20Related%20Pollution%20Report_c7389ae6-f956-40ef-98a7-f85a4fab1c59.pdf [EPA-HQ-OAR-2019-0660-0176-A1, p.2]

Organization: *California Air Resources Board (CARB)*

II. Environmental Justice Concerns

Aircraft are major contributors to PM emissions, and low-income and disadvantaged communities surrounding airports are most impacted. PM emissions are known to cause immediate and long-term detrimental health effects and severe environmental damage. For the safety of California's communities and the environment, PM reductions from aircraft engines are needed. [EPA-HQ-OAR-2019-0660-0206-A1, p.4]

In California, communities within 10 miles of international airports are disproportionately low-income and people of color.[12] Many low-income and disadvantaged communities experience criteria pollutant levels that significantly exceed the NAAQS, as well as exposure to hazardous air pollutants, which can have immediate and long-term detrimental health effects.[13] Members of these communities have raised concerns regarding aircraft emissions, citing aircraft as the predominant emission source in or near their community. We urge EPA to use this update as an opportunity to promulgate more stringent standards for aircraft. We have heard great concern from frontline disadvantaged communities who are severely impacted by aircraft emissions. Aircraft emission exposure is just one of the harmful emission sources experienced by communities disproportionately burdened and most significantly impacted by cumulative emissions exposure. [EPA-HQ-OAR-2019-0660-0206-A1, pp.4-5]

EPA's Proposed Standard outlines plans to undertake a separate action to conduct an analysis of the communities residing near airports where jet aircraft operate. This analysis will allow EPA to understand

the disproportionately high instances of adverse human health or environmental effects on people of color, low-income populations, and/or indigenous peoples. The Proposal states that the results from this analysis could help inform additional policies to reduce pollution in communities living in close proximity to airports. EPA should not wait for additional analysis; there is existing evidence to support the need for additional action to protect low-income and disadvantaged communities surrounding airports. EPA should act now by incorporating actions into the Proposal to protect underserved communities and reduce their exposure to harmful PM emissions. [EPA-HQ-OAR-2019-0660-0206-A1, p.5]

---

[12] Julian D. Marshall, "Environmental inequality: air pollution exposures in California's South Coast Air Basin," Atmos. Environ. 42:5499-5503 (Feb. 4, 2008), https://doi.org/10.1016/j.atmosenv.2008.02.005; Julian D. Marshall et al., "Prioritizing Environmental Justice and Equality: Diesel Emissions in Southern California," Envtl. Sci. Tech. 48:4063-4068 (Feb. 21, 2014), available at https://doi.org/10.1021/es405167f; Jason G. Su et al., "Inequalities in cumulative environmental burdens among three urbanized counties in California," Environment Int'l 40:79-87 (Jan. 3, 2012), available at https://superfund.berkeley.edu/pdf/402.pdf; Jason G. Su et al., "An index for assessing demographic inequalities in cumulative environmental hazards with application to Los Angeles, California," Envtl. Sci.Tech. 43:7626-7634 (Sept. 21, 2009), available at https://doi.org/10.1021/es901041p ; Wonsik Choi et al., Neighborhood-Scale Air Quality Impacts of Emissions From Motor Vehicles and Aircraft, 80 ATMOSPHERIC ENV'T 310, 316 (2013), DOI:10.1016/j.atmosenv.2013.07.043; Joshua Apte, "A Tool to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California" (Nov. 2019), available at https://ww3.arb.ca.gov/research/single-project.php?row_id=67021.

[13] E.g., American Lung Association, Disparities in the Impact of Air Pollution, updated April 20, 2020, https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities; Y.-Y. Meng et al.,"Are frequent asthma symptoms among low-income individuals related to heavy traffic near homes, vulnerabilities, or both?," 18:343-350 Annals of Epidemiology (2008); RB Gunier et al., "Traffic density in California: socioeconomic and ethnic differences among potentially exposed children," Journal of Exposure Science and Environmental Epidemiology (2003), 13(3): pp.240-246; A. Carlson, "The Clean Air Act's Blind Spot: Microclimates and Hotspot Pollution," 65 UCLA L. Rev. 1036 (2018); R.J. Delfino et al., "Asthma Symptoms in Hispanic Children and Daily Ambient Exposures to Toxic and Criteria Air Pollutants," Environmental Health Perspectives vol. 111 number 4 (April 2003); W.J. Gauderman et al., "The effect of air pollution on lung development from 10 to 18 years of age," New England Journal of Medicine 351(11): 1057-1067 (2004), Erratum in: New England Journal of Medicine 2005 352(12):1276.

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

While the Proposed Rule acknowledges significant evidence that these communities are inequitably impacted by aircraft PM pollution, EPA understates the environmental justice impacts of this pollution. There is inadequate monitoring data of PM levels in communities near airports, and EPA's county-level analysis does not adequately capture the highly localized impacts of aircraft PM emissions on airport-adjacent communities. [EPA-HQ-OAR-2019-0660-0203-A1, p.4] [[This comment is repeated in section 6.4]]

C. PM pollution has disproportionate impacts on environmental justice communities

EPA's Proposed Rule acknowledges that "environmental hazards such as air pollution are more prevalent in areas where people of color and low-income populations represent a higher fraction of the populations compared with the general population, including near transportation sources." Id. at 6336.

However, this acknowledgement understates the overwhelming evidence of the disproportionate impact of PM pollution on environmental justice communities. EPA previously noted, in the context of its review of the current PM NAAQS standards, that "[t]here is strong evidence demonstrating that [B]lack and Hispanic populations, in particular, have higher PM2.5 exposures than non-Hispanic white populations'' and "there is consistent evidence across multiple studies demonstrating an increase in risk for nonwhite populations."[28] [EPA-HQ-OAR-2019-0660-0203-A1, p.9]

Indeed, the evidence EPA relied on included one study showing that the exposure to PM poses a "relative risk for African Americans [that] is three times higher than that of the entire population."[29] Another analysis found that the average exposure of Latin, Asian, and African/Black Americans in the Northeast and Mid-Atlantic regions to PM2.5 from cars, trucks and buses exceeded the average exposure in those regions by 42 percent, 40 percent and 31 percent, respectively.[30] Other, more recent, studies not considered by EPA during its review of the PM NAAQS confirm these findings.[31]

D. Aircraft PM pollution has a disproportionate impact on environmental justice communities

Like PM pollution generally, aircraft PM emissions have a disproportionate impact on environmental justice communities. As noted above, the emissions of primary concern are those released during landings and takeoffs (LTO), defined as emissions between ground level and an altitude of about 3,000 feet. 87 Fed. Reg. at 6345. These emissions include those released during departure operations (from taxi-out movement from gate to runway, aircraft take-off run, and climb-out to 3,000 feet) and arrival operations (emissions from approach at or below 3,000 feet down to landing on the ground and taxi-in from runway to gate). Id. "These LTO emissions directly affect the ground level air quality at the vicinity of the airport since they are within the local mixing height." Id. Accordingly, "concentrations of PM increase with proximity to an airport." Id. Further, as discussed above, the scientific literature "consistently reports that particle numbers close to airports are significantly higher than locations distant and upwind of airports, and that the particle size distribution is different from traditional road traffic, with more extremely fine particles. Id. at 6332. [EPA-HQ-OAR-2019-0660-0203-A1,p.10]

This higher concentration of aircraft PM emissions reaching neighborhoods already living with environmental justice concerns is disproportionately impacting communities of color and/or communities with high poverty rates because airports are disproportionately located in these historically marginalized and overburdened communities. Id. at 6336. For example, one study cited by EPA found that "the relationship between minority population percentages and aircraft derived PM was found to grow stronger as [PM] concentrations increased."[32] Another study found "that over 65,000 students in California spend 1 to 6 hours a day during the academic year being exposed to airport pollution, and the percentage was higher for those who were economically disadvantaged."[33] Additionally, as noted above, airport workers are chronically exposed to these emissions and especially vulnerable to the resulting health impacts.[34] [EPA-HQ-OAR-2019-0660-0203-A1, p.10]

Information from California (drawn from the State's environmental justice screening tool, CalEnviroScreen) confirms that airports are often located in or near environmental justice communities. Several of the busiest airports in California (and in the United States), including Los Angeles International Airport (LAX), San Francisco International Airport (SFO), San Jose International Airport (SJO), and Oakland International Airport (OAK), are surrounded by communities in which residents are predominantly people of color and experience high levels of poverty.[35] The example of LAX is particularly striking. The census tracts due east of LAX include several communities in which people of

color and people living in poverty are the majority: [EPA-HQ-OAR-2019-0660-0203-A1, pp.10-11] [[See Docket Number EPA-HQ-OAR-2019-0660-0203-A1, p.11 for the census tract table]]

Additionally, data shows that the predominant wind direction blows west to east, or from LAX airport directly into these environmental justice communities.[36] Smaller commercial airports in California, including Ontario International Airport (ONT), Fresno Yosemite International Airport (FAT), and Meadows Field Airport in Bakersfield (BFL) have similar demographic patterns in the surrounding areas.[37] [EPA-HQ-OAR-2019-0660-0203-A1, p.11]

Data from other states show similar land-use patterns with airports located in or near historically disadvantaged and overburdened communities. For example, the Philadelphia International Airport is located in close proximity of neighborhoods which demographically are 88% to 97% people of color and communities with high poverty rates. Given the daily variability in wind direction, all of these communities are likely exposed to aircraft PM emissions.[38] [EPA-HQ-OAR-2019-0660-0203-A1, p.11]

---

[28] Review of the National Ambient Air Quality Standards for Particulate Matter, 85 Fed. Reg. 82,684, 82703 (Dec. 18, 2020) (quoting 2019 PM ISA, supra note 3, at 12-38).

[29] Independent Particulate Matter Review Panel, Consensus Responses to Charge Questions on EPA's Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter (External Review Draft – Sept. 2019), B-29 (citing Di et al., Air Pollution and Mortality in the Medicare Population, New England Journal of Medicine, 376(26): 2513-2522 (2017)), https://ucs-documents.s3.amazonaws.com/science-and-democracy/IPMRP-FINAL-LETTER-ON-DRAFT-PA-191022.pdf (attached as Exhibit 3).

[30] M. Pinto de Moura et al., Inequitable Exposure to Air Pollution from Vehicles in the Northeast and Mid-Atlantic, at 3 (June 2019), https://www.ucsusa.org/sites/default/files/attach/2019/06/Inequitable-Exposure-to-Vehicle-Pollution-Northeast-Mid-Atlantic-Region.pdf, (attached as Exhibit 4).

[31] See, e.g., I. Mikati, et al., Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status, 108(4) Am. J. Public Health 480 (Apr. 2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5844406/pdf/AJPH.2017.304297.pdf, (attached as Exhibit 5).

[32] Rissman et al., Equity and Health Impacts of Aircraft Emissions at the Hartfield-Jackson Atlanta International Airport, Landscape and Urban Planning 120: 234-274, (2013) https://www.sciencedirect.com/science/article/pii/S0169204613001382; see also McNair, A. et al., Investigation of Environmental Justice Analysis in Airport Planning Practice from 2000 to 2010, Transp. Research Part D 81:102286 (2020), https://www.sciencedirect.com/science/article/pii/S1361920919311149?via%3Dihub; Woodburn, A., Investigating Neighborhood Change in Airport-Adjacent Communities in Multiairport Regions from 1970 to 2010, Journal of Transportation Research Board, 2626, 1-8, https://doi.org/10.3141%2F2626-01.

[33] Henry et al., Estimating Potential Air Quality Impact of Airports on Children Attending the Surrounding Schools, Atmospheric Environment, 212: 128-135 (2019), https://www.sciencedirect.com/science/article/pii/S1352231019303516?via%3Dihub.

[34] Jet Engine Emissions In And Around Airports, supra note 14.

[35] Collection of Maps from CalEnviroScreen 4.0 (attached as Exhibit 6.) California Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40.

[36] WeatherSpark.com, Chart for Wind Direction at Los Angeles International Airport, https://weatherspark.com/y/145341/Average-Weather-at-Los-Angeles-International-Airport-California-United-States-Year-Round (attached as Exhibit 7).

[37] Exhibit 6, supra note 35.

[38] EPA EJ Screen, https://www.epa.gov/ejscreen.

Organization: Center for Biological Diversity and Friends of the Earth

V. The Proposal Does Not Meaningfully Discuss Environmental Justice Impacts.

"[E]nvironmental justice is not merely a box to be checked."[87] Executive Order 12898 and Title VI of the Civil Rights Act of 1964 require EPA to consider how its Proposal would impact disadvantaged communities.[88] EPA's action is arbitrary and capricious because the agency has made no effort to conduct any meaningful analysis of those impacts.[89] [EPA-HQ-OAR-2019-0660-0189-A1, p.11] [[This comment is repeated in section 11.5.]]

EPA's "Environmental Justice" discussion consists only of a recitation of Technical Guidance questions and a brief summary of existing scientific literature that notes that communities near airports experience higher concentrations of PM as well as that those same communities are disproportionately low-income and communities of color.[90] Rather than apply the Guidance questions, EPA summarily concludes that there will be no "improvement in air quality for those who live near airports where these aircraft operate."[91] [EPA-HQ-OAR-2019-0660-0189-A1, p.11] [[This comment is repeated in section 11.5.]]

It was insufficient for EPA to recite Technical Guidance questions without making any attempt to answer them. EPA's "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" offers recommendations on "conducting the highest quality [EJ] analysis feasible." [92] The Guidance document provides three broad questions that agencies should address when conducting an EJ analysis: (1) "[a]re there potential EJ concerns associated with environmental stressors affected by the regulatory action for population groups of concern in the baseline;" (2) "[a]re there potential concerns associated with environmental stressors affected by the regulatory action for population groups of concern for the regulatory option(s) under consideration;" and (3) "[f]or the regulatory option(s) under consideration, are potential EJ concerns created or mitigated compared to the baseline?" [93] As the Guidance notes, these questions are intended to help the agency understand "differences in impacts or risks," such as "differential exposures" and "differential health and environmental outcomes," that help decisionmakers understand whether they should take a different action.[94] [EPA-HQ-OAR-2019-0660-0189-A1, p.12] [[This comment is repeated in section 11.5.]]

EPA should have attempted to answer these questions and described in detail whether the Proposal will have a disproportionate impact on environmental justice communities near airports. To properly consider whether environmental justice concerns would be created or mitigated, EPA also should have analyzed the benefits of setting a standard for covered aircraft that would cause real and incremental reductions in PM emissions. [EPA-HQ-OAR-2019-0660-0189-A1, p.12] [[This comment is repeated in section 11.5.]]

It was also inappropriate for EPA to defer to a separate action a "demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic

disparity."[97] While EPA's efforts to better understand environmental justice concerns near airports are laudable, EPA is describing future efforts that are beyond the scope of this rulemaking. EPA should have at a minimum completed some environmental justice analysis before issuing its proposal and explained why the information it had was insufficient to provide a detailed analysis of the present implications of the action under consideration for disadvantaged communities. [EPA-HQ-OAR-2019-0660-0189-A1, pp.12-13]

---

[87] Friends of Buckingham v. State Air Pollution Control Bd., 947 F.3d 68, 92 (4th Cir. 2020).

[88] See, e.g., Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Exec. Order No. 12898, 59 Fed. Reg. 7,629 (Feb. 11, 1994), as amended, 60 Fed. Reg. 6,381 (Jan. 30, 1995).

[89] See Vecinos para el Bienestar de la Comunidad Costera v. FERC, 6 F.4th 1321, 1330-31 (D.C. Cir. 2021) (federal agency's environmental justice analysis was arbitrary and capricious where it failed to examine a pipeline project's environmental effects extending beyond the two-mile radius it studied).

[90] 87 Fed. Reg. at 6,336.

[91] Id.

[92] U.S. EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis 13 (2016) https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf.

[93] Id. at 11.

[94] Id.

[97] 87 Fed. Reg. at 6,336.

Organization: *Center for Biological Diversity et al.*

The harmful impacts of particle pollution fall most heavily on communities of color and low-income communities that disproportionately live near airports. These communities often already bear the brunt of climate change impacts and compounding air pollution from nearby industry and roadways. The Proposed Rule does not reduce particulate emissions from new planes beyond what manufacturers are already doing and does not regulate in-service planes.[9] ICAO and aviation industry groups also estimate that airplane traffic levels will rebound quickly following the COVID-19 pandemic and more than triple in the coming decades.[10] This means emissions are likely to increase with rising traffic, and the rule makes no effort to counteract this trend. With this Proposed Rule, EPA allows for further human suffering in already overburdened communities. [EPA-HQ-OAR-2019-0660-0185-A1, p.2] [[This comment is repeated in 2.3]]

---

[9] 87 Fed. Reg. at 6,347 (particulate matter standards are "technology-following").

[10] International Civil Aviation Organization, ICAO global environmental trends – Present and future aircraft noise and emissions, A40-WP/54 (2019), https://www.icao.int/Meetings/A40/Documents/WP/wp_054_en.pdf; International Air Transport Association and Tourism Economics, Air Passenger Forecasts: Potential Paths for

Recovery into the Medium- and Long-run (2020), https://resources.oxfordeconomics.com/hubfs/Webinar%20presentations/Air-Passenger-Forecasts-potential-pathsfor-recovery-into-medium-and-long-run.pdf.

Organization: *Clark, Mitchell*

The executive order which makes pursuing environmental justice a major priority will have many interesting effects on the policy of the EPA including this. I would have liked to see a consistent methodology laid out for conducting EJ analysis before any policies are created to avoid confusion and ensure consistency in policymaking. Despite this, limiting the amount of such particulate matter and changing the testing methods to include it does seem to further environmental justice for those living around the airports. As particulate matter, which is associated with potential health effects, would predominantly affect low-income areas around airports. [EPA-HQ-OAR-2019-0660-0139, p.1] [[This comment is repeated in section 11.5]]

Organization: *Environmental Defense Fund (EDF)*

There is wide agreement, as reported in the proposed rule, that many communities in vicinity to airports are disproportionally represented by people of color and low-income populations.[25,26,27,28,29,30,31,32] We agree with the agency that further analysis would help fully understand disproportionally high and adverse human health or environmental effects on people of color, low-income populations and/or indigenous peoples, and help inform additional policies to reduce pollution in communities living in vicinity to airports and direct support to the communities disproportionally impacted by aviation. However, these additional analyses will not change the need to act now to protect vulnerable communities and thereby address the disproportionally high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities as well as the economic challenges of such impacts. [EPA-HQ-OAR-2019-0660-0207-A1, p.5]

Indeed, According to Executive Order 14008 "[a]gencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts." Since communities in the vicinity of airports are disproportionately represented by people of color and low-income populations, setting more stringent standards would certainly address environmental injustice and contribute to this whole-of-government approach. [EPA-HQ-OAR-2019-0660-0207-A1, p.5] [[This comment can also be found in section 11.5 of the comment summary]]

---

[25] Rissman J., S. Arunachalam, T. BenDor, J.J. West, 2013, Equity and health impacts of aircraft emissions at the Hartsfield-Jackson Atlanta International Airport, Landscape and urban planning 120 (2013): 234-247

[26] Henry, R.C., S. Mohan, S. Yazdani, 2019, Estimating potential air quality impact of airports on children attending the surrounding schools, Atmospheric Environment 212 (2019): 128-135.

[27] Johnson K., D. Solet, K. Serry, 2020, Community Health and Airport Operations Related Noise and Air Pollution: Report to the Legislature in Response to Washington State HOUSE BILL 1109, December 1, 2020. Public Health Seattle & King County; Assessment, Policy Development and Evaluation Unit

[28] Rowangould G.M., 2013, A census of the near-roadway population: public health and environmental justice considerations, Trans Res D 25: 59-67. http://dx.doi.org/10.1016/j.trd.2013.08.003

[29] Marshall J.D., K.R. Swor, N.P. Nguyen, 2014, Prioritizing environmental justice and equality: diesel emissions in Southern California, Environ Sci Technol 48: 4063-4068. https://doi.org/10.1021/es405167f

[30] Marshall J.D., 2000, Environmental inequality: air pollution exposures in California's South Coast Air Basin, Atmos Environ 21: 5499-5503. https://doi.org/10.1016/j.atmosenv.2008.02.005

[31] Tessum C.W., D.A. Paolella, S.E. Chambliss, J.S. Apte, J.D. Hill, J.D. Marshall, 2021, PM2.5 polluters disproportionately and systemically affect people of color in the United States, Science Advances 7:eabf4491.

[32] Mohai, P., D. Pellow, J. Roberts Timmons, 2009, Environmental justice, Annual Reviews 34: 405-430. https://doi.org/10.1146/annurev-environ-082508-094348

Organization: *Gibbons, Laura*

I recently attended a helpful session about these regulations led by Bryan Manning and 5 other EPA staff people. Based on this meeting, I would say the EPA is well-informed about the adverse health consequences of aviation emissions and their disparate impact on communities of color and people with lower income. [EPA-HQ-OAR-2019-0660-0164, p.1]

Organization: *Hahnel, Tanya*

These EPA guidelines must not be adopted! The EPA must produce a rule that remedies the defects noted in Air Inc.'s detailed comment letter. Those comments are submitted on behalf of an Environmental Justice community that has been fighting the effects of fine particulate matter for half a century. Their comments deserve to be adopted into the EPA's approach to this issue. [EPA-HQ-OAR-2019-0660-0196, p.1] [[This comment can also be found in section 1.2 of the comment summary]]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should conduct a distributional analysis to evaluate the impacts of the Proposed Rule and all reasonable regulatory alternatives. Rather than conducting a separate analysis of the disproportionate burdens that pollution from aircraft imposes on communities of color living near airports, EPA should conduct a thorough distributional analysis as part of this rulemaking process. This analysis should include evaluation of the relative distributional consequences for each regulatory alternative. [EPA-HQ-OAR-2019-0660-0182-A1, p.1] [[This comment is repeated in section 11.5.]]

II. EPA Should Conduct a Distributional Analysis of the Consequences of Its Proposed Rule Instead of Postponing Such an Analysis for a Separate Action

EPA acknowledges the disproportionate burdens on people of color living near airports as a result of aircraft emissions.[28] A baseline understanding of disproportionate burdens created by the source category is helpful, but must be accompanied by an analysis that evaluates the distribution of impacts resulting from the Proposed Rule and any marginal differences from adopting EPA's proposed alternatives. [EPA-HQ-OAR-2019-0660-0182-A1, p.4] [[This comment is repeated in section 11.5.]]

But instead of evaluating how the Proposed Rule will—or, in this case, will not—provide any pollution benefit directly to these overburdened communities, EPA claims it will conduct a demographic analysis of pollution burdens from aircraft in an unnamed action separate from this proposed rulemaking.[31] EPA simply concludes that because the Proposed Rule will not result in any emission reductions, EPA "does not anticipate an improvement in air quality for those who live near airports where these aircraft operate."[32] But EPA fails to consider any policy that will "appropriately benefit . . . disadvantaged, vulnerable, or marginalized communities," since it merely proposes technology-following international

standards without considering any emission-reducing alternatives.[33] [EPA-HQ-OAR-2019-0660-0182-A1, p.4]

EPA should conduct a distributional analysis of the Proposed Rule—and all reasonable regulatory alternatives as described in section I, supra—to determine whether another approach may be more advantageous to disadvantaged communities. The agency should consider the results of that analysis—along with the findings of a full regulatory impact analysis—when assessing whether to adopt the regulation as proposed or whether to adopt a more stringent alternative. [EPA-HQ-OAR-2019-0660-0182-A1, pp.4-5]

---

[28] 87 Fed. Reg. at 6335–36.

[31] 87 Fed. Reg. at 6336 & n.83.

[32] Id. at 6336.

[33] Memorandum on Modernizing Regulatory Review, supra note 29, § 2(b)(ii).

Organization: Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)

The communities that are most affected by PM pollution from aircraft are those living near airports, which are disproportionately communities of color and low-income communities. The EPA's proposed rule acknowledges that there will be no improvement in air quality for these communities but does not engage in a meaningful discussion of environmental justice impacts of the standard. [EPA-HQ-OAR-2019-0660-0194-A1, p.1]

Organization: National Association of Clean Air Agencies (NACAA)

EPA also cites various studies that conclude, among other things, that PM concentrations increase with proximity to an airport; air pollution can disproportionately impact sensitive subpopulations near airports; the relationship between minority population percentages and aircraft PM was found to grow stronger as concentrations increased; minorities and low-income populations are disproportionately represented in many communities in close proximity to airports; and over time, the presence of marginalized groups residing in close proximity to hub airports, has increased.[7] It is also noteworthy that the community of workers at airports, particularly in jobs with the greatest and most prolonged exposure to aircraft emissions, also comprises minority and low-income populations. [EPA-HQ-OAR-2019-0660-0177-A1, pp.2-3]

EPA states in the NPRM that it is conducting "a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity." The agency notes that the results "could help inform additional policies to reduce pollution in communities living in close proximity to airports."[8] [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

NACAA acknowledges this demographic analysis and supports EPA's continuation of it. However, there is no need for EPA to wait until it completes this analysis to take additional action. [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

[7] 87 Fed. Reg. 6,324(February 3, 2022)–https://www.govinfo.gov/content/pkg/FR-2022-02-03/pdf/2022-01150.pdf at 6.336

[8] Id.

Organization: Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way

Finally, we deeply appreciate the significant attention to environmental justice (EJ) outlined in your proposal. We were pleased to see two specific next steps:

1) "In an action separate from this proposed rulemaking, EPA will be conducting an analysis of the communities residing near airports where jet aircraft operate in order to more fully understand disproportionately high and adverse human health or environmental effects on people of color, low-income populations and/or indigenous peoples. The results of this analysis could help inform additional policies to reduce pollution in communities living in close proximity to airports."

2) "Although not being conducted as part of this rulemaking, EPA is conducting a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity. This will help characterize the state of environmental justice concerns and inform potential future actions. Finely resolved population data (i.e., 30 square meters) will be paired with census block group demographic characteristics to evaluate if people of color, children, indigenous populations, and low-income populations are disproportionately living near airport runways compared to populations living further away. The results of this analysis could help inform additional policies to reduce pollution in communities living in close proximity to airports. [EPA-HQ-OAR-2019-0660-0174-A1, p.3]"

We not only welcome these analyses, but we would volunteer to serve as a partner in those efforts, such as by having EPA focus on our communities as a specific geography for analysis. In addition, the Port of Seattle – through both its South King County Community Impact Fund and its Duwamish Valley Community Equity Program (the latter of which was started through an EPA technical assistance grant) – has made significant investments in identifying social and environmental disparities and then directing resources towards the areas of greatest need. In fact, the Port's Equity Index[1] is an interactive map that Port staff uses to equitably guide funding decisions and broadly inform policy decisions, which the Port also makes available as a resource for community members and organizations to learn more about disparities in their community. These existing efforts provide a good baseline for potential collaboration between the Port and EPA. [EPA-HQ-OAR-2019-0660-0174-A1, p.3]

[1] https://www.portseattle.org/equityindex

Organization: Rose, Jillian

It's also interesting to note how this change will positively affect those who live in close proximity to airports, who are disproportionately represented by people of color and low income populations. [EPA-HQ-OAR-2019-0660-0195, p.1]

Organization: *Service Employees International Union (SEIU)*

Our working-class members - both those who work at airports and those who work in other industries - also live in the neighborhoods surrounding airports which are affected by aircraft pollution. SEIU represents nearly 300,000 workers who live in close proximity to one of the country's top 30 airports.[1] Near-airport communities, which tend to be heavily populated by people of color, are subjected to the detrimental negative health impacts associated with airports, such as noise, traffic, and pollution. These communities have endured environmental racism based on past practices, and today's decisions should not repeat yesteryear's injustices. [EPA-HQ-OAR-2019-0660-0191-A1, p.1]

SEIU files this comment because our members who work at and live near airports are directly impacted by particulate matter emissions from aircraft and pollution in general from airports. Our members and their communities will have to live with the emissions allowed by the Agency's rule for years to come. In proposing a rule that fails to meaningfully restrict emissions on new engines and takes no action on the emissions of engines already in service, the EPA's proposed rule is insufficient to protect the public health and does not live up to the mandates set forth for EPA in statute and Executive Orders. [EPA-HQ-OAR-2019-0660-0191-A1, p.2] [[This comment is repeated in sections 2.3, 3.2, and 11.5]]

We also cannot ignore that low-income communities and communities of color - communities where many of our members and their families live - appear to be facing the worst impacts of airport pollution.[11] The EPA's proposed study- separate from this rulemaking- to better understand the impact on people of color, children, indigenous populations, and low-income populations is commendable. But existing research - as well as studies already cited by the Agency in its proposed rulemaking- suggest that these populations are in fact disproportionately exposed to aviation-related pollution and, therefore, are already at heightened risk of the accompanying health impacts.[12] [EPA-HQ-OAR-2019-0660-0191-A1, p.3]

---

[1] Analysis of SEIU Member and Represented Worker Zip Code Information; Reflects the Number of Members Living in a Zip Code Whose Center is Within 10 Miles of One of the Top 30 Airports By Enplanements in 2019 (data via Bureau of Transportation Statistics, available at https://www.bts.gov/content/passengers-boarded-top-50-us-airports).

[11] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures; 87 Fed. Reg. 6324 (February 3, 2022) at 6327 (Studies have reported that many communities in close proximity to airports are disproportionately represented by people of color and low-income populations.).

[12] See Studies by Rissman and McNair, cited at footnotes 80 and 81 in Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures; 87 Fed. Reg. 6324, 6336 (February 3, 2022).

Organization: *Wagner, Debi*

The rulemaking, although acknowledging UFP and potential health effects to predominately low income minority population provides no information on whether EPA is working toward a new UFP standard. [EPA-HQ-OAR-2019-0660-0153-A1, p.2] [[This comment is repeated in 10]]

EPA acknowledges a majority of people living around airports are poorer and minority, eligible for environmental justice consideration and that the local impacts from airport operations are likely causing disproportionate impact but make no commitment for further investigation aside from mere acknowledgement there might be a problem. [EPA-HQ-OAR-2019-0660-0153-A1, p.2]

EPA Response to Comments in Section 6.6

The EPA agrees that minorities and disadvantaged communities are disproportionately impacted by airport pollution. Section III.G of the Preamble to the final rulemaking also includes a review of available research on environmental justice near airports. Moreover, the EPA conducted a systematic literature review on impacts of commercial aircraft activity on air quality near airports, where many socioeconomically disadvantaged communities are located. This review concluded that ultrafine PM is consistently elevated around airports. See, Riley, K., Cook, R., Carr, E., Manning, B. 2021. A Systematic Review of The Impact of Commercial Aircraft Activity on Air Quality Near Airports. City and Environment Interactions, 100066. The EPA believes these analyses are consistent with the Executive Orders and EPA's Technical Guidance as described in the paragraphs below.

A commenter cited EPA's Environmental Justice 2020 Action Agenda and the Draft FY 2022-2026 EPA Strategic Plan to suggest that the EPA should have assessed cumulative impacts in this rulemaking. The EPA's analysis was consistent with the Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (2016 Technical Guidance). As explained in Section III.G. of the Preamble to the final rulemaking, the EPA's 2016 Technical Guidance provides recommendations on conducting the highest quality analysis feasible, recognizing that data limitations, time and resource constraints, and that analytic challenges will vary by media and regulatory context. The EPA's 2016 Technical Guidance states that qualitative assessment is particularly appropriate when high quality and relevant quantitative data are not available for evaluating potential EJ concerns. Given current limitations in quantitative data, the Preamble to the final rulemaking provides a thorough qualitative discussion of relevant research, as directed by EPA's 2016 Technical Guidance.

Although not being done as part of this rulemaking, the EPA is conducting a demographic analysis to explore racial and economic disparities which may occur in populations living nearest the busiest runways. See 87 FR 6324, 6336 (Feb. 3, 2022). This will help characterize the state of environmental justice concerns and inform potential future actions. As EPA indicates in the Preamble of the final rulemaking, the EPA will continue to advocate for efforts in CAEP that will result in the development of future PM emissions standards which reflect best available technologies.

We address in section 2.4 of this document the comments claiming that EPA's decision to adopt the ICAO standards foreclosed the meaningful participation of environmental justice communities in this rulemaking. In addition, as described in more detail in the EPA's response in section 11.2, the public comment period for the proposal afforded the public an opportunity to comment before EPA drafted its final rule. Comments related to Executive Orders 12898 and 14008 are addressed in section 11.5 of this document. With respect to comments suggesting that EPA should have considered regulatory alternatives and analyzed their impacts, please see sections 10 and 11.3 of this document and Section IV.F.2 of the Preamble to the final rulemaking for the EPA's responses. Section 11 of this document addresses comments on the topic of the Administrative Procedure Act, Executive Orders, Title VI of the Civil Rights Act of 1964, White House Council on Environmental Quality and the White House Environmental Justice Advisory Committee, and related topics.

7. Particulate Matter Inventory Impacts

7.1 Aircraft Engine PM Emissions for Modeling

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Barnes, Miki
Batra, Neelesh
Wagner, Debi

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

The NPRM continues the long-standing practice of evaluating aircraft emissions and regulating them during the Landing and Takeoff cycle (LTO). We agree that for most gaseous pollutants this is the appropriate physical realm for evaluating and regulation. However, the NPRM acknowledges substantial peer-reviewed scientific research that indicates that the nvPM emissions being regulated in this action pose serious health risks and costs, are highly concentrated adjacent to runways or beneath flight tracks close to the airport, and that environmental justice communities are also likely to be located in these same areas[5]. Another consideration is the fact that aircraft engines operate inefficiently at idle thrust during taxi operations and can emit relatively high levels of particulates during taxi. [EPA-HQ-OAR-2019-0660-0175-A1, p.5]

The NPRM notes that EPA is conducting a demographic analysis, not being conducted as part of this rulemaking, to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity. EPA's June 2016 "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" states that EPA strives to answer three broad questions, one of which is: "Is there evidence of potential EJ concerns for the regulatory option(s) under consideration? Specifically, how are the pollutant(s) and its effects distributed for the regulatory options under consideration?" The use of the traditional LTO volume for assessing and regulating these nvPM emissions may not adequately protect EJ and other communities living in close proximity to the airport because are not distributed uniformly throughout the LTO volume, but are significantly concentrated close to the airport. [EPA-HQ-OAR-2019-0660-0175-A1, p.5] [[This comment can also be found in sections 2.3 and 6.6 of the comment summary]]

---

[5] See footnotes 46 through 61 in the NPRM

Organization: Barnes, Miki

I am writing to state my support for the comments submitted by AIRPORT IMPACT RELIEF (AIR INC) on Monday 3/28/22 on the proposed EPA rule: "Control of Air Pollution from Aircraft Engines: Emissions Standards and Test Procedures." [EPA-HQ-OAR-2019-0660-0200, p.1]

Organization: Batra, Neelesh

I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: Wagner, Debi

There are several primary problems, among others, with new aircraft engine certification; 1) certification never considers the thousands of older, dirtier engines operating daily at a single facility

and does not go the extra step of limiting that use; 2) giving a false impression that EPA is assuring compliance with the Clean Air Act/NAAQS for areas where the engines operate and deferral to the industry/local agencies limitations; 3) the disconnect between certification and modeling, or monitoring and enforcement. [EPA-HQ-OAR-2019-0660-0153-A1, p.2] [[This comment is repeated in section 3.2.]]

1. Pre-pandemic, fuel use continues to climb at the nation's busiest airports meaning local air quality impacts are worsening. Because certification does not take into consideration the use of thousands of engines at one location, local air districts/agencies become responsible for assuring air quality standards are not exceeded. It is no coincidence that many local, regional and national air monitoring systems are placed many miles away from airport environments and leave it up to the industry to self monitor and report. [EPA-HQ-OAR-2019-0660-0153-A1, p.2]

3. The use of the industries newest air pollution model AEDT, will provide air quality impacts for a local airport. However, the outcome is completely dependent upon input into the model. A 2017 use of the AEDT model by a consultant preparing draft emission rates for a proposed US airport expansion project produced results that were nearly cut in half from the same model use for the same year and airport estimated by EPA for several criteria emissions. When these errors were pointed out, the draft was withdrawn. There is a disconnect between what EPA does and what consultants working for airports are doing. It shouldn't have to be a citizen noticing the problems and bringing it to the attention of the agencies who should have oversight responsibility for the use of these EPA approved airport models. The models are too complex, data input used not transparent or readily available, impossible to know all elements of airport use, LTO, operations numbers and types of engines, etc. [EPA-HQ-OAR-2019-0660-0153-A1, p.3]

EPA Response to Comments in Section 7.1

The EPA notes that AEDT is not an industry model. Instead, it is a model developed by the FAA to model emissions around airports (as well as aircraft fuel consumption and noise).

The EPA is concerned about the near source impacts of airport activity, and we believe using the LTO cycle for PM emissions evaluation is appropriate to evaluate these impacts. As described in Section V of the Preamble to the final rulemaking, LTO emissions are defined as emissions between ground level and the mixing height, and the default mixing height in the U.S. is an altitude of 3,000 feet. (See, EPA, 1992: *Procedures for Emission Inventory Preparation - Volume IV: Mobile Sources*, EPA420-R-92-009. Available at https://nepis.epa.gov (last accessed June 23, 2021). LTO emissions directly affect the ground level air quality at the vicinity of the airport since they are within the local mixing height. See the EPA responses in section 6.3 above for discussions of these impacts and the EPA systematic literature survey for air quality impacts, and the EPA responses in sections 6.6 and 11.5 for responses to the environmental justice comments. In terms of emissions modeling, the EPA relies on LTO emissions inventories at all airports as the most important source and contributor to local air quality around airports and health impacts on near-by communities, but we can also model flight emissions above 3,000 feet (i.e., beyond LTO) and assess their impacts at local and regional levels. We have comprehensive capabilities to model nvPM mass and number emissions for the full flight and have updated the LTO-based National Emissions Inventories with the latest emissions data and modeling techniques for the aircraft PM final rule.

We acknowledge that aircraft engines may emit relatively high levels of particulates at idle during taxi operations, but evaluations of aircraft engine PM emissions during the LTO cycle is ongoing with the establishment of the first-ever test procedure and emission standards by ICAO. In regard to comments

about operational measures to reduce emissions during taxi, see section 10 of this document for responses to that topic.

7.2 Projected Reductions in PM Emissions

Organizations Included in this Section

California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Sierra Club

Organization: *California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin*

The Proposed Rule consists of a series of emission standards applicable to two different stages of an aircraft's life cycle. "New type" engines are based on new designs certified after January 1, 2023; "in production" engines are those based on already certified designs but manufactured after January 1, 2023. The Proposed Rule does not regulate in-service aircraft engines at all, despite EPA's acknowledged authority to do so.[53] The proposed PM standards are also differentiated according to how PM is measured: mass (milligrams (mg) of PM emitted per kilonewton (kN) of thrust), number (number of PM particles emitted per kN of thrust), and mass concentration (maximum concentration of PM at any thrust setting, measured in micrograms of PM per cubic meter (µg/m3)). Thus, the Proposed Rule includes (1) new-type mass standards, (2) in-production mass standards, (3) new-type numerical standards, (4) in-production numerical standards; and (5) in-production mass concentration standards. Each of the five standards is a mathematical formula that produces a "limit line" in which the mass, number, or concentration limit varies as a function of the engine's maximum thrust available for takeoff (called the "rated output"). If tests show the engine emitting PM below each limit line, it complies with the rule. 87 Fed. Reg. at 6337-44. [EPA-HQ-OAR-2019-0660-0203-A1, p.18]

As EPA's analysis confirms, none of these proposed aircraft emission standards reduces any PM emissions from aircraft. 87 Fed. Reg. at 6347 ("Due to the technology-following nature of the PM standards, the proposed in-production and new type standards would not result in emission reductions below current levels of engine emissions."). This is because the ICAO PM Standards themselves were set at such a lax stringency level that all aircraft engines currently in production already comply. Id. The majority of aircraft engines already in production emit significantly less PM per unit of thrust than the "new type" standards for new engine designs. Id.; see also id. at 6338-39 (Figures IV-1, IV-2). [EPA-HQ-OAR-2019-0660-0203-A1, p.18]

---

[53] See Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,354, 44,473 (July 30, 2008).

Organization: *Sierra Club*

Emission harm reduction. In a subheading entitled "Projected Reductions in PM Emissions," id. at 6347, EPA simply states that there will be none because the Proposal is technology-following and all covered aircraft already meet it. EPA does not relate emission harms to the Proposal or Section 231's statutory purpose – other than to acknowledge that emissions will be left unabated. Id. at 6348. Nor is the

Proposal accompanied by a Technical Support Document or even a single alternative considering a more stringent rule. EPA never considers what it might do to try to mitigate the emissions' harm despite the commands in Section 231(a)(1)(A) (requiring a study and investigation of the extent to which aircraft PM emissions affect public health and welfare). 42 U.S. § 7571. That is a stark departure from usual EPA remaking and falls far short of statutory requirements. [EPA-HQ-OAR-2019-0660-0184-A1, p.9] [[This comment can also be found in section 7.2 of the comment summary]]

EPA Response to Comments in Section 7.2

In addition to the rationale provided in Section V.C of the Preamble to the final rulemaking and the introductory paragraphs of Section VI of the Preamble to the final rulemaking for the PM standards, the EPA notes that the emissions reduction analysis concluded that no emissions reduction is expected from this rulemaking.

Comments related to EPA's statutory authority, including the onetime study required by CAA section 231(a)(1)(A) are addressed in the Preamble to the final rulemaking in Sections IV.F.1 and IV.F.2, as well as in section 11.1 of this document.

Comments related to purported changes in the EPA policy in aircraft emission standards rulemakings are addressed in section 11.3 of this Response to Comments document.

Other topics raised by these comments are addressed in Section IV.F.2 of the Preamble to the final rulemaking and sections 11.3 and 11.4 of this document. Also, see Section I.C of the Preamble to the final rulemaking for the EPA's current and intended future work on aircraft engine PM standards.

8. Technological Feasibility

8.1 Market Considerations

Organizations Included in this Section

Aerospace Industries Association (AIA)
Airlines for America (A4A)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
General Aviation Manufacturers Association (GAMA)
General Electric Company (GE)

Organization: Aerospace Industries Association (AIA)

The impact of a scenario in which the U.S. fails to adopt equivalent domestic rules to the ICAO nvPM standards in a timely fashion could jeopardize sales of U.S. aircraft and aircraft engines to the effect of tens of billions of dollars. This could have catastrophic impacts on the future strength and competitiveness of the U.S. A&D [Aerospace and Defense] sector, especially in conjunction with the unprecedented downturn in activity that the sector has recently faced as a result of the COVID-19 pandemic. As our industry contributed 920,000 direct jobs, a further 1.28 million jobs throughout the shared A&D supply chain and a positive trade balance of $79 billion in 2019, this would also be extremely detrimental to the prosperity and national security of the United States.[7] [EPA-HQ-OAR-2019-0660-0178-A1, pp.3-4] [[This comment is repeated in section 2.2.]]

[7] Aerospace Industry Association (2020), Facts and Figures: Aerospace and Defense

Organization: *Airlines for America (A4A)*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 49-50.] [[This comment is repeated in sections 2.1, 2.4, and 11.1]]

As acknowledged in the proposal, it is critical to the competitiveness of the U.S. aircraft and aircraft engine manufacturers that the U.S. follow these international standards which, in turn, improve airlines' ability to acquire U.S.-manufactured aircraft and help foster competitive market prices. Experts from the USEPA and Federal Aviation Administration played leading roles in the ICAO process leading to the adoption of the PM standard. A4A participated as an observer. These efforts ensured that ICAO's PM standard incorporated all of these critical features and -- so that it could be adopted into U.S. law.

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

We also are mindful of the importance of this rulemaking to the continued vitality and competitiveness of U.S. aircraft engine manufacturers. As was the case with the ICAO carbon dioxide (CO2) aircraft standards, which EPA adopted into U.S. law through a final rule published on January 11, 2021,[5] adopting the ICAO Aircraft Engine PM Standards into U.S. law will ensure U.S.-manufactured aircraft engines are available to aircraft manufacturers and U.S. airlines, while fostering global competition and enabling our airlines to acquire aircraft and aircraft engines at market-driven, competitive prices. Especially given that, as the Agency itself notes, the ICAO standards "have been or are being adopted by other ICAO member states that certify aircraft engines,"[6] the Agency needs to act to put U.S. aircraft engine manufacturers on the same footing as their foreign counterparts. [EPA-HQ-OAR-2019-0660-0192-A1, p.2] [[This comment is repeated in section 2.1]]

We also emphatically agree that the adoption of aircraft engine PM standards that are equivalent to the ICAO standards is critically important to the competitiveness of U.S. aircraft and aircraft engine manufacturers. EPA is correct to highlight that adoption of aircraft engine PM standards equivalent to the ICAO Aircraft Engine PM Standards will ensure U.S. aircraft and aircraft engine manufacturers are able to obtain FAA certification of their products, in turn ensuring that these products will be accepted in the world marketplace. This will remove the potential for U.S. manufacturers to be at a competitive disadvantage with foreign aircraft and engine manufactures with better or more favorable access to foreign certificating authorities. We also agree with EPA's observation that "compliance with the international standards (via U.S. type certification) is a critical consideration in aircraft manufacturer and airlines' purchasing decisions."[25] As noted above, adopting the ICAO Aircraft Engine PM Standards into U.S. law will ensure U.S.-manufactured aircraft and aircraft engines are available to U.S. airlines, while fostering global competition and enabling our airlines to acquire aircraft and aircraft engines at market-driven, competitive prices. This is critical to the continued competitiveness of U.S. airlines across the globe and helps ensure that we will have access to the advanced aircraft and aircraft engines we will need to attain our environmental goals and fulfill our commitments to address climate change. It also helps preserve the vitality of the U.S. aircraft and aircraft engine manufacturing sector, which not only is a very large component of our country's exports but is supported by a vast ecosystem of smaller businesses, manufacturers and service providers that employ thousands in their own right. Of course, economic and social factors like these take on even greater significance in the current economic downturn brought on by the COVID-19 pandemic. [EPA-HQ-OAR-2019-0660-0192-A1, pp.7-8] [[This comment is repeated in section 2.1.]]

[5] See 86 Fed. Reg. 2136 (Jan. 11, 2021).

[6] 87 Fed. Reg. at 6326, 6337.

[25] Id. at 6347.

Organization: *General Aviation Manufacturers Association (GAMA)*

GAMA also supports this EPA rulemaking effort because it will save many U.S. manufacturing jobs. These proposed standards would allow U.S. manufacturers to remain competitive in the global marketplace and strengthen the U.S. aviation industry by ensuring the worldwide acceptance of U.S. manufactured airplanes. Implementation of these standards will provide U.S. manufacturers with much needed certainty on regulatory matters as well as certainty on market and cost concerns. Companies cannot plan and operate efficiently in the midst of market and cost volatility, not to mention regulatory uncertainty. The U.S. aviation industry should not be placed at a competitive disadvantage globally because the U.S. does not adopt the same emission standards as the rest of the world, especially when the U.S. EPA and FAA actively participated in the ICAO proceedings in which these requirements were developed. [EPA-HQ-OAR-2019-0660-0205-A1, p.2]

Organization: *General Electric Company (GE)*

A. nvPM emissions standards that follow the standards adopted by ICAO are critical to ensure the preeminence of the U.S. aviation industry

Consistency with the ICAO nvPM emissions standards is critical to ensure the preeminence of the U.S. aviation industry. The proposed nvPM standards, if adopted, would ensure the acceptance of GE/CFM engines by countries and airlines around the world. Further, harmonization with ICAO's international standards ensures that all the world's manufacturers meet the same standards. Without this harmonization, countries may ban the use of any airplane within their airspace that is not certified to meet ICAO standards. Also, if EPA adopted no standards or standards inconsistent with ICAO's standards, U.S. aircraft engine manufacturers could be forced to seek a PM emissions certification from a foreign aviation certification authority to market their products for international operation, rather than from the Federal Aviation Administration ("FAA"). This would disrupt business and disadvantage U.S. firms. [EPA-HQ-OAR-2019-0660-0183-A1, p.4]

An inconsistent regulatory environment also would likely result in global market distortions. Efficient, safe, and effective airline operations rely on global harmonization. Furthermore, the ability of airlines to seek lease or loan financing in support of their accelerated adoption of new aircraft technology will rely on the ability of financial partners to deploy and finance aircraft where they are most beneficial to airlines globally, without regulatory discrimination by political jurisdictions. [EPA-HQ-OAR-2019-0660-0183-A1, p.4]

EPA Response to Comments in Section 8.1

See Sections IV.F.1 of the Preamble to the final rulemaking for the EPA's response to these comments on stringency of the PM standards. For further discussion on aligning with the ICAO standards see Preamble Section I.B.2 of the final rulemaking and the introductory paragraphs of Preamble Section IV of the final rulemaking. Also, see sections VI.A, VI.B., VI.C, and VI.E of the Preamble to the final rulemaking

for detailed discussions on market considerations and technological feasibility in setting the PM standards.

8.2 Technology Following Standards

Organizations Included in this Section

Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Center for Biological Diversity
Center for Biological Diversity et al.
Gibbons, Laura
National Association of Clean Air Agencies (NACAA)
Service Employees International Union (SEIU)
Sierra Club

Organization: Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)

Also particularly relevant here is that, as EPA explains in the preamble, ICAO/CAEP evaluates "technological feasibility" using the Technological Readiness Level ("TRL") scale and deems technologies that have attained TRL8 (defined as the "actual system completed and 'flight qualified' through test and demonstration") to be "technologically feasible."[18] Use of TRL8 to evaluate "technological feasibility" thus ensures emissions standards reflect what aircraft technologies can safely deliver, rather than hypothetical "technology forcing" standards that could pose a potential threat to air safety. [EPA-HQ-OAR-2019-0660-0192-A1, p.6] [[This comment can also be found in section 2.1 of the comment summary]]

---

[18] 87 Fed. Reg at 6347-48.

Organization: Center for Biological Diversity et al.

And although technology exists to cut particulate matter pollution from planes, EPA did not undertake any analysis of these available options. [EPA-HQ-OAR-2019-0660-0185-A1, p.1]

To reduce particulate matter emissions from aircraft, EPA should set technology-forcing standards […] [EPA-HQ-OAR-2019-0660-0185-A1, pp.2-3] [[This comment is also found in section 10.]]

EPA has previously recognized its broad authority to craft such standards,[11] and technology already exists to go much further than the rule proposes. Indeed, the Proposed Rule recognizes that many airplane engines powering planes today already meet the recommended standards for new planes and new types of planes by a "considerable margin."[12] [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

Strong, technology-forcing standards will drive needed changes and create good, family sustaining jobs in the aviation sector. [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

---

[11] In a 2008 notice EPA specifically discussed "a declining fleet average emissions program" that would involve consideration of efficiency gains from improved "engine, aircraft and operational [greenhouse gas] control[s]." Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,473 (July 30, 2008) (to be codified at 40 C.F.R. ch. 1). In a 2015 notice, EPA cited fuel venting and smoke number standards that applied to inuse aircraft and noted that "unlike the EPA's authority to promulgate emission standards for motor vehicles

under CAA section 202(a) or for nonroad engines and vehicles under section 213(a), section 231 of the CAA does not restrict the EPA's authority to set standards for only new aircraft." Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare, 80 Fed. Reg. 37,758, 37,791 n.203 (July 1, 2015) (to be codified at 40 C.F.R. pts. 87, 1068).

[12] 87 Fed. Reg. at 6,348.

Organization: *Gibbons, Laura*

At the meeting you said the EPA could make more stringent criteria, so please do. Write something technology-forcing that would help the climate as well as the health of those of us under flight paths. You can do better! [EPA-HQ-OAR-2019-0660-0164, p.1]

Organization: *National Association of Clean Air Agencies (NACAA)*

III. NACAA's Recommendations

For all three of these categories – new type aircraft designs, in-use production models and in-service engines – EPA should require the newest, cleanest aircraft engines and emission-reducing technologies. [EPA-HQ-OAR-2019-0660-0177-A1, p.4] [[This comment is repeated in section 10.]]

Organization: *Service Employees International Union (SEIU)*

V. EPA Should Propose a Technology-Forcing Rule with Application to In-Service Engines

In keeping with its statutory mission and the Biden Administration's policy, we urge the EPA to adopt a stricter, technology-forcing standard, and to apply the particulate matter emissions standards to in-service engines. By doing so, the Agency will create real reductions in emissions and protect the health and welfare of airport workers and local airport communities. [EPA-HQ-OAR-2019-0660-0191-A1, p.5] [[This comment is repeated in section 10.]]

Organization: *Sierra Club*

Technological feasibility. In a section entitled "Technological Feasibility and Economic Impacts," 87 Fed. Reg. at 6347, EPA repeats the same explanation: because "[t]he proposed standards match the ICAO standards, and ICAO intentionally established its standards at a level which is technology following," all covered aircraft already meet the standards and manufacturers will incur no costs. EPA says nothing at all about how anything else could be done, such as whether technology already in full commercial use could be installed in additional aircraft or whether best-in-kind technology could be applied – let alone whether new emission reduction technology is in the offing. The lack of a Technical Support Document is even more striking in this context. [EPA-HQ-OAR-2019-0660-0184-A1, p.9]

This absence of any technical feasibility inquiry is particularly startling since EPA does report on work performed by CAEP analyzing that issue. CAEP did consider what could be done to reduce emissions by analyzing three alternatives, each yielding emission reductions, with the most stringent reducing them by 25%, at costs ranging from minimal amounts to $500 million. Id. at 6348-49. CAEP also described the available technology it had considered, ranging from minimum changes such as testing and certification procedures to use of best-in-class engine technology. Id. But EPA took no position on the feasibility of these alternatives. This disregard of evidence in the record before EPA is yet another fatal flaw of the Proposal. [EPA-HQ-OAR-2019-0660-0184-A1, p.9]

EPA Response to Comments in Section 8.2

See sections IV.F.1 and IV.F.2 of the Preamble to the final rulemaking for the EPA's response to comments on the stringency of the standards. In particular, for the EPA's response to comments on considering alternative levels of stringency in proposing standards, see Section IV.F.2 of the Preamble to the final rulemaking. In addition, see sections VI.A, VI.B., VI.C, and VI.E of the Preamble to the final rulemaking for a detailed discussion on technological feasibility in setting the aircraft engine PM standards.

In regard to comments on technology following standards (as compared to technology forcing standards), today's approach is consistent with past EPA actions, under section 231 of the CAA, where we have aligned the U.S. emissions requirements with those promulgated by ICAO. All of these previous ICAO emission standards, and the EPA's standards reflecting them, have generally been considered anti-backsliding standards, which are technology following. Under this longstanding EPA and FAA rulemaking approach, international emission standards have been adopted by ICAO, with significant involvement from the FAA and the EPA, and subsequently the EPA has undertaken rulemakings under CAA section 231 to establish domestic standards that are the same as or at least as stringent as ICAO's standards.

The EPA is adopting technology following standards that match ICAO's standards, and the ICAO applicability date of the PM mass and number standards of January 1, 2023, is fast approaching. As described in detail in Section IV.F.2 of the Preamble to the final rulemaking for the EPA's response on the stringency of the standards, the EPA's final standards are consistent with section 231 of the Clean Air Act that does not require technology forcing standards. Also, in the interests of expediency, as described above, and of bringing U.S. domestic law into conformity with our obligations under the Chicago Convention, and for the other reasons explained in the preambles to the proposed and final rules, we have decided that the most appropriate course for now, under CAA section 231, is to adopt aircraft engine PM standards that are harmonized with the standards adopted by ICAO in 2017 and 2020.

9. Costs and Benefits

Organizations Included in this Section

Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Batra, Neelesh
General Electric Company (GE)
Hudda, Neelakshi
Institute for Policy Integrity at New York University School of Law (Policy Integrity)
Kroeker, Anne
Palosaari, Kent
Sierra Club

Organization: *Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)*

C. EPA's Assessment of the Costs and Benefits Associated with the Proposed Rule is Flawed

A4A and ALPA strongly disagree with EPA's assertion that for both in-production and new type aircraft engines, "there would not be costs or emission reductions associated with" the proposed PM mass concentration, PM mass, and PM number standards "beyond the business-as-usual fleet turnover that

would occur absent . . . the proposed standards."[27] However, we want to make perfectly clear that, in our view, despite our disagreement with the Agency on this point, the Administrative Record here is sufficient to support the expeditious finalization of the proposed EPA Aircraft Engine PM Standards. [EPA-HQ-OAR-2019-0660-0192-A1, p.8]

As discussed above, the ICAO/CAEP process for developing, considering, and approving standards such as the ICAO Aircraft Engine PM Standards is rigorous and exhaustive, ensuring that any such standards meet the CAEP TOR. We again underscore that ICAO/CAEP's assessment of each of the criteria it must consider under the TOR (technical feasibility, economic reasonableness, environmental benefit and the potential interdependencies with noise and other emissions) is directly related to the decisions that EPA (and FAA) must make when establishing aircraft emission standards under Section 231 of the Clean Air Act. The current Administrative Record contains information, data and analyses that directly and sufficiently support the adoption of the ICAO Aircraft Engine PM Standards into U.S. law as EPA has proposed in this rulemaking. [EPA-HQ-OAR-2019-0660-0192-A1, p.9]

First, EPA fails to acknowledge or account for the extensive work that enabled and created the foundation for the adoption in 2017 and 2020 of the ICAO Aircraft Engine PM Standards. That lengthy and costly effort, of course, has been essential to understanding and evaluating the technology available to control aircraft engine PM emissions and how such technologies interact with other technologies designed to control other environmental parameters, including noise and NOx and CO2 emissions. Indeed, the effort undertaken to measure PM mass and PM number emissions and the ability of various technologies to control these has been at the very cutting edge of scientific knowledge. Far from sitting back passively, FAA, EPA, engine and aircraft manufacturers, airlines and all the other stakeholders in the ICAO process have proactively advanced scientific and technical knowledge necessary to enable PM control (and to set the foundation for future, more stringent controls). Absent this effort, no basis would exist for designing aircraft engines to control PM emissions, which would raise the possibility that as manufacturers seek to optimize engine performance (as always, subject to safety) for fuel efficiency (i.e., CO2 emissions) while meeting increasingly stringent standards for other parameters like noise and NOx, PM emissions would remain unimproved if not increase. In short, notwithstanding the fact that the standards are technology-following, there are considerable costs and undeniable benefits associated with their development and existence. [EPA-HQ-OAR-2019-0660-0192-A1, p.9]

Moreover, EPA's assessment, which diverges from the ICAO/CAEP analysis of the costs and benefits of the ICAO Aircraft Engine PM Standards, is flawed in that it ignores the billions of dollars required for aircraft engine research and development, testing, and demonstration borne by manufacturers to bring the necessary PM control technologies to market safely and integrate them across the aircraft/aircraft engine fleet. EPA's "logic" is apparently that the costs (and associated emissions reductions) are not "caused by" its proposed PM standards. In this sense, EPA's position appears to be that for costs and benefits to be attributable to a set of standards, the standards must be technology-forcing (rather than technology-following) and/or beyond that which was agreed at ICAO. However, as EPA affirms, aircraft engines that do not comply with the ICAO Aircraft Engine PM Standards will not be permitted to operate internationally and, therefore, will not be marketable. For example, EPA asserts that "[a]ircraft and aircraft engine manufacturers make business decisions and respond to the international market by designing and building products that conform to ICAO's international standards."[28] This rightly acknowledges the reality that manufacturers' expectations and actions in the marketplace are plainly related to the very existence of standards, which, in this case, were adopted at the international level in

2017 and 2020. Put differently, the costs and benefits are appropriately attributable to the standards because manufacturers have no choice but to comply with them (and airlines have no choice but to acquire and operate compliant aircraft and aircraft engines). [EPA-HQ-OAR-2019-0660-0192-A1, pp.9-10]

We are proud of the aviation sector's long history of improving aircraft and aircraft engine technologies that have enabled us to greatly reduce our impact on the environment and the cost of air travel for the public. We also anticipate and are hopeful that this progress will continue into the coming decades. As emphasized at the outset of these comments, we have a strong record of improving our environmental performance as we have grown and supported the expansion of our global, national and local economies. Achieving this record has required dedication, commitment, and investment of hundreds of billions of dollars. Extending our record into the future will require continual rededication and recommitment to making the investments and taking the actions necessary to achieve our environmental goals and meet the PM standards proposed in this rulemaking. It is simply incorrect to conclude there are no costs or benefits associated with the proposed standards. [EPA-HQ-OAR-2019-0660-0192-A1, p.10]

---

[27] Id. at 6347.

[28] Id.

Organization: *Batra, Neelesh*

I support the comments submitted by AIR INC. [EPA-HQ-OAR-2019-0660-0198, p.1]

Organization: *General Electric Company (GE)*

E. EPA should consider the comments made by Aerospace Industries Association (AIA) and Airlines for America (A4A).

In finalizing the proposed standard, GE respectfully requests that EPA consider the comments to the rule: A4A:

In Section VI (E) of the proposed rule, EPA states, "[T]here would be no costs and no additional benefits from complying with these proposed standards…" A4A recognized this statement could be misinterpreted to mean manufacturers would incur no additional costs as a result of the proposed rule. A4A, with support of GE, respectfully requests EPA to consider acknowledging the added costs for fuel specification test procedures and continued technology evolution in Sections VI(D) and (E) of the proposed rule. GE reiterates its support for A4A's comments on EPA's proposed rule, incorporating A4A's 1.C section herein by reference. [EPA-HQ-OAR-2019-0660-0183-A1, pp.7-8]

Organization: *Hudda, Neelakshi*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 32-33.]

First, the expected benefits to air quality are anticipated to occur via business-as-usual aircraft fleet turnover. The methodology for how emissions would be accounted in national emissions inventory are sufficiently detailed in the proposal. However, there is no discussion of whether near-airport communities will see any net improvements in their air quality. That is, what improvements due to

cleaner engines outweigh the increased flight activity in the business as-usual scenario? There's also no discussion of the pace of resulting air quality improvements. When are the near-airport communities likely to see improvements in air quality in the business-as-usual fleet turnover approach?

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 34-35.]

However, it is not clear at all if a business-as-usual fleet turnover approach will lead to a net improvement in air quality in near-airport communities or overall reduced emissions. It is not clear how the success of this standard would be evaluated.

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*
Compounding this failure to consider factors that may weigh in favor of adopting more stringent standards, EPA does not evaluate the costs and benefits of a more stringent alternative that would actually decrease emissions. Indeed, the agency does not consider any regulatory alternatives at all. [EPA-HQ-OAR-2019-0660-0182-A1, p.3]

Organization: *Kroeker, Anne*
[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 55-56.]

I would like to make -- support very much what Kent Palosaari has just underlined, that this -- that the role of the EPA is not to follow the economic dollars of private industry but to cover -- which it doesn't talk about the loss of local businesses to development of aircraft operations, and certainly doesn't cover the health costs which could easily run in billions, but no one has actually taken account of that. That would be something that EPA could do. But they need to do the hard job of holding the development to be responsible to the health of the communities and, in fact, the health of the planet because we're not talking -- haven't been talking yet about the carbon emissions, although that is certainly a factor, of 2.5 particle emissions because they also are related to the carbon emissions.

Organization: *Palosaari, Kent*
[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 52.] [[A portion of this comment appears in section 10.]]

I also want to make a comment on SAF. We don't know for sure that it will reduce the ultra-fine particulates that are especially damaging, and you're currently not even close to having it be the majority of any kind of flying fuel. So if we're increasing the number of flights and only reducing at a level that's minimal, the net result is an increase of pollution that's particularly harmful to the communities around airports. We need to have community health be the primary mover on all of this. We can never put wealth before health. We need to think in terms of the EPA caring for the living environment that people are living in around the airport.

Organization: *Sierra Club*
Nonetheless, EPA notes that CAEP did in fact consider three additional levels of stringency and their costs, each of which would have resulted in emission reductions. *Id*. at 6348-49. The first level, encompassing minor improvements, additional testing and emissions re-certifications, would achieve emission reductions between 1 and 10 percent at a cost of $15 million. The second level,

which would have applied "scaled proven technology," or the best-proven, already-certified technology present in at least one other engine, would reduce emissions by a minimum of 10 percent at a cost between $150 and $250 million. *Id.* at 6349. The third level, employing current industry best practices demonstrated by one or more manufacturers, would cut emissions by some 25 percent at a cost of $500 million. Other than reporting this extremely promising work, EPA did not engage with it at all—it examined none of these alternative levels of stringency, nor any other alternatives, and made no comment about CAEP's conclusions. *Id.* [EPA-HQ-OAR-2019-0660-0184-A1, p.5 and 6]

Costs. In a subsection entitled "Market Considerations," the agency repeats that the standards are based on technologies already developed, and informs the reader that there will be no costs or burdens. Id. at 6347. Once again, EPA's failure to consider the costs of any alternative standards is striking because such alternatives and estimates of their costs are contained in the record. But EPA never once contemplated whether costs of $500 million to achieve the most stringent of the alternatives CAEP explored would be justified based on the harm they might avoid, including some of the approximately 210 premature deaths from aircraft per year in the U.S. alone. [EPA-HQ-OAR-2019-0660-0184-A1, pp.9-10]

B. The Proposal does not consider benefits of the reduction of other harmful aircraft emissions.

The combustion of aircraft fuel creates emissions of criteria, hazardous, and greenhouse gas pollutants that cause well-recognized harm to human health and the environment.[38] Standards that increase aircraft fuel efficiency decrease fuel use, and therefore the emissions of not only PM, but also other pollutants. But EPA failed to consider these benefits of its Proposal. It never even assessed the amount of PM emitted under the standard it proposed, nor under any alternative—and it considered none of the benefits of a reduction in co-pollutants. It never estimated the damage to human health done by its Proposed Rule nor any alternative course of action. EPA has consistently assessed, disclosed, and compared the costs and benefits of increasing or reducing co-pollutants in its rulemakings for the nation's light duty vehicle fleet under Section 202.[39] But in the Proposal, it did not consider this matter at all. EPA's failure to consider an important aspect of the problem before it is arbitrary and capricious.[40] [EPA-HQ-OAR-2019-0660-0184-A1, pp.11-12]

E. The Proposal fails to consider any alternative that would reduce emissions.

EPA failed to analyze the costs and benefits of any alternative other than to adopt ICAO's standards. Yet, in the Proposal EPA describes CAEP's analysis of three alternatives, each of which would have reduced PM emissions beyond the status quo, with the most stringent achieving some 25 percent reductions at an estimated cost of $500 million. Id. at 6348-49. EPA gives no explanation for its refusal to evaluate the feasibility and costs of any of these alternatives, or any other. At a minimum, EPA should have explained its reasoning for failing to do so, but it did not. Id. at 6339. [EPA-HQ-OAR-2019-0660-0184-A1, p.15]

---

[38] See Manisalidis 2020, *supra* note 4.

[39] *See, e.g.*, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks, 84 Fed. Reg. 24,174, 24,585 (Apr. 20, 2020); see also Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25,324, 25,657 (May 7, 2010);

see also 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624, 63,119 (Oct. 15, 2012).

[40] *State Farm*, 463 U.S. at 43; *Michigan v. E.P.A.*, 576 U.S. 743, 753 (2015) (explaining that "reasonable regulation ordinarily requires paying attention to the advantages *and* the disadvantages of agency decisions").

EPA Response to Comments in Section 9

See Section VI.E of the Preamble to the final rulemaking for a summary of the benefits (emission reductions) and costs of the standards, which serves as a response to the comments on this subject. The EPA addresses comments on the topic of the health and environmental impacts of PM in sections 6.2 and 6.3 of this document.

Some comments assert that the EPA's explanation in the proposed rulemaking of how ICAO/CAEP assesses cost indicates that more stringent standards would not be cost-prohibitive. Specifically, commenters seem to believe that because ICAO/CAEP considered costs for different ranges of technology levels that both ICAO and EPA agree that more stringent standards would not be cost-prohibitive. However, this assumption is incorrect and seems to be based on a misunderstanding of what ICAO/CAEP did in assessing costs.

To be clear on what ICAO/CAEP did: ICAO/CAEP did not conduct a cost assessment for any level of stringency of PM standards that could be considered technology-forcing, in the sense that new technologies would need to be developed and brought to market. Nor did ICAO/CAEP identify actual technologies that would support more stringent standards. Rather, ICAO/CAEP described a framework for considering costs in the abstract that is pertinent to the non-recurring costs (NRC) estimates of a technology level for engine changes for PM mass and number. (ICAO, 2019: *Report of the Eleventh Meeting*, Montreal, 4-15 February 2019, Committee on Aviation Environmental Protection, Document 10126, CAEP11. See pages 3C-17 to 3C-19 in Appendix C to the report on Agenda Item 3 (starting on page 3C-1); 77 FR 36342, 36375-36376, June 18, 2012). This framework was based on high-level industry input to support ICAO/CAEP's analysis of stringency options, and it was similar to the past stringency assessments for aircraft engine NO_x standards. ICAO/CAEP uses three different technology levels to broadly define distinct categories of engine changes, but ICAO/CAEP does not describe specific engine technologies for these categories. (1) The first technology level was regarded as a minor change, and it could include minor improvements, and additional testing and re-certification of emissions. The PM mass and number emission reductions for the first technology level would be from 1 to 10 percent, and the estimated associated costs would be $15 million. (2) The second technology level was considered a scaled proven technology. At this level an engine manufacturer applies its best-proven, combustion technology that had already been certificated in at least one other engine type to another engine type. This second technology level would include substantial modeling, design, combustion rig testing, modification and testing of development engines, and flight-testing. The PM mass and number emission reductions for the second technology level would be a minimum of 10 percent, and the estimated associated costs would be $150 million and $250 million, respectively for PM mass and number. (3) The third technology level was regarded as new technology or current industry best practice, and it was considered where a manufacturer has no proven technology that can be scaled to provide a solution and some technology acquisition activity is required. (One or more manufacturers have demonstrated the necessary technology, while the remaining manufacturers would need to

acquire the technology to catch up.) The PM mass and number emission reductions for the third technology level would be a minimum of 25 percent, and the estimated costs would be $500 million.

The EPA provided information on ICAO/CAEP's NRC cost assessment methodology simply to illustrate one possible approach to estimating costs for aircraft standards. In doing so, the EPA was not adopting ICAO/CAEP's method for assessing costs of EPA's PM standards, endorsing ICAO/CAEP's conclusions as to the costs of other potential PM standards, or suggesting that ICAO/CAEP's method identified cost-effective technology-forcing levels of PM standard stringency. As already noted, the ICAO/CAEP cost assessments of PM are abstract in nature and were not based on actual technologies. For instance, with regard to the first technology level, ICAO/CAEP did not identify an actual $15 million dollar technology package that would lead to 1-10% emission reductions. Thus, the EPA does not agree that by themselves they support the argument that more stringent standards than the ones the EPA is adopting in this rulemaking are not cost-prohibitive. To make that kind of determination, a detailed assessment of stringency levels of such standards, including the actual technologies that could be used to meet such standards, would be needed to make appropriate estimates of their costs. However, ICAO/CAEP did not conduct that work.

Nonetheless, as a result of these comments, the EPA has revised Section VI.D of the Preamble to the final rulemaking to clarify how we assessed the costs associated with this rule. The EPA does not follow ICAO/CAEP's approach in assessing costs in this rulemaking. As described in Section VI.D of the Preamble to the final rulemaking, the EPA does not anticipate the final rule to result in new technology costs (non-recurring costs). Since all in-production engines meet the in-production standards and nearly all in-production engines meet these new type design standards, there will be no required changes in technology. So, we project there will not be costs, nor emission reductions, as a result of the final rule. Cost is only one of the considerations supporting EPA's final PM standards. While more stringent standards would likely incur greater costs, we are not rejecting more stringent standards today based solely on costs (or based on any determination of costs being prohibitive), but rather based on our holistic evaluation of the considerations described in this rulemaking.

10. Requests for EPA to Consider Additional Policies

Organizations Included in this Section

Beacon Hill Council of Seattle (BHC)
California Air Resources Board (CARB)
Center for Biological Diversity
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Environmental Defense Fund (EDF)
Growth Energy
Hazard, Thomas
Huang, Wen-Yen
Institute for Policy Integrity at New York University School of Law (Policy Integrity)
Kroeker, Ann
National Association of Clean Air Agencies (NACAA)
Palosaari, Kent
Port of Seattle in collaboration with the cites of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way

Rosetta Advisory Services, Brussels
Service Employees International Union (SEIU)
Sierra Club
Simons-Wilson, Alex
Wagner, Debi
Wilson, Charles

Organization: *Beacon Hill Council of Seattle (BHC)*

First of all, we appreciate the United States' need to align its Emission Standards and Test Procedures with the International Civil Aviation Standards Organization (ICAO). However, the proposed rule is meaningless to us because it:

3. Discusses at length ultrafine particles, but does not propose a regulation [EPA-HQ-OAR-2019-0660-0176-A1, p.1] [[This comment is repeated in section 2.3]]

Organization: *California Air Resources Board (CARB)*

EPA has not considered a variety of demonstrated and in-development emissions-reducing technologies, measures, and policies, and has yet to address emissions from in-service and smaller aircraft. This leaves out major portions of the aviation sector. There are EPA and FAA-certified technologies already on the market that could achieve meaningful and effective reductions in PM. This approach would not require radically new technologies but simply use the cleanest available technologies already in use within the industry. [EPA-HQ-OAR-2019-0660-0206-A1, pp.5-6]

IV. EPA Should Explore the Use of Sustainable Aviation Fuel

Sustainable aviation fuels (SAF), along with cleaner engine requirements or incentives, could reduce PM emissions by over 50 percent with already-commercially-available technology. SAFs are drop-in substitutes for petroleum jet fuels that are derived from renewable feedstock, such as vegetable, or waste-based oils. A drop-in jet fuel blend is "completely interchangeable and compatible with conventional jet fuel when blended with conventional jet fuel," and thus drop-in SAF would "not require adaption of the aircraft/engine fuel system or the fuel distribution network, and can be used 'as is' on currently flying turbine-powered aircraft."[20] [EPA-HQ-OAR-2019-0660-0206-A1, p.8]

According to a study conducted at California Bay Area's three largest airports, if 100 percent of the flights used SAF blend instead of conventional jet fuel, a 5 percent SAF blend reduced PM emissions by 9 percent, a 25 percent blend reduced PM emissions by 40 percent, and a 50 percent blend reduced PM emissions by 65 percent.[21] In addition to SAF's PM reduction benefits, SAF also has greenhouse gas (GHG) and SOx emission reduction benefits. According to the same study, a 50 percent blend of SAF would reduce SOx emissions by 37 percent while reducing full-cycle GHG emissions by 4.6 million metric tons per year.[22] [EPA-HQ-OAR-2019-0660-0206-A1, p.8]

The FAA's CLEEN program and other initiatives fund the development and demonstration of drop-in SAFs that "require no modifications to aircraft or fuel supply infrastructure."[23] According to FAA, SAFs "also can help to expand jet fuel supplies beyond petroleum, improving jet fuel price stability, enhancing supply security, and contributing to economic development."[24] Furthermore, in 2019, the ICAO Assembly adopted a resolution "[r]ecognizing that the technological feasibility of drop-in sustainable

aviation fuels is proven and that the introduction of appropriate policies and incentives to create a long-term market perspective is required[.]"[25] [EPA-HQ-OAR-2019-0660-0206-A1, p.8]

In combination with regulating in-service aircraft and requiring robust reporting, EPA in coordination with FAA should implement a consumer demand program based on emission profiles. A consumer demand program would require all airlines to display the total emissions, both criteria and GHG emissions, of an aircraft for every specific flight. Emissions from aircraft should be transparent and easily available to the public, enabling consumers to make informed decisions. Private companies have started to implement a similar approach for carbon emissions.[27] A consumer demand program at the federal level would enable accurate data collection and reporting and has the potential to reduce emissions. If consumers make choices based on the emission profiles of their flights, this has the potential for airlines to be incentivized to implement emissions reductions that precede or exceed regulatory requirements. [EPA-HQ-OAR-2019-0660-0206-A1, p.9]

VI. EPA Should Consider Electrification and Hydrogen

EPA also has the ability to go beyond existing available technology and be technology-forcing and as such should incorporate and incentivize zero-emissions and hybrid aircraft technologies that have shown promise in recent years. In a 2019 report, ICAO highlighted the promise of electric and hybrid technologies, noting that "a number of ongoing projects have been identified globally, [including] general aviation or recreational aircraft, business and regional aircraft, [and] large commercial aircraft. Most of them target an entry-in-service date between 2020 and 2030, and some are already commercially available."[28] [EPA-HQ-OAR-2019-0660-0206-A1, pp.9-10]

In June 2020, a private company successfully flew a commercial-grade plane powered by a hydrogen-electric powertrain.[29] The company anticipates making retrofitted zero-emission aircraft commercially available as soon as the end of 2023.30 [EPA-HQ-OAR-2019-0660-0206-A1, p.10]

Airbus recently announced three types of zero-emission hydrogen-fueled commercial aircraft that the company intends to introduce into service by 2035.[31] Collectively termed "ZEROe," the aircraft include a turbofan design with a range of over 2,000 nautical miles and a 120 to 200 passenger capacity, a turboprop design with a range of over 1,000 nautical miles and a 100-passenger capacity, and a "blended-wing design" with a 200-passenger capacity. These zero-emission aircraft are anticipated to be able to execute short-haul and trans-continental flights. Zero-emission aircraft will provide the urgently needed reductions in criteria pollutants and GHG emissions. [EPA-HQ-OAR-2019-0660-0206-A1, p.10]

It is evident that hydrogen-powered, electric, and hybrid aircraft will soon be an available option. EPA should take these technologies and designs into consideration in promulgating its emissions standard. [EPA-HQ-OAR-2019-0660-0206-A1, p.10]

VII. EPA Should Consider Aerodynamic Improvements and Weight-Reducing Technologies

Congress and federal agencies have recognized the need for emissions reducing aerodynamic, weight-reducing, and fuel-saving technologies for aircraft and supported their development and use. The result is that many technologies are actively advancing. EPA must account for and incorporate potential reductions from these technologies into its standards. [EPA-HQ-OAR-2019-0660-0206-A1, p.11]

The FAA Reauthorization Act of 2018 requires FAA, in coordination with the National Aeronautics and Space Administration (NASA), to "conduct a review of current and planned research on the use of advanced aircraft technologies, innovative materials, alternative fuels, additive manufacturing, and novel aircraft designs, to increase aircraft fuel efficiency[,]" and to report its findings to Congress.[32] FAA and NASA programs are demonstrating the effectiveness and current and near-term viability of engine, aerodynamics, and weight-reducing technologies that it appears EPA failed to consider in their rule development. [EPA-HQ-OAR-2019-0660-0206-A1, p.11] [[This comment can also be found in section 13 of the comment summary]]

NASA programs, including the Advanced Air Vehicles Program and the Integrated Aviation System Research Program, research new vehicle technologies that are anticipated to result in meaningful and effective emissions reductions. NASA's Environmentally Responsible Aviation Project, designed to halve fuel burn for subsonic passenger and cargo transport aircraft by 2020, has developed technologies to reduce fuel burn and emissions, including tail enhancements and surface coatings to reduce weight and drag, and lighter-weight structures.[33] The 2015 U.S. Aviation GHG Emissions Reduction Plan submitted to ICAO notes, "Typically five to ten years after the conclusion of a NASA program, the industry will build on NASA's research results and integrate the associated knowledge into commercial products."[34] [EPA-HQ-OAR-2019-0660-0206-A1, p.11]

FAA's Continuous Lower Emissions, Energy, and Noise (CLEEN) program, launched in 2010, is a cost-sharing program in which participants match or exceed federal awards to accelerate the development and commercialization of new certifiable aircraft technologies and sustainable aviation fuels. Congress codified the program into statute in 2018.[35] During the CLEEN program's first phase, from 2010 to 2015, it provided 125 million dollars to help aircraft and components companies develop and demonstrate technologies to reduce aircraft fuel burn by 33 percent, with a target entry into service date of 2018.[36] In the second phase, from 2015 to 2020, FAA provided another 100 million dollars to develop technologies that would reduce aircraft fuel burn by 40 percent, with a target entry into service date of 2026.[37] Emissions-reducing technologies successfully developed through the program include composite airframe technologies; advanced wing technologies; and advanced fan systems, among many others.[38] Several technologies developed through CLEEN are now commercially available.[39] The CLEEN program is currently in its third phase, from 2020 to 2025, with goals to reduce noise, fuel burn, NOx, and PM emissions. Both NASA programs and CLEEN programs have been successful in developing technology to reduce emissions. For many of the technologies developed there are potential co-benefit reductions for criteria pollutants and GHGs.[40] [EPA-HQ-OAR-2019-0660-0206-A1, pp.11-12]

EPA should consider all these technologies during their rule-making process. To achieve necessary and feasible emissions reductions from aircraft, all technologies should be considered and incorporated into the standard. [EPA-HQ-OAR-2019-0660-0206-A1, p.12]

VIII. EPA Should Consider Measures to Reduce Emissions from Landing and Takeoff, Taxi, and Auxiliary Power Units (APU)

While the Proposed Standard states, "due to the technology-following nature of the PM standards, the proposed in-production and new type standards would not result in emission reductions below current levels of engine emissions," we encourage EPA and FAA to explore operational requirements as a tool to achieve reductions. [EPA-HQ-OAR-2019-0660-0206-A1, p.12]

It is critical for EPA and FAA to consider measures that reduce all criteria emissions and GHGs during the landing and take-off cycle, as well as through the use of Auxiliary Power Units (APU). EPA should consider strategies that improve the current air traffic operation and transition APUs toward zero-emission technologies. Such strategies include de-rated take-off, reduced power during taxiing, improved taxi time, and reduced usage of APUs. [EPA-HQ-OAR-2019-0660-0206-A1, p.13]

De-Rated Take Off

Aircraft are designed to take off safely without full thrust. By not applying full thrust during take-off, aircraft reduce emissions as well as the level of noise. A 2017 study by Koudis et al. has shown that using reduced thrust takeoff reduces fuel consumption, NOx, and black carbon emissions by 1.0 to 23.2 percent, 10.7 to 47.7 percent, and 49.0 to 71.7 percent, respectively, depending on aircraft-engine combinations relative to 100 percent thrust takeoff.[41] Additionally, a study by the Electronic Navigation Research Institute of Japan has indicated that reduced thrust near the top of the climb can result in fuel saving.[42] The engine derate can also extend engine life and reduce maintenance costs.[43] [EPA-HQ-OAR-2019-0660-0206-A1, p.13]

Reduced Power During Taxiing

Most commercial aircraft are equipped with two to four engines. Aircraft engines, even at idle or minimal power settings, are used to taxi the aircraft while on the ground. Because of this, taxi-in, idle, and even taxi-out can be completed with one or more of those engines not operating. Shutting down an engine during the taxi-in, until the aircraft is in an advanced stage of the taxi out for takeoff, has the potential to reduce emissions.[44] [EPA-HQ-OAR-2019-0660-0206-A1, p.13]

Improved Taxi Time

Minimizing taxi time when the aircraft is taxi-in or taxi-out, reduces emissions. Such a control measure would require real-time optimization of air traffic with constant feedback from all associated airports. [EPA-HQ-OAR-2019-0660-0206-A1, p .13]

Reduced Usage of APUs

The typical aircraft APU is a small turbine engine that starts the aircraft's main engines and powers the electrical systems on the aircraft when the main engines are off. Switching to the on-board rechargeable batteries as the power supply would reduce the usage of the gas turbine APU and hence reduce emissions. [EPA-HQ-OAR-2019-0660-0206-A1, p.14]

These are a few of the strategies that EPA should consider for reducing near-ground GHG, criteria, and hazardous air pollutants. These strategies, along with more stringent standards, would make major contributions to California and local air districts' ability to meet federal air quality standards and climate goals. [EPA-HQ-OAR-2019-0660-0206-A1, p.14]

---

[20] ICAO, Sustainable Aviation Fuels Guide (Dec. 2018), available at https://www.icao.int/environmentalprotection/Documents/Sustainable%20Aviation%20Fuels%20Guide_100519.pdf.

[21] https://onlinepubs.trb.org/onlinepubs/acrp/acrp_wod_41.pdf.

[22] Frontiers in Energy Research, Perspectives on Fully Synthesized Sustainable Aviation Fuels: Direction and Opportunities, updated January 2022, available at https://www.frontiersin.org/articles/10.3389/fenrg.2021.782823/full.

[23] FAA, Continuous Lower Energy, Emissions, and Noise (CLEEN) Program, updated June 19, 2020, https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/, U.S. Department of Transportation, FAA Top Policy Issues, updated Jan. 27, 2017, available at https://www.transportation.gov/transition/FAA/Top-Policy-Issues.

[24] U.S. Department of Transportation, FAA Top Policy Issues, updated Jan. 27, 2017, available at https://www.transportation.gov/transition/FAA/Top-Policy-Issues.

[25] ICAO Assembly, Resolution A40-18, available at https://www.icao.int/environmentalprotection/Documents/Assembly/Resolution_A40-18_Climate_Change.pdf.

[27] Forbes, Google Now Reports Emissions Data For Every Flight, available at https://www.forbes.com/sites/jenniferleighparker/2021/10/06/google-now-reports-emissions-data-for-everyflight/?sh=7cdd81cf7826.

[28] ICAO, Introduction to the ICAO Basket of Measures to Mitigate Climate Change, Climate Change Mitigation: Technology and Operations, Ch. 4 (2019), at 113, available at https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg111-115.pdf.

[29] Ilana Marcus, ''Can Airplanes Go Green?,'' Washington Post (July 31, 2020), available at https://www.washingtonpost.com/climate-solutions/2020/07/31/electric-airplane/; Anmar Frangoul, ''A battery-electric plane takes to skies over England in latest example of 'zero emission' flight,'' CNBC (June 24, 2020), available at https://www.cnbc.com/2020/06/24/battery-electric-zero-emission-plane-takes-to-skies-over-england.html.

[30] Ibid.; Charles Alcock, ''ZeroAvia Hydrogen Flight Paves Way to 2023 Service Entry,''AINonline (September 25, 2020), available at https://www.ainonline.com/aviation-news/airtransport/2020-09-25/zeroavia-hydrogen-flight-paves-way-2023-service-entry.

[31] Airbus, "Airbus reveals new zero-emission concept aircraft" (Sept. 21, 2020), available at https://www.airbus.com/newsroom/press-releases/en/2020/09/airbus-reveals-newzeroemission-concept-aircraft.html.

[32] FAA Reauthorization Act of 2018, Pub.L. 115-254, 115th Congress, 132 Stat. 3413, § 742.

[33] U.S. Aviation Greenhouse Gas Emissions Reduction Plan (June 2015), available at https://www.icao.int/environmental-protection/Lists/ActionPlan/Attachments/30/UnitedStates_Action_Plan-2015.pdf.

[35] FAA Reauthorization Act of 2018, Pub.L. 115-254, 115th Congress, 132 Stat. 3413, adding 49 U.S.C. § 47511.

[36] Chris Dorbian, FAA Office of Environment & Energy, CLEEN Program Overview (March 3, 2020), available at https://anesymposium.aqrc.ucdavis.edu/sites/g/files/dgvnsk3916/files/inline-files/20200303%20UC%20Davis%20ANE%20Symposium%20-%20CLEEN%20Overview%20%28Dorbian%29.pdf; CLEEN Phase I Recipients include Boeing, General Electric, Honeywell, Pratt & Whitney, and Rolls-Royce. FAA, Continuous Lower Energy, Emissions, and Noise (CLEEN) Program, updated June 19, 2020, https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen

[37] Id. CLEEN Phase II Recipients include Aurora Flight Sciences, Boeing, Collins Aerospace, Delta Tech Ops/MDS Coating Technologies, General Electric, Honeywell, Pratt & Whitney, and Rolls-Royce. FAA, Continuous Lower

Energy, Emissions, and Noise (CLEEN) Program, updated June 19, 2020, https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/.

[38] FAA, CLEEN Phase I and II Projects, Feb. 27, 2020, available at https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/media/CLEENI_CLEENII_Projects.pdf

[39] FAA, CLEEN Phase I and II Projects, Feb. 27, 2020, available at https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/media/CLEENI_CLEENII_Projects.pdf

40 FAA, Continuous Lower Energy, Emissions, and Noise (CLEEN) Program, updated September 2021, available at https://www.faa.gov/newsroom/continuous-lower-energy-emissions-and-noise-cleen-program?newsId=22534.

[41] G.S. Koudis et al., "Airport emissions reductions from reduced thrust takeoff operations, ''Transportation Research Part D: Transport and Environment, 52, 15-28 (2017). See also M. King and I. Waitz, "Assessment of the Effects of Operational Procedures and Derated Thruston American Airlines B777 Emissions from London's Heathrow and Gatwick Airports," Partner, Cambridge, MA (2005) (showing that each 1 percent of derate can approximately reduce NOx emissions by 0.7 percent below 3000 feet while slightly increasing the fuel burn).

[42] R. Mori, "Fuel-Saving Climb Procedure by Reduced Thrust near Top of Climb," Journal of Aircraft (2020), at 1-7.

[43] R. Donaldson et al., "Economic Impact of Derated Climb on Large Commercial Engines," Proceedings of the Performance and Flight Operations Engineering Conference (2007).

[44] Sustainable Aviation, "Aircraft on the Ground CO2 Reduction Programme," UK's Airport Operators Association.

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

Finally, by restricting its analysis to the ICAO PM Standards, EPA has failed to evaluate forms of PM emissions control beyond the jet engine technologies favored by ICAO. Thus, EPA did not study whether changes to fuel composition—either fossil-based jet fuel with reduced aromatics content,[56] or alternative aviation fuels such as biofuels,[57] hydrogen,[58] or battery-stored electricity[59]—could secure better PM emission reductions cost-effectively. Because the PM mass and numerical standards measure PM emissions per unit of thrust, the ICAO PM Standards fail to measure the total PM emitted over a flight and thus fail to reward absolute reductions in PM achieved by technologies or operational methods that reduce fuel burn, especially during LTO operations.[60] And by restricting itself to standards for new-type and in-production engines, EPA disregards the immediate and cost-effective reductions achievable through regulating in-service aircraft—e.g., through a declining fleetwide average standard. See 73 Fed. Reg. at 44,473 (discussing a fleetwide average standard to control greenhouse gas emissions from in-service aircraft). [EPA-HQ-OAR-2019-0660-0203-A1, pp.20-21]

EPA has offered no explanation for failing to even examine these demonstrated and effective methods of controlling emissions beyond the ICAO PM Standards, contrary to Section 231 and the principles of rational decision-making.[61] [EPA-HQ-OAR-2019-0660-0203-A1, p.21]

---

[56] Id. at 32 ("The formation of PM and soot is very dependent on the nature of the fuel used. Flight experiments with alternative fuels (with low aromatic content hydrocarbons or bio-fuels) reveal significant reductions in soot

production."); see also A.J. Beyersdorf et al., "Reductions in aircraft particulate matter due to the use of Fischer-Tropsch fuels," Atmos. Chem. Phys., 14, 11-12 (2014) (discussing dramatic reductions in PM from alternative fossil-based jet fuels with lower sulfur and aromatic content), https://acp.copernicus.org/articles/14/11/2014/acp-14-11-2014.pdf (attached as Exhibit 9).

[57] See, e.g., Durdina et al., "Reduction of Non-Volatile Particulate Matter Emissions of a Commercial Turbofan Engine at Ground Level from the Use of a Sustainable Aviation Fuel Blend," Environmental Science and Technology (Oct. 2021), (finding a 32% blend of sustainable aviation fuels reduced non-volatile PM mass and number measures by 20% and 25%, respectively, during LTO thrusts), https://pubs.acs.org/doi/pdf/10.1021/acs.est.1c04744 (attached as Exhibit 10).

[58] See, e.g., J. Mukhopadhaya & D. Rutherford, "Performance analysis of evolutionary hydrogen-powered aircraft," at 1 (Jan. 2022) (finding hydrogen-fueled aircraft could fly 31-38% of passenger air traffic), https://theicct.org/wp-content/uploads/2022/01/LH2-aircraft-white-paper-A4-v4.pdf (attached as Exhibit 11). In September 2020, Airbus unveiled designs for a hydrogen-fueled, zero-emission aircraft, but notes that the success of such alternative-fuel aircraft depends on government regulators incenting the aviation sector to retire older aircraft and install the necessary infrastructure. Energywire, "Airbus unveils hydrogen designs for zero-emission flight" (Sept. 22, 2020), https://www.eenews.net/energywire/stories/1063714307 (attached as Exhibit 12). The present rulemaking is precisely one such opportunity to steer the industry toward cleaner fuels.

[59] In addition to fully electrified commercial-sized aircraft, which are still being developed, hybrid electrification technologies can decrease emissions by powering on-board systems and can even support jet engines during certain phases of flight. See Airbus, "Micro-hybridisation: the next frontier to electrify flight?" (Sept. 21, 2021), https://www.airbus.com/en/newsroom/news/2021-09-micro-hybridisation-the-next-frontier-to-electrify-flight (attached as Exhibit 13).

[60] The Proposed Rule's failure to consider any PM control measures based on reduced fuel burn is particularly glaring given EPA's recent aircraft greenhouse gas standard, which is premised exclusively on technologies that reduce fuel burn. See 86 Fed. Reg. at 2167. As pointed out in relation to the aircraft greenhouse gas rule, numerous operational methods can reduce fuel burn during LTO operations. See Comments of California et al., EPA-HQ-OAR-2018-0267-0176, at 19 (Oct. 19, 2020) (attached as Exhibit 14); 73 Fed. Reg. at 44,471 (discussing single-engine taxiing, use of gate or ground-based electricity, and air traffic control improvements as operational methods to reduce fuel burn).

[61] EPA does not assert that its adoption of the ICAO PM Standards is urgent, but to the extent EPA asserts any lack of time as reason not to consider more protective standards, the Commenting States note that EPA's own delay in issuing the Proposed Rule, five years after the 2017 ICAO PM standards, cannot excuse its thorough and rational evaluation of the statutory factors under Section 231.

Organization: *Center for Biological Diversity*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 21.]

EPA needs to withdraw and reconsider this rule and, instead, adopt one that sets technology-forcing standards that apply across the airplane fleet instead of to individual engines. The standards should: number one, cover aircraft in operation, not just new aircraft; number two, reduce emissions through airplane designs and operational improvements in addition to engine technologies; and three, include a ratchet mechanism to reduce total emissions over time. Strong technology-forcing standards will drive needed changes and create good, family-sustaining jobs in the aviation sector. [[This comment is repeated in section 3.2.]]

Organization: *Center for Biological Diversity and Friends of the Earth*

B. Standards should include emissions reductions achievable through improvements that do not relate to aircraft engine technology.

EPA also should have taken design, operational, and other non-engine improvements into account when setting particulate matter standards. EPA has a history of considering such options in prior rulemakings. When EPA set emissions standards for hydrocarbons, carbon monoxide, and nitrogen oxides in 1973, for example, it recognized that evidence of compliance with standards through improved operations was sufficient to counter arguments that certain technologies would impose drastic compliance costs.[107] Other examples where EPA considered incorporation of aircraft design and operational improvements include the 2015 proposed endangerment finding for greenhouse gas emissions, and 2008 Advanced Notice of Proposed Rulemaking related to *Massachusetts v. EPA*.[108] [EPA-HQ-OAR-2019-0660-0189-A1, p.14]

EPA's failure to consider non-engine improvement options was especially problematic here because certain non-engine improvements could target emissions at airports and during the landing and take-off cycles, which contribute most to particulate matter impacts.[109] For example, emissions would be reduced by minimizing engine idling time on runways and employing single engine taxiing and reducing engine thrust and reverse during high-intensity periods like take-off and landing.[110] Other operational strategies include optimizing timetables, route networks, and flight frequencies to reduce stopovers and select fuel-efficient routes; reducing the use of auxiliary power units; reducing the amount of excess weight carried, including fuel; and more regular maintenance and cleaning of engines and airframes to correct minor deterioration.[111] [EPA-HQ-OAR-2019-0660-0189-A1, p.15]

Finally, given the relationship between fine particulate matter generation and fuel composition, EPA should have considered more aggressive emissions standards that could be met by using particular fuels and by transitioning away from fuels to hybrid and all-electric aircraft. For example, the Federal Aviation Administration has determined that fuel with reduced aromatics—especially napthalenes—and sulfates results in less particle matter pollution.[112] Studies indicate that use of low sulfur jet fuel globally is "likely to prevent 1000-4000 premature mortalities per year."[113] Jet fuel can be desulfurized in the same way as road transportation fuels, with "an increase in the cost of a gallon of just over 1% at 2011 prices."[114] Aircraft electrification is also gaining momentum and becoming more cost-effective, especially for short flights. The country of Norway has committed to fully electrifying such flights by 2040.[115] [EPA-HQ-OAR-2019-0660-0189-A1, p.15]

The combined effect of these reduction strategies is substantial. For example, one cost assessment of near- and mid-term technologies aimed at improving new aircraft fuel efficiency (i.e., not including fuel composition changes), found that the fuel consumption of new aircraft could be reduced by approximately 25% in 2024 and 40% in 2034 when compared with 2016's aircraft by deploying emerging cost-effective technologies.[116] The rate of fuel efficiency improvement for new aircraft can be more than doubled through 2034, from about 1% in 2016 to 2.2% annually, through technologies to improve engine efficiency, reduce aerodynamic drag, and trim aircraft empty weight.[117] [EPA-HQ-OAR-2019-0660-0189-A1, pp.15-16]

C. Standards should decrease emissions over time and should be technology forcing.

EPA has also previously discussed the option of creating "a declining fleet average emissions program," which would consider efficiency gains from improved "engine, aircraft and operational greenhouse gas control[s]."[118] This type of emissions program is critical for actually decreasing emissions over time. EPA admits that there will be no emission reductions from the proposed rule.[119] Worse, because the standards apply to emissions at individual engines, the rule will do nothing to curb emissions that will continue to rise with increased passenger and cargo traffic. To abate emissions, EPA needs to set a cap across the sector. [EPA-HQ-OAR-2019-0660-0189-A1, p.16]

That fleetwide emissions cap should decrease over time to encourage retirement of the most polluting aircraft and continue to push technological innovation. Congress intended the Clean Air Act to be a technology-forcing statute. The statute itself provides that standards should take effect "after such period as [EPA] finds necessary . . . to permit the development . . . of the requisite technology."[120] Thus, as EPA explained in its first rulemaking under Section 231, "the standards set by EPA may reflect technology which may reasonably be obtained within a given time frame but which is not yet available."[121] EPA in 2005 again confirmed its authority to implement a "technology-forcing standard," and the agency need not "demonstrate that a [necessary] technology is currently available universally or over a broad range of aircraft" to require implementation of its standards, so long as "sufficient lead time" is provided.[122] EPA should have analyzed what suite of technologies are available now, and what technologies could become readily deployed in the coming years. [EPA-HQ-OAR-2019-0660-0189-A1, p.16]

---

[107] Control of Air Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,088, 19,089 (July 17, 1973) ("Commenters representing general aviation interests opposed the introduction of emission standards applicable to piston engine aircraft, on the arounds that compliance would require introductions of exhaust system reactors which would have drastic and costly effects on the configuration of the entire aircraft. The Agency has concluded that sufficient evidence is already available in the form of measured emissions data on current aircraft to indicate that the proposed standards can be met by improved fuel management and will not require exhaust system reactors.")

[108] Proposed Finding that Greenhouse Gas Emissions from Aircraft Cause or Contribute to Air Pollution that May Reasonably Be Anticipated to Endanger Public Health and Welfare and Advance Notice of Proposed Rulemaking, 80 Fed. Reg. 37,758, 37,797 (July 1, 2015) (discussing use of advanced materials, new manufacturing processes, aircraft changes to improve propulsion and aerodynamics, and means to reduce drag and improve combustion and engine cycle refinements); Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,470-473 (July 30, 2008) (discussing technology and operational changes).

[109] 87 Fed. Reg. at 6,345; see also Heathrow Airport Ltd., Heathrow Air Quality Strategy 2011-2020 (2011); Yunos, S.N.M.M. et al., Aircraft LTO Emissions Regulations and Implementations at European Airports, 1831 AIP Conf. Proc. 020006-1 (2017).

[110] Waitz, Ian A. et al., Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions, Report to the United States Congress (2004) ("Aviation & the Environment") at 34, http://web.mit.edu/aeroastro/partner/reports/congrept_aviation_envirn.pdf; Center for Clean Air Policy and Northeast States for Coordinated Air use Management, Controlling Airport Related Pollution (2003) ("CCAP Report") at III-7-9, https://crp.trb.org/acrp0267/controlling-airport-related-air-pollution/.

[111] CCAP Report at III-7-11; see also Aviation & the Environment at 34.

[112] Hileman, Jim, Federal Aviation Admin., Fuel Composition & Aircraft Emissions (2018), https://www.caafi.org/resources/pdf/3.2_SAJF_Benefits.pdf.

[113] Ascent, Project 27: Environmental cost-benefit analysis of ultra low sulfur jet fuels, https://ascent.aero/partner-27/.

[114] Id.

[115] Fleming, John, Flight Path: A Trajectory for U.S. Aviation to Meet Global Climate Goals (2020), https://www.biologicaldiversity.org/programs/climate_law_institute/pdfs/Flight-Path-A-Trajectory-for-U-SAviation-to-Meet-Global-Climate-Goals.pdf.

[116] Kharina, Anastasia et al., Cost Assessment of Near- and Mid-term Technologies to Improve New Aircraft Fuel Efficiency, International Council on Clean Transportation (2016), https://theicct.org/publications/costassessmentnear-and-mid-term-technologies-improve-new-aircraft-fuel-efficiency; see also Rutherford, Dan, Standards to promote airline fuel efficiency, International Council on Clean Transportation (2020), https://theicct.org/sites/default/files/publications/Airline-fuel-efficiency-standard-2020.pdf (a declining fleet average standard could yield 2.5 percent annual fuel efficiency improvements via three main pathways: (1) replacing older aircraft with newer, more fuel-efficient aircraft; (2) improving operations to carry more passengers and freight per flight and to fly more directly to destinations; and (3) finding optimal flight paths and avoiding congestion near airports using advanced air traffic management).

[117] Kharina, Anastasia et al., Cost Assessment of Near- and Mid-term Technologies to Improve New Aircraft Fuel Efficiency, International Council on Clean Transportation (2016), https://theicct.org/publications/costassessmentnear-and-mid-term-technologies-improve-new-aircraft-fuel-efficiency.

[118] Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,472-73 (July 30, 2008). Section 231's language is similar to that in Section 202, under which EPA has historically employed a fleet-wide averaging approach to regulate of emissions from new motor vehicles. The D.C. Circuit has upheld this approach as lawful, emphasizing the "absence of any clear evidence that Congress intended to prohibit averaging" under section 202 and the strong policy arguments for adopting this approach. See NRDC v. Thomas, 805 F.2d 410, 425 (D.C. Cir. 1986).

[119] 87 Fed. Reg. at 6,347.

[120] 42 U.S.C. § 7571(b) (1990).

[121] Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. at 19,089.

[122] Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. at 69,676 ("forward-looking language" of section 231 does not preclude EPA from setting a technology-forcing standard, and "the Agency is not limited in identifying what is 'technologically feasible' as what is already technologically achieved").

Organization: *Center for Biological Diversity et al.*

To reduce particulate matter emissions from aircraft, EPA should set technology-forcing standards that apply across the airplane fleet, instead of to individual engines. The standards should: (1) cover aircraft in operation, not just new aircraft; (2) reduce emissions through airplane designs and operational improvements in addition to engine technologies; and (3) include a ratchet mechanism to reduce total emissions over time. [EPA-HQ-OAR-2019-0660-0185-A1, pp.2-3]

And these standards should be paired with investment in climate adaptation and filtration technologies for communities near airports that have borne the brunt of historical pollution. [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

Organization: *Environmental Defense Fund (EDF)*

The health and environmental impacts of PM from aviation can be mitigated by means of (1) cleaner aircraft engine combustor technologies,[3] (2) reducing the concentration of aromatics[4] in jet fuel[5] or using synthetic fuels with low aromatics,[6] and (3) operations, including reduced thrust takeoff operations[7] and flight planning process avoiding low-temperature ice-supersaturated air.[8] [EPA-HQ-OAR-2019-0660-0207-A1, p.2]

Specifically, EPA should undertake the following, within its broad statutory authority under the CAA, and in consultation with the Administrator of the FAA under Sec. 232 of the CAA and 49 U.S.C. Sec. 44714:

• set protective emissions limits for engine/aircraft combinations that encourage and recognize the emission reduction effects of more aerodynamic aircraft designs, lightweight materials, and innovative engineering;[60] [EPA-HQ-OAR-2019-0660-0207-A1, p.9]

Such approaches could be pursued in a manner that supports and recognizes the primary role that other agencies have in these areas, while spurring American innovation and creating jobs in the United States. EPA and the FAA have in fact previously asserted the authority to consider "new air traffic systems and flight management techniques that can result in environmental benefits," when developing and implementing standards. [64] EPA can build on these prior approaches with FAA in this rulemaking. [EPA-HQ-OAR-2019-0660-0207-A1, pp.9-10]

IV. Dramatic health benefits and lives saved from reduced PM2.5 levels are possible through jet fuel regulation (aromatic levels) and increased use of low aromatic sustainable aviation fuel (SAF) being promoted by the Department of Energy, Department of Transportation and the FAA as part of the SAF Grand Challenge

A route to lower nvPM is the alteration of jet fuel to remove most of the aromatics,[65] and within them the naphthalenes, which are responsible for a large fraction of nvPM emissions.[66] Reducing the concentration of aromatics in jet fuel by blending synthetic fuels with low aromatics can help reduce nvPM mass and number emissions at low thrust conditions at ground level[67] and at cruise conditions.[68] [EPA-HQ-OAR-2019-0660-0207-A1, p.10]

It is widely accepted that synthetic hydrocarbons with negligible aromatic content[69] burn more cleanly than fossil fuels, meaning that these alternative fuels can deliver local health benefits to communities by helping cut air pollution around airports[70,71] and reduce non-CO2 climate effects that cause net warming.[72] [EPA-HQ-OAR-2019-0660-0207-A1, p.10]

As currently approved by ASTM International,[73] the blend ratio of SAF to conventional jet fuel in the aircraft for drop-in SAF range between 10% and 50%,[74] but the blend ratio could quickly increase once the minimum aromatic content required in drop-in fuels is better understood.[75] [EPA-HQ-OAR-2019-0660-0207-A1, p.10]

According to ASTM International D7566-21 for synthetic hydrocarbons, a minimum level of aromatics is desirable to ensure that shrinkage of aged elastomer seals and associated fuel leakage. As a result,

currently, a minimum aromatics content of 8% (in volume) is required for aviation turbine fuels containing synthesized hydrocarbons, a significant reduction compared to the maximum of 25% aromatic content allowed in the standard (Table 1, Part 1 & 2, ASTM D7566-21). [EPA-HQ-OAR-2019-0660-0207-A1, p.11]

However, seals that have not been exposed to fuel with high aromatic content do not appear to require aromatics for acceptable performance with some 100% SAF without aromatics,[76] a critical outcome that allows envisioning a transition to 100% SAF with negligible aromatic content, provided the legacy aircraft have sufficient time to adapt. [EPA-HQ-OAR-2019-0660-0207-A1, p.11]

An alternative route to blending synthetic fuels involves hydrotreating jet fuel to reduce aromatic content and remove naphthalene and sulfur in the near term, when SAF is not widely available.[77] In this context, a targeted 8% aromatics content (combined with no naphthalene and sulfur content) could be extended beyond synthetic hydrocarbons to all aviation turbine fuels without adversely affecting safety until the safety considerations related to negligible aromatics have been resolved. This option would achieve the key public health and climate benefits from nvPM until synthetic hydrocarbons with significant greenhouse gas emissions life-cycle emissions reductions become available at scale to displace fossil jet fuel, delivering so the full scope of environmental and social benefits. Currently, the ASTM D16555-21a, sets a 25% volume limit for aromatics and a 3% limit for naphthalenes. [EPA-HQ-OAR-2019-0660-0207-A1, p.11]

Hydrotreating using hydrogen from steam-methane reforming represents a priori a small cost compared to the environmental and social benefits of lower nvPM emissions: to reduce aromatics by 50% and remove naphthalene and sulfur content would amount to an increase in jet fuel cost for air carriers of around 2%.[78] This would come with a GHG emissions penalty of around 2.5% compared to the average total lifecycle GHG emissions of fossil jet fuel.[79] But this penalty only materializes in jurisdictions without GHG emissions control policies. When the hydrotreating takes place in jurisdictions such as California, there is no such penalty because refinery emissions are covered by the economy-wide cap under the California Cap-and-Trade System. Moreover, a fraction of the additional process emissions would be compensated by the greater aircraft fuel efficiency derived from the higher fuel hydrogen content. [EPA-HQ-OAR-2019-0660-0207-A1, p.11]

The FAA's Office of Environment and Energy has supported exploratory cost-benefit analyses to estimate the impact of fuel composition changes on aircraft emissions.[80] PARTNER FAA Center of Excellence Project 27 (2007-2011) provided a cost-benefit analysis for sulfur removal resulting in a net cost after accounting for significant non-CO2 climate effect driven by reduced SO2 aerosols, which otherwise have a cooling effect. ASCENT FAA Center of Excellence Project 39[81] provided an integrated cost-benefit analysis of impacts of naphthalene removal in the United States accounting for the additional refining cost as well as the air quality and climate impacts excluding contrail effects. The results suggest that benefits of widespread naphthalene removal would be outweighed by the cost of processing the fuel and the CO2 emissions associated with that processing. However, when the latest science on the climate impacts of contrails is taken into account the cost-benefit analysis could result in a net benefit, i.e., naphthalene removal would be beneficial and cost-effective. [EPA-HQ-OAR-2019-0660-0207-A1, pp.11-12]

In addition to contrails, the latest science on air quality and public health in the vicinity of airports and the social cost of GHG emissions suggest potentially larger benefits than those, a priori, considered in

ASCENT's Project 39. Finally, the processing cost of reducing naphthalenes could be significantly smaller after considering the synergies with existing refinery infrastructure leading to smaller capital expenditures. Furthermore, a strategy focused not only on removing naphthalene but also reducing overall aromatics content to minimum levels should increase both air quality and public health benefits and decrease climate impact beyond what could be achieved solely focusing on naphthalene removals. [EPA-HQ-OAR-2019-0660-0207-A1, p.12]

---

[3] Jacob S.D., T. Rindlisbacher, "The landing and take-off Particulate Matter Standards for Aircraft Gas Turbine Engines", 2019 ICAO Environmental Report. Available at:

https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg100-105.pdf (last accessed April 1, 2022)

[4] Aromatics are hydrocarbons containing a benzene ring and range from benzene, the smallest aromatic compound to others such as toluene, xylene and naphthalene. Particulate matter emissions from aircraft turbine engines are a function of aromatic content. According to ASTM D7566, the maximum allowable aromatics content for jet fuel is 25% (v/v).

[5] Faber J., J. Király, D. Lee, B. Owen, A. O'Leary, 2022, "Potential for reducing aviation non-CO2 emissions through cleaner jet fuel" – CE Delft, February 2022

https://cedelft.eu/wp-content/uploads/sites/2/2022/03/CE_Delft_210410_Potential_reducing_aviation_non-CO2_emissions_cleaner_jet_fuel_FINAL.pdf (last accessed April 1, 2022)

[6] Voigt, C., Kleine, J., Sauer, D. et al. Cleaner burning aviation fuels can reduce contrail cloudiness. Commun Earth Environ 2, 114 (2021). https://doi.org/10.1038/s43247-021-00174-y

[7] Koudis G.S., S. J. Hu, A. Majumdar, R. Jones, M. E.J. Stettler, Airport emissions reductions from reduced thrust takeoff operations, Transportation Research Part D: Transport and Environment, Volume 52, Part A, 2017, Pages 15-28, ISSN 1361-9209, https://doi.org/10.1016/j.trd.2017.02.004.

[8] Faber et al., 2022, (op. cit.)

[60] See 49 U.S.C. §§ 44701(a)(1)-(2) ("The Administrator of [FAA] shall promote safe flight of civil aircraft in air commerce by prescribing minimum standards for the design, material, construction, quality of work, and performance of aircraft, aircraft engines, and propellers," and "regulations and minimum standards [for ensuring compliance]."). In consulting with FAA on aircraft engine emission standards, EPA may consider the reduction effects of particular designs and engineering techniques that FAA would then mandate to ensure compliance with EPA's standards.

[64] FAA and EPA, ''Agreement Between Federal Aviation Administration and Environmental Protection Agency Regarding Environmental Matters Relation to Aviation,'' signed on March 24, 1998 by FAA's Acting Assistant Administrator for Policy, Planning, and International Aviation, Louise Maillet, and EPA's Acting Assistant Administrator for Air and Radiation, Richard Wilson. A copy of this document can be found in EPA Docket OAR–2002–0030.

[65] ICAO, 2019 (op. cit.) and Faber et al., 2022 (op. cit.)

[66] Faber et al., 2022 (op. cit.)

[67] Durdina L., B. T. Brem, M. Elser, D. Schönenberger, F. Siegerist, and J. G. Anet, 2021, Reduction of Nonvolatile Particulate Matter Emissions of a Commercial Turbofan Engine at the Ground Level from the Use of a Sustainable

Aviation Fuel Blend, Environmental Science & Technology 2021 55 (21), 14576-14585, DOI: 10.1021/acs.est.1c04744

[68] Moore, R., Thornhill, K., Weinzierl, B. et al., 2017, Biofuel blending reduces particle emissions from aircraft engines at cruise conditions, Nature 543, 411–415 (2017). https://doi.org/10.1038/nature21420

[69] Aromatics are hydrocarbons containing a benzene ring and range from benzene, the smallest aromatic compound to others such as toluene, xylene and naphthalene. Particulate matter emissions from aircraft turbine engines are a function of aromatic content. According to ASTM D7566, the maximum allowable aromatics content for SAF is 25%.

[70] Johnathan Holladay J., Z. Abdullah and J. Heyne, 2020, "Sustainable Aviation Fuel: Review of Technical Pathways", U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 9 September 2020, https://www.energy.gov/sites/default/files/2020/09/f78/beto-sust-aviation-fuel-sep-2020.pdf

[71] National Academies of Sciences, Engineering, and Medicine, 2018, "State of the Industry Report on Air Quality Emissions from Sustainable Alternative Jet Fuels." Washington, DC: The National Academies Press. https://doi.org/10.17226/25095.

[72] Voigt et al., 2021, (op. cit.)

[73] ASTM International, formerly known as American Society for Testing and Materials, is a standards organization that develops and publishes technical standards for a wide range of products including SAF and jet fuel specification. 74 ASTM International D7566-21. "Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons."

[75] A minimum level of aromatics is desirable to ensure that shrinkage of aged elastomer seals and associated fuel leakage (ASTM International D7566-21). However, seals that have not been exposed to fuel with high aromatic content do not appear require aromatics for acceptable performance with some 100% SAF without aromatics (Holladay et al., 2020, op. cit.)

[76] Holladay et al., 2020, (op. cit.)

[77] Faber et al., 2022, (op. cit.)

[78] Ibid.

[79] Ibid.

[80] Hileman J., 2018, Fuel Composition & Aircraft Emissions, presented to CAAFI Biennial General Meeting, December 4, 2018, available https://www.caafi.org/resources/pdf/3.2_SAJF_Benefits.pdf (last accessed April 1, 2022)

[81] ASCENT Project 39 Naphthalene Cost Benefit Analysis Description https://ascent.aero/project/naphthalene-removal-assessment/

Organization: Growth Energy

As the proposal and studies show, there are numerous negative health and environmental impacts from PM emissions from combustion in mobile sources. Low-carbon, plant-based biofuels are among the best and most cost-effective options for reducing both PM and greenhouse gas emissions in mobile sources including the aviation sector. [EPA-HQ-OAR-2019-0660-0204, p.1]

U.S.-based airlines used more than 18 billion gallons of jet fuel in 2019[1]. Accessing the aviation market through ethanol to sustainable aviation fuel (SAF) provides America's bioethanol industry the

opportunity to be utilized in more than just light-duty cars and trucks all while contributing to the rural economy and improving air quality. [EPA-HQ-OAR-2019-0660-0204, p.1]

As we have already seen with higher biofuel blends and light-duty vehicles, the use of sustainable aviation fuel (SAF) holds tremendous potential for reducing air pollution and improving our air quality. Ethanol to jet fuel as SAF has the potential to replace 50% of the petroleum used in jet fuel. While, thus far, the discussion has focused on the ability of SAF to significantly reduce greenhouse gas emissions to address climate change. However, there has been a great deal of research to show the reductions in other harmful pollutants through the expanded use of SAF including for this comment, PM emissions. [EPA-HQ-OAR-2019-0660-0204, pp.1-2]

A recent project from the Airport Cooperative Research Program for the National Academies of Science, Engineering, and Medicine on alternative jet fuel emissions, compiled SAF emissions data from 51 technical publications and then validated the expected results.[2] The in-depth analysis shows that at a 50% blend, SAF can reduce PM emissions by nearly 70%, sulfur by 37%, and carbon monoxide by 11%. These are meaningful reductions that would be a win-win for our environment, human health, and for our rural economy. [EPA-HQ-OAR-2019-0660-0204, p.2] [[See Docket Number EPA-HQ-OAR-2019-0660-0204,p.2 for a chart of Emissions Changes and Air Quality Impacts]]

With the appropriate investment in critical research and development, and the right policy environment, our industry can work to remove these harmful emissions from our aviation fleet. However, to achieve the Biden Administration's goal of three billion gallons of SAF production by 2030 and 35 billion gallons by 2050 to achieve net-zero GHG emissions in aviation, we will need game-changing solutions. [EPA-HQ-OAR-2019-0660-0204, pp.2-3]

3. Prioritizing Fuel Quality: As the agency considers PM emission standards for aircraft engines, it should examine and prioritize the benefits that can be achieved through the use of SAF. As has been researched, simply working to expand and maximize the use of SAF can significantly improve air quality and reduce PM emissions. [EPA-HQ-OAR-2019-0660-0204, p.3]

---

[1] "Airline Fuel Cost and Consumption (U.S. Carriers - Scheduled)," Bureau of Transportation Statistics: OST_R | BTS | Transtats.

[2] National Academies of Science, Engineering, and Medicine, "State of the Industry Report on Air Quality Emissions from Sustainable Alternative Jet Fuels", April 2018: State of the Industry Report on Air Quality Emissions from Sustainable Alternative Jet Fuels | Blurbs New | Blurbs | Publications (trb.org)

Organization: *Hazard, Thomas*

I think the only part that should be altered would be to set emission standards every year, each lower than the last. This would allow for more time to be allocated to research and design on safer engines. [EPA-HQ-OAR-2019-0660-0135, p.1]

Organization: *Huang, Wen-Yen*

There should be an incentive given by the EPA or FAA as the air carrier and the airport may be more willing to follow or make changes. [EPA-HQ-OAR-2019-0660-0149, p.1]

Organization: *Ilabdfara, Rasanjali*

Main Issues

The overall big concern regarding the aviation issue is that it's causing climate change to increase as well as our overall health. Looking more into specifics of how aviation has affected us I want to bring up two main topics: sound, water, and gas pollution. [EPA-HQ-OAR-2019-0660-0170, p.1] [[This comment can also be found in section 13 of the comment summary]]

Noise Pollution:

From take-off to landing aircraft engines tend to emit loud noises. Loud sounds, from aviation and others, give the potential to cause loss of hearing, interfere with communication and even cause changes in biological behavior, such as mating. This causes an issue for animals and humans as well. With such risks, it may eventually lead to less biodiversity among species. [EPA-HQ-OAR-2019-0660-0170, p.1]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

I. EPA Should Consider, and Evaluate the Costs and Benefits of, Regulatory Alternatives to the ICAO Standards [EPA-HQ-OAR-2019-0660-0182-A1, p.1]

Organization: *Kroeker, Anne*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp.56.]

Two-point-five particle emissions is really nothing. It's almost not worth spending time on because, besides not addressing the whole problem, it doesn't get to the ultra-fines. And even our HEPA filters, if you want to know that, we have them everywhere, and that's already accepted.

Organization: *National Association of Clean Air Agencies (NACAA)*

EPA states in the NPRM that it is conducting "a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity." The agency notes that the results "could help inform additional policies to reduce pollution in communities living in close proximity to airports."8 [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

NACAA acknowledges this demographic analysis and supports EPA's continuation of it. However, there is no need for EPA to wait until it completes this analysis to take additional action. [EPA-HQ-OAR-2019-0660-0177-A1, p.3] [[This comment also appears in sections 6.4 and 6.6]]

Finally, in addition to adopting more protective emission standards, EPA should consider additional policies to reduce emissions near and minimize impacts to overburdened communities nearby airports. [EPA-HQ-OAR-2019-0660-0177-A1, p.4] [[This comment also appears in section 6.4]]

For all three of these categories – new type aircraft designs, in-use production models and in-service engines – EPA should require the newest, cleanest aircraft engines and emission-reducing technologies. [EPA-HQ-OAR-2019-0660-0177-A1, p.4] [[This comment is repeated in section 8.2.]]

III. NACAA's Recommendations

Third, EPA should consider measures that take advantage of technology developments to reduce PM and other pollutants during takeoff, landing, taxiing and other air traffic operations and from auxiliary

power units (APUs). Such strategies include, among others, de-rated takeoff, accelerated implementation of Optimized Profile Descents, reduced power during taxiing, improved taxi time, reduced usage of APUs and transitioning APUs to zero-emission technologies. [EPA-HQ-OAR-2019-0660-0177-A1, p.4]

The agency should also explore the use of sustainable aviation fuel, which has the potential to yield substantial reductions in PM and sulfur oxides. [EPA-HQ-OAR-2019-0660-0177-A1, p.4] [[The comment also appears in section 13]]

Organization: *Palosaari, Kent*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, p. 52.] [[A portion of this comment appears in section 9.]]

I also want to make a comment on SAF. We don't know for sure that it will reduce the ultra-fine particulates that are especially damaging, and you're currently not even close to having it be the majority of any kind of flying fuel.

Organization: *Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way*

As we look beyond these proposed updated PM standards, the focus of our community collaboration centers on two areas: 1) sustainable aviation fuels (SAF) and 2) ultrafine particulates (UFP). With regard to SAF, we know that SAF not only reduces lifecycle carbon emissions but also emits significantly less UFP and Sulphur oxides (SOx), which benefits the global climate and local airport communities. For that reason, SEA has set a goal to fuel all aircraft at the airport with at least a 10% blend by 2028. We strongly support those provisions of the Build Back Better Act that would incentivize SAF production and infrastructure development, and we applaud the Biden Administration's Sustainable Aviation Fuel Grand Challenge and related actions. Without policy leadership, investment, and partnership at the federal level, it will be challenging to achieve necessary levels of SAF availability and affordability. If there are ways for EPA, SEA, and near-airport communities to work together to advance SAF implementation, we welcome further discussion. [EPA-HQ-OAR-2019-0660-0174-A1, p.2] [[A portion of this comment also appears in section 13]]

Organization: *Rosetta Advisory Services, Brussels*

The EPA docket explains that LTO aircraft operations give rise to both non volatile and volatile PM2.5. And justifies the US' failure to address the latter because they are "significantly influenced by the ambient conditions (or ambient air background composition) for which a test procedure to measure volatile PM has yet to be developed for aircraft engines". Yet volatile PM emissions are a function of fuel sulphur content (EASA non CO2 page 43) and can be reduced - readily and cheaply – by refinery hydrotreatment. Work funded by the FAA/EPA/Partner and QinetiQ for EASA made these findings clear over a decade ago. Bilateral EU/US discussion at the time failed to progress this work. [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

The docket omits to say that removal of black carbon/soot emissions from jet engines is, like sulphur, technically and economically feasible today. Not via engine standards, but by tackling fuel quality. More extensive refinery hydrotreatment or extractive distillation of fossil jet kerosene cuts/eliminates the aromatics/naphthalene which trigger soot. FAA funded MIT/Ascent work in 2020 makes this clear. The

hydrotreatment also means that the sulphur/SOx volatile PM disappears first – and for free - because the cleaner fuel's higher energy intensity means you burn less fuel. [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

In Europe, amendments to the Fit for 55 Fuel EU Aviation Regulation call for measures to first cut aromatics in Jet A1. A recent Dutch Government report suggests a cost as low as €10/tonne kerosene. The task now on both sides of the Atlantic is to overcome regulatory inertia and aviation/oil refiner resistance to such action. There can be no rational argument for leaving fossil kerosene fuel specifications untouched today while waiting 10-20 years for a progressive blend of SAF to slowly help reduce soot induced contrail formation. After all, SAF is only soot free because it is produced using the same hydrogenation/hydrotreatment process. HEFA requires possibly four times as much H2 as cutting aromatics in kerosene – less if you use palm oil feedstock… [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

At the February 2022 CAEP 12 meeting, USG promoted the use of "drop-in SAF blends resulting in a large reduction in fuel sulphur and aromatics, leading to lower sulphur and non-volatile particulate matter (NvPM) emissions. A reduction in these non-CO2 pollutants have a direct impact on air quality, health and climate impacts. These emissions also have an indirect impact on the formation of contrails and contrail radiative forcing." There was no USG acknowledgement that these same results can be achieved today through hydrotreatment of fossil kerosene. [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

Organization: *Service Employees International Union (SEIU)*

SEIU further calls on the EPA to consider additional policies to reduce emissions from airport pollution and minimize impacts to these negatively impacted communities. [EPA-HQ-OAR-2019-0660-0191-A1, p.2]

V. EPA Should Propose a Technology-Forcing Rule with Application to In-Service Engines

In keeping with its statutory mission and the Biden Administration's policy, we urge the EPA to adopt a stricter, technology-forcing standard, and to apply the particulate matter emissions standards to in-service engines. By doing so, the Agency will create real reductions in emissions and protect the health and welfare of airport workers and local airport communities. [EPA-HQ-OAR-2019-0660-0191-A1, p.5] [[This comment is repeated in section 8.2.]]

Organization: *Sierra Club*

In connection with the regulation of a different aircraft pollutant—greenhouse gas emissions—EPA issued an Advance Notice of Proposed Rulemaking in 2008 ("2008 ANPR"), seeking input on approaches of how emissions could be regulated under Section 231.[16] EPA's discussion and tentative conclusions about how to do so is relevant for PM emissions as well. In particular, the 2008 ANPR considered a wide range of available mechanisms, including reducing emissions from aircraft engines, regulating other parts of aircraft such as frames and design elements to increase aerodynamics and reduce fuel consumption, and, in collaboration with the Federal Aviation Administration, changing aircraft operations to increase efficiency.[17] It also went far beyond aircraft themselves, discussing "a continuum of regulatory approaches" ranging from "near- and long-term" emission standards to "emission averaging, banking and trading programs" applied to manufacturers and fleet operators "to provide more flexibility in phasing-in and phasing-out engine models."[18] Notably, the ANPR also considered standards for newly built airplanes in light of the fact that Section 231 applies to all aircraft, not only those newly produced.[19] While the 2008 ANPRM was concerned with greenhouse gas emissions, EPA's

discussion of the available emission reduction technologies and mechanisms under Section 231 also pertains to the reduction of PM emissions. EPA, however, considered none of them in the Proposal – not even standards limited to reducing emissions from aircraft engines themselves. [EPA-HQ-OAR-2019-0660-0184-A1, p.4]

EPA has long assumed that emission standards may be met through operational efficiencies where those would be more cost-effective than applying certain technologies to the engine itself,[60] and has set performance standards that offer flexibility as to the technologies used to achieve the standards. In connection with curbing aircraft greenhouse gas emissions, EPA specifically discussed "a declining fleet average emissions program" which would involve consideration of efficiency gains from improved "engine, aircraft and operational greenhouse gas control[s]."[61] In the greenhouse gas context, EPA also reiterated in 2015 that the "broad degree of discretion" afforded the agency under Section 231 enables reconciliation of ICAO's holistic "aircraft standards" with domestic standards "even if the GHG standards take a different form than the traditional thrust-based NOx aircraft engine standards."[62] EPA listed a wide range of technologies that can cost-effectively reduce emissions and that "illustrate that it is best to consider the aircraft as a whole in addressing CO2 emissions."[63] These considerations apply equally to PM emission reduction measures. [EPA-HQ-OAR-2019-0660-0184-A1, pp.16-17]

Operational improvements that reduce fuel consumption and therefore PM emissions should also be considered, including:

• Minimizing engine idling time on runways and employing single engine taxing;[64]

• Reducing engine thrust and reverse during high-intensity periods such as take-off and landing;[65]

• Optimizing timetables, route networks, and flight frequencies to reduce stopovers and select fuel-efficient routes;[66]

• Reducing the use of auxiliary power units;[67]

• Reducing the amount of excess fuel carried;[68]

• More regular maintenance and cleaning of engines and airframes to correct minor deterioration;[69] and

• Retiring older, more polluting aircraft in favor of newer, more efficient aircraft. [EPA-HQ-OAR-2019-0660-0184-A1, p.17]

EPA's failure to consider any of these available technologies and operational methods was arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0184-A1, p.17]

The final regulations should employ strong mechanisms to reduce emissions from aircraft and protect the public health and welfare, and EPA must consider the full panoply of available measures, including declining fleetwide emissions averages and operational and design improvements. [EPA-HQ-OAR-2019-0660-0184-A1, p.18] [[This comment can also be found in section 2.3 of the comment summary.]]

---

[16] 73 Fed. Reg. 44,354. *in-service*

[17] *Id*. at 44,470-71.

[18] *Id*. at 44,472.

[19] *Id*.

[60] 38 Fed. Reg. at 19,089 ("Commenters representing general aviation interests opposed the introduction of emission standards applicable to piston engine aircraft, on the arounds that compliance would require introductions of exhaust system reactors which would have drastic and costly effects on the configuration of the entire aircraft. The Agency has concluded that sufficient evidence is already available in the form of measured emissions data on current aircraft to indicate that the proposed standards can be met by improved fuel management and will not require exhaust system reactors.")

[61] 73 Fed. Reg. at 44,473. Section 231's language is similar to that in Section 202, under which EPA has historically employed a fleet-wide averaging approach to regulate of emissions from new motor vehicles. The D.C. Circuit has upheld this approach as lawful, emphasizing the "absence of any clear evidence that Congress intended to prohibit averaging" under section 202 and the strong policy arguments for adopting this approach. See NRDC v. Thomas, 805 F.2d 410, 425 (D.C. Cir. 1986).

[62] 80 Fed. Reg. at 37,794 n.227 (emphasis added).

[63] Id. at 37,797 (discussing use of advanced materials, new manufacturing processes, aircraft changes to improve propulsion and aerodynamics, and means to reduce drag and improve combustion and engine cycle refinements).

[64] Ian Waitz et al., Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions at 34 (Dec. 2004), available at: http://web.mit.edu/aeroastro/partner/reports/congrept_aviation_envirn.pdf [hereinafter "Aviation & the Environment"]; Center for Clean Air Policy & Northeast States for Coordinated Air use Management, Controlling Airport Related Pollution at III-7 to III-8 (June 2003), available at https://crp.trb.org/acrp0267/controlling-airportrelated-air-pollution/ [hereinafter "CCAP Report"].

[65] CCAP Report, supra note 62, at III-9.

[66] CCAP Report, supra note 62, at III-7 to III-11; see also Aviation & the Environment, supra note 62, at 34.

[67] Aviation & the Environment, supra note 62, at 34.

[68] Id.

[69] Id.

Organization: *Simons-Wilson, Alex*

I also encourage the EPA to find methods of increasing production and reducing costs of sustainable aviation fuels (SAF). [EPA-HQ-OAR-2019-0660-0147, p.1]

Organization: *Wagner, Debi*

The rulemaking, although acknowledging UFP and potential health effects to predominately low income minority population provides no information on whether EPA is working toward a new UFP standard. [EPA-HQ-OAR-2019-0660-0153-A1, p.2] [[This comment is repeated in 6.6.]]

Organization: *Wilson, Charles*

Commercial aviation and general aviation are generously subsidized by taxpayers in many ways. Airlines and aircraft and engine manufactures should return the favor by supporting fuel-use technology research. Incidentally, a United Airlines 737max recently flew from Chicago to Washington with one of its two engines powered only by used cooking oil. [EPA-HQ-OAR-2019-0660-0148-A1, pp.1-2]

EPA Response to Comments in Section 10

Comments related to regulating pollutants or chemicals that are not particulate matter are outside the scope of this rulemaking. However, the modification to 40 CFR Part 1030 to clarify the applicability of the EPA's airplane GHG standards cover all jet airplanes with an MTOM greater than 5,700 kg is within scope. The proposal did not reexamine or reopen the endangerment finding for greenhouse gases from aircraft, 81 FR 54421 (Aug. 15, 2016), or the first greenhouse gas standards for airplanes and airplane engines, 86 FR 2136 (Jan. 11, 2021), so comments on those topics are beyond the scope of this rulemaking. The EPA did not propose and is not finalizing any compliance mechanisms (including incentives and penalties related to compliance), and comments on that topic are beyond the scope of this rulemaking and appropriately directed to FAA's subsequent rulemaking under CAA section 232(a). Additionally, the EPA did not propose and is not finalizing any standard or regulation applicable to aviation fuel. Comments on that topic are beyond the scope of this rulemaking and are appropriately directed to any rulemaking undertaken by FAA under 49 U.S.C. section 44714. FAA, not EPA, generally has authority to establish compliance mechanisms for aircraft standards and to regulate aviation fuel. The EPA did not propose or take comment related to any provision of the Renewable Fuel Program in CAA section 211(o), and comments on that are outside the scope of this rulemaking. The proposal did not reexamine or reopen the endangerment finding for greenhouse gases from aircraft, 81 FR 54421 (Aug. 15, 2016), or the first greenhouse gas standards for airplanes and airplane engines, 86 FR 2136 (Jan. 11, 2021)

In response to comments on the topic of volatile PM, as described in the Preamble to the final rulemaking in Section III.A, the introductory paragraphs of Section IV, and Section IV.D.2, the EPA's rule adopts standards for the emission of nvPM, due to the difficulty in measuring volatile PM as described in section 4.2 of this response to comments document. Even so, Section III of the Preamble to the final rulemaking discusses impacts of total PM on air quality and public health. Also, it should be noted that, as discussed in Section VI.C of the Preamble to the final rulemaking, new technologies aimed at reducing aircraft engine NO_X also resulted in an order of magnitude reduction in non-volatile PM (nvPM) mass and nvPM number in comparison to most in-service engines. (ICAO, 2019: Independent Expert Integrated Technology Goals Assessment and Review for Engines and Aircraft, Document 10127. It is found on page 34 of the English Edition of the ICAO Products & Services 2022 Catalog and is copyright protected; Order No. 10127.)

The EPA responds to comments seeking more stringent PM standards than those proposed in the Preamble to the final rulemaking in Section IV.F.2, and to comments seeking standards applicability to in-service airplanes in section 3.2 of this document. For reasons discussed in Section IV.F.2 and in the introductory paragraphs of Section IV of the Preamble to the final rulemaking, the EPA sought to harmonize its regulations with those adopted by ICAO, including aligning on standards applicability. However, the EPA may consider broadening the applicability to include engines in smaller aircraft (or smaller engines) in the future. Commenters suggested several ways to address aircraft engine PM emissions that go beyond the proposed adoption of PM standards that match the ICAO standards, which include the following: implementing operational measures for aircraft (including the main aircraft engines and auxiliary power units) during landing and takeoff, changing aviation fuels (e.g., using sustainable alternative fuels, or hydrogen and reducing the sulfur levels in conventional jet fuel), electrification, utilizing airplane aerodynamic improvement and weight-reducing technologies, introducing increasingly stringent requirements over time, and imposing fleet average standards for

aircraft engines. While some or all of these potential measures could potentially address aircraft engine PM emissions, they would require substantial new data gathering, and technical, legal, and economic analysis. Even assuming the EPA had legal authority to implement the policy suggestions requested by the commenters to address PM emissions from aircraft engines, the EPA has not gathered data, conducted analyses of such data, or otherwise developed a record that could support the EPA finalizing a rule with standards reflecting these requested policies and regulatory approaches. Nor has the public been provided an opportunity to evaluate and comment upon these programs. Furthermore, such a record would include new analyses and assessment. Thus, the EPA does not, at this time, have a sufficient record of information to evaluate whether to propose future standards reflecting these measures. The EPA continues to believe that the appropriate approach at this time is to adopt PM standards that match the ICAO standards, an action that we believe is well justified by the information provided in this final rule.

On the matter of timing, the EPA was not unreasonably delayed in promulgating these PM standards. As noted in the Preamble to the proposed rulemaking, the EPA addressed the 2017 ICAO PM standard in 2018 through a formal Information Collection Request. 87 FR 6324, 6330 (Feb. 3, 2022); 83 FR 44621 (Aug. 31, 2018). Also in 2017, ICAO agreed upon the first-ever international CO_2 standards with international effective dates in 2020, 2023, and 2028. The EPA then conducted work to propose and promulgate the first-ever domestic airplane and airplane engine GHG standards. 85 FR 51556 (Aug. 20, 2020) (proposal); 86 FR 2136 (Jan. 11, 2021) (final). In 2020, ICAO agreed upon two more PM standards with an international effective date in 2023. After completing the airplane and airplane engine GHG standards rulemaking, the EPA proposed aircraft PM standards that matched ICAO's PM standards in early 2022 (87 FR 6324, Feb. 3, 2022) and is now in this action finalizing the same. During the development of the PM standards, the EPA was also devoting resources to complying with Executive Order 13990 (Jan. 20, 2021), litigation related to the GHG standards. *California v. EPA*, No. 21-1018 (D.C. Cir.) (and consolidated cases), and on-going work in ICAO/CAEP. Against this backdrop, the EPA appropriately allocated its resources for the GHG and PM rulemaking efforts.

Also, the U.S. aircraft engine manufacturers are urging the EPA to promptly promulgate this final rulemaking to adopt ICAO's standards, which were adopted back in 2020, citing potential competitive disadvantage concerns (see comments in Sections 2.2, 2.3, and 8.1 of this document). We have not yet provided that opportunity for public comment on the additional items described by other commenters, and attempting to do so now would in the EPA's view unacceptably slow down this rulemaking. In the interests of expediency and avoiding the U.S. failing to meet obligations under the Chicago Convention, we have decided that the most appropriate course for now, under CAA section 231, is to adopt aircraft engine PM standards that are harmonized with the standards adopted by ICAO in 2020 (in terms of stringency level, timing, scope, etc.).

As reiterated in section 6.4 of this document, the EPA did not solicit comment on the demographic analysis it is planning. See sections I.B.3, III.G, and VIII.J of the Preamble to the final rulemaking for discussion of this analysis.

11. Legal and Rulemaking Topics

11.1 CAA section 231 Statutory Authority

Organizations Included in this Section

Airlines for America (A4A)
Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)
Airport Impact Relief, Inc. (AIR, Inc.)
Barnes, Miki
Batra, Neelesh
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Center for Biological Diversity et al.
Environmental Defense Fund (EDF)
General Electric Company (GE)
National Association of Clean Air Agencies (NACAA)
Service Employees International Union (SEIU)
Sierra Club

Organization: Airlines for America (A4A)

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 49-50.] [[This comment is repeated in sections 2.1, 2.4, and 8.1.]]

Second, A4A strongly supports the proposal to adopt the aircraft PM certification standards as agreed by the International Civil Aviation Organization -- ICAO. The ICAO process for setting aircraft standards is rigorous and ensures they are technically sound. Further, the ICAO criteria for adopting such standards align with the criteria under Section 231 of the U.S. Clean Air Act. Even more critically, the standards will ensure that aviation safety is maintained even as environmental progress is ensured.

As acknowledged in the proposal, it is critical to the competitiveness of the U.S. aircraft and aircraft engine manufacturers that the U.S. follow these international standards which, in turn, improve airlines' ability to acquire U.S.-manufactured aircraft and help foster competitive market prices. Experts from the USEPA and Federal Aviation Administration played leading roles in the ICAO process leading to the adoption of the PM standard. A4A participated as an observer. These efforts ensured that ICAO's PM standard incorporated all of these critical features and -- so that it could be adopted into U.S. law.

Organization: Airlines for America (A4A) and Air Line Pilots Association, International (ALPA)

Perhaps most critically, the adoption into U.S. law of aircraft engine PM standards that are equivalent to the ICAO Aircraft Engine PM Standards will ensure that aviation safety is maintained even as environmental progress continues. [EPA-HQ-OAR-2019-0660-0192-A1, p.1] [[This comment is repeated in section 2.1]]

1. A4A AND ALPA STRONGLY SUPPORT INCORPORATION OF THE ICAO AIRCRAFT ENGINE PM

STANDARDS INTO U.S. LAW

A4A and ALPA very strongly support the proposal to adopt the ICAO Aircraft Engine PM Standards into U.S. law for several reasons. [EPA-HQ-OAR-2019-0660-0192-A1, p.5]

A. Adoption into U.S. Law of PM Emissions Standards that are Equivalent to the ICAO Aircraft Engine PM Standards is Consistent with the Authority Conferred on EPA by Section 231 of the CAA

The ICAO Aircraft Engine PM Standards clearly meet the criteria for adoption of aircraft engine standards set out in section 231 of the CAA. As EPA highlights in the preamble to the Proposed Rule, the ICAO Aircraft Engine PM Standards resulted from an intense, multi-year effort within ICAO to assess aircraft engine technologies, develop the metrics for evaluating PM emissions, and agree on the applicability, timing, and stringency of the standards. The technical grounding for the standards was established through many meetings of the ICAO/CAEP. Upon recommendation of the standards by CAEP in 2016 and 2019, the ICAO Council reviewed and voted to adopt the standards in 2017 and 2020. The ICAO Aircraft Engine PM Standards were formally adopted into ICAO's Standards and Recommended Practices ("SARPs") and are codified in Annex 16, Volume II of the Chicago Convention. [EPA-HQ-OAR-2019-0660-0192-A1, p.5]

As a result, there is no doubt that the ICAO Aircraft Engine PM Standards (and associated test procedures) are technically sound.[15] In addition, there is no doubt that the standards are consistent with the Terms of Reference ("TOR") for CAEP, which provide that such standards must be technologically feasible, economically reasonable, environmentally beneficial, and balanced against interdependencies (aircraft noise and competing emission reductions of other pollutants, such as NOx).[16] [EPA-HQ-OAR-2019-0660-0192-A1, p.6]

Critically, the CAEP TOR align well with the criteria EPA must follow pursuant to CAA section 231, and ICAO's assessment of each element of the TOR is directly related to the decisions EPA must make when adopting aircraft engine emission standards. Section 231(b) requires any engine emissions standard to allow sufficient lead time "to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period." Due to the rigorous performance criteria required of aircraft dictated by safety imperatives and the need to match aircraft mission capability to demand, the process involved in designing, certifying, and building new aircraft and aircraft engines is inherently lengthy. In addition, section 231(a)(2)(B)(ii) expressly prohibits changes in engine emission standards that "would significantly increase noise and adversely affect safety."[17] [EPA-HQ-OAR-2019-0660-0192-A1, p.6]

Also particularly relevant here is that, as EPA explains in the preamble, ICAO/CAEP evaluates "technological feasibility" using the Technological Readiness Level ("TRL") scale and deems technologies that have attained TRL8 (defined as the "actual system completed and 'flight qualified' through test and demonstration") to be "technologically feasible."[18] Use of TRL8 to evaluate "technological feasibility" thus ensures emissions standards reflect what aircraft technologies can safely deliver, rather than hypothetical "technology forcing" standards that could pose a potential threat to air safety. [EPA-HQ-OAR-2019-0660-0192-A1, p.6] [[This comment can also be found in section 10.3 of the comment summary]]

EPA affirms the "long-established ICAO/CAEP terms of reference were taken into account when deciding the international PM standards, principal among these being technical feasibility."[19] Given the close relationship between the criteria it must follow under CAA section 231 and the ICAO/CAEP TOR, it is

clear that the comprehensive technical and economic data and analyses developed by CAEP to support its standards are more than sufficient to support the adoption of those standards into U.S. law. [EPA-HQ-OAR-2019-0660-0192-A1, p.6] [[This comment is also in section 2.1]]

---

[15] As EPA notes, CAEP provided a summary of its analysis and findings regarding the PM standards in ICAO, 2019: Report of the Eleventh Meeting, Montreal, 4-15 February 2019, Committee on Aviation Environmental Protection, Document 10126, CAEP/11.

[16] The CAEP TOR are available at https://www.icao.int/environmental-protection/Pages/Caep.aspx#ToR.

[17] CAA section 231(c) creates an additional mechanism to ensure aircraft engine emission standards are not inconsistent with the imperative to maintain air safety, providing that any requirements promulgated pursuant to section 231 "shall not apply" if the Secretary of Transportation makes a finding that the regulation "would create a hazard to aircraft safety" and the President disapproves the requirement after public notice and comment.

[18] 87 Fed. Reg at 6347-48.

[19] Id. at 6347

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

As the NPRM notes, section 231(a)(2)(A) of the Clean Air Act (CAA) directs the Administrator of EPA to, "from time to time, propose aircraft engine emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonably be anticipated to endanger public health or welfare". A plain reading of that language requires the EPA to make the necessary determination of the need for and level of emissions control that are required, not to delegate that responsibility to CAEP. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[This comment can also be found in sections 2.4, 2.5, and 11.2 of the comment summary]]

In section II.A EPA Statutory Authority and Responsibilities Under the Clean Air Act, the NPRM restates the directive in the Clean Air Act that the agency administrator "propose aircraft engine emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonably be anticipated to endanger public health or welfare". Nowhere in that section, however, could we find a statutory directive for EPA to protect the US engine manufacturing industry from competitive commercial disadvantage. The is assumption that EPA has a role in protecting US manufacturers from competition is reminiscent of the long standing conflict in various FAA authorizing statutes dating from 1950 that established dual mandate for FAA to promote aeronautics as well as to regulate safety. That conflict was resolved in section 401 of the 1996 FAA reauthorization, which deleted the mandate to "promote". We urge EPA to remain focused on its responsibility to protect the public health or welfare. [EPA-HQ-OAR-2019-0660-0175-A1, pp.3-4]

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

Second, as explained in Section III, the Proposed Rule fails to satisfy EPA's duty to issue protective standards that reasonably respond to the dangers of aircraft PM emissions.[2] [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5]

By elevating a nonstatutory policy preference to restrict domestic standards to ICAO standards above the actual factors Congress directed EPA to consider, EPA violates its duty under Clean Air Act section 231 to protect the public health and welfare and acts arbitrarily. [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5] Finally, the Proposed Rule suffers additional legal flaws that would render its final adoption arbitrary and capricious, including EPA's failure to accurately evaluate and redress the cumulative and disproportionate impacts of aircraft emissions on environmental justice communities and evaluate federalism implications according to its own stated practices. [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5]

Accordingly, the Commenting States request that EPA rescind the Proposed Rule and issue a revised Notice of Proposed Rulemaking that assesses all of the environmental justice implications of aircraft emissions, evaluates the full range of feasible options for effective emissions control, and proposes emission standards that actually reduce dangerous PM emissions from aircraft. [EPA-HQ-OAR-2019-0660-0203-A1, p.5]

II. AIRCRAFT PARTICULATE MATTER EMISSIONS CREATE AND EXACERBATE ENVIRONMENTAL INEQUITIES IN ENVIRONMENTAL JUSTICE COMMUNITIES

Section 231 of the Clean Air Act directs EPA to regulate dangerous aircraft emissions based on a diligent investigation of these emissions' harmful impacts in air quality control regions across the United States. 42 U.S.C. § 7571(a)(1)(A), (2)(A), (3); see Part III.A, infra. [EPA-HQ-OAR-2019-0660-0203-A1, p.5]

III. EPA'S FAILURE TO CONSIDER FEASIBLE REDUCTIONS IN PARTICULATE MATTER EMISSIONS IS UNLAWFUL AND ARBITRARY

The Clean Air Act requires EPA to adopt aircraft emission standards to address pollution that endangers the public health and welfare, based on the factors specified in section 231: pollution impacts, the technological feasibility of controlling the emissions, lead time, costs, noise, and safety. 42 U.S.C. § 7571(a)(1), (a)(2), (b), (c). Yet the Proposed Rule grounds its PM emission standards solely in EPA's policy preference to "harmonize" U.S. standards with ICAO's 2017 and 2020 PM standards. Disregarding Congress's mandatory factors in favor of a nonstatutory "harmonization" goal and the wholly ineffectual ICAO PM Standards, as proposed, would violate section 231. Furthermore, such a rule would "run[] counter to the evidence before the agency," "rel[y] on factors which Congress has not intended it to consider," and "entirely fail[] to consider an important aspect of the problem" and therefore be arbitrary and capricious. *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 43 (1983). [EPA-HQ-OAR-2019-0660-0203-A1, p.13]

A. Under Section 231, EPA must base its emission standards on the danger of the pollutant and the technological feasibility of control

1. The plain language of Section 231 requires EPA to base standards on the factors set out in statute, including pollution impacts and technological feasibility

Section 231 directs EPA to issue "appropriate" emission standards for emissions from aircraft engines that endanger public health and welfare. 42 U.S.C. § 7571(a)(2)(A), (a)(3). Accordingly, those emission standards must represent EPA's reasoned response to the danger posed by the regulated emissions. [EPA-HQ-OAR-2019-0660-0203-A1, pp.13-14]

In developing its emission standards, EPA must be guided by the statutory factors that Congress set out in Section 231. Subsection (a)(1) directs EPA to study and investigate aircraft emissions, particularly "(A) the extent to which such emissions affect air quality in air quality control regions throughout the United States, and (B) the technological feasibility of controlling such emissions." Id. § 7571(a)(1). Subsection (a)(2) requires EPA to issue proposed emission standards for "air pollution which may reasonably be anticipated to endanger public health or welfare" and to consult with the Federal Aviation Administration (FAA) and ensure the proposed standards do not significantly increase aircraft noise or adversely impact safety. Id. § 7571(a)(2)(A), (B). Subsection (a)(3) requires EPA to hold hearings on the proposed standards "in air quality control regions which are most seriously affected by aircraft emissions," and then to "issue such regulations with such modifications as [EPA] deems appropriate." Id. § 7571(a)(3). In setting the compliance dates for these emission standards, EPA must give enough lead time "to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period." 42 U.S.C. § 7571(b). Finally, the FAA may veto emission standards that "would create a hazard to aircraft safety." Id. § 7571(c). [EPA-HQ-OAR-2019-0660-0203-A1, p.14]

"These provisions, all of which use compulsory language, together create a comprehensive scheme for the regulation of harmful aircraft emissions, of which paragraph 231(a)(2)(A) is the centerpiece." *Center for Biological Diversity v. EPA*, 794 F. Supp. 2d 151, 160 (D.D.C. 2011). EPA and the D.C. Circuit have confirmed that the above provisions set out the factors that EPA must "weigh . . . in arriving at appropriate standards": (1) the impacts of emissions on public health and welfare, including air quality; (2) the technological feasibility of controlling these emissions; (3) lead time; (4) compliance costs; (5) aircraft noise and safety. *Nat'l Ass'n of Clean Air Agencies v. EPA*, 489 F.3d 1221, 1229-30 (D.C. Cir. 2007) ("NACAA").[46] EPA's duty to regulate dangerous aircraft emissions under Section 231 is separate and independent of the United States' obligations regarding ICAO standards under the Chicago Convention.[47] [EPA-HQ-OAR-2019-0660-0203-A1, p.14]

EPA contends that Section 231 "confers an 'extraordinarily broad' degree of discretion on EPA to 'weigh various factors' and adopt aircraft engine emission standards as the Agency determines are reasonable." 87 Fed. Reg. at 6327 (citing NACAA, 489 F.3d at 1229-30). Yet, however broad, EPA's discretion under Section 231 must be exercised according to the factors set out in Section 231, which inform what kind of standards EPA can determine to be "reasonable," see id., and "appropriate" under subsection (a)(3). See *Center for Biological Diversity*, 794 F. Supp. 2d at 160 (finding Section 231 provision authorizing EPA emission standards "cannot be understood without reference to the provisions around it"). Moreover, EPA's discretion is at all times constrained by the broad anti-pollution goals of the Clean Air Act. *Del. Dept. of Natural Res. & Envtl. Control v. EPA*, 905 F.3d 90, 97 (D.C. Cir. 2018) (courts construe provisions of Clean Air Act according to "the language and design of the statute as a whole"). Thus, the impacts of emissions on public health and welfare, including air quality and the technological feasibility of controlling these emissions, must inform the standards EPA adopts. [EPA-HQ-OAR-2019-0660-0203-A1, p.15]

2. The legislative history of Section 231 confirms EPA's selection of emission standards must be tied to the statutory factors of pollution impacts and technological feasibility

Section 231 as it now reads is primarily a product of the 1970 Clean Air Act amendments, Pub. L. 91-604, 84 Stat. 1676 (Dec. 31, 1970). The history of those amendments confirms that EPA must base its aircraft standards, at minimum, on its reasoned consideration of pollution impacts and technological feasibility. [EPA-HQ-OAR-2019-0660-0203-A1, p.15]

Most of Section 231's operative language represents a compromise between the 1970 House and Senate bills to amend the Clean Air Act. While the House bill preserved language from a prior version of the statute requiring "appropriate consideration to technological feasibility and economic costs,"[48] the Senate bill deleted this language and instead prioritized pollution reduction needs: as the accompanying Senate report stated, "standards should be a function of the degree of control required, not the degree of technology available today."[49] The conference substitute, which became law, omitted the House language but added three requirements that neither bill had featured: (1) an EPA study of the effect of aircraft emissions on air quality and the availability of emission control technology; (2) public hearings in regions where air quality is most affected by aircraft emissions; and (3) effective dates that provide necessary lead time to develop and apply requisite technology.[50] [EPA-HQ-OAR-2019-0660-0203-A1, p.15]

Because the conference substitute represents a compromise between the House and Senate bills, the only logical way to read these three requirements is that they strike a balance between the House amendments' solicitude for technological feasibility and costs, on the one hand, and the Senate amendments' prioritization of pollution reduction needs, on the other. The final law thus directs EPA to study both air quality impacts and technological feasibility, with the necessary premise that such study should inform the standards themselves. As the Secretary of Health, Education, and Welfare told both houses: "[W]e are conducting and supporting research [on] aircraft emissions and to explore various means of controlling gaseous emissions … . We will seek prompt application of new knowledge that is obtained."[51] The second and third requirements likewise convey a particular attention to the impacts of pollution and the state of emission control technology. [EPA-HQ-OAR-2019-0660-0203-A1, p.16]

An alternative reading—one that allows EPA, after dutifully studying pollution impacts and the existing and projected state of control technologies, to jettison these considerations and base emission standards on a policy preference never mentioned in the Clean Air Act—not only cuts against the plain text of Section 231 but is also wholly contrary to the manifest intent of Congress in adopting these provisions. [EPA-HQ-OAR-2019-0660-0203-A1, p.16]

B. Failure to adopt or even consider standards that reduce particulate matter emissions violates Section 231 and is arbitrary and capricious

By considering only PM standards that do not reduce PM emissions, EPA has violated Section 231 and failed to consider an "important aspect of the problem." State Farm, 463 U.S. at 43. EPA's analysis shows that the Proposed Rule does not result in any PM reductions over current levels, because all currently existing aircraft engines already meet the proposed standards. EPA has embraced these zero-benefit standards despite acknowledging the severe and inequitably distributed health and environmental effects of PM pollution and the existence of current and projected jet engine technology that significantly outperforms the ICAO PM Standards. Moreover, by confining the Proposed Rule to the

same constraints that ICAO imposed in developing the ICAO PM Standards, EPA has ignored other, promising approaches to PM control, including fuel burn reductions and alternative fuels. [EPA-HQ-OAR-2019-0660-0203-A1, p.17] [[This comment is repeated in section 11.3.]]

1. EPA has examined only standards that result in no PM emission reductions

The Proposed Rule's stated purpose is to adopt PM standards that "are equivalent in scope, stringency, and effective date to the PM standards adopted by ICAO." 87 Fed. Reg. at 6326. But because the ICAO PM Standards by design carry no environmental benefits, EPA is proposing to adopt completely ineffectual standards, without regard to whether protective standards are required by Section 231's mandatory factors. [EPA-HQ-OAR-2019-0660-0203-A1, p.18]

EPA has provided no alternative analysis that considers any more stringent version of the PM standards. Thus, the only analysis of the Section 231 factors in the Proposed Rule consists of measuring the ICAO PM Standards under these factors. And because all existing aircraft engines already comply with these standards, this analysis is trivial: zero emission reductions, zero technology response from manufacturers, zero lead time needed, zero costs, zero effect on noise or safety. See 87 Fed. Reg. at 6347-49. This is far from the analysis that Section 231 envisions, in which the full range of technologically feasible emission standards are explored and a balance struck based on the statutory factors. The proposed standards, if adopted, would thus be contrary to Section 231 and arbitrary and capricious. Cf. *Sw. Elec. Power Co. v. EPA*, 920 F.3d 999, 1022 (5th Cir. 2019) (finding EPA's "choice of an outdated and ineffective technology" in setting Clean Water Act standards was arbitrary and capricious). [EPA-HQ-OAR-2019-0660-0203-A1, pp.18-19]

---

2. By failing to consider any technologically feasible alternatives likely to result in meaningful emission reductions, EPA is proceeding in a manner "untethered to Congress's approach"

Despite its failure to conduct any meaningful analysis of the statutory factors, the Proposed Rule itself shows that more stringent standards are feasible. Figures IV-1 to IV-3 of the Proposed Rule show a large number of jet engines already in production perform better than the ICAO PM Standards by orders of magnitude, whether measured by mass, number, or mass concentration. 87 Fed. Reg. at 6338-41. And EPA itself identifies several of the jet engine technologies supporting these superior levels of PM emission performance, including lean-burn technologies and advanced rich-quench-lean (RQL) combustion designs. Id. at 6348.[54] [EPA-HQ-OAR-2019-0660-0203-A1, p.19] [[This comment is repeated in section 11.3]]

The record shows that not only are more stringent PM standards technologically feasible, they are imperative to protect the public health and welfare and advance EPA's environmental justice commitments. As described above, the Proposed Rule itself acknowledges the significant health and environmental effects of PM and cites compelling evidence that these effects disproportionately fall on the communities of color and low-income communities that live, work, and go to school near major airports, where aircraft PM emissions tend to concentrate. Id. at 6331-33, 6335. Yet not only does the Proposed Rule offer ineffectual standards; EPA does not even evaluate whether alternative, more stringent standards were appropriate. This failure is arbitrary and completely "untethered to Congress's

approach" in Section 231. *Nat. Res. Def. Council v. EPA*, 777 F.3d 456, 469 (D.C. Cir. 2014). [EPA-HQ-OAR-2019-0660-0203-A1, p.19] [[This comment is repeated in section 11.3.]]

Further, it is particularly irrational—and contrary to Section 231—to defer so heavily to ICAO's technological review, because ICAO explicitly limits its deliberations to technology-following standards, based on its particular view of "technical feasibility." 87 Fed. Reg. at 6329. In fact, the Independent Expert Assessment cited by EPA identifies a number of promising control strategies while deeming them insufficiently advanced to study.[55] However, Section 231 directs EPA to set its standards according to technology expected to be developed and proven in the future, provided that EPA allows manufacturers sufficient lead time. 42 U.S.C. § 7571(b). By limiting its own consideration to ICAO's narrower scope of technical feasibility, EPA has failed to apply Section 231's factors to the record rationally and in accordance with the statute. [EPA-HQ-OAR-2019-0660-0203-A1, pp.19-20]

First, "uniformity in international aviation regulations and standards" is not a goal of the Clean Air Act. Indeed, in the context here, it actively undermines the Clean Air Act's purposes. It is unlawful and arbitrary to substitute this uniformity goal for the factors Congress actually specified in Section 231. See *Indep. U.S. Tanker Owners Comm. V. Dole*, 809 F.2d 847, 854 (D.C. Cir. 1987) (EPA "is not free to substitute new goals in place of the statutory objectives without explaining how these actions are consistent with [its] authority under the statute."). An agency may not simply rubber-stamp international standards in lieu of its mandate in the name of "harmonization." *Natural Res. Def. Council v. EPA*, 808 F.3d 556, 570 (2d. Cir. 2015) (EPA's adoption of International Maritime Organization's (IMO) standards for certain discharges was arbitrary, where EPA failed to explain "why standards higher than the IMO Standard should not be used given available technology"); see also *U.S. Telecomm Ass'n v. FCC*, 359 F.3d 554, 565-66 (D.C. Cir. 2004) ("[D]elegation to outside entities increases the risk that these parties will not share the agency's 'national vision and perspective,' . . . and thus may pursue goals inconsistent with those of the agency and the underlying statutory scheme."). [EPA-HQ-OAR-2019-0660-0203-A1, pp.21-22] [[This comment is repeated in section 2.5.]]

---

[2] The Commenting States have no objection to EPA's decision to reformulate PM controls in terms of the proposed PM mass, PM number, and PM mass concentration metrics. See 87 Fed. Reg. at 6337-41. However, as set forth below, emission reductions that far exceed the Proposed Rule are technologically feasible and necessary to meaningfully control PM emissions.

[46] See also Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards & Test Procedures, 86 Fed. Reg. 2136, 2157 (Jan. 11, 2021) ("EPA interprets its authority under Section 231 to be somewhat similar to those provisions that require us to identify a reasonable balance of specified emissions reduction, cost, safety, noise, and other factors.").

[47] The Chicago Convention on International Civil Aviation, 15 U.N.T.S. 295 (Dec. 7, 1944), established the International Civil Aviation Organization (ICAO) to coordinate the regulation and development of international air navigation. Its Committee on Aviation Environmental Protection (CAEP) develops and recommends international standards for noise and emissions from aircraft engines; once ICAO adopts these standards, member nations must adopt domestic standards that are "at least as stringent as" ICAO's "minimum standards" in order to maintain their fleets' permission to fly in other states' airspace. Chicago Convention, art. 33. However, any member nation is free to adopt their own, more stringent emission standards. Id. art. 38; see infra Part III.C.

[48] Motor Vehicle Air Pollution Control Act of 1965, Pub. L. 89-272, § 202(a), 79 Stat. 992 (Oct. 20, 1965); see H.R. 17255, 91st Cong., § 231(a) (Jun. 3, 1970), reprinted in 2 LEG. HIST. OF THE CLEAN AIR ACT AMENDMENTS OF 1970 ("LEG. HIST."), at 935 (1970).

[49] S. Rep. No. 91-1196, at 24, 1 LEG. HIST. at 424; see S. 4358, 91st Cong. § 202(a) (Sept. 17, 1970), 1 LEG. HIST. at 575.

[50] H.R. Rep. No. 91-1783, at 55 (Conf. Rep.), 1 Leg. Hist. at 205; see Pub. L. 91-604, 84 Stat. 1703-1704 (Dec. 31, 1970).

[51] Air Pollution–1970, Hearings on S. 3229, S. 3466, S. 3546 Before the Subcomm. On Air and Water Pollution of the S. Comm. Of Public Works, 91st Cong. 140 (1970) (statement of Hon. Robert H. Finch, Secretary of Health, Educ. & Welfare), 2 LEG. HIST. at 980 (emphasis added); accord Air Pollution Control and Solid Wastes Recycling: Hearings Before the Subcomm. On Public Health and Welfare of the H. Comm. On Interstate and Foreign Commerce, 91st Cong. 290 (1969) (statement of Secretary Finch), 2 LEG. HIST. at 1371.

[54] EPA appears not to have performed its own review of PM reduction technology—there is no technical support document—but rather relied on ICAO's technology review, most of which is confidential and based on data presented by the aviation industry. Id.; see also ICAO, Independent Expert Integrated Technology Goals Assessment and Review for Engines and Aircraft, Document 10127, at 50 (2019) ("Independent Expert Assessment") (noting limits on information and access provided by industry to confidential PM data).

[55] Independent Expert Assessment, p. 49 ("The IE review of the research program covered multi-point lean direct injection (LDI), active combustor control, fuel composition optimization, improved diagnostics and design tools, and combustor materials. All but the first of these technologies were judged to be at too low a [technology readiness level] and firmly outside of the scope of the review.").

Organization: *Center for Biological Diversity and Friends of the Earth*

To fulfill the requirements of Section 231 of the Clean Air Act and the guiding objective of the Act to "prevent" pollution, EPA is required to set standards that reduce harmful emissions from aircraft.[1] Yet the Biden administration continues to embrace weak, industry-developed standards that do not improve air quality at all.[2] Like the 2021 greenhouse gas emissions standards that the Biden administration is defending in court,[3] EPA's Proposal here does not reduce emissions. [EPA-HQ-OAR-2019-0660-0189-A1, p.1]

EPA has rubberstamped international standards that intentionally lag behind current pollution control technologies, making no effort to study alternatives that would decrease emissions. [EPA-HQ-OAR-2019-0660-0189-A1, p.1] [[The comment is repeated in section 2.3]]

As described below, the Proposal violates the Clean Air Act and is arbitrary and capricious. EPA should replace the Proposal with strong, technology-forcing standards to advance environmental justice and demonstrate international leadership. [EPA-HQ-OAR-2019-0660-0189-A1, p.1]

III. The Proposal Violates Section 231 of the Clean Air Act.

The Proposal violates the Clean Air Act because it fails to reduce aircraft-related PM emissions or even consider the factors set out in Section 231. [EPA-HQ-OAR-2019-0660-0189-A1, p.7]

The purpose of the Clean Air Act is to protect the public health and welfare through the prevention of air pollution.[51] To further this purpose, in 1971, EPA determined that PM harmed the public health and welfare and promulgated its first national ambient air quality standards for PM.[52] Thereafter, in 1973,

EPA found that aircraft-related PM emissions harm the public health and welfare and set emission standards under Section 231.[53] Since 1973, the EPA has strengthened ambient air quality standards multiple times in recognition of its significant health and environmental impacts and last year announced that "available scientific evidence and technical information indicate that the current standards may not be adequate to protect public health and welfare."[54] Similarly, with this Proposal, EPA continues to acknowledge that aircraft-related PM emissions "endanger the public health and welfare," and cites to numerous studies emphasizing that PM is more harmful and its damage more certain than was previously understood.[55] [EPA-HQ-OAR-2019-0660-0189-A1, p.7]

Despite the Clean Air Act's primary goal to prevent air pollution, Section 231(a)(2)(A)'s requirement that EPA set emission standards for air pollutants from aircraft that "may reasonably be anticipated to endanger public health or welfare,"[56] and EPA's acknowledgement that aircraft-related PM emissions harm the public health and welfare, the Proposal does nothing to reduce PM emissions.[57] The new standards will not "produce any emission reductions, beyond the business-as-usual fleet turn over that would occur absent of the proposed standards."[58] Without any emission reductions, the Proposal cannot address the growing harms to public health and welfare from airplane PM pollution. [EPA-HQ-OAR-2019-0660-0189-A1, p.7]

EPA notes that Section 231 does not require it to obtain the "greatest degree of emission reduction achievable,"[59] but this does not give EPA license to issue standards that entirely fail to reduce emissions.[60] Nor does it give EPA the ability to ignore other considerations set out in Section 231, such as the "technological feasibility of controlling . . . emissions" that affect air quality.[61] In fact, Section 231(b) provides that standards should take effect "after such period as [EPA] finds necessary . . . to permit the development . . . of the requisite technology."[62] Thus, EPA should have considered technology that is currently available as well as technology that may reasonably be developed and deployed within a given time frame but which is not yet available.[63] EPA did not do that here; it conducted no analysis of options that could control PM emissions and analyzed the ICAO standards in only a cursory manner, to show that aircraft engines already meet them.[64] [EPA-HQ-OAR-2019-0660-0189-A1, pp.7-8]

EPA justifies its action by noting it has "greater flexibility" under Section 231 than other sections of the Clean Air Act that require EPA to obtain the ''greatest degree of emission reduction achievable,'' and explaining that it is not required "to give subordinate status to factors such as cost, safety, and noise in determining what standards are reasonable."[65] While EPA is permitted to weigh other factors, it cannot give emission reduction no weight at all.[66] Moreover, EPA does not explain anywhere in the Proposal why "cost, safety, and noise" justify the standards. It never considers those factors. Instead, EPA attempts to graft the adoption of international standards onto the framework of Section 231 without applying any of the factors Congress set out in the section. Whatever discretion is afforded to EPA in adopting aircraft emissions standards, it does not encompass a rule that fails to achieve any reduction in PM emissions. And EPA's discretion certainly does not encompass a rule that fails to even consider standards that could achieve reductions. [EPA-HQ-OAR-2019-0660-0189-A1, p.8]

IV. The Proposal is Arbitrary and Capricious

An agency's rule is arbitrary and capricious when the agency has "relied on factors which Congress did not intend it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that

it could not be ascribed to a difference in view of the product of agency expertise."[67] [EPA-HQ-OAR-2019-0660-0189-A1, p.8]

A. The Proposal is arbitrary and capricious because it fails to consider EPA's duty to reduce PM emissions to protect public health and welfare, or other factors set forth in Section 231.

EPA has a duty under the Clean Air Act to reduce or prevent pollution consistent with the goal of protecting public health and welfare. This Proposal fails to fulfill this duty or explain why technological infeasibility, cost, noise, safety, or any other factor laid out in the statute prevented EPA from setting standards to address harmful PM emissions. EPA's analysis is untethered to the Clean Air Act's emission-reduction purpose as outlined in the statute and which EPA emphasized when setting its initial aviation smoke standards; that proposal acknowledged the importance of standards under Section 231 to address regional air quality challenges around airports.[68] Here, EPA admits that the proposed standards are not expected to reduce pollution or improve air quality near airports.[69] The factors set out in the statute are "important aspects of the problem" that EPA has ignored.[70] EPA's failure is particularly egregious in this rulemaking because there is ample evidence that if EPA had performed any analysis, it would have found that technology exists to cost-effectively reduce emissions.[71] [EPA-HQ-OAR-2019-0660-0189-A1, pp.8-9]

C. The Proposal is arbitrary and capricious because EPA relies on factors Congress did not intend to be considered.

EPA states that the purpose of the Proposal is "international harmonization of aviation requirements," and also claims that the standards are "anti-backsliding."[76] Yet international harmonization is not a factor Congress identified for setting emission limits under Section 231— nor is it even expected by the Chicago Convention. Moreover, EPA's assertion that the Proposal adopts "anti-backsliding" standards is misleading. [EPA-HQ-OAR-2019-0660-0189-A1, p.9]

EPA has some discretion under Section 231 to consider cost, safety, and noise when setting standards.[84] However, EPA has not tied the development of the Proposal to these factors. EPA relies on factors outside the scope of Section 231 and prioritizes them over EPA's statutory obligations. It is arbitrary and capricious for EPA to prioritize the harmonization of international aviation standards over its statutory duty to protect the public health and welfare. [EPA-HQ-OAR-2019-0660-0189-A1, pp.10-11]

D. The Proposal is arbitrary and capricious because it failed to consider alternatives.

EPA is "required to address common and known or otherwise reasonable options, and explain any decision to reject such options."[85] The Proposal does not offer any alternatives to the proposed standards. Instead, EPA states that it "considered whether to propose more stringent standards," but decided to adopt the ICAO's standards because "international uniformity and regulatory certainty are important elements of these proposed standards."[86] EPA provides no further information about the more stringent standards it supposedly "considered" but rejected before formally developing them into a viable alternative. The agency offers no insight into how much those standards would reduce emissions and how many aircraft engines would already meet them. This is improper. In order to weigh the costs and benefits of a rule and determine that it is reasonable, it is essential to consider alternatives. This is especially true here, where the statutory factors that should have been considered include emissions-reduction-potential, feasibility, and cost—factors that cannot be properly weighed

without considering a range of options. EPA has failed to meaningfully consider and provide reasonable alternatives to the proposed standards, and such a failure is arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0189-A1, p.11]

VII. EPA Should Replace the Proposal with a Rule that Complies with Section 231 and Basic Requirements of the Administrative Procedure Act.

The Proposal violates Section 231 of the Clean Air Act because it fails to reduce particulate matter emissions from aircraft when cost-effective technology is available to safely do so. EPA did not even consider the statutory factors laid out in Section 231 and made no attempt to look at any alternative. Instead, it relied on factors outside the statute. Adoption of ICAO's emission standards was the purpose of the regulation, and the description of those standards was the entirety of the agency's analysis. The flaws in this approach cannot be remedied in a final rule. EPA must therefore replace the Proposal with one that meets its duties under the Clean Air Act to reduce emissions from aircraft and protect the public health and welfare. [EPA-HQ-OAR-2019-0660-0189-A1, p.17] [[This comment can also be found in section 2.3 of the comment summary]]

---

[1] 42 U.S.C. § 7401.

[2] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures, 87 Fed. Reg. 6,324, 6,327, 6,336 (Feb. 3, 2022) (to be codified at 40 C.F.R. pts. 87, 1030, 1031).

[3] California v. EPA, No. 21-1018 (D.C. Cir.); Center for Biological Diversity v. EPA, No. 21-1021 (D.C. Cir.).

[51] 42 U.S.C. § 7401(b)-(c).

[52] National Primary and Secondary Ambient Air Quality Standards, 36 Fed. Reg. 8,186, 8,187 (Apr. 30, 1971).

[53] Emission Standards and Test Procedures for Aircraft, 38 Fed. Reg. 19,088 (July 17, 1973).

[54] U.S. EPA, EPA to Reexamine Health Standards for Harmful Soot that Previous Administration Left Unchanged, Press Release (June 10, 2021), https://www.epa.gov/newsreleases/epa-reexamine-health-standards-harmful-sootprevious-administration-left-unchanged.

[55] 87 Fed. Reg. at 6,327, 6,331; see Memorandum, supra footnote 5.

[56] 42 U.S.C. § 7571(a)(2)(A).

[57] 87 Fed. Reg. at 6,324.

[58] Id. at 6,347.

[59] Id. at 6,327 (citing 42 U.S.C. § 7547(a)(3)).

[60] See National Association of Clean Air Agencies (NACAA) v. EPA, 489 F. 3d. 1221, 1230 (D.C. Cir. 2007) (Court held that EPA's NOX emission standards under Section 231 were not required to be more stringent because "to the extent that §231 requires rules promulgated thereunder to tighten emissions standards, the Final Rule in fact does so by 16%.").

[61] 42 U.S.C. § 7571(a)(1)(b).

[62] 42 U.S.C. § 7571(b).

[63] Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,087, 19,089 (July 17, 1973).

[64] Control of Air Pollution from Aircraft Engines: Emission Standards and Test Procedures Proposed Rule, 87 Fed. Reg. 6,324, 6,338, 6,339, 6,341 (Feb. 3, 2022).

[65] 87 Fed. Reg. at 6,327.

[66] See NACAA v. EPA, 489 F.3d at 1226 ("EPA interprets its authority under section 231 to be somewhat similar to those provisions that require us to identify a reasonable balance of specified emissions reduction, cost, safety, noise, and other factors.").

[67] Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983).

[68] 37 Fed. Reg. at 26,488.

[69] 87 Fed. Reg. at 6,327.

[70] State Farm, 463 U.S. at 29.

[71] See infra Section VI.

[76] 87 Fed. Reg. at 6,326.

[85] Int'l Ladies' Garment Workers' Union v. Donovan, 722 F.2d 795, 818 (D.C. Cir. 1983).

[86] 87 Fed. Reg. at 6,337.

Organization: *Center for Biological Diversity et al.*

Yet EPA rubberstamped the standards without even studying options that would require more, rationalizing that the rule would "promote international harmonization" and "avoid placing U.S. manufacturers at a competitive disadvantage." Under the Clean Air Act, these industry-friendly rationales cannot replace EPA's obligation to protect public health and welfare by reducing and preventing pollution. EPA's guiding principle must be effective pollution reduction, not "harmonization" with ineffective international standards. [EPA-HQ-OAR-2019-0660-0185-A1, p.3]

Organization: *Environmental Defense Fund (EDF)*

I.a. EPA is authorized to promulgate standards more stringent than ICAO standards.

EPA is specifically authorized, and in fact required, to promulgate standards for aircraft engine emissions. Section 231 of the Clean Air Act (CAA) grants EPA the authority to "issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines," which are determined by EPA to cause or contribute to "air pollution which may reasonably be anticipated to endanger public health or welfare."[34] [EPA-HQ-OAR-2019-0660-0207-A1, pp.5-6]

Additionally, as an International Civil Aviation Organization (ICAO) Member State, the United States has committed to "adopt and put into operation the appropriate standard systems . . .which may be recommended or established [by ICAO] from time to time."[35] The United States is only able to fulfill its commitment if the administrator of EPA works with the Secretary of Transportation to issue emission standards and "prescribe regulations to insure compliance with all standards."[36] [EPA-HQ-OAR-2019-0660-0207-A1, p.6]

As mentioned above, section 231 of the CAA expressly states, "the Administrator [of EPA] shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any

class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare."[44] [EPA-HQ-OAR-2019-0660-0207-A1, p.7]

III. EPA has authority under the CAA to promulgate stringent emissions standards that foster new technologies and fuel, and can do so in consultation with the Administrator of the Federal Aviation Administration (FAA) under Sec. 232 of the CAA and 49 U.S.C. 44714.50

As EPA asserts in the current proposed rule, EPA is authorized to consider a wide range of methods for achieving reductions in aircraft engine emissions.[51] Section 231 of the CAA does not specify how standards promulgated by EPA must be formulated.[52] Moreover, the lack of statutory specifics has in fact been interpreted to grant EPA significant discretion in how it chooses to promulgate standards.[53] EPA itself has noted that "the U.S. Court of Appeals of the District of Columbia has held that [Sec. 231] confers an unusually broad degree of discretion on the EPA to adopt aircraft engine emissions standards as the agency determines are reasonable."[54] Consequently, EPA is empowered to consider a variety of possible methods that may reduce "the emission of any air pollutant" which "in [the Administrator's] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare,"[55] even though the reductions may occur outside of the immediate class or classes of engines which emit those pollutants. [EPA-HQ-OAR-2019-0660-0207-A1, pp.7-8]

Section 231 requires EPA to promulgate standards that are applicable to aircraft engine emissions of air pollutants determined to cause or contribute to "air pollution which may reasonably be anticipated to endanger public health or welfare," such that the standards result in the reduction or elimination of those pollutants. However, EPA's proposed standard does not do so. In fact, it does not achieve any reductions in the pollutants beyond those already expected. EPA must consider and adopt options which would actually reduce the danger to public health. As stated in *Nat'l Ass'n of Clean Air Agencies v. EPA*, "Congress has delegated expansive authority to EPA to enact appropriate regulations applicable to the emission of air pollutants from aircraft engines."56 [EPA-HQ-OAR-2019-0660-0207-A1, p.8]

"[Section] 231 requires rules promulgated thereunder to tighten emission standards," but does not necessarily require such standards to be technology-forcing.[57] Provided standards promulgated by EPA achieve the goal of addressing the endangerment, and that the EPA Administrator consult with the Administrator of the Federal Aviation Administration and avoid standards that would "significantly increase noise or adversely affect safety,"[58] EPA has broad latitude to craft a standard that will actually significantly protect public health, spur technology development for airplane engines and airframes, and provide flexibility, enabling industry to meet even tighter emissions standards.[59] [EPA-HQ-OAR-2019-0660-0207-A1, p.8]

---

[34] 42 U.S.C. § 7571(a)(2)(A).

[35] ICAO, 2006: Convention on International Civil Aviation, 9th ed., Doc. 7300/9, Art. 28. Available at: https://www.icao.int/publications/Documents/7300_cons.pdf (last accessed April 1, 2022).

[36] 42 U.S.C. §§ 7571(a)(2)(B)(i), 7572(a).

[44] Id.

[50] A current example is EPA's evaluation of emissions from piston-engine aircraft operating on leaded fuel, as announced on January 12, 2022. https://www.epa.gov/newsreleases/epa-evaluate-whether-lead-emissions-piston-engine-aircraftendanger-human-health-and

[51] 85 Fed. Reg. 51562.

[52] See id; 42 U.S.C. § 7571.

[53] Nat'l Ass'n of Clean Air Agencies, 489 F.3d at 1230.

[54] 85 Fed. Reg. 51561

[55] 42 U.S.C. § 7571(a)(2)(A).

[56] 489 F.3d 1221, 1230 (D.C. Cir. 2007).

[57] Id.

[58] 42 U.S.C. § 7571(a)(2)(B)(ii).

[59] See id.

Organization: General Electric Company (GE)

1. EPA's proposal is consistent with the Clean Air Act

Section 231 of the CAA directs EPA to, from time to time, propose aircraft engine emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonable be anticipated to endanger public health or welfare.[5] Public comments on the proposed standards must be considered, but EPA need only makes changes that it "deems appropriate."[6] The D.C. Circuit ruled in 2007 that Section 231 of the CAA confers a broad degree of discretion on EPA in establishing airplane emission standards.[7] Consequently, EPA's proposal to control nvPM emissions in a manner identical to ICAO's standards is well within its broad legal discretion. [EPA-HQ-OAR-2019-0660-0183-A1, pp.4-5]

Section 231 of the CAA requires EPA to consider noise, safety, and cost in developing aircraft standards. However, this section is different than other CAA provisions, which require explicit performance standards.[8] Congress charged EPA with proposing emission standards for aircraft, in consultation with the FAA Administrator, and to "not change the aircraft engine emission standards if such change would significantly increase noise and adversely affect safety."[9] Additionally, Congress made clear that proposed standards should take effect after the EPA Administrator, with consultation from the Secretary of Transportation, gives "appropriate consideration to the cost of compliance within such period."[10] [EPA-HQ-OAR-2019-0660-0183-A1, p.5]

Here, EPA properly weighed these factors through its participation in the development of the nvPM standards with ICAO. At the CAEP/11 meeting in 2019, ICAO's Committee on Environmental Protection (CAEP) agreed to three different forms of international nvPM standards for aircraft engines: a PM mass concentration standard (μg/m³), a PM mass standard (mg/kN), and a PM number standard (#/kN), applying its "terms of reference" which consider technical feasibility, economic reasonableness, and environmental interdependencies (such as trade-offs between noise and emissions, and between CO2 emissions and other emissions).[11] These criteria correlate with the noise, safety, and cost factors under

Section 231 of the CAA, thus showing EPA's proposal is consistent with Section 231. [EPA-HQ-OAR-2019-0660-0183-A1, p.5]

---

[5] 42 U.S.C. 7571(a)(2)(A).

[6] 42 U.S.C. 7571(a)(3).

[7] National Association of Clean Air Agencies v. EPA, 489 F.3d 1221, 1229-30 (D.C. Cir. 2007) ("When Congress enacted § 231 providing that the Administrator could, 'from time to time,' act 'in his judgment,' as 'he deems appropriate,' it conferred broad discretion to the Administrator to weigh various factors in arriving at appropriate standards.").

[8] E.g., 42 U.S.C. 7521(l)(2) (requiring EPA to set standards for hazardous air pollutant emissions from motor vehicles and motor fuels that "reflect the greatest degree of emission reduction achievable through the application of technology which will be available" after consideration of specified factors).

[9] 42 U.S.C. 7571(a)(2)(B)(ii).

[10] 42 U.S.C. 7571(b).

[11] See ICAO, CAEP Terms of Reference, available at https://www.icao.int/environmentalprotection/Pages/Caep.aspx. See also ICAO, 2016 Environmental Report, The CAEP/10 Recommendation on New ICAO Aeroplane CO2 Emissions Standard (2016) at 113 (available at https://www.icao.int/environmentalprotection/Documents/EnvironmentalReports/2016/ENVReport2016_pg112-114.pdf); 85 Fed. Reg. 51,556, at 51,560 (Aug. 20, 2020).

Organization: *National Association of Clean Air Agencies (NACAA)*

II. EPA Has Clear Authority to Adopt Standards More Stringent than ICAO's

EPA is in no way limited by ICAO's BAU, technology-following standards. The agency has authority under Clean Air Act (CAA) Section 231 to adopt standards more stringent than ICAO's. The only limits placed on the establishment or amendment of U.S. aircraft standards are that such standards not significantly increase noise or create hazards to aircraft safety. [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

In 2007, the U.S. Court of Appeals for the D.C. Circuit put a fine point on this when it held that CAA Section 231(a)(2)(A) confers broad discretion on EPA to weigh relevant factors and adopt aircraft engine emission standards as the agency determines are reasonable.[9] EPA proposes to codify ICAO standards that incorporate only technology that existed at the time of their adoption by ICAO in 2017 and 2020. This proposal is not reasonable, considering the scale of the pollution and its impacts and the availability of current and near-term technologies and measures to effectively reduce it. [EPA-HQ-OAR-2019-0660-0177-A1, p.3]

---

[9] *Nat'l Ass'n of Clean Air Agencies v. EPA*, 489 F.3d 1221, 1229–30 (D.C. Cir. 2007)

Organization: *Service Employees International Union (SEI)*

IV. The Clean Air Act and Current Executive Orders Demand Stricter Standards

Under the Clean Air Act (the "Act"), the EPA is tasked with the prevention of pollution. Specifically, one of the key purposes of the Act is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare." [19] [EPA-HQ-OAR-2019-0660-0191-A1, p.4]

In proposing a standard that fails to reduce emissions, fails to adequately protect public health, and fails to address the disproportionate impact of these emissions on low-income and communities of color, the EPA has fallen short of these mandates. [EPA-HQ-OAR-2019-0660-0191-A1, p.5] [[This comment is repeated in section 11.5]]

---

[19] 42 USC §740\(b)(I).

Organization: Sierra Club

II. Statutory and Regulatory Background

A. Clean Air Act Section 231

The Clean Air Act[8] requires EPA to regulate the emission of pollutants from aircraft engines. Section 231(a) directs the Administrator to study and investigate (a) the extent to which they affect air quality in the United States and (b) the technological feasibility of controlling them.[9] Based on its findings, EPA "shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare."[10] If the Administrator determines that emissions from aircraft engines contribute to air dangerous pollution, he or she must issue proposed standards to regulate these pollutants.[11] [EPA-HQ-OAR-2019-0660-0184-A1, p.3]

EPA first regulated emissions from aircraft engines under Section 231 in 1973.[12] As part of this first rulemaking, EPA determined that what it then called "smoke" emissions—in light of the fact that PM reduces visibility—violated national ambient air quality standards in a number of air quality control regions, and that those smoke emissions endangered public health and welfare.[13] And it determined that airports and aircraft either were already, or projected to become, significant sources of those emissions.[14] Following up, EPA first regulated aircraft PM emissions under Section 231 in the early 1980s in the form of "smoke" standards.[15] [EPA-HQ-OAR-2019-0660-0184-A1, p.3 and 4]

III. The Proposal Violates Section 231 of the Clean Air Act.

When it passed the Clean Air Act, Congress was specific about its purpose: the Act "promote[s] reasonable Federal, State, and local government actions . . . for pollution prevention."[25] Congress specifically defined "pollution prevention" as the "reduction or elimination, through any measure, of the amount of pollutants produced or created at the source."[26] To implement this purpose, the Clean Air Act's provisions require EPA to determine whether pollutants emitted by specified sources contribute to the endangerment of human health and welfare, and then issue emission standards to reduce them. The purpose of EPA's standard setting under the Act thus is not merely to mirror an ever upwards-pointing

curve of pollution increases, or even to hold the pollution level steady, but to reduce or eliminate pollution from sources subject to regulation altogether. [EPA-HQ-OAR-2019-0660-0184-A1, p.6]

A. The Regulatory Purpose and Requirements of Section 231.

Section 231. Section 231 carries out this purpose for aircraft emissions. It provides "a comprehensive scheme for the regulation of harmful aircraft emissions, of which paragraph 231(a)(2)(A) is the centerpiece."[27] EPA has specifically recognized that its "duties regarding aircraft air pollution emissions under CAA section 231 reflect a combination of the CAA's goals to protect public health and welfare and encourage improved emissions performance."[28] [EPA-HQ-OAR-2019-0660-0184-A1, p.6]

Congress was prescriptive about the steps EPA must take to regulate harmful aircraft pollution and the factors it must consider in doing so. First, EPA "shall" investigate emissions of aircraft pollutants to "determine (A) the extent to which such emissions affect air quality … and (B) the technological feasibility of controlling such emissions." 42 U.S.C. § 7571(a)(1)(A), (B). Based on those determinations, EPA "shall" then propose standards for any pollutant that it finds contributes to pollution endangering the public health and welfare. 42 U.S.C. § 7571(a)(2)(A). The standards EPA adopts may not significantly increase aircraft noise or adversely affect safety. 42 U.S.C. §7571(a)(2)(B)(i), (ii). And lastly, EPA must make its regulation effective "after such period as the Administrator finds necessary … to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance." 42 U.S.C § 7571(b). [EPA-HQ-OAR-2019-0660-0184-A1, p.6 and 7]

The factors EPA must analyze in seeking to reduce aircraft emissions are thus clearly identified: the extent of the harm the emissions cause; the technological feasibility of reducing them; the time needed to develop and apply the requisite technology; the cost of compliance; and the implications on safety and noise. See *Kingdomware Technologies, Inc. v. United States*, 579 U.S. 162, 172 (2016) ("[I]t is generally clear that 'shall' imposes a mandatory duty."); *Ctr. For Biological Diversity*, 794 F. Supp. 2d at 160 (Section 231's "provisions, all of which use compulsory language, together create a comprehensive scheme for the regulation of harmful aircraft emissions;" "Congress's use of 'shall' throughout subsection 231(a) suggests that it intended to mandate a certain outcome—the regulation of harmful aircraft emissions."). The failure to do so is unlawful. See *Util. Air Regul. Grp. V. EPA*, 573 U.S. 303, 328 (2014) ("[A]n agency may not rewrite clear statutory terms to suit its own sense of how the statute should operate.") [EPA-HQ-OAR-2019-0660-0184-A1, p.7]

Legislative history. The history of Section 231 further demonstrates Congress's intent to prompt effective and forward-looking technology-based regulatory action to reduce air pollution. See *Nat. Res. Def. Council v. EPA*, 725 F.2d, 761, 770 (D.C. Cir. 1984) (legislative history shows the Clean Air Act's primary emphasis is air pollution reduction). In 1970, Congress applied that objective to the regulation of mobile sources, giving EPA the authority to "set air pollution emission standards for aircraft."[29] Notably, Section 231's current language is the result of a conference reconciliation of differing texts provided by the House and Senate as part of the 1970 Clean Air Act amendments, Pub. L. 91-604, 84 Stat. 1676 (Dec. 31, 1970). While the House bill would have required only "appropriate consideration to technological feasibility and economic costs," Motor Vehicle Air Pollution Control Act of 1965, Pub. L. 89-272, § 202(a), 79 Stat. 992 (Oct. 19, 1965); see Pub. L. 91-604, 84 Stat. 1676, 1703-1704, the Senate bill pushed EPA much further. It omitted the House language and instead prioritized harm reduction and attention to future technological feasibility by adding three new requirements that appear in Section 1 today. EPA must: (1) study and determine the effect of aircraft emissions on air quality and the

technological feasibility of controlling them, (2) hold public hearings in regions where aircraft emissions most affect air quality, and (3) set effective dates that provide the time needed to develop and apply the requisite technology. H.R. Rep. No. 91-1783, at 55 (Dec. 17, 1970) (Conf. Rep.); see Pub. 91-604, 84 Stat. 1676, 1703-1704. The report accompanying the Senate bill spelled out the intent behind these changes: aircraft standards should be "a function of the degree of control required, not the degree of technology available today." National Air Quality Standards Act of 1970, Report of the Committee on Public Works, United States Senate together with Individual Views to Accompany, S. 4358, 91 Cong., Rep. No. 91-1196, at 24 (1970) (emphasis added). [EPA-HQ-OAR-2019-0660-0184-A1, p.7]

Section 231's legislative history confirms what the text of Section 231 plainly states: EPA is to set standards after analyzing not merely presently available technology, but the degree of harm aircraft pollution inflicts and the technology that can be developed and applied in the future to reduce it. As EPA explained in its very first rulemaking under Section 231, "the standards set by EPA may reflect technology which may reasonably be obtained within a given time frame but which is not yet available."[30] EPA does not have to "demonstrate that a [necessary] technology is currently available universally or over a broad range of aircraft" to require implementation of its standards.[31] [EPA-HQ-OAR-2019-0660-0184-A1, p.7 and 8]

B. EPA's Failure to Engage with Section 231's Statutory Factors and Illegal Substitution of its own Policy Choices to Upend Congressional Intent.

The Proposal does nothing to reduce PM emissions from aircraft beyond the status quo, even though EPA acknowledges the harm PM emissions do to public health and welfare. Indeed, EPA clearly explains that the Proposal would have no such effect, stating that the Proposal "reflects[s] the current state of technology," is "technology following" [32] to align with ICAO, does not "result in further reductions in PM" and has no costs. 87 Fed. Reg. at 6326, 6327, 6348. EPA equally and frankly states it does not anticipate any improvement of air quality for the vulnerable populations living near airports. Id. These proposed outcomes are unlawful because EPA never engaged in any way with the factors Section 231 instructs it to analyze, and instead substituted its own policy goals, undermining Congress's intent. [EPA-HQ-OAR-2019-0660-0184-A1, p.8]

Instead of considering aircraft PM emissions' harms, the technical feasibility of reducing it, the time needed to develop and apply the requisite technology, and costs, safety and noise impacts as Section 321 instructs, EPA redefined the Proposal's regulatory purpose, declaring it to be the achievement of "uniformity" in international aviation regulation. 87 Fed. Reg. at 6326. EPA states uniformity "ensures that passengers and the public can expect similar levels of protection for safety and human health and the environment regardless of manufacturer, airline, or point of origin of a flight," and helps to "reduce barriers in the global aviation market, benefiting both U.S. aircraft engine manufacturers and consumers." Id. But EPA fails to cite any U.S. statute from which to derive that purported regulatory objective – and none exist. This is a fatal error: no agency may act in the absence of Congressional authority. *NRDC v. NHTSA*, 894 F.3d. 95, 108 (2nd Cir. 2018) ("[a]n agency may only act within the authority granted by the statute"). [EPA-HQ-OAR-2019-0660-0184-A1, p.8]

Emission harm reduction. In a subheading entitled "Projected Reductions in PM Emissions," id. at 6347, EPA simply states that there will be none because the Proposal is technology-following and all covered aircraft already meet it. EPA does not relate emission harms to the Proposal or Section 231's statutory purpose – other than to acknowledge that emissions will be left unabated. Id. at 6348. Nor is the

Proposal accompanied by a Technical Support Document or even a single alternative considering a more stringent rule. EPA never considers what it might do to try to mitigate the emissions' harm despite the commands in Section 231(a)(1)(A) (requiring a study and investigation of the extent to which aircraft PM emissions affect public health and welfare). 42 U.S. § 7571. That is a stark departure from usual EPA remaking and falls far short of statutory requirements. [EPA-HQ-OAR-2019-0660-0184-A1, p.9] [[This comment can also be found in section 7.2 of the comment summary]]

EPA completely ignored Section 231(a)(1)(B)'s focus on controlling emissions. [EPA-HQ-OAR-2019-0660-0184-A1, p.9]

The Proposal relies on *National Ass'n of Clean Air Agencies v. EPA*, 489 F.3d 1221 (D.C. Cir. 2007) ("NACAA") to claim broad discretion in setting aircraft emission standards— which it apparently believes are broad enough to substitute EPA's interest in international standards uniformity for Section 231's mandates. But NACAA provides no such license. In NACAA, EPA issued a rule increasing the stringency of aircraft nitrogen oxide emissions standards by 16 percent that also brought the United States' standard in line with the ICAO standard. Id. at 1225. In challenging EPA's rule, Petitioner argued that Section 231 compels EPA to set technology-forcing standards, prioritize emission reductions over any of the other specific statutory factors, and exclusively consider factors enumerated in the statute. Id. at 1229- 30. The court rejected this statutory interpretation, observing that "in the absence of clear congressional direction to the contrary, we will not deprive the agency of the power to fine-tune its regulations." Id. at 1230 (quoting *George E. Warren Corp. v. EPA*, 159 F.3d 616, 623-24 (D.C. Cir. 1998)). The court deferred to EPA's interpretation that Section 231 "require[s] [EPA] to identify a reasonable balance of specified emissions reduction, cost, safety, noise, and other factors," id. at 1226, 1230, and held that EPA's rule, which tightened emissions standards by 16 percent, was reasonable. Id. at 1230. [EPA-HQ-OAR-2019-0660-0184-A1, p.10]

The agency here contends that NACAA allows it to issue "reasonable aircraft engine standards with either technology-following or technology-forcing results," provided it "has a reasonable basis after considering all the relevant factors for setting the standard." 87 Fed. Reg. at 6327. EPA is incorrect in asserting that NACAA endorsed technology-following standards, as the rule at issue there increased the stringency of aircraft Nox emission standards. More importantly, EPA did not actually consider, let alone analyze, any of the factors enumerated in Section 231, nor proffer a reasonable basis for adopting ICAO's technology-following standards. Rather than using its interest in international uniformity to potentially "fine-tune" a balanced consideration of all of the statutory factors, EPA jettisoned those factors altogether and instead based the Aircraft Rule exclusively on adopting the ICAO standards. That decision was unlawful. NACAA, 489 F.3d at 1230; NRDC, 777 F.3d at 468. [EPA-HQ-OAR-2019-0660-0184-A1, p.10]

An agency rule is arbitrary and capricious "if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise."[34] EPA's reasoning to support its Proposal is arbitrary and capricious for each of these reasons. [EPA-HQ-OAR-2019-0660-0184-A1, p.11]

A. The Proposal fails to consider the agency's duty to seek to reduce PM emissions to protect public health and welfare.

EPA has an obligation under the Clean Air Act to seek to reduce or prevent harmful pollution consistent with the goal of protecting public health and welfare. The Proposal fails to fulfill this duty. [EPA-HQ-OAR-2019-0660-0184-A1, p.11]

Clean Air Act Section 231 is intended to promote the "public health [and] welfare,"[35] and imposes on EPA a duty to reduce these emissions.[36] Yet even while EPA's Proposal lists the harms PM emissions from aircraft cause to public health and welfare, the Proposal deliberately adopts standards designed not to do anything at all about them and ignores the factors the statute commands it to analyze. For these reasons, the Proposal is a clear example of arbitrary agency decision-making:

As the Supreme Court stated in State Farm, an agency's rule normally is arbitrary and capricious if it "entirely failed to consider an important aspect of the problem" before it. 436 U.S. at 43. A statutorily mandated factor, by definition, is an important aspect of any issue before an administrative agency, as it is for Congress in the first instance to define the appropriate scope of an agency's mission. When Congress says a factor is mandatory, that expresses its judgment that such a factor is important. In accordance with this principle, we have held that "the complete absence of any discussion" of a statutorily mandated factor "leaves us with no alternative but to conclude that [the agency] failed to take account of this statutory limit on [its] authority," making the agency's reasoning arbitrary and capricious.[37] [EPA-HQ-OAR-2019-0660-0184-A1, p.11]

At a minimum, under Section 231, EPA had to explain why more stringent standards could not be adopted, but it gave no such explanation because it never considered any alternative to ICAO standards. [EPA-HQ-OAR-2019-0660-0184-A1, pp.12-13]

EPA has discretion under Section 231 to consider cost, safety, and noise when setting emission standards,[43] and must determine whether the effective date of a regulation "permit[s] the development and application of the requisite technology."[44] However, EPA has not tied the purpose of the Proposal to these factors in any way. A decision that balances the cost of imposing requirements that would reduce emissions against the potential safety and environmental benefits is different from a decision to dismiss any standard that diverges from a do-nothing international standard as categorically harmful to manufacturers and therefore unworthy of consideration. EPA is not permitted to prioritize factors that are irrelevant to its duties under Section 231 of the Clean Air Act. [EPA-HQ-OAR-2019-0660-0184-A1, p.13]

G. The Proposal did not consider technology-forcing alternatives.

Congress intended the Clean Air Act to be a technology forward-looking, or forcing, statute, and Section 231 in particular gives EPA the ability to establish standards based on "the degree of control required" to address the "contribution of moving sources to deterioration of air quality."[70] In describing EPA's responsibilities with respect to aircraft emissions in 1970, the Senate noted that EPA is "expected to press for the development and application of improved technology rather than be limited by that which exists."[71] [EPA-HQ-OAR-2019-0660-0184-A1, p.17]

The statute itself provides that standards should take effect "after such period as [EPA] finds necessary . . . to permit the development . . . of the requisite technology."[72] Thus, as EPA explained in its first

rulemaking under Section 231, "the standards set by EPA may reflect technology which may reasonably be obtained within a given time frame but which is not yet available."[73] EPA in 2005 again confirmed its authority to implement a "technology-forcing standard," and the agency need not "demonstrate that a [necessary] technology is currently available universally or on a broad range of aircraft" to require implementation of its standards, so long as "sufficient lead time" is provided.[74] EPA's failure to consider technology-forcing alternatives, and its additional failure to explain why it did not, render the Proposal arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0184-A1, p.18]

---

[5] See Brandon Graver et al., CO2 emissions from commercial aviation, 2018 at 1-2 (Int'l Council on Clean Transp. Sept. 2019), available at https://theicct.org/sites/default/files/publications/ICCT_CO2-commercl-aviation-2018_20190918.pdf [hereinafter "Graver 2019"].

[6] Xinyi Zheng & Dan Rutherford, Fuel burn of new commercial jet aircraft: 1960 to 2019 at 1 (Int'l Council on Clean Transp. Sept. 2020), available at https://theicct.org/publications/fuel-burn-new-comm-aircraft-1960-2019-sept2020 [hereinafter "Zheng 2020"].

[7] See Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare and Advance Notice of Proposed Rulemaking, 80 Fed. Reg. 37,758, 37,788 (July 1, 2015).

[8] 42 U.S.C. §§ 7401 et seq.

[9] Id. § 7571(a)(1).

[10] Id. § 7571(a)(2)(A).

[11] Id. § 7571(a)(2).

[12] Control of Air Pollution from Aircraft and Aircraft Engines, Proposed Standards, 37 Fed. Reg. 26,488 (Dec. 12, 1972).

[13] Id.

[14] Id.

[25] 42 U.S.C. § 7401(c).

[26] 42 U.S.C. § 7401(a)(3).

[27] *Center for Biological Diversity v. U.S. EPA*, 794 F. Supp. 2d 151, 160 (D.D.C. 2011).

[28] Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare, 81 Fed. Reg. 54,422, 54,425 (Aug. 15, 2016); *see* also 42 U.S.C. § 7401(b).

[29] National Air Quality Standards Act of 1970, Report of the Committee on Public Works, United States Senate together with Individual Views to Accompany, S. 4358, 91 Cong., Rep No. 91-1196, at 23-24, (1970). https://hdl.handle.net/2027/uc1.b4131893?urlappend=%3Bseq=2%3Bownerid=9007199270393584-6

[30] Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,087, 19,089 (July 17, 1973); see also 70 Fed. Reg. at 69,676 ("forward-looking language" of section 231 does not preclude EPA from setting a technology-forcing standard).

[31] 70 Fed. Reg. at 69,676.

[32] EPA states that "all future new type engines would meet the proposed new type standards." 87 Fed. Reg. at 6347. "There are a few in-production engines that do not meet the proposed new type standards, but since in-production engines would not be subject to these new type standards," manufactures need not make any improvements to their aircraft. Id.

[34] *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 43 (1983).

[35] See 42 U.S.C. § 7571(a)(2)(A).

[36] Center for Biological Diversity v. EPA, 794 F. Supp. 2d 151, 159-62 (D.D.C. 2011).

[37] Public Citizen v. Federal Motor Carrier Safety Admin., 374 F.3d 1209, 1216 (D.C. Cir. 2004) (quoting United Mine Workers v. Dole, 870 F.2d 662, 673 (D.C. Cir. 1989)).

[43] Nat'l Ass'n of Clean Air Agencies v. EPA, 489 F.3d 1221, 1230 (2007).

[44] 42 U.S.C. § 7571(b).

[70] National Air Quality Standards Act of 1970, Report of the Committee on Public Works United States Senate together with Individual Views to Accompany S. 4358 at 24, 91st Cong., 2nd Session, Report No. 91-1196.

[71] Id.

[72] 42 U.S.C. 7571(b).

[73] 38 Fed. Reg. at 19,089.

[74] 70 Fed. Reg. at 69,676 ("forward-looking language" of Section 231 does not preclude EPA from setting a technology-forcing standard, and "the Agency is not limited in identifying what is 'technologically feasible' as what is already technologically achieved").

EPA Response to Comments in Section 11.1

These comments, as related to statutory interpretation of CAA section 231 and the nature of the ICAO negotiations, are addressed in in the Preamble to the final rulemaking in Sections IV.F.1 and IV.F.2. Comments on the topic of the administrative record are addressed in the response in section 11.3 in this document.

The EPA makes a few more remarks in response to these comments here.

In response to the characterization of *Center for Biological Diversity v. EPA*, 794 F. Supp. 2d 151 (D.D.C. 2011) by commenters, the EPA notes that case did not in any way address the substantive requirements of CAA section 231, and ruled only on the questions of whether EPA (1) had a duty to make a prerequisite finding of whether aircraft greenhouse gas emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, and (2) if such a duty existed, had EPA unreasonably delayed making the prerequisite judgment. The court ruled EPA had a duty, but found the EPA had not unreasonably delayed discharging it. *Center for Biological Diversity v. EPA* states at most that EPA has a duty to "regulat[e]" harmful aircraft emissions it determines cause or contribute to endangering air pollution; the court in fact affirmed that CAA section 231's mandatory language "does not rob EPA of regulatory discretion; on the contrary, … section 231 'confer[s] broad discretion to the Administrator to weigh various factors in arriving at appropriate standards' for aircraft

emissions." 794 F. Supp. 2d 151, 160, 162 (D.D.C. 2011), declined to follow regarding the existence of a duty in CAA section 231 to make endangerment findings by *Friends of the Earth v. EPA*, 934 F. Supp. 2d 40, 47-48 (D.D.C. 2013) (finding EPA has no duty under CAA section 231 to make endangerment findings) (quoting *NACAA*).

A commenter also points to CAA section 231's use of the term "shall" in support of their argument that the stringency of the PM standards are allegedly unlawful under CAA section 231. The commenter also quotes *Util. Air Regul. Grp. v. EPA*, 573 U.S. 303 (2014), in which the Supreme Court "reaffim[ed] the core administrative-law principle that an agency may not rewrite clear statutory terms to suit its own sense of how the statute should operate" *Id.* at 328. The EPA does not dispute that determining that a class of aircraft engines "causes, or contributes to" endangering air pollution triggers a mandatory duty that EPA "shall" propose and promulgate standards, but that duty is only to take that action, and the existence of the duty does not govern the stringency of the standards. CAA section 231(a)(2)(A), (a)(3).

One commenter, asserting that "EPA's discretion is at all times constrained by the broad anti-pollution goals of the Clean Air Act," cites *Del. Dept. of Natural Res. & Envtl. Control v. EPA*, 895 F.3d 90, 97 (D.C. Cir. 2018) for the premise that courts construe provisions of Clean Air Act according to "the language and design of the statute as a whole" (the commenter cited 905 F.3d, but the EPA assumes they meant 895 F.3d). The EPA does not take issue with the characterization of the statutory purpose as one of "the 'traditional tools of statutory constructions.'" 895 F.3d. at 97 (citing *Nat. Res. Def. Council, Inc. v. Browner*, 57 F.3d 1122, 1125 (D.C. Cir. 1995) (quoting *Chevron*, 467 U.S. at 843 n.9)). However, "[n]o legislation pursues its purposes at all costs," Am. Exp. Co. v. Italian Colors Rest., 133 S. Ct. 2304, 2309 (2013), and EPA's authority is foremost defined by the statutory text, read in its context. Thus, EPA disagrees with the overbroad and oversimplified characterization of the limits on the EPA's discretion under particular parts of the CAA because the D.C. Circuit has already spoken to this issue. "Finding nothing in 'the text or structure of the statute to indicate that the Congress intended to preclude the EPA from considering [factors other than air quality],' we refused 'to infer from congressional silence an intention to preclude the agency from considering factors other than those listed in a statute.'" *NACAA*, 489 F.3d at 1230 (quoting *George E. Warren Corp. v. EPA,* 159 F.3d 616, 623–24 (D.C. Cir. 1998)); *see also Allied Local & Reg'l Mfrs. Caucus v. U.S. EPA*, 215 F.3d 61, 78 (D.C. Cir. 2000); *George E. Warren Corp*., 159 F.3d at 623–24 ("'In the absence of clear congressional direction to the contrary, we will not deprive the agency of the power to fine-tune its regulations to accommodate worthy nonsafety interests' under a statute focused upon safety." (*quoting Int'l Bhd. of Teamsters v. United States*, 735 F.2d 1525, 1529 (D.C. Cir. 1984))).

The EPA also believes that the reference to *Indep. U.S. Tanker Owners Comm. v. Dole*, 809 F.2d 847 (D.C. Cir. 1987) is misplaced. The comment said that the case stood for the premise that EPA "is not free to substitute new goals in place of the statutory objectives without explaining how these actions are consistent with [its] authority under the statute." In that case, the D.C. Circuit held that the Department of Transportation violated section 553(c) of the Administrative Procedure Act for failing to tie the "statement of basis and purpose" of the rule at issue with the objectives of the Merchant Marine Act of 1936 specifically enumerated in 46 U.S.C. section 1101 (1982). *Id.* at 854. However, twenty years later, the D.C. Circuit upheld the EPA's decision to consider international harmonization and "factors other than air quality" in setting and revising aircraft engine emission standards under the EPA's authority in CAA section 231 in *NACAA*. *NACAA*, 489 F.3d at 1230. Here, as in the 1997 NO_X aircraft standard at issue in *NACAA* and in other aircraft engine standard setting rulemakings over the past 25 years, the EPA

appropriately considered, and explained why it considered, international harmonization as a relevant consideration to the aircraft engine standards. There is a more in-depth discussion on this topic in the Preamble to the final rulemaking in Section IV.F.2. To the extent the case was cited for the purpose of criticizing the EPA's administrative record in this rulemaking, the EPA notes that comments claiming EPA's rule is arbitrary and capricious are addressed in this document in section 11.3.

The EPA also views the reference to *Natural Res. Def. Council v. EPA*, 808 F.3d 556 (2d. Cir. 2015) as inapplicable to this rulemaking. In that case, the Second Circuit found that the EPA's adoption of International Maritime Organization's standards for certain technology-based effluent limits under Clean Water Act sections 301(b), 301 (e), and 304(b) was arbitrary because EPA failed to explain "why standards higher than the IMO Standard should not be used given available technology". 808 F.3d at 570. But in that case, the EPA was required to set the effluent limits at issue based on the "best available technology economically achievable" pursuant to Clean Water Act (CWA) sections 301(b)(2)(A) and 304(b)(2)(B). First, the EPA does not rely on authority in CWA for this rulemaking. The Court held that "seeking to find systems that are capable of doing better than the current standard is in keeping with the technology-forcing aspect of the CWA." *Id.* But CAA section 231, unlike CWA sections 301(b)(2)(A) and 304(b)(2)(A), does not require the EPA to apply "best available technology economically achievable" or any other prescribed level of technology in setting aircraft engine emission standards, nor does it require technology-forcing standards. There is a more in-depth discussion on this topic in the Preamble to the final rulemaking in Section IV.F.2. To the extent the case was cited for the purpose of criticizing the EPA's administrative record in this rulemaking, the EPA notes that comments claiming EPA's rule is arbitrary and capricious are addressed in this document in section 11.3.

11.2 CAA section 307(d) Rulemaking Procedures

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Aviation-Impacted Communities Alliance (AICA)

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

CAEP conducts its work program through 11 working groups, consisting of 31 member state delegations led by the various state's Civil Aviation Authorities (FAA in the case of the US delegation), six observer states, and 15 international non-governmental organizations representing airlines, airports, aircraft and engine manufacturers, an international pilot's union association, and several other aviation industry lobbying groups. The CAEP work program typically spans three years per cycle to produce a new noise or air pollution standard, and the work program is conducted by the 11 working groups in series of multiple individual meetings held in cities throughout the world. The meetings are not open to the public, their work product is considered private, and their key reports, even when included in the EPA rulemaking docket, are not publicly available due to claimed copyright restrictions.[3] This means that the public and the EJ communities affected by the rule have been effectively precluded from participating in, or reviewing, any of the critical considerations leading up to the adoption of the standards. The fact that EPA publishes the conclusions of the CAEP standards as its own proposed rule does not satisfy the requirements of the Administrative Procedure Act, the two Executive Orders on Environmental Justice, or the requirements of the Office of Management and the Budget Circular A-4 guidance to Federal agencies on the development of regulatory analysis. As the NPRM notes, section 231(a)(2)(A) of the Clean Air Act (CAA) directs the Administrator of EPA to, "from time to time, propose aircraft engine

emission standards applicable to the emission of any air pollutant from classes of aircraft engines which in his or her judgment causes or contributes to air pollution that may reasonably be anticipated to endanger public health or welfare". A plain reading of that language requires the EPA to make the necessary determination of the need for and level of emissions control that are required, not to delegate that responsibility to CAEP. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[A portion of this comment can also be found in sections 2.4, 2.5, 11.1, 11.4, and 11.5 of the comment summary]]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

3) Commence the development of a PM regulation for new production that reflects the significantly reduced PM emissions of contemporary engines, and is fully compliant with the EJ and public participation requirements as well as the Administrative Procedure Act, the relevant Executive Orders on EJ, and OMB Circular A-4. [EPA-HQ-OAR-2019-0660-0175-A1, p.6] [[Parts of this comment are repeated in sections 2.3, 2.5, 11.2, 11.4, and 11.5.]]

---

[3] The CAEP Finance and Economics Study Group report contains key data and conclusions on forecast global aviation activity, costs of the proposed standards being considered, the rationale for choosing whether to pursue a technology forcing or an anti-backsliding standard, and the cost effectiveness of the candidate standards. The document is listed in the Docket as "Unavailable – Copyrighted".

Organization: *Aviation-Impacted Communities Alliance (AICA)*

We request EPA to not align with ICAO on the PM10 & PM2.5 aircraft engine standard. This presents a risk that residents impacted by airport operations will not be equally or sufficiently represented when seeking access to their right to a healthful environment through local, state and federal oversight.[EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[This comment can also be found in sections 2.3 , 2.4, and 11.5 of the comment summary]]

We are concerned about the lack of public participation due to closed door meetings, disproportionate impact on often disadvantaged populations in proximity to airports, and also that ensuring global competitiveness on behalf of manufacturer's is not a requirement. [EPA-HQ-OAR-2019-0660-0201, p.1] [[This comment can also be found in sections 2.4and 11.5 of the comment summary]]

EPA Response to Comments in Section 11.2

Comments on the topic of the ICAO/CAEP process are addressed in section 2.4 of this document. The reasons why the EPA is adopting the final rule are explained in the Preamble to the final rulemaking.

The EPA disagrees with the premise this rulemaking violated any public participation or legal rulemaking procedure requirements. Comments related to Executive Orders and OMB Circular A-4, are addressed in sections 11.4, 11.5, and 11.6 of this document.

CAA section 307(d)(1)(F) identifies "the promulgation or revision of any aircraft emissions standard under [CAA section 231]" as subject to the rulemaking procedures of CAA section 307(d). Therefore, the EPA followed the rulemaking procedures as required by CAA section 307(d).

The EPA made the docket for this action available to the public on February 3, 2022, in accordance with CAA section 307(d)(2). As explained in the Preamble for the Proposal, the EPA does not include certain documents in the *online* version of the docket available on regulations.gov, such as documents

protected as Confidential Business Information or documents protected by copyright. See 87 FR 6324. However, the public may view copyrighted documents included in the docket in person at the address listed in the Preamble to the proposed rulemaking. Further, the Preamble to the proposed rulemaking directed the public to https://www.epa.gov/dockets for further information on EPA Docket Center Services, which include assisting the public with accessing particular documents in the docket. The EPA did not receive any requests from the public to view copyrighted materials included in the docket for this rulemaking.

In addition, the EPA published notice of the proposed rulemaking in the *Federal Register*, accompanied by a statement of its basis and purpose and specified the period available for public comment in accordance with CAA section 307(d)(3)). 87 FR 6324 (February 3, 2022). Although the proposed (and finalized) PM standards match the ICAO PM standards in scope and stringency, EPA provided its own rationale for why it proposed the PM standards, and provided the opportunity for public input on that rationale, including at a virtual public hearing (CAA section 307(d)(5)). CAA section 231(a)(3) similarly requires public hearings with respect to proposed aircraft engine standards, stating that "Such hearings shall, to the extent practicable, be held in air quality control regions which are most seriously affected by aircraft emissions."

The public hearing was announced in the *Federal Register* and on the EPA's website at https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-control-air-pollution-aircraft-engines. 87 FR 2735 (January 19, 2022). It was held on February 17, 2022, and twelve testifiers spoke. The transcript of the February 17, 2022, hearing is available in the docket to this action at regulations.gov pursuant to CAA section 307(d)(4)(B). The transcript of the February 17, 2022 public hearing is also currently hosted on EPA's website at https://www.epa.gov/system/files/documents/2022-03/aircraft-pm-hearing-transcript-2022-02-17.pdf.

The public comment period on the proposal lasted 60 days and ended on April 4, 2022. 87 FR 6324.The EPA received 66 unique written comments on its proposed rule through regulations.gov, which included one mass mailer of 17,949 comments, and no hard copies of comments. The EPA did receive one comment letter one day after the close of the comment period, and decided to consider it as well (EPA-HQ-OAR-2019-0660-0131). All comments are available in the docket to this action on regulations.gov. Despite their complaints that EPA failed to provide sufficient public process, the adverse commenters actually participated in this public notice and comment process, in many cases submitting detailed and lengthy comments. Many of them also participated in the public hearing.

Pursuant to CAA section 307(d)(6)(B), the EPA has responded to "each of the significant comments, criticisms, and new data submitted in written or oral presentations during the comment period" in either the Preamble to the final rulemaking, this document, or both.

The rulemaking requirements of the Administrative Procedure do not apply to this rulemaking, which is instead governed by CAA section 307(d). See CAA section 307(d)(1) ("The provisions of section 553 through 557 and section 706 of title 5 shall not, except as expressly provided in this subsection, apply to actions to which this subsection applies.").

11.3 Other Administrative Law Topics

Organizations Included in this Section

California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
General Electric Company (GE)
Sierra Club

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

3. Past practice under Section 231 supports basing emission standards on pollution reduction needs and technological feasibility

In the first decade after Section 231 invested EPA with regulatory authority over aircraft emissions, EPA consistently exercised that authority to subject aircraft to "a program of control compatible with their significance as pollution sources," such that "emissions from aircraft and aircraft engines should be reduced to the extent practicable with present and prospective technology."[52] Thus, the very first Section 231 aircraft emission standards that EPA proposed represented its "best estimates of achievable technology by 1979," which EPA expected industry to "translate . . . into practice with reasonably aggressive and imaginative research and development programs." 37 Fed. Reg. at 26,488 (emphasis added). Subsequently, EPA has used similar formulations of controlling emissions to the maximum extent feasible with current and projected technology:

• "Exhaust emission standards … will be based on the best available combuster design technology expected in 1979 and later." 38 Fed. Reg. at 19,088.

• Rulemaking for large engines will "ensure that the best technology available is reflected in these standards." Id.; accord 43 Fed. Reg. at 12,617.

• Supersonic aircraft engine standards "are believed to be the most stringent that can be imposed by [the Jan. 1, 1980 compliance date]. They reflect the emission control technology currently under development and expected to be available to the SST [supersonic transport] engine manufacturers. The standards established here for newly certified SST engines reflect the best technology expected for subsonic engines." 41 Fed. Reg. at 34,722.

• Emission levels for new engines were "based on the best technology available, short of sector burning," where the sector burning technique was deemed a risk to airworthiness. Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 47 Fed. Reg. 58,462, 58,467 (Dec. 30, 1982) (final rule). [EPA-HQ-OAR-2019-0660-0203-A1, pp.16-17]

Thus, in the earliest rules adopted under Section 231, EPA demonstrated its understanding that section 231 required it to set emission standards according to the statutory factors, e.g.: "In determining appropriate levels for standards, consideration was given to air quality needs, technical feasibility, and comparative cost effectiveness." 43 Fed. Reg. at 12,618. This practice reaffirms EPA's statutory duty to base aircraft standards on a forward-looking evaluation of air quality needs and technological feasibility, so that emissions are "reduced to the extent practicable with present and prospective technology." 37

Fed. Reg. at 26,488. Nor has EPA renounced these formulations or given a reasoned explanation for its departure from its practice. Cf. *FCC v. Fox Television Studios*, 556 U.S. 502, 515-16 (2009) (agencies must acknowledge and explain reversals in established policy). [EPA-HQ-OAR-2019-0660-0203-A1, p.17]

B. Failure to adopt or even consider standards that reduce particulate matter emissions violates Section 231 and is arbitrary and capricious

By considering only PM standards that do not reduce PM emissions, EPA has violated Section 231 and failed to consider an "important aspect of the problem." *State Farm*, 463 U.S. at 43. EPA's analysis shows that the Proposed Rule does not result in any PM reductions over current levels, because all currently existing aircraft engines already meet the proposed standards. EPA has embraced these zero-benefit standards despite acknowledging the severe and inequitably distributed health and environmental effects of PM pollution and the existence of current and projected jet engine technology that significantly outperforms the ICAO PM Standards. Moreover, by confining the Proposed Rule to the same constraints that ICAO imposed in developing the ICAO PM Standards, EPA has ignored other, promising approaches to PM control, including fuel burn reductions and alternative fuels. [EPA-HQ-OAR-2019-0660-0203-A1, p.17] [[This comment is repeated in section 11.1.]]

2. By failing to consider any technologically feasible alternatives likely to result in meaningful emission reductions, EPA is proceeding in a manner "untethered to Congress's approach"

Despite its failure to conduct any meaningful analysis of the statutory factors, the Proposed Rule itself shows that more stringent standards are feasible. Figures IV-1 to IV-3 of the Proposed Rule show a large number of jet engines already in production perform better than the ICAO PM Standards by orders of magnitude, whether measured by mass, number, or mass concentration. 87 Fed. Reg. at 6338-41. And EPA itself identifies several of the jet engine technologies supporting these superior levels of PM emission performance, including lean-burn technologies and advanced rich-quench-lean (RQL) combustion designs. Id. at 6348.[54] [EPA-HQ-OAR-2019-0660-0203-A1, p.19] [[This comment is repeated in section 11.1.]]The record shows that not only are more stringent PM standards technologically feasible, they are imperative to protect the public health and welfare and advance EPA's environmental justice commitments. As described above, the Proposed Rule itself acknowledges the significant health and environmental effects of PM and cites compelling evidence that these effects disproportionately fall on the communities of color and low-income communities that live, work, and go to school near major airports, where aircraft PM emissions tend to concentrate. Id. at 6331-33, 6335. Yet not only does the Proposed Rule offer ineffectual standards; EPA does not even evaluate whether alternative, more stringent standards were appropriate. This failure is arbitrary and completely "untethered to Congress's approach" in Section 231. *Nat. Res. Def. Council v. EPA*, 777 F.3d 456, 469 (D.C. Cir. 2014). [EPA-HQ-OAR-2019-0660-0203-A1, p.19] [[This comment is repeated in section 11.1.]]

---

[52] Control of Air Pollution from Aircraft and Aircraft Engines: Proposed Standards, 37 Fed. Reg. 26,488 (Dec. 12, 1972); Control of Air Pollution from Aircraft and Aircraft Engines: Emission Standards and Test Procedures for Aircraft, 38 Fed. Reg. 19,088, 19,089 (July 17, 1973) (final rule); Control of Air Pollution from Aircraft and Aircraft Engines: Supersonic Aircraft, 41 Fed. Reg. 34,722 (Aug. 16, 1976) (final rule); Control of Air Pollution from Aircraft and Aircraft Engines: Proposed Amendments to Standards, 43 Fed. Reg. 12,615, 12,617 (Mar. 24, 1978); see also Control of Air Pollution from Aircraft and Aircraft Engines: Emission Standards and Test Procedures, 62 Fed. Reg. 25,356, 25,357 (May 8, 1997) (direct final rule)

[54] EPA appears not to have performed its own review of PM reduction technology—there is no technical support document—but rather relied on ICAO's technology review, most of which is confidential and based on data presented by the aviation industry. Id.; see also ICAO, Independent Expert Integrated Technology Goals Assessment and Review for Engines and Aircraft, Document 10127, at 50 (2019) ("Independent Expert Assessment") (noting limits on information and access provided by industry to confidential PM data).

Organization: *General Electric Company (GE)*

C. EPA's proposal to adopt ICAO-equivalent nvPM emission standards is consistent with the law, precedent, and the administrative record

The proposed standards comply with the statutory requirements of the Clean Air Act (the "CAA") and treaty obligations. The standards continue the long collaborative tradition between EPA and ICAO. They also are well supported by an extensive administrative record. [EPA-HQ-OAR-2019-0660-0183-A1, p.4] [[This comment is repeated in section 2.5]]

4. EPA's proposal is supported by the administrative record

EPA has properly performed its own emissions inventory assessment, technological feasibility study, and economic impact assessment independent of the ICAO standard development.[24] These studies emphasize why adoption of an ICAO-equivalent standard within the specified time frames is important. As EPA has stated, "the proposed action to adopt in the U.S. PM standards that match the ICAO standards would help ensure international consistency and acceptance of U.S. manufactured engines worldwide."[25] Thus, GE believes that EPA has properly supported the proposed rule with the administrative record. [EPA-HQ-OAR-2019-0660-0183-A1, p.7]

---

[24] 87 Fed. Reg. at 6,347 – 6,349.

[25] Id. at 6,337.

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

I. EPA Should Consider, and Evaluate the Costs and Benefits of, Regulatory Alternatives to the ICAO Standards

Under Section 231 of the Clean Air Act, EPA is directed to propose and enact emission standards for any air pollutant emitted by aircraft engines when such emissions "cause[], or contribute[] to, air pollution which may reasonably be anticipated to endanger public health or welfare."[5] Given the lack of further statutory direction, the D.C. Circuit has interpreted EPA's mandate under this section to provide significant discretion in setting standards, allowing the agency to balance among various factors including emission reductions, cost, energy, and safety.[6] But in the Proposed Rule, rather than balancing among relevant factors, EPA exclusively justifies its proposed standard based on a purported need for international harmonization.[7] While the D.C. Circuit in NACAA agreed with EPA that it had discretion to "weigh various factors,"[8] it did not find that the agency could entirely ignore some factors and base its decision solely on one factor as the agency did here. [EPA-HQ-OAR-2019-0660-0182-A1, p.1]

Since the Supreme Court held in State Farm that NHTSA had acted arbitrarily and capriciously by refusing to consider a "technological alternative within the ambit of [its] existing standards,"[20] the D.C. Circuit has repeatedly held that rational decisionmaking by administrative agencies requires

consideration of "significant alternatives to the course it ultimately chooses."[21] Agencies must consider "obvious" alternatives and provide an explanation when alternatives are rejected.[22] And in explaining why alternatives are rejected, agencies may not "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[23] EPA's failure to consider alternatives is particularly egregious here, where proposing alternative performance standards with varying levels of stringency is such a "familiar tool in [EPA]'s tool kit."[24] [EPA-HQ-OAR-2019-0660-0182-A1, p.3]

---

[5] 42 U.S.C. § 7571(a)(2)(A); id. § 7571(a)(3).

[6] See *Nat'l Ass'n of Clean Air Agencies v. EPA*, 489 F.3d 1221, 1230 (D.C. Cir. 2007) [hereinafter NACAA] (finding that Congress "conferred broad discretion to the Administrator to weigh various factors in arriving at appropriate standards").

[7] See, e.g., 87 Fed. Reg. at 6326.

[8] NACAA, 489 F.3d at 1230.

[20] *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 51 (1983).

[21] *Allied Local & Reg'l Mfrs. Caucus v. EPA*, 215 F.3d 61, 80 (D.C. Cir. 2000).

[22] *Int'l Ladies' Garment Workers' Union v. Donovan*, 722 F.2d 795, 816 n.41 (D.C. Cir. 1983).

[23] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.,* 538 F.3d 1172, 1198 (9th Cir. 2008).

[24] See *Chamber of Com. of U.S. v. Sec. & Exch. Comm'n*, 412 F.3d 133, 144 (D.C. Cir. 2005).

Organization: Sierra Club

What the agency does not do is to consider how it might remedy these alarming effects. Instead, EPA's description of these harms is immediately and incongruously followed by a "summary" concluding that its proposed standards "are not expected to result in emission reductions" and will not cause "improvement in air quality for those who live near airports." Id. at 6336. This failure to engage with the record is unlawful, arbitrary, and capricious. [EPA-HQ-OAR-2019-0660-0184-A1, p.2]

Nor is the Proposal accompanied by a Technical Support Document or even a single alternative considering a more stringent rule. EPA never considers what it might do to try to mitigate the emissions' harm despite the commands in Section 231(a)(1)(A) (requiring a study and investigation of the extent to which aircraft PM emissions affect public health and welfare). 42 U.S. § 7571. That is a stark departure from usual EPA remaking and falls far short of statutory requirements. [EPA-HQ-OAR-2019-0660-0184-A1, p.9] [[This comment is repeated in sections 7.2 and 11.1]]

EPA Response to Comments in Section 11.3

Scope of Proposal and Administrative Record

The EPA received comments on this rulemaking arguing that EPA's record supports the PM standards and comments arguing that it does not. The EPA believes the record supports the PM standards, as well as the rest of the rulemaking package, and that the EPA's rule is not arbitrary and capricious.

Some commenters argue that the EPA's action was arbitrary and capricious, citing cases such as *Int'l Ladies' Garment Workers' Union v. Donovan*, 722 F.2d 795 (D.C. Cir. 1983), *Motor Vehicle Mfrs. Ass'n v.*

State Farm Mut. Auto. Ins. Co., 463 U.S. 29 (1983), *Allied Local & Reg'l Mfrs. Caucus v. EPA*, 215 F.3d 61 (D.C. Cir. 2000), *Public Citizen v. Federal Motor Carrier Safety Admin.,* 374 F.3d 1209, 1216 (D.C. Cir. 2004), *Chamber of Com. of U.S. v. Sec. & Exch. Comm'n*, 412 F.3d 133 (D.C. Cir. 2005), and *Michigan v. EPA*, 576 U.S. 743 (2015).

The EPA responds in part to these comments in the Preamble to the final rulemaking in Section IV.F.2, but adds additional responses here.

Despite arguments from commenters that the EPA was arbitrary and capricious for only "considering" standards that align with ICAO's standards, EPA clearly explained the reasons for the proposed and the ultimate adopted PM standards in the Preambles to both the proposed and final rulemaking. 87 FR 6324, 6336-37; Section IV of final rule. Some commenters argue that EPA's record supports a finding that more stringent standards are feasible (Sierra Club, referring to the ICAO cost assessment approach description in the Preamble to the proposed rulemaking; California et al., referring to Figures IV-1 to IV-3 showing that some jet engines in production perform better than the PM standards and noting that the airplane GHG standards are based on fuel burn improvement technologies), or that if EPA had conducted additional analysis it would have identified cost-effective emissions reductions (CBD, concluding that 'EPA presumably could reduce emissions from new planes with little cost'). The EPA addressed these comments in the Preamble in Section IV to the final rulemaking and in the response to sections 9 and 10 of this document. Further, the EPA did consider the significant alternatives, which were raised in comments, to the proposed emission standards, as discussed in Preamble Section IV.F.2 to the final rulemaking and in more detail in section 10 of this document.

In response to claims that the EPA allegedly failed to consider PM emissions and environmental justice, the EPA notes that it did consider these issues. See Section III of the Preamble to the final rulemaking. The underlying concern in these comments appears to be a difference of opinion with EPA's ultimate conclusions that the PM standards are reasonable and "appropriate" in light of the totality of considerations that the EPA weighed. CAA section 231(a)(3). The EPA directs the commenter to Section I.C of the Preamble to the final rulemaking for the EPA's planned future actions with regard to regulation PM emissions from aircraft and Section III.G of the Preamble to the final rulemaking for information about the Demographic Analysis the EPA is conducting, separate from this rulemaking, to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity.

The case *Nat. Res. Def. Council v. EPA* was cited by a commenter for the premise that the EPA's proposal of a single stringency of PM standards was arbitrary for being "untethered to Congress's approach". *Nat. Res. Def. Council v. EPA*, 777 F.3d 456 (D.C. Cir. 2014). However, in the cited portion of that case, the D.C. Circuit did not reach the merits of the arbitrary and capricious claim, but concluded, based in part on a comparison of statutory attainment schedules for national ambient air quality standards for ozone and other pollutants in Title I of the CAA, that EPA did not have statutory authority to extend attainment dates for the 2008 ozone national ambient air quality standards on the basis of the number of ozone seasons within which nonattainment areas must attain the standards. 777 F.3d at 469. The "'comprehensive regulation' of ozone and five other pollutants" introduced to Title I of the CAA in the 1990 Amendments, including specific requirements in CAA section 182 *et seq* that prescribe exactly how and when different control regimes must be applied in varying nonattainment areas is not analogous to the "broad" discretion in CAA section 231 under which EPA shall "from time to time, issue proposed

emission standards" and, after public input, "issue such regulations with such modifications as he deems appropriate." *See id.* at 460 (citing *South Coast Air Quality Mgmt. Dist. v. EPA*, 472 F.3d at 886-887); *NACAA*, 489 F.3d at 1229.

The reference to *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172 (9th Cir. 2008) is also misplaced. In that case, the Ninth Circuit reviewed and rejected National Highway Traffic Safety Administration's approach to determining the "maximum feasible" fuel economy standards under 49 U.S.C. section 32902(a). *Id.* at 1198. The court found fault in the rationale supporting the rule at issue because, whether or not NHTSA was allowed to use a cost-benefit analysis to determine maximum feasible fuel economy standards, NHTSA did not consider benefits of carbon emissions reduction, either quantitatively or qualitatively, but it had considered costs. Unlike 49 U.S.C. section 32902(a) CAA section 231 imposes no requirement on EPA to set aircraft engine standards at any prescribed level of technology, let alone prescribes specific factors to consider in determining what constitutes that level of technology as 49 U.S.C. section 32902(f) does. There is a more in-depth discussion on this topic in the Preamble to the final rulemaking in Section IV.F.2.

The EPA believes that the reference in comments to *Sw. Elec. Power Co. v. EPA*, 920 F.3d 999 (5th Cir. 2019) is also misplaced. In that case, the Fifth Circuit found that the EPA acted arbitrarily in concluding a certain technology constituted the "best available technology economically achievable" for legacy wastewater under Clean Water Act section 304(b)(2)(B) and remanded the rule to the EPA. *Id.* at 1022. The court found in that case that the EPA's record supporting the rule indicated the selected technology had long-recognized deficiencies and that more advanced technologies existed, were available, and were in use at some plants. *Id.* at 1020. However, CAA section 231, unlike CWA section 304(b)(2)(B), does not require the EPA to set an aircraft engine emission standard at the "best available technology economically achievable" or any other prescribed level of technology. Furthermore, the EPA is not relying on CWA authority in this rulemaking.

Other commenters tried to suggest the EPA's action lacked a sufficient administrative record due to the absence of a technical support document (TSD) in the record. A document specifically titled a technical support document is just one way to provide the Agency's rationale to support a rulemaking. The EPA followed the rulemaking procedures in CAA section 307(d) and included its rationale and analyses supporting the rule in the Preamble to the final rulemaking and other supporting documentation in the docket (Docket No. EPA-HQ-OAR-2019-0660, available online at regulations.gov).

Other topics covered by these comments are addressed in the Preamble to the final rulemaking and elsewhere in this document. For example, comments on rulemaking procedure are addressed in section 11.2 of this document, benefits and costs of the rule are discussed in the Preamble to the final rulemaking and additional comments on that topic are addressed in section 9 of this document.

Alleged Shift in Practice and Policy

EPA disagrees with the commenter's assertion that by issuing early aircraft rules emphasizing technology development the agency established a "duty" to continue that practice. EPA has long explained that it has discretion in any specific rulemaking under section 231 to choose whether it is appropriate to set technology-forcing or technology-following standards. EPA's earlier rules (*see* 38 FR 19088(July 17, 1973); 70 FR 69664(Nov. 17, 2005); 77 FR 36342(June 18, 2012)), including those establishing technology-forcing standards and those establishing technology-following ones, reaffirm

that discretion. Moreover, the comment that the EPA has in this action shifted its policy regarding aircraft standard setting without explanation, at odds with *FCC v. Fox Television Studios*, 556 U.S. 502, 515-16 (2009), is inaccurate. While the Agency may have placed a greater emphasis on technology development in aircraft standard settings in the 1970s, the EPA has taken the same approach in setting aircraft standards for decades while consistently maintaining its interpretation of its legal authority to promulgate either technology forcing or technology following standards under CAA section 231. *See* 70 FR 69664 (Nov. 17, 2005); 77 FR 36342 (June 18, 2012); 86 FR 2136 (Jan. 11, 2021). However, it *would* be a shift in policy or practice for EPA to adopt the commenters' interpretation of CAA section 231. Comments related to interpretation of EPA's statutory authority under CAA section 231 are addressed in the Preamble to the final rulemaking in Sections IV.F.1 and IV.F.2 and section 11.1 of this document.

All but one of the commenter's examples of EPA past practice under CAA section 231 date to the 1970's, before ICAO had adopted any international aircraft standards for air pollutants. (On June 30, 1981, ICAO issued its first international standards and recommended practices covering aircraft engine emissions.) That one rule is the EPA's 1997 rule updating standards for aircraft emissions of nitrogen oxides and carbon. 62 FR 25356 (May 8, 1997). The rule did state that "emissions from aircraft and aircraft engines should be reduced to the extent practicable with present and developing technology." 62 FR 25356, 25359. But that rule, like all subsequent rules in the era since ICAO began adopting emission standards, adopted the existing and newly issued ICAO standards for these pollutants. 62 FR 25356, 25359 ("EPA is adopting ICAO's 1993 amendments, ICAO's existing [nitrogen oxides] and [carbon monoxide] emission standards issued in 1981, and other technical amendments to further align EPA and ICAO requirements."). In the same preamble, the EPA noted that "all engines" covered by the carbon monoxide standard and the 1986 ICAO nitrogen oxide standard currently meet those standards and that "all but two" engines already met the more stringent 1993 ICAO standard for nitrogen oxides. 62 FR 25356, 25359.

11.4 Executive Order 12866

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Institute for Policy Integrity at New York University School of Law (Policy Integrity)

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

CAEP conducts its work program through 11 working groups, consisting of 31 member state delegations led by the various state's Civil Aviation Authorities (FAA in the case of the US delegation), six observer states, and 15 international non-governmental organizations representing airlines, airports, aircraft and engine manufacturers, an international pilot's union association, and several other aviation industry lobbying groups. The CAEP work program typically spans three years per cycle to produce a new noise or air pollution standard, and the work program is conducted by the 11 working groups in series of multiple individual meetings held in cities throughout the world. The meetings are not open to the public, their work product is considered private, and their key reports, even when included in the EPA rulemaking docket, are not publicly available due to claimed copyright restrictions.[3] This means that the public and the EJ communities affected by the rule have been effectively precluded from participating in, or reviewing, any of the critical considerations leading up to the adoption of the standards. The fact that EPA publishes the conclusions of the CAEP standards as its own proposed rule does not satisfy the requirements of the Administrative Procedure Act, the two Executive Orders on Environmental Justice,

or the requirements of the Office of Management and the Budget Circular A-4 guidance to Federal agencies on the development of regulatory analysis. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[This comment can also be found in sections 2.4, 11.2, and 11.5 of the comment summary]]

---

[3] The CAEP Finance and Economics Study Group report contains key data and conclusions on forecast global aviation activity, costs of the proposed standards being considered, the rationale for choosing whether to pursue a technology forcing or an anti-backsliding standard, and the cost effectiveness of the candidate standards. The document is listed in the Docket as "Unavailable - Copyrighted".

Organization: Institute for Policy Integrity at New York University School of Law (Policy Integrity)

It is well established that agencies should consider a range of regulatory alternatives in order to properly evaluate the costs and benefits of a regulatory proposal. Executive Order 12,866 explains that "agencies should select those approaches that maximize net benefits" when "choosing among alternative regulatory approaches."[15] Accomplishing such a goal of maximizing net benefits is impossible without first considering a broad range of alternatives at different levels of stringency.[16] [EPA-HQ-OAR-2019-0660-0182-A1, p.3]

Circular A-4 directs agencies to "describe the alternatives available to [the agency] and the reasons for choosing one alternative over another."[17] When, as here, there is a continuum of possible alternatives based on the level of stringency, agencies "generally should analyze at least three options: the preferred option; a more stringent option that achieves additional benefits (and presumably costs more) beyond those realized by the preferred option; and a less stringent option that costs less (and presumably generates fewer benefits) than the preferred option."[18] Circular A-4 makes clear that an analysis that, as here, merely compares the agency's proposal to a baseline without discussing the incremental costs and benefits of alternatives is not adequate.[19] [EPA-HQ-OAR-2019-0660-0182-A1, p.3]

Without any analysis of more stringent alternatives, EPA cannot rationally conclude that a Proposed Rule that provides zero benefits is a reasonable approach. At minimum, EPA should have proposed a preferred alternative along with one less stringent alternative and one more stringent alternative, as Circular A-4 recommends.[25] As EPA instead only proposed what is essentially the least-stringent option possible, EPA should include at least two more stringent alternatives in its final rule. The agency should presumptively select the alternative that maximizes net benefits,[26] and, if it does not select that policy, should offer an adequate justification for rejecting the alternative that is most economically efficient.27 [EPA-HQ-OAR-2019-0660-0182-A1, pp.3-4]

In order to ensure adequate notice and opportunity for comment on any new alternatives evaluated, EPA should consider issuing a Supplemental Notice of Proposed Rulemaking before moving to the final rulemaking stage. [EPA-HQ-OAR-2019-0660-0182, p.4]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

3) Commence the development of a PM regulation for new production that reflects the significantly reduced PM emissions of contemporary engines, and is fully compliant with the EJ and public participation requirements as well as the Administrative Procedure Act, the relevant Executive Orders on EJ, and OMB Circular A-4. [EPA-HQ-OAR-2019-0660-0175-A1, p.6] [[Parts of this comment are repeated in section 2.3, 2.5, 11.2, and 11.5.]]

[15] 58 Fed. Reg. 51,735 §1(a) (Oct. 4, 1993).

[16] See Richard L. Revesz & Samantha Yi, Distributional Consequences and Regulatory Analysis, 52 ENV. LAW _ , *33–34 (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3927277.

[17] OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 16 (2003).

[18] Id.

[19] Id.

[20] *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 51 (1983).

[21] *Allied Local & Reg'l Mfrs. Caucus v. EPA*, 215 F.3d 61, 80 (D.C. Cir. 2000).

[22] *Int'l Ladies' Garment Workers' Union v. Donovan*, 722 F.2d 795, 816 n.41 (D.C. Cir. 1983).

[23] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1198 (9th Cir. 2008).

[24] See *Chamber of Com. of U.S. v. Sec. & Exch. Comm'n*, 412 F.3d 133, 144 (D.C. Cir. 2005).

[25] CIRCULAR A-4, supra note 17, at 16.

[26] Exec. Order 12,866 §1(a) ("[A]gencies should select those approaches that maximize net benefits . . ., unless a statute requires another regulatory approach.").

[27] EPA, Guidelines for Preparing Economic Analyses 1-4 (2010) ("The policy that maximizes net benefits is considered the most efficient").

EPA Response to Comments in Section 11.4

The Office of Management and Budget (OMB) Circular A-4 is guidance for Federal agencies in developing a regulatory analysis under EO 12866 section 6(a)(3)(c) for rules that have been determined by the OMB's Office of Information and Regulatory Affairs (OIRA) to be a "significant regulatory action" for economic reasons under EO 12866 section 3(f)(1). Even were Circular A-4 to apply to this action, it is merely guidance and would not bind the agency. Moreover, Circular A-4 does not apply to this action. The EPA's PM Standards were not determined to be an economically significant regulatory action under EO 12866 section 3(f)(1) by OIRA, and so the EPA did not prepare a regulatory analysis under EO 12866 section 6(a)(3)(c). Therefore, it was unnecessary for EPA to follow the guidance of OMB Circular A-4.

Executive Order 12866 by its own terms does not create a right to judicial review (Executive Order 12,866 section 10). *See Air Transp. Ass'n of Am. v. FAA*, 169 F.3d 1, 8-9 (D.C. Cir. 1999) (holding that a claim under another executive order with nearly identical judicial review language was not judicially reviewable and that petitioner's claim that the action at issue was arbitrary and capricious because of the agency's alleged violation of the order was "nothing more than an indirect—and impermissible—attempt to enforce private rights under the order").

Other issues raised by these comments are addressed elsewhere in the Preamble to the final rulemaking and in this document. For example, comments related to rulemaking procedure are addressed in section 11.2 of this document.

11.5 Executive Orders 12898 and 14008

Organizations Included in this Section

Airport Impact Relief, Inc. (AIR, Inc.)
Aviation-Impacted Communities Alliance (AICA)
Beacon Hill Council of Seattle (BHC)
California Air Resources Board (CARB)
California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin
Center for Biological Diversity and Friends of the Earth
Clark, Mitchell
Environmental Defense Fund (EDF)
Institute for Policy Integrity at New York University School of Law (Policy Integrity)
Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)
National Association of Clean Air Agencies (NACAA)
Service Employees International Union (SEIU)

Organization: Airport Impact Relief, Inc. (AIR, Inc.)

ENVIRONMENTAL JUSTICE AND PUBLIC PARTICIPATION IN THE RULEMAKING

In the executive summary of the NPRM (Section I, B, 3) EPA defines environmental justice as "the fair treatment and meaningful involvement (emphasis added) of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies". Section III, Particulate Matter Impacts on Air Quality and Health, further expands on this responsibility in the section on Environmental Justice (Section III.G, footnote 72) noting that: Meaningful involvement occurs when "(1) potentially affected populations have an appropriate opportunity to participate in decisions about a proposed activity [e.g., rulemaking] that will affect their environment and/or health; (2) the public's contribution can influence [the EPA's rulemaking] decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) [the EPA will] seek out and facilitate the involvement of those potentially affected"[2] [EPA-HQ-OAR-2019-0660-0175-A1, p.2] [[This comment can also be found in sections 2.4 of the comment summary]]

The EPA's decision to adopt the particulate standards for airplane engines created by the Committee on Aviation Environmental Protection (CAEP) of the International Civil Aviation Organization (ICAO) effectively foreclosed the opportunity for environmental justice communities to participate with meaningful involvement in the development of the proposed rule. [EPA-HQ-OAR-2019-0660-0175-A1, p.2] [[This comment can also be found in sections 2.4 of the comment summary]]

CAEP conducts its work program through 11 working groups, consisting of 31 member state delegations led by the various state's Civil Aviation Authorities (FAA in the case of the US delegation), six observer states, and 15 international non-governmental organizations representing airlines, airports, aircraft and engine manufacturers, an international pilot's union association, and several other aviation industry lobbying groups. The CAEP work program typically spans three years per cycle to produce a new noise or air pollution standard, and the work program is conducted by the 11 working groups in series of multiple individual meetings held in cities throughout the world. The meetings are not open to the public, their work product is considered private, and their key reports, even when included in the EPA rulemaking

docket, are not publicly available due to claimed copyright restrictions.[3] This means that the public and the EJ communities affected by the rule have been effectively precluded from participating in, or reviewing, any of the critical considerations leading up to the adoption of the standards. The fact that EPA publishes the conclusions of the CAEP standards as its own proposed rule does not satisfy the requirements of the Administrative Procedure Act, the two Executive Orders on Environmental Justice, or the requirements of the Office of Management and the Budget Circular A-4 guidance to Federal agencies on the development of regulatory analysis. [EPA-HQ-OAR-2019-0660-0175-A1, pp.2-3] [[This comment can also be found in sections 2.4, 11.2, and 11.4 of the comment summary.]]

AIR, Inc requests that the deficiencies in this NPRM be remedied by:

[…]

3) Commence the development of a PM regulation for new production that reflects the significantly reduced PM emissions of contemporary engines, and is fully compliant with the EJ and public participation requirements as well as the Administrative Procedure Act, the relevant Executive Orders on EJ, and OMB Circular A-4. [EPA-HQ-OAR-2019-0660-0175-A1, p.6] [[Parts of this comment are repeated in sections 2.3, 2.5, 11.2, and 11.4.]]

_____

[2]''Guidance on Considering Environmental Justice During the Development of an Action.'' Environmental Protection Agency, https://www.epa.gov/ environmental justice.

[3] The CAEP Finance and Economics Study Group report contains key data and conclusions on forecast global aviation activity, costs of the proposed standards being considered, the rationale for choosing whether to pursue a technology forcing or an anti-backsliding standard, and the cost effectiveness of the candidate standards. The document is listed in the Docket as "Unavailable - Copyrighted".

Organization: *Aviation-Impacted Communities Alliance (AICA)*

We request EPA to not align with ICAO on the PM10 & PM2.5 aircraft engine standard. This presents a risk that residents impacted by airport operations will not be equally or sufficiently represented when seeking access to their right to a healthful environment through local, state and federal oversight.[EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[This comment can also be found in sections 2.3, 2.4, and 11.2 of the comment summary]]

We are concerned about the lack of public participation due to closed door meetings, disproportionate impact on often disadvantaged populations in proximity to airports, and also that ensuring global competitiveness on behalf of manufacturer's is not a requirement. [EPA-HQ-OAR-2019-0660-0201, p.1] [[This comment can also be found in sections 2.4 and 11.2 of the comment summary]]

Organization: *Beacon Hill Council of Seattle (BHC)*

EPA must rise to the challenge of writing rules that align with the White House Council on Environmental Quality and the White House Environmental Justice Advisory Committee entities that it hosts; worthy of President Joe Bidens climate, environmental justice, and health vision. [EPA-HQ-OAR-2019-0660-0176-A1, p.2] [[This comment is repeated in section 1.2]]

Organization: *California Air Resources Board (CARB)*

President Biden issued an Executive Order (EO) on Tackling the Climate Crisis at Home and Abroad. The EO states, "Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related, and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."[14] EPA can follow the President's EO by taking this opportunity to act and require technologies and actions described in this letter to help address the disproportionate burden that disadvantaged communities face with air pollution. [EPA-HQ-OAR-2019-0660-0206-A1, p.5]

---

[14] Executive Order on Tackling the Climate Crisis at Home and Abroad, available at https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/.

Organization: *California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin*

Finally, the Proposed Rule suffers additional legal flaws that would render its final adoption arbitrary and capricious, including EPA's failure to accurately evaluate and redress the cumulative and disproportionate impacts of aircraft emissions on environmental justice communities and evaluate federalism implications according to its own stated practices. [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5] [[This comment is repeated in sections 11.1 and 11.6.]]

In evaluating the impacts of pollution, EPA and other executive agencies have committed to studying not just the broadest and most generalized harms, but also the way pollution creates and exacerbates social inequities by overburdening particular communities with pollution and its cumulative associated health and environmental effects. Exec. Order 12,898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," 59 Fed. Reg. 7629 (Feb. 11, 1994); see also Exec. Order 14,008, "Tackling the Climate Crisis at Home and Abroad," § 219 et seq., 86 Fed. Reg. 7619, 7629 (Jan. 27, 2021). [EPA-HQ-OAR-2019-0660-0203-A1, p.5]

The Commenting States have significant concerns about EPA's failure to conduct a meaningful environmental justice analysis in the Proposed Rule. Although EPA acknowledges the robust evidence that aircraft PM emissions drive serious health and environmental harms in communities located near or downwind from airports, many of which already disproportionately experience environmental and social inequities, the Proposed Rule understates these environmental justice concerns and postpones consideration of the inequitable impacts of aircraft PM pollution to another day. This renders EPA's environmental justice analysis—and thus its analysis of pollution impacts under Section 231—substantively inadequate. [EPA-HQ-OAR-2019-0660-0203-A1, p.5]

D. The Proposed Rule's environmental justice analysis fails EPA's own stated environmental justice principles

EPA's analysis of the environmental justice implications of the proposed rule is inadequate according to its own environmental justice commitments, including Executive Orders 12,898 and 14,008. This self-contradictory approach to evaluating the pollution impacts of aircraft PM emissions on historically

marginalized and overburdened communities renders the Proposed Rule arbitrary and capricious. First, EPA fails to analyze the key questions and issues its own environmental justice guidelines identify as the relevant inquiry. Second, EPA fails to consider the cumulative impacts of PM emissions from aircraft on environmental justice communities near airports. Third, EPA's conclusion that its "action does not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, and/or indigenous people," 87 Fed. Reg. at 6354, is irrational and unsupported by the record, and thus likewise arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0203-A1, p.24]

1. EPA's failure to perform an environmental justice analysis of aircraft PM pollution in accordance with its own policies is arbitrary and capricious

Under Executive Order 12,898, each federal agency has committed, "to the greatest extent practicable and permitted by law" to "make achieving environmental justice part of its mission by identifying and addressing as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories . . . ." 64 Fed. Reg. 7629 (Feb. 16, 1994). Additionally, EPA recently committed to "make achieving environmental justice part of [its] mission[] by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."[63] Exec. Order 14,008 § 219, 86 Fed. Reg. at 7629. The goal of achieving environmental justice includes the mitigation of existing disparities through regulation, not just an avoidance of aggravating disparities through regulatory action.[64] [EPA-HQ-OAR-2019-0660-0203-A1, p.24]

Under these principles, EPA must analyze "the actual or potential lack of fair treatment or meaningful involvement of minority populations, low-income populations, tribes, and indigenous peoples in the development, implementation and enforcement of environmental laws, regulations and policies."[65] EPA's analysis must likewise address any (1) preexisting concerns regarding pollution in the communities that would impacted by the action, (2) disparate impact that the rule would have on environmental justice communities in comparison to the population at large, and (3) potential for the action to exacerbate or create new environmental justice concerns.[66] [EPA-HQ-OAR-2019-0660-0203-A1,pp.24-25]

In this Proposed Rule, however, EPA has not answered or even attempted to answer these questions. Instead, EPA merely states that going forward it is "committed to conducting environmental justice analysis for rulemakings based on a framework similar to what is outlined in EPA's technical guidance." 87 Fed. Reg. at 6335. EPA goes on to state that, apart and separate from the Proposed Rule, it "is conducting a demographic analysis to explore whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity" to help it "characterize the state of environmental justice concerns." Id. at 6336. However, EPA's statement that it will analyze existing environmental justice concerns separate from and in parallel to the rulemaking does not satisfy its duty to do so in this rulemaking. This is especially the case when, as here, there is already substantial evidence showing that impoverished and communities of color are disproportionately located near airports and are thus disproportionately impacted by PM emissions from aircraft. In light of this evidence, EPA's failure to evaluate and address these very real current environmental justice problems in this rulemaking is arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0203-A1, p.25]

2. EPA's failure to consider the cumulative impacts of aircraft PM emissions on environmental justice communities is arbitrary and capricious

Under Executive Order 14,008, EPA has acknowledged that environmental justice communities have already been disproportionately burdened by polluting sources, including PM polluting sources, and has committed to "secure environmental justice" for those communities "by address[ing] cumulative impacts" in its "programs, policies, and activities." Id. § 219, 86 Fed. Reg. at 7629-32. EPA has previously emphasized the importance of cumulative impact assessments in Strategy #1 of its EJ 2020 Action Agenda and its overall Draft FY 2022-2026 EPA Strategic Plan:

EPA must make significant and urgent progress in fundamentally grounding its work in addressing disproportionality, which includes understanding of and reacting to issues of cumulative impacts and cumulative risks, and rapidly advance its ability to analyze for disproportionate impacts.[67] [EPA-HQ-OAR-2019-0660-0203-A1,p.25]

However, the Proposed Rule fails to conduct a cumulative impact analysis that addresses the health impacts of aircraft PM to airport-adjacent environmental justice communities already burdened with a disproportionate amount of polluting sources, including PM sources. This failure falls short of EPA's repeated commitments. Health equity and environmental justice cannot be achieved through an approach that siloes the consideration of impacts from different polluting sources. Failure to perform any cumulative impacts analysis renders the Proposed Rule insensitive to the environmental inequities faced by many this country's marginalized and overburdened communities. A more holistic approach, one that considers the totality of exposure to PM from polluting sources on communities near airports, is necessary to achieve the goals Executive Order 14,008, the EPA's EJ 2020 Action Agenda, and environmental justice more broadly. [EPA-HQ-OAR-2019-0660-0203-A1, pp.25-26]

EPA acknowledges in its Proposed Rule the need to conduct a demographic analysis that explores whether populations living nearest the busiest runways show patterns of racial and socioeconomic disparity. 87 Fed. Reg. at 6327. To be sure, this is an important analysis to undertake. But EPA does not—because it cannot—explain how a future demographic analysis cures its failure in this rulemaking to conduct a cumulative human health or environmental impact analysis. A demographic assessment may further highlight the disproportionate burden of aircraft PM emissions on historically marginalized communities, but it would not address the cumulative impacts that aircraft PM emissions left unmitigated by the Proposed Rule have on these neighborhoods. [EPA-HQ-OAR-2019-0660-0203-A1, p.26]

3. EPA's conclusion that its proposed rule will not exacerbate environmental inequities is arbitrary and capricious

Contrary to EPA's conclusion, EPA's failure to set stronger standards will have disproportionate impacts on environmental justice communities. See 87 Fed. Reg. at 6354 (concluding "this action does not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, and/or indigenous people"). While the Proposed Rule has failed to adequately conduct an environmental justice analysis, the evidence already gathered and discussed above demonstrates that communities of color and people experiencing poverty are more likely to live adjacent to and downwind from airports and disproportionately suffer the negative health and environmental effects of aircraft PM emissions. Further, EPA has elsewhere collected clear evidence that

the airport traffic driving these emissions will increase in the near- and long-term.[68] Without stronger standards, communities near airports will suffer ever increasing levels of PM pollution from aircraft as these sources remain underregulated, even as communities further from airports will benefit from improvements in ambient PM levels from implementation of the PM NAAQS and vehicle emission standards. Accordingly, EPA's proposal not to reduce aircraft PM emissions will prolong and exacerbate longstanding inequities in environmental justice and the disproportionate exposure environmental justice communities have to aircraft emissions. EPA's conclusion otherwise is irrational, contrary to the record, and thus arbitrary and capricious. [EPA-HQ-OAR-2019-0660-0203-A1, p.26]

---

[63] Exec. Order No. 14,008.

[64] EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis, 1 (2016), https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf.

[65] Id. at 4.

[66] Id. at 11.

[67] EPA, DRAFT FY 2022-2026 EPA STRATEGIC PLAN – OCTOBER 1, 2021, at 27; see also EJ 2020 ACTION AGENDA, supra note 1, at 33-34.

[68] See, e.g., EPA, Airplane Greenhouse Gas Standards: Technical Support Document, pp. 97-106 (Jan. 2021) (modeling significant increases in fuel consumption from greater air traffic through 2040).

Organization: *Center for Biological Diversity and Friends of the Earth*

V. The Proposal Does Not Meaningfully Discuss Environmental Justice Impacts.

"[E]nvironmental justice is not merely a box to be checked."[87] Executive Order 12898 and Title VI of the Civil Rights Act of 1964 require EPA to consider how its Proposal would impact disadvantaged communities.[88] EPA's action is arbitrary and capricious because the agency has made no effort to conduct any meaningful analysis of those impacts. [89] [EPA-HQ-OAR-2019-0660-0189-A1, p.11] [[This comment is repeated in section 6.6.]]

EPA's "Environmental Justice" discussion consists only of a recitation of Technical Guidance questions and a brief summary of existing scientific literature that notes that communities near airports experience higher concentrations of PM as well as that those same communities are disproportionately low-income and communities of color.[90] Rather than apply the Guidance questions, EPA summarily concludes that there will be no "improvement in air quality for those who live near airports where these aircraft operate."[91] [EPA-HQ-OAR-2019-0660-0189-A1, p.11]

It was insufficient for EPA to recite Technical Guidance questions without making any attempt to answer them. EPA's "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" offers recommendations on "conducting the highest quality [EJ] analysis feasible." [92] The Guidance document provides three broad questions that agencies should address when conducting an EJ analysis: (1) "[a]re there potential EJ concerns associated with environmental stressors affected by the regulatory action for population groups of concern in the baseline;" (2) "[a]re there potential concerns associated with environmental stressors affected by the regulatory action for population groups of concern for the regulatory option(s) under consideration;" and (3) "[f]or the regulatory option(s) under consideration,

are potential EJ concerns created or mitigated compared to the baseline?" [93] As the Guidance notes, these questions are intended to help the agency understand "differences in impacts or risks," such as "differential exposures" and "differential health and environmental outcomes," that help decisionmakers understand whether they should take a different action.[94] [EPA-HQ-OAR-2019-0660-0189-A1, p.12]

EPA should have attempted to answer these questions and described in detail whether the Proposal will have a disproportionate impact on environmental justice communities near airports. To properly consider whether environmental justice concerns would be created or mitigated, EPA also should have analyzed the benefits of setting a standard for covered aircraft that would cause real and incremental reductions in PM emissions. And it should have considered how standards might be paired with investment in climate adaptation and filtration technologies for communities near airports that have borne the brunt of historical pollution. [EPA-HQ-OAR-2019-0660-0189-A1, p.12] [[This comment is repeated in section 6.6.]]

The Guidance further recommends that "[a]nalysts should present information on estimated health and environmental risks, exposures, outcomes, benefits and other relevant effects disaggregated by income and race/ethnicity."[95] According to this recommendation, EPA should have provided information on the anticipated health and environmental risks and impacts the proposed standards will have on these vulnerable subcommunities. Where this data is not available, the Guidance recommends using other metrics.[96] EPA cites to several studies that examine the disparate health impacts experienced by communities near airports. EPA should have utilized this information to conduct a disparate impacts analysis to explain how its Proposal would allow continued and even increasing PM emissions in these communities due to rising air traffic, resulting in further suffering in already overburdened communities. [EPA-HQ-OAR-2019-0660-0189-A1, p.12]

---

[87] *Friends of Buckingham v. State Air Pollution Control Bd.*, 947 F.3d 68, 92 (4th Cir. 2020).

[88] See, e.g., Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Exec. Order No. 12898, 59 Fed. Reg. 7,629 (Feb. 11, 1994), as amended, 60 Fed. Reg. 6,381 (Jan. 30, 1995).

[89] See *Vecinos para el Bienestar de la Comunidad Costera v. FERC*, 6 F.4th 1321, 1330-31 (D.C. Cir. 2021) (federal agency's environmental justice analysis was arbitrary and capricious where it failed to examine a pipeline project's environmental effects extending beyond the two-mile radius it studied).

[90] 87 Fed. Reg. at 6,336.

[91] Id.

[92] U.S. EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis 13 (2016) https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf.

[93] Id. at 11.

[94] Id.

[95] Id. at 13.

[96] Id.

Organization: *Clark, Mitchell*

The executive order which makes pursuing environmental justice a major priority will have many interesting effects on the policy of the EPA including this. I would have liked to see a consistent methodology laid out for conducting EJ analysis before any policies are created to avoid confusion and ensure consistency in policymaking. Despite this, limiting the amount of such particulate matter and changing the testing methods to include it does seem to further environmental justice for those living around the airports. As particulate matter, which is associated with potential health effects, would predominantly affect low-income areas around airports. [EPA-HQ-OAR-2019-0660-0139, p.1] [[This comment is repeated in section 6.6]]

Organization: *Environmental Defense Fund*

Only by increasing the stringency of the standards EPA will be able to bring environmental justice in accordance with Executive Order 14008.[33] [EPA-HQ-OAR-2019-0660-0207-A1, p.5]

Indeed, According to Executive Order 14008 "[a]gencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts." Since communities in the vicinity of airports are disproportionately represented by people of color and low-income populations, setting more stringent standards would certainly address environmental injustice and contribute to this whole-of-government approach. [EPA-HQ-OAR-2019-0660-0207-A1, p.5]

---

33 See 86 Fed. Reg. 7629, n.19 Executive Order 14008 of January 27, 2021, Tackling the Climate Crisis at Home and Abroad.

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should conduct a distributional analysis to evaluate the impacts of the Proposed Rule and all reasonable regulatory alternatives. Rather than conducting a separate analysis of the disproportionate burdens that pollution from aircraft imposes on communities of color living near airports, EPA should conduct a thorough distributional analysis as part of this rulemaking process. This analysis should include evaluation of the relative distributional consequences for each regulatory alternative. [EPA-HQ-OAR-2019-0660-0182-A1, p.1]

II. EPA Should Conduct a Distributional Analysis of the Consequences of Its Proposed Rule Instead of Postponing Such an Analysis for a Separate Action

EPA acknowledges the disproportionate burdens on people of color living near airports as a result of aircraft emissions.[28] A baseline understanding of disproportionate burdens created by the source category is helpful, but must be accompanied by an analysis that evaluates the distribution of impacts resulting from the Proposed Rule and any marginal differences from adopting EPA's proposed alternatives. Indeed, President Biden's Memorandum on Modernizing Regulatory Review calls for analysis of rules' "distributional consequences . . . to ensure that regulatory initiatives appropriately benefit and do not inappropriately burden disadvantaged, vulnerable, or marginalized communities."[29] And evaluation of alternatives is crucial to a meaningful analysis, as the distributional impacts of an

available regulatory alternative may be more desirable than those of the proposed policy.[30] [EPA-HQ-OAR-2019-0660-0182-A1, p.4]

---

[28] 87 Fed. Reg. at 6335–36.

[29] Memorandum on Modernizing Regulatory Review § 2(b)(ii), 86 Fed. Reg. 7223, 7223 (Jan. 25, 2021) (emphasis added).

[30] See Revesz & Yi, supra note 16, at *35.

Organization: Mass Comment Campaign sponsored by Friends of the Earth (FoE) (17,949)

The proposal lists the questions that EPA should answer when assessing EJ impacts according to the agency's Technical Guidance Document but makes no effort to answer them. [EPA-HQ-OAR-2019-0660-0194-A1, p.1]

Organization: National Association of Clean Air Agencies (NACAA)

EPA must also adopt more stringent aircraft PM standards to remain faithful to the Administration's, and President Biden's in particular, environmental justice mission and commitments.[4] [EPA-HQ-OAR-2019-0660-0177-A1, p.2] [[This comment can also be found in section 2.3 of the comment summary]]

As EPA articulates in the NPRM, the Administration has directed federal agencies, "to the greatest extent practicable and permitted by law, to make achieving environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States."[5] [EPA-HQ-OAR-2019-0660-0177-A1, p.2]

---

[4] *See for example*, President Biden's "Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" (EO 13990, January 20, 2021) and "Executive Order on Tackling the Climate Crisis at Home and Abroad" (EO 14008, January 27, 2021).

[5] *Supra* note 1, at 6,326

Organization: Service Employees International Union (SEIU)

SEIU files this comment because our members who work at and live near airports are directly impacted by particulate matter emissions from aircraft and pollution in general from airports. Our members and their communities will have to live with the emissions allowed by the Agency's rule for years to come. In proposing a rule that fails to meaningfully restrict emissions on new engines and takes no action on the emissions of engines already in service, the EPA's proposed rule is insufficient to protect the public health and does not live up to the mandates set forth for EPA in statute and Executive Orders. [EPA-HQ-OAR-2019-0660-0191-A1, p.2] [[This comment is repeated in sections 2.3, 3.2, and 6.6]]

In President Biden's Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, the President declares his Administration's policy to "improve public health and protect our environment; to ensure access to clean air and water; ... to hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; ... and to prioritize ... environmental justice . ... "[20] [EPA-HQ-OAR-2019-0660-0191-A1, p.5]

In proposing a standard that fails to reduce emissions, fails to adequately protect public health, and fails to address the disproportionate impact of these emissions on low-income and communities of color, the EPA has fallen short of these mandates. [EPA-HQ-OAR-2019-0660-0191-A1, p.5] [[This comment is repeated in section 11.1]]

---

[20] Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, (E.O. 13990), 86 FR 7037 (January 25, 2021) available at https:/lwww.whitehouse.gov/briefingroom/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoringscience-to-tackle-climate-crisis/.

EPA Response to Comments in Section 11.5

Executive Order 12898 requires EPA to address "disproportionately high and adverse human health or environmental effects" of its actions "on minority populations and low-income populations," see Executive Order 12898 section 1-101. The PM standards provide similar levels of environmental protection for all affected populations by preventing aircraft engine PM levels from increasing beyond their current levels. The EPA believes it appropriately considered environmental justice in the context of this rulemaking, as described in Section III.G of the Preamble to the final rulemaking and in response to comments in 6.6 of this document.

Executive Orders 12898 and 14008 by their own terms do not create a right to judicial review (Executive Order 12898 section 6-609 and Executive Order 14008 section 301(c)). *See Sur Contra La Contaminacion v. EPA*, 202 F.3d 443, 449-50 (1st Cir. 2000) (judicial review is not available under EO 12898); *Air Transp. Ass'n of Am. v. FAA*, 169 F.3d 1, 8-9 (D.C. Cir. 1999) (holding that a claim under another executive order with nearly identical judicial review language was not judicially reviewable and that petitioner's claim that the action at issue was arbitrary and capricious because of the agency's alleged violation of the order was "nothing more than an indirect—and impermissible—attempt to enforce private rights under the order").

CBD's reference to *Vecinos Para El Bienestar De La Comunidad Costera v. FERC*, 6 F.4th 1321, 1325 (D.C. Cir. 202) is misplaced. *Vecinos* is part of a line of cases in which the D.C. Circuit has allowed review of environmental justice analyses expressly incorporated into Environmental Impact Statements and other evaluations specifically required under the National Environmental Policy Act (known as "NEPA"), and that comprised part of the foundation for the agency's decision. *See, e.g., Cmtys. Against Runway Expansion, Inc. v. FAA*, 355 F.3d 678, 688-89 (D.C. Cir. 2004) (explaining that its review did not arise under Executive Order 12,898 but that the "claim is properly before this court because … [t]he FAA exercised its discretion to include the environmental justice analysis in its NEPA evaluation, and that analysis therefore is properly subject to 'arbitrary and capricious' review under the [Administrative Procedure Act]"); *Vecinos*, 6 F.4th at 1330 (citing *Cmtys. Against Runway Expansion* and allowing a challenge "under NEPA and the [Administrative Procedure Act]"). No court has ever applied the *Vecinos* line of cases outside of the NEPA context to review an agency's discussion of its compliance with Executive Order 12,898. EPA actions under the Clean Air Act are not subject to obligations under NEPA, see 15 U.S.C. section 793(c)(1), so the narrow right of review discussed in *Vecinos* has no bearing here. The EPA did not propose, nor is finalizing, any federal financial assistance for any program or activity in this rulemaking, so comments related to Title VI of the Civil Rights Act of 1964 are out of the scope of this rulemaking.

The EPA's proposed rule (87 FR 6324, 6353, February 3, 2022) was subject to interagency review through OMB's Office of Information and Regulatory Affairs. The White House Environmental Justice Advisory Committee advises the White House Council on Environmental Quality, which was provided the opportunity to comment on the proposed rule during interagency review. All comments the EPA received during interagency review are available in the docket for this action.

11.6 Executive Order 13132

Organizations Included in this Section

California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

Organization: California Attorney General on behalf of California (by and through the California and California Air Resources Board), Connecticut, Illinois, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin

Finally, the Proposed Rule suffers additional legal flaws that would render its final adoption arbitrary and capricious, including EPA's failure to accurately evaluate and redress the cumulative and disproportionate impacts of aircraft emissions on environmental justice communities and evaluate federalism implications according to its own stated practices. [EPA-HQ-OAR-2019-0660-0203-A1, p.4-5] [[This comment is repeated in sections 11.1 and 11.5.]]

E. EPA arbitrarily disregards the Proposed Rule's federalism implications

Executive Order 13,132 instructs agencies, before promulgating a rule with "substantial direct effects on the States, [or] on the relationship between the national government and the States," to ensure "meaningful and timely input" from State and local officials in the rule's development. Exec. Order 13,132 §§ 1(a), 6(a), 6(b)(2)(A), 64 Fed. Reg. 43,255, 43,256-58 (Aug. 4, 1999). The agency must also include in the rule preamble a "federalism summary impact statement" describing "the extent of the agency's prior consultation with State and local officials, a summary of the nature of their concerns and the agency's position supporting the need to issue the regulation, and a statement of the extent to which the concerns of State and local officials have been met." Id. § 6(b)(2)(B). Here, however, EPA includes nothing more than a bald assertion that the Proposed Rule "will not have substantial direct effects on the states, [or] on the relationship between the National Government and the states," and thus provides no impact statement under Executive Order 13,132. 87 Fed. Reg. at 6353. [EPA-HQ-OAR-2019-0660-0203-A1, p.27]

EPA's assertion is inaccurate and troubling. In fact, as described above the Proposed Rule, if adopted, would have substantial direct effects on the States, particularly the Commenting States, and would disrupt the cooperative relationship between the Commenting States and the federal government. Because the Clean Air Act prohibits States from adopting aircraft emission standards unless they are identical to federal standards, 42 U.S.C. § 7573, they depend on the federal government to adopt effective aircraft standards and are injured when EPA shirks this duty. See *Massachusetts v. EPA*, 549 U.S. 497, 519-21 (2007) (having surrendered their "sovereign prerogatives" to the Union, the States are harmed when the federal government refuses to regulate greenhouse gas emissions). These negative effects extend beyond the grave harms to the health and welfare of their residents detailed in Part II. First, by failing to reduce dangerous pollution within the federal government's exclusive jurisdiction, the

Proposed Rule strains the resources of state health and environmental programs treating the avoidable health effects and ecological damage that EPA declines, in the name of international harmonization, to prevent. Second, the Proposed Rule frustrates the Commenting States' efforts to meet national ambient air quality standards for PM, because "when EPA allows higher [] emissions from aircraft engines, state agencies have no choice but to impose greater restrictions on other sources." NACAA, 489 F.3d at 1227. [EPA-HQ-OAR-2019-0660-0203-A1, p.27]

The Clean Air Act is a hallmark of cooperative federalism, as EPA and state air agencies partner to protect public health from the harmful effects of air pollution. The Proposed Rule—which fails to reduce PM emissions and thereby fails to mitigate the danger to public health and welfare from these emissions—poses a risk of significant public health, economic, and quasi-sovereign harms to the Commenting States. The relationship between the States and the federal government suffers when the States cannot trust the federal government to fulfill its obligations to protect the public health and welfare as required under federal law. The Proposed Rule's inefficacy thus gravely burdens the States' quasi-sovereign interests and the relationship between the national government and the States. EPA's failure to recognize these serious federalism implications undermines the rationality of the entire Proposed Rule. [EPA-HQ-OAR-2019-0660-0203-A1, p.27]

EPA Response to Comments in Section 11.6

The EPA disagrees that the PM standards raise federalism concerns under Executive Order 13132 or is inconsistent with the cooperative federalism framework of the Clean Air Act. In CAA section 233, Congress, not the EPA, preempted the States from directly regulating aircraft emissions – favoring unilateral federal control over cooperative State-federal partnership. As such, the EPA's adoption of these PM aircraft emissions standards does not take away any authority that a state would otherwise have to regulate such pollution. This rulemaking thus does not alter the relationship between the States and the federal government, nor does it create any substantial new burden affecting the States. Indeed, this rulemaking does not directly regulate any State and or local governments at all. The cooperative federalism framework of the Clean Air Act includes areas where Congress has decided to preempt state and local regulation, and aircraft emissions are one area where state and local governments may not adopt standards different from those that the United States adopts. Accordingly, EPA believes that this rule is consistent with the Clean Air Act and its policies.

Executive Order 13132 by its own terms does not create a right to judicial review (Executive Order 13132 section 11). *See Air Transp. Ass'n of Am. v. FAA*, 169 F.3d 1, 8-9 (D.C. Cir. 1999) (holding that a claim under another executive order with nearly identical judicial review language was not judicially reviewable and that petitioner's claim that the action at issue was arbitrary and capricious because of the agency's alleged violation of the order was "nothing more than an indirect—and impermissible—attempt to enforce private rights under the order").

12. Technical Amendments

12.1 Migration of Regulatory Text to New Part

Organizations Included in this Section

Aerospace Industries Association (AIA)
Boeing Company (Boeing)
General Electric Company (GE)

Organization: *Aerospace Industries Association (AIA)*

AIA supports the EPA's structural changes and streamlining of the existing regulations with the migration to 40 CFR Part 1031. [EPA-HQ-OAR-2019-0660-0178-A1, p.4]

Regarding Section 40 CFR 1031.40 (a), the equation shown does not align with ICAO's smoke number (SN). The equation formatting in the draft rule should show the number -0.168 as an exponent to rO, the engine rated maximum thrust. [EPA-HQ-OAR-2019-0660-0178-A1, p.5]

In Section 40 CFR 1031.50 (a) and 40 CFR 1031.90 (a) the equation shown does not align with ICAO's smoke number (SN). The equation formatting in the draft rule should show the number -0.274 as an exponent to rO, the engine rated maximum thrust. [EPA-HQ-OAR-2019-0660-0178-A1, p.6]

In Section 40 CFR 1031.90 (c) the equation shown does not align with ICAO's HC limit. For supersonic engines, the equation should show rPR (rated pressure ratio) as an exponent, not a multiplier. [EPA-HQ-OAR-2019-0660-0178-A1, p.6]

In Section 40 CFR 1031.90 (d), the equation shown does not align with ICAO's CO limits. The equation formatting in the draft rule should show the number -1.03 as an exponent to rPR, the engine rated pressure ratio. [EPA-HQ-OAR-2019-0660-0178-A1, p.6]

Finally, in 40 CFR 1031.200, the Abbreviations Section, the abbreviation for microgram, milligram, grams, and kilogram should be µg, mg, g, and kg, respectively. [EPA-HQ-OAR-2019-0660-0178-A1, p.6]

Organization: *Boeing Company (Boeing)*

In reviewing the proposed rule Boeing has been in coordination with AIA and its members and has helped AIA identify some specific details in EPA's proposed stringency equations and nomenclature that could be misinterpreted, creating potential inconsistency with the standard developed through ICAO. [EPA-HQ-OAR-2019-0660-0180-A1, p.1]

Organization: *General Electric Company (GE)*

E. EPA should consider the comments made by Aerospace Industries Association (AIA) and Airlines for America (A4A).

In finalizing the proposed standard, GE respectfully requests that EPA consider the comments to the rule:

AIA: In reviewing the proposed rule, AIA identified some specific areas in stringency equations and nomenclature where EPA's regulations could be misinterpreted, creating potential inconsistency with what was developed through ICAO. GE restates its support for AIA's suggested specific modifications to the rule, incorporating AIA's "Specific comments on the EPA's proposed rule" section herein by reference. [EPA-HQ-OAR-2019-0660-0183-A1, p.7]

EPA Response to Comments in Section 12.1

The EPA notes the support for the streamlining of the existing regulations and of their migration to a new part in the CFR.

The EPA agrees with AIA that a number of equations, when migrated from 40 CFR part 87 to a new 40 CFR part 1031, were proposed incorrectly. Since the EPA's clearly stated intent was to migrate those

regulatory provisions to the new part 1031 without change, the equations in 40 CFR 1031.40(a), 103150(a), and 1031.90(a), (c), and (d) have been corrected accordingly in the final rule. Finally, the EPA agrees with the AIA comment regarding the abbreviations. Accordingly, the abbreviations µg, mg, g, and kg are being adopted for microgram, milligram, grams, and kilogram, respectively. Similarly, the EPA is finalizing an abbreviation for meter of m, as opposed to the proposed abbreviation of M. This change conforms with the type of clarifying edits requested by AIA and will make this abbreviation consistent with standard scientific practice.

12.2 Deletion of Unnecessary Provisions

Organizations Included in this Section

Aerospace Industries Association (AIA)

Organization: *Aerospace Industries Association (AIA)*

ICAO's nvPM standards explicitly acknowledge that they apply only to civil aircraft and shall not apply to state aircraft such as those used by military, customs, and police services. AIA appreciates that the EPA's proposed regulatory text aligns with ICAO's and explicitly states applicability to civil subsonic jet engines greater than 26.7 kN. [EPA-HQ-OAR-2019-0660-0178-A1, p.4]

EPA Response to Comments in Section 12.2

The EPA notes the support for the applicability provisions as proposed.

12.3 Other Technical Amendments and Minor Changes

Organizations Included in this Section

Aerospace Industries Association (AIA)
Layog, Joshua

Organization: *Aerospace Industries Association (AIA)*

AIA supports the change in Section 40 CFR 1031.30 (b) (fuel venting requirements) to clearly state that the intention of the rule is to prevent liquid fuel exiting the engine after engine shutdown. This was not clear in the previous language and created challenges in interpretation among the requirements in different states. The new text aligns well with ICAO language for consistency among the aerospace industry requirements. [EPA-HQ-OAR-2019-0660-0178-A1, p.4]

AIA supports the inclusion of the current U.S. supersonic engine emissions standards in the revised regulation, and the harmonization with the ICAO provisions for these engines. [EPA-HQ-OAR-2019-0660-0178-A1, p.5]

AIA also supports the detailed provisions in Section 40 CFR 1031.130 (c) explicitly adopting ICAO's guidance for similarity of a derivative engine to previously certificated engines as demonstrated by the type certificate holder, which includes reasonable ranges of a no-emissions change for NOx, CO, UHC, SN, nvPM mass concentration, nvPM LTO mass, and nvPM LTO number. [EPA-HQ-OAR-2019-0660-0178-A1,p.5]

Organization: *Layog, Joshua*

I agree with the application of smoke number standards to engines less than or equal to 26.7 kilonewtons rated output in supersonic airplanes because our modern society continues to forward innovation towards bigger and faster jets than send more people in faster times. With this trend of

technology further innovating in aviation, it is my opinion that emissions need to be held to these standards in order to set a benchmark for the future, as more faster jets will continue to be built. In our environment, air travel is something that people enjoy and need in order to realistically see their far away loved ones, so it is a necessary emissions standard for the sake our society's collective air quality. These standards prevent pollution because the Federal Aviation Admin. and EPA collaborated on this. [EPA-HQ-OAR-2019-0660-0144, p.1]

EPA Response to Comments in Section 12.3

The EPA notes the commenters' support of the proposed provisions relating to fuel venting, derivative engines and the application of supersonic emission standards to engines at or below 26.7 kN rated output.

13. Outside the Scope of Rulemaking

Organizations Included in this Section

Anonymous Public Comment – 8
Center for Biological Diversity and Friends of the Earth
Environmental Defense Fund (EDF)
Growth Energy
Kroeker, Anne
National Association of Clean Air Agencies (NACAA)
Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way
Rojas, Angell
Rosetta Advisory Services, Brussels
Simons-Wilson, Alex
South Coast Air Quality Management District (South Coast AQMD)
Ventura, Paula
Wagner, Debi

Organization: Anonymous Public Comment - 8

Blessed is he who comes in the name of the lord. Looking foward to speaking with Kendell Owensworker at forrest city school district. concerning matters that reach local attention and for training in FAA. For bettering understanding this is a goal set to help our youth and families traveling to and from our historic and national parks and support in traveling in our educational fields and careers. and also training in aircraft and engines. and supportive upgrading that supports safety and procedures, i will be contacting board members in location that supports document. [EPA-HQ-OAR-2019-0660-0156, p.1]

Organization: Anonymous Public Comment - 11

It has been concluded that aircraft jet engines produce carbon dioxide (CO2), water vapor (H2O), nitrogen oxides (NO2), carbon monoxide (CO), oxides of sulfur (SO2), unburned or partially combusted hydrocarbons (also known as volatile organic compounds (VOCs), particulates, and other trace compounds. These particles are being released into the air causing two issues which are an increase of greenhouse gases and health issue for American citizens. [EPA-HQ-OAR-2019-0660-0166, p.1] [[This comment is repeated in section 6.2]]

The first issue is the increase of the greenhouse gas, carbon dioxide being released. For example, human activity is a cause of the increase due to the demand for aircrafts in which humans must engineer the aircrafts ultimately allowing humans to travel on these aircrafts. Leading into my second point, as we fly, we are burning fossil fuels through aircraft engines in which the engines are releasing nitrogen oxide into the air. Nitrogen oxide creates smog and acid rain. It has been noted that one major source of nitrogen oxide comes from airplanes. [EPA-HQ-OAR-2019-0660-0166, p.1]

Organization: *Aviation-Impacted Communities Alliance (AICA)*

More stringently regulate CO2 and disregard ICAO recommendations and strengthen all US standards. [EPA-HQ-OAR-2019-0660-0159-A1, p.1] [[This comment can also be found in section 2.3 of the comment summary]]

Organization: *Center for Biological Diversity and Friends of the Earth*

To effectively reduce greenhouse gas emissions from the aviation sector, emission standards should: (1) apply to in-service aircraft, not just to new aircraft and new aircraft designs; […] If EPA chooses not to employ these options, it should provide a reasonable explanation for that decision.[99] [EPA-HQ-OAR-2019-0660-0189-A1, p.13]

---

[99] See, e.g., State Farm, 463 U.S. at 47-49 (reaffirming that "an agency must cogently explain why it has exercised its discretion in a given manner").

Organization: *Environmental Defense Fund*

In addition to air quality impacts, nvPM also contribute to global warming. Aviation's non- CO2 climate effects represent about two thirds of the net climate impact.[41] Contrails are one of the key drivers of aviation's non-CO2 climate effects, and these are induced primarily by nvPM emissions from aircraft engines. Contrails form when aircraft engines emit particulates in ice-supersaturated regions which act as condensation nuclei for ice crystals. These result from the incomplete combustion of aromatic compounds such as naphthalenes.[42] Contrails represent a contribution to global warming that is significant when compared to that of aviation CO2 emissions.43 [EPA-HQ-OAR-2019-0660-0207-A1, pp.6-7]

Pursuant to EPA's 2016 "Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare" (2016 Findings), EPA is bound to issue standards under section 231. In the 2016 Findings, EPA found that aircraft engine emissions of six well-mixed greenhouse gases (GHG) contribute to air pollution as defined under CAA section 231 and "endanger the public health and welfare."[45] Consequently, EPA is now required by law to propose standards applicable to the emissions referenced in the 2016 Findings. [EPA-HQ-OAR-2019-0660-0207-A1, p.7]

In its 2016 findings, EPA determined that six well-mixed GHG—carbon dioxide (CO2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—all emitted from aircraft engines, contribute to air pollution causing climate change, and thus endanger public health and welfare.[46,47] However, by the time EPA began the process of developing the standards, new studies found that non-carbon dioxide (non-CO2) emissions, including water vapor, NOX, and aerosol particles including nvPM together contribute to roughly two-thirds of the environmental impact of aviation, while carbon dioxide emissions contribute to the remaining third.[48] These non-CO2 emissions were omitted from the 2016

Findings[49] due in part to the fact that the "effective radiative forcing" (ERF) metric utilized by the new study not fully available when the 2016 Findings were being assembled. With more complete and accurate information now available, EPA should work to tailor its standards to address newly recognized areas of environmental concern. [EPA-HQ-OAR-2019-0660-0207-A1, p.7]

Specifically, EPA should undertake the following, within its broad statutory authority under the CAA, and in consultation with the Administrator of the FAA under Sec. 232 of the CAA and 49 U.S.C. Sec. 44714:

• set protective emissions limits for aircraft engines that encourage and incentivize the emission reductions actually achieved

o by flight techniques that reduce total emissions per flight[61] including reduced thrust takeoff operations[62] and flight planning process avoiding low-temperature ice-supersaturated air.[63]

o through the use of synthetic hydrocarbons (also known as Sustainable Aviation Fuels or SAF) that have been determined by EPA, working from the framework established by ICAO with the participation and approval of the United States, to meet stringent sustainability criteria, provided that EPA has determined that the fuels:

- emit at least 60% less GHG than conventional jet fuels on a lifecycle basis,

- the associated feedstocks have low indirect land use change risk and therefore avoid unintended environmental and social consequences including, ecosystem destruction, biodiversity loss, hunger, food insecurity and malnutrition, and

- the emissions reductions are not double-counted;

o through the removal of naphthalenes and sulfur and the reduction or removal of aromatics from conventional jet fuel. [EPA-HQ-OAR-2019-0660-0207-A1, p.9]

Such approaches could be pursued in a manner that supports and recognizes the primary role that other agencies have in these areas, while spurring American innovation and creating jobs in the United States. EPA and the FAA have in fact previously asserted the authority to consider "new air traffic systems and flight management techniques that can result in environmental benefits," when developing and implementing standards.[64] EPA can build on these prior approaches with FAA in this rulemaking. [EPA-HQ-OAR-2019-0660-0207-A1, pp.9-10] [[This comment can also be found in section 10 of the comment summary]]

---

41 Lee et al, 2020, (op. cit.)

42 Arrowsmith S., D. Lee, B. Owen, J. Faber, Wijngaarden, Boucher, Celikel, Deransy, Fuglestvedt, J. Laukia, et al., 2020, Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4), Final report. Cologne, European Union Aviation Safety Agency (EASA).

---

[43] Lee et al, 2020, (op. cit.)

[45] 81 Fed. Reg. 54422.

[46] 81 Fed. Reg. 54422.

[47] See 85 Fed. Reg. 51558.

[48] Lee et al., (op. cit.)

[49] See 81 Fed. Reg. 54447.

[61] See 49 U.S.C. §§ 40103(b) ("The Administrator of [FAA] shall develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace."). In consulting with FAA on aircraft engine emission standards, EPA may consider the reduction effects of particular flight techniques and flight paths that FAA would then mandate to ensure compliance with EPA's standards.

[62] Koudis et al., 2017, (op. cit.)

[63] Faber et al., 2022, (op. cit.)

[64] FAA and EPA, ''Agreement Between Federal Aviation Administration and Environmental Protection Agency Regarding Environmental Matters Relation to Aviation,'' signed on March 24, 1998 by FAA's Acting Assistant Administrator for Policy, Planning, and International Aviation, Louise Maillet, and EPA's Acting Assistant Administrator for Air and Radiation, Richard Wilson. A copy of this document can be found in EPA Docket OAR–2002–0030.

Organization: Growth Energy

1. A strong and growing Renewable Fuel Standard (RFS): To reach the volumes being discussed, it is critical to have the solid foundation of the RFS. As we recently outlined in our submission, the agency must move as quickly as possible to fix the flaws and finalize its proposed renewable volume obligation (RVO) for 2020 – 2022 and continue robust growth in renewable fuels into the future.[3]

2. Accurate life-cycle emissions modeling: We strongly support the use of the Department of Energy's Argonne National Laboratory's GREET model which appropriately accounts for innovations in American agriculture and biofuel production. Use of the GREET model is best suited to assess American-made SAF from bio-based feedstocks. [EPA-HQ-OAR-2019-0660-0204, p.3]

---

[3] Growth Energy, "Comments on EPA's Renewable Fuel Standard (RFS) Program: RFS Annual Rules", February 4, 2022: Growth-Energy-RVO-Comment_Exhibits.pdf (growthenergy.org)

Organization: Ilabdfara, Rasanjali

The overall big concern regarding the aviation issue is that it's causing climate change to increase as well as our overall health. Looking more into specifics of how aviation has affected us I want to bring up two main topics: sound, water, and gas pollution. [EPA-HQ-OAR-2019-0660-0170, p.1] [[This comment can also be found in section 10 of the comment summary]]

Noise Pollution:

From take-off to landing aircraft engines tend to emit loud noises. Loud sounds, from aviation and others, give the potential to cause loss of hearing, interfere with communication and even cause changes in biological behavior, such as mating. This causes an issue for animals and humans as well.

With such risks, it may eventually lead to less biodiversity among species. [EPA-HQ-OAR-2019-0660-0170, p.1]

Gas Pollution:

Looking at planes and air crafts, most of them use gasoline as fuel or even biofuels which releases CO2 into our atmosphere. CO2, needless to say, increases the greenhouse effect and causes an increase in the Earth's temperature. In addition to CO2, Ozone is also a big drawback of aviation. This short-lived greenhouse gas has been reported by scientists to have been more apparent in the Pacific. With planes emitting gasses like nitrogen oxide, it has the potential for interference with ozone gasses. Due to such interferences, it would lead to the ozone layer breaking and again leading to effects of global warming to increase. [EPA-HQ-OAR-2019-0660-0170, p.1]

Such pollution also leads to effects on human health. Smog, and overall carbon dioxide, lead to toxic and polluted air that humans breathe in. This polluted air becomes toxic to our lungs and causes serious health issues. Some concerns include the risk of asthma, lung cancer, infections, and more. Ozone interference leads to consequences such as skin cancer, immune deficiencies, an overall effect on the food chain, and many more. [EPA-HQ-OAR-2019-0660-0170, p.1]

Water Pollution:

Aircraft are most known to use petroleum-based fuels, which excrete sulfur dioxide and nitrogen oxides. These glasses are known to be the roots of acid rain. As they rise and mix in with water and O2, it will eventually come down as acid rain. Acid rain leads to depletion of soil quality and crop quality, eventually causing issues with human health and lowering the availability of food. Acid rain falling into rivers and lakes also pose a threat to aquatic life and even habitats humans depend on such as mangroves. In addition, with the wind blowing the clouds acid rain becomes a problem for all countries. [EPA-HQ-OAR-2019-0660-0170, p.1]

Organization: *Kroeker, Anne*

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 56.]

The sustaining -- so-called sustainable aviation fuels or biofuels are not also addressing carbon emissions because the burn at the tailpipe is still the same. And the global carbon accounting still covers what comes out of the tailpipe, not production pathways. So it is a bit of a red herring when we go down this -- what will save us will be alternate biofuels because it doesn't take care of the growth that has been talked about when you have multiple aircraft operations. And even recently I saw that ethanol production pathways could perhaps be producing more greenhouse gas emissions than the gasoline or jet fuel, either one of those standard oil-based productions.

[The following comments were submitted as testimony at the virtual public hearing on February 17, 2022. See Docket Number EPA-HQ-OAR-2019-0660-0160, pp. 56.]

And even our HEPA filters, if you want to know that, we have them everywhere, and that's already accepted.

Organization: *National Association of Clean Air Agencies (NACAA)*

Further, EPA is now in the process of reconsidering the existing PM NAAQS, adopted in 2012 and reaffirmed in December 2020. In a letter transmitted to Administrator Michael S. Regan on March 18, 2022, EPA's science advisors on the Clean Air Science Advisory Committee (CASAC) wrote that "all CASAC members agree that the current level of the annual [PM2.5] standard [12 micrograms per cubic meter (µg/c3)] is not sufficiently protective of public health and should be lowered" and that a majority of CASAC members finds "that the available evidence calls into questions the adequacy of the current 24-hour standard [35-µg/m3]" and "conditional on retaining the current form, the majority of CASAC members favor lowering the 24-hour standard."[3] [EPA-HQ-OAR-2019-0660-0177-A1, p.2]

Fourth, there is also the potential here for garnering further, important reductions in aircraft nitrogen oxide (NOx) emissions. EPA should analyze this potential and take steps to maximize aircraft NOx reductions. [EPA-HQ-OAR-2019-0660-0177-A1, p.4]

III. NACAA's Recommendations

The agency should also explore the use of sustainable aviation fuel, which has the potential to yield substantial reductions in PM and sulfur oxides. [EPA-HQ-OAR-2019-0660-0177-A1, p.4]

---

[3] "CASAC Review of the EPA's Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter" (External Review Draft 22 – October 2021)" (March 18, 2022) – https://www.4cleanair.org/wp-content/uploads/PM-NAAQS-CASACResponses-to-EPA-PM-Draft-PA-031822.pdf

Organization: *Port of Seattle in collaboration with the cities of SeaTac, Burien, Des Moines, Tukwila, Normandy Park and Federal Way*

As we look beyond these proposed updated PM standards, the focus of our community collaboration centers on two areas: 1) sustainable aviation fuels (SAF) and 2) ultrafine particulates (UFP). With regard to SAF, we know that SAF not only reduces lifecycle carbon emissions but also emits significantly less UFP and Sulphur oxides (SOx), which benefits the global climate and local airport communities. For that reason, SEA has set a goal to fuel all aircraft at the airport with at least a 10% blend by 2028. We strongly support those provisions of the Build Back Better Act that would incentivize SAF production and infrastructure development, and we applaud the Biden Administration's Sustainable Aviation Fuel Grand Challenge and related actions. Without policy leadership, investment, and partnership at the federal level, it will be challenging to achieve necessary levels of SAF availability and affordability. If there are ways for EPA, SEA, and near-airport communities to work together to advance SAF implementation, we welcome further discussion. [EPA-HQ-OAR-2019-0660-0174-A1,p.2] [[This comment also appears in section 10]]

Organization: *Rojas, Angell*

Additionally, contrails are condensation trails that are released by airplanes, which trap heat that's released from the earth. Regulating these emissions could lower the number of contrails and/or the severity of them, therefore promoting healthier air and ecosystem. [EPA-HQ-OAR-2019-0660-0168-A1, p.1]

Organization: *Rosetta Advisory Services, Brussels*

The February 22 EAP hearing and subsequent submissions seem to have missed a key point. Reducing LTO NvPM (soot/black carbon) emissions also cuts these emissions at altitude where emitted soot particles trigger the formation of climate warming contrails/cirrus cirrus whose total impact accounts for over 60% of aviation climate warming. Cutting LTO NvPM therefore addresses both airport local air quality and climate warming. Cuts to black carbon, a powerful SLCF, means the climate impact of less soot/contrails will be immediate. [EPA-HQ-OAR-2019-0660-0181-A1, p.1]

A related elephant in the room is the CAEP 10 aircraft CO2 "do nothing" emission standards which are equally technology following. Despite pressure for greater ambition, the EPA declined last November to review its decision to support their adoption in US domestic law. The proposed "stringency" provisions were already weak when CAEP members met in secret in the final negotiating week in 2015 and agreed an "Option 3" - five year delay to the in-Production cutoff date - 01 January 2028 instead of 2023. The EPA's January 2021 Docket EPA-HQ-OAR-2018-0276 recommends adopting these ICAO CO2 aircraft standards in US domestic law. Page 29 reveals a Boeing request that the 2028 in-Production cut-off date be extended another 10 years for Boeing 767F aircraft "in order to upgrade or replace the 767F in a practicable and economically feasible manner". In the separate Response to Comments document, the EPA questions Boeing's arguments about the impact of Covid delays and dismisses as "an unprecedented product in the modern jet era" Boeing's suggestion to build a new dedicated freighter aircraft type – not passenger conversion. The EPA noted that at the time "the Boeing 767F… did not already meet the in-production standards under consideration and did not already have a replacement airplane under development". Page 138 now makes clear for the first time the connection between "Option 3" and the B767F; "the U.S. advocated for additional flexibilities for freight airplanes in the final standards. ICAO then adopted its standards imposing a 2028 date". [EPA-HQ-OAR-2019-0660-0181-A1, p.2]

The US joined public criticism at the time of an alleged European plot to weaken the standards to protect the already ailing and non-compliant A380 production line. Less well known - and denied at the time - was a possible move to protect the USAF's order of 177 KC46 tanker aircraft – completion date end 2027. The KC46 - a modified Boeing 767–2C "provisioned freighter" (GAO page 6) certified under FAA commercial airworthiness procedures (so also facilitating the use of existing/cheaper civilian aircraft suppliers) is also subject to the 2028 in-P cutoff date. Could Boeing's surprise request today to extend the In-P production cutoff date a further decade for B767F domestic freight reasons also be related to speculation that the B767/KC46 could be the best way to meet the USAF's need for further (up to 160) such aircraft – the so-called KC-Y bridge tanker program? Might past suggestions of transatlantic collusion involving just two aircraft - the A380 and the B767/KC46 – in order to render global emission cuts a mere fairy tale be well founded after all? [EPA-HQ-OAR-2019-0660-0181-A1, p.2]

Organization: *Simons-Wilson, Alex*

However, ourworldindata.org states that in 2018, it's estimated that global aviation – which includes both passenger and freight – emitted 1.04 billion tonnes of CO2. This represents 2.5% of total emissions in 2018. Since aviation represents a relatively small amount of global CO2 contribution, I encourage the EPA to find other measures in which emissions can be reduced. [EPA-HQ-OAR-2019-0660-0147, p.1]

On a final note, general aviation aircraft (GA) are still using 100LL which is fuel containing lead. This lead remains in the air which can be breathed in by those living in or working in the vicinity of airports.

Leaded aviation fuel, or av gas, now makes up the largest remaining aggregate source of lead emissions to air in the U.S according to the EPA. The EPA must work with congressional leaders as well as oil firms to develop and use non-leaded fuel. [EPA-HQ-OAR-2019-0660-0147, p.1]

Organization: *South Coast Air Quality Management District (South Coast AQMD)*

While all sectors of mobile sources are expected to reduce emissions, U.S. EPA has not revised commercial aircraft NOx emission standards since 2012.4 As a result there are no new regulations applicable to aircraft to reduce NOx emissions between now and 2037. Aircraft NOx emissions must therefore be addressed so that South Coast AQMD and other areas of the country can meet federal clean air standards. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

We are further concerned that this rule, like others for aircraft engines, targets only one pollutant in isolation without considering inadvertent increases in others. In 2021, U.S. EPA finalized Greenhouse Gas (GHG) emission standards for commercial aircraft, which aligned with standards adopted by ICAO in 2017.[5] While these regulations require more fuel-efficient aircraft with lower GHG emissions, NOx emissions from these aircraft are typically higher. For example, TAPS-II LEAP combustor aircraft engines increase fuel efficiency to meet GHG standards while simultaneously increasing NOx emissions. A Boeing 737-8 MAX equipped with a LEAP-1B28 engine increases landing/takeoff NOx emissions by about 50% compared to a Boeing 737-700 equipped with a CMF56-7B24 engine.[6] It is therefore imperative that EPA consider an integrated, multipollutant approach to aircraft engine standards that avoids such inadvertent increases. [EPA-HQ-OAR-2019-0660-0210-A1, p.2]

---

[4] 40 CFR Parts 87 and 1068, (https://www.govinfo.gov/content/pkg/FR-2012-06-18/pdf/2012-13828.pdf)

[5] 40 CFR Parts 87 and 1030, (https://www.govinfo.gov/content/pkg/FR-2021-01-11/pdf/2020-28882.pdf)

[6] ICAO Engine Emissions Databank, https://www.easa.europa.eu/domains/environment/icao-aircraft-engine-emissions-databank

Organization: *Ventura, Paula*

I understand that when the Clean Air Act was initially amended, it was targeting the regulation of toxic air pollution coming from various industries and their factories. However, as time has gone by and the modern times around us have evolved, our means of transportation powered by fossil fuels also poses a threat to our national air quality, endangering public health and the environment. I respect that the EPA has begun setting emission standards on domestic vehicles under the Clean Air Act after the outcome of Massachusetts vs. the EPA, but now it is time to acknowledge that aircraft also play the same role in greenhouse gas emissions. [EPA-HQ-OAR-2019-0660-0136, p.1]

If this proposition is amended, it can be seen as an effort for our country in the fight against climate change. [EPA-HQ-OAR-2019-0660-0136, p.1]

Organization: *Wagner, Debi*

More stringently regulate CO2 and disregard ICAO recommendations and strengthen all US standards. [EPA-HQ-OAR-2019-0660-0153-A1, p.4] [[This comment can also be found in section 2.3 of the comment summary]]

For airports, it is very important not to allow AEDT to truncate CO2 and to also add other aircraft produced global warming emissions such as NOx, methane, etc. [EPA-HQ-OAR-2019-0660-0153-A1, p.4]

EPA Response to Comments in Section 13

Many of the subject areas included in this section are also covered in section 10 of this document and are addressed in EPA's response in section 10.

For the EPA's rationale for finalizing the standards, including international harmonization of aviation requirements, see section 2 of this response to comments document and see the introductory paragraphs of Section IV.F. of the Preamble to the final rulemaking and sections IV.F.1 and IV.F.2 of the Preamble to the final rulemaking.

While this rulemaking does not directly address noise as a pollutant, EPA's assessment of the rule's impact on noise is described in the Preamble to the final rulemaking in Section IV.F.1, Section IV.F.2, and Section VI.D.

For comments suggesting several ways to address aircraft engine PM emissions that go beyond the proposed adoption of PM standards that match the ICAO standards, see section 10 of this response to comments document.