ORAL ARGUMENT NOT YET SCHEDULED
Case No. 21-1018 (and consolidated cases)

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, et al.,

Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, et al.,

Respondents.

STATE PETITIONERS' INITIAL OPENING BRIEF

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CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

Pursuant to Circuit Rule 28(a)(1), the undersigned counsel of record certifies as follows:

A. Parties

Petitioners

The following parties appear as petitioners:

In case no. 21-1018: State of California (by and through Attorney General Rob Bonta and the California Air Resources Board), State of Connecticut, State of Illinois, State of Maryland, Commonwealth of Massachusetts, State of Minnesota, State of New Jersey, State of New York, State of Oregon, Commonwealth of Pennsylvania, State of Vermont, State of Washington, and the District of Columbia (together, State Petitioners).

In case no. 21-1021: Center for Biological Diversity, Friends of the Earth, and Sierra Club (together, Environmental Petitioners).

Respondents

The following parties appear as respondents: the United States Environmental Protection Agency and Michael S. Regan, in his official

capacity as Administrator of the U.S. Environmental Protection Agency (together, EPA).

Intervenors

The following parties have intervened on the side of respondents: the Boeing Company and Aerospace Industries Association of America.

Amici

Airlines for America has been granted leave to appear as amicus curiae.

B. Ruling Under Review

The State and Environmental Petitioners seek review of the final agency action by EPA entitled: "Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures," published at 86 Fed. Reg. 2136 (Jan. 11, 2021) (the Aircraft Rule).

C. Related Cases

The final agency action at issue in this proceeding has not been previously reviewed in this or any other court. There are no related cases within the meaning of D.C. Circuit Rule 28(a)(1)(C).

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GLOSSARY

Aircraft Rule	Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures, 86 Fed. Reg. 2136 (Jan. 11, 2021)
Aircraft Rule RTC	EPA, *Airplane Greenhouse Gas Standards Response to Comments* (Jan. 2021), EPA-HQ-OAR-2018-0267-0228
Aircraft Rule TSD	EPA, *Airplane Greenhouse Gas Standards Technical Support Document* (Jan. 2021), EPA-HQ-OAR-2018-0267-0227
CO_2	Carbon dioxide
Endangerment Finding	Finding that Greenhouse Gas Emissions from Aircraft Cause or Contribute to Air Pollution that May Reasonably Be Anticipated to Endanger Public Health & Welfare, 81 Fed. Reg. 54,422 (Aug. 15, 2016)
EPA	U.S. Environmental Protection Agency
GHG	Greenhouse gas(es)
ICAO	International Civil Aviation Organization
JA	Joint Appendix
NOx	Oxides of nitrogen
Section 231	42 U.S.C. § 7571

INTRODUCTION

The State Petitioners challenge EPA's final rule titled Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures, 86 Fed. Reg. 2136 (Jan. 11, 2021) (Aircraft Rule or Rule). The Aircraft Rule fails on two counts: *first*, it is contrary to law for the reasons set forth in the Environmental Petitioners' brief; and *second*, it is arbitrary, capricious, and an abuse of EPA's discretion for the reasons discussed herein.

In 2016, EPA properly found that airplanes' greenhouse gas emissions contribute to pollution that endangers the public health and welfare. Greenhouse gas pollution causes disastrous changes to Earth's climate systems, with more frequent and destructive storms, wildfires, floods, and drought costing lives, ruining crops and fisheries, drowning coastlines, and threatening to eliminate whole species and ways of life. EPA's finding, which is not disputed by any party to this case, triggered its obligation to develop protective standards to control aircraft greenhouse gas emissions. Clean Air Act § 231, *codified at* 42 U.S.C. § 7571. Yet the Rule, by EPA's own analysis, will reduce no emissions whatsoever and will prompt no improvements to airplanes' emissions

reduction technology, compared to a no-rule scenario. 86 Fed. Reg. at 2164, 2167. In fact, *none* of the three narrow alternatives EPA considered would have mitigated, by any amount, the pollution that EPA found to be a danger to public health and welfare.

The Aircraft Rule's total inefficacy stems from EPA's decision to rubber-stamp standards adopted by the International Civil Aviation Organization (ICAO) rather than consider airplanes' real-world potential to reduce greenhouse gas emissions. ICAO is a multilateral organization created to facilitate international air travel and its emissions standards are designed to be a global "floor" that even the worst-performing fleets in the world can readily achieve. Thus, its greenhouse gas standards for new aircraft in 2028 already lag *current* technology by a decade. EPA's insistence on treating these technology-lagging standards as a "ceiling" for domestic standards cannot be justified as a reasoned exercise of its discretion under section 231.

Moreover, despite the agency's express commitment to considering the environmental justice and federalism implications of its rules, as set out in Executive Orders 12,898 and 13,132, respectively, EPA left both aspects entirely unexamined and unaddressed, with cursory, irrational

dismissals in place of analysis. These failures underscore the agency's arbitrary and shallow approach to the Rule.

As a response to the endangerment finding, the Aircraft Rule is equivalent to no rule at all. For the reasons set forth herein and in the Environmental Petitioners' brief, this Court should grant the petitions for review and hold the Rule is unlawful and arbitrary.

JURISDICTIONAL STATEMENT

State Petitioners adopt the Jurisdictional Statement set forth in the Environmental Petitioners' Opening Brief.

ISSUES PRESENTED

State Petitioners adopt the Statement of the Issues set forth in the Environmental Petitioners' Opening Brief.

STATUTES AND REGULATIONS

Applicable statutes and regulations are set forth in the Addendum to the Environmental Petitioners' Opening Brief.

STATEMENT OF THE CASE

State Petitioners adopt the Statement of the Case set forth in the Environmental Petitioners' Opening Brief.

STANDARD OF REVIEW

Petitioners adopt the Standard of Review set forth in the Environmental Petitioners' Opening Brief.

SUMMARY OF ARGUMENT

The Aircraft Rule violates section 231 of the Clean Air Act and is arbitrary and capricious.

1. As explained in the Environmental Petitioners' opening brief, EPA violated section 231 by adopting completely ineffectual standards based on its decision to tie domestic aircraft standards to standards adopted by ICAO, rather than on the factors enumerated in statute.

2. EPA arbitrarily failed to adopt or even consider adopting standards that would reduce aircraft greenhouse gas emissions. As a response to EPA's 2016 finding that greenhouse gas emissions posed a danger to public health and welfare, the Aircraft Rule's zero-benefit standards are equivalent to doing nothing at all. And despite extensive public comments identifying emission-reduction technologies and strategies that are already in use, EPA did not examine what level of protection these or future reduction measures could actually achieve.

Instead, EPA relied entirely on extra-statutory considerations of "harmonization" with ICAO's standards and aircraft manufacturers' competitive position. This "harmonization" interest, as the Rule applied it, reduced section 231 to a rubber stamp on ICAO's standards and was unjustified by the record. Nor did EPA substantiate its concern that more stringent standards would result in a competitive disadvantage to the U.S. aviation industry, or find that these purported disadvantages would outweigh the well-documented costs of letting dangerous aircraft emissions increase unabated.

3. The Aircraft Rule similarly gave short shrift to EPA's commitment under Executive Order 12,898 to consider environmental justice. The Rule devoted two sentences to asserting, without support, that it carries no disproportionately high health or environmental effects on any population, contrary to the ample evidence in the record that aircraft greenhouse gas and co-pollutant emissions particularly harm low-income communities and communities of color.

4. Finally, EPA arbitrarily disregarded federalism concerns raised by State Petitioners, in spite of Executive Order 13,132. Because section 233 of the Clean Air Act prohibits States from adopting aircraft

emissions standards unless these standards are identical to EPA's, the Rule's do-nothing approach means that States cannot effectively control greenhouse gas or co-pollutant emissions from flights in and out of their own airports, despite the significant impact these emissions have on state-law climate mandates and the attainment or maintenance of national ambient air quality standards.

STANDING

It is well-established that the adverse effects of climate change injure the States, including through increased heat-related deaths, lost or damaged coastal areas, disrupted ecosystems, more severe weather events, and longer and more frequent droughts. *Massachusetts v. EPA*, 549 U.S. 497, 522-23 (2007). State Petitioners drew EPA's attention to the specific harms they face due to increasing greenhouse gas emissions and are submitting several declarations highlighting these threats.[1] For example, States face enormous fire suppression costs, the destruction of

[1] Comments of California et al., EPA-HQ-OAR-2018-0267-0176, at 8-15 (States' Comment), JA__-__; Declaration of Elizabeth Scheele (California); Declaration of Lisa Engler (Massachusetts); Declaration of Christine Kirby (Massachusetts); Declaration of Erica Fleishman (Oregon). These declarations are included an addendum filed with the State Petitioners' opening brief.

state parklands and infrastructure, and strains on state health services associated with the unprecedented wildfire seasons that climate change has made more frequent, longer, and more destructive, such as the 2020 fires that burned five million acres and caused weeks of terrible air quality across California, Oregon, and Washington.[2] Massachusetts and other coastal States incur significant expenditures to protect residents, commercial zones, and public infrastructure from sea-level rise and face major losses of coastal industries, property taxes, and state-owned land and infrastructure from increased severe storms and flooding.[3] In 2016, EPA itself determined that emissions from aircraft covered by the Rule contribute to the increasing atmospheric concentrations of greenhouse gases that drive climate change and its associated harms. *See* Finding that Greenhouse Gas Emissions from Aircraft Cause or Contribute to Air Pollution that May Reasonably Be Anticipated to Endanger Public Health & Welfare, 81 Fed. Reg. 54,422, 54,452-58, 54,461 (Aug. 15, 2016) (Endangerment Finding).

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[2] Fleishman Decl. ¶¶10-15; Scheele Decl. ¶¶17-18, 20, 21; States' Comment at 9-10, JA__-__.

[3] Engler Decl. ¶¶19-23, 25; Scheele Decl. ¶¶18-20; Fleishman Decl. ¶¶22-24; States' Comment at 10-14, JA__-__.

The Rule also injures State Petitioners' interests by increasing the burden of achieving state-law decarbonization mandates and attaining or maintaining national ambient air quality standards for co-pollutants associated with aircraft greenhouse gas emissions, specifically, oxides of nitrogen (NOx), ozone, and particulate matter.[4] Passenger flights account for 9-10 percent of energy-related carbon dioxide emissions in New York and California, and 7 percent in Massachusetts, Washington, and New Jersey.[5] In the airshed around Los Angeles International Airport, aircraft will emit 20 tons of NOx *per day* by 2030.[6] Because the States must rely on EPA to regulate these emissions effectively, *see* 42 U.S.C. § 7573, EPA's failure to adopt protective standards increases the burden on States to reduce greenhouse gases and aviation co-pollutants from other sources more aggressively.[7]

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[4] Scheele Decl. ¶¶26-29; Kirby Decl. ¶¶8, 16-19; States' Comment at 17-21, JA__-__.

[5] Scheele Decl. ¶26 & n.43 (citing Zheng, X. & Rutherford, D., "Reducing aircraft CO_2 emissions: The role of U.S. federal, state, and local policies," at 2-3 (Feb. 4, 2021)).

[6] States' Comment at 17, JA__.

[7] *Id.*; Kirby Decl. ¶¶17-18.

Meaningful standards developed as a result of a favorable order from this Court would result in decreased climate-changing emissions and a decreased burden on States to meet their climate mandates and national ambient air quality standards.

ARGUMENT

I. THE AIRCRAFT RULE IS CONTRARY TO SECTION 231

Once EPA found that aircraft greenhouse gas emissions contribute to dangerous pollution, the Clean Air Act required EPA to adopt aircraft emission standards to address that danger, based on express statutory factors: 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 Aircraft Rule unlawfully grounded its emission standards solely in EPA's choice to "harmonize" U.S. standards with those adopted in 2017 by ICAO (the ICAO Standards). By disregarding Congress's mandatory factors in favor of a non-statutory "harmonization" goal and the wholly ineffectual ICAO Standards, EPA violated section 231. *See* Envtl. Petrs. Br. 26-41.

II. EPA ACTED ARBITRARILY IN FAILING TO ADOPT OR EVEN TO CONSIDER ADOPTING STANDARDS THAT ACTUALLY REDUCE AIRCRAFT GREENHOUSE GAS EMISSIONS

The Aircraft Rule is indefensible as a reasoned application of the statutory factors to the record before EPA. A rule that "runs counter to the evidence before the agency," "relie[s] on factors which Congress has not intended it to consider," or "entirely fail[s] to consider an important aspect of the problem" is arbitrary and capricious. *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983). Here, EPA's 2016 Endangerment Finding compelled EPA to set standards to limit aircraft greenhouse gas emissions precisely because of the danger they represent. 42 U.S.C. § 7571(a)(2). Under the Rule, however, that danger remains wholly unmitigated. EPA did not even investigate whether feasible emission-reduction strategies—including current and projected technologies identified by the Petitioners—could support more protective standards. At the very least, the impact of aircraft emissions on public health and welfare and the feasibility of controlling those emissions are important aspects of the regulatory problem, which EPA ignored. 42 U.S.C. § 7571(a)(1), (a)(2); *see Mozilla Corp. v. FCC*, 940 F.3d 1, 60 (D.C. Cir. 2019) ("A statutorily mandated factor, by

definition, is an important aspect of any issue before an administrative agency." (cleaned up)).

Instead, EPA arbitrarily relied on considerations well outside the Clean Air Act: its desire to tie domestic standards to ICAO minimum standards and a purported competitive disadvantage to industry from stricter standards. Because EPA "prioritize[d] non-statutory objectives to the exclusion of the statutory purpose," the Aircraft Rule is arbitrary and capricious. *Gresham v. Azar*, 950 F.3d 93, 104 (D.C. Cir. 2020), *cert. granted*, 141 S. Ct. 890; *Indep. U.S. Tanker Owners Comm. v. Dole*, 809 F.2d 847, 854 (D.C. Cir. 1987) (agency's substitution of "new goals in place of the statutory objectives" was arbitrary).

A. The Aircraft Rule Arbitrarily Ignored the Catastrophic Harms of Climate Change

Climate change is an important aspect of the problem for any greenhouse gas regulation; the point of regulating greenhouse gas emissions is to mitigate the danger posed by their climate-forcing effect. *See Am. Lung Ass'n v. EPA*, 985 F.3d 914, 993 (D.C. Cir. 2021) (holding EPA's deferral of the compliance deadlines in power plant greenhouse gas rule was arbitrary where EPA "did not even mention the need for prompt reduction of emissions or the human and environmental costs"

of delayed action on climate change), *cert. granted on other grounds sub nom. West Virginia v. EPA*, 142 S. Ct. 420.[8] But, just as in *American Lung*, a casual reader of the Rule "would have no idea that the EPA actually recognized that greenhouse gas pollution was causing a global climate crisis requiring urgent remediation." *Id.* at 994. Accordingly, the Rule is arbitrary and capricious.

EPA's failure to consider climate change is particularly egregious given its own Endangerment Finding. Surveying an extensive body of scientific literature, EPA determined that human activities have caused unprecedented levels of carbon dioxide and other greenhouse gases in the atmosphere, which are driving global temperature increases, sea-level rise, and acidifying oceans. 81 Fed. Reg. at 54,440-44. EPA traced how these climate impacts lead to deadly heat waves; aggravated respiratory illnesses; more food-, water-, and insect-borne diseases; and grave harms to agriculture, forestry, water supplies, infrastructure, and other resources from increasingly severe wildfires, storms, and drought.

[8] In *American Lung*, this Court reviewed the repeal of a 2015 rule, its replacement rule, and EPA's revisions to regulatory deadlines for States to submit compliance plans. 985 F.3d at 995. The Supreme Court granted certiorari only on the first two issues; no party challenged the Court's vacatur of the revised deadlines. 142 S. Ct. 420.

Id. at 54,452-58. And EPA explained how aircraft emissions contributed to this dangerous pollution, with greenhouse gas emissions from regulated U.S. aircraft outpacing the *total* greenhouse gas emissions of more than 150 countries. *Id.* at 54,486.

In addition to the Endangerment Finding, public comment on the proposed rule by Petitioners and others supplied more recent evidence of climate change's threats to public health and welfare, including the U.S. Government's own 2017-18 Fourth National Climate Assessment.[9] State Petitioners catalogued how wildfires, extreme weather, flooding, and drought, exacerbated by climate change, were anticipated to cause and have already caused grievous loss of lives, property, resources, and

[9] U.S. Global Change Research Program, *Climate Science Special Report: Fourth National Climate Assessment, Volume I*, at 36 (D.J. Wuebbles, et al., eds., 2017), EPA-HQ-OAR-2018-0276-0151, JA__ (finding "no alternative explanations supported by the evidence" for the observed rise in global temperatures, besides anthropogenic greenhouse gas emissions, "that are either credible or that can contribute more than marginally to the observed patterns"); *ibid.*, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief*, at 102 (D.R. Reidmiller et al. eds., 2018), EPA-HQ-OAR-2018-0276-0151, JA__ (by shifting from a high-emissions scenario to a low-emissions scenario, "thousands of American lives could be saved and hundreds of billions of dollars in health-related economic benefits gained *each year*" (emphasis added)).

livelihoods for their residents and industries.[10] The record is clear: deep reductions across sectors and in this decade are needed to constrain warming to 1.5° Celsius and avoid even more severe, cascading harms.[11] Yet the aviation industry is not on anything like a decarbonization path: airplanes' emissions are expected to *triple* by midcentury and constitute more than a quarter of the global "carbon budget" that keeps warming below 1.5° Celsius.[12]

The Aircraft Rule's response to this danger is to do nothing about it. The Rule creates *zero* environmental benefits: in terms of emissions, the Rule is equivalent to no rule at all. 86 Fed. Reg. at 2164 (projecting the Rule's "standards will not result in reductions in . . . GHG emissions beyond the baseline"). As EPA explained, because all new U.S. aircraft covered by the Rule are projected to comply with current technology (or

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[10] States' Comment at 8-15, JA__-__.

[11] *See, e.g.*, Intergovernmental Panel on Climate Change, *Global Warming of 1.5°C: An IPCC Special Report*, SPM-8 to SPM-15, 153-65, 177-182 (Oct. 2018), EPA-HQ-OAR-2018-0276-0151, JA__-__, __-__, __-__.

[12] Comment of Earthjustice, et al., at 5, EPA-HQ-OAR-2018-0267-0151, JA__ (Envtl. Petitioners' Comment).

go out of production)[13] by the time its standards take effect, it found "no cost" and "no benefit" from its standards. *Id.* Nor did EPA consider any alternative standards that would reduce emissions. *See*, *infra*, Part B.2. And when confronted with the Endangerment Finding and commenters' climate change impacts, EPA refused to engage this evidence: "we do not address in this rule the potential environmental or other impacts requiring reduced airplane emissions beyond adopting the ICAO CO_2 standards."[14] Instead, the Rule allows aircraft greenhouse gas emissions to continue to increase unabated through 2040, worsening the problem.[15] "In short, Petitioners called the EPA's attention to an important aspect of the regulatory problem, and the EPA looked away." *Am. Lung*, 985 F.3d at 995.

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[13] EPA concluded that even if the no-rule, "business as usual" scenario involved *no* improvements to existing technologies to reduce emissions, new airplanes would still meet the ICAO standards with these existing technologies and thus, "the projected GHG emissions reductions for the final standards will still be zero." *Id.*

[14] EPA, *Airplane Greenhouse Gas Standards Response to Comments*, at 330 (Jan. 2021), EPA-HQ-OAR-2018-0267-0228 (Aircraft Rule RTC), JA__.

[15] EPA, *Airplane Greenhouse Gas Standards Technical Support Document*, at 106 (Jan. 2021), EPA-HQ-OAR-2018-0267-0227 (Aircraft Rule TSD), JA__.

B. The Aircraft Rule Ignored Feasible Technologies to Control Greenhouse Gas Emissions from Aircraft

EPA's failure to adopt standards that will trigger *any* greenhouse gas emission reductions is all the more arbitrary given the U.S. fleet's ability to reduce emissions. As EPA admits, the Aircraft Rule produces "no benefit" because all new U.S. aircraft subject to the rule ("covered aircraft") are either already in compliance today or projected to go out of production by the compliance deadline under a no-rule, "business as usual" scenario. 86 Fed. Reg. at 2164. Even this is an understatement: the ICAO Standards adopted by the Rule "lag[] the existing efforts of manufacturers by more than 10 years" and new U.S. aircraft deliveries *in 2019* comfortably outperformed limits the Rule set for *2028*.[16]

As discussed below, the ICAO Standards produce no emission benefits because they are based on only a small subset of feasible technologies and are so lax that even the dirtiest new aircraft can meet them. By limiting its analysis of alternatives to ICAO's technology-

[16] Zheng, S. & Rutherford, D., "Fuel Burn of New Commercial Jet Aircraft: 1960 to 2019," at iv, 8 (Sept. 2020), EPA-HQ-OAR-2018-0276-0168, JA__, __ (finding 89% of new aircraft deliveries meet the emission limits adopted in the Aircraft Rule, and the average new delivery exceeds the limits by 6%).

lagging standards and two minor variations on those standards—none of which prompted *any* action to apply available control technologies—EPA effectively disregarded the wide range of options that commenters urged it to study. This crabbed approach turned the Rule's alternatives analysis into an empty exercise, back-calculated to ratify the ICAO Standards rather than explore whether effective standards were in fact possible. EPA thereby deprived itself and the public of any legitimate analysis and guaranteed an uninformed decision.

1. ICAO's Standards Are Based on Only a Small Subset of Feasible Control Technologies and Methods

To appreciate how inadequate the Aircraft Rule's consideration of technological feasibility was, a brief overview of the different means of reducing aircraft greenhouse gas emissions is necessary.

First, airplanes can be *built* or *retrofitted* to reduce the amount of fuel they burn per mile traveled, by improving engines' performance or by making the planes lighter or more aerodynamic.[17] Second, airplanes can be *operated* to reduce fuel burn per flight—*e.g.*, by using only one

[17] Aircraft Rule TSD at 33-39, JA__-__.

engine during runway taxiing or through improved routing and traffic control.[18] Third, lower-emitting *alternative fuels* and technologies (such as some biofuels, hydrogen fuels, or electric aircraft) can be phased into the fleet,[19] reducing the fleet's aggregate contribution to greenhouse gas pollution.[20] Under section 231, EPA does not prescribe the use of any particular technology, operational method, or fuel, only emission standards; but EPA bases its emission standards on the reductions such measures can achieve. 42 U.S.C. § 7571.

The level of reduction that each approach can achieve will vary for the different stages of an airplane's life cycle. *New type* designs, which

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[18] *See* Envtl. Petrs. Br. at 9-10.

[19] *Contra* 86 Fed. Reg. at 2156 (asserting that "limiting fuel burn is the only means by which airplanes control their GHG emissions"). In fact, EPA and the FAA have recently announced initiatives to promote sustainable aviation fuels and other, non-efficiency emission controls in the aviation sector. *See* U.S. Climate Aviation Plan 2021 at pp. 15-23, https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf. The Rule offers no explanation why technologies that can be adopted by the fleet voluntarily should not inform consideration of section 231 aircraft emission standards.

[20] States' Comment at 31, JA__; Envtl. Petitioners' Comment at 24 & n.167, 27, JA__, __; *see also* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,354, 44,472 (July 30, 2008) (recognizing EPA authority to impose a "declining fleet average emissions program" for aircraft, similar to fleet standards for vehicles).

represent new or significantly modified airplane models, "typically yield large fuel burn reductions—10 percent to 20 percent over the prior generation they replace"—but by EPA's estimate occur only every 8-10 years. 86 Fed. Reg. at 2146. *In-production* aircraft—those built off an existing design, but which have not yet entered service—can still meaningfully reduce emissions through retrofits, like advanced wingtips or "riblet coatings" installed on the airframe to reduce drag.[21] *In-service* aircraft—airplanes that are currently being flown—can reduce emissions significantly through improved operations and some retrofits.[22] Finally, retiring particularly old and dirty in-service airplanes and replacing them with new, cleaner models—a process called *fleet renewal* or turnover—can improve fleet total emissions.[23]

The ICAO Standards, however, address only *new type* designs and *in-production* aircraft; there is no standard for in-service planes. 86 Fed. Reg. at 2146. For these aircraft, the ICAO Standards examined

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[21] Aircraft Rule TSD at 35, 37-38, JA__, __-__.

[22] Envtl. Petitioners' Comment at 24-26, JA__-__; Comment of Intl. Council on Clean Transp. at 3-4, EPA-HQ-OAR-2018-0267-0168 (ICCT Comment), JA__-__.

[23] *Id.*

only emission reduction technologies that improved fuel efficiency, and only a subset of those. *Id.* at 2167. And from among *those* technologies, ICAO considered only those that were in wide commercial application by 2016-17.[24] Using this subset of widely commercialized fuel efficiency technologies, ICAO developed ten "stringency levels," with "1" being the least stringent and "10" the most stringent considered.[25] ICAO then set its standards at a stringency level so low that even the worst-performing new aircraft could meet it.[26]

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[24] Aircraft Rule TSD at 39, JA__; *see also* States' Comment at 30 & n.144, JA__.

[25] *Id.* at 122-23, JA__. These stringency levels are difficult to visualize. An ICAO standard is not a specific value (*e.g.*, 0.4 kilogram of fuel burned per kilometer of flight), but a mathematical formula that produces different values based on the airplane's weight (*e.g.*, 0.4 kg/km for a 40,000 kg aircraft, 0.6 kg/km for a 60,000 kg aircraft, etc.). Figures IV-1 to IV-4 in the Aircraft Rule plot the ICAO Standards as compliance curves, with the ICAO metric on the vertical axis and aircraft weight on the horizontal axis. 86 Fed. Reg. at 2149-50, 2152-53. Greater stringency means a compliance curve that is generally "lower" on the graph, allowing less emissions for a given aircraft weight, and lesser stringency means a compliance curve that is generally "higher" on the graph, allowing more emissions for a given aircraft weight.

[26] Aircraft Rule TSD at 39, JA__ ("Thus, most or nearly all in-production and on-order airplanes already meet the levels of the final standards."); *see also* 86 Fed. Reg. at 2149-50, 2152-53. These levels range from "8.5" all the way down to "3" for different classes of aircraft. Aircraft Rule TSD at 123-25, JA__-__. Figures IV-1 to IV-4 show every

2. EPA Refused to Consider Any Standards that Actually Reduce Emissions

EPA recognized the limitations of ICAO's approach when it first started developing the Aircraft Rule.[27] And, importantly, EPA quickly realized that the ICAO Standards would not reduce emissions at all over "business as usual."[28] Yet not only did EPA proceed to adopt these standards, it refused to consider alternatives that *did* reduce emissions. Instead, EPA modeled three scenarios: the ICAO Standards (Scenario 1); the ICAO Standards with advanced compliance dates (Scenario 2);

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single aircraft model projected to remain in production (the black dots) plotted *below* the compliance curves—*i.e.*, passing the standards—while aircraft models projected to go out of production (the white dots) are the only ones plotted *above* the curves—*i.e.*, failing the standards.

[27] 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, 37,803 (July 1, 2015) (2015 ANPR) (noting that none of the stringency levels under consideration at ICAO considered forward-looking technologies and that the lowest stringency options would achieve "minimal" reductions).

[28] Control of Air Pollution From Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures (Proposed Rule), 85 Fed. Reg. 51,556, 51,583 (Aug. 20, 2020) (explaining EPA's modeling work showed that ICAO had incorrectly projected emissions reductions over "business as usual," all of which occurred in aircraft models slated to go out of production, and concluding that its "no cost-no benefit conclusion is quite robust").

and standards 2-7 percent more stringent than the ICAO Standards, with advanced compliance dates as well (Scenario 3). Scenarios 1 and 2 produced no emission benefit.[29] Scenario 3 required improvement from one airplane model, but that model was projected to go out of production (and in fact did go out of production) in 2021; so Scenario 3 produced no emission benefit either.[30] EPA did not consider any other alternative. 86 Fed. Reg. at 2145.

This blinkered analysis was arbitrary. *Int'l Ladies' Garment Workers' Union v. Donovan*, 722 F.2d 795, 816 & n.41 (D.C. Cir. 1983) ("the agency's consideration of some alternatives does not free it from considering other obvious alternatives"). By restricting its alternatives analysis to standards that had *no* effect on greenhouse gas emissions, EPA left obvious, safe, and effective alternatives unexamined.

First, EPA should have evaluated standards reflecting the current state of the art. Standards for new type designs or in-production aircraft could be at least as stringent as ICAO level "10," given there are planes

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[29] Aircraft Rule TSD at 107, JA__.

[30] *Id.* at 107, 130-31, 134-35, JA__, __-__, __-__.

currently in service—*i.e.*, being safely flown now—that already perform to this level.[31] By EPA's own record, there are in-production models that even exceed ICAO's stringency level "10."[32] Thus, it was irrational not to study standards for new type and in-production airplanes at and above ICAO's stringency level "10."[33]

Second, EPA should have evaluated technology-forcing standards based on controls that could be developed and deployed with sufficient lead time. According to EPA, new aircraft designs occur every eight to ten years and "typically yield large fuel burn reductions—10 percent to 20 percent over the prior generation." 86 Fed. Reg. at 2146.[34] Another study showed cost-effective technologies could reduce emissions from

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[31] States' Comment at 29 & n.140, JA__.

[32] Aircraft Rule TSD at 126-127 (Figures 6-1, 6-2), JA__-__.

[33] States' Comment at 29-30, JA__-__. The most stringent standard studied under Scenario 3 corresponds to stringency level 9. *Id.* at 129-31, JA__-__.

[34] *See also* Aircraft Rule TSD at 14 ("with the fast pace of advancing aviation technology[,] the status of CO_2 technology improvements has changed" even from 2015 to 2018).

new aircraft by 2.2 percent annually through 2034.[35] This translates to improved emissions reduction of *25 percent* in 2024 and *40 percent* in 2034, relative to 2015 aircraft.[36] Thus, it should be feasible for EPA to set a standard for new type designs, with a compliance date eight to ten years in the future, that are 10 to 20 percent—or even 25 to 40 percent—more stringent than the ICAO Standards.[37] Yet EPA refused to consider this possibility either.

EPA's refusal to look beyond ICAO's stringency options was particularly arbitrary because these options were explicitly restricted to technology widely commercialized *four years prior* to the Rule.[38] Section 231, by contrast, steers EPA toward setting its standards according to technology expected to be developed *in the future*, provided EPA allows manufacturers sufficient lead time. 42 U.S.C. § 7571(b); Envtl. Petrs. Br. 29-32.

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[35] Kharina, A. et al., "Cost Assessment of Near and Mid-Term Technologies to Improve New Aircraft Fuel Efficiency," at 28 (Sept. 27, 2016), EPA-HQ-OAR-2018-0276-0151, JA__.

[36] *Id.* at 28, 31, 35, JA__, __, __.

[37] States' Comment at 30, JA__.

[38] Aircraft Rule TSD at 39, JA__; *see also* States' Comment at 30 & n.144, JA__.

Standards based on the current state of the art and technologies under development are both obvious alternatives that EPA had a duty to consider. The agency was "required to address common and known or otherwise reasonable options, and to explain any decision to reject such options." *Int'l Ladies Garment Workers' Union*, 722 F.2d at 818. EPA's failure to do so here was arbitrary.

3. By Not Considering the Full Range of Feasible Technologies, EPA Ignored an Important Aspect of the Problem

Multiple commenters urged EPA to consider a third, equally obvious option: in addition to considering what stringency levels current and future fuel efficiency technologies could support, EPA should have considered controls *beyond* fuel efficiency as a supplement to the ICAO Standards. Instead, by narrowing its review to minor variations on the ICAO Standards, EPA disregarded most of the available emission reduction technologies and methods. In a similar vein, because ICAO Standards apply to new aircraft only, EPA never considered what reductions *in-service* aircraft could achieve.[39] Because ICAO considered

[39] Aircraft Rule RTC at 103, JA__; Envtl. Petitioners' Comment at 24-25, JA__-__; ICCT Comment at 3-4, JA__-__.

only fuel efficiency technologies, EPA never studied emission reductions from operational improvements or alternative fuels. Because ICAO's test procedures measure fuel burn only at "cruise altitude," 86 Fed. Reg. at 2139 n.11, EPA never studied reductions from improved takeoffs and landings. Because the ICAO Standards do not reward reductions in airplanes' weight,[40] EPA excluded all weight reduction technologies from consideration—even though these constituted one-third of the technologies its own consultant determined to be available.[41] "Such an artificial narrowing of options is antithetical to reasoned decisionmaking," *Int'l Ladies Garment Workers' Union*, 722 F.2d at 817 (cleaned up), and "ignored an important aspect of the problem," *State Farm*, 463 U.S. at 43.

[40] Because ICAO made the standard a function of an aircraft's weight, reducing aircraft weight simply moves the plane to a different spot on the same compliance curve, rather than bring the plane *below* the compliance curve. *Cf.* nn. 25-26 *supra*. While ICAO's choice to design the standard this way has its benefits, it undervalues the real emission reductions that occur when individual planes, or even entire fleets, are lighter. States' Comment at 31 & n.145, JA__; ICCT Comment at 5, JA__.

[41] Aircraft Rule TSD at 33, JA__.

EPA was aware of all these options long before commenters raised them in public comment. In 2008, EPA published an advance notice of proposed rulemaking to collect input on numerous strategies to reduce greenhouse gas emissions across different mobile and stationary sources, including aircraft. 73 Fed. Reg. at 44,468-73. There, EPA noted potential emissions reductions not only from fuel efficiency technologies applied to engines and airframes, *id.* at 44,470-71, but also from weight reduction; operational changes such as improved air traffic control and single-engine taxiing; phase-ins of alternative fuels; and a fleet average emission standard for in-service aircraft, *id.* at 44,471-73. EPA also recognized it could develop its section 231 emission standards at levels reflecting application of these strategies to in-service aircraft as well as to new-type and in-production planes. *Id.* at 44,473.

This makes the Aircraft Rule's sole explanation for not evaluating these strategies—that EPA ran out of time—ring hollow. According to EPA, because it must adopt the ICAO Standards now, there is no longer time to study and receive comment on the above reduction strategies.[42] But that does not explain or excuse EPA's failure to study such options

[42] Aircraft Rule RTC, at 26, 87, 203, 256, JA__, __, __, __.

in the *twelve years* since it first sought public comment on them, or the four years since the Endangerment Finding. Nor does EPA intend to study these reduction strategies now that it has finalized the Rule. *Id.* at 2146 ("Through this action, . . . the EPA is *fully discharging* its obligations under the CAA that were triggered by the 2016 Findings") (emphasis added); Doc. #1922539 at 1-2 (EPA will not revisit Aircraft Rule).[43] And for EPA to refuse to consider safe, widely available, and cost-effective options solely because it failed to study and present them in the notice of proposed rulemaking violates EPA's duty to consider all important aspects of a problem, *see State Farm*, 463 U.S. at 43, and to seriously consider significant public comment, *see AT&T Servs., Inc. v.*

[43] The lack of further, pending standard-setting proceedings, among many other factors, distinguishes this case from *National Association of Clean Air Agencies v. EPA*, 489 F.3d 1221 (D.C. Cir. 2007) ("*NACAA*"). There, EPA faced the real prospect of the United States falling out of compliance with ICAO's 1999 emission standards for NOx without immediate agency action to adopt them. *Id.* at 1225-26; 70 Fed. Reg. 69,664, 69,675 (Nov. 17, 2005). EPA therefore used an "ongoing phased approach" to implement 1999 ICAO standards for NOx emissions in the near term while studying the just-adopted 2005 ICAO NOx standards for further rulemaking. *NACAA*, 489 F.3d. at 1225-26. The Court also held the petitioner had forfeited most of its arguments that the NOx rule was arbitrary and capricious, so it did not reach the merits of any argument resembling those the State Petitioners bring here. *Id.* at 1231-32.

FCC, 21 F.4th 841, 853 (D.C. Cir. 2021) ("[T]he opportunity to comment is meaningless unless the agency responds to significant points raised by the public.").

* * *

A rational consideration of the feasible control technologies for aircraft greenhouse gas emissions, given the Endangerment Finding, would have produced a rule that significantly reduced aircraft emissions over a "business as usual" scenario. Not only did EPA fail to adopt a meaningful rule, it did not even consider doing so. This failure was arbitrary, capricious, and an abuse of discretion.

C. EPA's Reliance on Extra-Statutory Interests in "International Uniformity" and Industry Competitiveness Was Arbitrary

Because the Aircraft Rule cannot be justified as a rational product of the record under the statutory factors, EPA instead relied on a miscellany of reasons for tying domestic limits precisely to the ICAO Standards. But EPA may not "rel[y] on factors which Congress has not intended it to consider." *State Farm*, 463 U.S. at 43. Assuming it could properly consider factors that are not mentioned explicitly in the Clean Air Act, still, 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." *Indep. U.S. Tanker Owners*, 809 F.2d at 854.

As discussed below, while all parties agree that EPA should adopt U.S. aircraft emission standards that are "at least as stringent as ICAO standards," 86 Fed. Reg. at 2140, EPA restricted itself further, citing a goal of "regulatory uniformity throughout the world" to justify standards that do not *exceed* ICAO's. *Id.* at 2157. This so-called "harmonization" rationale is arbitrary, both as a general policy and on the specific record here. Similarly, the Rule's other rationales of protecting U.S. aircraft manufacturers from "competitive disadvantage," *id.* at 2157, promoting international cooperation, *id.* at 2158, and preventing "backsliding," *id.*, are inconsistent with section 231's objectives, unsupported by the record, or both.

1. A General Policy of Restricting Section 231 Standards to ICAO Standards Is Arbitrary

No one disputes the U.S. must adopt domestic aircraft emission standards "equal to or above the minimum standards" established by

ICAO.[44] But the Rule's "harmonization" rationale committed it to *never exceeding* ICAO Standards, to ensure "regulatory uniformity throughout the world." 86 Fed. Reg. at 2157. This is not a goal of the Clean Air Act, *see* Envtl. Petr. Br. at 38-41, and it was arbitrary for EPA to substitute this goal for a reasoned evaluation of the section 231 factors. *See Indep. U.S. Tanker Owners*, 809 F.2d at 854.

An interest in international harmonization can, of course, play a limited role in a reasoned application of the statutory factors. *See, e.g.*, *NACAA*, 489 F.3d at 1230. EPA may "fine-tune its regulations to accommodate worthy [extra-statutory] interests" without letting these interests wholly displace the statutory factors. *Id.* (quoting *George E. Warren Corp. v. EPA*, 159 F.3d 616, 623-24 (D.C. Cir. 1998)). But here, EPA elevated "regulatory uniformity throughout the world" into an overriding goal. The Rule started with the premise that EPA should fix aircraft emission standards exactly at ICAO's stringency, then used its "harmonization" goal to *dismiss* record evidence about the danger of

[44] Chicago Convention on International Civil Aviation, art. 33, Dec. 7, 1944, 15 U.N.T.S. 295 (9th ed. 2006, ICAO Doc. 7300/9), EPA-HQ-OAR-2018-0276-0006, JA__ (Chicago Convention).

aircraft greenhouse gas emissions and the feasibility of reducing them. 86 Fed. Reg. at 2157-58.

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 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"). As this Court explained, harmonization for its own sake compromises the bases of agency authority:

> [W]hen an agency delegates power to outside parties, lines of accountability may blur, undermining an important democratic check on government decision-making. . . . Also, delegation 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*.

U.S. Telecom Ass'n v. FCC, 359 F.3d 554, 565-66 (D.C. Cir. 2004) (citations omitted, emphasis added).

The divergent mandates for EPA under the Clean Air Act and ICAO under the Chicago Convention underscore the above concerns.

EPA's core mission is to protect public health and welfare against pollution. 42 U.S.C. § 7401(b)(1). Consistent with that mission, EPA's obligation to regulate aircraft emissions arises from the danger that these emissions pose to the public, and its standards must reflect the scientific and technical record developed in response to that danger. 42 U.S.C. §§ 7571(a)(2), 7607(d)(9). By contrast, ICAO's core mission is to "develop the principles and techniques of international air navigation" and "foster the planning and development of international air transport."[45] ICAO adopts emission standards not in response to any endangerment finding, but as a negotiation among member nations to set minimum conditions for flying over each other's airspaces and landing in each other's airports.[46]

For ICAO's members, it makes sense to adopt minimum emission standards that all fleets can readily achieve: if standards are too strict, a member's airplanes may be cut off from others' airports and airspaces.

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[45] Chicago Convention, art. 44, JA__.

[46] *Id.* art. 33, JA__ (requiring member nations to recognize airworthiness certificates issued by other members, provided "the requirements under which such certificates or licences [sic] were issued . . . are equal to or above the minimum standards" set by ICAO).

In that sense, it is reasonable for ICAO's emission standards—like its standards for air traffic control and landing strip markings—to reflect a global consensus. But EPA, charged with protecting the public against dangerous pollution, fails that charge when it automatically restricts its standards to the lowest common denominator.

EPA and ICAO's divergent mandates also translate to important substantive and procedural differences in developing their standards. EPA considers technologies that could be developed and applied by the rule's effective date, and can adopt technology-forcing rules. 42 U.S.C. § 7571(b); 86 Fed. Reg. at 2157. ICAO considers widely commercialized technologies only.[47] EPA is accountable to the electorate via the President; ICAO is not. EPA is bound by rational decision-making on a record, 42 U.S.C. § 7607(d)(9); ICAO is driven by diplomatic majorities.[48] EPA's process is transparent due to public notice and comment obligations, 42 U.S.C. § 7607(d)(4)-(6); ICAO's deliberations are opaque to virtually everyone outside the national government

[47] Aircraft Rule TSD at 39, JA__.

[48] Chicago Convention, art. 48(c), JA__.

parties and industry.[49] For all these reasons, unthinking adherence to ICAO standards, without regard to their efficacy in protecting the public health and welfare, is an irrational exercise of EPA's discretion. *U.S. Telecom*, 359 F.3d at 565-66.

2. Restricting Section 231 Standards to the ICAO Standards Is Arbitrary in this Instance

The Aircraft Rule's "harmonization" interests are also irrational on this particular record. The Rule did cogently explain that failure to adopt standards "at least as stringent as" the ICAO Standards, 86 Fed. Reg. at 2142, would undermine important (if extra-statutory) interests, including the United States' credibility in ICAO negotiations and the marketability and certification of U.S.-manufactured aircraft, *id.* at 2145-46, 2157-58. Yet the Rule claimed, without explanation, that these interests would also be compromised by EPA standards that *exceed* the ICAO Standards in stringency. *Id.* at 2157-58.

[49] *See, e.g.*, 2015 ANPR, 80 Fed. Reg. at 37,797 (explaining the "official stringency options under consideration at [ICAO]," in developing what would become the 2017 ICAO Standard, "have not been cleared for release outside of the participating members since deliberations on the standard are still ongoing . . .").

The Rule offered no reasoned explanation for this position despite commenters' objections to it.[50] EPA failed to identify any evidence that aircraft certifications to stricter domestic standards will not be accepted abroad or that any U.S. interest at all supports "worldwide recognition of the *sufficiency* of ICAO's standards." *Id.* at 2157 (emphasis added); *see also infra*, Part II.C.4. Nothing in the Chicago Convention suggests ICAO's emissions standards should be a ceiling as well as a floor.[51] Because the Rule failed to offer a reasoned explanation as to why "harmonization" requires EPA to stop at the ICAO Standards—despite overwhelming evidence that EPA can and must go further—it is arbitrary. *State Farm*, 463 U.S. at 43 (agency acts arbitrarily where it does not "articulate a satisfactory explanation for its action" (cleaned up)).

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[50] *See, e.g.*, States' Comment at 32, JA__.

[51] *See* Chicago Convention, art. 33, JA__ (providing for mutual recognition of airworthiness certificates where domestic laws are "equal to *or above* the minimum [ICAO] standards") (emphasis added); *id.*, art. 38 (member nation "which deems it necessary to adopt regulations or practices differing" from ICAO standard need only give notice to ICAO).

3. Concern for Industry Competitiveness Is No Reason to Adopt Wholly Ineffectual Standards

The Aircraft Rule's unsupported assertion that a more protective greenhouse gas emission standard places U.S. aircraft manufacturers at a "competitive disadvantage" is irrational as well. 86 Fed. Reg. at 2157. Section 231 gives no indication that protecting the aviation industry's competitive advantage should limit EPA's protection of the public from dangerous pollution. *See* Envtl. Petrs. Br. at 39-40. But assuming that EPA could ground such a concern in technological feasibility, lead time, or compliance costs, *see* 42 U.S.C. § 7571(a)(1)(B), (b), the Aircraft Rule identified no factual basis to believe stricter standards actually create a disadvantage—particularly because EPA never evaluated such stricter standards. At most, EPA vaguely suggested that stricter domestic standards might pose "administrative complexity" or create unspecified "disruptive effects on manufacturers' ability to market planes for international operation," but never explained what these effects are or offered supporting evidence. 86 Fed. Reg. at 2157-58. Assuming, again, that manufacturers face some non-trivial costs in responding to a stricter standard, the Rule never evaluated such costs in light of the dangers of unmitigated carbon pollution. Because EPA never analyzed

any standards that would reduce aircraft emissions over "business as usual," its conclusory references to "competitiveness" are no basis to elevate one industry's economic interests above the public health and welfare.

Nor did the Aircraft Rule analyze the competitive *advantages* of stricter domestic standards. As State Petitioners explained in their comments, holding U.S. aircraft manufacturers to ambitious standards could help U.S. aircraft compete in global markets that have adopted or are planning to adopt stricter controls on aviation emissions, such as China and Europe.[52] Aircraft that meet stricter emission limits through reduced fuel burn gain a cost advantage in fuel savings.[53] Ambitious standards likewise protect U.S. industry's technological superiority by spurring innovation. Assuming EPA may consider competitive impacts, it must study both the advantages and disadvantages of a meaningful standard; in failing to do so, it again acted arbitrarily. *See Michigan v. EPA*, 576 U.S. 743, 753 (2015) ("[R]easonable regulation ordinarily

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[52] States' Comment, at 33 & n.150, JA__; Comment of the Office of the Comptroller of New York City et al. at 2, EPA-HQ-OAR-2018-0276-0166, JA__.

[53] States' Comment at 33 & n.149, JA__.

requires paying attention to the advantages *and* the disadvantages of agency decisions.").

4. The Aircraft Rule's Other Reasons for Adopting Zero-Benefit Standards Are Irrational

The Aircraft Rule's remaining justifications for not adopting or considering more stringent standards fare no better. The Rule asserted, counterintuitively, that refusing to adopt more stringent U.S. standards would carry "substantial"—albeit unspecified—"benefits for future international cooperation on airplane emission standards." 86 Fed. Reg. at 2158. Assuming, again, that "international cooperation" can be relevant to what level of regulation EPA adopts under section 231,[54] the Aircraft Rule never examined how more stringent standards might *positively* impact international cooperation. In today's pledge-based climate diplomacy, it is domestic ambition, not complacency, that gives a nation credibility to lead in multilateral negotiations.[55]

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[54] *But see Massachusetts*, 549 U.S. at 533-34 (rejecting EPA's argument that regulating greenhouse gases might impair the President's ability to negotiate with other nations to reduce emissions, since President's foreign affairs power "does not extend to the refusal to execute domestic laws").

[55] Jody Freeman, *The Environmental Protection Agency's Role in U.S. Climate Policy—A Fifty-Year Appraisal*, 31 DUKE ENVTL. L. &

The Aircraft Rule's "anti-backsliding" rationale is similarly conclusory. The Rule asserted that tying domestic standards to ICAO's standards "prevent[s] backsliding by ensuring that all new type design and in-production airplanes are at least as efficient as today's airplanes." 86 Fed. Reg. at 2158. This assertion contradicts the record showing that "today's airplanes" are in fact far *more* efficient than the Rule requires and thus have room under EPA's standards to backslide. *See supra*, Part II.B.2. It also ignores a glaring loophole in the Rule allowing aircraft design modifications to *increase* emissions by 1.5 percent at a time. 86 Fed. Reg. at 2151.[56] Because there is no limit to how many such modifications (and thus, how many 1.5 percent increases) a manufacturer may undertake, even the Rule's "anti-backsliding" benefit is illusory.

At the very least, it was incumbent on EPA to ask whether these putative benefits prevail over the imperative need, unmistakably

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POL'Y F. 1, 64, 75 (2020) ("[EPA's] experience shows that domestic action can drive international climate progress rather than the other way around. … [U.S.] credibility internationally hinges on our ability to deliver meaningful emission reductions through domestic policies.").

[56] Envtl. Petitioners' Comment at 16, JA__.

supported by EPA's own record, to slash greenhouse gas emissions from major sectors in this decade. Its failure to do so was arbitrary.

III. THE AIRCRAFT RULE ARBITRARILY DISMISSED ENVIRONMENTAL JUSTICE IMPACTS

Like its treatment of climate change, the Aircraft Rule's regard for environmental justice, and EPA's commitment under Executive Order 12,898 to examine the effect of its rules on vulnerable communities, is alarmingly scant. In the Endangerment Finding, EPA detailed the numerous ways that climate impacts of greenhouse gas emissions will fall especially heavily on particular populations and disadvantaged communities—low-income communities and communities of color, the elderly, indigenous peoples, and children. 81 Fed. Reg. at 54,454-55, 54,458. As EPA found, although climate change is a global challenge, its impacts are experienced unevenly. Thus, for example, "limited resources make low-income populations more vulnerable to ongoing climate-related threats, less able to adapt to anticipated changes, and less able to recover from climate change impacts," *id.* at 54,454, while indigenous peoples face unique losses of traditional homelands and livelihoods, *id.* at 54,458. In addition, State Petitioners and other commenters offered uncontradicted evidence that co-pollutants

associated with aircraft greenhouse gas emissions—especially criteria pollutants and toxic air contaminants emitted during aircraft takeoffs and landings—severely harm the health and welfare of communities near major airports, which are disproportionately low-income communities and communities of color.[57]

The Aircraft Rule answered none of this evidence. Its discussion of environmental justice—two sentences in total—claimed without support that the Rule's standards have no "disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population." 86 Fed. Reg. at 2171. This finding "runs counter to the evidence before the agency." *State Farm*, 463 U.S. at 43. The Response to Comments does not elaborate, but refers back to the preamble and declines to "address . . . the potential environmental or other impacts requiring reduced airplane emissions beyond adopting the ICAO CO_2 standards."[58]

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[57] States' Comment at 34-35 & n.153, JA__-__; *see also* Aircraft Rule RTC at 281-82, 293-99, 308-11, 315-17, 319, 321-24, 327-29, JA__-__, __-__, __-__, __-__, __, __-__, __-__.

[58] Aircraft Rule RTC at 330, JA__.

EPA's cavalier treatment of environmental justice reinforces how arbitrary the agency's approach to the Aircraft Rule was. This Court recently found a federal agency's environmental justice analysis arbitrary and capricious where it failed to examine a pipeline project's environmental effects extending beyond the two-mile radius it studied. *Vecinos para el Bienestar de la Comunidad Costera v. FERC*, 6 F.4th 1321, 1330-31 (D.C. Cir. 2021). Here, the Aircraft Rule performed *no* analysis: not in the preamble, not in the technical support document, and not in response to the twenty-four pages of environmental justice comments. This failure falls far short of the rational decision-making demanded of agencies, especially where vulnerable communities are at stake. EPA's decision not to reduce aircraft emissions despite readily available means to do so arbitrarily places environmental justice communities in needless risk and cannot be sustained.

IV. EPA'S FINDING THAT THE AIRCRAFT RULE CARRIED NO FEDERALISM IMPLICATIONS IS ARBITRARY

The Rule's perfunctory conclusion that "[t]his action does not have federalism implications" is further evidence of EPA's arbitrary analysis. 86 Fed. Reg. at 2170. Executive Order 13,132 instructs agencies, before promulgating rules 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 provided nothing more than a bald assertion that the Rule "will not have substantial direct effects on the states, [or] on the relationship between the National Government and the states," and thus provided no impact statement under Executive Order 13,132. 86 Fed. Reg. at 2171.

EPA was wrong. As State Petitioners explained,[59] because the Clean Air Act prohibits them from adopting aircraft emission standards unless they are identical to federal standards, 42 U.S.C. § 7573, States depend on the federal government to adopt effective aircraft standards

[59] States' Comment at 25, 35-36, JA__, __-__.

and are injured when EPA shirks this duty. *See Massachusetts*, 549 U.S. at 519-21 (having surrendered their "sovereign prerogatives" to the Union, the States are harmed when the federal government refuses to regulate greenhouse gas emissions). This harm extends beyond the loss of life, industry, territory, and resources detailed above.[60] In particular, the Aircraft Rule frustrates State Petitioners' efforts to meet state-law climate mandates and to attain or maintain national ambient air quality standards for certain co-pollutants,[61] 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. The Rule's total inefficacy thus gravely burdens the States' quasi-sovereign interests and the relationship between the national government and the States.

EPA's refusal to acknowledge these burdens and insistence that the Rule "does not have federalism implications" further illustrate the agency's arbitrary and irrational decision-making. 86 Fed. Reg. at 2170.

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[60] *Id.* at 8-15, JA__-__.

[61] *Id.* at 18-21, 34-36, JA__-__, __-__. Nonattainment of ambient air standards carries serious federal sanctions, including loss of federal highway construction funds. *See* 42 U.S.C. § 7509(b).

EPA's sole response to States' comments on the issue was similarly absurd: "The EPA acknowledges the commenting states' long history of litigation and regulatory efforts to limit GHG emissions, and notes that no specific request was made by the commenters."[62] The Rule contains no "summary of the nature of [State] concerns and . . . the extent to which the concerns . . . have been met," EO 13,132 § 6(b)(2)(B), because EPA would not even admit the States *have* concerns.

But the States' "request" is and has always been clear: EPA must adopt technologically feasible standards that actually and meaningfully mitigate the danger from aircraft greenhouse gas emissions, as section 231 requires. Its failure to do so is not neutral, but undermines the cooperative federalism model the Clean Air Act exemplifies.

CONCLUSION

For the foregoing reasons, and for the reasons stated in the Environmental Petitioners' opening brief, the Aircraft Rule is unlawful, arbitrary, capricious, and an abuse of discretion. The Court should grant the petitions for review and direct EPA to set aircraft greenhouse gas emission standards justified by the statutory factors and the record.

[62] Aircraft Rule RTC at 333, JA__.

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I hereby certify that:

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/s/ Theodore McCombs
Theodore A.B. McCombs

CERTIFICATE OF SERVICE

Case Name: **California v. EPA** No. **21-1018**

I hereby certify that on February 28, 2022, I electronically filed the following documents with the Clerk of the Court by using the CM/ECF system:

STATE PETITIONERS' INITIAL OPENING BRIEF;

ADDENDUM OF DECLARATIONS IN SUPPORT OF STANDING

I certify that **all** participants in the case are registered CM/ECF users and that service will be accomplished by the CM/ECF system.

I declare under penalty of perjury under the laws of the State of California and the United States of America the foregoing is true and correct and that this declaration was executed on February 28, 2022, at San Diego, California.

Charlette Sheppard	Charlette Sheppard
Declarant	Signature

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ORAL ARGUMENT NOT YET SCHEDULED
Case No. 21-1018 (and consolidated cases)

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, et al.,

Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, et al.,

Respondents.

STATE PETITIONERS' DECLARATIONS IN SUPPORT OF STANDING

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Aircraft Rule Litigation: State Petitioners' Declarations In Support of Standing

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ATTACHMENT A

Dr. Elizabeth Scheele, State of California

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, *et al.*, *Petitioners*, v. UNITED STATES ENVIRONMENTAL PROTECTOIN AGENCY, *et al.*, *Respondents.*	No. 21-1018 (and consolidated cases)

DECLARATION OF ELIZABETH SCHEEHLE

I, Elizabeth Scheehle, state and declare as follows:

Experience

1. I am currently the Chief of the Research Division of the California Air Resources Board (CARB). I have a B.S. in Earth and Atmospheric Sciences from the Georgia Institute of Technology, a Masters of Public Policy from the Kennedy School of Government at Harvard University, and a Masters of Public Health from the Bloomberg School of Public Health at Johns Hopkins University.

2. I have worked for more than 20 years in climate change and air quality programs, starting at the U.S. Environmental Protection Agency (U.S. EPA) where I led national and international efforts on non-carbon dioxide greenhouse gases (GHGs). I served as an expert for the United Nations Framework Convention on

Climate Change and the Intergovernmental Panel on Climate Change (IPCC). In that role, I earned recognition for my contribution to the IPCC's Nobel Prize. I continued my career at U.S. EPA, developing its Carbon Capture and Sequestration expertise, including comprehensive risk assessment considerations.

3. I joined CARB's Research Division in 2007 and led three climate change-related efforts: carbon capture and sequestration, an ozone-depleting substance offset protocol, and an early action climate measure. I was a Section Manager of the Research Division's GHG Technology and Field-Testing Section before next joining the Cap-and-Trade Program in CARB's Industrial Strategies Division. In 2014, I became a Branch Chief in the Industrial Strategies Division, overseeing programs related to oil and gas operations, alternative fuel regulations, and carbon capture and sequestration.

4. In 2018, I began my current role of Chief of the Research Division. In that capacity, I oversee CARB's research program, which investigates the causes of human health and welfare impacts from air pollutant emissions and the potential for reducing those impacts through emission reduction strategies. I also lead the development and implementation of multidisciplinary research plans and studies to provide a robust scientific foundation for our air quality and climate policy decisions. In addition, the Division implements programs on indoor air quality and high global-

warming potential gas mitigation. I have broad experience with climate science and research.

5. I make this declaration based upon my knowledge and expertise in the matters within and upon my review of relevant rulemakings, reports, and other documents discussed below. I submit this declaration in support of the Petitioner State of California's Opening Brief.

Climate Change

6. Climate change is driven by the accumulation of greenhouse gases in the atmosphere. Greenhouse gases retain heat that would otherwise escape back to space. Increasing concentrations of greenhouse gases in the atmosphere thus cause a continuing increase of the planet's average temperature over time, which in turn disrupts established geophysical systems (such as ocean circulation) and ecosystems across the globe.

7. Of all the long-lived greenhouse gases, the ones that have the largest climate impact are carbon dioxide (CO_2), methane, and nitrous oxide. Of those three, CO_2 is the most important because, even though it absorbs less heat per molecule than methane or nitrous oxide, it is more abundant and stays in the atmosphere much longer.

8. Since the Industrial Revolution, the predominant source of climate change-causing greenhouse gas emissions has been human activities. Human

activities cause the emission of greenhouse gases in various ways, including deforestation and the combustion of fossil fuels for energy. Before the Industrial Revolution started in the mid-1700s, the global average amount of CO_2 was about 280 parts per million. The most recent data shows average global CO_2 concentrations peaked for 2021 in May at a monthly average of 419 parts per million (ppm).[1] In August 2021, the IPCC Working Group 1 released part of the 6th Assessment Report (AR6) titled "Climate Change 2021: The Physical Basis,"[2] which reaffirmed with high confidence that there is a near-linear relationship between cumulative anthropogenic CO_2 emissions and the global warming they cause.

9. Because of this dramatic uptick in CO_2 concentrations, the average global surface temperature has increased by around 1.1 degrees Celsius compared to the average in 1850–1900—a level that hasn't been witnessed since 125,000 years ago, before the most recent ice age.[3]

10. The warming climate is also significantly changing Earth's oceans. The oceans have absorbed about 29 percent of global CO_2 emissions since the end of the

[1] National Oceanic and Atmospheric Association (NOAA), "Carbon dioxide peaks near 420 parts per million at Mauna Loa observatory," June 7, 2021), https://research.noaa.gov/article/ArtMID/587/ArticleID/2764/Coronavirus-response-barely-slows-rising-carbon-dioxide; see also *ibid.*, Global Monitoring Laboratory, "Trends in Atmospheric Carbon Dioxide," https://gml.noaa.gov/ccgg/trends/ (last accessed Feb. 15, 2022).
[2] IPCC AR6 Climate Change 2021: The Physical Science Basis, https://www.ipcc.ch/report/ar6/wg1/.
[3] IPCC AR6 2021, *Summary for Policymakers*, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf (IPCC uses the reference period 1850–1900 to approximate pre-industrial temperature, as this is the earliest period with near-global observations.).

activities cause the emission of greenhouse gases in various ways, including deforestation and the combustion of fossil fuels for energy. Before the Industrial Revolution started in the mid-1700s, the global average amount of CO_2 was about 280 parts per million. The most recent data shows average global CO_2 concentrations peaked for 2021 in May at a monthly average of 419 parts per million (ppm).[1] In August 2021, the IPCC Working Group 1 released part of the 6th Assessment Report (AR6) titled "Climate Change 2021: The Physical Basis,"[2] which reaffirmed with high confidence that there is a near-linear relationship between cumulative anthropogenic CO_2 emissions and the global warming they cause.

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[1] National Oceanic and Atmospheric Association (NOAA), "Carbon dioxide peaks near 420 parts per million at Mauna Loa observatory," June 7, 2021), https://research.noaa.gov/article/ArtMID/587/ArticleID/2764/Coronavirus-response-barely-slows-rising-carbon-dioxide; see also *ibid.*, Global Monitoring Laboratory, "Trends in Atmospheric Carbon Dioxide," https://gml.noaa.gov/ccgg/trends/ (last accessed Feb. 15, 2022).
[2] IPCC AR6 Climate Change 2021: The Physical Science Basis, https://www.ipcc.ch/report/ar6/wg1/.
[3] IPCC AR6 2021, *Summary for Policymakers*, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf (IPCC uses the reference period 1850–1900 to approximate pre-industrial temperature, as this is the earliest period with near-global observations.).

pre-industrial era, making it more acidic and slowing its ability to take up more CO_2. Furthermore, warming global and regional temperatures are contributing to rising sea levels, from both thermal expansion of the ocean itself and melting sea ice and glaciers around the world. Extreme sea level events that occurred once per century in the recent past are projected to occur at least annually, which will lead to loss of land, resources, infrastructure, and life.

11. The timing of greenhouse gas emissions is also important because greenhouse gases can remain in the atmosphere for long periods of time. Their warming effect is compounded by future emissions, thereby accelerating climate impacts. Carbon dioxide in particular remains in the atmosphere longer than the other major greenhouse gases emitted as a result of human activities. Some of the excess CO_2 is absorbed quickly (for example, by the ocean surface), but some will remain in the atmosphere for thousands of years, due in part to the very slow process by which carbon is transferred to ocean sediments. As explained in the federal government's Fourth National Climate Assessment, "[w]aiting to begin reducing emissions is likely to increase the damages from climate-related extreme events (such as heat waves, droughts, wildfires, flash floods, and stronger storm surges due to higher sea levels and more powerful hurricanes)."[4]

[4] U.S. Global Change Research Program, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*, at 1488 (2018), https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

12. The timing of greenhouse gas emissions also affects the likelihood of reaching climate tipping points. Tipping points are thresholds of abrupt and irreversible change (such as creating an irreversible shift to a hotter world with higher sea levels, changes in ocean circulation, or near-permanent drought in some regions). Tipping points have varying degrees of probability, but are high-risk in that they could lead to dramatic changes in the climate system. Two IPCC Special Reports (published in 2018 and 2019)[5,6] suggest that tipping points could be exceeded by warming of even between 1 and 2 degrees Celsius. As global temperature increases, threshold environmental events are increasingly likely to occur that will themselves significantly accelerate climate change beyond current projections.

13. Because of the compounding effect of greenhouse gas emissions (particularly CO_2) and the cascade effect of tipping points, additional emissions now, which accelerate global warming and its impacts, are more harmful than additional emissions in the future.

Climate Change Impacts on California

14. California is one of the most geographically and ecologically diverse regions in the world, with landscapes ranging from chaparral and grasslands to sandy beaches and rugged coastal areas to redwood rainforests and dense interior forests to

[5] IPCC, *Global Warming of 1.5°C* (2018), https://www.ipcc.ch/sr15/
[6] IPCC, *Special Report on the Ocean and Cryosphere in a Changing Climate* (2019), https://www.ipcc.ch/srocc/

snow-covered alpine mountains to dry desert valleys. Each of these regions experiences a unique combination of impacts from climate change. From record temperatures to increasingly intense wildfires[7] to rising sea levels and increasingly acidic seas[8] to less reliable snowpack,[9] climate change poses an immediate and escalating threat to California's environment, public health, and economic vitality.

15. California temperatures have risen since records began in 1895, with the rate of increase accelerating since the 1980s.[10] September 2020 officially ranks as California's hottest September since record-keeping began in 1880.[11] In 2021, the period from June through August was the hottest on record in the United States, exceeding even the Dust Bowl summer of 1936, and five states—California, Idaho, Nevada, Oregon and Utah—recorded their warmest summers on record.[12] Warmer air temperatures alter precipitation and runoff patterns, affecting the availability of freshwater supplies. Temperature changes can also increase the risk of severe

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[7] N.S. Diffenbaugh, A.G. Konings, C.B. Field, "Atmospheric variability contributes to increasing wildfire weather but not as much as global warming," Proceedings of the National Academy of Sciences (Nov. 2021), https://www.pnas.org/content/pnas/118/46/e2117876118.full.pdf. https://www.pnas.org/content/118/46/e2117876118

[8] E.B. Osborne, et al., "Decadal Variability in Twentieth-century Ocean Acidification in the California Current Ecosystem," 13 NAT. GEOSCI. 43–49 (2020), https://doi.org/10.1038/s41561-019-0499-z

[9] P.W. Mote, et al., "Dramatic Declines in Snowpack in the Western US," 1 NATURE PARTNER JS. CLIM. ATMOS. SCI. (2018), https://doi.org/10.1038/s41612-018-0012-1.

[10] Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, *Indicators of Climate Change in California* (2018), https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf.

[11] NOAA, "Earth just had its hottest September on record" (Oct. 14, 2020), https://www.noaa.gov/news/earth-just-had-its-hottest-september-on-record.

[12] NOAA, "Summer 2021 neck and neck with Dust Bowl summer for hottest on record" (Sep. 9, 2021), https://www.noaa.gov/news/summer-2021-neck-and-neck-with-dust-bowl-summer-for-hottest-on-record

weather events, such as heat waves and intense storms. A wide range of impacts on ecosystems and on human health and well-being are associated with increased temperatures.[13]

16. Melting ice from Antarctica is also causing higher sea-level rise in California than the global average. California is particularly vulnerable to sea level rise because approximately 80 percent of the population lives within 30 miles of the Pacific Ocean. Several recent studies further found that impacts of sea-level rise, storms, and flooding in California were previously underestimated,[14] and that the waters of the California current ecosystem have already acidified by over twice the global average.[15] The sea level around San Francisco, California, has risen by 6 inches since 1950. Its speed of rise has accelerated over the last ten years and it's now rising by about 1 inch every 10 years.[16]

17. In addition, a warming climate in the western United States is causing changes to the wildfire regime, with wildfires increasing in frequency, duration, and

[13] *Indicators of Climate Change in California*, *supra*, at S-8 to S-12.
[14] Patrick L. Barnard, et al., "Dynamic Flood Modeling Essential to Assess the Coastal Impacts of Climate Change," 9 SCIENTIFIC REPORTS 4309 (2019), https://doi.org/10.1038/s41598-019-40742-z.
[15] Osborne, E.B., et al., *supra*.
[16] *See* NOAA, "Sea Level Trends," https://tidesandcurrents.noaa.gov/sltrends/sltrends.html (last accessed Feb. 15, 2022).

severity in the western United States.[17,18,19] A 2016 study published in Proceedings of the National Academy of Sciences concluded that anthropogenic climate change has doubled the cumulative wildfire area burned in the West during 1984–2015.[20] California's annual wildfire extent has increased fivefold since the 1970s, due mainly to an eightfold increase in summertime forest-fire area and very likely driven by drying of fuels promoted by human-induced warming.[21] Tracking with rising temperatures, California's 2020 fire season was record-breaking, not only because over 4 million acres burned but also because 5 of the 6 largest wildfires in California history occurred in 2020.[22,23] Some of those fires burned so hot that they created their own tornadoes and lightning storms.[24] At one point, California came under siege from record-breaking heat waves and smoke from more than 7,000 fires

[17] Anthony LeRoy Westerling, "Wildfire Simulations for the Fourth California Climate Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate" in *California's Fourth Climate Change Assessment*, Cal. Energy Commiss'n, Pub. No. CCCA4-CEC-2018-014 (2018), http://www.climateassessment.ca.gov/techreports/docs/20180827-Projections_CCCA4-CEC2018-014.pdf.
[18] J.K. Balch, et al., "Human-started Wildfires Expand the Fire Niche Across the United States," Proceedings of the National Academy of Sciences (Mar. 2017), https://doi.org/10.1073/pnas.1617394114.
[19] Kasha Patel, NASA's Earth Observatory, "Six Trends to Know about Fire Season in the Western U.S." (Dec. 5, 2018), https://climate.nasa.gov/ask-nasa-climate/2830/six-trends-to-know-about-fire-season-in-the-western-us/.
[20] B.J. Harvey, "Human-caused Climate Change is Now a Key Driver of Forest Fire Activity in the Western United States," Proceedings of the National Academy of Sciences (Oct. 2016), https://doi.org/10.1073/pnas.1612926113.
[21] A.P. Williams, et al., "Observed impacts of anthropogenic climate change on wildfire in California," 7 EARTH'S FUTURE 892–910 (2019), https://doi.org/10.1029/2019EF001210.
[22] John Myers, "California unveils sweeping wildfire prevention plan amid record fire losses and drought," LA TIMES, Apr. 8, 2021, https://www.latimes.com/california/story/2021-04-08/california-wildfire-prevention-536-million-newsom-lawmakers.
[23] Marshall Burke et al., "The Changing Risk and Burden of Wildfire in the United States," Proceedings of the National Academy of Sciences (Jan. 2021), https://doi.org/10.1073/pnas.2011048118.
[24] A.P. Williams, et al., *supra*.

burning simultaneously.[25] If greenhouse gas emissions continue to rise, by 2100 the frequency of extreme wildfires burning 25,000 acres or more may increase by nearly 50 percent and average area burned statewide may increase by 77 percent.[26]

18. California's infrastructure is at increasing risk from climate change. California owns and operates a wide range of physical assets and infrastructure, including the state highway system, university campuses, parks, and historic structures. These assets are worth billions of dollars, and the State uses this infrastructure to provide critical services to its residents. Climate change impacts, including sea-level rise, more severe heat days, more frequent drought, and increased risk of wildfires, heighten the risk of the State's infrastructure being damaged or lost, disruption to the State providing key services, and impairment of natural habitats within the State.[27]

19. In particular, California has the nation's largest ocean economy, valued at over $44 billion per year, with the vast majority of it connected to coastal recreation and tourism as well as ports and shipping. Many of the facilities and infrastructure that support California's ocean economy—not to mention the public

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[25] Thomas Fuller & Christopher Flavelle, "A Climate Reckoning in Fire-Stricken California," N.Y. TIMES, Sept. 18, 2020, https://www.nytimes.com/2020/09/10/us/climate-change-california-wildfires.html.
[26] State of California, *California's Fourth Climate Change Assessment: Statewide Summary Report* at 9 (2018), https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf013_Statewide_Summary_Report_ADA.pdf.
[27] Legislative Analyst's Office, *Assessing Vulnerability of State Assets to Climate Change* (Jan. 9, 2020), https://lao.ca.gov/Publications/Report/4133.

beaches themselves—lie within a few feet of the present high tide line. Rising sea levels from global warming thus are the main cause of the biggest impacts to California's coastal land, infrastructure, and development, through more frequent flooding and inundation as well as increased cliff, bluff, dune, and beach erosion.[28]

20. The California State Parks system is the largest state park system in the United States, with 280 separate parks spanning 1.6 million acres. These parks are located in a variety of diverse terrestrial, aquatic, and coastal ecosystems. Climate change will have a variety of impacts on the state parks, and impacts will vary by park location and habitat types. Climate change impacts on the state park sites are driven by increases in heat and aridity, including: accelerated coastal erosion, the spread of pests and pathogens (such as bark beetles), large-scale tree losses at Sequoia National Park, more extensive wildfires at Yosemite National Park and in other Western parks, and threats to iconic species like the Joshua trees at Joshua Tree National Park. These changes can affect the composition, structure, and function of entire ecosystems, and alter habitats for plants and wildlife. Over the last 15 years, several state parks have been impacted by wildfires, and the increasing frequency of wildfires also increases the risk that irreplaceable resources will be lost, including historic structures.

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[28] G. Griggs, et al., California Ocean Protection Council Science Advisory Team Working Group, *Rising Seas in California: An Update on Sea-Level Rise Science* (Apr. 2017), https://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf.

21. Climate change also exacerbates air pollution problems throughout California. Increasing temperatures generally cause increases in ozone concentrations in California's polluted regions. Increasing frequency and intensity of wildfires is already having a measurable effect on air quality. The intense heat waves and widespread wildfire smoke in 2020 caused Southern California to experience its worst air pollution readings and highest number of health-damaging bad air days since the mid-1990s. There were 157 bad air days for ozone pollution across the vast, coast-to-mountains basin spanning Los Angeles, Orange, Riverside and San Bernardino counties. That is the most days above the federal health standard since 1997. And particulate matter exposure is a heightened problem during droughts, which climate change is also anticipated to exacerbate in California as changes in weather patterns block rainfall from reaching the State.[29,30] Worse air quality leads to increased risk for respiratory infections like bronchitis and pneumonia, which will result in greater

[29] A.P. Williams, et al., "Contribution of Anthropogenic Warming to California Drought During 2012-2014," 42 GEOPHYS. RES. LETT. 6819–28 (2015), https://doi.org/10.1002/2015GL064924.
[30] I. Cvijanovic, B.D. Santer, C. Bonfils, et al., "Future Loss of Arctic Sea-ice Cover Could Drive a Substantial Decrease in California's Rainfall," 8 NAT. COMMUN. 1947 (2017), https://doi.org/10.1038/s41467-017-01907-4.

health costs to the State.[31,32,33] Considering California is the most populous State in the country, these climate impacts put more people at heightened risk.

22. In sum, California faces both existing and expected climate risks from sea-level rise that is expected to be more intense in California than other areas; water supply shortages and resulting impacts on the nation's most productive agricultural economy; drought and land subsidence; increasing frequency and severity of wildfires; extreme heat events; and harm to coastal infrastructure.

Climate and Air Quality Impacts of Aviation Emissions

23. Aviation emissions are a significant source of the world's total greenhouse gas emissions, and the United States is the single largest emitter. In 2016, EPA found "the collective GHG emissions from U.S. [] aircraft clearly contribute to endangering GHG pollution."[34] Subsequent data and trends have only confirmed EPA's contribution finding. Globally, in 2018 aviation produced 2.4 percent of total energy-related CO_2 emissions,[35] and in 2020, produced 12 percent of greenhouse gas

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[31] J.A. Romley, A. Hackbarth & D.P. Goldman, RAND Corp. "Cost and Health Consequences of Air Pollution in California" (2010), https://www.rand.org/pubs/research_briefs/RB9501.html.

[32] M. Wang, C.P. Aaron, J. Madrigiano, et al., "Association Between Long-term Exposure to Ambient Air Pollution and Change in Quantitatively Assessed Emphysema and Lung Function," 322(6) J. AM. MED. ASSOC. 546-56 (2019), https://jamanetwork.com/journals/jama/fullarticle/2747669.

[33] A. Inserro, *Air Pollution Linked to Lung Infections, Especially in Young Children*, AM. J. MANAGED CARE (May 6, 2018), https://www.ajmc.com/newsroom/air-pollution-linked-to-lung-infections-especiallyin-young-children.

[34] 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, 54,461 (Aug. 15, 2016) (2016 Endangerment Finding).

[35] Envtl. & Energy Study Inst., *Fact Sheet: The Growth in Greenhouse Gas Emissions from Commercial Aviation*, at 1 (Oct. 2019), https://www.eesi.org/files/FactSheet_Climate_Impacts_Aviation_1019.pdf ("EESI Fact

emissions from all transportation sources.[36] Within the United States, in 2017 aviation accounted for 3 percent of total domestic CO_2 emissions, and over 12 percent of total U.S. transportation-related CO_2 emissions.[37] Aviation emissions have been found to cause 5% of global anthropogenic climate forcing due to the radiative forcing effect of pollutants emitted at altitude.[38]

24. Aviation greenhouse gas emissions were projected to grow at a rapid rate in studies conducted before the COVID-19 pandemic crisis arose in early 2020. Globally, by 2050, commercial aircraft emissions were estimated to triple under these projected growth patterns.[39] Greenhouse gas emissions from U.S. aircraft covered by the rule challenged in this case were projected to grow by 43 percent over the next two decades.[40] Despite diminished use due to the COVID-19 crisis, aviation emissions have since rebounded and are expected to return to these projected growth patterns. The World Meteorological Organization has found that the estimated high-water mark of GHG emission reductions of 17 percent, caused by global lockdowns early in 2020, have now fallen away.[41]

Sheet"), B. Graver, et al., "CO2 emissions from commercial aviation, 2018" (Sept. 2019), https://theicct.org/sites/default/files/publications/ICCT_CO2-commercl-aviation-2018_20190918.pdf.

[36] Air Transport Action Group, "Facts & Figures" (Sept. 2020), https://www.atag.org/facts-figures.html.

[37] EESI Fact Sheet, *supra*, at 1. For comparison, when EPA made its 2016 Endangerment Finding, U.S. covered aircraft represented 2.8 percent of U.S. total GHG emissions, and 10 percent of total transportation GHG emissions. 81 Fed. Reg. at 54,465-66.

[38] D.W. Fahey & D.S. Lee, "Aviation and Climate Change. A Scientific Perspective," in *Carbon & Climate Law Review* 2:7 (2016).

[39] Bock, L. & Burkhardt, U., "Contrail cirrus radiative forcing for future air traffic," *Atmos. Chem. Phys.* 19:8163–8174 (Jun. 27, 2019), https://acp.copernicus.org/articles/19/8163/2019/.

[40] 2016 Endangerment Finding, 81 Fed. Reg. at 54,426 & n.29.

[41] World Meteorological Organization, *United in Science 2020*, at 6 (Sept. 9, 2020), https://library.wmo.int/doc_num.php?explnum_id=10361.

25. By contributing to global atmospheric concentrations of greenhouse gases, these aviation greenhouse gas emissions—and the federal government's decision not to reduce these emissions—contribute to and worsen the impacts of climate change throughout California.

26. In anticipation of, and increasingly in response to, harms from climate change, California has been proactive in taking steps to reduce greenhouse gas emissions. In 2006, California enacted Assembly Bill (AB) 32, the Global Warming Solutions Act, requiring the State to reduce its greenhouse gas emissions to 1990 levels by 2020. In 2016, the State Legislature set more ambitious goals in Senate Bill (SB) 32, which directs CARB to ensure that State greenhouse gas emissions are reduced 40 percent below 1990 levels by 2030. However, because California cannot adopt aircraft emissions standards unless they are identical to federal standards, the federal government's failure to adopt standards that meaningfully reduce emissions from aviation means California cannot meaningfully reduce these emissions either.[42] Recently, the International Council on Clean Transportation calculated that in 2017, passenger flights accounted for nine percent of all energy-related CO_2 emissions in California.[43] The federal government's decision not to meaningfully reduce aircraft

[42] *See* 42 U.S.C. § 7573.

[43] Zheng, X. & Rutherford, D., "Reducing aircraft CO_2 emissions: The role of U.S. federal, state, and local policies" (Feb. 4, 2021), https://theicct.org/sites/default/files/publications/Aviation-CO2-US-feb2021.pdf. The study calculated that California and New York are the two highest emitting states in terms of total passenger flight emissions. Passenger flights accounted for ten percent of energy-related CO_2 emissions in New York and seven percent in Washington, Massachusetts, and New Jersey. *Id.*

greenhouse gas emissions thus interferes with California's ability to achieve its greenhouse gas mandates.

27. Recent research from the Massachusetts Institute of Technology (MIT) found that 94 percent of air quality impacts are driven by nitrogen oxides (NO_X), a co-pollutant of CO_2 found in aviation emissions.[44] These NO_X emissions contribute to formation of ozone and particulate matter (PM) and MIT research has shown that the generation of these chemicals due to global aviation results in 16,000 premature deaths. Commercial aviation engines certified by US EPA show that the NO_X emissions and smoke number (which can be used to estimate PM emissions) have made little progress in the last 40 years.

28. Nineteen areas of California are designated as nonattainment under the most recent, 70 parts per billion 8-hour ozone national ambient air quality standard. These areas include the South Coast Air Basin and San Joaquin Valley, the only two Extreme ozone nonattainment areas in the country.

29. In CARB's baseline emissions inventory, aviation emissions account for 24 Tonnes Per Day (TPD) of NO_X in South Coast in 2037. This is as much as 40 percent of the total preliminary carrying capacity of 60-70 TPD in South Coast that will provide for attainment of the federal 70 ppb 8-hour ozone standard. Again,

[44] C. Grobler et al., "Marginal climate and air quality costs of aviation emissions," Environmental Research Letters, Vol. 14, No. 11 (2019), https://iopscience.iop.org/article/10.1088/1748-9326/ab4942

because California cannot establish aircraft emission standards that are different from federal standards, the federal government's decision not to adopt more stringent aircraft standards frustrates South Coast's ability to reduce an entire 40 percent of its "NO_X budget" and attain federal air quality standards. The federal government's inaction on aircraft emissions similarly burdens other California air basins' attainment or maintenance of ozone and PM ambient air standards.

I certify under penalty of perjury under the laws of the State of California and the United States of America that the foregoing is true and correct to the best of my knowledge and belief.

Executed on February 24, 2022, at Sacramento, County of Sacramento, California.

Elizabeth Scheehle

ELIZABETH SCHEEHLE

ATTACHMENT B

Christine Kirby, State of Massachusetts

ORAL ARGUMENT NOT YET SCHEDULED

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, *et al.*, Petitioners, v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Respondent.	No. 21-1018 and consolidated case

DECLARATION OF CHRISTINE KIRBY

I, Christine Kirby, declare as follows:

1. I am currently employed by the Massachusetts Department of Environmental Protection (MassDEP) as the Assistant Commissioner in charge of the Bureau of Air and Waste and was, prior to my current position, the Director of the Division of Air and Climate Programs. I have held the former position for more than 5 years, and I held the latter for 6 years. I have been employed by MassDEP since 1985, having previously held the positions of Deputy Division Director of the Mobile Source Section for 8 years, and Branch Chief for Transportation Programs for 7 years.

2. My job duties include, but are not limited to, overseeing the promulgation and implementation of MassDEP regulations that establish emission standards and other emission-related requirements applicable to all sources of air pollution including emissions from the transportation sector. MassDEP's regulatory programs address emissions from new vehicles (e.g., Massachusetts Low Emission Vehicle (LEV) program) and emissions from existing vehicles and engines (e.g., Massachusetts Vehicle Inspection and Maintenance Program, Vehicle Idling limits, Logan Airport Parking Freeze). In addition to Massachusetts regulations and programs and given the federal role in setting national emission standards for certain categories of vehicles and engines, I have followed and advocated for stringent federal standards for vehicles and engines at the federal level to reduce emissions from transportation sources including aircraft, locomotive engines, and non-road engines.

3. In my tenure as the Director of Air and Climate Programs, I was the chair of the Mobile Source Committee of the Ozone Transport Commission, which is a multi-state organization created under the Clean Air Act and is responsible for advising the United States Environmental Protection Agency (EPA) on transportation issues and for developing and implementing regional solutions to the ground-level ozone problem in the Northeast and Mid-Atlantic regions. I also served on the Board of Directors of the Northeast States for Coordinated Air Use

Management (NESCAUM), an association of the air quality agencies in eight Northeast states that provides scientific, technical, analytical, and policy support to the air quality programs of those agencies, especially regarding implementation of national environmental programs required under the Clean Air Act and other federal legislation. I also previously served on the Board of Directors of the National Association of Clean Air Agencies—a national association of state and local air quality agencies.

4. I have a Bachelor of Arts degree from Clark University.

5. This declaration refers to the final action of Respondent EPA set forth in the notice published at 86 Fed. Reg. 2136 (Jan. 11, 2021) and titled "Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures" (Aircraft Rule). The Aircraft Rule adopts greenhouse gas emission standards for certain classes of airplane engines, for new type design and in-production airplanes, that are equivalent to the airplane carbon dioxide standards adopted in 2017 by the International Civil Aviation Organization (ICAO). EPA is not projecting any greenhouse gas emission reductions from these standards. I am personally familiar with the Aircraft Rule.

6. I am submitting this declaration in support of the States' petition for review in the above-captioned case.

Massachusetts is Legally Obligated to Reduce Economywide Greenhouse Gas Emissions

7. The Commonwealth of Massachusetts (Commonwealth) is committed to protecting public health and the environment through programs and policies that address air pollution and climate change.

8. Massachusetts state law imposes legally binding requirements on the Commonwealth to reduce emissions of climate-warming greenhouse gases from sources across the economy. *See Kain v. Mass. Dep't Envtl. Prot.,* 474 Mass. 278, 287–88 (2016). The Global Warming Solutions Act, signed into law in 2008, and An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy, signed into law in 2021, set forth emission-reduction mandates for the Commonwealth known as the "Climate Protection and Green Economy Act." *See* MASS. GEN. LAWS ch. 21N. Chapter 21N mandates that the Commonwealth achieve at least net zero statewide greenhouse gas emissions while also reducing statewide greenhouse gas emissions at least 85% below the 1990 emissions level in 2050, and meet interim emissions-reduction limits in 2020, 2025, 2030, 2035, 2040, and 2045. MASS. GEN. LAWS ch. 21N, §§ 3(b), 4(a), & 4(h). Specifically, the law requires the Commonwealth's Secretary of Energy and Environmental Affairs (Secretary) to adopt a 2030 statewide greenhouse gas emissions limit at least 50% below the 1990 emissions level, and a 2040 limit at least 75% below the 1990 emissions level. *Id.* § 4(h).

9. In addition, Chapter 21N directs the Secretary to adopt sector-based statewide greenhouse gas emissions sublimits for various sectors of the Commonwealth's economy, including the transportation sector. MASS. GEN. LAWS ch. 21N, § 3A(a). Those sublimits "shall be designed to maximize the ability of the commonwealth to meet the 2050 statewide greenhouse gas emissions limit." *Id.* §3A(b).

10. The law also directs the Secretary to develop implementation plans for obtaining sufficient emission reductions to meet the 2025, 2030, 2035, 2040, 2045, and 2050 emissions limits and sector-specific sublimits. *Id.* §§ 3(b), 4, 5.

11. The Secretary must adopt statewide greenhouse gas emission reductions limits and sector-specific submits for 2025 and 2030, and release a comprehensive plan to achieve those limits, by July 1, 2022. 2021 Mass. Acts ch. 8, § 107.

12. The Secretary commissioned a 2050 Decarbonization Roadmap Study (Roadmap Study) to provide the Commonwealth with a comprehensive understanding of the necessary strategies and transitions in the near- and long-term to achieve net zero in 2050 using best-available science and research methodology.[1] Informed by the Roadmap Study, on December 30, 2020, the

[1] Mass. Executive Office of Energy & Environmental Affairs, *et al*., *Massachusetts 2050 Decarbonization Roadmap* (2020), at 7, https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download.

Secretary published an interim updated implementation plan, entitled the "Clean Energy and Climate Plan for 2030" (MA Interim 2030 Climate Plan), which includes a menu of policies to reduce greenhouse gas emissions from all significant emitting sectors, including transportation.[2] The policies set forth in the MA Interim 2030 Climate Plan represent the Commonwealth's comprehensive strategy to address greenhouse gas emissions from emissions sources across the economy.

13. The Secretary is implementing the strategies, policies, and actions outlined in the MA Interim 2030 Climate Plan as it works to develop and finalize a Clean Energy and Climate Plan for 2025 and 2030 by July 1, 2022, as required by statute.[3]

14. By Executive Order, Governor Charles Baker established the Commission on the Future of Transportation in the Commonwealth to advise the Governor on how to ensure that transportation planning, forecasting, operations, and investments for 2020 through 2040 can best account for likely demographic,

[2] *See* Kathleen Theoharides, *Request for Comment on Clean Energy and Climate Plan for 2030* (Dec. 30, 2020), https://www.mass.gov/doc/interim-clean-energy-and-climate-plan-for-2030-december-30-2020/download.
[3] *See* Mass. Executive Office of Energy & Environmental Affairs, *Massachusetts Clean Energy and Climate Plan for 2025 and 2030* (2021), https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2025-and-2030#development-of-the-clean-energy-and-climate-plan-for-2025-and-2030-.

technological, climate, and other changes in future mobility and transportation behaviors, needs, and options.[4]

15. MassDEP plays a critical role in implementing Chapter 21N and facilitating the Commonwealth's compliance with emission-reduction requirements. For instance, MassDEP monitors state-level emissions trends, collects data on emissions from various sources, and records and reports annual statewide and sector-specific emissions through the Commonwealth's Greenhouse Gas Emissions Inventory. MassDEP is also responsible for implementing numerous policies and programs included in the MA Interim 2030 Climate Plan. The Commonwealth's highest court, the Massachusetts Supreme Judicial Court, has recognized that MassDEP shoulders a crucial responsibility in statewide emission-reductions efforts. Section 3(d) of the Chapter 21N requires MassDEP to promulgate regulations that address multiple sources or categories of sources of greenhouse gas emissions, impose a limit on emissions that may be released from such sources, limit the aggregate emissions released from each group of regulated sources or categories of sources, set emission limits for each year, and set limits that decline on an annual basis. *See Kain,* 474 Mass. at 292. MassDEP has promulgated two regulations that impose declining limits on the transportation

[4] *See* Exec. Order No. 579, § 1 (Mass. 2018), https://www.mass.gov/executive-orders/no-579-establishing-the-commission-on-the-future-of-transportation-in-the.

sector, but they do not take aircraft emissions in account. *See* 310 MASS. CODE REGS. 60.05 ("Global Warming Solutions Act Requirements for Transportation"); *id.* 60.06 ("CO_2 Emission Limits for State Fleet Passenger Vehicles").

Reductions in Transportation-Sector Emissions, Including Aircraft Emissions, Are Necessary to Achieving Massachusetts' Required Greenhouse Gas-Emission Reductions

16. Significant reductions in transportation-sector greenhouse gas emissions are critical to achieving Massachusetts' emission-reduction requirements for 2030 and beyond. The transportation sector is the single largest source of greenhouse gas emissions in the Commonwealth, accounting for 42.3% of Massachusetts' statewide emissions in 2018.[5] Emissions from domestic aircraft comprise approximately 6.1% of the 42.3% state-wide emissions from the transportation sector in 2018. According to a briefing prepared by the International Council on Clean Transportation (ICCT) that I have personally reviewed, in the Boston metropolitan area, carbon dioxide emissions from passenger flights account for 5% of total greenhouse gas emissions for the area.[6]

[5] *See* MASSDEP, PROPOSED ADDENDUM STATEWIDE GREENHOUSE GAS (GHG) EMISSIONS LEVEL: 1990 BASELINE UPDATE, APPENDIX C: MASSACHUSETTS ANNUAL GREENHOUSE GAS EMISSIONS INVENTORY: 1990–2018, WITH PARTIAL 2019 & 2020 DATA (2022), https://www.mass.gov/doc/statewide-ghg-emissions-level-proposed-1990-baseline-update-appendix-c/download.

[6] Zheng, S. & Rutherford, D., Reducing Aircraft CO2 Emissions: The Role of U.S. Federal, State, and Local Policies, International Council on Clean Transportation,

17. If Massachusetts' transportation-sector emissions were to remain, through 2050, at the 2018 level of 31.1 million metric tons of carbon dioxide equivalent ($MMTCO_2e$), Massachusetts would not be able to meet its required 2050 emissions limit of, at maximum, 14.1 $MMTCO_2e$ (which is equivalent to 85% below the 1990 emissions level). Even if emissions from all other sectors of the economy were eliminated, emissions from the transportation sector alone would exceed Massachusetts' economy-wide 2050 emissions limit if they did not decline after 2020.

18. The Commonwealth's Roadmap Study projected that the lack of decarbonization of the commercial aviation sector will likely be a source of residual emissions in the Commonwealth in 2050, unless zero-carbon aviation fuels are rapidly scaled and become cost-effective.[7] However, the Aircraft Rule failed to establish standards that would promote such advances, and EPA projects that the Aircraft Rule will result in no greenhouse gas emission reductions. Therefore, a direct result of the insufficiently protective standards adopted under the Aircraft Rule is an increase in the burden to find greenhouse gas emission reductions from other in-state sources.

(Feb. 2021), at 5-6, https://theicct.org/sites/default/files/publications/Aviation-CO2-US-feb2021.pdf.

[7] Roadmap Study, *supra* n.1, at 39.

The Aircraft Rule Directly Harms Massachusetts

19. For the reasons described above, by failing to adopt standards that would result in emission reductions, the Aircraft Rule will make it harder for the Commonwealth to achieve its decarbonization mandates.

20. In conclusion, the lack of emission reductions that will result from the federal standards adopted by the Aircraft Rule directly harms Massachusetts.

I declare under penalty of perjury that the foregoing is true and correct.

Executed in Boston, Massachusetts on February 28, 2022.

Christine Kirby
Assistant Commissioner
Bureau of Air and Waste
Massachusetts Department of
Environmental Protection

ATTACHMENT C

Dr. Lisa Engler, State of Massachusetts

ORAL ARGUMENT NOT YET SCHEDULED

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, *et al.*, Petitioners, v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Respondent.	No. 21-1018 and consolidated case

DECLARATION OF LISA BERRY ENGLER

I, Lisa Berry Engler, declare of my personal knowledge as follows:

1. I am currently employed by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) as Director of the Office of Coastal Zone Management (CZM). CZM is the lead policy and planning agency on coastal and ocean issues in Massachusetts. I have held this position for three years. I have been employed by CZM since 2011, having held positions with increasing responsibility. I previously held the positions of Assistant Director, Boston Harbor Regional Coordinator, Acting Director for the Massachusetts Bays National Estuary Program (MassBays), and MetroBoston Regional Coordinator for MassBays. Prior to joining CZM, I held positions with the Massachusetts

Department of Transportation and the Massachusetts Department of Conservation and Recreation.

2. I have extensive professional knowledge and experience regarding the impacts of climate change on coastal resources and communities in Massachusetts, as well as Massachusetts' efforts to plan and prepare for such impacts. My job duties include providing oversight and administration for CZM and directing policy development, planning efforts, and technical approaches for CZM program areas. I supervise a team of 34 multidisciplinary professionals working in a range of program areas, including climate change adaptation and coastal resilience administered as CZM's StormSmart Coasts Program. Many of the staff I oversee have significant professional experience in coastal and environmental management, planning, science, policy, and other related fields. I routinely engage and partner with scientific and technical subject matter experts in federal agencies and academia. As part of my management responsibilities, I oversee CZM's work to provide information, strategies, tools, and financial resources to support communities and people working and living on the Massachusetts coast to address the challenges of erosion, flooding, storms, sea level rise, and other climate-change impacts. For instance, I oversee the development of sea level rise decision-support tools and services including inundation maps and guidance documents. I also direct CZM's work to provide policy and planning support and technical assistance to

other state agencies, local communities, and private entities regarding adapting and increasing resilience to current and future impacts of climate change on our coast. For example, I oversee CZM's StormSmart Coasts Program that offers competitive grants, hands-on technical and planning assistance, and decision-support tools to Massachusetts cities and towns and non-profit organizations for the purposes of planning for and adapting to sea level rise and other climate-change-related coastal hazards.

3. In my role with CZM, I chair and participate in various legislative and executive branch groups, including the Massachusetts Ocean Advisory Commission and Science Advisory Council and associated work groups. I also represent the Commonwealth of Massachusetts (Commonwealth) on several multi-state organizations, including the Coastal States Organization, Northeast Regional Ocean Council, and the Gulf of Maine Council on the Marine Environment.

4. I have a bachelor's degree in Biology from Colby College and a master's degree in Environmental Management from Duke University.

5. I am aware of and familiar with the science related to global and local climate change. My knowledge comes from my review of scientific peer-reviewed literature and consensus assessment reports, attendance at professional conferences and workshops, and professional exposure to other research and material. As a result of my professional experience and my knowledge of the peer-reviewed

literature and reports, as well as my knowledge of the Massachusetts coastal resources and policies and planning related thereto, I can attest to the following.

6. The purposes of this declaration are to: (i) briefly describe the serious harms that climate change, caused in part by aircraft emissions, is causing and will continue to cause to Massachusetts' coastal resources, infrastructure, and communities; and (ii) briefly summarize extensive state and local initiatives, programs, and plans to respond to and prepare for such impacts.

7. I am submitting this declaration in support of the States' petition for review in the above-captioned case challenging the final action of the EPA entitled *Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures* (Aircraft Rule), 86 Fed. Reg. 2136 (Jan. 11, 2021). In that rule, the EPA adopts greenhouse gas emission standards for certain classes of airplane engines, for new type design and in-production airplanes, that are equivalent to the airplane carbon dioxide standards adopted in 2017 by the International Civil Aviation Organization (ICAO).

Climate Change Threatens Massachusetts' Coastal Resources and Communities

8. The accelerated rate of global sea level rise and the severity and timing of coastal impacts due to this rise in sea level are largely dependent on current and future global greenhouse gas emissions, including carbon dioxide emissions, and reduction measures. Climate scientists have high confidence that anthropogenic drivers have been the dominant cause of global mean sea level rise since 1970.[1] Continued emissions of greenhouse gases, including from aircrafts, will result in increases in global temperature, yielding additional contributions to global sea level rise (*i.e.*, increased contributions from thermal expansion of warmer waters and melting of land-based ice sheets).[2]

9. According to the U.S. Global Change Research Program, human-caused climate change has led to a rise in global mean sea levels of 8 inches since 1900, and a rate of rise greater than that in any preceding century in the last 2,800 years.[3] Global average sea levels will continue to rise by 1 to 4 feet by 2100, and

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1 Oppenheimer, M., B.C. Glavovic et al., *Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities*, *in* IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE (H.-O. Pörtner et al. eds., 2019).

2 *See generally* U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I (D.J. Wuebbles et al. eds., 2017), https://science2017.globalchange.gov/.

3 *Id.* at 10.

emerging science regarding Antarctic ice sheet instability indicates sea level rise of as much as 8 feet by 2100 cannot be ruled out.[4] Due to the relationship of the East Coast to the Gulf Stream and melting Antarctic ice sheets, sea level rise will be higher than the global average on the East Coast of the United States.[5]

10. A March 2018 report entitled *Massachusetts Climate Change Projections* (2018 Projections Report), informed by a team of scientists from the U.S. Department of the Interior's Northeast Climate Adaptation Science Center at the University of Massachusetts Amherst, presents the best available, peer-reviewed science on climate change downscaled, or localized, for Massachusetts through the end of this century.[6] The 2018 Projections Report identifies substantial increases in air temperature, precipitation, and sea levels across Massachusetts as a result of human-caused greenhouse gas emissions.

11. A key component of the 2018 Projections Report is sea level rise projections for the state's coastline. The analysis for Massachusetts consisted of a probabilistic assessment of future relative sea level rise at tide gauge stations with long-term records at Boston Harbor, MA, Nantucket, MA, Woods Hole, MA, and

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[4] *Id.*

[5] *Id.*

[6] MASSACHUSETTS CLIMATE CHANGE PROJECTIONS (2018), https://nescaum-dataservices-assets.s3.amazonaws.com/resources/production/MA%20Statewide%20and%20MajorBasins%20Climate%20Projections_Guidebook%20Supplement_March2018.pdf.

Newport, RI.[7] The sea level projections are based on a methodology that provides complete probability distributions for different greenhouse gas emissions scenarios.[8] Working with the principal investigators (Robert DeConto and Robert Kopp) and a team of external peer reviewers, CZM reviewed and synthesized the downscaled projections, which are made available by the Commonwealth, to set forth a standard set of sea level rise projections to be used by municipalities, state government, industry, the private sector, and others to assess vulnerability and identify and prioritize actions to reduce risk. Given a high emissions pathway (Representative Concentration Pathway 8.5), Massachusetts is projected to experience approximately 4.0 to 7.6 feet of sea level rise over the twenty-first century (99.5% probability), with as much as 10.2 feet possible when accounting for higher ice sheet contributions (99.9% probability).

12. Massachusetts has 2,819 miles of tidal coastline, and a coastal zone (land areas from the shoreline to 100 feet inland of major roads or railways from New Hampshire to Rhode Island) that encompasses 886 square miles. Approximately 5.1 million people or 75% of the Commonwealth's population

[7] *See id.* at 11 (citing Robert M. DeConto & Robert E. Kopp, *Massachusetts Sea Level Assessment and Projections*, Technical Memorandum (2017).

[8] *See id.* (citing Robert E. Kopp et al., *Probabilistic 21st and 22nd century sea level projections at a global network of tide gauge sites*, 2 EARTH'S FUTURE 383–406 (2014)).

reside in coastal counties. In 2018, the total output of the Massachusetts economy across all industries in coastal shoreline counties was $487.7 billion.[9] Approximately 170,000 year-round residents are currently (as of the 2010 U.S. census) located within coastal flood hazard areas, as defined by the Federal Emergency Management Agency (FEMA), and are susceptible to 1% annual chance coastal storm flooding under current sea level conditions.[10] Accelerated sea level rise will lead to more regular flooding of developed and natural coastal areas due to an increase in the extent of tidal inundation, and will also exacerbate erosion along beaches, dunes, and coastal banks.

13. In addition, there is very high confidence that climate change and sea level rise will increase the frequency and extent of flooding associated with coastal storms, such as hurricanes and nor'easters.[11] Moderate to major coastal storm events will cause inundation of larger areas, and will occur more frequently, damaging or destroying coastal engineering structures such as seawalls; critical

[9] NAT'L OCEAN ECONOMICS PROGRAM, STATE OF THE U.S. OCEAN AND COASTAL ECONOMIES: COASTAL STATES SUMMARIES – 2016 UPDATE 29 (2016), http://midatlanticocean.org/wp-content/uploads/2016/03/CoastalStatesSummaryReports_2016.pdf.

[10] *See* Mark Crowell et al., *Estimating the United States Population at Risk from Coastal Flood-Related Hazards*, *in* COASTAL HAZARDS, 151, 167 (Charles W. Finkl ed., 2013), https://tinyurl.com/yaolf6bk.

[11] *See* U.S GLOBAL CHANGE RESEARCH PROGRAM, *supra*, at 27.

infrastructure such as pump stations, wastewater treatment plants, and transportation systems; and businesses and private property.

14. More frequent severe storm surges will create serious risks for public safety and health, especially where roads, sewer mains, and pump stations are impacted. Frequent tidal flooding from sea level rise may also lead to increases in respiratory diseases due to mold from dampness in homes.[12] Saltwater intrusion—or the increased penetration of salt water into sources of fresh water—from sea level rise will impact water resources (such as drinking water) by contaminating freshwater sources with salt water and also through the corrosion of water supply infrastructure.

15. The Massachusetts coast includes a diverse array of marine and estuarine ecosystems including, among others, sandy beaches, rocky shores, barrier beaches, islands, and salt marshes. These ecosystems offer immense commercial, recreational, cultural, and aesthetic values to the residents of and visitors to the Commonwealth, while also serving important ecological functions. For instance, natural coastal resources, especially beaches and salt marshes, provide valuable

[12] *See generally* CENTERS FOR DISEASE CONTROL & PREVENTION, U.S. DEP'T OF HEALTH & HUMAN SERVS., COASTAL FLOODING, CLIMATE CHANGE, AND YOUR HEALTH: WHAT YOU CAN DO TO PREPARE (2017), www.cdc.gov/climateandhealth/pubs/CoastalFloodingClimateChangeandYourHealth-508.pdf.

coastal resilience services to the Commonwealth by buffering inland coastal communities and the built environment from waves and storm surges. Salt water will also impact natural coastal resources, as saltwater intrusion into salt marshes and freshwater wetlands will alter the composition of plant species and affect wildlife that depend on these ecosystems.

Massachusetts is Experiencing Economic Impacts from Climate Change and is Expending Significant Resources to Adapt and Prepare for Impacts of Climate Change on Our Coastal Areas

16. The Commonwealth is already experiencing impacts of climate change. The relative sea level trend at the Boston tide station is (+) 2.87 millimeters per year based on monthly mean sea level data from 1921 to 2020, which is equivalent to a change of 0.94 feet over 100 years.[13]

17. These impacts are directly harming the welfare of Massachusetts residents and causing significant economic losses. Coastal storms currently result in flooding with extensive damages to public infrastructure, private homes and businesses, and a significant demand for emergency response and recovery services. For example, a nor'easter on March 2–3, 2018, which reached the third-highest water level recorded at the Boston Harbor tide gauge, resulted in major

[13] *See* Nat'l Oceanic & Atmospheric Admin., *Relative Sea Level Trend 8443970 Boston, Massachusetts*, TIDES & CURRENTS, https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8443970.

flooding, damages, and expenditures for response and recovery. On April 30, 2018, Massachusetts Governor Charles Baker requested a federal disaster declaration, which the Trump Administration approved on June 25, 2018. The disaster declaration authorized FEMA Public Assistance funding for eligible applicants (FEMA DR-4372-MA), and as of August 2021, FEMA has obligated over $29 million for public storm-related costs related to the event.

18. Rising sea levels increase the frequency, depth, and duration of coastal flooding events; and the associated magnitude of damage costs, including costs associated with the increased demand on first responders, will escalate accordingly.

19. Sea level rise and other impacts of a changing climate pose major risks to communities in Massachusetts' coastal zone. Looking out to the end of the century, a 2018 study analyzed the number of coastal homes and commercial properties throughout the United States that will be at risk from frequent tidal flooding (meaning at least 26 higher tides per year) as a result of projected sea level conditions without any storm events.[14] In Massachusetts, over 89,000 existing homes and 8,000 commercial properties may be disrupted by chronic tidal flooding

[14] *See* UNION OF CONCERNED SCIENTISTS, UNDERWATER: RISING SEAS, CHRONIC FLOODS, AND THE IMPLICATIONS FOR US COASTAL REAL ESTATE (2018), www.ucsusa.org/resources/underwater.

or inundation by 2100 under a high-emissions scenario. The 2018 market value of residential buildings at risk of higher tides in 2100 was estimated at $63 billion, and these homeowners currently contribute over $400 million to the local property tax base.[15]

20. Development along the Massachusetts coast is afforded protection from coastal buffers such as beaches and dunes, and from engineered coastal infrastructure such as revetments and seawalls. These coastal engineered structures will experience greater impacts from flooding and wave energy from the anticipated increase in frequency and intensity of coastal storm events associated with accelerated sea level rise and climate change. With these greater impacts will come more frequent need for maintenance and replacement of coastal engineered structures as well as beaches in the form of sediment nourishment at significant costs. For example, the Town of Winthrop needed additional protection from storm surge and flooding impacts for a suburban neighborhood with existing engineered shoreline structures (*i.e.*, seawalls, groins, and breakwaters) and an eroding beach. At a cost of approximately $25 million in state funding, 460,000 cubic yards of sand, gravel, and cobble were placed along 4,200 linear feet of shoreline in 2013–2014. The community gained approximately 150 feet of beach width at high tide

[15] *See* Massachusetts-specific data available at: www.ucsusa.org/sites/default/files/attach/2018/06/underwater-data-by-state.xlsx.

and increased protection against wave energy and coastal storms. Other communities across Massachusetts (*e.g.*, New Bedford, Rockport, Duxbury, and Scituate) have worked to design beach nourishment projects and address erosion and failing coastal engineered structures that will be exacerbated by accelerated sea level rise and increased flooding from coastal storms. As described below, the Commonwealth provides substantial funding for these projects to protect coastal communities and their residents and businesses.

21. Coastal engineered structures, such as seawalls and revetments, have been constructed along over a quarter of the Commonwealth's ocean-facing shoreline to protect public and private infrastructure and assets from flooding and erosion. The Commonwealth and its municipalities own approximately 92 miles of such structures along the coastline. As a result of wave forces on the coastal structures and lowered beach elevations, the Commonwealth and local governments routinely invest millions of dollars to repair and reinforce these structures so they can adequately protect coastal communities. For example, in 2018 a seawall reconstruction project was completed in the Town of Marshfield to address coastal flooding and public safety issues. The Commonwealth provided a $1.85 million grant and loan award to the town, which was matched with roughly $620,000 in local funds. The approximately 600-foot section of seawall sustained damages during a coastal storm in January 2015, and the state-funded project

increased the height of the seawall by two to three feet to better protect a public road, utilities, and homes. The Town of Marshfield has 32 coastal engineered structures along 12 miles of exposed shoreline, totaling over 20,000 feet (3.9 miles), that have been identified as needing repairs and retrofits to address the current and future threats of sea level rise and coastal storms. With higher flood levels and greater storm surges, significantly more investments will be required to achieve the current flood-design protections afforded by these engineered structures across the coast.

22. The Commonwealth owns a substantial portion of the state's coastal property and infrastructure. The Commonwealth owns, operates, and maintains approximately 177 coastal state parks, beaches, reservations, and wildlife refuges located within the Massachusetts coastal zone. The Commonwealth also owns, operates, and maintains numerous properties, facilities, and infrastructure in the coastal zone, including roads, parkways, piers, and dams. Rising sea levels along the Massachusetts coast will result in either the permanent or temporary loss of the Commonwealth's coastal property through inundation, storm surge, flooding, and erosion events. These projected losses of coastal property will likely destroy or damage many of the state-owned facilities and infrastructure described above. The Commonwealth likely will be required to expend significant resources to protect, repair, rebuild, or possibly relocate the affected properties, facilities, and

infrastructure. According to the Commonwealth's 2018 *State Hazard Mitigation and Climate Adaptation Plan*,[16] the replacement cost of state-owned facilities exposed to FEMA's 1% annual chance flood event in coastal counties exceeds $500 million.

23. The Massachusetts coastal zone is home to several major ports including the Port of Boston and New Bedford/Fairhaven Harbor. Recent economic studies indicate the income generated from the Massachusetts maritime economy supports 2.6% of the state's direct employment and 1.3% of gross domestic product.[17] In 2018, New Bedford/Fairhaven Harbor alone generated $3.7 billion in direct business revenue from seafood processing and fleet operation businesses.[18] By nature of their purpose, the state's ports and harbors are generally low-lying, coastal-dependent areas of high density-built environment and are susceptible to service interruption and associated revenue loss when flooded or otherwise impacted by coastal events. Additionally, coastal dependent businesses,

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[16] Available at: www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan.

[17] *See* DAVID R. BORGES ET AL., UMASS DARTMOUTH PUBLIC POLICY CTR., NAVIGATING THE GLOBAL ECONOMY: A COMPREHENSIVE ANALYSIS OF THE MASSACHUSETTS MARITIME ECONOMY 11 (2018), www.mass.gov/files/documents/2018/01/24/Maritime_Economy.pdf.

[18] MARTIN ASSOCIATES & FOTH-CLE ENG'G GROUP, ECONOMIC IMPACT STUDY OF THE NEW BEDFORD/FAIRHAVEN HARBOR 5 (2019), https://www.fairhaven-ma.gov/system/files/uploads/economic_impact_study_nbfh_harbor_2019-martin-report_0.pdf.

maritime schools, and public facilities and departments will face disruptions in service in post-storm conditions.

24. The Commonwealth is committed to protecting public safety, human health, the environment, and public resources through programs and policies that address sea level rise and other climate-change-related coastal hazards. EEA and CZM provide information, strategies, and tools to help other state agencies and communities plan for and address the challenges of erosion, flooding, storms, sea level rise, and other climate change impacts.

25. EEA and CZM climate grant programs have been able to address about half of the need requested by communities. Since 2014, CZM has awarded approximately $25 million (of $50 million requested) in state-funded grants to local communities and non-profit organizations to support sea level rise adaptation planning and implementation through the Coastal Resilience Grant Program. Local governments and non-profit organizations have matched these state funds with roughly $11 million in local funds and in-kind services. Since 2017, EEA has awarded over $65 million of $140 million requested in municipal grants for climate vulnerability planning and implementation statewide through the Municipal Vulnerability Preparedness (MVP) Program. Since the start of the MVP Program, local governments have matched MVP grants with over $29 million in

local funds and staff time. EEA and CZM see a significant and growing need for support at the local level.

26. Municipalities, private entities, and other partners are also supporting planning and implementation of adaptation measures to address the impacts of sea level rise and other climate change impacts in Massachusetts. Adaptation planning efforts include vulnerability assessments to determine areas and infrastructure susceptible to coastal impacts, prioritization of vulnerable assets and areas, and development of adaptation alternatives to mitigate climate risks in the near and long term. One example is the City of Boston's "Climate Ready Boston" initiative, which has been developing district-level adaptation plans to address near-term coastal flooding and establish a framework for the funding and implementation of long-term, broader scale solutions. For the East Boston and Charlestown neighborhoods, the City of Boston identified near-term (2030–2050) and long-term (2050–2070) actions for addressing future flood risks created by sea level rise. The City of Boston's report estimates the costs for these actions range from $202 million to $342 million for East Boston and Charlestown alone.[19] More recently, the city completed a coastal resilience plan for the South Boston neighborhood and

[19] *See* COASTAL RESILIENCE SOLUTIONS FOR EAST BOSTON AND CHARLESTOWN: FINAL REPORT (2017), https://www.boston.gov/sites/default/files/embed/c/climatereadyeastbostoncharlestown_finalreport_web.pdf.

a similar plan for the Downtown area in 2020. An example of regional planning for the impacts of coastal climate change is the *Great Marsh Coastal Adaptation Plan* led by the National Wildlife Federation in partnership with the Ipswich River Watershed Association.[20] The plan assesses climate impacts and vulnerability for the Great Marsh region and each of its six communities (Salisbury, Newburyport, Newbury, Rowley, Ipswich, and Essex), examining the risk and exposure of critical infrastructure and natural resources, and identifies areas of special concern. The plan states that in Newburyport, estimated one-time damages to buildings and structures (not contents) from a 1% annual exceedance probability storm (also known as the 100-year storm) under 1.09 feet of sea level rise would be $18.3 million, and under 3.45 feet of sea level rise the damages would increase to $32.4 million.[21]

27. In conclusion, any increase in the rate of sea level rise and the frequency, magnitude, and severity of coastal flooding, erosion, and storms related to greenhouse gas emissions, including from aircrafts, will adversely impact the Commonwealth and its residents and will require the Commonwealth to expend additional resources and incur additional costs.

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[20] *See* TAJ SCHOTTLAND ET AL., GREAT MARSH COASTAL ADAPTATION PLAN (2017), www.nwf.org/-/media/Documents/PDFs/NWF-Reports/NWF-Report_Great-Marsh-Coastal-Adaptation-Plan_2017.ashx.

[21] *Id.* at 49, tbl.3.3-3.

I declare under penalty of perjury that the foregoing is true and correct.

Executed in Boston, Massachusetts on February 28, 2022.

Lisa Berry Engler
Director
Massachusetts Office of Coastal Zone Management

ATTACHMENT D

Dr. Erica Fleishman, State of Oregon

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF CALIFORNIA, *et al.*, *Petitioners*, v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *et al.*, *Respondents.*	No. 21-1018 (and consolidated cases)

DECLARATION OF ERICA FLEISHMAN

I, Erica Fleishman, declare as follows:

1. I serve as director of the Oregon Climate Change Research Institute (OCCRI), which is housed at the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University.

2. I submit this declaration in support of the State Petitioners' standing in *California v. EPA*, No. 21-1018, before the Court of Appeals for the D.C. Circuit. I make this declaration on the basis of my own personal knowledge, unless otherwise indicated.

3. In the United States, aircraft are substantial contributors to emissions of greenhouse gases, especially carbon dioxide. The U.S. Environmental Protection Agency estimated that in 2019, the transportation sector contributed 29% of greenhouse emissions, 9.6% of which was

produced by commercial and other aircraft (U.S. EPA 2021[1]). All else being equal, regulations that reduce emissions from aircraft would contribute to mitigating the effects of anthropogenic climate change that are discussed below.

4. The Oregon Legislature set a goal of reducing greenhouse gas emissions to at least 75% below 1990 levels by 2050. Oregon's ability to meet that goal is affected by federal regulations. As the accompanying brief notes, because the Clean Air Act prohibits states from adopting or enforcing standards for aircraft emissions unless they are identical to those set by the U.S. Environmental Protection Agency (EPA), states cannot effectively control greenhouse gas emissions from flights into and out of airports within their jurisdictions unless the EPA sets more stringent standards.

PERSONAL BACKGROUND AND QUALIFICATIONS

4. I received a BS and MS in Biological Sciences from Stanford University in 1991 and 1992, respectively, and a PhD in Ecology, Evolution, and Conservation Biology from University of Nevada, Reno, in 1997. I have 30 years of experience in assessing the effects of climate and other types of environmental variability, extremes, and change on natural and human-dominated ecosystems in the western United States. Since 2012 I have served as a co-principal investigator of the Southwest Climate Adaptation Science Center, one of eight such regional centers across the United States. These centers develop data and tools to address the climate change-related information needs of managers of species, ecosystems, and the human communities they support.

5. OCCRI was created in 2007 by the Oregon State Legislature under House Bill 3543. Among

[1] U.S. Environmental Protection Agency. 2021. Inventory of U.S. greenhouse gas emissions and sinks 1990–2019. EPA 430-R-21-005.

OCCRI's charges from the Legislature is "assess[ment of]… the state of climate change science, including biological, physical and social science, as it relates to Oregon and the likely effects of climate change on the state." The *Fifth Oregon Climate Assessment* (https://blogs.oregonstate.edu/occri/oregon-climate-assessments/), which was authored by OCCRI scientists and collaborators, was released in January 2021. OCCRI scientists also contributed to the Northwest chapter of the Fourth National Climate Assessment (https://nca2018.globalchange.gov/chapter/24/) and regularly support the Oregon Department of Land Conservation and Development in its production of state- and county-level natural hazard mitigation plans (e.g., https://blogs.oregonstate.edu/occri/projects/dlcd/). These documents and previous Oregon Climate Assessment reports, other publications in the peer-reviewed literature, and a limited amount of personal communication from agencies of the State of Oregon form the basis of this declaration.

6. I am making this declaration in my personal capacity on the basis of my expertise, experience, and training, and not on behalf of Oregon State University.

CLIMATE CHANGE IN OREGON AND ASSOCIATED RISKS

7. Global increases in concentrations of greenhouse gases are changing the climate in Oregon. Not only are average values of annual temperature and, in some cases, precipitation and humidity changing; but the incidence of extreme temperature, precipitation, and other forms of extreme climate is increasing; and climate is becoming less predictable. Anthropogenic climate change also is contributing to sea-level rise. As sea level rises, coastal storms and high tides are likely to increase the frequency and severity of flooding along the Oregon coastline. For example, by the year 2050, relative sea level at Newport, Oregon, is highly

likely to rise by 0.6–1.8 feet, and at least one flood is likely to exceed 4 feet above mean high tide. Many of the consequences of climate change also directly and indirectly threaten Oregon residents' physical and mental health, their economic and social well-being, and, as a result, the demands on Oregon's health and social services. Disasters may result not only from isolated events, but from recurrent events that individually are not extreme, yet degrade a community's infrastructure (Field et al. 2012[2]).

8. The Pacific Northwest has warmed by about 2˚F since 1900. Average temperatures in Oregon are projected to increase by another 5–8.2°F by the 2080s, depending on the global level of greenhouse gas emissions. Hot days and warm nights are likely to become more frequent as a result of anthropogenic climate change. Extreme heat poses risk to human health, especially among those who work or live outdoors, the elderly, those with underlying health conditions, and the economically disadvantaged, and can stress local emergency healthcare systems. As noted below, there also is evidence that the incidence of some infectious diseases, such as Lyme disease, West Nile virus, and salmonella, increase as average temperatures increase or during heat waves.

9. Oregon's annual snowpack is decreasing as the proportion of precipitation falling as rain increases and snowmelt occurs earlier. For example, from 1982–2017, peak snow water equivalent on the east side of the central Cascade Range declined by more than 70%. Snowmelt trended earlier in all mountain regions of the state, with maximum regional changes of 16 days earlier per decade. As a result, runoff during autumn and winter is

[2] Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Medgley, editors. 2012. Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom.

projected to increase across Oregon, increasing the probability of seasonal flooding and landslides that can threaten human lives, private property, and infrastructure such as roads and other transportation corridors (see below). Additionally, the runoff associated with extreme precipitation may introduce human-made or naturally occurring toxins into the domestic water supply. Spring and summer runoff are likely to decrease, and vulnerability to water shortages to increase, in western and northeastern Oregon. For example, in the Columbia River basin, snowmelt runoff accounts for about 25% of total surface water allocated to irrigation (Qin et al. 2020[3]). Decreases in water availability also may decrease the quality and quantity of water that Oregon's public water systems can deliver for domestic consumption and use, including but not limited to drinking, cooking, washing, and bathing.

10. Projected changes in climate in both the short term and the long term contribute to changes in fire dynamics in Oregon and beyond. Across the United States, changes in fire dynamics are leading to losses of human life and property, and to substantial financial costs to states. Nationwide, the damages associated with wildfires in 2017 and 2018 were greater than $40 billion (Smith 2019[4]). Shifts in fire dynamics often reflect interactions among historic fire suppression; changes in vegetation structure and composition, including the introduction of non-native invasive grasses that are highly flammable (Brooks et al. 2004[5], Fusco et al.

[3] Qin, Y., J.T. Abatzoglou, S. Siebert, L.S. Huning, A. AghaKouchak, J.S. Makin, C. Hong, D. Tong, S.J. Davis, and N.D. Mueller. 2020. Agricultural risks from changing snowmelt. Nature Climate Change 10:459–465.

[4] Smith, A.B. 2019. 2018's billion dollar disasters in context. https://www.climate.gov/news-features/blogs/beyond-data/2018s-billion-dollar-disasters-context, accessed December 2019.

[5] Brooks, M.L., C.M. D'Antonio, D.M. Richardson, J.B. Grace, J.E. Keeley, J.M. DiTomaso, R.J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. BioScience 54:677–688.

2019[6]), the increasing role of humans in igniting wildfires (Balch et al. 2017[7]), and changes in climate and fire weather.

11. In the Pacific Northwest, the duration of the fire season more than quadrupled, from an average of 23 days to an average of 116 days, from the 1970s to the 2000s. Across the western United States, roughly half of the observed increase in fuel aridity and more than 16,000 square miles of burned area from 1984–2015 were attributed to human-caused climate change.

12. As climate, fuel loads, and associated fire dynamics change, the cost of fire suppression in Oregon is increasing. The average number of acres that burned in Oregon increased from 11,600 from 1990–1999 to 41,700 from 2010–2019 (GCWR 2019[8]). Prior to 2013, the Oregon Department of Forestry rarely required state General Fund dollars for fire suppression on lands under its jurisdiction. Since 2013, however, the Department has required General Fund support annually; the annual cost to the General Fund for suppressing large fires has been approximately $20 million.

13. The State of Oregon owns forests in which the frequency and size of wildfires is likely to increase. The Oregon Department of Forestry noted that wildfires in the Santiam State Forest during September 2020, which burned over 16,000 acres, not only had ecological effects but also damaged recreation sites and roads[9]. The area burned in Oregon during 2020 (approximately 1.2 million acres) was among the largest in the reliable historic record.

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[6] Fusco, E.J., J.T. Finn, J.K. Balch, R.C. Nagy, and B.A. Bradley. 2019. Invasive grasses increase fire occurrence and frequency across US ecoregions. Proceedings of the National Academy of Sciences of the United States 116:23594–23599.

[7] Balch, J.K., B.A. Bradley, J.T. Abatzoglou, R.C. Nagy, E.J. Fusco, and A.L. Mahood. 2017. Human-started wildfires expand the fire niche across the United States. Proceedings of the National Academy of Sciences of the United States 114:2946–2951.

[8] [Oregon] Governor's Council on Wildfire Response (GCWR), Report and Recommendations, November 2019. https://www.oregon.gov/gov/policy/Documents/FullWFCReport_2019.pdf.

[9] https://www.oregon.gov/odf/recreation/Pages/santiam-state-forest.aspx

14. Oregon incurs diverse costs from wildfires. The estimated cost to the state of completed and projected cleanup efforts in the wake of the September 2020 wildfires, including removal of ash, debris, hazardous materials, and trees that threatened to impede the roadway, is $75.63 million from the State Highway Fund and $75.75 million from the State General Fund[10]. These direct costs to the State will not be reimbursed by the Federal Emergency Management Agency.

15. The human costs of wildfires are considerable, and also result in costs to the state. For example, high levels of fine particulate matter are associated with respiratory illness in humans and other animals, especially in individuals with compromised respiratory systems, and with reductions in outdoor exercise (Evans 2019[11]). To illustrate, on a peak smoke day during the 2017 Eagle Creek fire, the Oregon Health Authority reported a 20% increase in emergency room visits for respiratory symptoms in the Portland metropolitan region (OHA 2017[12]). Short-term exposure to fine particulate matter from smoke also has been linked to increases in violent crime, especially assaults (Burkhardt et al. 2020[13]). The number of days on which the air quality index (AQI) was poor for all groups (AQI categories unhealthy, very unhealthy, or hazardous) in many Oregon municipalities as a result of wildfire smoke increased considerably in recent years (DEQ 2018[14]). For example, the AQI in Medford was poor due to wildfire smoke for a total of 28 days from 1985–2014, primarily in 1987 (16

[10] F. Reading, Oregon Debris Management Task Force, Oregon Department of Transportation, personal communication, 16 December 2021.
[11] Evans, G.W. 2019. Projected behavioral impacts of global climate change. Annual Review of Psychology 70:449–474.
[12] Oregon Health Authority (OHA). 2017. Statewide fire activation surveillance report (090517-090617).
[13] Burkhardt, J., J. Bayham, A. Wilson, J. Berman, K. O'Dell, B. Ford, E.V. Fischer, and J.R. Pierce. 2020. The relationship between air pollution and violent crime across the United States. Journal of Environmental Economics and Policy 9:188–205.
[14] State of Oregon Department of Environmental Quality (DEQ). 2018. Wildfire smoke trends and associated health risks, Bend, Klamath Falls, Medford and Portland – 1985 to 2018. https://www.oregon.gov/deq/FilterDocs/smoketrends.pdf, accessed March 2019.

days). By contrast, from 2015–2018, Medford's AQI was poor due to wildfire smoke for a total of 46 days: 7 in 2015, 14 in 2017, and 25 in 2018. Portland's AQI was not affected by wildfire smoke from 1985–2014, but smoke resulted in a poor AQI in the city on five days from 2015–2018. Similarly, during extreme wildfires in September 2020, the AQI in Portland, Oregon, reached levels higher (indicating high risks to human health) than those in any other major city worldwide (IQAir 2020[15]). The AQI in Portland was considered hazardous for three consecutive days, and unhealthy for seven consecutive days (IQAIR 2020[11]). During that period, levels of fine particulate matter in smaller cities in Oregon, such as Applegate Valley and Cave Junction, sometimes exceeded those in Portland (AirNow 2020[16]). Moreover, smoke-driven reductions in air quality in Oregon are affecting regional economies. For example, *The New York Times* reported that in 2018, the Oregon Shakespeare Festival in Ashland estimated losses of $2 million as a result of cancelled performances and reduced attendance due to wildfire smoke[17].

16. The Oregon Health Authority (OHA), drawing on data on air quality, emergency department visits, and hospitalizations in areas affected by wildfire smoke, can estimate certain health care costs for diseases and conditions known to be caused or exacerbated by exposure to particulate matter.

17. The OHA estimates that smoke from the Chetco Bar Fire and other wildfires that affected central and southwestern Oregon (1.1 million residents) during two months in late summer 2017 resulted in 207 excess emergency department visits and 18 excess hospitalizations for asthma, at a cost of $556,000.

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[15] https://www.iqair.com/us/blog/wildfires/washington-oregon-fires-choke-northwest
[16] https://www.airnow.gov/state/?name=oregon
[17] The New York Times. 24 August 2018. Wildfire smoke disrupts Oregon Shakespeare Festival. https://www.nytimes.com/2018/08/24/theater/oregon-shakespeare-festival-wildfire-smoke.html

18. The OHA estimates that smoke from the 2017 Eagle Creek Fire in the Columbia River Gorge (2 million residents in seven counties) resulted in 96 excess emergency department visits and 9 excess hospitalizations for asthma, at a cost of $529,000.

19. Climate change, including the effects of wildfires that are driven in part by climate change, is expected to have continuing negative effects on the health of Oregonians. The cost of those negative effects, in turn, will increase burdens on the state's budget. The OHA, relying primarily on the Oregon All Payer Claims Database, estimates that about 13% of all Oregon health care costs are borne by the state. In addition to the health effects of wildfire smoke and extreme heat, climate change may increase Oregonians' exposure to vector-borne diseases. For example, above-average temperatures were associated with expansion of West Nile virus from the eastern to the western United States (Reisen et al. 2006[18]). As summer becomes longer and warmer, the incidence of West Nile virus, and other viral infections that cause brain inflammation, may increase (Bethel et al. 2013[19]). Additionally, as water temperatures in oceans and estuaries in the Northwest increase, so may the incidence of *Vibrio parahaemolyticus* infections, which are caused by consuming raw oysters or other shellfish that are infected with the bacterium (Bethel et al. 2013[12]). Exposure to and incidence of other water-borne diseases, especially cryptosporidosis, may increase as precipitation and flooding in Oregon increase (Bethel et al. 2013[12]). High flows can carry cattle feces into recreational waters and sources of drinking water, resulting in cryptosporidosis and other gastrointestinal illnesses in humans.

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[18] Reisen, W.K., Y. Fang, and V.M. Martinez. 2006. Effects of temperature on the transmission of West Nile virus by *Culex tarsalis* (Diptera: Culicidae). Journal of Medical Entomology 43:309–317.

[19] Bethel, J., S. Ranzoni, and S.M. Capalbo. 2013. Human health: impacts and adaptation. Pages 181 – 206 in Dalton, M., P.W. Mote, and A.K. Snover. 2013. Climate change in the Northwest: implications for our landscapes, waters, and communities. Island Press, Washington, D.C.

20. Climate change is likely to reduce many populations' access to sufficient and nutritious food[12], which in turn poses risks to physical and mental health, maternal health, and child development (Schnitter and Berry 2019[20]). Mechanisms by which food security may be affected include droughts and floods within or beyond the region; both can affect agricultural production, and floods and landslides can affect the infrastructure used to transport food. Individuals, populations, and communities that have low incomes, are relatively isolated, or are in poor health may be especially vulnerable to climate change-induced food insecurity. Given the role that certain foods play in tribal communities, not only health but cultural values and identity are threatened by some elements of climate change and related food access (Quaempts et al. 2018[21]).

21. Mental health also is likely to be adversely affected by climate change. For example, extreme events that are caused in part by climate change, such as wildfires or floods, can displace people from their homes either temporarily or permanently and degrade social and economic infrastructure (Bethel et al. 2013[12]). Similar effects on social and economic systems may result from recurrent events even if the individual events are not extreme (Field et al. 2012[22]). Heat waves have been associated with increases in violent criminal activity during the following week in jurisdictions across the United States (Jacob et al.

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[20] Schnitter, R., and P. Berry. 2019. The climate change, food security, and human health nexus in Canada: a framework to protect population health. International Journal of Environmental Research and Public Health 16:2531. doi:10.3390/ijerph16142531.

[21] Quaempts, E.J., K.L. Jones, S.J. O'Daniel, T.J. Beechie, and G.C. Poole. 2018. Aligning environmental management with ecosystem resilience: a First Foods example from the Confederated Tribes of the Umatilla Indian Reservation, Oregon, USA. Ecology and Society 23(2):29. doi:10.5751/ES-10080-23029.

[22] Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Medgley, editors. 2012. Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom.

2007[23]), and increases in larceny and violent crime are projected to increase as maximum monthly temperatures increase (Ranson 2014[24]).

22. Rising sea levels, increases in ocean temperature, coastal erosion, ocean acidification, and an increase in the frequency of harmful algal blooms will continue to threaten private property and subsistence, recreational, and commercial fisheries, including but not limited to shellfish fisheries, along the Pacific Coast of the United States. For example, because warm water holds less oxygen than cold water, increases in water temperature directly reduce the concentration of dissolved oxygen. The number of Dungeness crabs (*Metacarcinus magister*) caught per person-hour of fishing, and the general condition of those crabs, decreases as oxygen concentrations off the coast of west-central Oregon decrease (Keller et al. 2010[25]). Additionally, in 2016, high concentrations of domoic acid from a regional harmful algal bloom led to a prolonged delay in the opening of the West Coast Dungeness crab fishery. Sea level rise could drive saltwater intrusion into coastal aquifers from which water for domestic and agricultural uses is derived. Additionally, extreme winter storms increase storm surge, erosion, and the likelihood of flooding in coastal communities.

23. Transportation systems in Oregon are threatened by extreme precipitation and temperatures, sea level rise, and wildfires, all of which can damage roads to the point that closures are

[23] Jacob, B., L. Lefgren, and E. Moretti. 2007. The dynamics of criminal behavior: evidence from weather shocks. Journal of Human Resources 42:489–527.

[24] Ranson, M. 2014. Crime, weather, and climate change. Journal of Environmental Economics and Management 67:274–302.

[25] Keller, A, V. Simon, F. Chan, W.W. Wakefield, M.E. Clarke, D. Kamikawa, E.L. Frush, and J.A. Barth. 2010. Demersal fish and invertebrate biomass in relation to an offshore hypoxic zone along the U.S. West Coast. Fisheries Oceanography 19:76–87.

necessary (OLIS 2019[26]). Current levels of funding are not sufficient for the Oregon Department of Transportation to proactively clear drainages (reducing the risk of flood), reshape slopes (reducing the risk of landslides), and maintain roadside vegetation (reducing the risk of flood and ignition or expansion of wildfire) (OLIS 2019[26]).

24. Climate change is likely to have negative effects on transportation infrastructure absent substantial new investments. An assessment conducted by the Oregon Department of Transportation, Federal Highway Administration, and local government authorities in 2014 (ODOT 2014[27]) identified vulnerabilities to climate change and extreme weather on highways in the Coast Range, roads in low-elevation areas that increasingly are prone to flooding, and the transportation infrastructure in coastal areas that are exposed to storm surges and inundation, both of which are becoming more frequent as anthropogenic climate change continues. Seismic Lifeline Routes in Oregon, intended to facilitate emergency response and recovery after an earthquake, also were found to be vulnerable. Furthermore, incremental increases in relative sea-level rise can produce exponential increases in flood frequency (Taherkhani et al. 2020[28]). For example, on the west coast of the United States, a rise in sea level of about 2.1 inches doubles the likelihood of exceeding the contemporary 50-year flood (a flood that has a 2% probability of occurring in a given year) (Taherkhani et al. 2020[28]). Global mean sea level has risen by about 7–8 inches since 1900, and rates of sea

[26] Oregon State Legislature, Oregon Legislative Information (OLIS). 2019. An adaptation menu of investment options: potential transportation investments to adapt to climate change impacts. Committee meeting document. https://olis.leg.state.or.us/liz/2019R1/Downloads/CommitteeMeetingDocument/165202.

[27] Oregon Department of Transportation (ODOT). 2014. Climate change vulnerability assessment and adaptation options study. www.oregon.gov/ODOT/Programs/TDD%20Documents/ Climate-Change-Vulnerability-Assessment-Adaptation-Options-Study.pdf.

[28] Taherkhani, M., S. Vitousek, P.L. Barnard, N. Frazer, T.R. Anderson, and C.H. Fletcher. 2020. Sea-level rise exponentially increases coastal flood frequency. Scientific Reports 10:6466. doi: 10.1038/s41598-020-62188-4.

level rise have accelerated over the past 25 years (Nerem et al. 2018[29]). Global mean sea level is likely to continue to rise by about 1–4 feet, relative to the year 2000, by the year 2100 (Sweet et al. 2017[30]). Sea level rise projections vary along the Oregon coast, primarily due to local differences in vertical land motions. To illustrate, median local sea level projections for Astoria, near Fort Stevens State Park, range from 0.1–2.4 feet above a 1992 baseline by 2050, depending on the emissions scenario. By contrast, median local sea level projections for Newport, near South Beach State Park and Lost Creek State Recreation Site, range from 0.6–2.9 feet above a 1992 baseline by 2050.

25. Native American tribes both on and off reservations generally are among the communities most strongly and adversely affected by climate change. Climate change affects the lands, identity, economies, physical and mental health, and culture of Native American tribes in addition to tribal fisheries and other sources of traditional foods, including but not limited to salmon, shellfish, and berries. In 2015, 15 tribes in the Columbia River Basin and three intertribal organizations identified protection of water quality and quantity; fishes, their habitats, and connectivity among them; preparation for wildfires in forests; and wildlife and their habitat among their highest priorities for climate action plans (Sampson 2015[31]).

[29] Nerem, R., B. Beckley, J. Fasullo, B. Hamlington, D. Masters, and G. Mitchum. 2018. Climate change-driven accelerated sea-level rise detected in the altimeter era. Proceedings of the National Academy of Sciences 115:2022–2025.

[30] Sweet, W.V., R. Horton, R.E. Kopp, A.N. LeGrande, and A. Romanou, 2017. Sea level rise. Pages 333–363 in D.J. Wuebbles, D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock, editors. Climate science special report: fourth National Climate Assessment, volume I. U.S. Global Change Research Program, Washington, D.C. https://science2017.globalchange.gov/.

[31] Sampson, D. 2015. Columbia River Basin tribes climate change capacity assessment. Portland State University, Portland, Oregon. https://www.tribalclimatecamp.org/sites/default/files/ColBasinTribes_CCCassessment.pdf

I state under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge and belief.

Executed in Corvallis, Oregon on February 26, 2022

Erica Fleishman

Director, Oregon Climate Change Research Institute