To: Scoville, Pat[Scoville.Pat@epa.gov]
From: Burch, Julia
Sent: Tue 2/6/2018 3:08:31 PM
Subject: FW: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Revised abstract for Aircraft CO2 rule is below.

From: Manning, Bryan
Sent: Tuesday, February 06, 2018 8:17 AM
To: Burch, Julia <Burch.Julia@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Hi Julia,

Below is the updated abstract, which includes some minor edits from Mike Thrift. It is good to go now. Let me know if you have any questions.

Ex. 5 - Deliberative Process

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Burch, Julia
Sent: Monday, February 05, 2018 4:49 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Yes. I'd rather have it correct than on time since we have another opportunity to make corrections/updates. I'll let Pat know that you are working with OGC to update the abstract.

From: Manning, Bryan
Sent: Monday, February 05, 2018 4:16 PM
To: Burch, Julia <Burch.Julia@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: FW: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Hi Julia,

See the below message from Mike Thrift of OGC regarding his review of the abstract for the spring reg agenda (aircraft CO2 standard rule). If you really need an updated abstract today, I can send you what I have, but I would prefer to wait for Mike's review. Since Mike works in California (pacific time), it is likely I will not see his edits until tomorrow morning. Can you wait until then for the updated abstract?

Thanks,

Bryan

Bryan Manning

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Thrift, Mike
Sent: Monday, February 05, 2018 3:00 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

I was on leave all of Thursday and worked overtime on Friday to deal with a toxics crisis flowing Ex. 5 - Deliberative Process Ex. 5 - Deliberative Process That crisis is continuing today. I will get to the Reg Agenda abstract when that is over today. If it ever is.

From: Manning, Bryan
Sent: Monday, February 05, 2018 11:03 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>

Subject: FW: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

Hi Mike,

Sorry to bother you again. With all the email traffic, I did not want to distract you from this message that I sent earlier.

Did you happen to see my below email that I sent you on Thursday? Any comments on the new sentence I added at the end of the abstract for the spring regulatory agenda? See the attachment.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Manning, Bryan
Sent: Thursday, February 01, 2018 4:40 PM
To: Thrift, Mike <thrift.mike@epa.gov>

Cc: Samulski, Michael <samulski.michael@epa.gov>; Mueller, John <mueller.john@epa.gov>
Subject: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

Hi Mike,

For the spring regulatory agenda, we have been asked to update the abstract for the aircraft CO2 standard rule by COB Feb 5. Attached please find an updated abstract. I just added one new sentence at the end to indicate how this standard relates to the ICAO CO2 standard. Let me know if you have any comments.

Also, it has been suggested by OTAQ I/O staff that we may want add the following sentence somewhere in the abstract (or something like this sentence):

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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What do you think?

Thanks,

Bryan

Bryan Manning

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Manning, Bryan[manning.bryan@epa.gov]
Cc: Mueller, John[mueller.john@epa.gov]
From: Burch, Julia
Sent: Thur 2/1/2018 9:15:09 PM
Subject: RE: regulation updates for spring reg agenda

Sounds good.

Regards,

Julia Burch

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202-564-0961

From: Manning, Bryan
Sent: Thursday, February 01, 2018 3:21 PM
To: Burch, Julia <Burch.Julia@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: regulation updates for spring reg agenda

Okay, Julia. Good suggestions for updating the abstract. I will work on incorporating your suggestions. In the past, we have always run the abstract language by OGC (Mike Thrift), and I think any updates to it will need to run by him as well. I will try to send him something later today, and hopefully, we will hear back from him by Feb 5.

Thanks,

Bryan

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thoughts?

Thanks!

Regards,

Julia Burch

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202-564-0961

From: Manning, Bryan
Sent: Thursday, February 01, 2018 9:25 AM
To: Burch, Julia <Burch.Julia@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: FW: regulation updates for spring reg agenda

Hi Julia,

Sorry, but I have a couple more questions. For the spring reg agenda, can we just submit our updates to you? Or, do we have to go into the ADP tracker and change them ourselves by Feb 5 COB? Now that Lucie is retired, I would prefer the former, but let us know.

Thank you,

Bryan

P.S. John, I have should have included you on the below email exchanges with Julia since you are now the Workgroup Chair for the aircraft CO2 rule. My apologies.

From: Manning, Bryan
Sent: Wednesday, January 31, 2018 5:45 PM
To: Burch, Julia <Burch.Julia@epa.gov>
Subject: RE: regulation updates for spring reg agenda

Ex. 5 - Deliberative Process

Thanks again,

Bryan

Bryan Manning

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Burch, Julia
Sent: Wednesday, January 31, 2018 5:30 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: regulation updates for spring reg agenda

Ex. 5 - Deliberative Process

Thanks!

Regards,

Julia Burch

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202-564-0961

From: Manning, Bryan
Sent: Wednesday, January 31, 2018 4:53 PM
To: Burch, Julia <Burch.Julia@epa.gov>
Subject: RE: regulation updates for spring reg agenda

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks again,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Burch, Julia
Sent: Wednesday, January 31, 2018 4:26 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: regulation updates for spring reg agenda

Hi Bryan,

We are currently pulling together our submissions for the spring reg agenda, which will go to OP on Monday Feb 5. I just wanted to check in with you to see if there are any corrections/updates we can make to the Aircraft CO2 entry.

I've pasted the Aircraft CO2 entries from OTAQ tracker and the categories of info for ADP

Ex. 5 - Deliberative Process

Thanks!

Regards,

Julia Burch

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202-564-0961

To: OTAQ Materials[OTAQMaterials@epa.gov]
Cc: Charmley, William[charmley.william@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Samulski, Michael
Sent: Thur 10/20/2016 12:39:17 PM
Subject: Draft Email for Chris to send to Janet: Aircraft Early Guidance
Early Guidance Briefing_Aircraft GHG Std_October 25 2016.pptx

Chris,

On Tuesday you said that you wanted to send the Aircraft Early Guidance Briefing to Janet and ask if she wanted to cancel the Monday pre-brief. The updated briefing is attached and we took the liberty of drafting a note you could use to send to Janet.

Ex. 5 - Deliberative Process

Mike

Hi Janet,

Ex. 5 - Deliberative Process

Thanks,

Chris

To: OTAQ Materials[OTAQMaterials@epa.gov]
Cc: Audette, Lucie[audette.lucie@epa.gov]; Yen, David[Yen.David@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Mueller, John[mueller.john@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Sargeant, Kathryn[sargeant.kathryn@epa.gov]; Charmley, William[charmley.william@epa.gov]; Iffland, JoNell[Iffland.JoNell@epa.gov]; Gonzalez, Gail[Gonzalez.Gail@epa.gov]
From: Manning, Bryan
Sent: Thur 10/13/2016 5:03:45 PM
Subject: Pre-brief for Chris: Advanced Guidance Mtg - Aircraft GHG Standards (Oct 18 at 4:00)
Early Guidance_Aircraft GHG Std for Chris_Oct 13 2016.pptx

Hello,

Attached please find the materials for the pre-brief that is scheduled with Chris on October 18 at 4:00. This meeting is a pre-brief on the Advanced/Early Guidance Meeting for the Aircraft GHG Standards (where we subsequently brief Janet on Oct 24). Let us know if you have any questions.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Charmley, William[charmley.william@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
Cc: Burch, Julia[Burch.Julia@epa.gov]; Schenk, Ruth[schenk.ruth@epa.gov]; Simon, Karl[Simon.Karl@epa.gov]; Cook, Rich[Cook.Rich@epa.gov]
From: Sargeant, Kathryn
Sent: Thur 5/25/2017 6:52:38 PM
Subject: SAB Questions regarding the GHG Emissions for aircraft
EPA questions 2060-at26.docx

Below and attached are the questions from SAB.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Hockstad, Leif
Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

Pasted in below and attached are the questions from the Work Group on the issues we have discussed on the Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26). I polled the Work Group looking for availability and have scheduled a teleconference for June 1, 2017 from 1- 2:30 pm.

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Ex. 5 - Deliberative Process

Best

Tom

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. (

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Burch, Julia[Burch.Julia@epa.gov]
Cc: Mueller, John[mueller.john@epa.gov]
From: Manning, Bryan
Sent: Tue 2/6/2018 1:17:13 PM
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Hi Julia,

Below is the updated abstract, which includes some minor edits from Mike Thrift. It is good to go now. Let me know if you have any questions.

Ex. 5 - Deliberative Process

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Burch, Julia
Sent: Monday, February 05, 2018 4:49 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Ex. 5 - Deliberative Process

From: Manning, Bryan
Sent: Monday, February 05, 2018 4:16 PM
To: Burch, Julia <Burch.Julia@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: FW: Abstract for Spring Reg Agenda - Aircraft CO2 Rule

Hi Julia,

See the below message from Mike Thrift of OGC regarding his review of the abstract for the spring reg agenda (aircraft CO2 standard rule). If you really need an updated abstract today, I can send you what I have, but I would prefer to wait for Mike's review. Since Mike works in California (pacific time), it is likely I will not see his edits until tomorrow morning. Can you wait until then for the updated abstract?

Thanks,

Bryan

Bryan Manning

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manning.bryan@epa.gov

From: Thrift, Mike
Sent: Monday, February 05, 2018 3:00 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: RE: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

Ex. 5 - Deliberative Process

From: Manning, Bryan
Sent: Monday, February 05, 2018 11:03 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Cc: Mueller, John <mueller.john@epa.gov>
Subject: FW: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

Hi Mike,

Sorry to bother you again. With all the email traffic, I did not want to distract you from this message that I sent earlier.

Ex. 5 - Deliberative Process

Did you happen to see my below email that I sent you on Thursday? Any comments on the new sentence I added at the end of the abstract for the spring regulatory agenda? See the attachment.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Manning, Bryan
Sent: Thursday, February 01, 2018 4:40 PM
To: Thrift, Mike <thrift.mike@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>; Mueller, John <mueller.john@epa.gov>
Subject: Abstract for Spring Reg Agenda - Aircraft CO2 Rule - TIME SENSITIVE (due Feb 5)

Hi Mike,

For the spring regulatory agenda, we have been asked to update the abstract for the aircraft CO2 standard rule by COB Feb 5. Attached please find an updated abstract. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process Let me know if you have any comments.

Ex. 5 - Deliberative Process

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: OTAQ Materials[OTAQMaterials@epa.gov]; Charmley, William[charmley.william@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Yen, David[Yen.David@epa.gov]; Mueller, John[mueller.john@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Sargeant, Kathryn[sargeant.kathryn@epa.gov]; Hoyer, Marion[hoyer.marion@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]
From: Samulski, Michael
Sent: Fri 8/12/2016 7:40:36 PM
Subject: Materials for Monday Chris Brief on Aircraft CO2 Rulemaking Analysis
Rulemaking Analyses for Aircraft CO2 Standard Rule - 8 15 16.pptx

Please find attached the materials for our Monday meeting with Chris on aircraft CO2 rulemaking analysis.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

To: OTAQ Materials[OTAQMaterials@epa.gov]; Charmley, William[charmley.william@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]; Orlin, David[Orlin.David@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Mueller, John[mueller.john@epa.gov]; Yen, David[Yen.David@epa.gov]; Sargeant, Kathryn[sargeant.kathryn@epa.gov]; Hoyer, Marion[hoyer.marion@epa.gov]
Cc: Iffland, JoNell[Iffland.JoNell@epa.gov]; Gonzalez, Gail[Gonzalez.Gail@epa.gov]
From: Samulski, Michael
Sent: Fri 9/16/2016 7:51:11 PM
Subject: Materials for Monday Briefing with Chris on the Aircraft CO2 Rule
Rulemaking Analyses for Aircraft CO2 Standard Rule - 9 19 16.pptx

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

To: Burch, Julia[Burch.Julia@epa.gov]; Sutton, Tia[sutton.tia@epa.gov]
From: Hengst, Benjamin
Sent: Tue 2/28/2017 1:56:05 PM
Subject: FW: To Woo Trump, Backers Pitch 'Business Case' For Global Aircraft GHG Deals

From: Audette, Lucie
Sent: Tuesday, February 28, 2017 8:52 AM
To: Charmley, William <charmley.william@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Leggett, Cullen <Leggett.Cullen@epa.gov>; Yen, David <Yen.David@epa.gov>; Mueller, John <mueller.john@epa.gov>; Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>
Subject: To Woo Trump, Backers Pitch 'Business Case' For Global Aircraft GHG Deals

FYI

Inside EPA.com

Daily News

To Woo Trump, Backers Pitch 'Business Case' For Global Aircraft GHG Deals

February 27, 2017

Environmentalists and industry groups are urging EPA and the Department of Transportation (DOT) to craft rules to implement two international agreements reached last year curbing aircraft greenhouse gases (GHGs), pitching a “business case” for the deals and arguing that they are less controversial than carbon controls directed at other industries, such as the power sector.

However, it is largely undetermined how the new administration will proceed, particularly since participation in the agreements would require EPA to promulgate GHG standards for aircraft engines -- at a time when the Trump team is looking to roll back many Obama-era climate rules and potentially target the agency's authority to regulate in that space.

In addition, aircraft industry representatives have said legislation will be needed implement one of the deals, though there is debate with some environmentalists over whether this is necessary. If Congress does need to act, it may be difficult to find enough Republican support for any legislation given many GOP lawmakers' opposition to GHG controls.

The two agreements were adopted by the United States and nearly 190 countries under the International Civil Aviation Organization (ICAO) last year. The first, a certification standard -- known as the carbon dioxide standard -- covering new and in-production aircraft, was adopted in February.

The second, adopted in October, is a global market-based measure (MBM) limiting emissions from existing aircraft. That measure functions as an offset system, under which airlines would cap their GHG emissions at 2020 levels and purchase offsets to cover any emissions from international flights beyond that level they are unable to reduce through other measures like fuel efficiency, technology improvements and sustainable alternative jet fuels.

The U.S. aircraft industry broadly views the two global policies as part of a larger strategy to address GHG emissions from the sector and to meet an overall industry-wide goal of carbon-neutral growth after 2020. The sector was heavily involved in the ICAO negotiations crafting both the CO2 standard and the MBM, and it strongly supports both outcomes.

And industry groups and other observers warn that if the United States declines to participate in the agreements -- particularly the CO2 standard -- it could carry

risks, potentially limiting manufacturers' ability to sell their aircraft to other countries and restricting airlines' ability to fly internationally.

The Obama EPA initiated the process of adopting the CO2 standard into law, finalizing a finding that aircraft GHGs endanger public health and welfare -- which serves as a legal prerequisite to any regulation of the sector's emissions. In the finding, the agency said it would craft GHG limits that are “at least as stringent” as the global CO2 standard.

It remains an open question whether the Trump EPA, under the control of Scott Pruitt, will move forward with the standards, or whether the administration in general will adhere to the MBM deal. The Trump team has already pledged to roll back or weaken several of the Obama administration's GHG controls, including those for existing power plants and for light-duty vehicles.

'Differently Situated'

But supporters of the aircraft deals, including industry and environmentalists, are attempting to paint the aviation standards as noncontroversial, particularly given the strong support from industry and the global dynamic, thus decoupling the issue from the heated debate to come over whether and how EPA should regulate GHGs.

The decision in front of EPA to regulate GHGs from aircraft engines, by adopting into domestic law ICAO's CO2 standard, “is not a political statement. It is more of a business case” involving “industry certainty,” said Suzanne Murray, a former EPA Region 6 counsel who now works as an attorney for Haynes and Boone.

Speaking at a Feb. 22 conference hosted by the International Air Transport Association, Murray said she believes the aviation industry is “very differently

situated" than other industries like the power sector in part because "you have recognition of the ICAO efforts in the U.S. Regulation."

She also noted the involvement of the DOT's Federal Aviation Administration (FAA), which is charged with implementing the CO2 certification standard EPA would set. Thus, if the Trump EPA declines to adopt ICAO's CO2 standard into domestic law, it could place the FAA, which has to have "some certainty and . . . clarity about what they're certifying to," in a "precarious position," Murray said.

DOT and FAA's involvement in implementing the standards could ultimately help them get across the regulatory finish line, should the Trump administration decide the issue falls in the realm of transportation policy and not environmental policy, Annie Petsonk of the Environmental Defense Fund (EDF) suggested.

"If the Department of Transportation has the lead" on these issues "as a policy matter within the administration, and if industry is saying, . . . 'This is our chance to get a set of regulations for ourselves that we think address the problem and we can live with economically,' then I think it has a chance to survive," Petsonk said.

Although the Trump administration has not yet publicly addressed aircraft GHG policy or the ICAO agreements, advisers have suggested the Trump EPA could attempt to target the agency's 2009 GHG endangerment finding, which underpins EPA's climate regulations including the aircraft risk finding and any potential standards for that sector.

But Murray said she finds it "unlikely" that the Trump administration will ultimately target the underlying endangerment finding. Instead, she suggested the Trump EPA is more likely "going to do an analysis of the endangerment finding and regulation of carbon industry-by-industry."

Such a scenario, she suggested, could benefit the aviation industry. Analysis of carbon regulation for a sector like the power industry, for example, “could be very different from the analysis you would do on regulation of carbon from the aviation industry where you have . . . already made some decisions about cost effectiveness, about technology, about how you want to participate in the global market,” Murray said.

She added: “I think that may weigh differently in the analysis of how this regulation may move forward.”

'Love Sonnet'

Aircraft industry groups are also perfecting their pitch to the new administration in support of the ICAO deals.

Nancy Young of Airlines for America said if she were writing a “love sonnet” to the Trump administration to persuade it to pursue the ICAO deals, her message would “come back to technology, operations and infrastructure.”

She described the MBM in particular as a “critical gap filler for our ability to do business internationally under a common set of goals,” noting that message should speak to the administration's “business” and “America first” interests.

However, she cautioned that industry's “love sonnet” to the Trump administration “is a different story” if other countries do not adhere to the notion that the MBM is the sole international deal to limit existing aircraft GHGs -- which was a crucial request of industry during the negotiations.

Young criticized efforts like a proposed international aviation tax being floated in Sweden and the European Union's Emissions Trading System -- should it continue to cover intra-Europe flights after 2021 when the MBM takes hold -- noting industry's message to the Trump team is about the whole “package and the ability to do this right for business.”

Young, as well as Murray, warned of a “worst-case scenario” if the Trump administration were to not move forward with GHG standards for aircraft engines.

Young noted that if the United States did not adopt the ICAO CO2 standard into law so that American manufacturers such as Boeing can ensure their aircraft are properly certified, “other countries could use the technique of, 'We won't let those aircraft into our air space because it's an air worthiness standard that it doesn't meet.'” That refers to a seldom-used provision under the Chicago Convention, the 1944 treaty establishing ICAO, that gives countries the ability to not allow another country's aircraft to enter their air space if that country is not complying with ICAO standards.

Such enforcement of the MBM, covering existing aircraft, is more complicated, however, because that measure applies to airlines and to countries, and functions as an offsetting program rather than a technology-based certification standard, making it more difficult to respond when parties are not “living up to the real deal” of the MBM.

Young said instead that enforcement of the MBM will “rely on the will of the states and the bilateral process for consultation to make sure that that happens right,” adding that industry groups will also play a “persuasive role.”

EDF's Petsonk also noted the importance of self-regulation by industry, arguing “that kind of culture will be crucial” to the MBM's implementation.

She suggested another important aspect to enforcement of the aircraft GHG limits could be an “increasing consciousness among the flying public that this is an issue that must be dealt with.”

Petsonk noted “that is true not only for the customers flying in travel terms, but also in freight terms.” The latter dynamic could also come into play as countries and localities committed to GHG reductions seek to import products with a low carbon impact.

California and several other national and subnational markets “want to know the carbon footprint of the products they are buying,” Petsonk said, “and if [the products] are flown in, they want to know how the airline is dealing” with its GHG emissions. -- *Abby Smith* (asmith@iwpnews.com)

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To: Birgfeld, Erin[Birgfeld.Erin@epa.gov]; Argyropoulos, Paul[Argyropoulos.Paul@epa.gov]; Sutton, Tia[sutton.tia@epa.gov]; Burch, Julia[Burch.Julia@epa.gov]; Mylan, Christopher[Mylan.Christopher@epa.gov]; Alson, Jeff[alson.jeff@epa.gov]; Haley, Mike[Haley.Mike@epa.gov]; Bradish, Tracey[bradish.tracey@epa.gov]; Cook, Leila[cook.leila@epa.gov]; McCubbin, Courtney[McCubbin.Courtney@epa.gov]; Meekins, Tanya[Meekins.Tanya@epa.gov]; Scoville, Pat[Scoville.Pat@epa.gov]; Hula, Aaron[Hula.Aaron@epa.gov]; Cook, Leila[cook.leila@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Richards, David
Sent: Tue 8/30/2016 1:29:04 PM
Subject: OTAQ Daily News Brief

OTAQ Daily News Brief

Reuters

Mitsubishi Motors overstated fuel economy on eight more models: Nikkei

Mitsubishi Motors Corp (7211.T) overstated the fuel economy on eight of its vehicle models, in addition to four others the embattled Japanese automaker admitted to earlier this year, the Nikkei newspaper reported on Tuesday. Japan's transport ministry, which had been investigating the fuel economy on Mitsubishi models including the Pajero SUV, would report its findings as early as Tuesday, the Nikkei said, citing an unnamed source. The Nikkei said the company would likely withdraw the affected vehicles from the market to revise its catalogs, a process which could take about two to three weeks. Compensation to customers was a possibility, it added. Both Mitsubishi and the transport ministry declined to comment on the report. Shares in the automaker slipped 0.8 percent in early trade. Japan's sixth-largest automaker has been struggling to recover after admitting in April that it had falsified the fuel economy on two of its minivehicle models, along with two similar models produced for Nissan Motor Co (7201.T). The scandal led to a suspension of sales for nearly three months, and prompted a slump in Mitsubishi's market value. The company sought financial assistance from Nissan, which agreed to buy a controlling one-third stake for $2.2 billion.

Detroit Free Press

GOP congressmen push back against NHTSA, EPA on mileage study

Brent Snavely

Three members of the House Energy and Commerce Committee are urging government regulators to give automakers more time to respond to a July report that will help to shape fuel economy and greenhouse gas regulations over the next 10 years. Automakers are passionately arguing to modify, delay or extend the current corporate average fuel economy standards that get increasingly more difficult to meet from 2022 through 2025 and want more time to comment on

a report issued by the government in July. But both the U.S. Environmental Protection Agency and the National Highway Traffic Safety Administration said in a July report that the industry has become adept at developing new, more fuel-efficient technology and is able to meet the standards that were put in place in 2012. Both automakers and the government agreed in 2012 to review those standards and consider changes in a process that began this year. The agencies gave the industry 60 days to respond to an exhaustive report that kicked off that mid-term review. Republican members of the committee said the industry should have an additional 60 days to respond.

The NY Times

Stuck in Traffic, Polluting the Inside of Our Cars

The average American commuter spent 50 hours in traffic last year. As a nation, we spent eight billion hours sitting in our cars, waiting for lights to change, for the driver ahead to sneak into that parking spot, for an accident to be cleared. That's not much more time than many Europeans spend in cars. According to Inrix, a roadway and traffic analytics company, drivers and passengers in Belgium spent 44 hours in traffic last year; in Germany, 39 hours. Wherever it happens, new research suggests that all that sitting and waiting is exposing us to more pollutants than we'd take in if were we cruising along. According to a study published Thursday in Environmental Science: Processes & Impacts, pollution levels inside cars at red lights or in traffic jams are up to 40 percent higher than when traffic is moving. Air quality is already a problem outside of cars: More than 80 percent of people living in cities where pollution is tracked are exposed to air quality levels below World Health Organization limits. The W.H.O. has estimated that poor air quality is responsible for the deaths of 3.7 million people younger than 60 in 2012.

Forbes

A Wealth Transfer From Refiners To Ethanol Producers

Robert Rapier

A few months ago in Why Refiners Are Getting Crushed, I explained that rising oil prices were the primary factor behind deteriorating margins for refiners. But there is one more factor that was alluded to in oil refiner Valero's most recent earnings release. Valero noted that it "incurred $173 million of costs to meet our biofuel blending obligations (primarily for the purchase of Renewable Identification Numbers ("RINs") in the U.S.)" What exactly does this mean? And if it was a cost to Valero, who benefited? Let's do a quick review. The Energy Policy Act of 2005 created a Renewable Fuel Standard (RFS) requiring 7.5 billion gallons of renewable fuel — primarily corn ethanol — to be blended into the fuel supply by 2012. The ethanol industry responded by overbuilding capacity, which resulted in bankruptcies even as ethanol volumes

were growing exponentially. So the US government bailed out the industry by expanding the ethanol mandate with the Energy Independence and Security Act (EISA) of 2007. The new Renewable Fuel Standard – the RFS2 – accelerated the renewable fuel adoption schedule. Instead of 7.5 billion gallons by 2012, the new law required 9 billion gallons by 2008, soaring to 36 billion gallons by 2022. Most of the latter volume was to be "advanced biofuel", which I will address in my next article.

Ethanol Producer Magazine

Ethanol prices stabilize as corn market tumbles

Ethanol prices have remained relatively stable in the last four weeks. Front-month futures have fallen just 3 cents per gallon despite strong demand for blending through the end of August. The shift in the ethanol market has been dynamic, moving away from continued support in RBOB gasoline and toward recent losses in the corn market. Corn futures have moved to new contract lows; September was trading at $3.16 per bushel when this was written. The focus of the corn market has turned to expectations for record production which will increase overall supplies without a significant shift in demand. These lower corn prices mean lower production costs for ethanol, potentially improving plant margins. But on the energy side, recent stability and slight drawdowns in supplies through late summer are expected to keep buyers active. Long-term pressure is likely to be seen, eventually, due to significant production increases. RBOB gasoline markets continue to hold a strong premium to the ethanol market, which will limit additional ethanol losses over the near future.

Environmental Leader

Low-Carbon, Efficient Ships Save Millions. So Why Aren't Owners Reaping the Rewards?

Jessica Lyons Hardcastle

The shipping industry, like aviation, doesn't have its own carbon reduction targets under last year's Paris climate deal. And while it is far more carbon-efficient than road or air transport — shipping makes up around 2.4 percent of global CO2 emissions compared to 16.8 percent from road transportation — the UN's International Maritime Organization projects CO2 emissions from vessels will rise between 50 percent and 250 percent by 2050 in its "business as usual" case. Also unlike its road and air counterparts, there isn't much of a business benefit to ship owners to decarbonize. While road greenhouse gas and fuel efficiency standards are expected to save billions for corporate owners, efficiency and fuel costs play no part in the returns shipping asset owners see, according to research published today. Researchers from UCL Energy Institute and global NGO Carbon War Room today confirmed that vessels with high design efficiency leave millions in the pockets of fuel payers. However, the market often fails to reward owners of efficient vessels by way of premiums or preferential hiring. This does not help the industry's

efforts to decarboize and could challenge regulations designed to reduce total industry emissions, the report says.

The Economic Times

Climate change high on the agenda for John Kerry at the second US-India Strategic Dialogue

NEW DELHI: Climate change is high on the agenda for US Secretary of State John Kerry at the second US-India Strategic Dialogue. Three issues will dominate the US climate change agenda at the dialogue and its side meetings: formal accession to the Paris Agreement for an early entry into force, the phasedown of chemical refrigerants, hydrofluorocarbons (HFCs), that are contributing to rising global temperatures, and reducing carbon emissions from international aviation. Kerry, who in his tenure as Secretary of State has actively pushed the climate change agenda, will raise these issues with his counterpart External Affairs Minister Sushma Swaraj, and Prime Minister Modi on Wednesday evening, when Kerry calls on him. Besides the top-level focus on the three climate change related issues, the two-day programme includes a meeting of the Joint Working Group on Combating Climate Change. The high priority accorded to climate change is evident from the inclusion of US.

International

The Guardian

UK air quality shows little improvement over past 20 years, says study

There has been little improvement in air quality over the past 20 years as transport planners focus on preventing road deaths, according to a study. Two university academics set out to try to understand why there has been little improvement in air pollution concentrations from road transport since the UK signed up to international air quality standards in 1995, as part of the Environment Act. Dr Tim Chatterton and Prof Graham Parkhurst, from the Bristol-based University of the West of England, said their work concluded that UK transport planners were not taking the environmental impacts of transport choices sufficiently into account. They said that current figures estimate that more than 50,000 deaths a year can be attributed to air pollution in the UK yet planners focus on reducing road accidents. “Air pollution is perhaps the grossest manifestation of a general failure of UK transport planning to take the environmental impacts of transport choices sufficiently into account,” said Prof Parkhurst.

To: OTAQ Materials[OTAQMaterials@epa.gov]
Cc: Audette, Lucie[audette.lucie@epa.gov]; Yen, David[Yen.David@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Mueller, John[mueller.john@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Sargeant, Kathryn[sargeant.kathryn@epa.gov]; Charmley, William[charmley.william@epa.gov]; Iffland, JoNell[Iffland.JoNell@epa.gov]; Gonzalez, Gail[Gonzalez.Gail@epa.gov]
From: Manning, Bryan
Sent: Mon 10/24/2016 4:22:48 PM
Subject: Aircraft GHG Standards- Early Guidance Meeting with AA and workgroup members (Oct 25 at 3:00)
Early Guidance Briefing_Aircraft GHG Std_October 25 2016.pptx

Hello,

Attached please find the materials for the Early Guidance Meeting with Janet on October 25 at 3:00. Let us know if you have any questions.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Burch, Julia[Burch.Julia@epa.gov]; Sutton, Tia[sutton.tia@epa.gov]
Cc: Manning, Bryan[manning.bryan@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Audette, Lucie
Sent: Mon 10/30/2017 6:01:27 PM
Subject: talking point for aircraft CO2 standard

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process Lee Cook is making a presentation at Ozone Transport Commission shortly and we've been asked to provide an update on status of the aircraft rulemaking. Is there anything that has been previously approved in this Administration we could use? **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

- **Aircraft CO_2 emissions standards**

Ex. 5 - Deliberative Process

To: Charmley, William[charmley.william@epa.gov]
From: Samulski, Michael
Sent: Tue 6/23/2015 4:55:30 PM
Subject: FW: Call with Lourdes
Summary of Issues ICAO CO2 Standard 6-22-15.docx

Here is the issues table that I mentioned yesterday.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Samulski, Michael
Sent: Monday, June 22, 2015 4:24 PM
To: charmley.william@epa.gov
Subject: Call with Lourdes

Bill,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

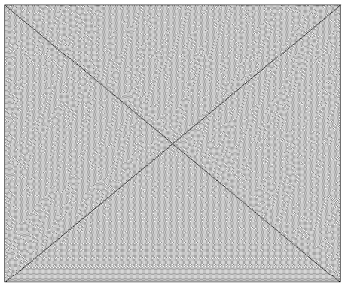
To: Charmley, William[charmley.william@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
Cc: Stewart, Gwen[Stewart.Gwen@epa.gov]
From: Hengst, Benjamin
Sent: Mon 1/12/2015 8:55:41 PM
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Bill, Michael: please advise on whether this should be a meeting with Chris, or whether ASD will cover it. Ben

From: Grundler, Christopher
Sent: Friday, January 09, 2015 5:42 PM
To: Charmley, William; Hengst, Benjamin; Samulski, Michael
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Ex. 5 - Deliberative Process

From: Young, Nancy [mailto:NYoung@airlines.org]
Sent: Friday, January 09, 2015 5:35 PM
To: Grundler, Christopher
Cc: Maurice, Lourdes
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard



January 9, 2015

Submitted By Email to *Grundler.christopher@Epa.gov*

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org.

Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

Nancy N. Young

Vice President, Environmental Affairs

cc: Lourdes Maurice, FAA, via email Lourdes.maurice@faa.gov

Nancy N. Young

Vice President, Environmental Affairs

Airlines for America

We Connect the World

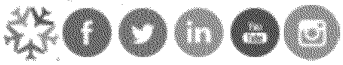
1301 Pennsylvania Ave, NW, Suite 1100

Washington, DC 20004

Phone: (202) 626-4207

email: nyoung@airlines.org

VISIT US:



[1] Besides being well-established for international standard-setting, the CAEP Terms of Reference and the ICAO/CAEP standard-setting process align well with the bases for the adoption of aircraft engine emission standards by EPA and FAA under Section 231 of the Clean Air Act.

To: Charmley, William[charmley.william@epa.gov]
Cc: Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]
From: Audette, Lucie
Sent: Mon 4/11/2016 2:46:33 PM
Subject: Aircraft GHG Draft FRM text re: ICAO standards and EPA domestic process
DRAFT section US AIRCRAFT REGULATIONS AND INTERNATIONAL COMMUNITY.docx

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Charmley, William[charmley.william@epa.gov]
From: Samulski, Michael
Sent: Thur 3/24/2016 7:45:16 PM
Subject: FW: Draft ICAO section of aircraft GHG endang FRM (for Bill's review)
aircraft GHG finding FRM preamble_for Bill review 3-24-16b.docx

Bill,

You had asked to see the section of the draft endangerment FRM discussing the decision from CAEP/10 on CO2 standards.

Ex. 5 - Deliberative Process

I will also leave a paper copy on your chair.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Manning, Bryan
Sent: Thursday, March 24, 2016 3:28 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Subject: Draft ICAO section of aircraft GHG endang FRM (for Bill's review)

Hello Mike,

Attached please find the draft upfront/ICAO section of the aircraft GHG endangerment FRM, for Bill to review. I will also bring you down a hard copy.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Charmley, William[charmley.william@epa.gov]
From: Samulski, Michael
Sent: Mon 8/10/2015 11:46:23 AM
Subject: Aircraft FR Notice
EF NPRM and ANPR 2015-15192.pdf

The Federal Register notice is attached and also available at:

http://www.gpo.gov/fdsys/pkg/FR-2015-07-01/pdf/2015-15192.pdf

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Charmley, William[charmley.william@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]
From: McCabe, Janet
Sent: Sat 1/30/2016 2:27:57 AM
Subject: FW: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Ex. 5 - Deliberative Process

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Friday, January 29, 2016 5:43 PM
To: Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy; Lourdes.Maurice@faa.gov; Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; McCabe, Janet <McCabe.Janet@epa.gov>; Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Charmley, William <charmley.william@epa.gov>; LeFranc, Maurice <LeFranc.Maurice@epa.gov>; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson, Emily <Atkinson.Emily@epa.gov> Ex. 6 - Personal Privacy
Cc: Ex. 6 - Personal Privacy Arthur.Rypinski@dot.gov; Ex. 6 - Personal Privacy; Laszlo.Windhoffer@faa.gov; maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

Ex. 5 - Deliberative Process

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

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ralph.iovinelli@faa.gov

To: Ex. 6 - Personal Privacy]; McCabe, Janet[McCabe.Janet@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Charmley, William[charmley.william@epa.gov]; LeFranc, Maurice[LeFranc.Maurice@epa.gov]; Rich.Swayze@faa.gov[Rich.Swayze@faa.gov]; carl.burleson@faa.gov[carl.burleson@faa.gov]; shoshana.lew@dot.gov[shoshana.lew@dot.gov]; Atkinson, Emily[Atkinson.Emily@epa.gov]; brandon.belford@dot.gov[brandon.belford@dot.gov]
Cc: Ex. 6 - Personal Privacy
Ex. 6 - Personal Privacy

Ex. 6 - Personal Privacy

From: Lourdes.Maurice@faa.gov
Sent: Mon 11/2/2015 10:05:05 PM
Subject: RE: ICAO CO2 Standard Meeting - Agenda and NEW TIME
CAEP 10 WP XX US CO2 Stringency_EPA-FAA- final 2 November 2015.docx

Ex. 5 - Deliberative Process

From: Vahlsing, Candace Ex. 6 - Personal Privacy
Sent: Friday, October 23, 2015 4:18 PM
To: Maurice, Lourdes (FAA); McCabe.Janet@epa.gov; Hengst.Benjamin@epa.gov; charmley.william@epa.gov; lefranc.maurice@epa.gov; Swayze, Rich (FAA); Burleson, Carl (FAA); Lew, Shoshana (OST); Atkinson.Emily@epa.gov; Belford, Brandon (OST)
Cc: Welsh, Kevin; Utech, Dan G.; Bodnar, Paul; Duke, Rick; Zaidi, Ali; Mohtadi, Shara
Subject: RE: ICAO CO2 Standard Meeting - Agenda and NEW TIME

Thank you!

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Friday, October 23, 2015 1:37 PM
To: Vahlsing, Candace; McCabe.Janet@epa.gov; Hengst.Benjamin@epa.gov; charmley.william@epa.gov; lefranc.maurice@epa.gov; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson.Emily@epa.gov; brandon.belford@dot.gov
Cc: Welsh, Kevin; Utech, Dan G.; Bodnar, Paul; Duke, Rick; Zaidi, Ali; Mohtadi, Shara
Subject: RE: ICAO CO2 Standard Meeting - Agenda and NEW TIME

Dear Kevin and Candace

Ex. 5 - Deliberative Process

Cheers Lourdes

From: Vahlsing, Candace Ex. 6 - Personal Privacy
Sent: Sunday, October 18, 2015 10:00 PM
To: 'McCabe, Janet'; 'Hengst, Benjamin'; 'charmley.william@epa.gov'; 'lefranc.maurice@epa.gov'; Swayze, Rich (FAA); Burleson, Carl (FAA); Maurice, Lourdes (FAA); Lew, Shoshana (OST); 'Atkinson,

Emily'; Belford, Brandon (OST)
Cc: Welsh, Kevin; Utech, Dan G.; Bodnar, Paul; Duke, Rick; Zaidi, Ali; Mohtadi, Shara
Subject: RE: ICAO CO2 Standard Meeting - Agenda and NEW TIME

Ex. 5 - Deliberative Process

Please let us know if you have any questions.

Many thanks!

Kevin and Candace

IPC ON Aircraft CO2 Standard

DATE: October 15, 2015

LOCATION: EEOB 208

TIME: 6:00-7:00pm

Summary of Conclusions

I. Process and Timeline through February CAEP Meeting

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

VIII. September 2016: ICAO Assembly Meeting To Formally Adopt The Standard

IX. Fall 2016: EPA Moves Forward With Rulemaking

From: Welsh, Kevin
Sent: Wednesday, October 14, 2015 6:21 PM
To: 'McCabe, Janet'; 'Hengst, Benjamin'; 'charmley.william@epa.gov'; 'lefranc.maurice@epa.gov'; 'Rich.Swayze@faa.gov'; 'carl.burleson@faa.gov'; 'Lourdes.Maurice@faa.gov'; 'shoshana.lew@dot.gov'; 'Atkinson, Emily'; 'brandon.belford@dot.gov'
Cc: Utech, Dan G.; Bodnar, Paul; Duke, Rick; Vahlsing, Candace
Subject: RE: ICAO CO2 Standard Meeting - Agenda and NEW TIME

Ex. 5 - Deliberative Process

Look forward to seeing you tomorrow.

Thanks,

Kevin

From: Welsh, Kevin
Sent: Tuesday, October 13, 2015 7:56 PM
To: 'McCabe, Janet' <McCabe.Janet@epa.gov>; 'Hengst, Benjamin' <Hengst.Benjamin@epa.gov>; 'charmley.william@epa.gov' <charmley.william@epa.gov>; 'lefranc.maurice@epa.gov' <lefranc.maurice@epa.gov>; 'Rich.Swayze@faa.gov' <Rich.Swayze@faa.gov>; 'carl.burleson@faa.gov' <carl.burleson@faa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>; 'shoshana.lew@dot.gov'

<shoshana.lew@dot.gov>; 'Atkinson, Emily' <Atkinson.Emily@epa.gov>
Cc: Utech, Dan G. <Ex. 6 - Personal Privacy>; Bodnar, Paul <Ex. 6 - Personal Privacy>; Duke, Rick <Ex. 6 - Personal Privacy>; Vahlsing, Candace <Ex. 6 - Personal Privacy>
Subject: ICAO CO2 Standard Meeting - Agenda and NEW TIME

All,

Attached is the agenda for Thursday's aircraft CO2 discussion. Also please note that due to a conflict that has arisen here, WE WILL START AT 6PM (we will still plan to stop at 7pm).

Thanks,

Kevin

From: Welsh, Kevin
Sent: Friday, October 09, 2015 12:03 PM
To: 'McCabe, Janet' <McCabe.Janet@epa.gov>; 'Hengst, Benjamin' <Hengst.Benjamin@epa.gov>; 'charmley.william@epa.gov' <charmley.william@epa.gov>; 'lefranc.maurice@epa.gov' <lefranc.maurice@epa.gov>; 'Rich.Swayze@faa.gov' <Rich.Swayze@faa.gov>; 'carl.burleson@faa.gov' <carl.burleson@faa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>; 'shoshana.lew@dot.gov' <shoshana.lew@dot.gov>; 'Atkinson, Emily' <Atkinson.Emily@epa.gov>
Cc: Utech, Dan G. <Ex. 6 - Personal Privacy>; Bodnar, Paul Ex. 6 - Personal Privacy Duke, Rick Ex. 6 - Personal Privacy; Vahlsing, Candace Ex. 6 - Personal Privacy
Subject: RE: NEW TIME: RE: ICAO CO2 Standard Meeting - Please Hold October 15 from 5:30-7pm

All,

Next Thursday's meeting will be in EEOB 208 at 5:30pm. Here is a link to register for the

Ex. 5 - Deliberative Process

We will send a detailed agenda by COB Tuesday, Ex. 5 - Deliberative Process
Ex. 5 - Deliberative Process

Also, since this is a late meeting, we will do are best to start right on time, so please leave enough time for security.

Thanks,

Kevin

From: Welsh, Kevin
Sent: Thursday, October 08, 2015 4:09 PM
To: 'McCabe, Janet' <McCabe.Janet@epa.gov>; 'Hengst, Benjamin' <Hengst.Benjamin@epa.gov>; 'charmley.william@epa.gov' <charmley.william@epa.gov>; 'lefranc.maurice@epa.gov' <lefranc.maurice@epa.gov>; 'Rich.Swayze@faa.gov' <Rich.Swayze@faa.gov>; 'carl.burleson@faa.gov' <carl.burleson@faa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>; 'shoshana.lew@dot.gov' <shoshana.lew@dot.gov>
Cc: Utech, Dan G. <Ex. 6 - Personal Privacy>; Bodnar, Paul <Ex. 6 - Personal Privacy>; Duke, Rick <Ex. 6 - Personal Privacy> Vahlsing, Candace <Ex. 6 - Personal Privacy>
Subject: NEW TIME: RE: ICAO CO2 Standard Meeting - Please Hold October 15 from 5:30-7pm

All,

Due to several conflicts, we will now hold this meeting on October 15 from 5:30pm to 7pm. Apologies for the late time, but looks to be about the only time that will work in the next couple of weeks.

Thanks,

Kevin

From: Welsh, Kevin
Sent: Monday, October 05, 2015 8:01 PM
To: 'McCabe, Janet' <McCabe.Janet@epa.gov>; 'Hengst, Benjamin' <Hengst.Benjamin@epa.gov>; charmley.william@epa.gov; 'lefranc.maurice@epa.gov' <lefranc.maurice@epa.gov>; 'Rich.Swayze@faa.gov' <Rich.Swayze@faa.gov>; 'carl.burleson@faa.gov' <carl.burleson@faa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>; 'shoshana.lew@dot.gov' <shoshana.lew@dot.gov>
Cc: Utech, Dan G. <Ex. 6 - Personal Privacy>; Bodnar, Paul <Ex. 6 - Personal Privacy> Duke, Rick <Ex. 6 - Personal Privacy>; Vahlsing, Candace <Ex. 6 - Personal Privacy>
Subject: ICAO CO2 Standard Meeting - Please Hold October 15 from 3:00-4:30pm

All,

NSC and DPC will hold an interagency meeting on the developing the US position for the ICAO CO2 standard next week. Please hold Thursday, October 15 from 3-4:30pm.

We'll provide additional details later this week,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Best regards,

Kevin

To: Ralph.lovinelli@faa.gov[Ralph.lovinelli@faa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Lourdes.Maurice@faa.gov[Lourdes.Maurice@faa.gov]
Cc: Charmley, William[charmley.william@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; curtis.holsclaw@faa.gov[curtis.holsclaw@faa.gov]; Laszlo.Windhoffer@faa.gov[Laszlo.Windhoffer@faa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]
From: Manning, Bryan
Sent: Mon 2/9/2015 4:35:14 PM
Subject: RE: Draft ANPR
DRAFT Aircraft GHG Preamble to FAA 1-14-2015_FAAcomments.docx
Aircraft GHG Preamble - Master_2-6-15b_clean.docx

Hello Ralph,

It was good to see you, Lourdes, and Laszlo (and all FAA folks) last week at the CAEP WG3 meeting. We appreciate your comments on the draft ANPR. Mike is having computer issues, and thus, he asked me to send this message on our response to your January 27 ANPR comments – in preparation for our 1:00 call tomorrow.

Ex. 5 - Deliberative Process

Let us know if you have any questions. We look forward to talking with you tomorrow.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Tuesday, January 27, 2015 1:32 PM
To: Samulski, Michael; Lourdes.Maurice@faa.gov
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: RE: Draft ANPR

HI Mike,

Thank you for the opportunity to review this draft ANPR and EF. Attached are FAA's comments for your review and consideration. Overall, our comments fall into the following categories…

Ex. 5 - Deliberative Process

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Samulski, Michael [mailto:samulski.michael@epa.gov]
Sent: Monday, January 26, 2015 8:40 AM
To: Maurice, Lourdes (FAA); Iovinelli, Ralph (FAA)
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Holsclaw, Curtis (FAA); Windhoffer, Laszlo (FAA)
Subject: RE: Draft ANPR

Ralph and Lourdes,

I'm just checking in to see when we can expect additional feedback from FAA on the draft ANPR.

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Thursday, January 15, 2015 4:06 PM
To: Ralph.Iovinelli@faa.gov; Samulski, Michael
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: RE: Draft ANPR

Ex. 5 - Deliberative Process

From: Iovinelli, Ralph (FAA)
Sent: Thursday, January 15, 2015 4:05 PM
To: Samulski, Michael; Maurice, Lourdes (FAA)
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Holsclaw, Curtis (FAA); Windhoffer, Laszlo (FAA)
Subject: RE: Draft ANPR

Thanks Mike. This is helpful. We are doing the best we can to return our comments to you by next week. Would prefer to have until Friday, 23 Jan since next week is shortened by a holiday.

Thanks,

Ralph

From: Samulski, Michael [mailto:samulski.michael@epa.gov]
Sent: Thursday, January 15, 2015 4:01 PM
To: Maurice, Lourdes (FAA)
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Iovinelli, Ralph (FAA); Holsclaw, Curtis (FAA); Windhoffer, Laszlo (FAA)
Subject: RE: Draft ANPR

I realized that I never gave you any indication of timing when I sent this out…

To meet our schedule to get the package to OMB, and still incorporate FAA comments beforehand, we would like to get your feedback sometime next week. Our preference is by COB on Jan 21, but have some wiggle room depending on the extent of the comments.

From our perspective (which I hope you share) your feedback is most helpful on the ANPR section (Section 5), followed by the cause and contribute section (Section 4). Of course, we will consider any comments you provide.

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Wednesday, January 14, 2015 12:40 PM
To: Samulski, Michael
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Ralph.Iovinelli@faa.gov; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: Re: Draft ANPR

Thx Mike. On our list to review!

Sent from my iPhone

On Jan 14, 2015, at 12:14 PM, Samulski, Michael <samulski.michael@epa.gov> wrote:

Lourdes,

The attached file is a compiled document which contains all of the chapters associated with the EF and ANPR. This document is still going through EPA legal review in parallel with my sharing it with you. There may be some minor changes relative to the individual chapters that I have shared with you to date.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Sunday, January 11, 2015 2:14 PM
To: Samulski, Michael
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Ralph.Iovinelli@faa.gov; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: Re: Draft ANPR

Thx Mike. We will review ASAP. Happy 2015. Lourdes

Sent from my iPhone

On Jan 9, 2015, at 3:15 PM, Samulski, Michael <samulski.michael@epa.gov> wrote:

> As promised, here is revised draft ANPR text which is intended to respond to FAA comments.
>
> Best regards,
>
> Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Samulski, Michael
Sent: Tuesday, January 06, 2015 8:17 AM
To: 'Lourdes.Maurice@faa.gov'
Cc: Charmley, William; Manning, Bryan; Audette, Lucie; Ralph.Iovinelli@faa.gov; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: RE: Draft ANPR

Lourdes,

Thanks for the quick feedback on the ANPRM. We are revising the document taking your comments into consideration. Our plan is to get this revised draft to you this week.

I am attaching two additional pieces of the package. Chapter 1 provides an introduction and overview. Chapter IV is the proposed cause and contribute finding.

Other than boilerplate, there are two remaining chapters which are being drafted by different offices than ours. Chapter II is a legal discussion, which is still being drafted

Ex. 5 - Deliberative Process

Happy New Year,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Monday, December 29, 2014 11:55 AM
To: Samulski, Michael
Cc: Charmley, William; Iffland, JoNell; Manning, Bryan; Audette, Lucie; Ralph.Iovinelli@faa.gov; curtis.holsclaw@faa.gov; Laszlo.Windhoffer@faa.gov
Subject: RE: Draft ANPR

Dear Mike (cc EPA and FAA colleagues):

Attached AEE reaction to ANPRM. As discussed during our telecom – lawyers are not available to review.

Suggest addressing comments (as discussed during telecom) and then we can run a version by our lawyers.

Just a reminder that you were going to get us the other pieces of the document (we are particularly anxious to review EF)

Ex. 5 - Deliberative Process

Happy New Year and look forward to advancing this in (early!) 2015. From my perspective would be really good if EF and ANPRM were out before CAEP/SG in July 2015.

Cheers, Lourdes

From: Samulski, Michael [mailto:samulski.michael@epa.gov]
Sent: Thursday, December 18, 2014 9:47 AM
To: Maurice, Lourdes (FAA); Iovinelli, Ralph (FAA)
Cc: Charmley, William; Iffland, JoNell; Manning, Bryan; Audette, Lucie
Subject: FW: Draft ANPR

Lourdes and Ralph,

Bill wasn't aware we had a meeting set up at 1:00 tomorrow to discuss this. He would like to join us but has a conflict with outside parties in the afternoon (and I have one in

the morning).

Would you be available tomorrow at either 9:00am or 3:00pm?

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Charmley, William
Sent: Thursday, December 18, 2014 9:33 AM
To: Lourdes.Maurice@faa.gov; Samulski, Michael
Cc: Ralph.Iovinelli@faa.gov; Manning, Bryan; Hengst, Benjamin; Audette, Lucie
Subject: RE: Draft ANPR

Dear Lourdes,

Thanks for the initial feedback. I think it will be helpful if we try to find some time for all of us to talk regarding what are FAAs views on the Advanced Notice of Proposed Rulemaking, as well as on the proposed endangerment finding, from a conceptual level, to see where you all are coming from.

The sooner the better from my perspective, but I want to respect everyone's leave plans over the holidays.

Best regards,

Bill

Bill Charmley

Director

Assessment and Standards Division

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

National Vehicle and Fuel Emissions Laboratory

2000 Traverwood Drive

Ann Arbor, MI 48105

desk ph. 734-214-4466

cell ph. 734-545-0333

e-mail: charmley.william@epa.gov

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Thursday, December 18, 2014 9:26 AM
To: Samulski, Michael
Cc: Ralph.Iovinelli@faa.gov; Manning, Bryan; Hengst, Benjamin; Charmley, William; Audette, Lucie
Subject: Re: Draft ANPR

Mike. Have reviewed quickly.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Cheers. Lourdes.

Sent from my iPhone

On Dec 15, 2014, at 4:23 PM, Samulski, Michael <samulski.michael@epa.gov> wrote:

Lourdes and Ralph,

As promised, here is the draft ANPR text to be included in the upcoming aircraft package. It is still undergoing some internal review, but we wanted to get this to you sooner rather than later. We are interested in your thoughts on this.

If it would be helpful, we would be available to have a call this week to walk through it and/or answer questions.

We are interested in getting comments by the end of the year, if possible. I know, from Ralph, that such a deadline will be challenging given the holidays. I suggested to him that another week may be possible by squeezing the process from our end (Jan 7). Hopefully, the review won't be too onerous as the document is only 38 pages, double-spaced.

Best regards,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

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<Sec V ANPRM- to FAA 12-15-2014.docx>

<Sec V ANPRM- to FAA 12-29-2014_FAAcomments + EPA revisions to FAA 1 9 15.docx>

<DRAFT Aircraft GHG Preamble to FAA 1-14-2015.docx>

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FEDERAL REGISTER

Vol. 80 Wednesday,
No. 126 July 1, 2015

Part II

Environmental Protection Agency

40 CFR Parts 87 and 1068
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; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 87 and 1068

[EPA–HQ–OAR–2014–0828; FRL 9924–06–OAR]

RIN 2060–AS31

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

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule and advance notice of proposed rulemaking.

SUMMARY: In this action, the Administrator is proposing to determine that greenhouse gas concentrations in the atmosphere endanger the public health and welfare of current and future generations within the meaning of section 231(a) of the Clean Air Act. She proposes to make this finding specifically with respect to the same six well-mixed greenhouse gases (GHGs)—carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—that together were defined as the air pollution in the 2009 Endangerment Finding under section 202(a) of the Clean Air Act and that together constitute the primary cause of the climate change problem. The Administrator is also proposing to find that greenhouse gas emissions from certain classes of engines used in aircraft are contributing to air pollution—the mix of greenhouse gases in the atmosphere—that endangers public health and welfare under section 231(a) of the Clean Air Act. Concurrent with these proposed findings, the EPA is issuing an Advance Notice of Proposed Rulemaking to provide an overview of and seek input on a variety of issues related to setting an international CO_2 standard for aircraft at the International Civil Aviation Organization (ICAO), ICAO's progress in establishing global aircraft standards that achieve meaningful reductions in CO_2 emissions, and (provided the EPA promulgates final endangerment and cause and contribute findings for aircraft engine GHG emissions) the potential use of section 231 of the Clean Air Act to adopt and implement corresponding aircraft engine GHG emission standards domestically, ensuring transparency and the opportunity for public comment.

DATES: *Comments.* Comments must be received on or before August 31, 2015.

Public Hearing. The EPA will hold a public hearing on August 11, 2015 in Washington, DC, at the William Jefferson Clinton East Building, Room 1153, 101 Constitution Avenue NW., Washington, DC 20004. If no one contacts the EPA requesting to speak at the hearing for this proposal by July 13, 2015 the public hearing will not take place and will be cancelled with no further notice. Speakers should contact Ms. JoNell Iffland (see **FOR FURTHER INFORMATION CONTACT**) to request to speak at the hearing. The last day to pre-register in advance to speak at the hearing will be August 6, 2015. The hearing will start at 10:00 a.m. local time and continue until everyone has had a chance to speak. Requests to speak will be taken the day of the hearing at the hearing registration desk, although preferences on speaking times may not be able to be fulfilled. If you require the service of a translator or special accommodations such as audio description, please let us know at the time of registration. For further information on the public hearing or to register to speak at the hearing, *please see* section I.B below or go to *http://www.epa.gov/otaq/aviation.htm*.

ADDRESSES: *Comments.* Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2014–0828, by one of the following methods:

- *Online: www.regulations.gov* Follow the on-line instructions for submitting comments.
- *Email: A-and-R-Docket@epamail.epa.gov* Attention Docket ID No. EPA–HQ–OAR–2014–0828.
- *Fax:* (202) 566–9744, Attention Docket ID No. EPA–HQ–OAR–2014–0828.
- *Mail:* U.S. Postal Service, send comments to Air and Radiation Docket and Information Center, Environmental Protection Agency, Mail Code: 28221T, 1200 Pennsylvania Ave. NW., Washington, DC 20460. Attention Docket ID No. EPA–HQ–OAR–2014–0828.
- *Hand Delivery:* U.S. Environmental Protection Agency, EPA West, EPA Docket Center, EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington, DC 20004. Attention Docket ID No. EPA–HQ–OAR–2014–0828. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2014–0828. See section I.B on ''Public Participation'' for more information about submitting written comments. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov*, including any personal information provided, unless the comment includes information claimed to be confidential business information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or email. The *http://www.regulations.gov* Web site is an ''anonymous access'' system, which means the EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an email comment directly to the EPA without going through *http://www.regulations.gov,* your email address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, the EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, or any form of encryption, and be free of any defects or viruses. For additional information about the EPA's public docket visit the EPA Docket Center homepage at: *http://www.epa.gov/dockets*. For additional instructions on submitting comments, go to section I.B of this document.

Docket. The EPA has established a docket for this rulemaking under Docket ID No. EPA–HQ–OAR–2014–0828. All documents in the docket are listed in the *www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy in the EPA's docket. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the Air and Radiation Docket and Information Center, EPA/DC, EPA WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The Public Reading Room is open

from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: JoNell Iffland, Office of Transportation and Air Quality, Assessment and Standards Division (ASD), Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105; Telephone number: (734) 214–4454; Fax number: (734) 214–4816; Email address: *iffland.jonell@epa.gov*. Please use this contact information for general questions about this rulemaking, to request a hearing, to determine if a hearing will be held, and to register to speak at the hearing, if one is held.

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I. General Information

A. Does this action apply to me?

These proposed findings, if finalized, would trigger new duties that would apply to the EPA, but would not themselves apply new requirements to other entities outside the federal government. Specifically, if the EPA issues final findings that greenhouse gas emissions from certain classes of engines—those used in certain aircraft—cause or contribute to air pollution which endangers public health or welfare, then the EPA would have a duty under section 231 of the Clean Air Act to promulgate aircraft engine emission standards applicable to emissions of that air pollutant from those classes of engines. Only those standards would apply to and have an effect on other entities outside the federal government. Entities potentially interested in this proposed action are those that manufacture and sell aircraft engines and aircraft in the United States. Categories that may be regulated in a future regulatory action include:

Category	NAICS [a] Code	SIC [b] Code	Examples of potentially affected entities
Industry	3364412	3724	Manufacturers of new aircraft engines.
Industry	336411	3721	Manufacturers of new aircraft.

[a] North American Industry Classification System (NAICS).
[b] Standard Industrial Classification (SIC) code.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be interested in this proposed action. This table lists the types of entities that the EPA is now aware could potentially have an interest in this proposed action. If the EPA issues final affirmative findings under section 231(a) regarding greenhouse gases, the EPA would then be required to undertake a separate notice and comment rulemaking to issue emission standards applicable to greenhouse gas emissions from the classes of aircraft engines that the EPA finds cause or contribute in such a finding, and the FAA would be required to Prescribe regulations to insure compliance with these emissions standards pursuant to section 232 of the Clean Air Act. Other types of entities not listed in the table could also be interested and potentially affected by subsequent actions at some future time. If you have any questions regarding the scope of this proposed action, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. Public Participation

The EPA requests comment on all aspects of the proposed aircraft endangerment and cause or contribute findings and the Advance Notice of Proposed Rulemaking (ANPR). This section describes how you can participate in this process.

If you submitted comments on the issues raised by this proposal in dockets for other, earlier Agency efforts (*e.g.,* the 2009 Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202 of the Clean Air Act or the Advance Notice of Proposed Rulemaking on Regulating Greenhouse Gases under the Clean Air Act), you must still submit your comments to the docket for this action (EPA–HQ–OAR–2014–0828) by the deadline if you want them to be considered.

1. What should I consider as I prepare my comments for the EPA?

We are opening a formal comment period by publishing this document. We will accept comments during the period indicated in the **DATES** section. If you have an interest in the proposed aircraft endangerment and cause or contribute findings and/or the ANPR described in this document, we encourage you to comment on any aspect of this rulemaking.

Tips for Preparing Your Comments

When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, **Federal Register** date and page number).
- Follow directions—The agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.
- Explain why you agree or disagree, suggest alternatives, and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns, and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Make sure to submit your comments by the comment period deadline identified.

Do not submit information to the EPA containing CBI through *http://www.regulations.gov* or email. Clearly mark the part or all of the information that you claim to be CBI. For CBI information on a disk or CD–ROM that you mail to the EPA, mark the outside of the disk or CD–ROM as CBI and then identify electronically within the disk or CD–ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, you must submit a copy of the comment that does not contain the information claimed as CBI for inclusion in the public docket. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

2. Public Hearing

If a hearing is held, it will provide interested parties the opportunity to present data, views or arguments concerning the proposed action. The EPA will make every effort to accommodate all speakers who arrive and register. Because this hearing, if held, will be at a U.S. government facility, individuals planning to attend the hearing should be prepared to show valid picture identification to the security staff in order to gain access to the meeting room. Please note that the REAL ID Act, passed by Congress in 2005, established new requirements for entering federal facilities. These requirements took effect July 21, 2014. If your driver's license is issued by Alaska, American Samoa, Arizona, Kentucky, Louisiana, Maine, Massachusetts, Minnesota, Montana, New York, Oklahoma, or the state of Washington, you must present an additional form of identification to enter the federal buildings where the public hearings will be held. Acceptable alternative forms of identification include: Federal employee badges, passports, enhanced driver's licenses and military identification cards. In addition, you will need to obtain a property pass for any personal belongings you bring with you. Upon leaving the building, you will be required to return this property pass to the security desk. No large signs will be allowed in the building, cameras may only be used outside of the building and demonstrations will not be allowed on federal property for security reasons. The EPA may ask clarifying questions during the oral presentations but will not respond to the presentations at that time. Written statements and supporting information submitted during the comment period will be considered with the same weight as oral comments and supporting information presented at the public hearings.

Speakers should contact Ms. JoNell Iffland (see **FOR FURTHER INFORMATION CONTACT**) if they will need specific equipment, or if there are other special needs related to providing comments at the hearing. Oral testimony will be limited to no more than 10 minutes for each commenter, although we may need to adjust the time for each speaker if there is a large turnout. The EPA requests that commenters provide the EPA with three copies of their oral testimony in hard copy form the day of the hearing or an electronic copy in advance of the hearing date. Verbatim transcripts of the hearings and written

statements will be included in the docket for the rulemaking. The EPA will make every effort to follow the schedule as closely as possible on the day of the hearing; however, please plan for the hearing to run either ahead of schedule or behind schedule.

Information regarding the hearing (including information as to whether or not one will be held) will be available at *http://www.epa.gov/otaq/aviation.htm*. Again, if we do not receive a request to speak at the August 11, 2015 public hearing by July 13, 2015 the hearing will be cancelled.

C. Did the EPA conduct a peer review before issuing this notice?

As outlined in section IV.A of this action, the EPA's approach to providing the technical and scientific information to inform the Administrator's judgment regarding the question of whether greenhouse gases endanger public health and welfare was to rely primarily upon the recent, major assessments by the U.S. Global Change Research Program (USGCRP), the Intergovernmental Panel on Climate Change (IPCC), and the National Research Council (NRC) of the National Academies. These assessments draw synthesis conclusions across thousands of individual peer-reviewed studies that appear in scientific journals, and the reports themselves undergo additional peer review. The EPA has considered the processes and procedures employed by the USGCRP, IPCC, and the NRC, and has determined that these assessments have been adequately peer reviewed in a manner commensurate with the EPA's Peer Review Policy [1] and the guidelines in Office of Management and Budget's (OMB) Final Information Quality Bulletin for Peer Review (''OMB Bulletin'') for highly influential scientific assessments. According to guidelines in the EPA's Peer Review Handbook, if the Agency has determined that information has already been subject to adequate peer review, then it is not necessary to have further peer review of that information.[2]

The EPA also cites data from its annual Inventory of U.S. Greenhouse Gas Emissions and Sinks report,[3] which the Agency has determined to have been adequately reviewed in accordance with the OMB Bulletin and the EPA's Peer Review Handbook. For the presentation of emissions inventory information to support the cause or contribute finding, the EPA disaggregated the existing data in one area of the GHG Inventory (for the General Aviation Jet Fuel Category) and had the disaggregation methodology and results peer reviewed in accordance with the EPA's Peer Review Handbook. The EPA Science Advisory Board reviewed this approach to the underlying technical and scientific information supporting this action, and concluded that the approach had precedent and the action will be based on well-reviewed information. All relevant peer review documentation is located in the docket for today's action (EPA–HQ–OAR–2014–0828).

D. Children's Environmental Health

As described in detail in section IV of this preamble, the scientific evidence and conclusions in the USGCRP, IPCC, and the NRC assessment reports cited in the 2009 Endangerment Finding [4] indicate that children are uniquely vulnerable to climate change related health effects given behavioral, developmental, and physiological factors. The new assessment literature published since 2009 strengthens these conclusions by providing more detailed findings regarding children's vulnerabilities and projected impacts they may experience.

These assessments describe that children will be disproportionately impacted by climate change given the unique physiological and developmental factors that occur during this lifestage. Impacts to children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events. In addition, the assessments find that climate change will influence production of pollen that affects asthma and other allergic respiratory diseases, to which children are among those especially susceptible.

E. Environmental Justice

As described in detail in section IV below, the scientific evidence and conclusions in the USGCRP, IPCC, and the NRC assessment reports cited in the 2009 Endangerment Finding indicate that certain populations are most vulnerable to the health and welfare effects of climate change, including the elderly, the poor, and indigenous peoples in the United States, particularly Alaska Natives. The more recent assessment reports strengthen these conclusions by providing more detail regarding these populations' vulnerabilities and projected impacts they may experience.

In addition, the most recent assessment reports provide new analysis about how low-income populations and some populations defined jointly by ethnic/racial characteristics and geographic location are vulnerable to certain climate change health impacts, raising environmental justice concerns. Factors that contribute to increased vulnerability to the health effects of climate change include limited resources to adapt to and recover from climate impacts, as well as existing health disparities (*e.g.,* higher prevalence of chronic health conditions such as diabetes).

II. Introduction: Overview and Context for This Proposal

A. Summary

Pursuant to section 231(a)(2)(A) of the Clean Air Act (CAA or Act), the Administrator proposes to find that greenhouse gas (GHG) emissions from aircraft engines used in certain types of aircraft (referred to as ''covered aircraft'' throughout this notice) contribute to air pollution that endangers public health and welfare. Covered aircraft would be those aircraft to which ICAO has agreed the international CO_2 standard would apply: [5] subsonic jet aircraft with a maximum takeoff mass (MTOM) greater than 5,700 kilograms, and subsonic propeller-driven (*e.g.,* turboprop) aircraft with a MTOM greater than 8,618 kilograms. Examples of covered aircraft would include smaller jet aircraft such as the Cessna Citation CJ2+ and the Embraer E170, up to and including the largest commercial jet aircraft—the Airbus A380 and the Boeing 747. Other examples of covered aircraft would include larger turboprop aircraft, such as the ATR 72 and the Bombardier Q400.

In this proposed action, the EPA relies primarily on the extensive scientific and technical evidence in the record supporting the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 FR 66496, (December 15, 2009) (collectively

[1] U.S. EPA, 2006: *EPA Peer Review Policy*. Available at *http://www.epa.gov/peerreview/* (Last accessed May 12, 2015).

[2] U.S. EPA, 2012: *EPA Peer Review Handbook, Third Edition*. Available at *http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2012.pdf* (Last accessed May 12, 2015).

[3] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013*, 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport*, (Last accessed May 12, 2015).

[4] U.S. EPA, 2009: *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule*, 74 FR 66496 (December 15, 2009) (''2009 Endangerment Finding''); 74 FR 18886 (April 24, 2009) (''Proposed 2009 Endangerment Finding'').

[5] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO2 Emissions Standards*, Circular (Cir) 337, AN/192, Available at: *http://www.icao.int/publications/catalogue/cat_2015_en.pdf*. The ICAO Circular 337 is found on page 85 of the catalog and is copyright protected; Order No. CIR337 (last accessed May 12, 2015.

referred to as the 2009 Endangerment Finding in this action). This includes the major, peer-reviewed scientific assessments that were used to address the question of whether GHGs in the atmosphere endanger public health and welfare, and on the analytical framework and conclusions upon which the EPA relied in making that finding. The Administrator's view is that the body of scientific evidence amassed in the record for the 2009 Endangerment Finding also compellingly supports an endangerment finding under CAA section 231(a). Furthermore, this proposed finding under section 231 reflects the EPA's careful consideration not only of the scientific and technical record for the 2009 Endangerment Finding, but also of science assessments released since 2009, which, as illustrated below, strengthen and further support the judgment that GHGs in the atmosphere may reasonably be anticipated to endanger public health and welfare. No information or analyses published since late 2009 suggest that it would be reasonable for the EPA to now reach a different or contrary conclusion for purposes of CAA section 231(a)(2)(A) than the Agency reached for purposes of section 202(a). However, as explained below, in proposing this finding for purposes of section 231, we are not reopening or revising our prior findings under CAA section 202.

The Administrator is proposing to define the ''air pollution'' referred to in section 231(a)(2)(A) of the CAA to be the mix of six well-mixed GHGs: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. This is the same definition that was used for the finding for purposes of section 202(a). It is the Administrator's judgment that the total body of scientific evidence compellingly supports a positive endangerment finding that elevated concentrations of the six well-mixed GHGs constitute air pollution that endangers both the public health and the public welfare of current and future generations within the meaning of section 231(a) of the Clean Air Act.

Under section 231 of the CAA, the Administrator must also determine whether emissions of any air pollutant from a class or classes of aircraft engines cause or contribute to the air pollution that may reasonably be anticipated to endanger public health or welfare. Following the rationale outlined in the 2009 Endangerment Finding, the Administrator in this action is proposing to use the same definition of the air pollutant as was used for purposes of section 202(a) for purposes of making the cause or contribute determination under section 231(a)—that is, the aggregate group of the same six well-mixed GHGs. Based on the data summarized in section V, the Administrator is proposing to find that GHG emissions from aircraft engines used in covered aircraft, contribute to the air pollution that endangers public health and welfare under section 231(a).

The Administrator's proposed findings come in response to a citizen petition submitted by Friends of the Earth, Oceana, the Center for Biological Diversity, and Earthjustice (Petitioners) requesting that the EPA issue an endangerment finding and standards under section 231(a)(2)(A) of the Act for the GHG emissions from aircraft. The EPA is not proposing or taking action under any other provision of the CAA. Further, the EPA anticipates that ICAO will adopt a final CO_2 emissions standard in February 2016. This proposal, and any final endangerment and cause or contribute findings for aircraft engine GHG emissions, are also part of preparing for a possible subsequent domestic rulemaking process to adopt standards that are of at least equivalent stringency as the anticipated ICAO CO_2 standards. Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO. Section II. D provides additional discussion of the international aircraft standard-setting process.

B. Background Information Helpful to Understanding This Proposal

1. Greenhouse Gases and Their Effects

GHGs in the atmosphere effectively trap some of the Earth's heat that would otherwise escape to space. GHGs are both naturally occurring and anthropogenic. The primary GHGs directly emitted by human activities include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Of these six gases, two (CO_2 and nitrous oxide) are emitted by aircraft engines.

These six gases, once emitted, remain in the atmosphere for decades to centuries. Thus, they become well mixed globally in the atmosphere and their concentrations accumulate when emissions exceed the rate at which natural processes remove them from the atmosphere. Observations of the Earth's globally averaged combined land and ocean surface temperature over the period 1880 to 2012 show a warming of 0.85 [0.65 to 1.06] degrees Celsius or 1.53 [1.17 to 1.91] degrees Fahrenheit.[6] The heating effect caused by the human-induced buildup of these and other GHGs in the atmosphere, plus other human activities (*e.g.,* land use change and aerosol emissions), is extremely likely (>95 percent likelihood) to be the cause of most of the observed global warming since the mid-20th century.[7] A detailed explanation of climate change and its impact on health, society, and the environment is included in the record for the 2009 Endangerment Finding. The relevant scientific information from that record has also been included in the docket for this proposed determination under CAA section 231 (EPA–HQ–OAR–02914–0828). Section IV of this preamble discusses this information, as well as information from the most recent scientific assessments, in the context of the Administrator's proposed endangerment finding under CAA section 231.

The U.S. transportation sector constitutes a meaningful part of total U.S. and global anthropogenic GHG emissions. In 2013, aircraft remained the single largest GHG-emitting transportation source not yet subject to any GHG regulations. Aircraft clearly contribute to U.S. transportation emissions, accounting for 11 percent of all U.S transportation GHG emissions and representing more than 3 percent of total U.S. GHG emissions in 2013.[8] Globally, U.S. aircraft GHG emissions represent 29 percent of all global aircraft emissions and 0.5 percent of total global GHG emissions. Section V of this preamble provides detailed information on aircraft GHG emissions in the context of the Administrator's proposed cause or contribute finding under CAA section 231.

2. Statutory Basis for This Proposal

Section 231(a)(2)(A) of the CAA states that ''The Administrator shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.''

[6] ''IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[7] Ibid.

[8] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013,* 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport,* (last accessed May 12, 2015).

Before the Administrator may issue standards addressing emissions of GHGs under section 231, the Administrator must satisfy a two-step test. First, the Administrator must decide whether, in her judgment, the air pollution under consideration may reasonably be anticipated to endanger public health or welfare. Second, the Administrator must decide whether, in her judgment, emissions of an air pollutant from certain classes of aircraft engines cause or contribute to this air pollution.[9] If the Administrator answers both questions in the affirmative, she must issue standards under section 231. *See Massachusetts* v. *EPA,* 549 U.S. 497,533 (2007) (interpreting analogous provision in CAA section 202). Section III of this preamble summarizes the legal framework for this proposed action under CAA section 231. Typically, past endangerment and cause or contribute findings have been proposed concurrently with proposed standards under various sections of the CAA, including section 231. Comment has been taken on these proposed findings as part of the notice and comment process for the emission standards. *See, e.g.,* Rulemaking for non-road compression-ignition engines under section 213(a)(4) of the CAA, Proposed Rule at 58 FR 28809, 28813–14 (May 17, 1993), Final Rule at 59 FR 31306, 31318 (June 17, 1994); Rulemaking for highway heavy-duty diesel engines and diesel sulfur fuel under sections 202(a) and 211(c) of the CAA, Proposed Rule at 65 FR 35430 (June 2, 2000), and Final Rule 66 FR 5002 (January 18, 2001). However, there is no requirement that the Administrator propose the endangerment and cause or contribute findings concurrently with proposed standards. See 74 FR 66502 (December 26, 2001), (explaining that nothing in section 202(a) requires the EPA to propose or issue endangerment and cause or contribute findings in the same rulemaking, and that Congress left the EPA discretion to choose an approach that satisfied the requirements of section 202(a)). The same analysis applies to section 231(a)(2)(A), which is analogous to section 202(a). The EPA is choosing to propose these findings at this time for a number of reasons, including its previous commitment to issue such proposed findings in response to a 2007 citizens' petition.[10]

The Administrator is applying the rulemaking provisions of CAA section 307(d) to this action, pursuant to CAA section 307(d)(1)(V), which provides that the provisions of 307(d) apply to "such other actions as the Administrator may determine."[11] Any standard setting rulemaking under section 231 will also be subject to the notice and comment rulemaking procedures under 307(d), as provided in CAA section 307(d)(1)(F) (applying the provisions of 307(d) to the promulgation or revision of any aircraft emission standard under section 231). Thus, these proposed findings will be subject to the same rulemaking requirements that would apply if the proposed findings were part of a standard-setting rulemaking.

C. The EPA's Responsibilities Under the Clean Air Act

The CAA provides broad authority to combat air pollution to protect public health and welfare. Cars, trucks, construction equipment, airplanes, and ships, as well as a broad range of electric generation, industrial, commercial and other facilities, are subject to various CAA programs. Implementation of the Act over the past four decades has resulted in significant reductions in air pollution while the nation's economy has continued to grow.

1. The EPA's Regulation of Greenhouse Gases

In *Massachusetts* v. *EPA,* 549 U.S. 497 (2007), the Supreme Court found that GHGs are air pollutants that can be regulated under the CAA. The Court held that the Administrator must determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health and/or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the Administrator was bound by the provisions of section 202(a) of the CAA. The Supreme Court decision resulted from a petition for rulemaking under section 202(a) filed by more than a dozen environmental, renewable energy, and other organizations.

Following the Supreme Court decision, the EPA proposed (74 FR 18886, April 24, 2009) and then finalized (74 FR 66496, December 15, 2009) the 2009 Endangerment Finding, which can be summarized as follows:

- Endangerment Finding: The Administrator found that the then-current and projected concentrations of the six key well-mixed GHGs—CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—in the atmosphere threaten the public health and welfare of current and future generations.
- Cause or Contribute Finding: The Administrator found that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

The findings did not themselves impose any requirements on industry or other entities. However, these findings compelled the EPA to promulgate GHG emission standards for new motor vehicles under section 202(a). Subsequently, in May 2010 the EPA, in collaboration with the National Highway Traffic Safety Administration (NHTSA), finalized Phase 1 GHG emission standards for light-duty vehicles (2012–2016 model years).[12] This was followed in August 2011 by adoption of the first-ever GHG emission standards for heavy-duty engines and vehicles (2014–2018 model years).[13] On August 29, 2012, the second phase of the GHG emission standards for light-duty vehicles (2017–2025 model years) was finalized further reducing GHG emissions from light-duty vehicles.[14] In 2014, the President directed the EPA and the Department of Transportation to set standards by March 2016 that further increase fuel efficiency and reduce GHG emissions from medium- and heavy-duty vehicles.[15]

[9] To clarify the distinction between air pollution and air pollutant, the air pollution is the atmospheric concentrations and can be thought of as the total, cumulative stock of GHGs in the atmosphere. The air pollutants, on the other hand, are the emissions of GHGs and can be thought of as the flow that changes the size of the total stock.

[10] Center for Biological Diversity, Center for Food Safety, Friends of the Earth, International Center for Technology Assessment, and Oceana, 2007: Petition for Rulemaking Under the Clean Air Act to Reduce the Emissions of Air Pollutants from Aircraft the Contribute to Global Climate Change, December 5. Available at *http://www.epa.gov/otaq/aviation.htm* (last accessed May 12, 2015).

[11] As the Administrator is applying the provisions of section 307(d) to this rulemaking under section 307(d)(1)(V), we need not determine whether those provisions would apply to this action under section 307(d)(1)(F).

[12] U.S. EPA, 2010: *Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule,* 75 FR 25324 (May 7, 2010).

[13] US EPA, 2011: *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rule,* 76 **Federal Register** 57106 (September 15, 2011).

[14] U.S. EPA, 2012: *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule,* 77 FR 62623 (October 15, 2012).

[15] Executive Office of the President, 2014: *Remarks by the President on Fuel Efficiency Standards of Medium and Heavy-Duty Vehicles,* Office of the Press Secretary, February 18. Available at: *http://www.whitehouse.gov/the-press-office/*

Continued

The GHG rules for cars and trucks have been supported by a broad range of stakeholders, including states, major automobile and truck manufacturers, and environmental and labor organizations. Together these new standards for cars and trucks are resulting in significant reductions in GHG emissions, and over the lifetime of these vehicles GHG emissions will have been reduced by 6 billion metric tons.[16] [17]

On June 25, 2013, President Obama announced a Climate Action Plan that set forth a series of executive actions to further reduce GHGs, prepare the U.S. for the impacts of climate change, and lead international efforts to address global climate change.[18] As part of the Climate Action Plan, the President issued a Presidential Memorandum directing the EPA to work expeditiously to complete carbon pollution standards for the power sector.[19] In response, in January 2014, the EPA proposed carbon pollution standards for new electric utility generating units.[20] This was followed in June 2014, by proposed standards to address carbon pollution from modified and reconstructed power plants[21] and from existing power plants.[22]

In the Climate Action Plan, the President also indicated that the U.S. was working internationally to make progress in a variety of areas and specifically noted the progress being made by ICAO to develop global CO_2 emission standards for aircraft.[23] The proposed endangerment and cause or contribute findings for aircraft GHG emissions under section 231(a)(2)(A) of the CAA are a preliminary but necessary first step to begin to address GHG emissions from the aviation sector, the highest-emitting category of transportation sources that the EPA has not yet addressed. As presented in more detail in Section V of this preamble, total U.S. aircraft GHG emissions in 2013 represented 11 percent of GHG emissions from the U.S. transportation sector,[24] and in 2010, the latest year with complete global emissions data, U.S. aircraft GHG emissions represented 29 percent of global aircraft GHG emissions.[25] [26] U.S. aircraft GHG emissions are projected to increase by almost 50 percent over the next two decades.[27] See section V of this preamble for more information about the data sources that compose the aircraft GHG emissions inventory.

2. Background on the Aircraft Petition, 2008 ANPR, and D.C. District Court Decision

Section 231(a)(2)(A) of the CAA directs the Administrator of the EPA to, from time to time, propose aircraft engine emissions standards applicable to the emission of any air pollutant from any classes of aircraft engines which in her judgment causes or contributes to air pollution which may reasonably be anticipated to endanger public health or welfare.

On December 5, 2007, Friends of the Earth, Oceana, the Center for Biological Diversity, Earthjustice, and others (Petitioners) sent a letter to the EPA petitioning the Agency to undertake rulemaking regarding GHG emissions from aircraft.[28] Specifically, Petitioners requested that the EPA make a finding that GHG emissions from aircraft engines ''may reasonably be anticipated to endanger public health and welfare'' and that the EPA promulgate standards for GHG emissions from aircraft.

Following the Supreme Court's decision in *Massachusetts* v. *EPA* in 2007, the EPA issued an ANPR in 2008 presenting information relevant to potentially regulating GHGs under the Act, and soliciting public comment on how to respond to the Court's ruling and the potential ramifications of the Agency's decision to regulate GHGs under the CAA. This ANPR described and solicited comment on numerous petitions the Agency had received to regulate GHG emissions from both stationary and mobile sources, including aircraft. 73 FR 44354, 44468–44473 (July 30, 2008). With regard to aircraft, the Agency sought comment on the impact of aircraft operations on GHG emissions and the potential for reductions in GHG emissions from these operations.

In response to the ANPR, the EPA received comments from a wide range of aviation sector stakeholders including industry trade groups, individual manufacturers, states and local governments, and nongovernmental organizations (NGOs). Industry groups and individual manufacturers stressed that fuel costs (and market forces) created an economic incentive to reduce fuel consumption and thus GHG emissions. One industry association indicated its commitment to achieve an additional 30 percent fuel efficiency improvement by 2025. Another commenter identified engine technologies that were improving fuel efficiency by more than 15 percent in the next generation of aircraft. With regard to CO_2 engine emissions standards, these commenters felt that

2014/02/18/remarks-president-fuel-efficiency-standards-medium-and-heavy-duty-vehicl (last accessed May 12, 2015).

[16] U.S. EPA. ''EPA and NHTSA Set Standards to Reduce Greenhouse Gases and *Improve Fuel Economy for Model Years 2017–2025 Cars and Light Trucks.*'' Office of Transportation and Air Quality Document No. EPA–420–F–12–051, August 2012. Available at *http://www.epa.gov/otaq/climate/documents/420f12051.pdf* (last accessed May 26, 2015). See also US EPA, 2012: *Regulatory Impact Analysis: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporation Average Fuel Economy Standards,* August, Document No. EPA–420–R–12–016, Table 7.4–2. Available at: *http://www.epa.gov/oms/climate/documents/420r12016.pdf* (last accessed May 12, 2015).

[17] 76 FR 57106 (September 15, 2011).

[18] Executive Office of the President, 2013: *The President's Climate Action Plan,* June 25. Available at: *http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf* (last accessed May 26, 2015).

[19] Executive Office of the President, 2013: *Presidential Memorandum—Power Sector Carbon Pollution Standards,* Office of the Press Secretary, June 25. Available at: *http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards* (last accessed May 12, 2015).

[20] U.S. EPA, 2014: *Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units; Proposed Rule,* 79 FR 1430 (January 8, 2014).

[21] U.S. EPA, 2014: *Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units; Proposed Rules,* 79 FR 34960 (June 18, 2014).

[22] U.S. EPA, 2014: *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule,* 79 FR 34830 (June 18, 2014).

[23] Executive Office of the President, 2013: *The President's Climate Action Plan* at 21, June. Available at: *http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf* (last accessed May 12, 2015).

[24] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013,* 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport* (last accessed May 12, 2015).

[25] Ibid.

[26] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change.* Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, pp. 599–670.

[27] As discussed in section V.B.2.c., fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 49 percent from 2010 to 2035, and this provides a scaling factor for growth in GHG emissions which would increase at a similar rate as the fuel burn by 2030, 2035, and 2040. FAA, 2015: *FAA Aerospace Forecast Fiscal Years 2015–2035,* 134 pp. Available at *https://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/aerospace_forecasts/2015–2035/media/2015_National_Forecast_Report.pdf* (last accessed May 12, 2015).

[28] Center for Biological Diversity, Center for Food Safety, Friends of the Earth, International Center for Technology Assessment, and Oceana, 2007: *Petition for Rulemaking Under the Clean air Act to Reduce the Emissions of Air Pollutants from Aircraft the Contribute to Global Climate Change,* December 5. Available at *http://www.epa.gov/otaq/aviation.htm* (last accessed May 12, 2015).

international CO_2 standards for aircraft engines were not necessary and that, if pursued, such standards would burden the industry and necessitate the development of new test procedures if CO_2 emissions standards were based on aircraft cruise conditions instead of landing and takeoff operations (LTO). Industry commenters also argued that other potential approaches to reducing aircraft related emissions, such as averaging of GHGs among existing aircraft fleets and cap-and-trade schemes as existed in the European Union, were beyond the scope of the EPA's authority under section 231 of the CAA. Finally, industry commenters noted that any program developed by the EPA should incentivize market forces and provide for flexibility.

State/local governments and NGO commenters felt strongly that the EPA had clear authority to find endangerment under section 231 and that there were multiple options to reduce aircraft emissions, so that the Agency must set a GHG emissions standard for aircraft engines as states were preempted from doing so under CAA section 233. These commenters also argued that GHG standards for aircraft engines could provide aircraft manufacturers the incentive to renew or redesign aircraft and to adopt advanced engines brought to market. In addition these commenters suggested that an engine GHG standard could be set as a function of thrust similar to ICAO's standard for oxides of nitrogen (NO_X)[29] and should also include provisions for an averaging, banking, and trading (ABT) program.[30] Some commenters also stated their support for fleet-wide (in-use fleet) emission reductions through a cap-and-trade system. Finally, these stakeholders stated that, absent the EPA rulemaking, quick international actions were unlikely and that the EPA should engage internationally to push for action on reducing CO_2 emissions from aircraft.

On July 31, 2008, Earthjustice, on behalf of Petitioners, notified the EPA of its intent to file suit under CAA section 304(a) against the EPA for the Agency's alleged unreasonable delay in responding to its aircraft petition and in making an endangerment finding under section 231. On June 11, 2010, Petitioners filed a complaint against the EPA in the U.S. District Court for the District of Columbia claiming that, among other things, the EPA had unreasonably delayed because it had failed to answer the 2007 Petition and to determine whether or not GHG emissions from aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health and/or welfare.

The District Court found that while CAA section 231 generally confers broad discretion to the EPA in determining what standards to promulgate, section 231(a)(2)(A) imposed a nondiscretionary duty on the EPA to make a finding with respect to endangerment from aircraft GHG emissions. *Center for Biological Diversity, et al.* v. *EPA,* 794 F. Supp. 2d 151 (D.D.C. 2011). This ruling was issued in response to EPA's motion to dismiss the case on jurisdictional grounds and did not address the merits of the Plaintiffs' claims regarding the Agency's alleged unreasonable delay. Therefore, it did not include an order for the EPA to make such a finding by a certain date. In a subsequent ruling on the merits, the Court found that the Plaintiffs had not shown that EPA had unreasonably delayed in making an endangerment determination regarding GHG emissions from aircraft. *Center for Biological Diversity, et al.* v. *EPA,* No. 1:10–985 (D.D.C. March, 20, 2012). Thus, the Court did not find the EPA to be liable based on the Plaintiffs' claims and did not place the Agency under a remedial order to make an endangerment finding or to issue standards. The Plaintiffs did not appeal this ruling to the U.S. Court of Appeals for the D.C. Circuit.

The EPA issued a Response to the Aircraft Petition[31] on June 27, 2012 stating our intention to move forward with a proposed endangerment finding for aircraft GHG emissions under section 231, while explaining that it would take the Agency significant time to complete this action. The EPA explained that the Agency would not begin this effort until after the U.S. Court of Appeals completed its then-pending review of the previous section 202 Endangerment Finding, since the then-awaited ruling might provide important guidance for the EPA in conducting future GHG endangerment findings. The EPA further explained that after receiving the Court of Appeal's ruling, it would take at least 22 months from that point for the Agency to conduct an additional finding regarding aircraft GHG emissions.

Meanwhile, the Court upheld EPA's section 202 findings in a decision of a three-judge panel on June 26, 2012, and denied petitions for rehearing of that decision on December 20, 2012. *Coalition for Responsible Regulation, Inc.,* v. *EPA,* 684 F.3d 102 (D.C. Cir. 2012), reh'g denied 2012 U.S. App. LEXIS 26315, 25997 (D.C. Cir. 2012).[32] Given these rulings, we are proceeding with this proposed findings regarding aircraft engine GHG emissions as a further step toward responding to the Petition for Rulemaking.

D. U.S. Aircraft Regulations and the International Community

The EPA and the Federal Aviation Administration (FAA) traditionally work within the standard-setting process of ICAO's Committee on Aviation Environmental Protection (CAEP) to establish international emission standards and related requirements. Historically, under this approach, international emission standards have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings under CAA section 231 to establish domestic standards equivalent to ICAO's standards where appropriate. This approach has been affirmed as reasonable by the U.S. Court of Appeals for the D.C. Circuit. *NACAA* v. *EPA,* 489 F.3d 1221, 1230–32 (D.C. Cir. 2007). After EPA promulgates aircraft engine emissions standards, CAA section 232 requires the FAA to issue subsequent regulations to ensure compliance with these standards when issuing certificates under its United States Code Title 49 authority. In exercising the EPA's standard-setting and FAA's enforcement authorities, we expect to proceed using a similar approach for the future CAA section 231 aircraft engine

[29] Sections II.D.1 and II.E provide an overview of the history ICAO's regulation of aircraft engine NO_X emissions from 1981 through 2012 and the EPA's adoption of equivalent aircraft engine NO_X standards under the CAA.

[30] ABT programs have been utilized in a number of Clean Air Act programs to provide greater flexibilities that lower overall costs by allowing a manufacturer to comply with performance standards through averaging emissions among the vehicles it manufactures. Companies that achieve extra pollution reductions can bank these as 'credits'' and then 'trade or sell' emission credits to other companies, typically those that face higher costs to control pollution. Well-designed ABT programs can sometimes achieve greater emissions reductions at less cost and provide incentives for technology innovation.

[31] U.S. EPA, 2012: *Memorandum in Response to Petition Regarding Greenhouse Gas Emissions from Aircraft,* June 14. Available at *http://www.epa.gov/otaq/aviation.htm* (last accessed May 12, 2015) and Docket EPA–HQ–OAR–2014–0828.

[32] Petitions for *certiorari* were filed in the Supreme Court, and the Supreme Court granted six of those petitions but ''agreed to decide only one question: ''Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases''. *Utility Air Reg. Group* v. *EPA,* 134 S. Ct. 2427, 2438 (2014); *see also Virginia* v. *EPA,* 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA,* 134 S. Ct. 418 (2013), and *CRR,* 134 S. Ct. 468 (2013) (all denying cert.). Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding.

GHG standard (which may take the form of a CO_2 standard), provided the EPA issues final positive endangerment and cause or contribute findings under CAA section 231. This approach is contingent on ICAO's adoption of an international aircraft CO_2 standard that is consistent with CAA section 231 and is appropriate for domestic needs in the United States.

1. International Regulations and U.S. Obligations

As noted above, we have worked with the FAA since 1973, and later with ICAO, to develop domestic and international standards and other recommended practices pertaining to aircraft engine emissions. ICAO is a United Nations (UN) specialized agency, established in 1944 by the Convention on International Civil Aviation (Chicago Convention), ''in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically.'' [33] ICAO sets standards and regulations necessary for aviation safety, security, efficiency, capacity and environmental protection, and serves as the forum for cooperation in all fields of international civil aviation. ICAO works with the Chicago Convention's member States and global aviation organizations to develop international Standards and Recommended Practices (SARPs), which member States reference when developing their legally-enforceable national civil aviation regulations. The U.S. is currently one of 191 participating ICAO member States.[34] [35]

In the interest of global harmonization and international air commerce, the Chicago Convention urges its member States to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures and organization. The Chicago Convention also recognizes that member States may adopt standards that are more stringent than those agreed upon by ICAO. Any member State which finds it impracticable to comply in all respects with any international standard or procedure, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, is required to give immediate notification to ICAO of the differences between its own practice and that established by the international standard.[36]

ICAO's work on the environment focuses primarily on those problems that benefit most from a common and coordinated approach on a worldwide basis, namely aircraft noise and engine emissions. Standards and Recommended Practices (SARPs) for the certification of aircraft noise and aircraft engine emissions are covered by Annex 16 of the Chicago Convention. To continue to address aviation environmental issues, in 2004, ICAO established three environmental goals: (1) Limit or reduce the number of people affected by significant aircraft noise; (2) limit or reduce the impact of aviation emissions on local air quality; and (3) limit or reduce the impact of aviation greenhouse gas emissions on the global climate.

The Convention has a number of other features that govern international commerce. First, member States that wish to use aircraft in international transportation must adopt emissions standards and other recommended practices that are at least as stringent as ICAO's standards. Member States may ban the use of any aircraft within their airspace that does not meet ICAO standards.[37] Second, member States are required to recognize the airworthiness certificates of any State whose standards are at least as stringent as ICAO's standards, thereby assuring that aircraft of any member State will be permitted to operate in any other member State.[38] Third, to ensure that international commerce is not unreasonably constrained, a member State which elects to adopt more stringent domestic emission standards is obligated to notify ICAO of the differences between its standards and ICAO standards.[39]

ICAO's CAEP, which consists of Members and Observers from States, intergovernmental and non-governmental organizations representing aviation industry and environmental interests, undertakes ICAO's technical work in the environmental field. The Committee is responsible for evaluating, researching, and recommending measures to the ICAO Council that address the environmental impacts of international civil aviation. CAEP's terms of reference indicate that ''CAEP's assessments and proposals are pursued taking into account: technical feasibility; environmental benefit; economic reasonableness; interdependencies of measures (for example, among others, measures taken to minimize noise and emissions); developments in other fields; and international and national programs.'' [40] CAEP is composed of various task groups, work groups, and other committees whose contributing members include atmospheric, economic, aviation, environmental, and other professionals interested in and knowledgeable about aviation and environmental protection. The ICAO Council reviews and adopts the recommendations made by CAEP. It then reports to the ICAO Assembly, the highest body of the Organization, where the main policies on aviation environmental protection are adopted and translated into Assembly Resolutions.

At CAEP meetings, the U.S. is represented by the FAA and plays an active role.[41] The EPA has historically been a principal participant in various ICAO/CAEP working groups and other international venues, assisting and advising FAA on aviation emissions, technology, and policy matters. In turn, the FAA assists and advises the EPA on

[33] ICAO, 2006: *Convention on International Civil Aviation, Ninth Edition,* Document 7300/9. Available at: *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015).

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[34] Members of ICAO's Assembly are generally termed member States or contracting States. These terms are used interchangeably throughout this preamble.

[35] There are currently 191 Contracting States according to ICAO's Web site: *www.icao.int* (last accessed May 12, 2015).

[36] ICAO, 2006: *Doc 7300-Convention on International Civil Aviation, Ninth edition,* Document 7300/9. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Document 7300 is found on page 1 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. 7300.

[37] ICAO, 2006: *Convention on International Civil Aviation, Article 87, Ninth Edition,* Document 7300/9. Available *at http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[38] ICAO, 2006: *Convention on International Civil Aviation, Article 33, Ninth Edition,* Document 7300/9. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[39] ICAO, 2006: *Convention on International Civil Aviation, Article 38, Ninth Edition,* Document 7300/9. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Document 7300 is found on page 1 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. 7300.

[40] CAEP's terms of reference are available at *http://www.icao.int/environmental-protection/Pages/Caep.aspx#ToR* (last accessed May 12, 2015).

[41] Pursuant to the President's memorandum of August 11, 1960 (and related Executive Order No. 10883 from 1960), the Interagency Group on International Aviation (IGIA) was established to facilitate coordinated recommendations to the Secretary of State on issues pertaining to international aviation. The DOT/FAA is the chair of IGIA, and as such, the FAA represents the U.S. on environmental matters at CAEP.

aviation technology and certification matters. If ICAO adopts a CAEP proposal for a new environmental standard, it then becomes part of ICAO standards and recommended practices (Annex 16 to the Chicago Convention).[42 43]

The first international standards and recommended practices for aircraft engine emissions were recommended by CAEP's predecessor, the Committee on Aircraft Engine Emissions (CAEE), and adopted by ICAO in 1981.[44] These standards limited aircraft engine emissions of hydrocarbons, carbon monoxide, and NO_X. The 1981 standards applied to newly manufactured engines, which are those engines built after the effective date of the regulations—also referred to as in-production engines. In 1993, ICAO adopted a CAEP/2 proposal to tighten the original NO_X standard by 20 percent and amend the test procedures.[45] These 1993 standards applied both to newly-certified turbofan engines, which are those engine models that received their initial type certificate after the effective date of the regulations—also referred to as newly-certified engines or new engine designs—and to in-production engines, but with different effective dates for newly-certified engines and in-production engines. In 1995, CAEP/3 recommended a further tightening of the NO_X standards by 16 percent and additional test procedure amendments, but in 1997 the ICAO Council rejected this stringency proposal and approved only the test procedure amendments. At the CAEP/4 meeting in 1998, the Committee adopted a similar 16 percent NO_X reduction proposal, which ICAO approved in 1998. The CAEP/4 standards applied only to new engine designs certified (or newly-certified engines) after December 31, 2003 (*i.e.,* unlike the CAEP/2 standards, the CAEP/4 requirements did not apply to in-production engines). In 2004, CAEP/6 recommended a 12 percent NO_X reduction, which ICAO approved in 2005.[46 47] The CAEP/6 standards applied to new engine designs certified after December 31, 2007. In 2010, CAEP/8 recommended a further tightening of the NO_X standards by 15 percent for new engine designs certified after December 31, 2013.[48 49] The Committee also recommended that the CAEP/6 standards be applied to in-production engines (eliminating the production of CAEP/4 compliant engines with the exception of spare engines). ICAO approved these recommendations in 2011, then equivalent standards (to CAEP/6 and CAEP/8 standards) were promulgated domestically in 2012 by the EPA in consultation with FAA.[50]

2. The International Community's Reasons for Addressing Aircraft GHG Emissions

In October 2010, the 37th Assembly (Resolution A37–19) of ICAO requested the development of an ICAO CO_2 emissions standard.[51] Also, Resolution A37–19 provided a framework towards the achievement of an environmentally sustainable future for international aviation. With this Resolution, the ICAO Assembly agreed to a global aspirational goal for international aviation of improving annual fuel efficiency by two percent and stabilizing CO_2 emissions at 2020 levels.[52] The Resolution included the following statements regarding ICAO policies and practices related to climate change.

—. . . ICAO and its member States recognize the importance of providing continuous leadership to international civil aviation in limiting or reducing its emissions that contribute to global climate change;
—Reemphasizing the vital role which international aviation plays in global economic and social development and the need to ensure that international aviation continues to develop in a sustainable manner;
—. . . the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system; and
—Acknowledging that international aviation emissions, currently accounting for less than 2 per cent of total global CO_2 emissions, are projected to grow as a result of the continued development of the sector.

As the above statements indicate, reducing climate impacts of international aviation is a critical element of ICAO's strategic objective of achieving environmental protection and sustainable development of air transport. ICAO is currently pursuing a comprehensive set of measures to reduce aviation's climate impact, including alternative fuels, CO_2 emissions technology-based standards, operational improvements, and market based measures. The development and adoption of a CO_2 emissions standard is an important part of ICAO's comprehensive set of measures.

3. Relationship of the EPA's Proposed Endangerment and Cause or Contribute Findings to International Aircraft Standards

As described earlier, the EPA and the FAA work within the ICAO/CAEP standard setting process to establish international emission standards and related requirements. Under this approach international emission standards have first been adopted by

[42] ICAO, 2008: *Aircraft Engine Emissions,* International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Third Edition, July. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[43] CAEP develops new emission standards based on an assessment of the technical feasibility, cost, and environmental benefit of potential requirements.

[44] ICAO, 2008: *Aircraft Engine Emissions: Foreword,* International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Third Edition, July. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. AN16–2.

[45] CAEP conducts its work over a period of years. Each work cycle is numbered sequentially and that identifier is used to differentiate the results from one CAEP to another by convention. The first technical meeting on aircraft emission standards was CAEP's successor, *i.e.,* CAEE. The first meeting of CAEP, therefore, is referred to as CAEP/2.

[46] CAEP/5 did not address new aircraft engine emission standards.

[47] ICAO, 2008: *Aircraft Engine Emissions,* Annex 16, Volume II, Third Edition, July 2008, Amendment 5 effective on July 11, 2005. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. AN16–2.

[48] CAEP/7 did not address new aircraft engine emission standards.

[49] ICAO, 2010: *Committee on Aviation Environmental Protection (CAEP), Report of the Eighth Meeting, Montreal, February 1–12, 2010,* CAEP/8–WP/80 Available in Docket EPA–HQ–OAR–2010–0687.

[50] ICAO, 2011: *Aircraft Engine Emissions,* Annex 16, Volume II, Third Edition, July 2008, Amendment 7 effective on July 18, 2011. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. AN16–2/E/10 (last accessed February 5, 2015). U.S. EPA, 2012: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 77 FR 36342 (June 18, 2012).

[51] A consolidated statement of continuing policies and practices related to environmental protection (known as Assembly Resolutions) is revised and updated by the Council every three years for adoption by the ICAO Assembly. ICAO, 2010: *Resolutions Adopted by the Assembly, 37th Session, Montreal, September 29–October 8, 2010,* Provisional Edition, November.

[52] The global aspirational goal for international aviation of improving annual fuel efficiency by 2 percent is for the annual international civil aviation in-service fleet. Fuel efficiency is measured on the basis of the volume of fuel used per revenue tonne kilometer performed. (ICAO, CAEP, *Aspirational Goals and Implementation Options,* HLM–ENV/09–WP/5, High-Level Meeting on International Aviation and Climate Change, Presented by the Secretariat, Montreal, October 7 to 9, 2009. Available at *http://www.icao.int/Meetings/AMC/MA/High%20Level%202009/hlmenv_wp005_en.pdf* (last accessed May 12, 2015).

ICAO (with U.S. participation and agreement), and subsequently the EPA has initiated rulemakings under CAA section 231 to establish domestic aircraft engine emission standards that are of at least equivalent stringency as ICAO's standards. This approach has been affirmed as reasonable by the U.S. Court of Appeals for the D.C. Circuit. *NACAA* v. *EPA,* 489 F.3d 1221, 1230–32 (D.C. Cir. 2007). In exercising the EPA's standard-setting authority, provided the EPA makes positive endangerment and cause or contribute findings under CAA section 231 and ICAO adopts an international aircraft CO_2 standard that is consistent with CAA section 231 and is appropriate for domestic needs in the United States, the EPA expects to proceed along a similar approach for the future CAA section 231 aircraft GHG standard (or aircraft CO_2 standard).

We anticipate that ICAO/CAEP will adopt a final aircraft CO_2 emissions standard in February 2016. This proposal, and any final endangerment and cause or contribute finding for aircraft GHG emissions, are part of preparing for the possible subsequent domestic rulemaking process to adopt standards that are of at least equivalent stringency as the anticipated ICAO CO_2 standards. These findings, which are factual and science-based, encompass a determination of whether GHG emissions from aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. If positive findings are made, the EPA will be obligated under section 231 of the CAA to set emission standards applicable to GHG emissions from the classes of aircraft engines for which the EPA makes the cause or contribute finding. If positive findings are not made, the EPA will not have triggered its obligation to set GHG emission standards under CAA section 231.

The EPA has worked diligently over the past four years within the ICAO/CAEP process on a range of technical issues regarding aircraft CO_2 emission standards. The ANPR that accompanies this proposal, in Section VI, discusses the issues arising in the ongoing international proceedings and U.S. input to CAEP regarding the international CO_2 standard to help ensure transparency about this process. In addition, in the ANPR the EPA requests public comments on a variety of issues to assist the Agency in developing its position with regard to these issues and the aircraft engine GHG emission standards that it may potentially adopt under the CAA.

E. The EPA's Regulation of Aircraft Emissions

As required by the CAA, the EPA has been engaged in reducing harmful air pollution from aircraft engines for over 40 years. In 1973, the EPA began to regulate gaseous exhaust emissions, smoke, and fuel venting from aircraft engines.[53] We have occasionally revised these regulations. In a 1997 rulemaking, for example, we made our emission standards and test procedures more consistent with those of ICAO's CAEP for turbofan engines used in commercial aviation with rated thrusts greater than 26.7 kilonewtons. These ICAO requirements are generally referred to as CAEP/2 standards.[54] That action included new NO_X emission standards for newly manufactured commercial turbofan engines (as described earlier, those engines built after the effective date of the regulations that were already certified to pre-existing standards—also referred to as in-production engines)[55] and for newly-certified commercial turbofan engines (as described earlier, those engine models that received their initial type certificate after the effective date of the regulations—also referred to as new engine designs).[56] It also included a carbon monoxide emission standard for in-production commercial turbofan engines.[57] In 2005, we promulgated more stringent NO_X emission standards for newly-certified commercial turbofan engines.[58] That final rule brought the U.S. standards closer to alignment with ICAO CAEP/4 requirements that became effective in 2004. In 2012, we issued more stringent two-tiered NO_X emission standards for newly-certified and in-production commercial and non-commercial turbofan aircraft engines, and these NO_X standards align with ICAO's CAEP/6 and CAEP/8 requirements that became effective in 2013 and 2014, respectively.[59] [60]

The EPA's actions to regulate certain pollutants emitted from aircraft engines come directly from its authority in section 231 of the CAA, and we have aligned the U.S. emissions requirements with those promulgated by ICAO. In addressing CO_2 emissions, however, ICAO has moved to regulating a whole aircraft. This ICAO extension beyond pollutant emissions from engines to the whole aircraft was described in a 2013 ICAO circular.[61] Several factors are considered when addressing whole-aircraft CO_2 emissions, as the CO_2 emissions are influenced by aerodynamics, weight, and engine-specific fuel consumption. Since each of these factors may affect aircraft engine fuel consumption, they ultimately affect CO_2 emissions. Rather than viewing CO_2 as a measurable emission from engines, therefore, ICAO now addresses CO_2 emissions as a characteristic applicable to the entirety of the aircraft based on fuel consumption. In this proposed action, we are giving advance notice that the EPA may propose to adopt domestic GHG emission standards (which may take the form of CO_2 standards) for aircraft engines used in covered aircraft as an outgrowth of the international negotiations that commenced in 2010 under the auspices ICAO/CAEP. Such standards could then discharge the EPA's duties under CAA sections 231(a)(2)(A) and 231(a)(3), if triggered by final positive endangerment and cause or contribute findings, to ''issue proposed emission standards applicable to the emission of'' GHG

[53] U.S. EPA, 1973: *Emission Standards and Test Procedures for Aircraft; Final Rule,* 38 FR 19088 (July 17, 1973).

[54] The full CAEP membership meets every three years and each session is denoted by a numerical identifier. For example, the second meeting of CAEP is referred to as CAEP/2, and CAEP/2 occurred in 1994.

[55] This does not mean that in 1997 we promulgated requirements for the re-certification or retrofit of existing in-use engines.

[56] In the existing EPA regulations, 40 CFR part 87, newly-certified aircraft engines are described as engines of a type or model of which the date of manufacture of the first individual production model was after the implementation date. Newly manufactured aircraft engines are characterized as engines of a type or model for which the date of manufacturer of the individual engine was after the implementation date.

[57] U.S. EPA, 1997: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 62 FR 25355 (May 8, 1997).

[58] U.S. EPA, 2005: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 70 FR 2521 (November 17, 2005).

[59] U.S. EPA, 2012: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 77 FR 36342 (June 18, 2012).

[60] While ICAO's standards were not limited to ''commercial'' aircraft engines, our 1997 standards were explicitly limited to commercial engines, as our finding that NO_X and carbon monoxide emissions from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare was so limited. See 62 FR 25358 (May 8, 1997). In the 2012 rulemaking, we expanded the scope of that finding and of our standards pursuant to Section 231(a)(2)(A) of the Clean Air Act to include such emissions from both commercial and non-commercial aircraft engines based on the physical and operational similarities between commercial and noncommercial civilian aircraft and to bring our standards into full alignment with ICAO's.

[61] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard*, Circular (Cir) 337, AN/192. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

from aircraft engines and to issue final ''regulations with such modifications as [she] deems appropriate.''

III. Legal Framework for This Action

The EPA has previously made an endangerment finding for GHGs under Title II of the CAA, in the 2009 Endangerment Finding for section 202(a) source categories. In the 2009 Endangerment Finding, the EPA explained its legal framework for making an endangerment finding under section 202(a) of the CAA (74 FR 18886, 18890–94 (April 24, 2009), and 74 FR 66496, 66505–10 (December 15, 2009)). The text in section 202(a) that was the basis for the 2009 Endangerment Finding addresses ''the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in [the Administrator's] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' Similarly, section 231(a)(2)(A) concerns ''the emission of any air pollutant from any class or classes of aircraft engines which in [the Administrator's] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' Thus, the text of the CAA section concerning aircraft emissions in section 231(a)(2)(A) mirrors the text of CAA section 202(a) that was the basis for the 2009 Endangerment Finding.

The EPA's approach in the 2009 Endangerment Finding (described below in Sections III.A and III.B) was affirmed by the U.S. Court of Appeals for the D.C. Circuit in *Coalition for Responsible Regulation, Inc.* v. *EPA,* 684 F.3d 102 (D.C. Cir. 2012), reh'g denied 2012 U.S. App. LEXIS 26313, 26315, 25997 (D.C. Cir 2012) (*CRR*). In particular, the D.C. Circuit ruled that the 2009 Endangerment Finding (including the agency's denial of petitions for reconsideration of that Finding) was not arbitrary or capricious, was consistent with the U.S. Supreme Court's decision in *Massachusetts* v. *EPA* and the text and structure of the CAA, and was adequately supported by the administrative record. *CRR,* 684 F.3d at 116–128. The D.C. Circuit found that the EPA had based its decision on ''substantial scientific evidence'' and noted that the EPA's reliance on major scientific assessments was consistent with the methods that decision-makers often use to make a science-based judgment. *Id.* at 120–121. Petitions for certiorari were filed in the Supreme Court, and the Supreme Court granted six of those petitions but ''agreed to decide only one question: 'Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.''' *Utility Air Reg. Group* v. *EPA,* 134 S. Ct. 2427, 2438 (2014); see also *Virginia* v. *EPA,* 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA,* 134 S. Ct. 418 (2013), and *CRR,* 134 S. Ct. 468 (2013) (all denying cert.). Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding. Accordingly, the Agency proposes that it is reasonable to use that same approach under section 231(a)(2)(A)'s similar endangerment text, and as explained in the following discussion, is acting consistently with that judicially sanctioned framework for purposes of this proposed section 231 finding.

Two provisions of the CAA govern this proposal. Section 231(a)(2)(A) sets forth a two-part predicate for regulatory action under that provision: Endangerment and cause or contribute. Section 302 of the Act contains definitions of the terms ''air pollutant'' and ''welfare'' used in section 231(a)(2)(A). These statutory provisions are discussed below.

A. Section 231(a)(2)(A)—Endangerment and Cause or Contribute

As noted above, section 231(a)(2)(A) of the CAA (like section 202(a)) calls for the Administrator to exercise her judgment and make two separate determinations: First, whether the relevant kind of air pollution—here, GHGs—may reasonably be anticipated to endanger public health or welfare, and second, whether emissions of any air pollutant from classes of the sources in question (aircraft engines under section 231 and new motor vehicles or engines under section 202) cause or contribute to this air pollution.[62]

The Administrator interprets the two-part test required under section 231(a)(2)(A) as being the same as that explained in the 2009 Endangerment Finding. (*See* 74 FR 66505–06, December 15, 2009.) As in the section 202(a) context, this analysis entails a scientific judgment by the Administrator about the potential risks posed by GHG emissions to public health and welfare. *See CRR,* 684 F.3d at 117–118.[63]

In making this scientific judgment, the Administrator is guided by five principles. First, the Administrator is required to protect public health and welfare. She is not asked to wait until harm has occurred but instead must be ready to take regulatory action to prevent harm before it occurs.[64] The Administrator is thus to consider both current and future risks.

Second, the Administrator is to exercise judgment by weighing risks, assessing potential harms, and making reasonable projections of future trends and possibilities. It follows that when exercising her judgment the Administrator balances the likelihood and severity of effects. This balance involves a sliding scale: On one end the severity of the effects may be significant, but the likelihood low, while on the other end the severity may be less significant, but the likelihood high.[65] At different points along this scale, the Administrator is permitted to find endangerment. Accordingly, the Administrator need not set a precise or minimum threshold of risk or harm as part of making an endangerment finding, but rather may base her determination on '''a lesser risk of greater harm . . . or a greater risk of lesser harm' or any combination in between.'' *CRR,* 684 F.3d at 123 (quoting *Ethyl Corp.* v. *EPA,* 541 F.2d, 1, 18 (D.C. Cir. 1976)).

Third, because scientific knowledge is constantly evolving, the Administrator may be called upon to make decisions while recognizing the uncertainties and limitations of the data or information available, as risks to public health or welfare may involve the frontiers of scientific or medical knowledge.[66] At the same time, the Administrator must exercise reasoned decision making, and avoid speculative inquiries.

Fourth, the Administrator is to consider the cumulative impact of sources of a pollutant in assessing the risks from air pollution, and is not to look only at the risks attributable to a single source or class of sources. We additionally note that in making an endangerment finding, the Administrator is not limited to

[62] *See CRR,* 684 F.3d at 117 (explaining two-part analysis under section 202(a)).

[63] When agencies such as the EPA make determinations based on review of scientific data within their technical expertise, those decisions are given an ''extreme degree of deference'' by the D.C. Circuit, and as that court noted in reviewing the 2009 endangerment finding, ''although we perform a searching and careful inquiry into the facts underlying the agency's decisions, we will presume the validity of the agency action as long as a rational basis for it is presented.'' *CRR,* 684 F.3d at 120 (internal citations and marks omitted).

[64] *See id.* at 121–122.

[65] *See id.* at 122–123 (noting that the §202(a)(1) inquiry ''necessarily entails a case-by-case, sliding scale approach'' because endangerment is '''composed of reciprocal elements of risk and harm, or probability and severity''' (quoting *Ethyl Corp.* v. *EPA,* 541 F.2d, 1, 18 (D.C. Cir. 1976)).

[66] See *id.* at 121–122.

considering only those impacts that can be traced to the amount of air pollution directly attributable to the GHGs emitted by the subject source classes. Such an approach would collapse the two prongs of the test by requiring that any climate change impacts upon which an endangerment determination is made result solely from the GHG emissions of aircraft. *See* 74 FR 66542, December 15, 2009 (explaining the same point in the context of analogous language in section 202(a)). Similarly, the Administrator is not, in making the endangerment and cause or contribute findings, to consider the effect of emissions reductions from the resulting standards.[67] The threshold endangerment and cause or contribute criteria are separate and distinct from the standard setting criteria that apply if the threshold findings are met, and they serve a different purpose. Indeed, the more serious the endangerment to public health and welfare, the more important it may be that action be taken to address the actual or potential harm even if no one action alone can solve the problem, and a series of actions is called for.

Fifth, the Administrator is to consider the risks to all parts of our population, including those who are at greater risk for reasons such as increased susceptibility to adverse health effects. If vulnerable subpopulations are especially at risk, the Administrator is entitled to take that point into account in deciding the question of endangerment. Here too, both likelihood and severity of adverse effects are relevant. As explained previously in the 2009 Endangerment Finding and as reiterated below for this proposed section 231 finding, vulnerable subpopulations face serious health risks as a result of climate change.

As the Supreme Court recognized in *Massachusetts* v. *EPA,* 549 U.S. at 534, the EPA may make an endangerment finding despite the existence of ''some residual uncertainty'' in the scientific record. *See also CRR,* 684 F.2d at 122. Thus, this framework recognizes that regulatory agencies such as the EPA must be able to deal with the reality that ''[m]an's ability to alter his environment has developed far more rapidly than his ability to foresee with certainty the effects of his alterations.'' *See Ethyl Corp* v. *EPA,* 541 F.2d 1, 6 (D.C. Cir.), cert. denied 426 U.S. 941 (1976). Both ''the Clean Air Act 'and common sense * * * demand regulatory action to prevent harm, even if the regulator is less than certain that harm is otherwise inevitable.'''' *See Massachusetts* v. *EPA,* 549 U.S. at 506, n.7 (citing *Ethyl Corp.*); *see also CRR,* 684 F.3d at 121–122.

In the 2009 Endangerment Finding, the Administrator recognized that the scientific context for an action addressing climate change was unique at that time because there was a very large and comprehensive base of scientific information that had been developed over many years through a global consensus process involving numerous scientists from many countries and representing many disciplines. 74 FR 66506, December 15, 2009. That informational base has since grown. The Administrator also previously recognized that there are varying degrees of uncertainty across many of these scientific issues, which remains true. It is in this context that she is exercising her judgment and applying the statutory framework in this proposed section 231 finding. Further discussion of the language in section 231(a)(2)(A), and parallel language in 202(a), is provided below to explain more fully the basis for this interpretation, which the D.C. Circuit upheld in the 202(a) context.

1. The Statutory Language

The interpretation described above flows from the statutory language itself. The phrase ''may reasonably be anticipated'' and the term ''endanger'' in section 231(a)(2)(A) (as in section 202(a)) authorize, if not require, the Administrator to act to prevent harm and to act in conditions of uncertainty. They do not limit her to merely reacting to harm or to acting only when certainty has been achieved; indeed, the references to anticipation and to endangerment imply that to fail to look to the future or to less than certain risks would be to abjure the Administrator's statutory responsibilities. As the D.C. Circuit explained, the language ''may reasonably be anticipated to endanger public health or welfare'' in CAA §202(a) requires a ''precautionary, forward-looking scientific judgment about the risks of a particular air pollutant, consistent with the CAA's precautionary and preventive orientation.'' *CRR,* 684 F.3d at 122 (internal citations omitted). The court determined that ''[r]equiring that EPA find 'certain' endangerment of public health or welfare before regulating greenhouse gases would effectively prevent EPA from doing the job that Congress gave it in §202(a)—utilizing emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm.'' *Id.* The same language appears in section 231(a)(2)(A), and the same interpretation applies in that context.

Moreover, by instructing the Administrator to consider whether emissions of an air pollutant cause or contribute to air pollution in the second part of the two-part test, the Act makes clear that she need not find that emissions from any one sector or class of sources are the sole or even the major part of an air pollution problem. The use of the term ''contribute'' clearly indicates that such emissions need not be the sole or major cause of the pollution. Finally, the phrase ''in [her] judgment'' authorizes the Administrator to weigh risks and to consider projections of future possibilities, while also recognizing uncertainties and extrapolating from existing data.

Finally, when exercising her judgment in making both the endangerment and cause-or-contribute findings, the Administrator balances the likelihood and severity of effects. Notably, the phrase ''in [her] judgment'' modifies both ''may reasonably be anticipated'' and ''cause or contribute.''

2. How the Origin of the Current Statutory Language Informs the EPA's Interpretation of Section 231(a)(2)(A)

In the proposed and final 2009 Endangerment Finding, the EPA explained that when Congress revised the section 202(a) language that governed that finding, along with other provisions, as part of the 1977 amendments to the CAA, it was responding to decisions issued by the D.C. Circuit in *Ethyl Corp.* v. *EPA* regarding the pre-1977 version of section 211(c) of the Act. 74 FR 18891, (April 24, 2009); *see also* 74 FR 66506, (December 15, 2009). Section 231 was one of those other CAA provisions included in the 1977 amendments; therefore, the Agency's discussion for the 2009 Endangerment Finding regarding the history of section 202 and how it supports the EPA's approach is also relevant for section 231. The legislative history of those amendments, particularly the report by the House Committee on Interstate and Foreign Commerce, demonstrates that the EPA's interpretation of the section 231(a)(2)(A) language as set forth here in support of the Agency's section 231 finding (which is the same as its interpretation of the parallel language in section 202(a) as explained in the 2009 Endangerment Finding), is fully consistent with Congress' intention in crafting these provisions. See H.R. Rep. 95–294 (1977),

[67] As the D.C. Circuit explained in reviewing the 2009 Endangerment Finding under analogous language in section 202(a): ''At bottom, §202(a)(1) requires EPA to answer only two questions: Whether particular 'air pollution'—here, greenhouse gases—'may reasonably be anticipated to endanger public health or welfare,' and whether motor-vehicle emissions 'cause, or contribute to' that endangerment.'' *CRR,* 648 F.3d at 117.

as reprinted in 4 A Legislative History of the Clean Air Act Amendments of 1977 (1978) at 2465 (hereinafter LH).[68]

The legislative history clearly indicates that the House Committee believed the *Ethyl Corp.* decisions posed several ''crucial policy questions'' regarding the protection of public health and welfare. H.R. Rep. 95–294 at 48, 4 LH at 2515.[69] The following paragraphs summarize the *en banc* decision in *Ethyl Corp.* v. *EPA* and describe how the House Committee revised the endangerment language in the 1977 amendments to the CAA to serve several purposes consistent with that decision. In particular, the language: (1) Emphasizes the preventive or precautionary nature of the CAA[70]; (2) authorizes the Administrator to reasonably project into the future and weigh risks; (3) assures the consideration of the cumulative impact of all sources; (4) instructs that the health of susceptible individuals, as well as healthy adults, should be part of the analysis; and (5) indicates an awareness of the uncertainties and limitations in information available to the Administrator. H.R. rep. 95–294 at 49–50, 4 LH 2516–17.[71]

In revising the statutory language, Congress relied heavily on the *en banc* decision in *Ethyl Corp.* v. *EPA,* which reversed a 3-judge panel opinion regarding an EPA rule restricting the content of lead in leaded gasoline.[72] After reviewing the relevant facts and law, the full court evaluated the statutory language at issue to see what level of ''certainty [was] required by the Clean Air Act before EPA may act.'' 541 F.2d at 7.

The petitioners argued that the statutory language ''will endanger'' required proof of actual harm, and that the actual harm had to come from emissions from the fuels in and of themselves. *Id.* at 12, 29. The *en banc* court rejected this approach, finding that the term ''endanger'' allowed the Administrator to act when harm is threatened, and did not require proof of actual harm. *Id.* at 13. ''A statute allowing for regulation in the face of danger is, necessarily, a precautionary statute.'' *Id.* Optimally, the court held, regulatory action would not only precede, but prevent, a perceived threat. *Id.*

The court also rejected petitioner's argument that any threatened harm must be ''probable'' before regulation was authorized. Specifically, the court recognized that danger ''is set not by a fixed probability of harm, but rather is composed of reciprocal elements of risk and harm, or probability and severity.'' *Id.* at 18. Next, the court held that the EPA's evaluation of risk is necessarily an exercise of judgment, and that the statute did not require a factual finding. *Id.* at 24. Thus, ultimately, the Administrator must ''act, in part on 'factual issues,' but largely 'on choices of policy, on an assessment of risks, [and] on predictions dealing with matters on the frontiers of scientific knowledge * * *.'' *Id.* at 29 (citations omitted). Finally, the *en banc* court agreed with the EPA that even without the language in section 202(a) (which is also in section 231(a)(2)(A)) regarding ''cause or contribute to,'' it was appropriate for the EPA to consider the cumulative impact of lead from numerous sources, not just the fuels being regulated under section 211(c). *Id.* at 29–31.

The dissent in the original *Ethyl Corp.* decision and the en banc opinion were of ''critical importance'' to the House Committee which proposed the revisions to the endangerment language in the 1977 amendments to the CAA. H.R. Rep. 95–294 at 48, 4 LH at 2515. The Committee addressed those questions with the language that now appears in section 231(a)(2)(A) and several other CAA provisions—''emission of any air pollutant * * * which in [the Administrator's] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.''

As noted above in section III.A.1, the phrase ''in [her] judgment'' calls for the Administrator to make a comparative assessment of risks and projections of future possibilities, consider uncertainties, and extrapolate from limited data. Thus, the Administrator must balance the likelihood of effects with the severity of the effects in reaching her judgment. The Committee emphasized that the Administrator's exercise of ''judgment''[73] may include making projections, assessments and estimates that are reasonable, as opposed to a speculative or '''crystal ball' inquiry.'' Moreover, procedural safeguards apply to the exercise of judgment, and final decisions are subject to judicial review. Also, the phrase ''in [her] judgment'' modifies both the phrases ''cause and contribute'' and ''may reasonably be anticipated,'' as discussed above. H.R. Rep. 95–294 at 50–51, 4 LH at 2517–18.

As the Committee further explained, the phrase ''may reasonably be anticipated'' points the Administrator in the direction of assessing current and future risks rather than waiting for proof of actual harm. This phrase is also intended to instruct the Administrator to consider the limitations and difficulties inherent in information on public health and welfare. H.R. Rep. 95–294 at 51, 4 LH at 2518.[74]

Finally, the phrase ''cause or contribute'' ensures that all sources of the contaminant which contribute to air pollution are considered in the endangerment analysis (*e.g.,* not a single source or category of sources). It is also intended to require the Administrator to consider all sources of exposure to a pollutant (for example, food, water, and air) when determining risk. *Id.*

3. Additional Considerations for the Cause or Contribute Analysis

By instructing the Administrator to consider whether emissions of an air pollutant cause or contribute to air pollution, the statute is clear that she need not find that emissions from any one sector or class of sources are the sole or even the major part of an air pollution problem. The use of the term

[68] The committee explained that its action addressed not only section 211(c)(1)(A) but rather the entire proposal, and would thus apply its interpretation to all other sections of the Act relating to public health protection. 4 LH at 2516. It also noted that it had used the same basic formulation in section 202 and section 231, as well as in other sections. *Id.* at 2517.

[69] The Supreme Court recognized that the current language in section 202(a)(1), which uses the same formulation as that in section 231(a)(2)(A), is ''more protective'' than the 1970 version that was similar to the section 211 language before the D.C. Circuit in *Ethyl Corp. Massachusetts* v. *EPA,* 549 U.S. at 506, fn 7.

[70] *See* H.R. Rep. 95–294 at 49, 4 LH at 2516 (''To emphasize the preventive or precautionary nature of the Act, *i.e.* to assure that regulatory action can effectively prevent harm before it occurs'').

[71] Congress also standardized this language across the various sections of the CAA which address emissions from both stationary and mobile sources. H.R. Rep. 95–294 at 50, 4 LH at 2517; section 401 of the CAA Amendments of 1977.

[72] At the time of the 1973 rules requiring the reduction of lead in leaded gasoline, section 211(c)(1)(A) of the CAA stated that the Administrator may promulgate regulations that: ''Control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle or motor vehicle engine (A) if any emissions product of such fuel or fuel additive will endanger the public health or welfare * * *.'' CAA 211(c)(1)(A) (1970).

[73] Throughout this Notice under CAA section 231, as throughout the previous Notices concerning the 2009 Endangerment Finding under section 202, the judgments on endangerment and cause or contribute are described as a finding or findings. This is for ease of reference only, and is not intended to imply that the Administrator's judgment is solely a fact finding exercise; rather, the Administrator's exercise of judgment is to consider and weigh multiple factors when applying the scientific information to the statutory criteria.

[74] Thus, the statutory language does not require that the EPA prove the effects of climate change ''beyond a reasonable doubt.'' Indeed, such an approach is inconsistent with the concepts of reasonable anticipation and endangerment embedded in the statute. *See also CRR,* 684 F.3d at 121–122.

contribute clearly indicates a lower threshold than the sole or major cause.

Moreover, like the section 202(a) language that governed the 2009 Endangerment Finding, the statutory language in section 231(a)(2)(A) does not contain a modifier on its use of the term ''contribute.'' Unlike other CAA provisions, it does not require ''significant'' contribution. Compare, *e.g.,* CAA sections 111(b); 213(a)(2), (4). Congress made it clear that the Administrator is to exercise her judgment in determining contribution, and authorized regulatory controls to address air pollution even if the air pollution problem results from a wide variety of sources. While the endangerment test looks at the entire air pollution problem and the risks it poses, the cause or contribute test is designed to authorize the EPA to identify and then address what may well be many different sectors, classes, or groups of sources that are each part of the problem.

As explained for the 2009 Endangerment Finding, the D.C. Circuit has discussed the concept of contribution in the CAA, and its case law supports the EPA's interpretation that the level of contribution need not be significant. 74 FR 66542, December 15, 2009. In *Catawba County* v. *EPA,* 571 F.3d 20 (D.C. Cir. 2009), the court upheld EPA's PM[2.5] attainment and nonattainment designation decisions, analyzing CAA section 107(d), which requires EPA to designate an area as nonattainment if it ''contributes to ambient air quality in a nearby area'' not attaining the national ambient air quality standards. *Id.* at 35. The court noted that it had previously held that the term ''contributes'' is ambiguous in the context of CAA language. *See EDF* v. *EPA,* 82 F.3d 451, 459 (D.C. Cir. 1996). ''[A]mbiguities in statutes within an agency's jurisdiction to administer are delegations of authority to the agency to fill the statutory gap in reasonable fashion.'' 571 F.3d at 35 (citing *Nat'l Cable & Telecomms. Ass'c* v. *Brand X Internet Servs,* 545 U.S. 967, 980 (2005)). The court then proceeded to consider and reject petitioners' argument that the verb ''contributes'' in CAA section 107(d) necessarily connotes a significant causal relationship. Specifically, the D.C. Circuit again noted that the term is ambiguous, leaving it to EPA to interpret in a reasonable manner. In the context of this discussion, the court noted that ''a contribution may simply exacerbate a problem rather than cause it * * *.'' 571 F.3d at 39.

This is consistent with the D.C. Circuit's discussion of the concept of contribution in the context of CAA section 213 and rules for nonroad vehicles in *Bluewater Network* v. *EPA,* 370 F.3d 1 (D.C. Cir. 2004). In that case, industry argued that section 213(a)(3) requires a finding of a significant contribution before the EPA can regulate, while the EPA's view was that the CAA requires a finding only of contribution. *Id.* at 13. Section 213(a)(3), like section 231(a)(2)(A), is triggered by a finding that certain sources ''cause, or contribute to,'' air pollution, while an adjacent provision, section 213(a)(2), is triggered by a finding of a ''significant'' contribution. The court looked at the ''ordinary meaning of 'contribute'''' when upholding the EPA's reading. After referencing dictionary definitions of ''contribute,'' the court also noted that ''[s]tanding alone, the term has no inherent connotation as to the magnitude or importance of the relevant 'share' in the effect; certainly it does not incorporate any 'significance' requirement.'' 370 F.3d at 13.[75] The court found that the bare ''contribute'' language invests the Administrator with discretion to exercise judgment regarding what constitutes a sufficient contribution for the purpose of making a cause or contribute finding. *Id.* at 14.[76]

Like the statutory language considered in *Catawba County* and *Bluewater Network,* as well as the section 202(a) language that governed the Agency's previous findings for GHGs emitted by other types of mobile sources, section 231(a)(2)(A) refers to contribution and does not specify that the contribution must be significant before an affirmative finding can be made. To be sure, any finding of a ''contribution'' requires some threshold to be met; a truly trivial or *de minimis* ''contribution'' might not count as such. The Administrator therefore has ample discretion in exercising her reasonable judgment and determining whether, under the circumstances presented, the cause or contribute criterion has been met.[77] As noted above, in addressing provisions in section 202(a), the D.C. Circuit has explained that the Act at the endangerment finding step did not require the EPA to identify a precise numerical value or ''a minimum threshold of risk or harm before determining whether an air pollutant endangers.'' *CRR,* 684 F.3d at 122–123. Accordingly, EPA ''may base an endangerment finding on 'a lesser risk of greater harm . . . or a greater risk of lesser harm' or any combination in between.'' *Id.* (quoting *Ethyl Corp.,* 541 F.2d at 18). Recognizing the substantial record of empirical data and scientific evidence that the EPA relied upon in the 2009 Endangerment Finding, the court determined that its ''failure to distill this ocean of evidence into a specific number at which greenhouse gases cause 'dangerous' climate change is a function of the precautionary thrust of the CAA and the multivariate and sometimes uncertain nature of climate science, not a sign of arbitrary or capricious decision-making.'' *Id.* at 123. As the language in section 231(a)(2)(A) is analogous to that in section 202(a), it is clearly reasonable to apply this interpretation to the endangerment determination under section 231(a)(2)(A). Moreover, the logic underlying this interpretation supports the general principle that under CAA section 231 the EPA is not required to identify a specific minimum threshold of contribution from potentially subject source categories in determining whether their emissions ''cause or contribute'' to the endangering air pollution. The reasonableness of this principle is further supported by the fact that section 231 does not impose on the EPA a requirement to find that such contribution is ''significant,'' let alone the sole or major cause of the endangering air pollution. This context further supports the EPA's interpretation that section 231(a)(2)(A) requires some level of contribution that, while exceeding *de minimis* or trivial thresholds, does not need to rise to a pre-determined numerical level of significance.

In addition, when exercising her judgment in making a cause or contribute determination, the Administrator not only considers the cumulative impact, but also looks at the totality of the circumstances (*e.g.,* the air pollutant, the air pollution, the nature of the endangerment, the type or classes of sources at issue, the number of sources in the source sector or class, and the number and type of other source sectors or categories that may emit the air

[75] Specifically, the decision noted that '''contribute' means simply 'to have a share in any act or effect,' Webster's Third New International Dictionary 496 (1993), or 'to have a part or share in producing,' 3 Oxford English Dictionary 849 (2d ed. 1989).'' *Id.* at 13.

[76] The court explained, ''[t]he repeated use of the term 'significant' to modify the contribution required for all nonroad vehicles, coupled with the omission of this modifier from the 'cause, or contribute to' finding required for individual categories of new nonroad vehicles, indicates that Congress did not intend to require a finding of 'significant contribution' for individual vehicle categories.'' *Id.* at 13.

[77] Section V discusses the evidence in this case that supports the proposed finding of contribution. The EPA need not determine at this time the circumstances in which emissions would be trivial or de minimis and would not warrant a finding of contribution.

pollutant) when determining whether the emissions ''justify regulation'' under the CAA. *See Catawba County,* 571 F.3d at 39 (discussing EPA's interpretation of the term ''contribute'' under CAA §107(d) and finding it reasonable for the agency to adopt a totality of the circumstances approach); *see also* 74 FR at 66542, (December 15, 2009). Further discussion of this issue can be found in sections IV and V of this preamble.

B. Air Pollutant, Public Health and Welfare

The CAA defines both ''air pollutant'' and ''welfare.'' Air pollutant is defined as: ''Any air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air. Such term includes any precursors to the formation of any air pollutant, to the extent the Administrator has identified such precursor or precursors for the particular purpose for which the term 'air pollutant' is used.'' CAA section 302(g). Greenhouse gases fit well within this capacious definition. See *Massachusetts* v. *EPA,* 549 U.S. at 532. They are ''without a doubt'' physical chemical substances emitted into the ambient air. *Id.* at 529. Section V below contains further discussion of the ''air pollutant'' for purposes of this section 231 proposed contribution finding, which uses the same definition of air pollutant as the EPA adopted for purposes of the 2009 Endangerment Finding.

Regarding ''welfare,'' the CAA states that ''[a]ll language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants.'' CAA section 302(h). This definition is quite broad. Importantly, it is not an exclusive list due to the use of the term ''includes, but is not limited to, * * *.'' Effects other than those listed here may also be considered effects on welfare.

Moreover, the terms contained within the definition are themselves expansive. For example, deterioration to property could include damage caused by extreme weather events. Effects on vegetation could include impacts from changes in temperature and precipitation as well as from the spreading of invasive species or insects. Prior welfare effects evaluated by the EPA in other contexts include impacts on vegetation, as well as reduced visibility, changes in nutrient balance and acidity of the environment, soiling of buildings and statues, and erosion of building materials. *See, e.g.,* Final Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur, 77 FR 20218, April 3, 2012; Control of Emissions from Nonroad Large Spark Ignition Engines and Recreational Engines (Marine and Land-Based), 67 FR 68242, November 8, 2002; Final Heavy-Duty Engine and Vehicle Standards and Highway Diesel Sulfur Control Requirements, 66 FR 5002, January 18, 2001.

Although the CAA defines ''effects on welfare'' as discussed above, there are no definitions of ''public health'' or ''public welfare'' in the Clean Air Act. The Supreme Court has discussed the concept of ''public health'' in the context of whether costs can be considered when setting National Ambient Air Quality Standards. *Whitman* v. *American Trucking Ass'n,* 531 U.S. 457 (2001). In *Whitman,* the Court imbued the term with its most natural meaning: ''The health of the public.'' *Id.* at 466. When considering public health, the EPA has looked at morbidity, such as impairment of lung function, aggravation of respiratory and cardiovascular disease, and other acute and chronic health effects, as well as mortality. *See, e.g.,* Final National Ambient Air Quality Standard for Ozone, 73 FR 16436, March 27, 2008.

IV. The Proposed Endangerment Finding Under CAA Section 231

This section describes the Administrator's proposed endangerment finding under CAA section 231(a)(2) and its basis. Beginning with the air pollution under consideration, the Administrator is proposing to use the same definition of the ''air pollution'' under CAA section 231(a)(2) as that used under CAA section 202(a)(1), namely the mix of six well-mixed GHGs mentioned above: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. As described in section IV.A below, it is the Administrator's view that the reasons detailed in the 2009 Endangerment Finding for defining the scope and nature of the air pollution to be these six well-mixed GHGs remain valid and well-supported by the current science and are therefore reasonable bases for adopting the same definition of ''air pollution'' in this section 231(a)(2)(A) finding. Information from the new scientific assessments described in section IV.B below provides further support that the six well-mixed GHGs are the primary cause and driver of climate change. The Administrator considered other climate-forcing agents both in the 2009 Endangerment Finding and in this action; however, these substances are not included in the air pollution definition proposed in this action for the reasons discussed below in section IV.B.4.

The Administrator is proposing to find, for purposes of CAA section 231(a)(2)(A), that elevated concentrations of the six well-mixed GHGs constitute air pollution that endangers both the public health and the public welfare of current and future generations. The Administrator's view is that the body of scientific evidence amassed in the record for the 2009 Endangerment Finding compellingly supports an endangerment finding under CAA section 231(a). Information from the new scientific assessments described in section IV.B below provides further support and justification for this proposed finding.

Section IV.A below summarizes the 2009 Endangerment Finding under CAA section 202, explains the approach EPA took in compiling an extensive record to inform the Administrator's judgment on that finding, and describes the recent judicial affirmation of the 2009 Endangerment Finding. Section IV.B provides a summary of new scientific assessments that strengthen or provide further scientific evidence, in addition to that which the Administrator relied upon in making her prior judgment, for a finding that GHGs endanger public health and welfare.[78] Finally, section IV.C summarizes the Administrator's conclusion for purposes of section 231, in light of the evidence, analysis, and conclusions that led to the 2009 Endangerment Finding as well as more recent evidence, that emissions of the six well-mixed GHGs in the atmosphere endanger public health and welfare.

A. Scientific Basis of the 2009 Endangerment Finding Under CAA Section 202(a)(1)

In the 2009 Endangerment Finding, the Administrator found that elevated concentrations of the well-mixed GHGs in the atmosphere may reasonably be

[78] While the EPA is providing a summary of newer scientific assessments below, the EPA is also relying on the same scientific and technical evidence discussed in the notices for the 2009 Endangerment Finding in this proposed finding for purposes of CAA section 231. See sections III of the 2009 Proposed Endangerment Finding and sections III and IV of the 2009 Endangerment Finding.

anticipated to endanger public health and welfare of current and future generations. *See, e.g.,* 74 FR 66516, December 15, 2009. The Administrator reached this judgment by carefully considering a significant body of scientific evidence and public comments submitted to the Agency. The sections below summarize the scope and nature of the relevant air pollution for the 2009 Endangerment Finding, as well as the public health and welfare considerations within the finding.

1. The Definition of Air Pollution in the 2009 Endangerment Finding

The Administrator defined the scope and nature of the relevant air pollution as the aggregate group of six key, well-mixed GHGs: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.[79] The Administrator considered five primary reasons for focusing on this aggregate group as the air pollution in the 2009 Endangerment Finding: (1) They share common physical properties that influence their climate effects; (2) on the basis of these common physical properties, they have been determined to be the primary cause of human-induced climate change, are the best-understood driver of climate change, and are expected to remain the key driver of future climate change; (3) they are the common focus of climate change science research and policy analyses and discussions; (4) using the combined mix of these gases as the definition (versus an individual gas-by-gas approach) is consistent with the science, because risks and impacts associated with GHG-induced climate change are not assessed on an individual gas-by-gas basis; and (5) using the combined mix of these gases is consistent with past EPA practice, where separate substances from different sources, but with common properties, may be treated as a class (*e.g.,* oxides of nitrogen, particulate matter, volatile organic compounds).[80]

The common physical properties these six GHGs share that are relevant to the climate change problem include the following: All are long-lived in the atmosphere;[81] all become globally well mixed in the atmosphere, resulting in similar GHG concentrations around the globe regardless of geographic location of emissions; all trap outgoing heat that would otherwise escape to space; and all are directly emitted as GHGs rather than becoming a GHG in the atmosphere after emission of a precursor gas. The Administrator acknowledged that other anthropogenic climate forcers also play a role in climate change but for various scientific and policy reasons, these substances were not included in the air pollution definition.[82]

As explained in more detail in the 2009 Endangerment Finding, the EPA made the judgment that the scientific evidence is compelling that elevated concentrations of heat-trapping GHGs are the root cause of recently observed climate change and that the scientific record showed that most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. The attribution of observed climate change to anthropogenic activities was based on multiple lines of evidence.[83] The first line of evidence arises from our basic physical understanding of the effects of changing concentrations of GHGs, natural factors, and other human impacts on the climate system. The second line of evidence arises from indirect, historical estimates of past climate changes that suggest that the changes in global surface temperature over the last several decades are unusual. The third line of evidence arises from the use of computer-based climate models to simulate the likely patterns of response of the climate system to different forcing mechanisms (both natural and anthropogenic).

2. Public Health Impacts Detailed in the 2009 Endangerment Finding

Climate change resulting from anthropogenic GHG emissions threatens multiple aspects of public health.[84] In determining that the well-mixed GHG air pollution is reasonably anticipated to endanger public health for current and future generations, the Administrator noted her view that climate change can increase the risk of morbidity and mortality.[85] In making that public health finding, the Administrator considered direct temperature effects, air quality effects, the potential for changes in vector-borne diseases, and the potential for changes in the severity and frequency of extreme weather events. In addition, the Administrator considered whether and how susceptible populations may be particularly at risk. As explained in more detail in the 2009 Endangerment Finding, with respect to direct temperature effects, by raising average temperatures, climate change increases the likelihood of heat waves, which are associated with increased deaths and illnesses. Climate change is also expected to lead to reductions in cold-related mortality. The 2009 Endangerment Finding, while noting uncertainty about how heat and cold related mortality would change in the future, also pointed to a USGCRP assessment report discussion that increases in heat-related mortality due to global warming in the United States was unlikely to be compensated for by decreases in cold-related mortality (74 FR 66525, December 15, 2009). With regard to air quality effects, climate change is expected to increase ozone pollution over broad areas of the country, including large metropolitan population centers, and thereby increase the risks of respiratory infection, aggravation of asthma, and premature death. Other public health threats stem from the potential for increased deaths, injuries, infectious and waterborne diseases, stress-related disorders, and other adverse effects associated with increased hurricane intensity and increased frequency of intense storms and heavy precipitation associated with climate change. In addition, climate change is expected to be associated with an increase in the spread of food-, water-, and vector-borne diseases in susceptible populations. Climate change also has the potential to change aeroallergen production (for example, through lengthening the growing season for allergen-producing plants), and subsequent human exposures could increase allergenic illnesses. Children, the elderly, and the poor are among the most vulnerable to climate-related health effects.

3. Public Welfare Impacts Detailed in the 2009 Endangerment Finding

Climate change resulting from anthropogenic GHG emissions also threatens multiple aspects of public welfare.[86] In determining that the well-

[79] 74 FR 66516, December 15, 2009.

[80] 74 FR 66517 to 66519, December 15, 2009.

[81] We use "long-lived" here to mean that the gas has a lifetime in the atmosphere sufficient to become globally well-mixed throughout the entire atmosphere, which requires a minimum atmospheric lifetime of about one year. IPCC also refers to these six greenhouse gases as long-lived. According to the most recent IPCC Fifth Assessment Report (2014), methane has an atmospheric lifetime of about 12 years. One of the most commonly used hydrofluorocarbons (HFC–134a) has a lifetime of about 13 years. Nitrous oxide has a lifetime of around 130 years; sulfur hexafluoride over 3,000 years; and some perfluorocarbons up to 10,000 to 50,000 years. CO_2 is sometimes approximated as having a lifetime of roughly 100 years, but for a given amount of CO_2 emitted a better description is that some fraction of the atmospheric increase in concentration is quickly absorbed by the oceans and terrestrial vegetation, some fraction of the atmospheric increase will only slowly decrease over a number of years, and a small portion of the increase will remain for many centuries or more.

[82] 74 FR 66519 to 66521, December 15, 2009.

[83] 74 FR 66518, December 15, 2009.

[84] 74 FR 66524 to 66530, December 15, 2009.

[85] 74 FR 66524, December 15, 2009.

[86] 74 FR 66530 to 66536, December 15, 2009.

mixed GHG air pollution is reasonably anticipated to endanger public welfare for current and future generations, the Administrator considered the multiple pathways by which GHG air pollution and resultant climate change affect public welfare by evaluating the numerous and far-ranging risks to food production and agriculture; forestry; water resources; sea level rise and coastal areas; energy, infrastructure, and settlements; and ecosystems and wildlife. The Administrator also considered impacts on the U.S. population from climate change effects occurring outside of the United States. As explained in more detail in the 2009 Endangerment Finding, the potential serious adverse impacts of extreme events, such as wildfires, flooding, drought, and extreme weather conditions provided strong support for the determination. Climate change is expected to place large areas of the country at serious risk of reduced water supplies, increased water pollution, and increased occurrence of extreme events such as floods and droughts. Coastal areas are expected to face increased risks from storm and flooding damage to property, as well as adverse impacts from rising sea level such as land loss due to inundation, erosion, wetland submergence and habitat loss. Climate change is expected to result in an increase in peak electricity demand, and extreme weather from climate change threatens energy, transportation, and water resource infrastructure. Climate change may exacerbate existing environmental pressures in certain settlements, particularly in Alaskan indigenous communities. Climate change is also very likely to fundamentally change U.S. ecosystems over the 21st century and to lead to predominantly negative consequences for biodiversity, ecosystem goods and services, and wildlife. Though there may be some benefits for agriculture and forestry in the next few decades, the body of evidence points towards increasing risks of net adverse impacts on U.S. food production, agriculture and forest productivity as average temperature continues to rise. Looking across all sectors discussed above, the risk and the severity of adverse impacts on public welfare are expected to increase over time. Lastly, these impacts are global and may exacerbate problems outside the United States that raise humanitarian, trade, and national security issues for the United States.

4. The Science Upon Which the Agency Relied

As outlined in section III.A of the 2009 Endangerment Finding,[87] the EPA's approach to providing the technical and scientific information to inform the Administrator's judgment regarding the question of whether GHGs endanger public health and welfare was to rely primarily upon the recent, major assessments by the USGCRP, the IPCC, and the NRC. These assessments addressed the scientific issues that the EPA was required to examine, were comprehensive in their coverage of the GHG and climate change issues, and underwent rigorous and exacting peer review by the expert community, as well as rigorous levels of U.S. government review, in which the EPA took part. Primary reliance on the major scientific assessments provided assurance that the Administrator was basing her judgment on the best available, well-vetted science that reflected the consensus of the climate science research community. The major findings of the USGCRP, IPCC, and NRC assessments supported the Administrator's determination that elevated concentrations of GHGs in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future generations. The EPA presented this scientific support at length in the comprehensive record for the 2009 Endangerment Finding. Relevant sections of documents from the 2009 Endangerment Finding record have been placed in the docket for this proposed finding under CAA section 231.

The EPA then reviewed ten administrative petitions for reconsideration of the Endangerment Finding in 2010.[88] In the Reconsideration Denial, the Administrator denied those petitions on the basis of the Petitioners' failure to provide substantial support for their argument that the EPA should revise the Endangerment Finding and their objections' lack of ''central relevance'' to the Finding. The EPA prepared an accompanying three-volume Response to Petitions document to provide additional information, often more technical in nature, in response to the arguments, claims, and assertions by the Petitioners to reconsider the Endangerment Finding.[89]

The 2009 Endangerment Finding and the 2010 Reconsideration Denial were challenged in a lawsuit before the U.S. Court of Appeals for the D.C. Circuit.[90] On June 26, 2012, the Court upheld the Endangerment Finding and the Reconsideration Denial, ruling that the Finding (including the Reconsideration Denial) was not arbitrary or capricious, was consistent with the U.S. Supreme Court's decision in *Massachusetts* v. *EPA* (which affirmed the EPA's authority to regulate greenhouse gases)[91] and the text and structure of the CAA, and was adequately supported by the administrative record.[92] The Court also agreed with the EPA that the Petitioners had ''not provided substantial support for their argument that the Endangerment Finding should be revised.''[93] The Court found that the EPA had based its decision on ''substantial scientific evidence,'' observing that ''EPA's scientific evidence of record included support for the proposition that greenhouse gases trap heat on earth that would otherwise dissipate into space; that this 'greenhouse effect' warms the climate; that human activity is contributing to increased atmospheric levels of greenhouse gases; and that the climate system is warming,'' as well as providing extensive scientific evidence for EPA's determination that anthropogenically induced climate change threatens both public health and welfare.[94] The court further noted that the EPA's reliance on assessments was consistent with the methods decision-makers often use to make a science-based judgment.[95] Moreover, the Court supported the EPA's reliance on the major scientific assessment reports conducted by USGCRP, IPCC, and NRC and found:

The EPA evaluated the processes used to develop the various assessment reports, reviewed their contents, and considered the depth of the scientific consensus the reports

[87] 74 FR 66510 to 66512, December 15, 2009.

[88] Administrative petitions are available from *http://www.epa.gov/climatechange/endangerment/petitions.html* (last accessed May 12, 2015), and in the docket for the 2009 Endangerment Finding: EPA–HQ–OAR–2009–017.

[89] U.S. EPA, 2010: *Denial of the Petitions to Reconsider the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under section 202(a) of the Clean Air Act,* 75 FR 49557 (August 13, 2010) (''Reconsideration Denial''). In that notice, the EPA thoroughly considered the scientific and technical information relevant to the petitions. In addition to the other information discussed in the present notice, the EPA is also relying on the scientific and technical evidence discussed in that prior notice for purposes of its proposed determination under CAA section 231. See section III of the Reconsideration Denial.

[90] *Coalition for Responsible Regulation, Inc.* v. *Environmental Protection Agency,* 684 F.3d 102 (D.C. Cir. 2012),), reh'g en banc denied, 2012 U.S. App. LEXIS 25997, 26313, 26315 (D.C. Cir. 2012) (*CRR*).

[91] 549 U.S. 497 (2007).

[92] *CRR,* 684 F.3d at 117–27.

[93] *Id.* at 125

[94] *Id.* at 120–121.

[95] *Id.* at 121

represented. Based on these evaluations, the EPA determined the assessments represented the best source material to use in deciding whether GHG emissions may be reasonably anticipated to endanger public health or welfare. . . . It makes no difference that much of the scientific evidence in large part consisted of ''syntheses'' of individual studies and research. Even individual studies and research papers often synthesize past work in an area and then build upon it. This is how science works. The EPA is not required to re-prove the existence of the atom every time it approaches a scientific question.[96]

In addition, the EPA's reliance on the major assessments to inform the Administrator's judgment allowed for full and explicit recognition of scientific uncertainty regarding the endangerment posed by the atmospheric buildup of GHGs. The Administrator considered the fact that ''some aspects of climate change science and the projected impacts are more certain than others.'' [97] The D.C. Circuit subsequently noted that ''the existence of some uncertainty does not, without more, warrant invalidation of an endangerment finding.'' [98]

As noted above the Supreme Court granted some of the petitions for *certiorari* that were filed, while denying others, but agreed to decide only the question: ''Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.'' [99] Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding.

B. Recent Science Further Supports the Administrator's Judgment That the Six Well-Mixed Greenhouse Gases Endanger Public Health and Welfare

Since the closure of the administrative record concerning the 2009 Endangerment Finding (including the denial of petitions for reconsideration), a number of new major, peer-reviewed scientific assessments have been released. The EPA carefully reviewed the updated scientific conclusions in these assessments, largely to evaluate whether they would lead the EPA in this CAA section 231(a)(2)(A) finding to propose a different interpretation of, or place more or less weight on, the major findings reflected in the previous assessment reports that underpinned the Administrator's judgment that the six well-mixed GHGs endanger public health and welfare. From its review, the EPA finds that these new assessments are largely consistent with, and in many cases strengthen and add to, the already compelling and comprehensive scientific evidence detailing the role of the six well-mixed GHGs in driving climate change, detailed in the 2009 Endangerment Finding. Therefore, the new scientific assessments do not provide any reasonable basis on which to propose under CAA section 231(a)(2)(A) a different conclusion than the one the EPA reached in 2009 under CAA section 202(a). Rather, they provide further support for this proposed finding under section 231. In particular, the new assessments discussed in this preamble provide additional detail regarding public health impacts, particularly on groups and people at certain lifestages especially vulnerable to climate change including children, the elderly, low-income communities and individuals, indigenous groups, and communities of color.

The subsections below present brief summaries of the relevant key findings from the new major peer-reviewed scientific assessments, which include the following:

- IPCC's 2013–2014 Fifth Assessment Report (AR5) [100]
- IPCC's 2012 ''Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation'' (SREX) [101]
- USGCRP's 2014 ''Climate Change Impacts in the United States: the Third National Climate Assessment'' (NCA3) [102]
- NRC's 2010 ''Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean'' (Ocean Acidification) [103]
- NRC's 2011 ''Climate Change, the Indoor Environment, and Health'' (Indoor Environment) [104]
- NRC's 2011 ''Report on Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia'' (Climate Stabilization Targets) [105]
- NRC's 2011 ''National Security Implications for U.S. Naval Forces'' (National Security Implications) [106]
- NRC's 2011 ''Understanding Earth's Deep Past: Lessons for Our Climate Future'' (Understanding Earth's Deep Past) [107]
- NRC's 2012 ''Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future'' (Sea Level Rise) [108]
- NRC's 2013 ''Climate and Social Stress: Implications for Security Analysis'' (Climate and Social Stress) [109]

[96] *Id.* at 120.

[97] 74 FR at 66524, December 15, 2009.

[98] *CRR*, 684 F.3d at 121.

[99] *Utility Air Reg. Group* v. *EPA*, 134 S. Ct. 2427, 2438 (2014) (internal marks and citations omitted). *See also Virginia* v. *EPA*, 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA*, 134 S. Ct. 418 (2013), and *CRR*, 134 S. Ct. 468 (2013) (all denying cert.).

[100] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 1535 pp, doi:10.1017/CBO9781107415324; IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, 1132 pp; IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, 688 pp; and IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change.* Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

[101] IPCC, 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 [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. Midgley (eds.)]. Cambridge University Press, 582 pp.

[102] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, 841 pp.

[103] NRC, 2010: *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean.* The National Academies Press, 188 pp.

[104] NRC Institute of Medicine, 2011: *Climate Change, the Indoor Environment, and Health.* Washington, DC: The National Academies Press, 272 pp.

[105] NRC 2011: *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia.* The National Academies Press, 298 pp.

[106] NRC, 2011: *National Security Implications of Climate Change for U.S. Naval Forces.* The National Academies Press, 226 pp.

[107] NRC, 2011: *Understanding Earth's Deep Past: Lessons for Our Climate Future.* The National Academies Press, 212 pp.

[108] NRC, 2012: *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.* The National Academies Press, 201 pp.

[109] NRC, 2013: *Climate and Social Stress: Implications for Security Analysis.* The National Academies Press, 280 pp.

• NRC's 2013 ''Abrupt Impacts of Climate Change'' (Abrupt Impacts)[110]
• NRC's 2014 ''The Arctic in the Anthropocene: Emerging Research Questions'' (Arctic)[111].

1. More Recent Evidence That Elevated Atmospheric Concentrations of the Six Greenhouse Gases Are the Root Cause of Observed Climate Change

The EPA has carefully reviewed the recent assessments regarding elevated concentrations of the six well-mixed GHGs in the atmosphere. The EPA finds that the new assessments of the IPCC, USGCRP, and NRC support and strengthen the science underlying the 2009 Endangerment Finding that the six well-mixed GHGs are the root cause of recently observed climate change. Key findings are described briefly here.

According to the IPCC AR5, observations of the Earth's globally averaged combined land and ocean surface temperature over the period 1880 to 2012 show a warming of 0.85 [0.65 to 1.06] degrees Celsius or 1.53 [1.17 to 1.91] degrees Fahrenheit.[112] The IPCC AR5 concludes that the global average net effect of the increase in atmospheric GHG concentrations, plus other human activities (*e.g.,* land use change and aerosol emissions), on the global energy balance since 1750 has been one of warming. This total net heating effect, referred to as ''forcing,'' is estimated to be 2.3 Watts per square meter (W/m2), which has increased from the previous 2007 IPCC Fourth Assessment Report (AR4) total net estimate of 1.6 Watts per square meter (W/m2) that was referred to in the record for the 2009 Endangerment Finding. The reasons for this increase include continued increases in GHG concentrations, as well as reductions in the estimated negative forcing due to aerosols. The IPCC AR5 rates the level of confidence[113] in their radiative forcing estimates as ''high'' for methane and ''very high'' for CO_2 and nitrous oxide.

The new assessments also have greater confidence in attributing recent warming to human causes. The IPCC AR5 stated that it is extremely likely (>95 percent likelihood) that human influences have been the dominant cause of warming since the mid-20th century, which is a stronger statement than the AR4 conclusion that it is very likely (>90 percent likelihood) that most of the increase in temperature since the mid-20th century was due to the increase in GHG concentrations. The AR4 conclusion was referred to in the record for the 2009 Endangerment Finding. In addition, the IPCC AR5 found that concentrations of CO_2 and several other of the major GHGs are higher than they have been in at least 800,000 years. This is an increase from what was reported in IPCC AR4, which found higher concentrations than in at least 650,000 years.

The USGCRP NCA3 states that there is very high confidence[114] that the global climate change of the past 50 years is primarily due to human activities. Human activities are affecting climate through increasing atmospheric levels of heat-trapping gases, through changing levels of various particles that can have either a heating or cooling influence on the atmosphere, and through activities such as land use changes that alter the reflectivity of the Earth's surface and cause climatic warming and cooling effects. The USGCRP concludes that ''considering all known natural and human drivers of climate since 1750, a strong net warming from long-lived greenhouse gases produced by human activities dominates the recent climate record.''[115]

These recent and strong conclusions attributing recent observed global warming to human influence have been made despite what some have termed a warming slowdown or ''hiatus'' over the past 15 years or so. The IPCC AR5 notes that global mean surface temperature exhibits substantial natural decadal and interannual variability, such that trends based on short records are very sensitive to the beginning and end dates and do not in general reflect long-term climate trends. As an example, the IPCC AR5 notes that the rate of warming over the 15 year period from 1998–2012 was less than that over the period 1951–2012. This short term variability does not alter the long-term climate trend that the IPCC AR5 finds after its review of independently verified observational records: ''Each of the past three decades has been successively warmer at the Earth's surface than all the previous decades in the instrumental record, and the first decade of the 21st century has been the warmest.''[116] [117]

The NRC Climate Stabilization Targets assessment concludes that CO_2 emissions are currently altering the atmosphere's composition and will continue to alter Earth's climate for thousands of years. The NRC Understanding Earth's Deep Past assessment finds that ''the magnitude and rate of the present greenhouse gas increase place the climate system in what could be one of the most severe increases in radiative forcing of the global climate system in Earth history.''[118] This assessment finds that if no emissions reductions are made CO_2 concentrations by the end of the century are projected to increase to levels that Earth has not experienced for more than 30 million years.

2. More Recent Evidence That Greenhouse Gases Endanger Public Health

The EPA has carefully reviewed the key conclusions in the recent assessments regarding human-induced climate change risks and impacts on public health. The EPA finds that the new assessments are consistent with or strengthen the underlying science considered in the 2009 Endangerment Finding regarding public health effects from changes in temperature, air quality, extreme weather, and climate-sensitive diseases and aeroallergens. These key findings are described briefly here.

[110] NRC, 2013: *Abrupt Impacts of Climate Change: Anticipating Surprises.* The National Academies Press, 250 pp.

[111] NRC, 2014: *The Arctic in the Anthropocene: Emerging Research Questions.* The National Academies Press, 220 pp.

[112] ''IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[113] The IPCC expresses levels of confidence using five qualifiers: very low, low, medium, high, and very high. These levels are based on a qualitative evaluation of the robustness of the evidence (considering the type, amount, quality, and consistency of evidence such as data, mechanistic understanding, theory, models, and expert judgment) and the degree of agreement among the findings.

[114] The NCA expresses levels of confidence using four qualifiers: low, medium, high, and very high. These levels are based on the strength and consistency of the observed evidence; the skill, range, and consistency of model projections; and insights from peer-reviewed sources.

[115] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 741

[116] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, p. 161.

[117] Furthermore, we would note that according to both NOAA and NASA, 2014 was the warmest year in the modern instrumental record for globally averaged surface temperature, and that the ten warmest years, with the exception of 1998, have now occurred since 2000. Available at *http://www.giss.nasa.gov/research/news/20150116/* (last accessed May 12, 2015).

[118] NRC, 2011: *Understanding Earth's Deep Past: Lessons for Our Climate Future.* The National Academies Press, p. 138.

Regarding temperature effects, the conclusions of the assessment literature cited in the 2009 Endangerment Finding were uncertain with respect to the exact balance of how heat- versus cold-related mortality will change in the future, but noted that the available evidence suggested that the increased risk from heat would exceed the decreased risk from cold in a warming climate. The most recent assessments now have greater confidence that increases in heat-related mortality will be larger than the decreases in cold-related mortality. The USGCRP NCA3 concludes that, ''While deaths and injuries related to extreme cold events are projected to decline due to climate change, these reductions are not expected to compensate for the increase in heat-related deaths.'' [119] The IPCC AR5 also notes a potential benefit of climate change could include ''modest reductions in cold-related mortality and morbidity in some areas due to fewer cold extremes (low confidence),'' [120] but that, ''[o]verall, we conclude that the increase in heat-related mortality by mid-century will outweigh gains due to fewer cold periods.'' [121]

Regarding air quality effects, the assessment literature cited in the 2009 Endangerment Finding concluded that climate change is expected to increase regional ozone pollution, with associated risks in respiratory illnesses and premature death, but that the directional effect of climate change on ambient particulate matter levels was less certain. The USGCRP NCA3 similarly concludes that, ''Climate change is projected to harm human health by increasing ground-level ozone and/or particulate matter air pollution in some locations. . . . There is less certainty in the responses of airborne particles to climate change than there is about the response of ozone.'' [122] The IPCC AR5 finds that ozone and particulate matter have been associated with adverse health effects in many locations in North America, and that ozone concentrations could increase under future climate change scenarios if emissions of precursors were held constant. For particulate matter, both the USGCRP NCA3 and IPCC AR5 discuss increasing wildfire risk under climate change, and explain that wildfire smoke exposure can lead to various respiratory and cardiovascular impacts. The NRC Indoor Environment assessment identifies potential adverse health risks associated with climate-change induced alterations in the indoor environment, including possible exposure to air pollutants like ozone via changes in outdoor air quality. Other risks include potential for alterations in indoor allergens due to climate change-related increases in outdoor pollen levels, potential chemical exposures due to greater use of pesticides to address changes in geographic ranges of pest species, and dampness/mold associated symptoms and illness due to potential flooding and water damage in buildings from projected climate change-related increases in storm intensity and extreme precipitation events in some regions of the United States.

Regarding extreme weather events (*e.g.,* storms, heavy precipitation, and, in some regions of the United States, floods and droughts), the conclusions of the assessment literature cited in the 2009 Endangerment Finding found potential for increased deaths, injuries, infectious and waterborne diseases, and stress-related disorders. Similarly, the USGCRP NCA3 discusses elevated waterborne disease outbreaks and the potential for mold contamination and degraded indoor air quality following heavy precipitation. Other impacts include mortality associated with flooding and impacts on mental health, such as anxiety and post-traumatic stress disorder. The IPCC AR5 also discusses death and injury in coastal zones and regions vulnerable to inland flooding. The USGCRP NCA3 and the IPCC AR5 both find that climate change may increase exposure to and health risks associated with drought conditions, which includes impacts from wildfires, dust storms, extreme heat events, flash flooding, degraded water quality, reduced water quantity, and water-related diseases. The IPCC SREX assessment projects further increases in some extreme weather and climate events during this century, and specifically notes that changes in extreme weather events have implications for disaster risk in the health sector.

The effects of climate change on climate-sensitive diseases were also cited in the 2009 Endangerment Finding, including a likely increase in the spread of several food and water-borne pathogens among susceptible populations, and the potential for range expansion of some zoonotic disease carriers such as the Lyme disease-carrying tick. The new assessment literature similarly focuses on increased exposure risk for some diseases under climate change, finding that increasing temperatures may expand or shift the ranges of some disease vectors like mosquitoes, ticks, and rodents. The IPCC AR5 notes that climate change may influence the ''growth, survival, persistence, transmission, or virulence of pathogens'' [123] that cause food and water-borne disease. The USGCRP NCA3 notes that uncertainty remains regarding future projections of increased human burden of vector-borne disease, given complex interacting factors such as ''local, small-scale differences in weather, human modification of the landscape, the diversity of animal hosts, and human behavior that affects vector-human contact, among other factors.'' [124]

Regarding aeroallergens, the assessment literature cited in the 2009 Endangerment Finding found potential for climate change to affect the prevalence and severity of allergy symptoms, but that definitive data or conclusions were lacking on how climate change might impact aeroallergens in the United States. The most recent assessments now express greater confidence that climate change will influence production of pollen, which in turn could affect the incidence of asthma and other allergic respiratory illnesses such as allergic rhinitis, as well as effects on conjunctivitis and dermatitis. Both the USGCRP NCA3 and the IPCC AR5 found that increasing temperature has lengthened the allergenic pollen season for ragweed, and that increased CO_2 by itself can elevate production of plant-based allergens. The IPCC AR5 concludes that in North America, ''warming will lead

[119] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 224.

[120] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 713.

[121] Ibid. at p. 721.

[122] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 222.

[123] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 726.

[124] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 225.

to further changes in the seasonal timing of pollen release (high confidence).'' [125]

The assessment literature cited in the 2009 Endangerment Finding concluded that certain populations, including children, the elderly, and the poor, are most vulnerable to climate-related health effects. The 2009 Endangerment Finding also described climate change impacts facing indigenous peoples in the United States, particularly Alaska Natives. The new assessment literature strengthens these conclusions by providing more detailed findings regarding these populations' vulnerabilities and the projected impacts they may experience. In addition, the most recent assessment reports provide new analysis about how some populations defined jointly by ethnic/racial characteristics and geographic location may be vulnerable to certain climate change health impacts. The following paragraphs summarize information from the most recent assessment reports on these vulnerable populations.

The USGCRP NCA3 finds that, ''Climate change will, absent other changes, amplify some of the existing health threats the nation now faces. Certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.'' [126] 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. Low-income populations also face higher prevalence of chronic health conditions than higher income groups, which increases their vulnerability to the health effects of climate change.

According to the USGCRP NCA3 and IPCC AR5, some populations defined jointly by ethnic/racial characteristics and geographic location are more vulnerable to certain health effects of climate change due to factors such as existing health disparities (*e.g.,* higher prevalence of chronic health conditions), increased exposure to health stresses, and social factors that affect local resilience and ability to recover from impacts.

The USGCRP NCA3 also finds that climate change, in addition to chronic stresses such as extreme poverty, is affecting indigenous peoples' health in the United States through impacts such as reduced access to traditional foods, decreased water quality, and increasing exposure to health and safety hazards. The IPCC AR5 finds that climate change-induced warming in the Arctic and resultant changes in environment (*e.g.,* permafrost thaw, effects on traditional food sources) have significant observed and projected impacts on the health and well-being of Arctic residents, especially indigenous peoples. Small, remote, predominantly-indigenous communities are especially vulnerable given their ''strong dependence on the environment for food, culture, and way of life; their political and economic marginalization; existing social, health, and poverty disparities; as well as their frequent close proximity to exposed locations along ocean, lake, or river shorelines.'' [127] In addition, increasing temperatures and loss of Arctic sea ice increases the risk of drowning for those engaged in traditional hunting and fishing.

The USGCRP NCA3 concludes that children will suffer disproportionately from climate change given the unique physiological and developmental factors that occur during this lifestage. Impacts on children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events. The IPCC AR5 indicates that children are among those especially susceptible to most allergic diseases, as well as health effects associated with heat waves, storms, and floods.

Both the USGCRP and IPCC conclude that climate change will increase health risks facing the elderly. Older people are at much higher risk of mortality during extreme heat events. Pre-existing health conditions also make older adults susceptible to cardiac and respiratory impacts of air pollution and to more severe consequences from infectious and waterborne diseases. Limited mobility among older adults can also increase health risks associated with extreme weather and floods.

3. More Recent Evidence That Greenhouse Gases Endanger Public Welfare

The EPA has carefully reviewed the recent scientific conclusions in the assessments regarding human-induced climate change impacts on public welfare.[128] The EPA finds that they are largely consistent with or strengthen the underlying science supporting the 2009 Endangerment Finding regarding public welfare effects on food production and agriculture; forestry; water resources; sea level rise and coastal areas; energy, infrastructure, and settlements; ecosystems and wildlife; and impacts on the U.S. population from climate change effects occurring outside of the United States. These key findings are described briefly here.

Regarding agriculture, the assessment literature cited in the 2009 Endangerment Finding found potential for increased CO_2 levels to benefit yields of certain crops in the short-term, but with considerable uncertainty. The body of evidence pointed towards increasing risk of net adverse impacts on U.S. food production and agriculture over time, with the potential for significant disruptions and crop failure in the future. The most recent assessments now have greater confidence that climate change will negatively affect U.S. agriculture over this century. Specifically, the USGCRP NCA3 concludes, ''While some U.S. regions and some types of agricultural production will be relatively resilient to climate change over the next 25 years or so, others will increasingly suffer from stresses due to extreme heat, drought, disease, and heavy downpours. From mid-century on, climate change is projected to have more negative impacts on crops and livestock across the country.'' [129] The IPCC AR5 concludes, ''Overall yields of major crops in North America are projected to decline

[125] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1465–1466.

[126] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 221.

[127] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1581.

[128] The CAA states that ''[a]ll language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants.'' CAA section 302(h). This language is quite broad. Importantly, it is not an exclusive list due to the use of the term ''includes, but is not limited to, ...'' Effects other than those listed here may also be considered effects on welfare.

[129] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 16.

modestly by mid-century and more steeply by 2100 among studies that do not consider adaptation (very high confidence).'' [130] The IPCC AR5 notes that in the absence of extreme events, climate change may benefit certain regions and crops, but that in North America significant harvest losses have been observed due to recent extreme weather events. In addition, the IPCC SREX assessment specifically notes that projected changes in extreme weather events will increase disaster risk in the agriculture sector.

Regarding forestry, the assessment literature cited in the 2009 Endangerment Finding found that near term benefits to forest growth and productivity in certain parts of the country from elevated CO_2 concentrations and temperature increases to date are offset by longer term risks from wildfires and the spread of destructive pests and disease that present serious adverse risks for forest productivity. The most recent assessments provide further support for this conclusion. Both the USGCRP NCA3 and the IPCC AR5 conclude that climate change is increasing risks to forest health from fire, tree disease and insect infestations, and drought. The IPCC AR5 also notes risks to forested ecosystems associated with changes in temperature, precipitation amount, and CO_2 concentrations, which can affect species and ecological communities, leading to ecosystem disruption, reorganization, movement or loss. The NRC Arctic assessment states that climate change is likely to have a large negative impact on forested ecosystems in the high northern latitudes due to the effects of permafrost thaw and greater wildfire frequency, extent, and severity. The NRC Climate Stabilization Targets assessment found that for an increase in global average temperature of 1 to 2°C above pre-industrial levels, the area burnt by wildfires in western North America will likely more than double.

Regarding water resources, the assessment literature cited in the 2009 Endangerment Finding concluded that increasing temperatures and increased variability in precipitation associated with climate change will impact water quality and quantity through changes in snowpack, increased risk of floods, drought, and other concerns such as water pollution. Similarly, the new assessments further support projections of water resource impacts associated with increased floods and short-term drought in most U.S. regions. The USGCRP NCA3 also finds that, ''[c]limate change is expected to affect water demand, groundwater withdrawals, and aquifer recharge, reducing groundwater availability in some areas.'' [131] The IPCC AR5 finds that in part of the western United States, ''water supplies are projected to be further stressed by climate change, resulting in less water availability and increased drought conditions.'' [132] The IPCC AR5 also projects that climate change will degrade surface water quality, including the Great Lakes, and will negatively affect drinking water treatment/distribution and sewage collection systems.

The assessment literature cited in the 2009 Endangerment Finding found that the most serious potential adverse effects to coastal areas are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Coastal areas also face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding. The USGCRP NCA3 finds that, ''Sea level rise, combined with coastal storms, has increased the risk of erosion, storm surge damage, and flooding for coastal communities, especially along the Gulf Coast, the Atlantic seaboard, and in Alaska.'' [133]

The IPCC AR5, the USGCRP NCA3, and three of the new NRC assessments provide estimates of projected global sea level rise. These estimates, while not always directly comparable as they assume different emissions scenarios and baselines, are at least 40 percent larger than, and in some cases more than twice as large as, the projected rise estimated in the IPCC AR4 assessment, which was referred to in the 2009 Endangerment Finding.[134] The NRC Sea Level Rise assessment projects a global sea level rise of 0.5 to 1.4 meters by 2100, which is sufficient to lead to a relative rise in sea level even around the northern coasts of Washington State, where the land is still rebounding from the disappearance of the great ice sheets. The NRC National Security Implications assessment suggests that ''the Department of the Navy should expect roughly 0.4 to 2 meters global average sea-level rise by 2100.'' [135] The NRC Climate Stabilization Targets assessment states that an increase of 3°C will lead to a sea level rise of 0.5 to 1 meter by 2100. While these NRC and IPCC assessments continue to recognize and characterize the uncertainty inherent in accounting for ice sheet processes, these revised estimates are consistent with the assessments underlying the 2009 Endangerment Finding.

Regarding climate impacts on energy, infrastructure, and settlements, the 2009 Endangerment Finding cited the assessment literature's findings that temperature increases will change heating and cooling demand; that declining water quantity may adversely impact the availability of cooling water and hydropower in the energy sector; and that changes in extreme weather events will threaten energy, transportation, water, and other key societal infrastructure, particularly on the coast. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding. For example, the USGCRP NCA3 finds that, ''Coastal infrastructure, including roads, rail lines, energy infrastructure, airports, port facilities, and military bases, are increasingly at risk from sea level rise and damaging storm surges.'' [136] The NRC Arctic assessment identifies threats to human infrastructure in the Arctic from increased flooding, erosion, and shoreline ice pile-up, or *ivu,* associated

[130] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1462.

[131] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 70.

[132] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1456–1457.

[133] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 9.

[134] The 2007 IPCC AR4 assessment cited in 2009 Endangerment Finding estimated a projected sea level rise of between 0.18 and 0.59 meters by the end of the century, relative to 1990. It should be noted that in 2007, the IPCC stated that including poorly understood ice sheet processes could lead to an increase in the projections.

[135] NRC, 2011: *National Security Implications of Climate Change for U.S. Naval Forces.* The National Academies Press, p. 28.

[136] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 9.

with summer sea ice loss and the increasing frequency and severity of storms.

Regarding ecosystems and wildlife, the assessment literature cited in the 2009 Endangerment Finding found that climate change will predominantly adversely impact both terrestrial and marine biodiversity and the ability of these ecosystems to provide goods and services. The NRC Arctic assessment states that major marine and terrestrial biomes will likely shift pole ward, with significant implications for changing species composition, food web structures, and ecosystem function. The NRC Climate Stabilization Targets assessment found that coral bleaching will increase due both to warming and ocean acidification. The NRC Understanding Earth's Deep Past assessment notes four of the five major coral reef crises of the past 500 million years were caused by acidification and warming that followed GHG increases of similar magnitude to the emissions increases expected over the next hundred years. Similarly, the NRC Ocean Acidification assessment finds that "[t]he chemistry of the ocean is changing at an unprecedented rate and magnitude due to anthropogenic CO_2 emissions; the rate of change exceeds any known to have occurred for at least the past hundreds of thousands of years." [137] The assessment notes that the full range of consequences is still unknown, but the risks "threaten coral reefs, fisheries, protected species, and other natural resources of value to society." [138] The IPCC AR5 also projects biodiversity losses in marine ecosystems, especially in the Arctic and tropics.

In general, climate change impacts related to public welfare are expected to be unevenly distributed across different regions of the United States and have a greater impact on certain populations, such as indigenous peoples and the poor. The USGCRP NCA3 finds climate change impacts such as the rapid pace of temperature rise, coastal erosion and inundation related to sea level rise and storms, ice and snow melt, and permafrost thaw are affecting indigenous people in the United States. Particularly in Alaska, critical infrastructure and traditional livelihoods are threatened by climate change and, "[i]n parts of Alaska, Louisiana, the Pacific Islands, and other coastal locations, climate change impacts (through erosion and inundation) are so severe that some communities are already relocating from historical homelands to which their traditions and cultural identities are tied." [139] The IPCC AR5 notes, "Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty (high confidence). Climate-related hazards affect poor people's lives directly through impacts on livelihoods, reductions in crop yields, or destruction of homes and indirectly through, for example, increased food prices and food insecurity." [140]

In the 2009 Endangerment Finding, the Administrator considered impacts on the U.S. population from climate change effects occurring outside of the United States, such as national security concerns that may arise as a result of climate change impacts in other regions of the world. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding. The NRC Climate and Social Stress assessment found that it would be "prudent for security analysts to expect climate surprises in the coming decade . . . and for them to become progressively more serious and more frequent thereafter." [141] The NRC National Security Implications assessment recommends preparing for increased needs for humanitarian aid; responding to the effects of climate change in geopolitical hotspots, including possible mass migrations; and addressing changing security needs in the Arctic as sea ice retreats.

In addition, the NRC Abrupt Impacts report examines the potential for tipping points, thresholds beyond which major and rapid changes occur in the Earth's climate system, as well as in natural and human systems that are impacted by the changing climate. The Abrupt Impacts report did find less cause for concern than some previous assessments regarding some abrupt events within the next century such as disruption of the oceanic Atlantic Meridional Overturning Circulation (AMOC) and sudden releases of high-latitude methane from hydrates and permafrost. But, the same report found that the potential for abrupt changes in ecosystems, weather and climate extremes, and groundwater supplies critical for agriculture now seem more likely, severe, and imminent. The assessment found that some abrupt changes were already underway (*e.g.,* Arctic sea ice retreat and increases in extinction risk due to the speed of climate change), and cautioned that even abrupt changes such as the AMOC disruption that are not expected in this century can have severe impacts if/when they happen.

4. Consideration of Other Climate Forcers

Both in the 2009 Endangerment Finding and in this action, the Administrator recognizes that there are other substances in addition to the six well-mixed GHGs that are emitted from human activities and affect Earth's climate (referred to as climate forcers). These can be grouped into two categories: (1) other substances with similar physical properties to the six well-mixed GHGs—these include the ozone-depleting substances of chlorofluorocarbons, hydrochlorofluorocarbons, and halons, as well as nitrogen trifluoride and similar recently identified substances; and (2) short-lived substances—tropospheric ozone and its precursor gases, water vapor, and aerosol particles and precursors. For some short-lived substances—namely, water vapor; NO_X; and aerosol particles including black carbon—their physical properties result in these substances having different, and often larger, climate effects when emitted at high altitudes. However, the very properties that lead to differential climate effects depending on the altitude of emission—properties that are different from those of the six well-mixed, long-lived GHGs—lead to more uncertainty in the scientific understanding of these short-lived substances' total effect on Earth's climate. More detail is provided below.

As described in section III.B of the 2009 Endangerment Finding and in section IV.A.1 of this preamble, the primary reasons for defining the air pollution as the aggregate group of the six well-mixed GHGs include their common physical properties relevant to climate change (*i.e.,* long-lived, well-mixed, directly emitted), the fact that these gases are considered the primary drivers of climate change, and the fact that these gases remain the best

[137] NRC, 2010: *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean.* The National Academies Press, p. 5.

[138] Ibid.

[139] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 17.

[140] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 796.

[141] NRC, 2013: *Climate and Social Stress: Implications for Security Analysis.* The National Academies Press, p. 18.

understood drivers of anthropogenic climate change. The common physical properties of the six well-mixed GHGs not only support grouping them together as a class, but also contribute to their higher degree of scientific understanding related to climate change, relative to short-lived substances that are not well-mixed, or substances that are formed indirectly rather than being directly emitted. After considering additional information in the new assessments regarding the climate-relevant substances outside the basket of the six well-mixed GHGs, it is the Administrator's view that the reasons originally stated for not including these substances in the scope of the GHG air pollution still apply at this time. For example, nitrogen triflouride and some other recently discovered substances are not as well studied or understood as the six well-mixed GHGs. Similarly, for tropospheric ozone—a short-lived gas in the atmosphere that is not directly emitted (it forms from emissions of various precursor gases)—the understanding and quantification of the link between precursor emissions and climate change is not as strong as for the six well-mixed GHGs.

Regarding the short-lived substances with different climate effects when emitted at high altitudes, the Aircraft Petition (see section II of this preamble) mentions the effects of water vapor and NO_X on clouds and atmospheric chemistry. The major peer-reviewed scientific assessments of the IPCC and NRC provide the current state of scientific understanding of these effects; the USGCRP assessments have not dealt specifically with emissions at high altitude. The EPA considered the following assessment reports to obtain the best estimates of these substances' net impact on the climate system, which is generally discussed in terms of radiative forcing: the IPCC AR5, the IPCC 2007 Fourth Assessment Report (AR4),[142] the IPCC Special Report: Aviation and the Global Atmosphere (IPCC 1999),[143] the NRC's Advancing the Science of Climate Change (NRC 2010),[144] and the NRC's Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project (NRC 1999).[145] In addition to high altitude water vapor and NO_X, the literature indicates that aerosol particles, including black carbon, emitted at high altitudes have more interactions with clouds and therefore have different effects on the global energy balance than do particles emitted at the surface.

The state of the science as represented in the assessment literature highlights significant scientific uncertainties regarding the total net forcing effect of water vapor, NO_X, and aerosol particles when emitted at high altitudes. Given these uncertainties, the Agency is not including them in the proposed definition of air pollution for purposes of the endangerment finding under section 231 of the CAA. The short-lived nature of these substances means that, unlike the long-lived GHGs, the climatic impact of the substance is dependent on a number of factors such as the location and time of its emission. The magnitude, and often the direction (positive/warming or negative/cooling), of the globally averaged climate impact will differ depending on the location of the emission due to the local atmospheric conditions (*e.g.,* due to differing concentrations of other compounds with which the emissions can react, background humidity levels, or the presence or absence of clouds). In addition, for emissions at any given location, the spatial and temporal pattern of the climate forcing will be heterogeneous, again often differing in direction (for example, in the case of NO_X emissions, the near term effect in the hemisphere in which the emissions occur is usually warming due to increased ozone concentrations, but the longer term effects, and effects in the other hemisphere, are often cooling due to increased destruction of methane). As the climatic effects of these substances when emitted at high altitudes were not addressed at length in the 2009 Endangerment Finding, the following subsections briefly summarize the findings of the major scientific assessments regarding these substances' climatic effects at altitude and the various sources of uncertainty surrounding these estimates.

a. Changes in Clouds From High Altitude Emissions of Water Vapor and Particles

Aviation-induced cloudiness (sometimes called AIC) refers to all changes in cloudiness associated with aviation operations, which are primarily due to the effects of high altitude emissions of water vapor and particles (primarily sulfates and black carbon). Changes in cloudiness affect the climate by both reflecting solar radiation (cooling) and trapping outgoing longwave radiation (warming). Unlike the warming effects associated with the six long-lived, well-mixed GHGs, the warming effects associated with changes in cloud cover are more regional and temporal in nature. The three key components of aviation-induced cloudiness are persistent contrails, contrail-induced cirrus, and induced cirrus.

Aircraft engine emissions of water vapor at high altitudes during flight can lead to the formation of condensation trails, or contrails, under certain conditions such as ice-supersaturated air masses with specific humidity levels and temperature. The NRC estimates that persistent contrails increased cloudiness above the United States by two percent between 1950 and 1988, with similar results reported over Europe.[146] As stated above, clouds can have both warming and cooling effects, and persistent contrails were once considered to have significant net warming effects. However, more recent estimates suggest a smaller overall climate forcing effect of persistent contrails. The IPCC AR5 best estimate for the global mean radiative forcing from contrails is 0.01 W/m^2 (medium confidence and with an uncertainty range of 0.005 to 0.03 W/m^2).[147] To put this number into context, some examples of other IPCC AR5 best estimates for global mean radiative forcing include: 1.68 W/m^2 for CO_2 (very high confidence and with an uncertainty range of 1.33 to 2.03 W/m^2), 0.97 W/m^2 for methane (high confidence and with an uncertainty range of 0.74 to 1.20 W/m^2), and 0.17 W/m^2 for nitrous oxide (very high confidence and with an uncertainty

[142] IPCC, 2007: *Climate Change 2007: The Physical Scientific Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)] Cambridge University Press, 996 pp.

[143] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J. Dokken, M. McFarland (eds.)] Cambridge University Press, 373 pp.

[144] NRC, 2010: *Advancing the Science of Climate Change.* The National Academies Press, 528 pp.

[145] NRC, 1999: *Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project.* The National Academies Press, 54 pp.

[146] NRC, 1999: *Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project.* The National Academies Press, 54 pp.

[147] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 1535 pp.

range of .013 to 0.21 W/m^2).[148] In addition, the NRC (2010) assessment suggested that contrails may affect regional diurnal temperature differences, but this has been called into question by the recent findings presented in the IPCC AR5, which suggests that aviation contrails do not have an effect on mean or diurnal range of surface temperatures (medium confidence).

Persistent contrails also sometimes lose their linear form and develop into cirrus clouds, an effect referred to as contrail-induced cirrus. Studies to date have been unable to isolate this climate forcing effect, but the IPCC AR5 provides a combined contrail and contrail-induced cirrus best estimate of 0.05 W/m^2 (low confidence and with an uncertainty range of 0.02 and 0.15 W/m^2).[149]

Particles emitted or formed in the atmosphere as a result of aircraft emissions may also act as ice nuclei and modify naturally forming cirrus clouds, an effect referred to as ''induced cirrus.'' The two primary aviation-induced particles are sulfates and black carbon, and their effects on cirrus cloud modification is an area of active research. There are significant challenges in estimating the climatic impacts of induced cirrus; for example, the 2007 IPCC AR4 characterizes our knowledge of the natural freezing modes in cirrus conditions as ''poor,'' and notes that cirrus cloud processes are not well represented in global models.[150] Neither IPCC AR4 nor AR5 provided global or regional estimates related to this forcing.

Given differences in scientific understanding of the three components of aviation-induced cloudiness, the more recent assessments have not provided estimates of the net climate forcing effect of changes in clouds from high altitude emissions of water vapor and particles. Going back to the 1999 IPCC assessment, the science is characterized as ''very uncertain'' with a range for the best estimate between 0 to 0.040 W/m^2.[151]

b. Direct Radiative Forcing Effects of High Altitude Particle Emissions

The 2009 Endangerment Finding noted that much of the uncertainty range surrounding the estimate of total net forcing due to all human activities was due to uncertainties about the cooling and warming effects of aerosols[152] (though from all sources, not just aircraft). The Finding noted that the magnitude of aerosol effects can vary immensely with location and season of emissions, and also discussed black carbon as a specific type of aerosol particle, noting that estimates of its total climate forcing effect have a large uncertainty range.[153] Here, we discuss the direct radiative forcing effects of high altitude emissions of the two primary aviation-induced particles, sulfates and black carbon.

Aircraft emit precursor gases that convert to sulfate particles in the atmosphere, such as sulfur dioxide. Sulfate particles have direct effects on the climate by scattering solar radiation, which results in cooling. The more recent assessments have not quantified this effect from aviation. Going back to the 1999 IPCC assessment, the direct effect of sulfate aerosols from aviation for the year 1992 is estimated at ¥0.003 W/m^2 with an uncertainty range between ¥0.001 and ¥0.009 W/m^2.[154]

Black carbon emissions from aviation, which are produced by the incomplete combustion of jet fuel, primarily absorb solar radiation and heat the surrounding air, resulting in a warming effect. The more recent assessments have not quantified this effect from aviation. The 1999 IPCC assessment estimates the global mean radiative forcing of black carbon emissions to be 0.003 W/m^2 with uncertainty spanning 0.001 to 0.009 W/m^2.[155] The IPCC 1999 assessment suggests that because the contribution of black carbon in the stratosphere (which actually contribute to cooling of the surface rather than warming) was not included in its calculations, its estimates of radiative forcing were likely to be too high.

c. Changes in Atmospheric Chemistry From High Altitude Nitrogen Oxides Emissions

Emissions of NO_X do not themselves have warming or cooling effects, but affect the climate through catalyzing changes in the chemical equilibrium of the atmosphere. High altitude emissions of NO_X increase the concentration of ozone, which has a warming effect in the short term. Elevated NOx concentrations also lead to an increased rate of destruction of methane, which has a cooling effect in the long-term. The reduced methane concentrations eventually contribute to decreases in ozone, which also decreases the long-term net warming effect. Thus, the net radiative impact of NO_X emissions depends on the balance between the reductions in methane versus the production of ozone, which in turn depends on the time scale under consideration. Quantifying these impacts is an area of active study with large uncertainties. The quantification of the net global effect of NO_X is difficult because the atmospheric chemistry effects are heavily dependent on highly localized atmospheric properties and mixing ratios. Because the background atmospheric concentration of NO_X is important for quantifying the impact of aviation NO_X emissions on ozone and methane concentrations, the location of aircraft emissions would be an important additional factor. In addition, NO_X has different residence times in the atmosphere depending on the altitude at which it is emitted. The residence time of NO_X in the upper troposphere, or roughly the cruise altitude for jet aircraft, is on the order of several days. Going back to the IPCC 1999 assessment, the globally averaged radiative forcing estimates for aircraft emissions of NO_X in 1992 were 0.023 W/m^2 for O_3-induced changes (uncertainty range of 0.011 to 0.046 W/m^2), and ¥0.014 W/m^2 for methane-induced changes (uncertainty range of ¥0.005 to ¥0.042 W/m^2).[156]

The IPCC AR5 presents the impact of aviation NO_X emissions using a different metric, global warming potential (GWP), which is a measure of the warming impact of a pulse of

[148] IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[149] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, 1535 pp.

[150] IPCC, 2007: *Climate Change 2007: The Physical Scientific Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)] Cambridge University Press, 996 pp.

[151] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J. Dokken, M. McFarland (eds.)] Cambridge University Press, 373 pp.

[152] 74 FR at 66517, December 15, 2009.

[153] 74 FR at 66520, December 15, 2009.

[154] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J. Dokken, M. McFarland (eds.)] Cambridge University Press, 373 pp.

[155] Ibid.

[156] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J. Dokken, M. McFarland (eds.)] Cambridge University Press, 373 pp.

emissions of a given substance over 100 years relative to the same mass of CO_2. The AR5 presents a range from ¥21 to +75 for GWP of aviation NO_X.[157] The uncertainty in sign indicates uncertainty whether the net effect is one of warming or cooling. This report further suggests that at cruise altitude there is strong regional sensitivity of ozone and methane to NO_X, particularly notable at low latitudes.

The Administrator notes that NO_X emissions are already regulated under the EPA's rules implementing CAA section 231, at 40 CFR part 87. The prerequisite endangerment and cause or contribute findings that formed the basis for these standards, however, did not rely upon any conclusions regarding the climate forcing impacts of NO_X, but rather the role of NO_X emissions as a precursor to ozone formation in areas that did not meet the National Ambient Air Quality Standard (NAAQS) for ozone.[158] The continuing significant uncertainties regarding NO_X as a climate forcer do not undermine the Agency's prior conclusion under CAA section 231 that emissions of NO_X from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare due to their contribution to ozone concentrations that exceed the NAAQS.

d. Summary

Overall, the state of the science as represented in the assessment literature highlights significant scientific uncertainties regarding the total net forcing effect of water vapor, NO_X, and aerosol particles, when emitted at high altitudes. The dependence of the effects on where the substance is emitted, and the complex temporal and spatial patterns that result, mean that the current level of understanding regarding these short-lived substances is much lower than for the six long-lived, well-mixed GHGs. Given the aforementioned scientific uncertainties at present, the Agency is not including these constituents in the proposed definition of air pollution for purposes of the endangerment finding under section 231 of the CAA.

C. Summary of the Administrator's Proposed Endangerment Finding Under CAA Section 231

In sum, the Administrator proposes to find, for purposes of CAA section 231(a)(2)(A), that elevated atmospheric concentrations of the six well-mixed GHGs constitute air pollution that endangers both the public health and the public welfare of current and future generations. In this proposed action under CAA section 231(a)(2)(A), the EPA relies primarily on the extensive scientific and technical evidence in the record supporting the 2009 Endangerment Finding, including the major, peer-reviewed scientific assessments used to address the question of whether GHGs in the atmosphere endanger public health and welfare, and on the analytical framework and conclusions upon which the EPA relied in making that finding. This proposed finding under section 231 accounts for the EPA's careful consideration not only of the scientific and technical record for the 2009 Endangerment Finding, but also of new, major scientific assessments issued since closing the administrative record for the 2009 Endangerment Finding. No recent information or analyses published since late 2009 suggest that it would be reasonable for the EPA to now reach a different or contrary conclusion for purposes of CAA section 231(a)(2)(A) than the Agency reached for purposes of section 202(a). In proposing this finding for purposes of section 231, we are not reopening or revisiting our 2009 Endangerment Finding. To the contrary, in light of the recent judicial decisions upholding those findings, the EPA believes the 2009 Endangerment Finding is firmly established and well settled.[159] Moreover, there is no need for the EPA to reopen or revisit that finding for purposes of making an additional finding under section 231 of the CAA. Therefore, public comments addressing this finding for purposes of section 231(a)(2)(A) should be limited to the section 231 context; the EPA will not consider or respond to comments on this proposal that seek a reevaluation of our 2009 Endangerment Finding for purposes of section 202(a).

V. The Proposed Cause or Contribute Finding for Greenhouse Gases Under CAA Section 231

As noted above, the Administrator has proposed to define the air pollution for purposes of the endangerment finding under CAA section 231 to be the aggregate of six well-mixed GHGs in the atmosphere. The second step of the two-part endangerment test for this proposed finding is for the Administrator to determine whether the emission of any air pollutant from certain classes of aircraft engines causes or contributes to this air pollution. This is referred to as the cause or contribute finding, and is the second proposed finding by the Administrator in this action.

Section V.A of this proposal describes the Administrator's reasoning for using the same definition and scope of the GHG air pollutant that was used in the 2009 Endangerment Finding. Section V.0 puts forth the Administrator's proposed finding that emissions of well-mixed GHGs from classes of aircraft engines used in covered aircraft contribute to the air pollution which endangers public health and welfare.

A. The Air Pollutant

1. Proposed Definition of Air Pollutant

Under section 231, the Administrator is to determine whether *emissions of any air pollutant* from any class or classes of aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. As with the 2009 Endangerment Finding that the EPA conducted for purposes of CAA section 202(a), when making a cause or contribute finding under section 231(a)(2), the Administrator must first define the air pollutant being evaluated. The Administrator has reasonably and logically considered the relationship between the GHG air pollution and air pollutant: while the air pollution is the concentration (*e.g.,* stock) of the well-mixed GHGs in the atmosphere, the air pollutant is the same combined grouping of the well-mixed GHGs, the emissions of which are analyzed for contribution (*e.g.,* the flow into the stock). See 74 FR at 66537, (December 15, 2009), (similar discussion with respect to the finding for section 202). Thus, for purposes of section 231, the Administrator is proposing to use the same definition of the air pollutant that was used in the 2009 Endangerment Finding, namely, the aggregate group of the same six GHGs: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. See 74 **Federal Register** at 66536–66537, (December 15, 2009), (discussing the definition of the GHG air pollutant with respect to the finding for section 202). That is, as for the 2009 Endangerment Finding, the Administrator is proposing to define a

[157] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 1535 pp.

[158] U.S. EPA, "Control of Air Pollution from Aircraft and Aircraft Engines, Emission Standards and Test Procedures for Aircraft." Final Rule, 38 FR 19088, July 17, 1973.

[159] *CRR,* 684 F.3d at 117 (D.C. Cir. 2012), reh'g en banc denied, 2012 U.S. App. LEXIS 25997, 26313, 26315 (D.C. Cir. 2012); *see also Utility Air Reg. Group* v. *EPA,* 134 S. Ct. at 2438 (2014).

single air pollutant made up of these six GHGs.

To reiterate what the Agency has previously stated on this subject, this collective approach for the contribution test is consistent with the treatment of GHGs by those studying climate change science and policy, where it is common practice to evaluate GHGs on a collective, CO_2-equivalent basis.[160] This collective approach to defining the air pollutant is not unique; grouping of many substances with common attributes as a single pollutant is common practice under the CAA, for example with particulate matter and volatile organic compounds (VOC). As noted in section IV, these substances share common attributes that support their grouping as the air pollution for purposes of the endangerment finding. These same common attributes also support the Administrator grouping the six GHGs for purposes of defining the air pollutant for the proposed cause or contribute finding under CAA section 231.

The Administrator recognizes that in this case, the aircraft engines covered by this notice emit two of the six gases, but not the other four gases. Nonetheless, it is entirely appropriate, and in keeping with the 2009 Endangerment Finding and past EPA practice, for the Administrator to define the air pollutant in a manner that recognizes the shared relevant properties of all these six gases, even though they are not all emitted from the classes of sources before her.[161] For example, a source may emit only 20 of the possible 200-plus chemicals that meet the definition of VOC in the EPA's regulations, but that source is evaluated based on its emissions of VOC and not on its emissions of the 20 chemicals by name. The fact that these six substances within the definition of GHGs share common, relevant attributes is true regardless of the type of sources being evaluated for contribution. By proposing to use the definition of the air pollutant as comprised of the six GHGs with common attributes, the Administrator is taking account of these shared attributes and how they are relevant to the air pollution that endangers public health and welfare.

2. How the Definition of Air Pollutant in the Endangerment Determination Affects Section 231 Standards

Under section 231(a), the Administrator is required to set ''emission standards applicable to the emission of any air pollutant'' from classes of aircraft engines that the Administrator determines causes or contributes to air pollution that endangers public health or welfare. If the Administrator makes a final determination under section 231 that the emissions of the GHG air pollutant from certain classes of aircraft engines contribute to the air pollution that may reasonably be anticipated to endanger public health and welfare, then she is called on to set standards applicable to the emissions of this air pollutant. The term ''standards applicable to the emissions of any air pollutant'' is not defined, and the Administrator has the discretion to interpret it in a reasonable manner to effectuate the purposes of section 231 to set standards that either control the emissions of the group of six well-mixed gases as a whole and/or control emissions of individual gases, as constituents of the class. For example, it might be appropriate to set a standard that measures and controls the aggregate emissions of the group of GHGs, weighted by CO_2 equivalent. Depending on the circumstances, however, it may be appropriate to set standards for certain individual gases, or some combination of group and individual standards. These and other similar approaches could appropriately be considered in setting a standard or standards applicable to the emissions of the group of GHGs that are defined as the air pollutant. The Administrator would consider a variety of factors in determining what approach to take in setting the standard or standards; for example, she would consider the characteristics of the aircraft emissions, such as rate and variability, the kind and availability of control technology, and other matters relevant to setting standards under section 231.[162]

B. Proposed Cause or Contribute Finding

1. The Administrator's Approach in Making This Proposed Finding

As it did for the 2009 Endangerment Finding, and consistent with prior practice and current science, the EPA uses annual emissions as a reasonable proxy for contributions to the air pollution, *i.e.,* elevated atmospheric concentrations of GHGs. Cumulative anthropogenic emissions are primarily responsible for the observed change in concentrations in the atmosphere (*i.e.,* the fraction of a country's or an economic sector's cumulative emissions compared to the world's GHG emissions over a long time period will be roughly equal to the fraction of the change in concentrations attributable to that country or economic sector); likewise, annual emissions are a reasonable proxy for annual incremental changes in atmospheric concentrations.

There are a number of possible ways of assessing whether air pollutants cause or contribute to the air pollution which may reasonably be anticipated to endanger public health and welfare, and no single approach is required or has been used exclusively in previous determinations under the CAA. Because the air pollution against which the contribution is being evaluated is the six well-mixed GHGs, the logical starting point for any contribution analysis is a comparison of the emissions of the air pollutant from the section 231 category to the total U.S. and total global emissions of the six GHGs. The Administrator recognizes that there are other valid comparisons that can be considered in evaluating whether emissions of the air pollutant cause or contribute to the combined concentration of the six GHGs. To inform the Administrator's assessment, section V.B.2 presents the following types of simple and straightforward comparisons of U.S. aircraft GHG emissions:

- As a share of current total U.S. GHG emissions;
- As a share of current U.S. transportation GHG emissions;

[160] As detailed in the 2009 Endangerment Finding proposal (74 FR 18904 (April 24, 2009) and continuing today, the UNFCCC, the U.S. and other Parties report their annual emissions of the six GHGs in CO_2-equivalent units. This facilitates comparisons of the multiple GHGs from different sources and from different countries, and provides a measure of the collective warming potential of multiple GHGs. Emissions of different GHGs are compared using GWPs, which as described in section IV.B of this preamble are measures of the warming impact of a pulse of emissions of a given substance over 100 years relative to the same mass of CO_2. Therefore, GWP-weighted emissions are measured in teragrams of CO_2 equivalent (Tg CO_2eq). The EPA's Greenhouse Gas Reporting Program (*http://www.epa.gov/ghgreporting/index.html,* (last accessed May 12, 2015)) also reports GHG emissions on a CO_2-equivalent basis, recognizing the common and collective treatment of the six GHGs.

[161] In the 2009 Endangerment Finding, the Administrator found that four of the six gases that were included in the definition of the air pollutant were emitted by section 202 sources. 74 FR 66496, 66537 (December 15, 2009).

[162] In setting GHG emissions standards for model years 2012–2016 light-duty vehicles, the EPA set fleet-wide average CO_2 equivalent standards for cars and trucks based on a technology assessment analysis which indicated that there was a wide range of technologies available for manufacturers to use when upgrading vehicles to reduce CO_2 emissions and improve fuel economy. The final standards were based on CO_2 emissions-footprint curves, where each vehicle has a different CO_2 emissions compliance target depending on its footprint value (related to the size of the vehicle). The EPA also set standards to cap tailpipe nitrous oxide, methane emissions, and provided compliance credits to manufacturers who improved air conditioning systems, such as through reduced refrigerant leakage (hydrofluorocarbons) and indirect CO_2 emissions related to the increased load on the engine. 75 FR 25324 (May 7, 2010).

• As a share of current total global GHG emissions; and

• As a share of the current global transportation GHG emissions.

All annual GHG emissions data are reported on a CO_2-equivalent (CO_2eq) basis, which as described above is a commonly accepted metric for comparing different GHGs. This approach is consistent with how EPA determined contribution for GHGs under section 202 of the CAA in 2009.

2. Overview of Greenhouse Gas Emissions

Atmospheric concentrations of CO_2 and other GHGs are now at essentially unprecedented levels compared to the distant and recent past.[163] This is the unambiguous result of human emissions of these gases. Global emissions of well-mixed GHGs have been increasing, and are projected to continue increasing for the foreseeable future. According to IPCC AR5, total global (from all major emitting sources including forestry and other land use) emissions of GHGs in 2010 were about 49,000 teragrams[164] of CO_2 equivalent (Tg CO_2eq).[165] This represents an increase in global GHG emissions of about 29 percent since 1990 and 23 percent since 2000. In 2010, total U.S. GHG emissions were responsible for about 14 percent of global GHG emissions (and about 12 percent when factoring in the effect of carbon sinks from U.S. land use and forestry).

Because 2010 is the most recent year for which IPCC emissions data are available, we provide 2011 estimates from another widely used and recognized global dataset, the World Resources Institute's (WRI) Climate Analysis Indicators Tool (CAIT),[166] for comparison. According to WRI/CAIT, the total global GHG emissions in 2011 were 43,816 Tg of CO_2eq, representing an increase in global GHG emissions of about 42 percent since 1990 and 30 percent since 2000 (excluding land use, land use change and forestry). These estimates are generally consistent with those of IPCC. In 2011, WRI/CAIT data indicate that total U.S. GHG emissions were responsible for about 16 percent of global emissions, which is also generally in line with the percentages using IPCC's 2010 estimate described above. According to WRI/CAIT, current U.S. GHG emissions rank only behind China's, which was responsible for 24 percent of total global GHG emissions.

The *Inventory of U.S. Greenhouse Gas Emissions and Sinks Report*[167] (hereinafter "U.S. Inventory"), in which 2013 is the most recent year for which data are available, indicates that total U.S. GHG emissions increased by 5.7 percent from 1990 to 2013 (or by about 4.7 percent when including the effects of carbon sinks), and emissions increased from 2012 to 2013 by 1.8 percent. This 2012 to 2013 increase was attributable to multiple factors including an increase in carbon intensity of fuels consumed for electricity generation, a small increase in vehicle miles traveled and vehicle fuel use, and a colder winter leading to an increase in heating requirements. The U.S. Inventory also shows that while overall U.S. GHG emissions grew between 1990 and 2013, transportation GHG emissions grew at a significantly higher rate, 15 percent, more rapidly than any other U.S. sector. Within the transportation sector, aircraft remain the single largest source of GHG emissions not yet subject to any GHG regulations.

Section V.B.2.a which follows describes U.S. aircraft GHG emissions within the domestic context, while section V.B.2.b describes these same GHG emissions in the global context. Section V.B.2.c addresses future projections of aircraft GHG emissions.

a. U.S. Aircraft GHG Emissions Relative to U.S. GHG Transportation and Total U.S. GHG Inventory

Relying on data from the U.S. Inventory, we compare U.S. aircraft GHG emissions to the transportation sector and to total U.S. GHG emissions as an indication of the role this source plays in the total domestic contribution to the air pollution that is causing climate change. In 2013, total U.S. GHG emissions from all sources were 6,774 Tg CO_2eq. As stated above, total U.S. GHG emissions have increased by almost 6 percent between 1990 and 2013, while U.S. transportation GHG emissions from all categories have grown 15 percent since 1990. The U.S. transportation sector was the second largest GHG emitting sector (behind electricity generation), contributing 1,911 Tg CO_2eq or about 30 percent of total U.S. GHG emissions in 2013. This sectoral total and the total U.S. GHG emissions include emissions from combustion of U.S. international bunker fuels, which are fuels used for transport activities, from aviation (both commercial and military) and marine sources.[168] Consistent with IPCC guidelines for common and consistent accounting and reporting of GHGs under the UNFCCC, the "U.S. international aviation bunker fuels" category includes emissions from combustion of fuel purchased in and used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier. Total U.S. aircraft emissions clearly contribute to the U.S. transportation sector's emissions, accounting for 216 Tg CO_2eq or 11 percent of such emissions (see Table V.1.). In 2013, emissions from aircraft (216 Tg CO_2eq) were the third largest transportation source of GHGs within the United States, behind light-duty vehicles and medium- and heavy-duty trucks (totaling 1,494 Tg CO_2eq).

For purposes of making this cause or contribute finding, the EPA is focused on, and proposes to include, a set of aircraft engine classes used in types of aircraft as described below, which corresponds to the scope of the international CO_2 emissions standard contemplated by ICAO.

As mentioned earlier in section II.D, traditionally the EPA (and FAA) participates at ICAO in the development of international standards, and then where appropriate, the EPA establishes domestic aircraft engine emission standards under CAA section 231 of at least equivalent stringency to ICAO's standards. An international CO_2 emissions standard is anticipated in February 2016, and provided that the EPA makes a positive endangerment finding and ICAO adopts an

[163] IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, p. 11.

[164] One teragram (Tg) = 1 million metric tons = 1 megatonne (Mt). 1 metric ton = 1,000 kg = 1.102 short tons = 2,205 lbs.

[165] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

[166] World Resources Institute (WRI) Climate Analysis Indicators Tool (CAIT) Data Explorer (Version 2.0). Available at *http://cait.wri.org* (last accessed May 12, 2015).

[167] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013*, 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport*, (last accessed May 12, 2015).

[168] According to IPCC guidelines for common and consistent accounting and reporting of GHGs under the UNFCCC, the total U.S. GHG emissions from the U.S. Inventory that is reported to the UNFCCC excludes international bunker fuel emissions (aviation and marine international bunker fuel emissions) from the reported total national GHG emissions. However, the total U.S. GHG emissions in this proposed cause or contribute finding section of this action do include international bunker fuel emissions because we want to capture the full contribution of U.S. emissions, including those from U.S. aircraft.

international CO_2 emissions standard that is both consistent with CAA section 231 and appropriate for domestic needs, we would expect to proceed with promulgating a CO_2 emissions standard (or GHG standard) of at least equivalent stringency domestically. As described later in section VI.D, the thresholds of applicability for the international CO_2 emissions standard are based on gross weight as follows: For subsonic jet aircraft, a maximum takeoff mass (MTOM) greater than 5,700 kilograms; and for subsonic propeller driven (*e.g.,* turboprop) aircraft, a MTOM greater than 8,618 kilograms.[169] Applying these gross weight thresholds, our proposed cause or contribute finding applies to GHG emissions from classes of engines used in covered aircraft. Examples of covered aircraft would include smaller jet aircraft such as the Cessna Citation CJ2+ and the Embraer E170, up to the largest commercial jet aircraft—the Airbus A380 and the Boeing 747. Other examples of covered aircraft would include larger turboprop aircraft, such as the ATR 72 and the Bombardier Q400. Our intention is for the scope of the contribution finding to correspond to the aircraft engine GHG emissions that are from aircraft that match the applicability thresholds for the international aircraft CO2 standard. As such we have also identified aircraft that are not covered aircraft for purposes of our proposed contribution finding. That includes aircraft that fall below the international applicability thresholds: Smaller turboprop aircraft, such as the Beechcraft King Air 350i, and smaller jet aircraft, such as the Cessna Citation M2. In addition, ICAO (with U.S. participation) has agreed to exclude ''piston-engine aircraft,'' ''helicopters,'' and ''military aircraft'' [170] from the types of aircraft that would be covered by the anticipated ICAO standards.[171] These aircraft would not be covered aircraft and consequently, we are also not including GHG emissions from classes of engines used in these types of aircraft in our proposed cause or contribute finding.

Thus, for the purposes of the cause or contribute finding, the EPA proposes to include GHG emissions from aircraft engines used in covered aircraft in the scope of this proposed cause or contribute finding. This is an equivalent scope of applicability as that contemplated by ICAO. The majority of the GHG emissions from all classes of aircraft engines would be covered by this scope of applicability. Below we describe the contribution of these U.S. covered aircraft GHG emissions to U.S. GHG emissions, and later in section V.B.2.b we discuss the contribution of these U.S. covered aircraft emissions to global GHG emissions.

In 2013, GHG emissions from U.S. covered aircraft (which includes U.S. international aviation bunker fuels in certain cases) comprised 90 percent (195 Tg CO_2eq) of total U.S. aircraft GHG emissions [172] and 10 percent of total U.S. transportation sector GHG emissions (See Table V.1.). Overall, U.S. covered aircraft comprised the third largest source of GHG emissions in the U.S. transportation sector behind only the light-duty vehicle and medium- and heavy-duty truck sectors, which is the same ranking as total U.S. aircraft.[173] The U.S. covered aircraft also represent 3 percent of total U.S. GHG emissions, which is approximately equal to the contribution from total U.S. aircraft of 3.2 percent (Table V.1).[174]

It is important to note that in regard to the six well-mixed GHGs (CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride), only two of these gases—CO_2 and nitrous oxide—are reported as non-zero emissions for total aircraft and covered aircraft.[175] CO_2 represents 99 percent of all GHGs from both total aircraft (214 Tg CO_2eq) and U.S. covered aircraft (193 Tg CO_2eq), and nitrous oxide represents about one percent from total aircraft (2 Tg CO_2eq) and covered aircraft (1.8 Tg CO_2eq). Modern aircraft do not emit methane,[176] and hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are not products of aircraft engine combustion.

[169] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard,* Circular (Cir) 337, AN/192, Available at *http://www.icao.int/publications/ICAOProducts&Services2015catalogue/cat_2015en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[170] ICAO regulations only apply to civil aviation (aircraft and aircraft engines), and consequently, ICAO regulations do not apply to military aircraft.

[171] The applicability of the anticipated international CO_2 standard would be limited to subsonic aircraft, and would not extend to supersonic aircraft. Since space vehicles (or spacecraft) will be operated at supersonic speeds, space vehicles would not be covered by the anticipated international CO_2 standard.

[172] Eastern Research Group, Incorporated (ERG), *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds,* Final Report, EPA Contract Number EP–D–11–006, May 7, 2015.

[173] Compared independently, total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions are both ranked the third largest source in the U.S. transportations sector, behind only light-duty vehicle and medium- and heavy-duty truck sectors.

[174] Total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions were from 12 to 32 percent greater in 2000 and 2005 than in 1990. These increases in aircraft GHG emissions are primarily because aircraft operations (or number of flights) grew by similar amounts during this time period. Also, total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions were from 10 to 17 percent greater in 2000 and 2005 than in 2013. These decreases in aircraft GHG emissions are partly because aircraft operations decreased by similar amounts during this time period. In addition, the decreases in aircraft emissions are due in part to improved operational efficiency that results in more direct flight routing, improvements in aircraft and engine technologies to reduce fuel burn and emissions, and the accelerated retirement of older, less fuel efficient aircraft.

Also, the U.S. transportation GHG emissions were changing at similar rates as total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions for these same time periods, and thus, the aircraft GHG emissions share of U.S. Transportation remains approximately constant (over these time periods).

(U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013,* 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport*, Last accessed May 12, 2015; U.S. FAA. 2015, *APO Terminal Area Forecast Summary Report—Forecast Issued January 2015, http://aspm.faa.gov/apowtaf/* .).

[175] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013,* 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport*, (last accessed May 12, 2015).

[176] Emissions of methane from jet fuels are no longer considered to be emitted (based on the latest studies) across the time series from aircraft gas turbine engines burning jet fuel A at higher power settings (EPA, *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet and Turboprop Engines,* EPA–420–R–09–901, May 27, 2009 (see *http://www.epa.gov/otaq/regs/nonroad/aviation/420r09901.pdf (last accessed May 12, 2015)*). Based on this data, methane emissions factors for jet aircraft were reported as zero to reflect the latest emissions testing data. Also, the 2006 IPCC Guidelines indicate the following: ''Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines.'' (IPCC, 2006: *IPCC Guidelines for National Greenhouse Gas Inventories,* The National Greenhouse Gas Inventories Programme, The Intergovernmental Panel on Climate Change, H.S. Eggleston, L. Buendia, K. Miwa, T Ngara, and K. Tanabe (eds.). Hayama, Kanagawa, Japan.) The EPA uses an emissions factor of zero to maintain consistency with the IPCC reporting guidelines, while continuing to stay abreast of the evolving research in this area. For example, one recent study has indicated that modern aircraft jet engines operating at higher power modes consume rather than emit methane (Santoni et al., 2011: *Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment,* Environ. Sci. Technol., 45, pp. 7075–7082).

TABLE V.1—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL U.S. TRANSPORTATION AND TOTAL U.S. GHG EMISSIONS

	1990	2000	2005	2010	2011	2012	2013
Total U.S. Aircraft GHG emissions (Tg CO_2eq)	228	262	254	216	215	212	216
Share of U.S. Transportation	14%	13%	12%	11%	11%	11%	11%
Share of total U.S. Inventory	3.6%	3.6%	3.4%	3.1%	3.1%	3.2%	3.2%
U.S. Covered Aircraft GHG emissions (Tg CO_2eq)	169	223	217	190	193	190	195
Share of U.S. aircraft GHG emissions	74%	85%	85%	88%	90%	90%	90%
Share of U.S. Transportation	10%	11%	10%	9.7%	10%	9.9%	10%
Share of total U.S. Inventory	2.6%	3%	2.9%	2.7%	2.8%	2.9%	2.9%
Transportation Sector emissions (Tg CO_2eq)	1,659	2,044	2,137	1,966	1,932	1,907	1,911
Share of total U.S. Inventory	26%	28%	29%	28%	28%	29%	28%
Total U.S. GHG emissions	6,406	7,315	7,464	7,017	6,889	6,652	6,744

b. U.S. Aircraft GHG Emissions Relative to Global Aircraft GHG Inventory and the Total Global GHG Inventory

For background information and context, we first provide information on the contribution of GHG emissions from global aircraft and the global transportation sector to total global GHG emissions, and describe how this compares to the emissions from aircraft that would be covered by the anticipated ICAO CO_2 standard. We then compare U.S. aircraft GHG emissions to the global aircraft sector, to the global transport sector, and to total global GHG emissions as an indication of the role this source plays in the total global contribution to the air pollution that is causing climate change. As in the preceding section, we present comparisons from both total U.S. aircraft and U.S. covered aircraft.

According to IPCC AR5, global aircraft GHG emissions in 2010 were 11 percent of global transport GHG emissions and 2 percent of total global GHG emissions. Data from ICAO's 2013 Environmental Report indicate that the vast majority of global emissions from the aircraft sector are emitted by the types of aircraft that would be covered by the anticipated ICAO CO_2 standard (''ICAO covered aircraft'').[177] When compared to global data from IPCC AR5, worldwide GHG emissions from ICAO covered aircraft represented about 93 percent (688 Tg CO_2eq) of global aircraft GHG emissions,[178] 10 percent of global transport GHG emissions, and 1.5 percent of total global GHG emissions in 2010.

Comparing data from the U.S. Inventory to IPCC AR5, we find that total U.S. aircraft GHG emissions represented about 29 percent of global aircraft GHG emissions, about 3.1 percent of global transport GHG emissions, and about 0.5 percent of total global GHG emissions in 2010 (see Table V.2). For U.S. covered aircraft in 2010 GHG emissions represented about 26 percent of global aircraft GHG emissions, 2.7 percent of global transport GHG emissions, and 0.5 percent of total global GHG emissions (see Table V.2). Because 2010 is the most recent year for which IPCC emissions data are available, we also made comparisons using 2011 estimates from WRI/CAIT and the International Energy Agency (IEA)[179] and found that they yield very similar results.[180]

TABLE V.2—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL GLOBAL GREENHOUSE GAS EMISSIONS IN 2010

	2010 (Tg CO_2 eq)	Total U.S. Aircraft Share (%)	U.S. Covered Aircraft Share (%)	Global Aircraft Share (%)
Global Aircraft GHG emissions	743	29	26	.....
Global Transport GHG emissions	7,000	3.1	2.7	11
Total Global GHG emissions	49,000	0.5	0.5	2

For additional background information and context, we used 2011 WRI/CAIT and IEA data to make comparisons between the aircraft sector and the emissions inventories of entire countries and regions. When compared to entire countries, total global aircraft GHG emissions in 2011 ranked 9th overall, behind only China, United States, India, Russian Federation, Japan, Brazil, Germany, and Indonesia, and ahead of about 175 other countries. Total U.S. aircraft GHG emissions have historically been and continue to be by far the largest contributor to global aircraft GHG emissions. Total U.S. aircraft GHG emissions are about 7 times higher than aircraft GHG emissions from China, which globally is the second ranked country for aircraft GHG emissions, and about 5 times higher than aircraft GHG emissions from all of Asia. U.S. covered aircraft GHG emissions are about 6 times more than aircraft GHG emissions from China, and about 4 times more than aircraft GHG emissions from all of Asia. If U.S.

[177] ICAO CAEP, 2013: *ICAO Environmental Report 2013, Aviation and Climate Change,* 224 pp. Available at *http://cfapp.icao.int/Environmental-Report-2013/* (last accessed May 12, 2015).

[178] Worldwide GHG emissions from ICAO covered aircraft include emissions from both international and domestic aircraft operations around the world.

[179] International Energy Agency, Data Services. Available at *http://data.iea.org* (last accessed May 12, 2015).

[180] Data from WRI/CAIT and IEA show that, in 2011, total U.S. aircraft emissions represented about 28 percent of global aircraft GHG emissions, about 3.7 percent of global transport GHG emissions, and about 0.5 percent of total global GHG emissions. U.S. covered aircraft represented about 25 percent of global aircraft GHG emissions, 3.3 percent of global transport GHG emissions, and 0.5 percent of total global GHG emissions in 2011.

covered aircraft emissions of GHGs were ranked against total GHG emissions for entire countries, these covered aircraft emissions would rank ahead of Belgium, Czech Republic, Ireland, Sweden and about 150 other countries in the world.

c. Aircraft GHG Emissions Are Projected To Increase in the Future

While overall GHG emissions from U.S. covered aircraft increased by about 13 percent from 1990 to 2010, the portion attributable to U.S. international aviation bunker fuels[181] increased by about 90 percent.[182] During this same time period, global aircraft GHG emissions grew by about 40 percent, and the portion attributable to global international aviation bunker fuels increased by 80 percent.[183] [184] Notwithstanding the substantial growth in GHG emissions from U.S. international aviation bunker fuels, U.S. covered aircraft emissions have not increased as much as global aircraft emissions primarily because the U.S. aviation market was relatively mature compared to the markets in Europe and other emergent markets, and because during this time period the U.S. commercial air carriers suffered several major shocks that reduced demand for air travel.[185] [186] After consolidation and restructuring in recent years, the U.S. commercial air carriers have regained profitability and are forecasted by the FAA to grow more over the next 20 to 30 years.[187] With regard to global aircraft GHG emissions, the aviation markets in Asia/Pacific, Europe (where airline deregulation has stimulated significant new demands in this period), and the Middle East (and other emerging markets) have been growing rapidly, and the global market is expected to continue to grow significantly over the next 20 to 30 years.[188]

Recent studies estimate that both ICAO covered aircraft and U.S. covered aircraft will experience substantial growth over the next 20 to 30 years in their absolute fuel burn, and that this will translate into increased GHG emissions. ICAO estimates that the global fuel burn from ICAO covered aircraft will increase by about 120 percent from 2010 to 2030 and by about 210 percent from 2010 to 2040 (for a scenario with moderate technology and operational improvements).[189] The FAA projects that the fuel consumption from U.S. air carriers and general aviation aircraft operating on jet fuel will grow by 49 percent from 2010 to 2035, corresponding to an average annual increase rate in fuel consumption of 1.6 percent.[190] These aircraft groups (U.S. air carriers and general aviation aircraft operating on jet fuel) are of similar scope to the U.S. covered aircraft whose engine GHG emissions are the subject of this proposed finding. Using fuel burn growth rates provided above as a scaling factor for growth in GHG emissions (globally and nationally), it is estimated that GHG emissions from ICAO covered aircraft and U.S. covered aircraft would increase at a similar rate as the fuel burn by 2030, 2035, and 2040.

3. Proposed Contribution Finding for the Single Air Pollutant Comprised of the of Six Well-Mixed Greenhouse Gases

Taking into consideration the data summarized in section V.B.2 above, the Administrator proposes to find that GHG emissions from classes of engines used in U.S. covered aircraft, which are subsonic jet aircraft with a maximum takeoff mass (MTOM) greater than 5,700 kilograms and subsonic propeller driven (*e.g.,* turboprop) aircraft with a MTOM greater than 8,618 kilograms, contribute to the air pollution that endangers public health and welfare. The Administrator is not at this time proposing a contribution finding for GHG emissions from engines not used in covered aircraft (*i.e.,* those used in smaller turboprops, smaller jet aircraft, piston-engine aircraft, helicopters and military aircraft). We solicit comment on the scope of the proposed contribution finding, whether a broader contribution finding (*e.g.,* including all engines used in aircraft certified by the FAA) would be appropriate, and the extent to which EPA has discretion to establish standards pursuant to a contribution finding that do not impose requirements on every engine or class of engines within the scope of that finding.

It is the Administrator's judgment that the collective GHG emissions from the classes of engines used in U.S. covered aircraft clearly contribute, whether the comparison is domestic (10 percent of all U.S. transportation GHG emissions, representing 3 percent of total U.S. emissions) or global (26 percent of total global aircraft GHG emissions representing 3 percent of total global transportation emissions and 0.5 percent of all global GHG emissions). The proposed scope of GHG emissions from engines used in U.S. covered aircraft under this cause or contribute finding would result in the vast majority (90 percent) of U.S. aircraft GHG emissions being included in this determination. The Administrator believes that consideration of the global context is important for the cause or contribute test, but that the analysis should not solely consider the global context. GHG emissions from engines used in U.S. covered aircraft will become globally well-mixed in the atmosphere, and thus will have an effect not only on the U.S. regional climate but also on the global climate as a whole, for years and indeed many decades to come. It is the Administrator's view that the cause or contribute test used here

[181] The U.S. international aviation bunker fuels category includes emissions from combustion of fuel purchased in and used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier. GHG emissions from U.S. international aviation bunker fuels are a subset of GHG emissions from U.S. covered aircraft. From 1990 to 2010, GHG emissions from U.S. covered aircraft increased from 169 to 190 Tg CO2eq, and GHG emissions from the portion attributable to U.S. international aviation bunker fuels grew from 30 to 58 Tg CO2eq during this same time period. From 1990 to 2011, GHG emissions from U.S. covered aircraft increased from 169 to 192 Tg CO2eq (about 14 percent), and GHG emissions from the portion attributable to U.S. international aviation bunker fuels grew from 30 to 62 Tg CO2eq (about 110 percent).

[182] U.S. EPA, 2015: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013,* 564 pp. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#fullreport*, (last accessed May 12, 2015).

[183] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, pp. 599–670.

[184] According to IEA, from 1990 to 2011, global aircraft GHG emissions grew by about 50 percent, and global international aviation bunker fuels increased by 80 percent. International Energy Agency Data Services, Available at *http://data.iea.org* (last accessed May 12, 2015, 2015).

[185] FAA, 2014: *FAA Aerospace Forecast Fiscal Years 2014–2034,* 129 pp. Available at *https://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/aerospace_forecasts/2014-2034/media/2014_FAA_Aerospace_Forecast.pdf* (last accessed May 12, 2015).

[186] These shocks include the September 11 terror attacks, significant increases in fuel prices, debt restructuring in Europe and U.S., and a global recession.

[187] According to the *FAA Aerospace Forecast 2014–2034,* in 2013 U.S. air carriers were profitable for the fourth consecutive year.

[188] According to the *FAA Aerospace Forecast 2014–2034,* the International Air Transport Association (IATA) reports that world air carriers (including U.S. airlines) are expected to register an operating profit for 2013. Based on financial data compiled by ICAO and IATA, between 2004 and 2013 world airlines produced cumulative operating profits (with nine years out of ten posting gains) and net profits (with six years out of ten posting gains).

[189] ICAO CAEP, 2013: *ICAO Environmental Report 2013, Aviation and Climate Change,* 224 pp. Available at *http://cfapp.icao.int/Environmental-Report-2013/* (last accessed May 12, 2015).

[190] FAA, 2015: *FAA Aerospace Forecast Fiscal Years 2015–2035,* 134 pp. Available at *https://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/aerospace_forecasts/2015-2035/media/2015_National_Forecast_Report.pdf* (last accessed May 12, 2015).

under CAA section 231 can follow the same reasoning that was used in the 2009 GHG cause or contribute finding under CAA section 202; that is, the Administrator believes a positive cause or contribute finding for GHG emissions from engines used in U.S. covered aircraft is justified whether only the domestic context is considered, only the global context is considered, or both the domestic and global GHG emissions comparisons are viewed in combination.

As was the case in 2009, no single GHG source category dominates on the global scale, and many (if not all) individual GHG source categories could appear small in comparison to the total, when, in fact, they could be very important contributors in terms of both absolute emissions or in comparison to other source categories, globally or within the United States. If the United States and the rest of the world are to combat the risks associated with global climate change, contributors must do their part even if their contributions to the global problem, measured in terms of percentage, are smaller than typically encountered when tackling solely regional or local environmental issues.'' [191] Moreover, as the Supreme Court explained in *Massachusetts* v. *EPA,* agencies commonly take an incremental approach to resolving large issues, stating that, ''[a]gencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop. . . . They instead whittle away at them over time, refining their preferred approach as circumstances change and as they develop a more nuanced understanding of how best to proceed.'' 549 U.S. 497, 524 (2007) (citations omitted). The Administrator continues to believe that these unique, global aspects of the climate change problem—including that from a percentage perspective there are no dominating sources emitting GHGs and few sources that would even be considered to be close to dominating—tend to support consideration of contribution to the air pollution at lower percentage levels than EPA typically encounters when analyzing contribution towards a more localized air pollution problem. Thus, the Administrator, similar to the approach taken in the 2009 GHG cause or contribute finding under CAA section 202, is placing weight on the fact that engines [192] used in U.S. covered aircraft contribute 3 percent of total U.S. GHG emissions for the proposed contribution finding and comprise the single largest transportation source in the United States that has not yet been regulated for GHG emissions.

4. Additional Considerations

The Administrator is also concerned that reasonable estimates of GHG emissions from engines used in U.S. covered aircraft are projected to grow over the next 20 to 30 years. Given the projected growth in aircraft emissions compared to other sectors, it is reasonable for the Administrator to consider future emissions projections as adding weight to her primary reliance on annual emissions. Recent projections reveal that by 2035 GHG emissions from all aircraft and U.S. covered aircraft engines are likely to increase by almost 50 percent.[193] By contrast, it is estimated that by 2035 the light duty vehicle sector will see a 30 percent *reduction* in GHG emissions from the 2010 baseline, while the heavy duty vehicle sector will experience a 33 percent increase in GHG emissions from the 2010 baseline (this projected increase does not reflect the impact of GHG reductions anticipated from the Phase 2 heavy duty GHG standards that have not yet been promulgated). In addition, by 2035 the rail sector is projected to experience a 6 percent reduction in GHG emissions from 2010 baseline.[194] Because the projected growth in aircraft engine GHG emissions from U.S. covered aircraft appears to be greater in percentage terms than other transportation sources, this future consideration adds weight to the Administrator's proposed positive contribution finding.

VI. Advance Notice of Proposed Rulemaking: Discussion of Ongoing International Proceedings To Develop Aircraft CO_2 Emissions Standard and Request for Comment

For more than four years, the EPA and FAA have been engaged with the ICAO's Committee on Aviation Environmental Protection (ICAO/CAEP) to establish an international CO_2 emissions standard which the EPA could then consider proposing for adoption under its section 231 authority of the CAA. This section of this document serves as an ANPR to discuss the key issues of the ongoing international proceedings prior to February 2016, when ICAO/CAEP is expected to finalize an international aircraft CO_2 standard. An ANPR is intended to solicit comments and/or information from the public prior to an agency determining whether to propose a rulemaking. As such, an ANPR does not propose or impose any regulatory requirements. The EPA may choose to develop an ANPR for actions (such as the promulgation of standards pursuant to CAA section 231 to implement an international aircraft CO_2 standard domestically) which are still in the early stages of development and for which public input may be particularly helpful. This also helps ensure transparency, while assisting the EPA in obtaining input from a wide range of stakeholders as we continue work within CAEP to establish an international CO_2 aircraft standard. The EPA is seeking comments from all interested parties, including small businesses, on a variety of issues related to setting an international CO_2 standard for aircraft, including whether such standards should apply to in-production aircraft instead of new aircraft types only, the appropriate effective dates for the potential international CO_2 standard, as well as the appropriate stringency levels.

CAEP met an important milestone at its 9th meeting (CAEP/9) in 2013 in reaching an agreement on the

[191] 74 FR 66543 (December 15, 2009).

[192] For a standard promulgated under CAA section 231 to be ''applicable to'' emissions of air pollutants from aircraft engines, it could take many forms, and include multiple elements in addition to numeric permissible engine exhaust rate. For example, under CAA section 231, EPA's rules have long-standing regulations addressing fuel venting, as well as test procedures. *See* 40 CFR part 87, subparts B, G and H. Given both the absence of a statutory directive on what form a CAA section 231 standard must take (in contrast to, for example, CAA section 129(a)(4), which requires numerical emissions limitations for emissions of certain pollutants from solid waste incinerators), and the U.S. Court of Appeals for the DC Circuit's 2007 *NACAA* v. *EPA* ruling that section 231 confers an unusually broad degree of discretion in establishing aircraft engine emission standards, it should be possible to reconcile an ICAO ''aircraft standard'' that effectively limits aircraft engine GHG emissions with a CAA section 231 aircraft engine emission standard that achieves the same result, even if the GHG standards take a different form than the traditional thrust-based NOx aircraft engine emission standards recently issued by ICAO and the EPA. *See* 40 CFR part 87, subpart C.

[193] As discussed in Section V.B.2.c fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 49 percent from 2010 to 2035 and this provides a scaling factor for growth in GHG emissions which would increase at a similar rate as the fuel burn by 2030, 2035, and 2040.

[194] U.S. Energy Information Administration (EIA), 2015: *Annual Energy Outlook (AEO) 2015 with projections to 2040,* DOE/EIA–0383, 154 pp. EIA's reference case (used as the baseline in this comparison) assumes fuel economy levels for light duty vehicles required to meet federal light duty GHG standards for years 2012–2025, and for heavy duty trucks GHG standards for years 2014–2018, plus improvements in vehicles and engines for all subsectors due to availability of fuel-saving technologies and fuel price effects. EIA counts biofuels as zero tailpipe GHG emissions. Because the comparison in this section focuses on tailpipe emissions, we include them here, at volumes as forecast in the AEO 2015 reference case. Available at *http://www.eia.gov/forecasts/aeo/* (last accessed May 12, 2015).

appropriate metric to be used in assessing fuel efficiency (or CO_2 emissions)[195] of an engine/aircraft combination. They also reached agreement on a mature certification requirement[196] to evaluate CO_2 emissions for new aircraft types and also agreed on certain aspects of the scope of applicability of the CO_2 emissions standard; however, work on applicability options for in-production aircraft continues.

At the CAEP Steering Group meeting in November 2013, there was agreement on a set of stringency options to be used for the cost-effectiveness analysis, and at the Steering Group meeting in September 2014 there was a decision on the associated inputs for costs and technology responses to be utilized in the cost-effectiveness analysis of these stringency options. This analysis, and work on the applicability of the standard to in-production aircraft and the certification requirement are scheduled to be completed prior to the 10th CAEP meeting (CAEP/10) in February 2016. As described in section II.A, the EPA and the FAA traditionally work within the ICAO/CAEP standard-setting process to establish international emission standards and related requirements. Under this approach, international emission standards have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings under CAA section 231 to establish domestic standards that are of at least equal stringency as ICAO's standards. This approach has been affirmed as reasonable by the U.S. Court of Appeals for the DC Circuit. Provided the EPA makes a positive endangerment finding[197] under CAA section 231 and ICAO adopts an international aircraft CO_2 standard that is consistent with CAA section 231 and U.S. domestic needs, we would expect to proceed with a similar approach promulgating a CO_2 emissions standard (or GHG standard) of at least equivalent stringency domestically.

A. Purpose of the International Standard

At the CAEP Steering Group meeting in 2011, the U.S provided a paper recommending that CAEP agree that the purpose of the international CO_2 emissions standard be "to achieve CO_2 emissions reductions from the aviation sector beyond expected 'business as usual'—*i.e.,* a standard that achieves CO_2 emissions reductions from the aviation sector beyond what would be achieved in the absence of a standard. This would be analyzed using ICAO criteria of technical feasibility, environmental benefit, cost effectiveness, and impacts of interdependencies."[198] The Steering Group accepted the U.S. proposal for the purpose of the international CO_2 standard, and it is expected to be included in the standard setting process. The metric system, stringency options, costs, technology responses (inputs to be utilized in the cost-effectiveness analysis), and applicability ultimately chosen will all have an effect on whether the international CO_2 emissions standard adheres to this stated purpose of the standard. The U.S. continues to support the adoption of an international CO_2 emissions standard that meets this stated purpose, and the EPA requests comment on this continued support. The EPA requests comment on how to achieve the purpose of the standard.

B. Applicability of the International CO_2 Emissions Standard

The EPA requests comments on the applicability approaches that CAEP is considering. Specifically, we request comment on whether the aircraft CO_2 standard should apply to in-production aircraft, including aircraft with any engineered fuel efficiency improvements (*e.g.,* different engines, redesigned wings, or engine performance improvement packages, etc.) or whether the aircraft CO_2 standard should apply only to completely new aircraft type designs. CAEP is also considering a third, alternative approach, which would redefine a new aircraft type for CO_2 purposes to include in-production aircraft that have a significant change in CO_2 emissions. We are also requesting comment on this potential alternative option.

In-production aircraft and new aircraft types are defined as follows:

—*In-production aircraft:* Those aircraft types which have already received a Type Certificate, and for which manufacturers either have existing undelivered sales orders or would be willing and able to accept new sales orders.[199] [200] [201]

—*New aircraft types:* Aircraft types that have applied for a Type Certificate[202] after the effective date of a standard and that have never been manufactured prior to the effective date of a standard.

In addition, for context, out of production aircraft are those aircraft types which have already received a Type Certificate, but for which manufacturers either have no existing undelivered sales orders or would not be willing and able to accept new sales orders. These aircraft are aircraft types that are no longer in active production.[203]

As described earlier in section II.E, CAEP's Steering Group meeting in 2010

[195] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard*, Circular (Cir) 337, AN/192, Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337. Section 3.2 of this Circular states the following: "An important Phase 1 milestone in the development of the CO_2 Standard was reached on 11 July 2012, when the CAEP Steering Group agreed unanimously on a CO_2 metric system to measure the aeroplane fuel burn performance and therefore the CO_2 emissions produced."

[196] ICAO defines a certification requirement as a combination of metric, procedures, instrumentation and measurement methodology, and compliance requirements.

[197] As shorthand in this action, in many places we will use the term "endangerment finding" for both endangerment and cause or contribute findings.

[198] CAEP (U.S. Working Paper), "U.S. Position on the Development of ICAO'S Aircraft CO_2 Standard," CAEP–SG/20112–WP/25, Presented by the United States, U.S. Working Paper for CAEP Steering Group meeting, Beijing, China, 12 to 16 September 2011.

[199] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard*. Available *at http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015).The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[200] As described earlier in section D, in existing U.S. aviation emissions regulations, in-production means newly-manufactured or built after the effective date of the regulations—and already certified to pre-existing standards (if emission standards were established previously).). This is similar to the current CAEP definition for in-production aircraft types for purposes of the CO_2 standard.

[201] According to ICAO Cir 337, a Type Certificate is "[a] document issued by a Contracting State to define the design of an aircraft type and to certify that this design meets the appropriate airworthiness requirements of that State".

[202] A Type Certificate is a design approval process whereby the FAA ensures the manufacturer's designs meet the minimum requirements for aircraft safety and environmental regulations. This is typically issued only once for each aircraft, and modified as needed as an aircraft is modified over the course of its production life. This Type Certificate (for new aircraft types) would be the initial or new Type Certificate for this aircraft.

[203] Out of production aircraft that are still in operational use would become subject to the international standard only if the standard applied to "in-use" aircraft, which it will not since CAEP has agreed that the international aircraft CO_2 standard should not apply to out of production aircraft types. Note, the EPA's CAA section 231 aircraft engine standards have applied to in-use aircraft only in very limited situations, such as the prohibition against fuel venting at 40 CFR 87.11 and smoke number standards at 40 CFR 87.31. Note, however, that unlike the EPA's authority to promulgate emission standards for motor vehicles under CAA section 202(a) or for nonroad engines and vehicles under section 213(a), section 231 of the CAA does not restrict the EPA's authority to set standards for only new aircraft.

agreed that the scope of applicability for the international aircraft CO_2 standard will be subsonic jets with an applicability weight threshold of maximum takeoff mass (MTOM) greater than 5,700 kg (12,566 lb) and turboprop aircraft with a MTOM greater than 8,618 kg (19,000 lb). CAEP also agreed that the international CO_2 standard will apply to new aircraft types, but not apply to out of production aircraft types, and that applying the standard to in-production aircraft types should not be ruled out.[204]

It is important to further describe the difference between new aircraft types and in-production aircraft. There are three categories of aircraft under consideration when describing a CO_2 standard: New aircraft types submitted for certification (known as clean sheet designs), those with lesser levels of design change, such as a new series in an established type and model (considered to be significant partial redesigns), or an aircraft with incremental improvements.[205] New aircraft types or new type designs are significant investments for manufacturers and are used for new and significantly different designs (also characterized as complete redesigns). Significant partial redesigns may be characterized as a new or later series of an established model that may incorporate newly designed wings and give purchasers more choices of engines. Incremental improvements are less extensive changes to an aircraft such as performance improvement packages that may be added to an aircraft or engine at some point during the production cycle.

New aircraft types or new type designs are infrequent. The most recent new type designs introduced in service, such as the Airbus A380 in 2007, the Boeing 787 in 2011, and the original Boeing 777 in 1995,[206] [207] [208] indicate that it is unlikely a new type design will seek certification in the next 10 to 15 years.[209] (New aircraft types (and similarly for significant partial redesigns) typically yield large fuel burn reductions—10 percent to 20 percent over the prior generation they replace, and as one might expect, these significant fuel burn reductions do not happen frequently. Also, aircraft development programs are expensive. It is not unusual for new type designs to take 8–10 years to develop, from preliminary design to entry into service.[210] [211]) Significant partial redesigns do not occur often, but are slightly more frequent than new type designs. For example, after the current significant partial redesign wave[212] has passed (which includes the Boeing 747–8, Boeing 737 Max, Airbus 320 Neo, and Boeing 777–X), we do not currently have knowledge of many additional significant partial redesigns anticipated over the next decade (as the previous wave of significant partial redesigns included the Boeing 777–200LR in 2004, 777–300ER in 2006, 737NG in 1998, Airbus 319 in 1996, and Airbus 330–200 in 1998).[213] [214] Incremental improvements will likely be frequent and occur in the near term. One approach CAEP is considering would be to limit the applicability of any international CO_2 standard to only new type designs (or new aircraft types). Under this approach the international CO_2 standard would not apply to significant partial redesigned aircraft and incremental improvements. Under another approach CAEP is considering, CAEP would also apply the international CO_2 standard to in-production aircraft (in addition to new aircraft types). Significant partial redesigned aircraft and incremental improvements would be characterized as changes made to in-production aircraft; thus, these categories of aircraft (or these changes) would need to meet the international CO_2 standard under this approach (or they would need to meet the standard if it also applied to in-production aircraft).[215]

Another approach for applicability of the international CO_2 standard that CAEP could adopt (or CAEP is considering) would be an approach based on criteria addressing significant changes to aircraft designs, which could be considered an applicability requirement different than that for new aircraft types only and in-production aircraft. This alternative approach could redefine a new aircraft type for CO_2 purposes to include in-production aircraft that have a significant change in CO_2 emissions, thus including in-production aircraft in the applicability of the CO_2 standard. The alternative approach could even cover significant partial redesigned aircraft, depending upon the definition. CAEP's current mature certification requirement for the international CO_2 standard[216] provides further detail on technology changes to aircraft that would affect the aircraft's CO_2 metric value. A changed version of an aircraft could be defined as follows: An aircraft which incorporates changes in type design that may adversely affect[217] its CO_2 emissions. This possible definition could also note the

[204] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard*. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf* (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.

[205] New aircraft types fall under the initial or new Type Certificate, and significant partial redesigns and incremental improvements fall under an amended Type Certificate. Significant partial redesigns would be a new or later series of an established model, and incremental improvements would be a part of the same series as the established model.

[206] Boeing, 2011: *Boeing Unveils First 787 to Enter Service for Japan Airlines*, December 14. Available at *http://boeing.mediaroom.com/2011-12-14-Boeing-Unveils-First-787-to-Enter-Service-for-Japan-Airlines* (last accessed May 12, 2015).

[207] The Independent, 2012: *BA reveals Airbus A380 superjumbo flight plans*, by Peter Woodman, December 11. Available at *http://www.independent.co.uk/travel/news-and-advice/ba-reveals-airbus-a380-superjumbo-flight-plans-8405961.html* (last accessed May 12, 2015).

[208] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[209] Ibid.

[210] Ibid.

[211] Analysts estimate a new single aisle would have cost $10–12 billion to develop. The A380 and 787 are estimated to each have cost around $20 billion to develop; the A350 is estimated to have cost $15 billion, excluding engine development. Due to the large development cost of a totally new aircraft design, manufacturers are opting to re-wing or just re-engine their aircraft (significant partial redesigns). Boeing is said to have budgeted $5 billion for the re-wing of the 777 and Airbus and Boeing have budgeted $1–2 billion each for the re-engine of the A320 and the 737, respectively (excluding engine development costs). Embraer has publically stated they will need to spend $1–2 billion to re-wing the EMB–175 and variants. (ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.)

[212] In general, design waves are prompted by the combination of market demand for new aircraft performance needs (*e.g.*, more seats for longer range) and the age of existing aircraft, and design waves are typically enabled by advances in propulsion technology.

[213] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[214] Insofar as we are going through a wave of major redesign and service entry now, prospects for further step-function improvements will be low in the coming 10–15 years. (ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.)

[215] As described earlier, CAEP has not ruled out applying the international CO_2 standard to in-production aircraft types, which are aircraft types that have already received a Type Certificate and are produced after the effective date of the standard. In-production aircraft types would include significant partial redesigned aircraft and incremental improvements. CAEP is currently considering and analyzing in-production applicability.

[216] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard. Available at http://www.icao.int/publications/catalogue/cat_2015_en.pdf (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.* See Chapter 1.

[217] Due to substantial market forces to alleviate any adverse effects on aircraft fuel burn or CO_2 emissions, adverse changes are rare.

following: (1) Where the proposed change in design, configuration, power or mass is so extensive that a substantially new investigation of compliance with the applicable airworthiness regulations is required, the aircraft should be considered to be a new type design rather than a changed version, and (2) ''adversely'' refers to an increase in CO_2 emissions of more than an amount (or percentage) that has yet to be determined (this amount or criterion is still being considered by CAEP). The EPA requests comment on this change-based criteria approach, including how to identify those changes that would result in treating in-production aircraft as new types subject to the standard.

If CAEP were to limit the scope of applicability to new aircraft types only (and without the significant change criteria approach described above), the international CO_2 standard would not apply to later series aircraft with redesigned wings, aircraft that are available with different engines, or aircraft that undergo incremental improvements. Following are several examples that illustrate this situation. The re-engined Boeing 737 Max is an example of a significant partial redesigned aircraft that is expected to enter into service in 2017.[218] This aircraft would fall under the original Boeing 737 Type Certificate that was issued in 1967 (and entered into service in 1968)—or more specifically it would fall under an amended Type Certificate, and it would not be considered a new aircraft type as defined by CAEP. The current in-production 737s (Next Generation 737s or commonly abbreviated as 737 NGs) feature newer engines, have redesigned wings, and entered service in 1998 under the original 737 Type Certificate that was issued in 1967, and these also were not considered a new type aircraft when they were introduced in 1998.[219] Another example of an aircraft that does not qualify as a new type is the Boeing 747–8 aircraft, that entered into service in 2011, and which included a new wing, new engines, and a lengthened fuselage but fell under an amended Type Certificate for the original Boeing 747 that was certified in 1969 (and entered into service in 1969). An example of incremental improvements to in-production aircraft, is the Boeing Next Generation 737 performance improvement package which was implemented between 2011 and 2013 and the Boeing 767–300 winglets that entered into service in 2008, both of which improve aircraft fuel efficiency. There are many other examples that exist for different manufacturers and aircraft around the world as well, but for conciseness, we are limiting our discussion to these above examples. These examples illustrate the typical certification for significant partial redesigns and incremental improvements by various aircraft certificating or certifying authorities (or national airworthiness authorities) around the world.

Using CAEP's current definition of new aircraft types (clean sheet designs, which are completely new aircraft) we cannot today identify the first aircraft to which the new standard would apply. As the examples above illustrate, new aircraft types are infrequent,[220] and there are no currently announced new type designs that are expected to be introduced after the implementation dates being analyzed by CAEP—2020 and 2023. Furthermore, based on provisions to which CAEP has already agreed,[221] new aircraft types subject to the CO_2 standard would be aircraft that submit an application for a Type Certificate after the implementation dates of 2020 and 2023 (dates for the stringency analysis) which would likely result in entry into service dates of about 2025 or 2028.[222] If the international CO_2 standard is applied only to new aircraft types, then CO_2 emissions would not be expected to begin to deviate from business-as-usual (in comparison to CO_2 emissions reductions that would be achieved in the absence of a standard) before 2025. Therefore, an international standard developed for only new aircraft types may not actually apply to any new aircraft for at least a decade. Even if a few new type aircraft are introduced in this timeframe, it will take even longer for these aircraft to comprise any significant portion of the fleet. Therefore, applying an international standard which applies only to new aircraft types will likely result in no additional CO_2 reductions beyond what would have occurred absent a CO_2 standard, either for the near- and mid-term, about 5 to 10 years from 2016, or even in the longer-term of 20 years plus.[223] [224]

The EPA requests comments on the timeframes described above for introducing new aircraft types and their subsequent penetration into the fleet. Are there any aircraft manufacturer announcements that we missed in regard to new aircraft types that will be introduced or apply for a Type Certificate after 2020 and 2023 (or new aircraft types that will be introduced or apply for a Type Certificate five years after these dates)?[225] If so, what are these new aircraft types? How many new types are projected to enter the fleet in this timeframe and what portion of the fleet will they represent?

The alternative approach being considered by CAEP and described earlier (addressing changes in design of in-production aircraft) may offer an opportunity to cover more aircraft in an earlier timeframe (including significant partial redesigns), but it is unclear what effect this approach would have on

[218] Boeing, *737 Max Program ''LEAPS'' Into Engine Testing,* Article by Eric Olson, July 11, 2014. Available at *http://www.boeing.com/boeing/Features/2014/07/bca_737max_leap_07_11_14.page*, (last accessed May 12, 2015).

[219] The original 737 entered service in 1968. The 737 Classic entered service in 1984, and it had new high bypass engines, an updated wing, and other aerodynamic improvements. The 737 NGs entered service in 1998, and they featured a new wing and updated engines. Several mid-life upgrades were produced for the 737 NGs, offering improved range, payload, and efficiency. (ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft,* Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.)

[220] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[221] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard*. Available at *http://www.icao.int/publications/catalogue/cat_2015_en.pdf (last accessed May.12, 2015)*. The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337. Section 1.5 states that that the date to be used in determining the applicability of the CO_2 standard is the date the application for a Type Certificate was submitted to the certificating authority having jurisdiction over the manufacturer responsible for the aircraft design. Section 1.6 specifies that an application shall be effective for the period specified in the designation of the airworthiness regulations appropriate to the aircraft type. An application for a Type Certificate is valid for 5 years.

[222] These dates assume 5 years from application for the aircraft Type Certificate to entry into service, which is how long an application is valid for a Type Certificate.

[223] Approximate time-scales are considered to be 5 years for near-term, 10 years for mid-term, and 20 years or more for long-term.

[224] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[225] In November 2014, Boeing indicated that it would replace the 737 with a new aircraft type in 2030. Earlier this decade, Boeing was assessing an all new clean sheet 737 replacement, but eventually they decided to re-engine the 737 (the 737 Max) instead. (Flight Club, Paul Thompson, *Here's The Skinny On What's Next For Boeing,* November 16, 2014. Available at *http://flightclub.jalopnik.com/heres-the-skinny-on-whats-next-for-boeing-1656206527 (last accessed May 12, 2015),* Also, Wichita Business Journal, Daniel McCoy, *Boeing planning 737 MAX replacement by 2030—What it could mean for Spirit AeroSystems,* November 5, 2014. Available at *http://www.bizjournals.com/wichita/blog/2014/11/boeing-planning-737-max-replacement-by-2030-what.html*) (last accessed May 12, 2015). We would consider this as a Boeing projection or sketching out of plans for a new aircraft type, but it is not a commitment from Boeing.

additional CO_2 emissions reductions compared to a standard for only new aircraft types. The EPA requests comments on the timeframe for CO_2 emissions reductions and the likely share of annual aircraft production (or share of in-production aircraft built annually) that would be affected under this alternative approach.

If ICAO applies the aircraft CO_2 emission standard to in-production aircraft, and subsequently (provided the EPA makes a positive endangerment finding under CAA section 231(a)) the EPA establishes domestic aircraft engine standards that are equivalent to the ICAO international aircraft CO_2 standard, this means that all aircraft built (in-production) after the effective date would need to certify and comply with the standard to remain in production. This includes (as described earlier) in-production aircraft with incremental improvements (though we reiterate this would not include in-use aircraft). As an example of in-production aircraft, the Gulfstream G650, which is currently in production and expected to remain so after 2020, would need to certify and comply with the new CO_2 standard. In the next section we discuss in more detail how applicability to in-production aircraft could work.

C. CAEP Discussion on In-Production Aircraft Applicability

At the request of the CAEP Steering Group meeting in November 2013, CAEP began work on defining potential options to implement applicability requirements for in-production aircraft. Subsequently, based on the options provided to the 2014 Steering Group meeting, CAEP decided that it should continue to investigate potential in-production aircraft applicability options, and that these should be presented at the July 2015 Steering Group meeting, so that a decision can be taken at the 10th meeting of CAEP (CAEP/10) in February 2016 regarding whether the international CO_2 standard will apply to in-production aircraft. There are a wide range of options under consideration, including both mandatory and voluntary options for reporting and certification processes for in-production aircraft applicability, but the 2014 Steering Group meeting requested that CAEP focus on defining the mandatory options (in contrast to options such as voluntary reporting and certification).

1. Applicability to In-Production Aircraft and Date of Implementation

At the 2014 Steering Group meeting, CAEP also agreed that 2023 represented the earliest possible date for an in-production aircraft standard to allow time to promulgate domestic regulations and process manufacturer certification applications. CAEP did not rule out later dates though and could consider implementation dates for an in-production aircraft CO_2 standard later than 2023 (CAEP could consider applicability dates for in-production aircraft that are five years following the new aircraft type applicability date, *i.e.* dates ranging from 2023 to 2028).

The EPA seeks comments on both a 2023 implementation date and on possible later implementation dates for an in-production domestic CO_2 (or GHG) aircraft engine emissions standard that would be adopted under CAA section 231,[226] the impact the date of implementation might have on per-aircraft GHG or CO_2 emissions rates[227] and the ability of a domestic GHG or CO_2 standard to achieve aircraft emission reductions beyond what would occur in the absence of such a standard.

As described in section VI.F.2, the technologies considered for the CAEP analyses are those technologies that will be widely used on in-production aircraft by 2016 or shortly thereafter.[228] The EPA requests comments regarding whether applying an international CO_2 standard to in-production aircraft is consistent with the purpose of the standard as accepted by the CAEP Steering Group meeting in 2011: ''to achieve CO_2 emission reductions from the aviation sector beyond expected 'business as usual' . . . analyzed using ICAO criteria of technical feasibility, environmental benefit, cost effectiveness, and impacts of interdependencies.''[229] The International Coalition for Sustainable Aviation (ICSA),[230] which is a CAEP Observer organization, submitted papers to CAEP that analyzed this issue. Also, a member of ICSA[231] has developed similar analyses which indicate that applying the international standard only to new aircraft types would likely result in no additional CO_2 reductions beyond what would have occurred absent a CO_2 standard, either for the near- and mid-term, about 5 to 10 years from 2016, or even in the longer-term of 20 years plus. This occurs, the ICCT states, because the development cycles for new aircraft are very lengthy and it is not unusual for new aircraft to take 8 to 10 years to develop from preliminary design to entry into service and once in service it takes significant time for new aircraft types to penetrate the fleet.[232] [233]

[226] Traditionally, international emission standards have first been adopted by ICAO, and subsequently the EPA had initiated rulemakings under CAA section 231 to establish domestic standards equivalent to ICAO's standards where appropriate. Provided ICAO adopts an international aircraft CO_2 standard that is consistent with CAA section 231 and it is appropriate for domestic needs in the United States, we expect to proceed along a similar approach for the future CAA section 231 aircraft engine CO_2 standard (or aircraft engine GHG standard), provided the EPA issues final positive endangerment and cause or contribute findings under CAA section 231.

[227] For a standard promulgated under CAA section 231 to be ''applicable to'' emissions of air pollutants from aircraft engines, it could take many forms, and include multiple elements in addition to numeric permissible engine exhaust rate. For example, under CAA section 231, EPA's rules have long-standing regulations addressing fuel venting, as well as test procedures. *See* 40 CFR part 87, subparts B, G and H. Given both the absence of a statutory directive on what form a CAA section 231 standard must take (in contrast to, for example, CAA section 129(a)(4), which requires numerical emissions limitations for emissions of certain pollutants from solid waste incinerators), and the U.S. Court of Appeals for the D.C. Circuit's 2007 *NACAA* v. *EPA* ruling that section 231 confers an unusually broad degree of discretion in establishing aircraft engine emission standards, it should be possible to reconcile an ICAO ''aircraft standard'' that effectively limits aircraft engine GHG emissions with a CAA section 231 aircraft engine emission standard that achieves the same result, even if the GHG standards take a different form than the traditional thrust-based NO_X aircraft engine emission standards recently issued by ICAO and the EPA. *See* 40 CFR part 87, subpart C.

[228] CAEP determined in 2012 that all technology responses would have to be based on technology that would be in common use by the time the standard was to be decided upon in 2016 or shortly thereafter. This generation of technology was defined within CAEP as a Technology Readiness Level (TRL) 8—an actual system completed and ''flight qualified'' through test and demonstration—by 2016 or shortly thereafter.

[229] CAEP (U.S. Working Paper), ''U.S. Position on the Development of ICAO'S Aircraft CO_2 Standard,'' CAEP–SG/20112–WP/25, Presented by the United States, U.S. Working Paper for CAEP Steering Group meeting, Beijing, China, 12 to 16 September 2011. Available at *http://www.epa.gov/otaq/aviation.htm*. (last accessed May 12, 2015).

International Coalition for Sustainable Aviation (ICSA), ''ICAO'S CO_2 Standard as Part of a Basket of Measures to Meet Emission Reduction Goals'', ICAO Assembly—38th Session, Executive Committee, Agenda Item 17—Environmental Protection, A38–WP/297, EX/99, September 19, 2013.

[230] The International Coalition for Sustainable Aviation (ICSA) is a structured network of environmental non-governmental organizations (NGOs) who share a common concern with civil aviation's contribution to air quality issues, climate change and noise, and who are committed to developing and providing technical expertise, common policy positions and strategies with a view to reducing emissions and noise from aviation. See *http://www.icsa-aviation.org/* (last accessed May 12, 2015).

[231] The International Council on Clean Transportation (ICCT) is a member of ICSA, and ICCT is an independent nonprofit organization founded to provide research and technical and scientific analysis to environmental regulators. See *http://www.theicct.org/* (last accessed May 12, 2015).

[232] ICCT, Efficiency Trends for New Commercial Jet Aircraft 1960 to 2008, November 2009. Available at *http://www.theicct.org/sites/default/files/publications/ICCT_Aircraft_Efficiency_final.pdf* (last accessed May 12, 2015).

Another study funded by the EPA corroborates this analysis.[234] The EPA requests comments on whether applying the international CO_2 aircraft standard only to new aircraft types would be consistent with the accepted purpose of the international standard (the purpose of the standard that has been accepted by the CAEP Steering Group). Lastly, the EPA requests comment on the appropriateness of a possible EPA regulation following either of these approaches (applicability to only new aircraft types or applicability to both new types and in-production aircraft) which are under consideration at CAEP.

Also, there have been concerns raised in CAEP about applying the international CO_2 standard to in-production aircraft. These concerns include (a) the added resource burden on certificating authorities[235] to process manufacturers' certification applications, which will be more numerous compared to new aircraft types; and (b) the potential added costs to manufacturers to certify in-production aircraft. The EPA requests comment on these two concerns, including providing supporting documentation on the extent of these concerns and any other issues the commenters may identify with applying the international CO_2 standard to in-production aircraft.

2. Reporting Requirement for New In-Production Aircraft

CAEP is working to define mandatory in-production aircraft options, and one possible option is a reporting requirement[236] [237] [238] for in-production aircraft CO_2 emissions rates (measured according to the aircraft test procedure that was agreed upon at CAEP/9) as an alternative to establishing an aircraft CO_2 standard for in-production aircraft. Although a reporting requirement provides policy relevant information, it does not necessarily translate into specific emissions reductions. The EPA recognizes that only a mandatory standard for in-production aircraft would ensure that the aircraft CO_2 standard reduces per-aircraft CO_2 emissions rates. However, a reporting requirement could be an important component of an in-production aircraft CO_2 standard, especially if it is implemented shortly after an in-production aircraft standard is adopted. It would ensure that CO_2 emissions rates data are gathered quickly prior to an effective date for the final standard (tracking CO_2 emissions rates is beneficial for the reasons discussed later in this section and for potentially assisting with the assessment of a future CO_2 standard). The EPA requests comment on an aircraft manufacturer reporting requirement that is implemented soon after the adoption of an in-production international aircraft CO_2 standard, as a component of the in-production aircraft CO_2 standard.

In 2009 the EPA promulgated a final GHG reporting rule that applies to many sectors in the United States, including manufacturers of heavy-duty and offroad vehicles and engines, and manufacturers of aircraft engines.[239] [240] The EPA's experience with reporting programs indicates that the EPA and the public would be able to track CO_2 emissions rates trends (*i.e.,* trends of aircraft cruise fuel burn rates) from aircraft over time. Requiring the reporting of aircraft CO_2 emissions rates trends from aircraft over time is appropriate and feasible. Requiring aircraft manufacturers to report aircraft CO_2 emissions rates shortly after an in-production international aircraft standard is adopted would enable and expedite the tracking and understanding of these emission trends. In addition, reporting programs typically raise awareness of emissions and can improve the understanding of the factors that influence emission rates as well as the actions that can be taken to reduce emissions. When similar methods for monitoring, measurement, and reporting are applied across an industry, it can lead to more consistent, accurate, and timely data to inform decision-making for individual manufacturers and the EPA (including a comparison of the CO_2 emissions rates from aircraft of various manufacturers). Thus, a reporting requirement could potentially contribute to efforts to identify and implement future aircraft CO_2 emission reduction opportunities.

Independent of action that CAEP may or may not take in February 2016, the EPA could under its CAA section 114(a) authority pursue a reporting requirement for aircraft cruise GHG or CO_2 emissions rates—to ensure we have GHG or CO_2 emissions rates data on all in-production aircraft (and any new aircraft types that enter service).[241] The EPA could use the same metric agreed to at CAEP/9 (and in ICAO circular 337). This will be described in detail in

[233] ICCT, "*Could ICAO's CO_2 Standard Not Actually Cover Any Aircraft? Yes, If Nobody's Watching*". Blog, December 9, 2014. Available at *http://www.theicct.org/blogs/staff/could-icaos-co2-standard-not-cover-any-aircraft* (last accessed May 12, 2015).

[234] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[235] Pursuant to CAA section 232, the FAA, after consultation with the EPA, shall prescribe regulations to insure compliance with all standards prescribed by the EPA under CAA section 231. Section 232 then directs the FAA to include provisions making the EPA's standards applicable in the issuance, amendment, modification, suspension, or revocation of any certificate authorized by the FAA under part A of subtitle VII of Title 49. Under this unique statutory structure, the EPA promulgates the substantive emission standards, and the FAA enforces the EPA's standards and insures all necessary inspections are accomplished.

[236] Currently, CAEP is developing a publicly available database for aircraft CO_2 emissions (CAEP is now considering format, parameters, etc. for the database), but submissions to this database by aircraft manufacturers would be voluntary. There will not be a CAEP mandatory reporting requirement associated with this potential CO_2 database. In addition, if the international aircraft CO_2 standard applies to only new aircraft types, it could be many years before any data exists in this database.

[237] For many years, ICAO has maintained an Aircraft Engine Emissions Databank for landing and takeoff certificated emissions values of NO_X, hydrocarbon, carbon monoxide, and smoke number (ICAO and the EPA also have aircraft engine emission standards for these pollutants). It contains certified emissions data voluntarily reported from each aircraft engine manufacturer. This databank is available at *https://easa.europa.eu/document-library/icao-aircraft-engine-emissions-databank (last accessed May 12, 2015).*

[238] In 2012, the EPA promulgated annual reporting requirements for aircraft engine emissions of NO_X, hydrocarbon, carbon monoxide, and smoke number and related parameters. One of the reasons that the EPA issued these reporting requirements was due to the varying amount of voluntary data reported by aircraft engine manufacturers. (U.S. EPA, "Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures." Final Rule, 77 FR 36342 (June 18, 2012)).

[239] EPA's 2009 rule on Mandatory Reporting of Greenhouse Gases included engine manufacturers for the following mobile source sectors: Highway heavy-duty (engine and vehicle), non-road, aircraft, locomotive, marine, snowmobiles, and motorcycles. Manufacturers of aircraft jet engines of rated output (or thrust) greater than 26.7 kilonewtons are required under this program to report annually to the EPA CO_2 and NO_X emissions from aircraft engines during the landing and takeoff cycle. Manufacturers of these engines were already measuring and recording CO_2 emissions as part of existing criteria air pollutant emission requirements for the landing and takeoff cycle, but prior to this 2009 rule, these data were not reported to the EPA. Manufacturers voluntarily reported the data to ICAO, but there was no assurance that the EPA would receive this information, and thus, the 2009 rule required reporting of the aircraft engine CO_2 and NO_X emissions during the landing and takeoff cycle to the EPA.

[240] An aircraft manufacturer reporting requirement for in-production aircraft CO_2 emission rates would require the reporting of aircraft CO_2 emissions during the cruise phase of operation to the EPA. The majority of aircraft CO_2 emissions occurs in the cruise phase of operation, and thus, reporting CO_2 emission rates from this phase will improve our ability to track full-flight aircraft CO_2 emission rates over time (in addition to reporting the aircraft engine CO_2 emissions during the landing and takeoff cycle). Also, the aircraft test procedure that was agreed upon at CAEP/9 now enables us to measure aircraft CO_2 emissions during cruise.

[241] This GHG or CO_2 emissions rate data will help to track trends, raise awareness, better understand the technology in the fleet, etc.

VI.D.1 below. In general, the EPA asks for comment on a mandatory reporting requirement for in-production aircraft GHG or CO_2 emissions rates—either as part of the CAEP international standard or as an independent domestic requirement to be adopted by the EPA. If the EPA were to pursue this requirement independently from CAEP, what lead time would be appropriate for manufacturers to report the GHG or CO_2 emissions rates from all of their in-production aircraft [242] (after we promulgate such a requirement)? Additionally, if we were to pursue such an independent reporting requirement, should we require the annual reporting of the GHG or CO_2 emissions rates from in-production aircraft (and any new type aircraft) [243] to enable us to track any updates? We are not at this time proposing to promulgate such a requirement in advance of ICAO's decision. Due to the possibility of ICAO's adoption of a reporting requirement, we believe it is reasonable to await the outcome of that decision in order to determine whether to strictly follow ICAO's possible reporting requirement or make changes to it in the form of an additional U.S. domestic requirement, as appropriate.

D. Metric System, Applicability, and Certification Requirement

The CO_2 metric system and mature certification procedure were agreed upon by CAEP in 2013.[244] This section describes the metric system that was developed, the scope of aircraft to be covered by the international CO_2 standard, the certification test procedures that would be used to demonstrate compliance with the international CO_2 standard, and CAEP's decision to focus on the entire aircraft for the international CO_2 standard.

1. CO_2 Metric System

The metric system was developed to cover a wide range of aircraft types, designs, technology, and uses. To do this, the metric system was designed to differentiate between generations of aircraft and to equitably capture improvements in aerospace technology (structural, propulsion, and aerodynamic) that contribute to a reduction in the airplane CO_2 emissions. In addition, the metric system accommodates a wide range of technologies and designs which manufacturers may choose to implement to reduce CO_2 emissions from their aircraft.

The metric system agreed to at CAEP uses multiple Specific Air Range (SAR) test points to represent cruise fuel burn. SAR is a traditional measure of aircraft cruise performance which measures the distance an aircraft can travel for a unit of fuel. This is similar to the instantaneous ''miles per gallon'' readings in many cars today. However, here the inverse of SAR is used (1/SAR); therefore a lower metric value represents a better fuel efficiency. The SAR data are gathered at three gross weight points. The three equally weighted points are used to represent a range of day to day aircraft operations.[245] The functional form of the metric system is provided below.

$$CO_2\ Metric\ Value = \frac{\left(\frac{1}{SAR}\right)_{avg}}{RGF^{0.24}}$$

Equation 1: CO_2 Metric

$(1/SAR)_{avg}$ is calculated at 3 gross weight fractions of Maximum Takeoff Mass (MTOM):

High gross mass: 92% MTOM

Mid gross mass: Average of high gross mass and low gross mass

Low gross mass: (0.45* MTOM) + (0.63* (MTOM ¥ 0.924))

The Reference Geometric Factor (RGF) is a measure of the fuselage size on a given aircraft. In analyzing various metric system options it was found that in some instances, namely stretch aircraft, changes in aircraft size, and thus capability, were not reflected in changes to the aircraft's gross weight (MTOM). To account for these occurrences, and the variety of methods that manufacturers may use to make such a change, an adjustment factor was added (the RGF with a 0.24 exponent used in the metric system).

2. Applicability

CAEP has decided the scope of applicability for a future international CO_2 standard should be subsonic jet and propeller-driven aircraft meeting the following criteria:

All subsonic jet aircraft over 12,566 lbs (5,700 kg) MTOM.

All subsonic propeller driven (*e.g.,* turboprop) aircraft over 19,000 lbs (8618 kg) MTOM, except amphibious airplanes and those designed and used for fire-fighting operations.

No military aircraft will be subject to this international standard.

3. Certification Requirement

CAEP has developed a mature certification requirement [246] that would allow for the determination of an aircraft CO_2 metric value for any aircraft meeting the applicability criteria set forth above. This certification requirement incudes the metric system and test procedure. The test procedure was based upon industry's current best practices for establishing the cruise performance of their aircraft, and input from certification authorities. These procedures include specifications for aircraft conformity, weighing, fuel specifications, test condition stability criteria, required confidence intervals, measurement instrumentation required, and corrections to reference conditions.

These CO_2 test procedures are based upon manufacturer's existing practices when certifying new aircraft. This means that there is a very heavy reliance on dedicated flight testing of the aircraft. This potentially poses challenges for the certification of in-production aircraft. Manufacturers have stated that there could be logistical challenges associated with the certification of aircraft for CO_2 that have previously been type certificated (*e.g.* procuring and instrumenting an aircraft for flight testing). To address this, the EPA is currently working within CAEP to encourage the development of a modified or separate equivalent certification test procedure that would reduce this burden on manufacturers

[242] In this case, manufacturers would need to report the GHG or CO_2 emission rates for in-production aircraft (aircraft types which have already received a Type Certificate, and for which manufacturers either have existing undelivered sales order or would be willing and able to accept new sales orders) that are built after a certain date, which has yet to be determined but would likely be a date that occurs shortly after we promulgate the requirement.

[243] By applying a reporting requirement to in-production aircraft after a certain implementation date, this reporting requirement also includes new aircraft types that are produced after this implementation date.

[244] As described earlier, the certification requirement is the combination of metric, procedures, instrumentation and measurement methodology, and compliance requirements. We are using the terms metric system and certification test procedures to describe these elements of the certification requirement.

[245] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard. Available at http://www.icao.int/publications/catalogue/cat_2015_en.pdf (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.*

[246] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard. Available at http://www.icao.int/publications/catalogue/cat_2015_en.pdf (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR337.*

and allow for quicker/simpler certification of in-production types.

4. Regulating the Entire Aircraft Instead of the Engine

The CO_2 metric system intends to equitably reward improvements in aircraft technologies that reduce emissions, including advances in structures (aircraft weight), propulsion (engine specific fuel consumption), and aerodynamics. These three factors are key to the overall aircraft CO_2 emissions. In addition, CAEP has indicated (and EPA agrees) that it is best to consider the aircraft as a whole instead of only the aircraft engine technology in addressing factors that influence CO_2 emissions, because of the effects and interaction these key factors have on the aircraft CO_2 emissions from engines.[247] The three factors—and technology categories that improve these factors—are described as follows:[248]

Structures: Reducing basic aircraft weight to increase the commercial payload or extend range for the same amount of thrust and fuel burn;

Propulsion (thermodynamic and propulsion efficiency): Advancing the overall specific performance of the engine, to reduce the fuel burn per unit of delivered thrust; and

Aerodynamics: Advancing the aircraft aerodynamics, to reduce drag and its associate impacts on thrust.

Specific examples of technologies that affect these three factors help to further illustrate that it is best to consider the aircraft as a whole in addressing CO_2 emissions. For structural improvements, aircraft manufacturers have shown significant weight reduction results over time due to the progressive introduction of new technologies such as: Advanced alloys and composite materials, improved and new manufacturing processes and techniques (including integration and global evaluation simulation), and new systems (*e.g.* fly-by-wire).[249] [250]

For propulsion improvements, technologies include enhanced compressors (*e.g.,* intercooled compressors) and reduced hub-tip ratio fans.[251] As another example, manufacturers seek higher operating pressure ratios (OPR) to improve combustion and engine cycle refinements.

For aerodynamics, friction and lift-dependent drag are the biggest contributors to aerodynamic drag. Advances in aerodynamics enable significant lift-dependent drag reduction by maximizing effective wing span extension. For example, wing-tip devices can give an increase in the effective aerodynamic span of wings, particularly where wing lengths are limited by airport gate sizes. Manufacturers are also looking at ways of decreasing the drag caused by skin friction. An example of a technology to improve aircraft local skin friction is to utilize riblets (which are micro-grooves on the surface) to maintain laminar flow via Natural Laminar Flow and Hybrid Laminar Flow Control (HLFC) to reduce turbulent skin friction.[252] The first production example of a HLFC system went into service on the new Boeing 787–9 in 2014.

E. Stringency Options

At the Steering Group meeting in November 2013, CAEP agreed to analyze a range of CO_2 stringency options that cover the full range of aircraft in-production and in-development around the world (within the applicable weight thresholds and categories), and this includes the wide range of technology that is currently in the aircraft fleet.[253] Generally, the stringency options that are being evaluated fall into three categories as follows: (1) CO_2 stringency levels that could impact[254] only the oldest, least efficient aircraft in-production around the world, (2) middle range CO_2 stringency levels that could impact many aircraft currently in-production and comprising much of the current operational fleet, and (3) CO_2 stringency levels that could impact aircraft that have either just entered production or are in final design phase but will be in-production by the time the international CO_2 standard becomes effective. We are requesting comment on the level(s) at which the CO_2 stringency options should be set, what factors should be considered in establishing the stringency of the CO_2 standard, and on their potential relationship to any future CAA section 231 standard.

The figures below are intended to show the range of stringency levels under consideration at CAEP and CO_2 metric value levels of today's in-production and in-development[255] aircraft. The data shown were generated by the EPA using a commercially available aircraft modeling tool called PIANO.[256] This model contains non-manufacturer provided estimates of the performance of various aircraft. In contrast, CAEP is using manufacturer-provided estimates of the aircraft metric value performance.

The stringency options under consideration at CAEP are functions of the aircraft CO_2 Metric Value and have a correlating parameter of MTOM. They are upwards sloping and have a ''kink'' at 60,000 kilograms MTOM. The ''kink'' was included in the stringency options as a technical approach to reflect the different behaviors observed between the larger and smaller aircraft.

The official stringency options under consideration at CAEP have not been cleared for release outside of the participating members since deliberations on the standard are still ongoing (proceedings are expected to be completed at CAEP/10 in February 2016). To show the relative efficiency of the aircraft, Figure 1 and Figure 2 below show the aircraft metric values[257] versus MTOM. In place of the official stringency options under consideration, lines of constant technology are used to notionally show how the stringency options were set across the fleet. These lines reflect the three ranges of options discussed above. Lower metric values, for a given MTOM, represent an increased fuel efficiency. Figure 1

[247] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard. Available at http://www.icao.int/publications/catalogue/cat_2015_en.pdf (last accessed May 12, 2015). The ICAO Circular 337 is found on page 85 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. CIR33.*

[248] ICAO, *Environmental Report 2010—Aviation and Climate Change,* 2010, which is located at *http://www.icao.int/environmental-protection/Pages/EnvReport10.aspx* (last accessed May 12, 2015).

[249] Ibid.

[250] Fly-by-wire refers to a system which transmits signals from the cockpit to the aircraft's control surfaces electronically rather than mechanically. AirlineRatings.com, Available at *http://www.airlineratings.com/did-you-know.php?id=18* (last accessed on May 12, 2015, 2015).

[251] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[252] ICAO, *Environmental Report 2010—Aviation and Climate Change,* 2010, which is located at *http://www.icao.int/environmental-protection/Pages/EnvReport10.aspx.*(last accessed May 12, 2015).

[253] The ICAO standard has the following applicability weight thresholds: Maximum takeoff mass greater than 5,700 kilograms for subsonic jet aircraft and maximum takeoff mass greater than 8,618 kilograms for turboprops.

[254] The aircraft shown in these charts are in-production and current in-development. These aircraft could be impacted by an in-production standard in that, if they were above the standard, they would need to either implement a technology response or go out of production. For a new type only standard there will be no regulatory requirement for these aircraft to respond.

[255] Aircraft that are currently in-development but will be in production by the applicability dates. These could be new types or significant partial redesigned aircraft.

[256] PIANO (Project Interactive Analysis and Optimization), Aircraft Design and Analysis Software by Dr. Dimitri Simos, Lissys Limited, UK, 1990-present; Available at *www.piano.aero (last accessed May 12, 2015).* This is a commercially available aircraft design and performance software suite used across the industry and academia.

[257] Metric values were generated using PIANO.

shows the makeup of the current production fleet and the in-development aircraft. This is what CAEP is using as the starting point for modeling the effect of the CO_2 standard. Figure 2 shows what the EPA expects the market to look like in 2023, considering the publicly announced plans by industry to replace existing aircraft with new products.

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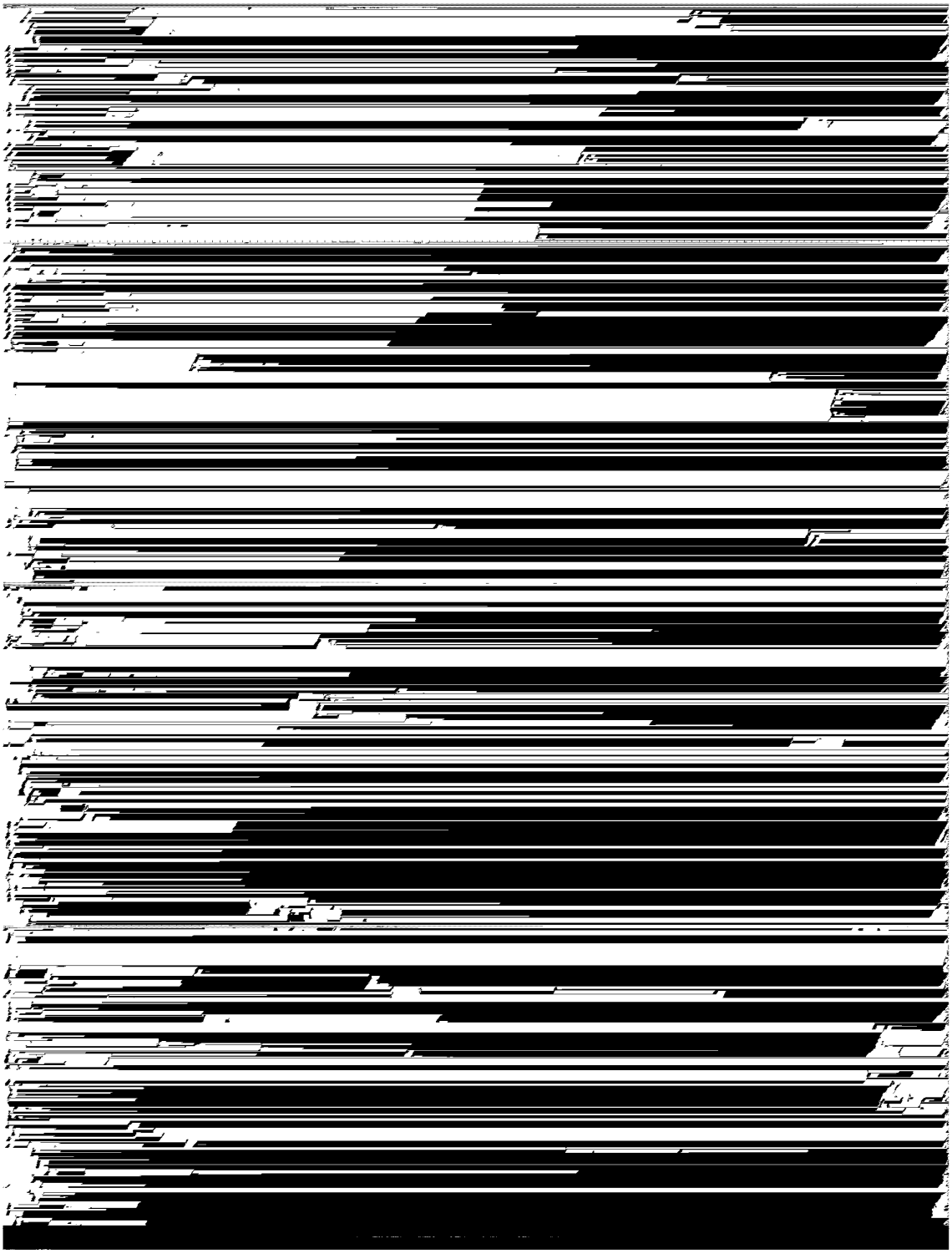
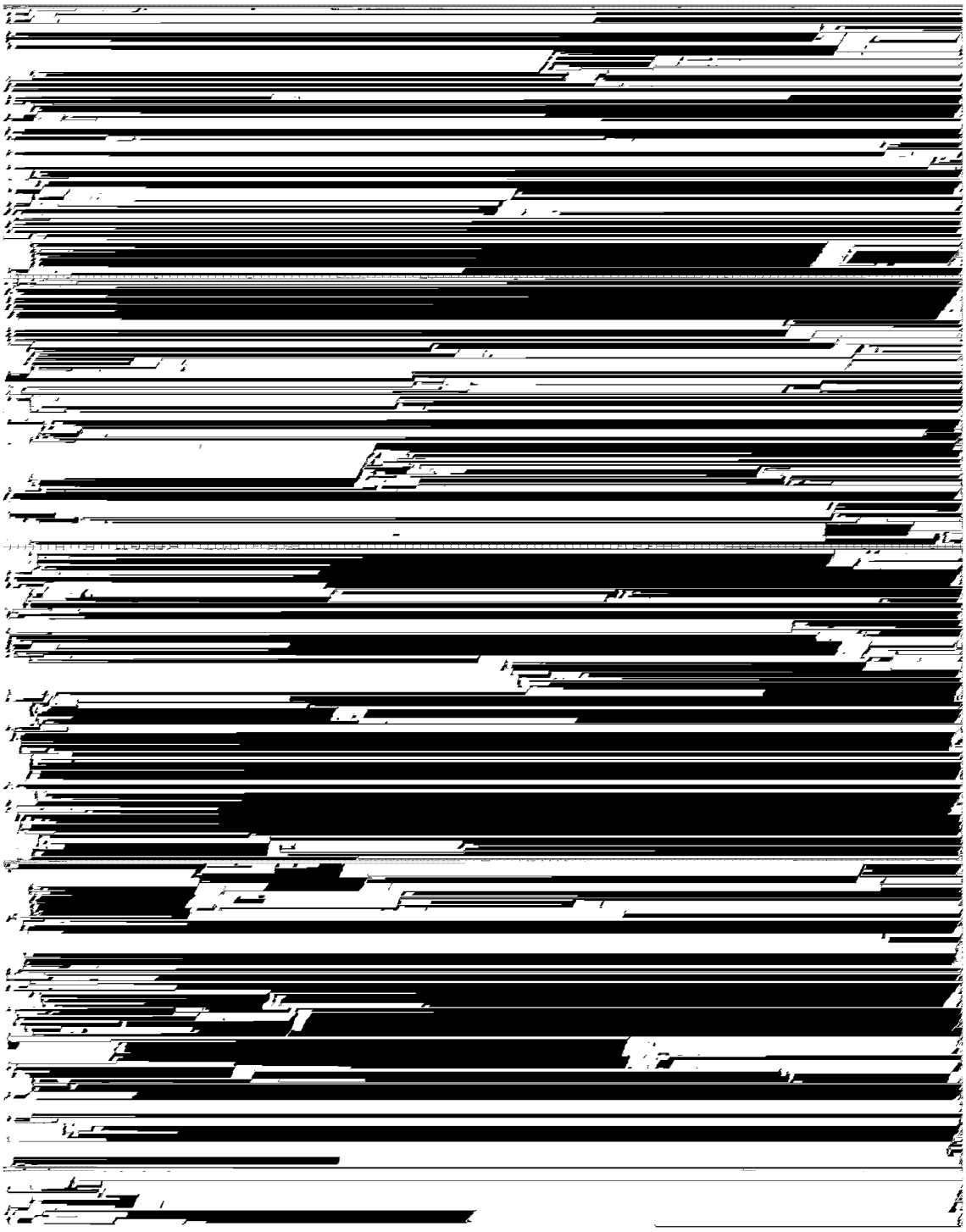




A standard set near the upper-most line of constant technology in Figures 1 and 2 would affect a very modest number of aircraft, namely the oldest, least efficient types. Many of the aircraft that would be affected by such a stringency level are being produced in very limited numbers and may not be eligible to operate in U.S. air space (*e.g.,* Russian and Ukraine aircraft).

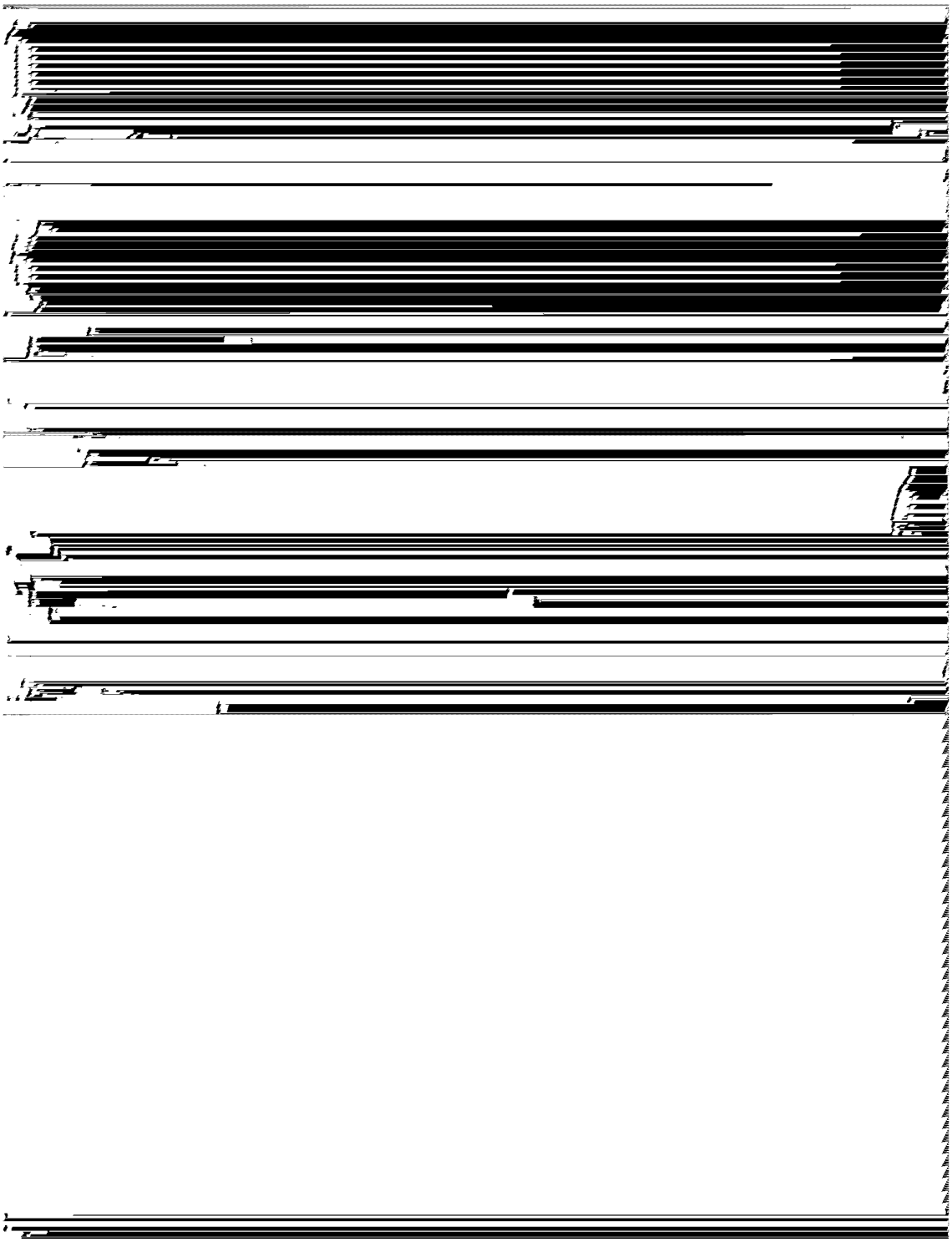
Aircraft around the middle two lines of constant technology in Figures 1 and 2 reflect the performance of many aircraft that are currently in production and compose much of the current operational fleet. The current generation of single aisle aircraft from Boeing and Airbus are in this middle range.

Aircraft near the lowest line of constant technology in Figures 1 and 2 reflect the most advanced aircraft currently for sale on the market. These are aircraft that have either just entered production or are still in-development

but will be in-production by the effective date of a potential in-production the standard. The replacement single aisle aircraft and new twin aisle aircraft from Boeing and Airbus are modeled to be clustered around the lowest line.

While Figures 1 and 2 show the ranges of stringency under consideration and how aircraft fall within those ranges, because of the scale, it is hard to see the range of technology present in the fleet. Therefore Figure 3 and 4 expand the view and show percent differences between the four constant technology lines represented in Figures 1 and 2. This allows for a clearer view of best and worst performing aircraft; Figure 3 provides the perspective from the current in-production and in-development fleet, and Figure 4 projects out to the 2023 fleet. In addition, these figures allow one to compare the technology level and efficiency of aircraft with differing MTOMs.

[redacted]



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The EPA requests comment on a range of stringency options within the constant technology lines identified in Figure 1 and Figure 2, on their potential impact, and on their potential relationship to any future CAA section 231 standard.

CAEP is considering the possibility of adopting two separate CO_2 stringency levels, one for new type aircraft and one for in-production aircraft. This would allow stringencies to be set for both new types and in-production aircraft at a level closer to what could be achieved by each aircraft type. Issues surrounding the potential for in-production standards are discussed in section VI.C.1.

There is ongoing discussion on what appropriate levels of stringency may be for new type and in-production aircraft. Any final decisions will have to wait until the full analysis has been conducted at CAEP. As explained in sections VI.B and VI.C.1, new types are infrequently developed and typically represent a step change in technology. It may be possible to set a level of stringency that is reasonable for in-production aircraft to meet, but at the same time provide an incentive for new type aircraft to improve. However, this is challenging to develop because of the significant efficiency improvements typically seen between in-production and new type aircraft. The EPA requests comment on the potential for developing a standard with two stringency levels at CAEP.

The development of a new aircraft type standard must take into consideration the standard's potential effect on any future type designs. Even the most stringent option under consideration at CAEP is still based on technology available today. Any new type aircraft that may be developed and certified 10 years or more from now would be expected to use more advanced fuel efficient technology that is not yet developed or tested.

The implications for an in-production standard are more significant in the near term for manufacturers. Aircraft currently in-production, and not meeting the level of an in-production standard, would need to be modified to meet the standard to remain in production; this would take time and resources from the manufacturers. The full implications of this have not yet been resolved in CAEP. However, we expect that the effect on aircraft CO_2 emissions would be minimal for less stringent options. The aircraft with the highest CO_2 metric values generally rely on older technology and were designed in the 1980's to early 1990's. Many of these aircraft are also expected to be replaced with updated versions in the near future, before a CO_2 standard would be implemented and go into effect. The EPA requests comment on the levels at which in-production and new type standards might be set and on what factors should be considered in establishing the stringency.

F. Costs, Technology Responses for Stringency Options, and Cost-Effectiveness Analysis

The EPA has been involved in CAEP's effort to analyze the CO_2 stringency options and the potential costs and environmental impacts that would result from both new type only CO_2 standards and in-production international CO_2 standards. CAEP is still determining the best way to conduct portions of this analysis. The inputs that have been developed by the CAEP include non-recurring costs data and technology responses for the various stringency options under consideration. This section describes the development of these inputs. The EPA requests comments on how the modeling should be conducted to differentiate in-production and new type scenarios.

1. Non-Recurring Costs (engineering development costs)

CAEP developed a single cost estimate that could be used for all aircraft as a function of MTOM and percent metric value improvement required. Based on past practice, industry provided estimates for developing clean sheet designs and significant partial redesigns, only including high level information that has been made available to the public. This was considered to be a top down estimate because it included all aircraft development costs (airworthiness certification, noise, etc.) not just those for CO_2 improvements.

Since the initial dataset provided by industry only included major changes (or major improvements), the EPA saw the need to supplement this dataset with an estimate of CO_2-only changes (or CO_2-only improvements), which was considered to be a bottom up estimate. These changes would be much smaller, on the order of a few percent, and could be applied to in-production aircraft at a cost much lower than projected by industry. The EPA contracted with ICF International to develop an estimate of the cost to modify in production aircraft to comply with a CO_2 standard. ICF International conducted a detailed literature search, conducted a number of interviews with industry leaders, and did its own modeling to estimate the cost of making modifications to in production aircraft.[258] The results from this peer-reviewed study (small changes) were then combined with inputs from the industry and the other CAEP participants (large changes) to develop the CO_2 technology response and cost estimation. For the cost estimation, the CAEP combined the two different methodologies to develop the final cost surface.[259]

A top-down approach is being used to model large changes to aircraft design, such as what would be seen in significant partial redesigns or new types. For significant partial redesigns that result in new series of an established model, these types of changes may include: Redesigned wings, new engine options, longer fuselages, improved aerodynamics, or reduced weight. When making significant changes to an aircraft many other changes and updates get wrapped into the process that do not have an effect on the CO_2 emissions of the aircraft, and significant partial redesigns may not have been spurred by changes to fuel efficiency (CO_2 reductions). This confluence of changes led CAEP to agree that it was reasonable to use the full development cost for a new type (clean sheet) or significant partial redesign for major changes. Total costs for past projects were used to estimate non-recurring cost for the CAEP analysis. This type of aircraft improvement/development program has historically ranged approximately from 1 to 15 billion Dollars (U.S.) depending on the size of the aircraft and scope of the improvements desired.

A bottom-up approach was used, by CAEP, to model smaller incremental metric value changes to aircraft design. The CAEP agreed that the above top-down approach would not be the best approach for minor changes or incremental improvements because the significant design efforts include many changes that would not be required for smaller CO_2 reductions. The EPA used the information gathered by ICF International to provide input on the cost for individual technologies which were used to build up non-recurring costs for these incremental improvements (a bottom-up approach). The technologies available to make incremental improvements to aircraft is wide ranging and aircraft specific. Some examples of technologies that could be integrated into an aircraft for incremental improvements include improved fan blade design or reduction in turbine clearances in the engine, reducing the gap between control surfaces, carbon brake pads, or advanced wing tip devices. As an example, ICF International estimated that depending on the additive nature of specific technologies and the magnitude improvement required, the cost to incrementally improve the Boeing 767 could range from approximately 230

[258] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft*, Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[259] The two datasets were merged together and a single cost surface was then generated to calculate the cost to modify any aircraft based on the MTOM, and percent metric value change needed.

million to 1.3 billion US dollars (3.5% to 11% metric value improvement).[260]

2. Technology Responses

When CAEP started to develop the technology responses for the stringency options, a determination needed to be made on what level of technology could be considered as a response to the standard. At the outset, CAEP decided the international CO_2 standard would be a technology following standard, rather than a technology forcing one. This means that the international standard would reflect a level of emissions performance that is already achieved by some portion of current in-production aircraft.

Additionally, CAEP determined in 2012 that all technology responses would have to be based on technology that would be in common use by the time the standard was to be decided upon in 2016 or shortly thereafter. This generation of technology was defined within CAEP as a Technology Readiness Level (TRL) 8[261]—an actual system completed and qualified through test and demonstration—by 2016 or shortly thereafter. This means that the technology responses considered for the future international CO_2 standard, going into effect in 2020 or 2023 for new types and potentially in 2023 or later for in-production, are based on what will be in operation by 2016 or shortly thereafter. Considering the technology response assumptions agreed to at CAEP, the EPA requests comment on how the international CO_2 standard should be established so that it meets the purpose of the standard—to achieve reductions beyond what would have been achieved in the absence of a standard.

3. Cost Effectiveness Analysis

CAEP is currently conducting the cost effectiveness analysis for new-type and in-production aircraft. With rare exceptions CAEP has historically developed new type only standards. To model cost impacts of a new type standard, CAEP has historically used an assumption that the in-production aircraft will respond to the new type standard, even though the standard would not apply to them and has assumed that the aviation sector is competitive enough that market forces will drive manufacturers to voluntarily upgrade their fleet to meet any new type aircraft standard. This scenario is modeled no differently from a mandatory in-production standard. The EPA requests comment on modeling cost and environmental impacts of new-type standards based on the assumed attainment of such emissions levels by in-production aircraft.

Because CAEP has modeled all in-production aircraft as responding by the implementation date of the new-type standard, CAEP has by definition, performed an in-production analysis. More stringent options for new-type aircraft may be restricted due to the assumed in-production impacts.

CAEP has recognized that its past methods for modeling a new-type only standard (by assuming in-production aircraft comply) may not be sufficient for the CO_2 standard analysis. Thus, CAEP developed new methods to model what cost and environmental impacts would result from only new types being regulated under a new-type emission standard. CAEP is still determining the best way to conduct an analysis of impacts only on new types using the agreed upon technology responses and cost estimates. The EPA requests comments on how to model cost impacts for only new types for the future international CO_2 standard, if it were to apply only to new types. The EPA also requests comment on how the modeling should be conducted to differentiate in-production and new type scenarios.

G. Request for Comment on EPA's Domestic Implementation of International CO_2 Standards

As described earlier in section II.E, traditionally international emission standards for aircraft engines have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings to establish domestic standards that are of at least equal stringency as ICAO's engine standards. However, the Chicago Convention,[262] which established ICAO, recognizes that ICAO member states may adopt their own unique standards that are more stringent than ICAO standards. A participating member state (or nation) that adopts more stringent standards is obligated to notify ICAO of the differences between its standards and ICAO's standards.[263]

Section 231(b) of the CAA requires that any emission standards "take effect after such period as the Administrator finds necessary (after consultation with the Secretary of Transportation) to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance during such period." 42 U.S.C. 7571(b). Section 231(a)(2)(B) provides that the Administrator shall consult with the Administrator of the FAA on standards, and "shall not change the aircraft engine emission standards if such change would significantly increase noise and adversely affect safety." 42 U.S.C. 7571(a)(2)(B).

As discussed in the 2005 rule (CAEP/4 aircraft engine NO_X standard),[264] the EPA needs to have a technical basis for expecting the standards will be achievable in a specific period of time. While the statutory language of section 231 is not identical to other provisions in title II of the CAA that direct the EPA to establish technology-based standards for various types of mobile sources, the EPA interprets its authority under section 231 to be similar to those provisions that grant us significant discretion to identify a reasonable balance of specified emissions reduction, and cost without adversely affecting safety or increasing noise. *See, e.g., Husqvarna AB* v. *EPA,* 254 F.3d 195 (D.C. Cir. 2001) (upholding the EPA's promulgation of technology-based standards for small non-road engines under section 213(a)(3) of the CAA). In this regard, we note CAEP's intent for the purpose of the international CO_2 standard (as accepted by the CAEP Steering Group in 2011), which is to achieve aircraft CO_2 emissions reductions beyond that which would

[260] ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft,* Final Report, EPA Contract Number EP–C–12–011, March 17, 2015.

[261] TRL is a measure of Technology Readiness Level. CAEP has defined TRL8 as the "actual system completed and 'flight qualified' through test and demonstration." TRL is a scale from 1 to 9, TRL1 is the conceptual principle, and TRL9 is the "actual system 'flight proven' on operational flight." The TRL scale was originally developed by NASA. ICF International, *CO_2 Analysis of CO_2-Reducing Technologies for Aircraft,* Final Report, EPA Contract Number EP–C–12–011, see page 40, March 17, 2015.

[262] ICAO, 2006: *Doc 7300-Convention on International Civil Aviation, Ninth edition,* Document 7300/9. Available at: *http://www.icao.int/publications/ICAOProducts&Services2015catalogue/cat_2015en.pdf* (last accessed May 12, 2015). The ICAO Document 7300 is found on page 1 of the ICAO Products & Services 2015 catalog and is copyright protected; Order No. 7300.

[263] According to the Chicago Convention, a participating member State that adopts regulations or practices differing in any particular respect from those established by an international standard is obligated to notify ICAO of the differences between its standards and ICAO's standards. However, member States that wish to use aircraft in international transportation must adopt emissions standards and other recommended practices that are at least as stringent as ICAO's standards. Member States may ban the use of any aircraft within their airspace that does not meet ICAO standards.

[264] U.S. EPA, "Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures;" Final Rule, 70 FR 2521, November 17, 2005.

have occurred in the absence of a standard.

In ruling on a petition for judicial review of the 2005 rule,[265] the U.S. Court of Appeals for the D.C. Circuit held that the EPA's approach in that action of tracking the ICAO standards was reasonable and permissible under the CAA. *NACAA* v. *EPA,* 489 F.3d 1221, 1230–32 (D.C. Cir. 2007). The Court also held that section 231 of the CAA confers a broad degree of discretion on the EPA to adopt aircraft emission standards that the Agency determines are reasonable. *Id.*

Although the EPA has traditionally established domestic standards that track the ICAO standards, for purposes of having a robust ANPR process, we ask for comment on the possibility of the EPA adopting a more stringent aircraft engine emissions standard than ICAO, provided ICAO/CAEP promulgates a standard in 2016 and the EPA makes a positive endangerment finding. In the same vein, the EPA requests that commenters consider the following factors (among others): The potential to reflect the CO_2 emissions performance of products from U.S. manufacturers, competitive advantages and disadvantages for U.S. manufacturers, certification reciprocity with certificating authorities of other nations, and the EPA's role in the ongoing ICAO negotiations. In addition, the EPA asks for comment on what action the EPA should take if the ICAO/CAEP process fails to result in the adoption of an aircraft CO_2 emissions standard.

VII. Statutory Authority and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is a significant regulatory action because it raises novel policy issues. Accordingly, it was submitted to the Office of Management and Budget (OMB) for review. This action proposes a finding that GHG emissions from aircraft cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare along with an ANPR which provides an overview of the international efforts to reduce GHG emissions, progress to date in establishing global aircraft standards that achieve meaningful CO_2 reductions and, if the EPA finds that aircraft GHG emissions do cause or contribute to endangerment, the potential use of CAA section 231 to implement these standards domestically ensuring transparency and the opportunity for public comment. Any changes made in response to OMB recommendations have been documented in the docket.

B. Paperwork Reduction Act (PRA)

This action does not impose an information collection burden under the PRA. The proposed endangerment and cause or contribute findings under CAA section 231 do not contain any information collection activities.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. The proposed endangerment and cause or contribute findings under CAA section 231 do not in-and-of-themselves impose any new requirements but rather set forth the Administrator's proposed determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare. Accordingly, this action affords no opportunity for the EPA to fashion for small entities less burdensome compliance or reporting requirements or timetables or exemptions from all or part of the proposal.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or tribal governments or the private sector.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

F. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. The proposed endangerment and cause or contribute findings under CAA section 231 do not in-and-of-themselves impose any new requirements but rather set forth the Administrator's proposed determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks

This action is not subject to Executive Order 13045 because it is not economically significant as defined in Executive Order 12866. The Administrator considered climate change risks to children as part of this proposed endangerment finding under CAA section 231. This action's discussion of climate change impacts on public health and welfare is found in section IV of this preamble. Specific discussion with regard to children are contained in sections IV and I.D of the preamble titled ''Children's Environmental Health.'' A copy of all documents pertaining to the impacts on children's health from climate change have been placed in the public docket for this action.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution or Use

This action is not a ''significant energy action'' because it is not likely to have a significant adverse effect on the supply, distribution or use of energy. Further, we have concluded that this action is not likely to have any adverse energy effects because the proposed endangerment and cause or contribute findings under section 231 do not in-and-of themselves impose any new requirements but rather set forth the Administrator's proposed determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare.

I. National Technology Transfer and Advancement Act (NTTAA)

This action does not involve technical standards.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-

[265] Ibid.

income, or indigenous populations because this action does not affect the level of protection provided to human health or the environment. The Administrator considered climate change risks to minority, low-income, and indigenous populations as part of this proposed endangerment finding under CAA section 231. This action's discussion of climate change impacts on public health and welfare is found in section IV of the preamble. Specific discussion with regard to minority, low-income, and indigenous populations are found in sections IV and I.E of this preamble titled ''Environmental Justice.'' A copy of all documents pertaining to the impacts on these communities from climate change have been placed in the public docket for this action.

K. Determination Under Section 307(d)

Section 307(d)(1)(V) of the CAA provides that the provisions of section 307(d) apply to ''such other actions as the administrator may determine.'' Pursuant to section 307(d)(1)(V), the Administrator determines that this action is subject to the provisions of section 307(d).

VIII. Statutory Provisions and Legal Authority

Statutory authority for this action comes from 42 U.S.C. 7571, 7601 and 7607.

List of Subjects

40 CFR Part 87

Environmental protection, Air pollution control, Aircraft, Aircraft engines.

40 CFR Part 1068

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements, Warranties.

Dated: June 10, 2015.

Gina McCarthy,

Administrator.

[FR Doc. 2015–15192 Filed 6–30–15; 8:45 am]

BILLING CODE 6560–50–P

From: Shoaff, John
Location: teleconference Ex. 6 - Personal Privacy conf. code
Importance: Normal
Subject: SAB Prep Call
Start Date/Time: Wed 6/21/2017 6:00:00 PM
End Date/Time: Wed 6/21/2017 7:00:00 PM
Aviation GHG Pages from Fall 2016 WkGrp Memo Appendix.pdf
Agenda SAB-June 29 post.pdf
Fall 2016 WkGrp Memo attAB.pdf
SAB - Aircraft GHG Emissons Standards.docx

Added supplementary info, scroll down under original note below, and attachments.

All,

Ex. 5 - Deliberative Process

Thanks!

John

Supplementary info. for our conversation:

Estimated timing & cost of contractor-led panel peer reviews (per OW colleague and under the 2013 EPA *Conflict of Interest Review Process for Contractor-Managed Peer Reviews of EPA HISA and ISI* policy based on 2004 OMB *Final Information Quality Bulletin for Peer Review* under the Information Quality Act).

Timeframe

We currently have 2 under way (Perchlorate part 2 and Lead modeling) and completed 2 (PFOA/PFOS and perchlorate part 1).

Typical timeframes from start to finish are 9 – 12 months with all of the FR notices and comment periods required.

Cost

Estimated cost is $25K per review using both ERG and Versar – their rates are comparable.

Fall 2016 SAB WG Memo - Work Group Recommendations Regarding Planned EPA Actions of Interest to the SAB

Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) is listed as a long term action, with a notice of proposed rulemaking due January 2018 and a final rule due December 2018. The Work Group finds that the planned action is significant and would benefit from SAB advice and comment. The Work Group notes that there are temporal constraints on completing the rulemaking and recommends the SAB provide advice on this issue, or at a minimum, the EPA should conduct a panel review that allows communication across the two proposed peer review panels in order to encourage synergistic understanding among the disciplines involved.

The Work Group notes the SAB previously reviewed *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 Advanced Notice of Proposed Rulemaking (2060-AS31)* in the Fall 20142 Regulatory Review and found that subsequent steps in the regulatory process will involve substantive scientific issues that may warrant SAB consideration. The Work Group recommends that the SAB ask the agency to regularly inform the SAB about the status of subsequent steps on this topic and also asks the EPA to provide it with briefings on the science underlying agency approaches to address greenhouse gas emissions and related climate change actions.

Attachments

1. Key Pages from SAB WG Memo Appendix

2. SAB Agenda

3. Full SAB WG Memo & Appendices

4. GHG Aviation Template submitted in follow up to Fall 2016 Reg Agenda

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From: McCabe, Janet
Location: WJC-N 5400 + Ex. 6 - Personal Privacy
Importance: Normal
Subject: Conf. Call with Boeing / EPA re: WH Meeting (Confirmed)
Categories: Green Category
Start Date/Time: Tue 1/5/2016 6:00:00 PM
End Date/Time: Tue 1/5/2016 6:30:00 PM
Meeting on Aircraft GHG Standards with Boeing 0n Jan. 5 - 1:00pm
Boeing Analysis of Production Impacts of USG ICAO Position dec212015.pdf

To: McCabe, Janet; Grundler, Chris; Hengst, Ben; Charmley, Bill
Outside Attendees (by phone): Peter A. Pagano

From: Ex. 6 - Personal Privacy
Location: Administrator's Office
Importance: Normal
Subject: Finalizing US Position: ICAO– Aircraft GHG Standards
Categories: Green Category
Start Date/Time: Fri 10/30/2015 7:30:00 PM
End Date/Time: Fri 10/30/2015 8:30:00 PM
Administrator's form request - 10-5-15.docx

Ex. 5 - Deliberative Process

SCt: Liel Azoolin
Ct: Emily Atkinson, 202-564-1850

Staff:
Janet McCabe, Chris Grundler, Bill Charmley, Ben Hengst, Michael Samulski, Bryan Manning, David Orlin (OAR)
Mike Thrift (OGC)

Optional:
Gwen Stewart, Jonell Iffland (OAR/OTAQ)

Conference Line: Ex. 6 - Personal Privacy

Video Conference Room:
Ann Arbor RM. C-174 DOD AA

Administrator's form request - 10-5-15.docx

To: Stewart, Lori[Stewart.Lori@epa.gov]; Simon, Karl[Simon.Karl@epa.gov]; Orlin, David[Orlin.David@epa.gov]; Silverman, Steven[silverman.steven@epa.gov]; Spears, Matthew[spears.matthew@epa.gov]; Moulis, Charles[moulis.charles@epa.gov]; Yanca, Catherine[yanca.catherine@epa.gov]
Cc: Stewart, Gwen[Stewart.Gwen@epa.gov]; Iffland, JoNell[Iffland.JoNell@epa.gov]; Millett, John[Millett.John@epa.gov]
To: McCabe, Janet[McCabe.Janet@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]; Charmley, William[charmley.william@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
Subject: ICAO CO2 Standard Briefing
HD GHG Phase 2 Bi weekly meetings II.DOCX
FW: Meeting with Janet next week on aircraft?
FW: Janet Briefing: June 29 at 11:30 (ICAO CO2 standard)

To: Janet McCabe, Chris Grundler, Bill Charmley, Ben Hengst, Mike Samulski, Bryan Manning, Cullen Leggett, Lucie Audette

To: Atkinson, Emily[Atkinson.Emily@epa.gov]; Browne, Cynthia[Browne.Cynthia@epa.gov]
From: Stewart, Gwen
Sent: Tue 6/23/2015 4:11:55 PM
Subject: FW: Janet Briefing: June 29 at 11:30 (ICAO CO2 standard)

Changes for the: ICAO CO2 Standard Meeting – June 29th – 11:30 AM

Emily,

Can you please help ensure we have the right folks on the list for the meeting next Monday at 11:30? Only the following folks should be on: Chris Grundler, Bill Charmley, Ben Hengst, Mike Samulski, Bryan Manning, Cullen Leggett, Lucie Audette. Everyone else should be removed from the invite. Thanks"

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

To: Atkinson, Emily[Atkinson.Emily@epa.gov]; Browne, Cynthia[Browne.Cynthia@epa.gov]
From: Stewart, Gwen
Sent: Mon 6/22/2015 4:24:23 PM
Subject: FW: Meeting with Janet next week on aircraft?

Good Afternoon:

I would like to make changes to the following meeting – Meeting Name and Participants:

Monday, June 29, 2015

From: Update Janet about HD GHG Phase

TO: NAME CHANGE: ICAO CO2 Standard Briefing

ATTENDEES:

Salmulski, Michael – ASD

Charmley, William - ASD

Hengst, Benjamin – I/O

Manning, Bryan – ASD

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

To: Atkinson, Emily[Atkinson.Emily@epa.gov]
From: Pagano, Peter A
Sent: Mon 1/4/2016 4:00:05 PM
Subject: Meeting on Aircraft GHG Standards with Boeing 0n Jan. 5 - 1:00pm
Boeing Analysis of Production Impacts of USG ICAO Position dec212015.pdf

Emily,

Thanks again for your help in moving this meeting to tomorrow. Attached below is my previous email with our participants as well as the background document. Please let me know who might accompany Janet.

Also let me know if you need any other information, otherwise we will see you tomorrow.

Pete

From: Pagano, Peter A
Sent: Monday, December 21, 2015 1:26 PM
To: 'Atkinson, Emily'
Subject: RE: Confirmed 1/7/16 at 9:30am Meeting Request on Aircraft GHG Standards

Thanks Emily,

In addition to me I will be accompanied by 3 colleagues from Boeing: Julie Felgar, Sean Newsum and Dan Allyn. Attached is the background document I mentioned. It is marked as CBI so please limit distribution accordingly. Please let me know if you have any questions or need more information.

Thanks again and all the best over the holidays.

Peter A. Pagano

Director, Environment

The Boeing Company

703-414-6486

Email: peter.a.pagano@boeing.com

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Monday, December 21, 2015 1:04 PM
To: Pagano, Peter A
Subject: Confirmed 1/7/16 at 9:30am Meeting Request on Aircraft GHG Standards

Hi Peter,

You are confirmed for a 30 minute meeting on Thursday, January 7, 2016 at 9:30am with Janet McCabe.

Directions and procedures to 1200 Pennsylvania Avenue NW:

Metro: If you come by Metro get off at the Federal Triangle metro stop. Exit the metro station and go up two sets of escalators to the surface level and turn right. You will see a short staircase and wheelchair ramp leading to a set of glass doors with the EPA logo - that is the William Jefferson Clinton Federal Building, North Entrance.

Taxi: Direct the taxi to drop you off on 12th Street NW, between Constitution and Pennsylvania Avenues, at the elevator for the Federal Triangle metro stop - this is almost exactly half way between the two avenues on 12th Street NW. Facing the building with the EPA logo and American flags, walk toward the building and take the glass door on your right hand side with the escalators going down to the metro on your left – that is the North Lobby of the William Jefferson Clinton building.

Security Procedures: A government issued photo id is required to enter the building and it is suggested you arrive 15 minutes early in order to be cleared and arrive at the meeting room on time. Upon entering the lobby, the meeting attendees will be asked to pass through security and provide a photo ID for entrance. Let the guards know that you were instructed to call 202-564-7404 for a security escort.

Please send me a list of participants in advance of the meeting and feel free to contact me should you need any additional information.

Emily

Emily Atkinson
Staff Assistant

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Atkinson, Emily
Sent: Monday, December 21, 2015 12:42 PM
To: peter.a.pagano@boeing.com
Subject: FW: Meeting Request on Aircraft GHG Standards

Hi Peter,

It looks like we could fit this in as a 30 minute meeting on Thursday, January 7, 2016 at 3:30pm. Let me know if this could work on your end.

Thank you.

Emily

Emily Atkinson
Staff Assistant

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Pagano, Peter A [mailto:peter.a.pagano@boeing.com]
Sent: Friday, December 18, 2015 4:59 PM

To: Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>
Subject: Meeting Request on Aircraft GHG Standards

Hi Emily,

Hope you are doing well. Hard to believe its almost the end of the year. I wanted to request that Boeing have an opportunity to meet with Janet in the New Year to share our views with her on the US Government's ICAO negotiating position for the GHG aircraft standard that will be the subject of the February meeting in Montreal. We have had discussions with her counterparts at FAA including Rich Swayze and we would just like 30 minutes to highlight our concerns and let her know firsthand the nature of our discussions with her counterparts. Some of our technical folks will be in DC the first week in January and we could possibly do it then on either the 5, 6, or 7th. You should know that we met with Bill Charmley and his folks on October 23 prior to the USG position coming out and also have time scheduled with him on January 8 as well. We also have time scheduled with FAA again that week too. Our goal is to make sure Janet is aware of these discussions so she is not surprised by any of these meetings and the issues we are raising. (Just to be clear, we still want to keep our appointment with OTAQ and that would be the opportunity to get into the details a bit more and make sure the program staff understand our views as well as what we see as our challenges and opportunities.) Please let me know if you need any additional information or have any questions on this request. Thanks in advance for your response.

All the best,

Peter A. Pagano

Director, Environment

The Boeing Company

703-414-6486

Email: peter.a.pagano@boeing.com

U.S. Environmental Protection Agency
Science Advisory Board (SAB)
Teleconference
Draft Agenda

June 29, 2017
1:00 p.m. to 5:00 p.m. Eastern Time

Purpose: To discuss the information provided by the EPA on planned actions in the Fall 2016 semi-annual regulatory agenda and their supporting science and receive briefings on current SAB activities.

1:00 p.m.	**Convene the teleconference and roll call**	**Mr. Thomas Carpenter** *Designated Federal Officer (DFO),*
1:05 p.m.	**Purpose of the teleconference and review of the agenda**	**Dr. Peter Thorne** *Chair, EPA SAB*
	Discussion of Planned Agency Actions in the Fall 2016 Regulatory Agenda and their Supporting Science	**Dr. Peter Thorne**
1:15 p.m.	**Public Comments**	**Registered Speakers**
1:30 p.m.	**Presentation from the Work Group Chair**	**Dr. Charles Werth** *Chair, SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science*
	Discussion and Disposition of the Planned Actions	**SAB Members and Liaisons**
3:15 p.m.	**Break**	
3:30 p.m.	**Updates on SAB Activities**	**SAB Committee and Panel Chairs**
5:00 p.m.	**Adjourn the Teleconference**	**The DFO**

MEMORANDUM

TO: Members of the Chartered SAB and SAB Liaisons

FROM: Charles Werth, Chair, SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science */signed/*

DATE: June 13, 2017

SUBJECT: Preparations for Chartered Science Advisory Board (SAB) Discussions of EPA Planned Agency Actions and their Supporting Science in the Fall 2016 Regulatory Agenda

The Chartered SAB will discuss whether to review the adequacy of the science supporting planned regulatory actions identified by the EPA as major actions in the Fall 2106 semi-annual regulatory agenda at its June 29, 2017 meeting. To support this discussion a SAB Work Group was charged with identifying actions for further consideration by the Chartered SAB. This memorandum provides background on this activity, a short description of the process for identifying actions for SAB consideration, a summary of the process used by the Work Group and Work Group recommendations on the planned actions.

Background

The Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA) requires the EPA to make available to the SAB proposed criteria documents, standards, limitations, or regulations provided to any other Federal agency for formal review and comment, together with relevant scientific and technical information on which the proposed action is based. The SAB may then make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed action.

EPA's current process (Attachment A) is to provide the SAB with information about the publication of the semi-annual regulatory agenda and to provide descriptions of major planned actions that are not yet proposed but appear in the semi-annual regulatory agenda. These descriptions provide available information regarding the science informing agency actions. This process for engaging the SAB supplements the EPA's process for program and regional offices to request science advice from the SAB.

Summary of the Process Used by the SAB Work Group

The SAB Work Group followed the process adopted by the Chartered SAB in 2013[1] to initiate its review of major planned actions identified in the Unified Regulatory Agenda by EPA. The current SAB review began when the EPA Office of Policy informed the SAB Staff Office that the Fall 2016 Unified (Regulatory) Agenda and Regulatory Plan had been published on November 17, 2016. This semi-annual regulatory agenda is available at http://www.reginfo.gov/public/.

[1] Available at http://yosemite.epa.gov/sab/sabproduct.nsf/WebSABSO/ProcScreen2017/$File/SABProtocol2017.pdf

This SAB Work Group was formed in January 2017 and includes SAB members with broad expertise in scientific and technological issues related to the proposed actions. The Work Group consists of Drs. Charles J. Werth (chair), Alison Cullen, H. Christopher Frey, Steven Hamburg, Denise Mauzerall, Jay Turner, Jeanne VanBriesen, and Mr. Richard Poirot.

On March 2, 2017, the Work Group received information and short descriptions from the EPA Program Offices on the major planned actions that are listed in the Fall 2016 semi-annual regulatory agenda but not yet proposed. Work Group members concurred on the recommendations presented in this memorandum after a discussion on May 18, 2017 and subsequently via email. A compiled set of the EPA descriptions of the actions and the Work Group's recommendations are provided in Attachment B.

Work Group Recommendations Regarding Planned EPA Actions of Interest to the SAB

The Work Group based the recommendations below on information received from the EPA and the Work Group's research. Of the 14 major planned actions considered, the Work Group recommends that twelve of the actions do not merit further SAB consideration.

The Work Group notes that the stage of the rulemaking for 11 of the planned actions is listed as long term actions. The Office of Management and Budget defines long term actions as planned actions "under development but for which the agency does not expect to have a regulatory action within the 12 months after publication of this edition of the Unified Agenda", and notes that some of these actions may only have abbreviated information. The SAB has considered long term actions in previous reviews of the Unified Agenda, and in some cases deferred the decision on whether the planned action merits further review until sufficient information is available. The Work Group considered the stage of rulemaking of the planned actions in making their recommendations.

A brief summary of the Work Group findings is provided and further information on each action is available in Attachment B.

Renewable Fuel Volume Standards (RFVS) for 2018 and Biomass Based Diesel Volume (BBD) for 2019 (2060 AT04) is a statutorily mandated annual rulemaking. The RFS program is a routine action that relies on the same approach and sources of data that were used in the rules establishing required standards in past years. The analytical work underlying the RFS annual rules is based on historical data regarding renewable fuel production, imports, distribution, and use. The EPA does "not currently expect to incorporate new methodological approaches that would rely on any new scientific data or touch upon novel issues" to determine the renewable fuel volume standards for 2018 and the biomass based diesel volume (BBD) for 2019. Therefore, this action does not merit further SAB consideration.

Two actions in the regulatory agenda, *Procedures for Evaluating Existing Chemical Risks Under the Toxic Substances Control Act (2070-AK20)* and *Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act (2070-AK23)*, are being developed in parallel under TSCA as amended on June 22, 2016, by the Frank R. Lautenberg Chemical Safety for the 21st Century Act, which sets i) mandatory requirements for the EPA to evaluate existing chemicals with clear and enforceable deadlines, ii) new risk-based safety standards, iii) increased public transparency for chemical information, and iv) a consistent source of funding for EPA to carry out the responsibilities under the new law. The planned actions were proposed on January 19, 2017 and the *Federal Register* notices for the proposed rules identify the steps in the prioritization and risk evaluation under the

amended TSCA for chemical substances, using existing methods and the weight of evidence approach that has been applied consistently by the Agency in the past. The Work Group notes that the SAB previously reviewed planned actions for several specific TSCA chemicals using these methods and peer review and found the evaluation and peer review approach to be scientifically sound and did not recommend further review. Therefore, these actions do not merit further SAB review.

The Endangerment Finding for Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline (2060-AT10) is a long-term action that requires the EPA to evaluate whether lead emissions from aircraft operating on leaded aviation gasoline ("avgas") cause or contribute to air pollution that may be reasonably anticipated to endanger public health. Lead is still used as an octane booster in avgas that is used in piston-engine aircraft, mostly for general aviation. EPA will use the National Emission Inventory of lead emissions from use of leaded avgas, demographic analysis of populations living or attending school near airports, surveillance monitoring data for 17 airports, and estimates of lead concentrations near airports. EPA plans to conduct a letter peer review of the nationwide analysis of lead concentrations in air at airports by five experts. EPA will provide responses to peer review comments and issue a final report. Because key elements of this action have already undergone, or will undergo, peer review, this action does not merit further review by the SAB.

Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) is listed as a long term action, with a notice of proposed rulemaking due January 2018 and a final rule due December 2018. The Work Group finds that the planned action is significant and would benefit from SAB advice and comment. The Work Group notes that there are temporal constraints on completing the rulemaking and recommends the SAB provide advice on this issue, or at a minimum, the EPA should conduct a panel review that allows communication across the two proposed peer review panels in order to encourage synergistic understanding among the disciplines involved.

The Work Group notes the SAB previously reviewed *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 Advanced Notice of Proposed Rulemaking (2060-AS31)* in the Fall 2014[2] Regulatory Review and found that subsequent steps in the regulatory process will involve substantive scientific issues that may warrant SAB consideration. The Work Group recommends that the SAB ask the agency to regularly inform the SAB about the status of subsequent steps on this topic and also asks the EPA to provide it with briefings on the science underlying agency approaches to address greenhouse gas emissions and related climate change actions.

The Emission Guidelines for the Existing Oil and Natural Gas Sector (2060–AT29) is a long-term action, which was triggered when the EPA established New Source Performance Standards (NSPS) on new sources of emissions of greenhouse gases in the oil and gas sector. This action is in the early stages of development and the Work Group notes the agency has withdrawn the 2016 Information Collection Request (ICR) from the oil and gas industry; as a result, there is insufficient information to review. The SAB should evaluate the science supporting the planned action when more information about the proposed rule and the science supporting it are made available. At that time, the SAB will determine whether it wishes to offer advice and comment to the Administrator.

[2] SAB Discussions about EPA Planned Actions in the Fall 2014 Unified Agenda and their Supporting Science https://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/d789240481a106d085257dc4005dcef6!OpenDocument

The Work Group notes that eight actions in the Fall 2016 semi-annual regulatory agenda are Risk and Technology Reviews (RTRs) for National Emissions Standards for Hazardous Air Pollutants (NESHAPs) are required by the Clean Air Act (see Table 1). Within eight years of promulgation of emission standards, EPA must assess the technology and residual risk to determine whether additional standards are needed to provide an ample margin of safety to protect public health and prevent adverse environmental effects (taking into consideration costs, energy, safety, and other relevant factors). Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone consultations, advisories and peer reviews by the SAB as the methodology is enhanced (SAB 1999, 2000, 2006, and 2010). The Work Group also notes that the EPA and SAB are planning an additional review of Screening Methodologies to Support Risk and Technology Reviews (RTR): A Case Study Analysis in 2017.

The Work Group finds that there are many different sectors that use the RTR methodology. These different sectors incorporate and use data and information that are appropriate to that sector. The Work Group finds that while these eight actions do not merit further review by the SAB, the agency may benefit from SAB advice when new novel science or technologies are part of a planned action for specific sectors. The Work Group encourages the Board to recommend that the Agency provide as much sector specific information as available to assist the Board in conducting the screening review of future regulatory agendas. The Work Group also notes that the planned SAB review may provide recommendations for changes in the RTR methodology and encourages the agency to incorporate those recommendations into future RTRs.

Table 1 identifies the 14 planned actions reviewed and summarizes the Work Group's recommendations. Attachment B provides the EPA's descriptions of the planned actions, and the SAB Work Group's recommendation for each of the planned actions with the supporting rationales.

Table 1: Summary of Proposed Actions that the SAB Work Group Considered for Additional SAB Comment on the Supporting Science

RIN[1]	Planned Action Title	Workgroup Recommendation
2060-AT04	Renewable Fuel Volume Standards (RFVS) for 2018 and Biomass Based Diesel Volume (BBD) for 2019	No further SAB consideration is merited.
2070-AK20	Procedures for Evaluating Existing Chemical Risks Under the Toxic Substances Control Act	No further SAB consideration is merited
2070-AK23	Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act	No further SAB consideration is merited
2060-AT10	Endangerment Finding for Lead Emissions From Piston-Engine Aircraft Using Leaded Aviation Gasoline	No further SAB consideration is merited

Table 1: Summary of Proposed Actions that the SAB Work Group Considered for Additional SAB Comment on the Supporting Science		
RIN[1]	**Planned Action Title**	**Workgroup Recommendation**
2060-AT26	Control of Air Pollution From Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures	The Chartered SAB should provide advice on this action
2060-AT29	Emission Guidelines for the Existing Oil and Natural Gas Sector	The Chartered SAB should evaluate whether to provide advice when more information are available.
2060-AT00	Stationary Combustion Turbine, National Emission Standard Hazardous Air Pollutant (NESHAP) Residual Risk and Technology Review (RTR)	No further SAB consideration is merited.
2060-AT01	Engine Test Cells National Emission Standard for Hazardous Air Pollutants (NESHAP) RTR	No further SAB consideration is merited.
2060-AT02	National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards--Ethylene Production (Subparts XX and YY)	No further SAB consideration is merited.
2060-AT03	National Emission Standards for Hazardous Air Pollutants for Integrated Iron and Steel Manufacturing Facilities RTR	No further SAB consideration is merited.
2060-AT05	National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing RTR	No further SAB consideration is merited.
2060-AT07	Rubber Tire Manufacturing RTR	No further SAB consideration is merited.
2060-AT08	Lime Manufacturing RTR	No further SAB consideration is merited.
2060-AT12	National Emission Standard for Hazardous Air Pollutants (NESHAP) RTR: Reinforced Plastics Composites and Boat Manufacturing	No further SAB consideration is merited.

[1]The Regulatory Identification Number provides a hyperlink to the Office of Management and Budget's webpage and information on the planned action provided in the Unified Regulatory Agenda on the OMB website http://www.reginfo.gov/

Attachments

Attachment A: Implementation Process for Identifying EPA Planned Actions for SAB Consideration
Attachment B: SAB Work Group Recommendations on Major EPA Planned Actions Identified in the Fall 2016 Semi-Annual Regulatory Agenda.

Attachment A
Implementation Process for Identifying EPA Planned Actions for SAB Consideration

Background on the EPA Process

* The Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA, see p. 4)
    * Requires the EPA to make available to the SAB proposed criteria documents, standards, limitations, or regulations provided to any other Federal agency for formal review and comment together with relevant scientific and technical information in the possession of the agency on which the proposed action is based.
    * States that the Board may make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed actions.
* In January 2012, Office of Policy Associate Administrator Michael Goo issued a memorandum to strengthen coordination with the SAB by providing the Board with information about *proposed* agency actions. (see page p. 9)
* In February 2012, SAB Staff developed an initial proposal to provide the SAB with information about *proposed* agency actions.
    * EPA Senior Leadership concluded that providing information to the SAB for consideration at the proposal stage was *too late* in the process for meaningful involvement.
* In March 2012, the SAB held a public meeting and discussed the Goo memo and a pilot to consider the science underlying four proposed rules identified by OAR (standards for air toxics from boilers and incinerators and greenhouse gas emissions and fuel economy standards for light-duty vehicles).
    * The SAB:
        * Did not identify any science topics related to the four proposed rules warranting SAB comment.
        * Noted that the proposal stage was *too late* in the process for meaningful input.
        * Discussed the need for adequate information on the underlying science for agency actions early in the process. Information beyond the information presented in the Semiannual Regulatory Agenda is needed for this purpose.
* On January 2, 2013, Associate Administrator Michael Goo, the Administrator's Science Advisor Glenn Paulson, and the SAB Office Director Vanessa Vu issued a memorandum (see p. 10) "Identifying EPA Planned Actions for Science Advisory Board (SAB) Consideration of the Underlying Science – Semi-annual Process" requiring EPA to provide short descriptions of *major planned actions that are not yet proposed* appearing in the semi-annual regulatory agenda

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* This process supplements the Deputy Administrator's annual memorandum requesting program and regional offices to identify scientific issues that might be appropriate for SAB consideration.

SAB Process

* The SAB Staff manages the semi-annual process for determining whether any planned EPA actions merit SAB advice and comment on the supporting science as part of the entire SAB operating plan (see Figure 1).

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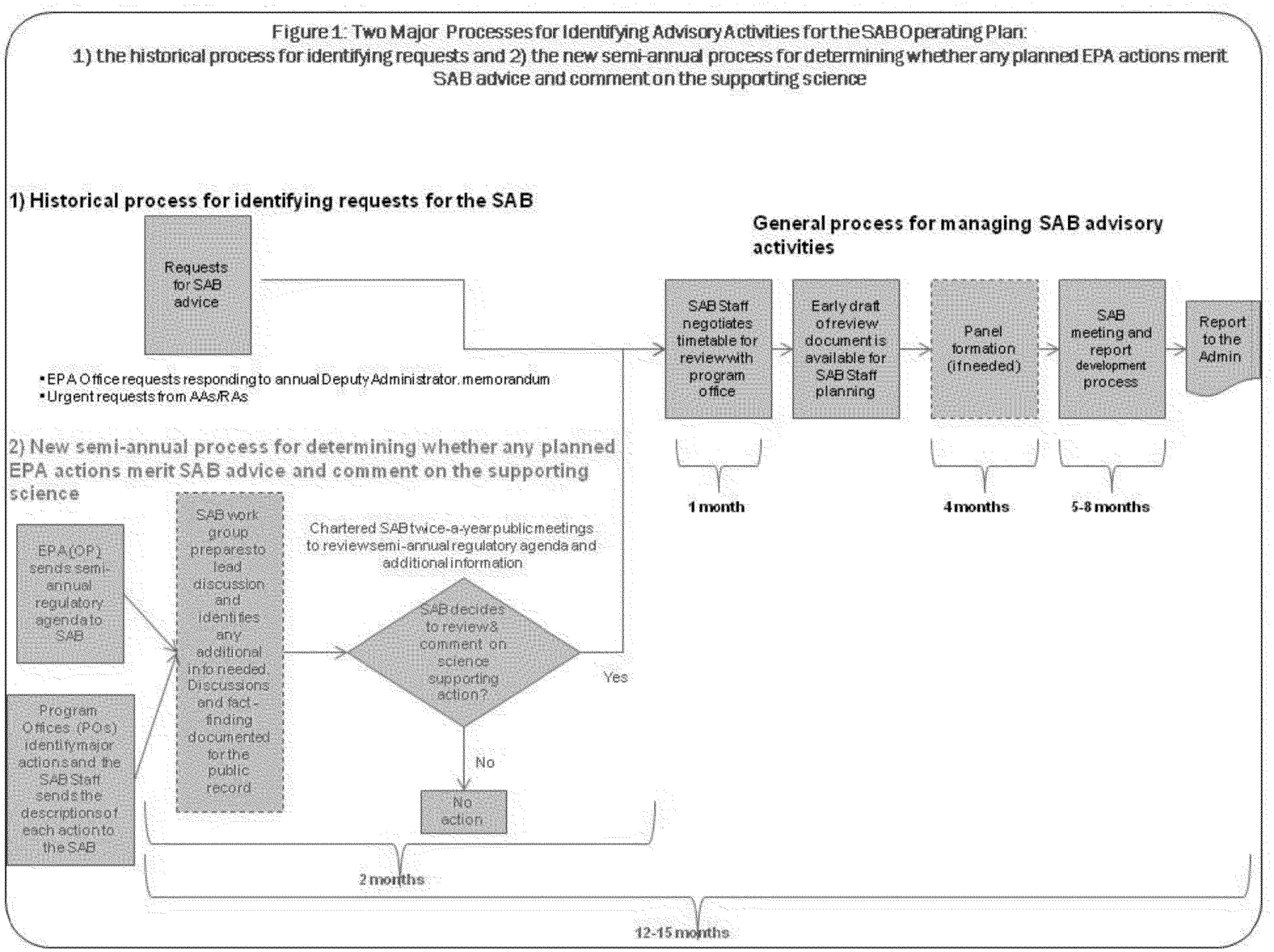
Attachment A: Identifying EPA Planned Actions for SAB Consideration



Environmental Research, Development, and Demonstration Authorization Act [(ERDDAA), 42 U.S.C. 4365]

TITLE 42--THE PUBLIC HEALTH AND WELFARE

CHAPTER 55--NATIONAL ENVIRONMENTAL POLICY

SUBCHAPTER III--MISCELLANEOUS PROVISIONS

Sec. 4365. Science Advisory Board

(a) Establishment; requests for advice by Administrator of Environmental Protection Agency and Congressional committees

The Administrator of the Environmental Protection Agency shall establish a Science Advisory Board which shall provide such scientific advice as may be requested by the Administrator, the Committee on Environment and Public Works of the United States Senate, or the Committee on Science, Space, and Technology, on Energy and Commerce, or on Public Works and Transportation of the House of Representatives.

(b) Membership; Chairman; meetings; qualifications of members

Such Board shall be composed of at least nine members, one of whom shall be designated Chairman, and shall meet at such times and places as may be designated by the Chairman of the Board in consultation with the Administrator. Each member of the Board shall be qualified by education, training, and experience to evaluate scientific and technical information on matters referred to the Board under this section.

(c) Proposed environmental criteria document, standard, limitation, or regulation; functions respecting in conjunction with Administrator

(1) The Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the Clean Air Act [42 U.S.C. 7401 et seq.], the Federal

Water Pollution Control Act [33 U.S.C. 1251 et seq.], the Resource Conservation and Recovery Act of 1976 [42 U.S.C. 6901 et seq.], the Noise Control Act [42 U.S.C. 4901 et seq.], the Toxic Substances Control Act [15 U.S.C. 2601 et seq.], or the Safe Drinking Water Act [42 U.S.C. 300f et seq.], or under any other authority of the Administrator, is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based.

(2) The Board may make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed criteria document, standard, limitation, or regulation, together with any pertinent information in the Board's possession.

(d) Utilization of technical and scientific capabilities of Federal agencies and national environmental laboratories for determining adequacy of scientific and technical basis of proposed criteria document, etc.

In preparing such advice and comments, the Board shall avail itself of the technical and scientific capabilities of any Federal agency, including the Environmental Protection Agency and any national environmental laboratories.

(e) Member committees and investigative panels; establishment; chairmenship

The Board is authorized to constitute such member committees and investigative panels as the Administrator and the Board find necessary to carry out this section. Each such member committee or investigative panel shall be chaired by a member of the Board.

(f) appointment and compensation of secretary and other personnel; compensation of members

(1) Upon the recommendation of the Board, the Administrator shall appoint a secretary, and such other employees as deemed necessary to exercise and fulfill the Board's powers and responsibilities. The compensation of all employees appointed under this paragraph shall be fixed in accordance with chapter 51 and subchapter III of chapter 53 of title 5.

(2) Members of the Board may be compensated at a rate to be fixed by the President but not in excess of the maximum rate of pay for grade GS-18, as provided in the General Schedule under section 5332 of title 5.

(g) Consultation and coordination with Scientific Advisory Panel

In carrying out the functions assigned by this section, the Board shall consult and coordinate its activities with the Scientific Advisory Panel established by the Administrator pursuant to section 136w(d) of title 7.

(Pub. L. 95-155, Sec. 8, Nov. 8, 1977, 91 Stat. 1260; Pub. L. 96-569, Sec. 3, Dec. 22, 1980, 94 Stat. 3337; Pub. L. 103-437, Sec. 15(o), Nov. 2, 1994, 108 Stat. 4593; Pub. L. 104-66, title II, Sec. 2021(k)(3), Dec. 21, 1995, 109 Stat. 728.)

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

2

OFFICE OF THE ADMINISTRATOR

MEMORANDUM

SUBJECT: Identifying EPA Planned Actions for Science Advisory Board (SAB) Consideration of the Underlying Science- Semi-annual Process

FROM: Michael Goo, Associate Administrator
Office of Policy

Glenn Paulson
Science Advisor

Vanessa Vu, Director
SAB Staff Office

TO: General Counsel
Assistant Administrators
Associate Administrators
Regional Administrators

The purpose of this memorandum is to provide guidance for implementing improved coordination with the SAB, the goal of the memorandum dated January 19,2012 on that topic (Attachment A).

We ask that you work with the Office of Policy to provide the SAB Staff Office with information about the science supporting major planned agency actions (Tier 1 and Tier 2 actions) that are in the pre-proposal stage. The *2012 Unified (Regulatory) Agenda and Regulatory Plan* was published on December 21, 2012 on the Office of Management and Budget web site http://www.reginfo.gov/public/.

Please provide the SAB Staff Office (contact: Angela Nugent) by January 30, 2013, a brief description of each action along with its supporting science, following the format provided in Attachment B. Please ensure that these submissions to the SAB are consistent with information developed in the action development process.

This process supplements the Deputy Administrator's annual memorandum requesting program and regional offices- to identify scientific issues that might be appropriate for SAB consideration.

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We look forward to working with you on this new process to strengthen science supporting EPA's decisions. Please contact us or Caryn Muellerleile (202-564-2855) in the Office of Policy or Angela Nugent (202-564-2218) in the SAB Staff Office, should there be questions.

Attachments

cc: Administrator
Deputy Administrator
Chief of Staff
Deputy Chief of Staff

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Attachment A: January 19, 2012 Memorandum from Michal L. Goo

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 19 2012

OFFICE OF POLICY

MEMORANDUM

SUBJECT: Coordination with the Science Advisory Board Regarding Proposed Criteria Documents, Standards, Limitations and Regulations

FROM: Michael L. Goo, Associate Administrator
Office of Policy

TO: Assistant Administrators
General Counsel
Chief of Staff
Associate Administrators
Regional Administrators

This is to confirm the procedures that we have discussed regarding coordination with the Science Advisory Board (SAB) on the science and technical information underlying the EPA's proposed criteria documents, standards, limitations and regulations.

In addition to the current process by which program offices identify actions on which they plan to seek advice from the SAB on scientific and technical issues, OP will semiannually inform the SAB, through the SAB Staff Office, of upcoming proposed actions. This process will focus on those proposed regulations, criteria documents, standards or limitations that undergo interagency review and will operate as follows:

1. OP will submit to the SAB staff office a list, based on the Agency's *Semiannual Regulatory Agenda* (*Regulatory Agenda*), augmented as necessary, of upcoming proposed regulations, criteria documents, standards or limitations that are expected to undergo interagency review. OP will work with program and regional offices to ensure that any actions not listed in the *Regulatory Agenda* that nevertheless are expected to be submitted for interagency review are included in this submission. For any of these additional actions, offices should provide a description similar to that provided for actions included in the *Regulatory Agenda*.

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2. Program and Regional offices will notify the SAB staff office when proposed Agency actions that undergo interagency review become formally available for public review and comment. EPA programs are also expected to provide additional information as requested by the SAB Staff Office to facilitate the SAB's consideration of this information.

If the SAB decides to review and, as appropriate, comment on the scientific and technical basis for a proposed action, OP will work with the SAB Staff Office and the relevant program or regional office to establish the appropriate time frame for SAB review and comment.

Thank you for your assistance in adhering to this process. If you have any questions or concerns, please contact me, or your staff can contact Nicole Owens owens.nicole@epa.gov, at 202 (564-1550).

cc: Bob Perciasepe
Bob Sussman
Deputy Assistant Administrators
Deputy Associate Administrators
Deputy Regional Administrators
Assistant Regional Administrators
Alex Cristofaro
Nicole Owens
Vanessa Wu
Thomas Brennan

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Attachment B - Sample Description of Major Planned EPA Action-Information to be Provided to the SAB

Name of action: Development of Best Management Practices for Recreational Boats Under Section 312(o) of the Clean Water Act

EPA Office originating action: OW

Brief description of action and statement of need for the action:

This action is for the development of regulations by EPA to implement the Clean Boating Act (Public Law 110-288), which was signed by the President on July 29, 2008. The Clean Boating Act amends section 402 of the Clean Water Act (CWA) to exclude recreational vessels from National Pollutant Discharge Elimination System permitting requirements. In addition, it adds a new CWA section 312(o) directing EPA to develop regulations that identify the discharges incidental to the normal operation of recreational vessels (other than a discharge of sewage) for which it is reasonable and practicable to develop management practices to mitigate adverse impacts on waters of the United States. The regulations also need to include those management practices, including performance standards for each such practice. Following promulgation of the EPA performance standards, new CWA section 312(o) directs the Coast Guard to promulgate regulations governing the design, construction, installation, and use of the management practices. Following promulgation of the Coast Guard regulations, the Clean Boating Act prohibits the operation of a recreational vessel or any discharge incidental to their normal operation in waters of the United States and waters of the contiguous zone (i.e., 12 miles into the ocean), unless the vessel owner or operator is using an applicable management practice meeting the EPA-developed performance standards.

Timetable:

Statutory: Phase 1 - 2009, Phase 2 - 2010, and Phase 3 – 2011
Regulatory Agenda: Phase 1 NPRM - 2013, Phase 1FR - 2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No

Scientific questions to be addressed and approach:

Recreational boating activities can contribute to the spread of aquatic nuisance species, primarily through the secondary transport of organisms introduced to U.S. waters via other vectors. For example, recreational boating has been linked to the spread of Zebra and Quagga mussels from their initial introduction into the Great Lakes to other U.S. waters. Consequently, the Agency is considering the development of regulations designed to reduce the spread of such organisms by reducing propagule pressure from the recreational vessel vectors. Propagule pressure is a measure

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of the number of individual organisms released as well as the number of discrete release events. While there is a general consensus that an increase in propagule pressure increases the probability of establishing a self-sustaining population of an aquatic nuisance species, the probability is a complex function of a wide range of variables. These variables include species traits (e.g., viability, reproductive capability, and environmental compatibility) and environmental traits (e.g., retention of propagules, and interactions with resident species). When addressing secondary transport via recreational vessels, as this project is designed to specifically do, additional variables such as vessel characteristics, voyage type, and propagule exposure need to be considered. Due to the complexity of this issue, the Agency is seeking expert scientific opinions on management practices that can reduce propagule pressure that results from recreational boating activities.

Plans for scientific analyses and peer review:

The Agency is planning to convene a workshop on secondary transport of aquatic nuisance species via recreational vessels. Invited participants will have expertise in the field of invasion biology and each participant will be charged to provide their expert scientific opinion on management practices that the Agency should consider as part of this rule making.

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Attachment B
SAB Work Group Recommendations on the Major EPA Planned Actions in the Fall 2016 Semi-Annual Regulatory Agenda

The SAB formed a Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science in December 2016 to review information and short descriptions provided by the EPA Program Offices on the major planned actions that are listed in the Fall 2016 semi-annual Unified Regulatory Agenda but not yet proposed.

After reviewing the Descriptions of Tier 1 and Tier 2 Actions and additional information provided by EPA, SAB Work Group members developed and concurred on the recommendations and discussion provided in this attachment to the June 13, 2017 Work Group memorandum.

RIN[1]	Title	Stage of Rulemaking	Page
2060-AT04	Renewable Fuel Volume Standards (RFVS) for 2018 and Biomass Based Diesel Volume (BBD) for 2019	Proposal	2
2070-AK20	Procedures for Evaluating Existing Chemical Risks Under the Toxic Substances Control Act	Proposed	8
2070-AK23	Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act	Proposed	12
2060-AT10	Endangerment Finding for Lead Emissions From Piston-Engine Aircraft Using Leaded Aviation Gasoline	Long-Term	16
2060-AT26	Control of Air Pollution From Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures	Long-Term	22
2060-AT29	Emission Guidelines for the Existing Oil and Natural Gas Sector	Long-Term	29
2060-AT00	Stationary Combustion Turbine, National Emission Standard Hazardous Air Pollutant (NESHAP) Residual Risk and Technology Review (RTR)	Long-Term	32
2060-AT01	Engine Test Cells National Emission Standard for Hazardous Air Pollutants (NESHAP) RTR	Long-Term	37
2060-AT02	National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards--Ethylene Production (Subparts XX and YY)	Long-Term	42
2060-AT03	National Emission Standards for Hazardous Air Pollutants for Integrated Iron and Steel Manufacturing Facilities RTR	Long-Term	47
2060-AT05	National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing RTR	Long-Term	52
2060-AT07	Rubber Tire Manufacturing RTR	Long-Term	57
2060-AT08	Lime Manufacturing RTR	Long-Term	62
2060-AT12	National Emission Standard for Hazardous Air Pollutants (NESHAP) RTR: Reinforced Plastics Composites and Boat Manufacturing	Long-Term	67

[1] Regulatory Identification Number is linked to the actions initial information on the OMB Regulatory Agenda webpage

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Recurring Action Form for Actions that
May not Merit Further SAB consideration
Description of Planned EPA Tier 1 or Tier 2 Action

Name of action: Proposed Renewable Fuel Volume Standards for 2018 and Biomass Based Diesel Volume (BBD) for 2019

RIN Number: 2060-AS72

EPA Office originating action: OAR

Brief description of action

Section 211(o) of the Clean Air Act establishes the Renewable Fuels Standard (RFS) program, which requires that an increasing amount of transportation fuel be made from renewable feedstocks over time. The statute includes volume targets for four different categories of biofuels, for which EPA is directed to establish annual percentage standards: cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel. The statute includes tables indicating volume objectives through 2022 for cellulosic biofuel, advanced biofuel, and total renewable fuel, and through 2012 for biomass-based diesel. The Act also includes waiver authorities allowing EPA to reduce statutory volumes in appropriate circumstances. After 2012 for biomass-based diesel and after 2022 for the other fuel categories the statute provides EPA the authority to determine the volumes (the statute sets a minimum of 1 billion gallons for biomass-based diesel), and specifies factors for EPA to consider in determining the required volumes.

EPA finalized Renewable Fuel Standards regulations implementing Section 211(o) of the Clean Air Act in 2007, and also adopted substantial revisions in 2010 to implement statutory amendments enacted as part of the 2007 Energy Independence and Security Act. However, the statute requires EPA to promulgate annual rules to translate the renewable fuel volumes into percentage standards that reflect the projected gasoline and diesel fuel demand in the following year. In establishing these annual standards EPA may implement either the statutory volumes, or alternative volumes that EPA establishes using its authorities to lower statutory volumes or to set volumes for years not addressed in the statute. EPA has promulgated these annual standards every year beginning with 2007. For 2014, for the first time, EPA proposed to exercise our waiver authorities to set the applicable volumes of advanced biofuel and total renewable fuels below statutory levels, in light of the unavailability of certain types of renewable fuels and practical and legal constraints on supplying renewable fuels to consumers. The SAB reviewed this action as part of the Review of the Spring 2013 Regulatory Agenda and concluded that the action did not merit further consideration.[2] EPA subsequently re-proposed the 2014 annual standards along with standards for 2015 and 2016 and the biomass-based diesel applicable volume for 2017. On November 30, 2015, EPA finalized the annual standards for 2014-16 and the biomass-based diesel applicable volume for 2017; our action on 2016 standards gets us back on the statutory schedule for completing these actions. On November 23, 2016 EPA finalized the annual standards for 2017 and the applicable volume of biomass-based diesel for 2018.

[2] SAB Discussions about EPA Planned Actions in the Spring 2013 Unified Agenda and their Supporting Science and recommendations are available on the SAB website

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The rule establishing the 2018 annual RFS standards and 2019 biomass-based diesel applicable volume is the next of these statutorily-required annual RFS rulemakings.

Justification for considering this action a recurring action.

As stated above, this is a statutorily mandated annual rulemaking. EPA is required to issue a rulemaking every year establishing applicable standards for obligated parties under the RFS program. This is a routine action that will rely on the same approach and sources of data that were used in the rules establishing required standards for recent years. The analytical work underlying the annual RFS annual rules (including for 2018) is based on historical data regarding renewable fuel production, imports, distribution, and use. That information is then used to project renewable fuel volumes for use in the proposed/final rulemakings. We then divide those volumes by gasoline and diesel projections taken from the Energy Information Agency (EIA) to calculate the percentage standards that apply directly to obligated parties like refiners.

For 2018, we will be updating all relevant data as we formulate the proposed and final rules. We do not currently expect to incorporate new methodological approaches that would rely on any new scientific data or touch upon novel issues.

For reference purposes, EPA is attaching the template we submitted to the SAB for the 2015 annual RFS volume rulemaking action. The SAB declined to select that action for in-depth review.

The SAB's decision on the earlier action (check the appropriate line and attach previous description)

_X_ The SAB did not select the earlier action for in-depth review

____ The SAB selected the earlier action for in-depth review.

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Attachments to Proposed RFVS for 2018 and BBD Volume (BBD) for 2019 (2060-AS72): Previous Agency Description[3]

Name of action: Renewable Fuel Standard (RFS) Volume Standards for 2015

RIN Number: 2060-AR63

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

Section 211(o) of the Clean Air Act establishes the Renewable Fuels Standard (RFS) program, which requires that an increasing amount of transportation fuel be made from renewable feedstocks over time, reaching 36 billion gallons by 2022. These 36 billion gallons are made up of four different categories of biofuels, each with its own standard: cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel. The statute includes tables indicating volume objectives through 2022 for cellulosic biofuel, advanced biofuel, and total renewable fuel, and through 2012 for biomass-based diesel. After 2012 for biomass-based diesel and after 2022 for the other standards the statute provides EPA the authority to determine the volumes (the statute sets a minimum of 1 billion gallons for biomass-based diesel), and specifies factors for EPA to consider in determining the required volumes. The Act also includes waiver authorities allowing EPA to reduce statutory volumes in appropriate circumstances.

EPA finalized Renewable Fuel Standards regulations implementing Section 211(o) of the Clean Air Act in 2007, and also adopted substantial revisions in 2010 to implement statutory amendments enacted as part of the 2007 Energy Independence and Security Act. However, the statute requires EPA to promulgate annual rules to translate the renewable fuel volumes into percentage standards that reflect the projected gasoline and diesel fuel demand in the following year. In establishing these annual standards EPA may implement either the statutory volumes, or alternative volumes that EPA establishes using its discretionary authorities to lower statutory volumes or to set volumes for years not addressed in the statute. EPA has promulgated these annual standards every year beginning with 2007. In 2014, for the first time, EPA proposed to exercise our waiver authorities to set the applicable volumes of advanced and total renewable fuels below statutory levels, in light of unavailability of certain types of renewable fuels and practical and legal constraints on supplying renewable fuels to consumers. The SAB reviewed this action in the as part of the Review of the Spring 2013 Regulatory Agenda and concluded that the action did not merit further consideration.[4]

The 2015 RFS volume rule is the next of these statutorily-required annual RFS rulemakings.

Timetable: To OMB: late fall or early winter 2014
NPRM - Signature: TBD

[3] submitted with Fall 2013 Regulatory Agenda
[4] SAB Discussions about EPA Planned Actions in the Spring 2013 Unified Agenda and their Supporting Science and recommendations are available on the SAB website

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Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No. The analytical work underlying the annual RFS volume rules is based on historical data regarding renewable fuel production, imports, distribution, and use, along with information on micro- and macro-economic factors affecting the underlying data. That information is then used to project renewable fuel volumes for use in the proposed/final rulemakings. This rulemaking will follow the same basic approach as prior annual rulemakings.

Scientific questions to be addressed and approach:

None – as noted above, the data and methodologies supporting this action are consistent with approaches established by previous volume standards, including the 2013 volume standard approach reviewed by the SAB.

Plans for scientific analyses and peer review:

As with previous rules, the analytical work underlying this annual RFS volume rule is based on historical data and updates to historical data regarding renewable fuel production, imports, distribution, and use, along with information on micro- and macro-economic factors affecting these underlying data. The updated information is used to conduct analyses and project renewable fuel volumes for use in the proposed/final rulemakings. This technical/analytical work, which is expected to apply approaches already established through prior volume standards, does not raise any new scientific issues. We also rely to some extent on the analyses conducted as part of the RFS2 final rulemaking released on March 26, 2010.[5] In addition to going through the full public notice and comment process, the relevant data and methods that might have raised novel scientific issues in establishing the RFS2 final regulations in 2010 were peer-reviewed. We do not expect to conduct an additional peer review process for analyses underlying the 2015 standards rule since the decisions will be informed by analyses and employ methodologies that are not expected to present any additional novel or controversial scientific issues and/or have been previously utilized.

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[5] Materials on the RFS2 are available on the EPA web page:

- Fact Sheet: EPA Finalizes New Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond (PDF) (7 pp, 162K, EPA-420-F-10-007, February 2010)
- Fact Sheet: EPA Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels (PDF) (4 pp, 109K, EPA-420-F-10-006, February 2010)
- Q&A on the RFS2 http://www.epa.gov/otaq/fuels/renewablefuels/compliancehelp/rfs2-aq.htm

The FR Notice http://www.gpo.gov/fdsys/pkg/FR-2010-03-26/pdf/2010-3851.pdf

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Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Proposed Renewable Fuel Volume Standards for 2018 and Biomass Based Diesel Volume (BBD) for 2019 [RIN 2060-AT04]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		x
Is the action primarily administrative (i.e., involve reporting or record keeping)?	x	
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		x
Is the action an extension of an existing initiative?	x	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			x
Addresses areas of substantial uncertainties			x
Involves major environmental risks			x
Relates to emerging environmental issues		x	
Exhibits a long-term outlook		x	

Recommendation: This action does not merit further SAB consideration.

Background: The Renewable Fuel Standard (RFS) program began in 2006 pursuant to the requirements in the Clean Air Act (CAA) section 211(o) that were added through the Energy Policy Act of 2005 (EPAct), and subsequently modified through the Energy Independence and Security Act of 2007 (EISA). EISA's goals include moving the United States toward "greater energy independence and security, to increase the production of clean renewable fuels." Per the CAA, section 211(o)(2), Congress specified increasing annual volume targets for total renewable fuel, advanced biofuel, and cellulosic biofuel for each year through 2022, and for biomass-based diesel through 2012, and authorized the EPA to set volume requirements for subsequent years in coordination with USDA and DOE, and after consideration of specified factors such economic impact, environmental impact, and domestic supply. Congress also recognized that under certain circumstances it would be appropriate for EPA to set volume requirements at lower levels than reflected in the statutory volume targets, and thus provided waiver provisions. For example, since 2014 the slower than expected development of the cellulosic biofuel industry and constraints in the marketplace have resulted in the use of waivers to set volume targets below congressionally specified values.

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Rationale: This is a statutorily mandated annual rulemaking. EPA is required to issue a rulemaking every year establishing applicable standards for obligated parties under the RFS program. This is a routine action that relies on the same approach and sources of data that were used in the rules establishing required standards in past years. The analytical work underlying the annual RFS annual rules is based on historical data regarding renewable fuel production, imports, distribution, and use. That information is then used to project renewable fuel volumes for use in the proposed/final rulemakings. These volumes are divided by gasoline and diesel volume projections taken from the Energy Information Agency (EIA) to calculate the percentage standards that apply directly to obligated parties like refiners. The EPA does "not currently expect to incorporate new methodological approaches that would rely on any new scientific data or touch upon novel issues" to determine the renewable fuel volume standards for 2018 and the biomass based diesel volume (BBD) for 2019.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Procedures for Chemical Risk Evaluation under the Amended Toxic Substances Control Act

2. **RIN Number:** RIN 2070-AK20

3. **EPA Office originating action:** Office of Chemical Safety and Pollution Prevention/Office of Pollution Prevention and Toxics

4. **Brief description of action and statement of need for the action:** As required under section 6(b)(4) of the Toxic Substances Control Act (TSCA), EPA is proposing to establish a process for conducting risk evaluations to determine whether a chemical substance presents an unreasonable risk of injury to health or the environment, without consideration of costs or other non-risk factors, including an unreasonable risk to a potentially exposed or susceptible subpopulation, under the conditions of use. Risk evaluation is the second step, after Prioritization, in the new process of existing chemical substance review and management established under recent amendments to TSCA. This procedural rule identifies the steps of a risk evaluation process including scope, hazard assessment, exposure assessment, risk characterization, and finally a risk determination. EPA is proposing that this process be used for the first ten chemical substances to be evaluated from the 2014 update of the TSCA Work Plan for Chemical Assessments, chemical substances designated as High-Priority Substances during the prioritization process, and those chemical substances for which EPA has initiated a risk evaluation in response to manufacturer requests. This rule also includes the required "form and criteria" applicable to such manufacturer requests.

5. **Timetable:** According to the statute, the Agency must publish the finalized risk evaluation rule 1 year after the law was enacted which would be June 22, 2017.

The proposed rule was published in the FR on January 19, 2016 and the associated comment period concludes on March 20, 2017.

https://www.federalregister.gov/documents/2017/01/19/2017-01224/procedures-for-chemical-risk-evaluation-under-the-amended-toxic-substances-control-act

6. **Scientific products that will inform the action and plans for peer review:**

6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.

This action, when finalized would establish the process for conducting risk evaluations under the amended TSCA, including steps that must be completed and associated timeframes. The process proposed here is not new, but uses processes already utilized by the Agency for evaluating chemicals. These processes have been extensively reviewed and have evolved utilizing external review and

comment. This rule itself does not contain specific scientific work products, however the result of the implementation of this rule, once finalized, may result in products.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

NA – there are no work products as a result of this rule.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

NA – there are no work products as a result of this rule.

6(d). Peer review:

This proposed rule did not require external peer review because it is not a scientific work product. The proposed rule does contain the requirement that the Agency conduct peer review for each risk evaluation as well as on any novel scientific method utilizing Agency policies and guidelines on peer review.

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Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Procedures for Evaluating Existing Chemical Risks Under the Toxic Substances Control Act [RIN 2070 AK20]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties		X	
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further SAB consideration.

Rationale: This action proposes a process for conducting risk evaluations under section 6(b)4 of TSCA. Risk evaluation follows Prioritization (considered under 2070-AK23). The rule identifies the steps in a risk evaluation, using existing methods and the weight of evidence approach that has been applied consistently by the agency. The proposed rule was published in the Federal Register on January 19, 2016 and the associated comment period concludes on March 20, 2017. EPA must publish the finalized risk evaluation rule one year after enactment, which would be June 22, 2017.

The Agency's procedures for the TSCA actions peer review include: 1) developing a Peer Review Plan for each assessment that is submitted to the public record in the docket and on the agency's web page, 2) following a documented process for reviews of Highly Influential Science Assessments and Influential Science Assessments, and 3) announcing the peer review panel public meetings in the Federal Register. The Federal Register notice announces opportunities for public comment (at the meetings and the

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docket), the public meeting logistics, and the peer review panel members. The Federal Register notice is submitted to the docket and posted on the agency's web page in addition to being published. There are also opportunities for public input on peer review plans, chemical assessments, and opportunities to submit relevant data on assessments to the EPA docket.

For the proposed action, there will be no work product for review. Instead, work products will be created during implementation (the risk evaluations). The completed risk assessment products resulting from the TSCA evaluations will meet *the EPA Peer Review Handbook definition of "an influential scientific or technical work product"* that imply a legal and/or statutory obligation to conduct a peer review. Thus, the SAB anticipates EPA will maintain the level of analysis and peer review demonstrated in previous regulatory reviews.

The Work Group notes that the SAB previously reviewed planned actions for several specific TSCA chemicals using these methods and peer review approaches and found the approach to be scientifically sound; for example, the SAB did not recommend further review for the *Trichloroethylene (TCE); Rulemaking Under TSCA Section 6(a) and N-Methylpyrrolidone (NMP) and Methylene Chloride; Rulemaking Under TSCA Section 6(a) action* included in the Spring 2015 Unified Agenda. [6]. Therefore, this action does not merit further SAB review. However, the Work Group recommends that the SAB urge EPA to retain and improve the TSCA peer review process, and to assess the adequacy of guidance documents related to risk evaluations with input from the SAB.

[6] SAB Discussions about EPA Planned Actions in the Spring 2015 Unified Agenda and their Supporting Science available at: https://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/0e748503053ede6285257e6e0069bc5c!OpenDocument&TableRow=2.3#2.

Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Procedures for Prioritization of Chemicals for Risk Evaluation under Toxic Substances Control Act

2. **RIN Number:** RIN 2070-AK23

3. **EPA Office originating action:** Office of Chemical Safety and Pollution Prevention/Office of Pollution Prevention and Toxics

4. **Brief description of action and statement of need for the action:** As required under section 6(b)(1) of the Toxic Substances Control Act (TSCA), EPA is proposing to establish a risk-based screening process and criteria that EPA will use to identify chemical substances as either High-Priority Substances for risk evaluation, or Low-Priority Substances for which risk evaluations are not warranted at this time. This procedural rule describes the processes for identifying potential candidates for prioritization, selecting a candidate, screening that candidate against certain criteria, formally initiating the prioritization process, providing opportunities for public comment, and proposing and finalizing designations of priority. Prioritization is the initial step in this new process of existing chemical substance review and risk management activity established under recent amendments to TSCA.

5. **Timetable:** According to the statute the Agency must publish the final prioritization rule 1 year after the law was enacted, which would be by June 22, 2017.

   The proposed rule was published in the FR on January 17, 2016 and the associated comment period concludes on March 20, 2017.

   https://www.federalregister.gov/documents/2017/01/17/2017-00051/procedures-for-prioritization-of-chemicals-for-risk-evaluation-under-the-toxic-substances-control

6. **Scientific products that will inform the action and plans for peer review:**

   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   This action, when finalized would establish the process for prioritizing chemicals for risk evaluation under the amended TSCA, including steps in the process and associated timeframes. Given the procedural nature of this rulemaking, no scientific work products have been or will be developed to inform the action.

   6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

   NA – there are no scientific work products as part of this action development.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
NA – there are no scientific work products as part of this action development.

6(d). Peer review:
NA – there are no peer review plans associated with this action development.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act [RIN 2070-AK23]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties	X		
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further SAB review.

Rationale: From EPA's Description of this action: "As required under section 6(b)(1) of the Toxic Substances Control Act (TSCA), EPA is proposing to establish a risk-based screening process and criteria that EPA will use to identify chemical substances as either High-Priority Substances for risk evaluation, or Low-Priority Substances for which risk evaluations are not warranted at this time. This procedural rule describes the processes for identifying potential candidates for prioritization, selecting a candidate, screening that candidate against certain criteria, formally initiating the prioritization process, providing opportunities for public comment, and proposing and finalizing designations of priority. Prioritization is the initial step in this new process of existing chemical substance review and risk management activity established under recent amendments to TSCA." The proposed rule was published in the Federal Register on January 17, 2016 and the associated comment period concludes on March 20,

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2017. EPA must publish the final prioritization rule one year after enactment, which would be by June 22, 2017.

The Agency's procedures for the TSCA actions peer review include: 1) developing a Peer Review Plan for each assessment that is submitted to the public record in the docket and on the agency's web page, 2) following a documented process for reviews of Highly Influential Science Assessments and Influential Science Assessments, and 3) announcing the peer review panel public meetings in the Federal Register. The Federal Register notice announces opportunities for public comment (at the meetings and the docket), the public meeting logistics, and the peer review panel members. The Federal Register notice is submitted to the docket and posted on the agency's web page in addition to being published. There are also opportunities for public input on peer review plans, chemical assessments, and opportunities to submit relevant data on assessments to the EPA docket.

For the proposed action, EPA would use a process similar to the prioritization previously used under TSCA, and would incorporate the new requirements of the Frank R. Lautenberg Chemical Safety for the 21st Century Act enacted on June 22, 2016. Thus, the process is not new or novel. The level of interest associated with resolution of uncertainties is assessed to be high, as there are significant data gaps for some chemicals, and we do not know how great the associated potential environmental risks might be. Overall, TSCA provides authority for EPA to establish this risk-based screening process and parts of the action have been considered by the SAB in previous review of the semi-annual regulatory agenda (Spring 2016).

When finalized, the action would establish the process for prioritizing chemicals for risk evaluation under the amended TSCA. Thus, this rulemaking is of a procedural nature and no scientific work products have been or will be developed to inform the action, and therefore no peer review will be required. The completed risk assessment products resulting from the TSCA evaluations will meet *the EPA Peer Review Handbook definition of "an influential scientific or technical work product"* that imply a legal and/or statutory obligation to conduct a peer review. Thus, the SAB anticipates EPA will maintain the level of analysis and peer review demonstrated in previous regulatory reviews, and this action does not merit further SAB review. However, as explained in the recommendation for planned action *Procedures for Evaluating Existing Chemical Risks Under the Toxic Substances Control Act* (2070 -AK20), the Work Group recommends that the SAB urge EPA to retain and improve the TSCA peer review process, and to assess the adequacy of guidance documents related to risk evaluations with input from the SAB.

Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Proposed Endangerment and Cause or Contribute Findings for Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline

2. **RIN Number: 2060-AT10**
   (ANPR: https://www.gpo.gov/fdsys/pkg/FR-2010-04-28/pdf/2010-9603.pdf)

3. **EPA Office originating action:** Office of Air and Radiation, Office of Transportation Air Quality

4. **Brief description of action and statement of need for the action:**
   The Office of Air and Radiation's Office of Transportation and Air Quality (OTAQ) is currently evaluating, under section 231 of the Clean Air Act, whether lead emissions from aircraft operating on leaded aviation gasoline cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. This action follows a previous ANPRM by issuing a NPRM that will describe the endangerment and cause or contribute determinations that EPA proposes for lead emissions from general aviation aircraft. Additional information on efforts to date related to this action can be found on the aviation lead emissions portion of the EPA website (https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-lead-emissions-aircraft). The FAA is currently evaluating unleaded fuels for use in the piston aircraft fleet and plans to identify an unleaded replacement fuel by 2018 (https://www.faa.gov/about/initiatives/avgas/).

5. **Timetable:**
   In responses to citizen petitions to make these determinations, EPA has publicly stated its intent to issue a 2017 NPRM endangerment determination, followed by a 2018 final determination. Key milestones in the current schedule include:

   December 2017 - NPRM
   January 2019 - Final Rule

6. **Scientific products that will inform the action and plans for peer review:**

   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   - *National Emissions Inventory of lead from the use of leaded aviation fuel*
     The EPA develops a national inventory of lead emissions from piston-engine aircraft as part of the National Emissions Inventory conducted every three years. This analysis provides information regarding the relative contribution of lead to the total US inventory from aircraft activity compared to other sources (e.g., industrial processes).

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- *Demographic analysis of populations living or attending school near airports*
  The EPA developed an analysis to characterize the number of people who live and attend school near airports. This analysis provides an estimate of the total population potentially living in or attending school in areas where emissions of lead from piston-engine aircraft may impact ambient concentrations of lead, including the number of children as well as an analysis by race. This analysis is not an exposure assessment, and thus will be used to provide estimates of the number of individuals living in areas around airports where piston-engine aircraft operate.

- *Monitored concentrations of lead in air at 17 airports*
  The EPA finalized lead monitoring requirements in 2008 and 2010 which resulted in NAAQS surveillance monitoring at 17 airports. This information will be used to evaluate the question of whether aircraft emissions of lead cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. Information about the criteria for selection of these airports and the monitored lead concentrations are available on EPA's aircraft lead website (https://www.epa.gov/regulations-emissions-vehicles-and-engines/airport-lead-monitoring-and-modeling).

- *Nationwide analysis of lead concentrations at airports*
  In order to characterize lead concentrations at and near airports nationwide, EPA first conducted air quality modeling at two airports using EPA's regulatory model AERMOD and evaluated the model output by comparison to airport monitoring data[7,8]. The EPA then developed scaling factors based on air quality modeling and used these scaling factors to estimate average 3-month concentrations of lead at locations immediately adjacent to and downwind of the maximum impact site at airports nationwide. A quantitative and qualitative uncertainty analysis was conducted. The model-extrapolated lead concentrations will provide information regarding the range of potential lead concentrations attributable to piston-engine aircraft at airports nationwide.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

- *Inventory of lead emissions from use of leaded aviation fuel*
  The EPA, in collaboration with the FAA, developed approaches to estimate piston-engine aircraft activity at airports in the U.S. The methods are described in full on EPA's National Emissions Inventory website (https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation).

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[7] Carr et al. Atmospheric Environment (2011) 45:5795-5804.
[8] U.S. EPA (2010) EPA-420-R-10-007; available at https://nepis.epa.gov/Exe/ZyPDF.cgi/P1007H4Q.PDF?Dockey=P1007H4Q.PDF

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- *Demographic analysis of populations living or attending school near airports*
  The EPA developed runway layers in ArcGIS using FAA input data and developed 500 meter boundaries around each runway at all airports in the U.S. Census block data from the 2010 U.S. Census was used to characterize populations living in or near the 500 meter boundaries around airports and data regarding schools and preschools located in this boundary were obtained from the Department of Education and the Department of Health and Human Services, respectively. The methodology for this study has been peer-reviewed and will be available in a forthcoming report.

- *Monitored concentrations of lead in air at 17 airports*
  State and local air authorities collected and certified lead concentration data for at least one year at 17 airports. The certified data are summarized on EPA's website (https://www.epa.gov/regulations-emissions-vehicles-and-engines/airport-lead-monitoring-and-modeling).

- *Nationwide analysis of lead concentrations at airports*
  EPA conducted a study to develop source-specific parameters that are necessary to conduct near-field air quality modeling of piston-engine aircraft. This study was conducted by collecting source-specific data (e.g., activity patterns, fuel consumption rates) and meteorology data (e.g., wind speed, wind direction, temperature) at one General Aviation (GA) airport in order to run the American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD). Air quality modeling results were used to identify key sources of ground-level lead concentrations from aircraft, and to characterize the lead concentration gradient relative to locations of aircraft activity. This methodology is described in full in Carr et al., 2011[9]. The methodology described by Carr et al, 2011 was then applied to a second GA airport that served as a model facility for developing scaling factors, in the form of concentration of lead per unit of aircraft activity (i.e., ug Pb /m^3 per landing-and-take-off cycle). The scaling factors were multiplied by corresponding estimates of aircraft activity at each airport nationwide in order to develop model-extrapolated concentrations of lead at U.S. airports. This analysis will be peer reviewed by five experts in a letter peer review and EPA intends to provide a response to peer review comments and final report in 2017.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

- The demographic analysis and the nationwide analysis of lead concentrations at airports are considered influential scientific information (ISI). As such, both products have, or will, undergo the appropriate peer review. The demographics analysis has gone through

[9] Carr et al. Atmospheric Environment: 45 (2011) 5795-5804.

EPA's letter peer review process. EPA intends to submit the national analysis to letter peer review in 2017.

6(d). Peer review:

- *National Emissions Inventory (NEI), including inventory of lead emissions from use of leaded aviation fuel*
  Peer review not required (data reviewed by state and local municipalities)

- *Demographic analysis of populations living or attending school near airports*
  EPA tasked Eastern Research Group, Inc. (ERG) with organizing an independent, external peer review of a draft analysis titled, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports," to ensure that the analysis was conducted in a rigorous, appropriate, and defensible way. ERG conducted a search to identify experts with appropriate expertise and who had no conflict of interest (COI) in performing this review. Three academic researchers (Francine Laden, Harvard Medical School; James R. Roberts, Medical University of South Carolina; George D. Thurston, New York University School of Medicine) provided comments in response to charge questions on the databases used, analytical methods, assumptions, the characterization of uncertainty, and the conclusions reached through the analysis. EPA intends to make the final report, including responses to peer review comments, publically available.

- *Monitored concentrations of lead in air at 17 airports*
  Monitoring data were collected by air monitoring agencies per 40 CFR Part 58 and submittal of all necessary data to EPA's Air Quality System and subsequent certification conforming to guidance criteria described here:
  https://www.epa.gov/sites/production/files/2015-09/documents/data_certification_criteria.pdf.

- *Nationwide analysis of lead concentrations at airports*
  Planned (contract mechanism in place for external letter peer review in 2017)

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Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Proposed Endangerment and Cause or Contribute Findings for Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline [RIN 2060-AT10]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"	X	
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties		X	
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Rationale: EPA is evaluating whether lead emissions from aircraft operating on leaded aviation gasoline ("avgas") cause or contribute to air pollution that may be reasonably anticipated to endanger public health. Lead is still used as an octane booster in avgas that is used in piston-engine aircraft, mostly for general aviation. Avgas has a much higher octane rating than gasoline for highway vehicles. Separately, the FAA is evaluating the potential to replace leaded avgas with non-leaded avgas. EPA will use the National Emission Inventory of lead emissions from use of leaded avgas, demographic analysis of populations living or attending school near airports, surveillance monitoring data for 17 airports, and estimates of lead concentrations near airports using AERMOD. The emission inventory methods were developed with FAA and are documented online. The demographic data will be from analysis of GIS layers of airport boundaries and Census block data. Census block data are reported to have been peer-reviewed. Monitoring data for the 17 airports have been certified by state and local authorities that collected the data. EPA plans to conduct a letter peer review of the nationwide analysis of lead

concentrations in air at airports by five experts. EPA will provide responses to peer review comments and issue a final report.

EPA considers that the demographic analysis and the nationwide analyses of lead concentrations are influential scientific information (ISI). The EPA reports it has already conducted a letter peer review of the demographic data and will conduct a letter peer review of the national analysis. EPA states that peer review is not required for the NEI because data were reviewed by state and local municipalities and that peer review is not required for the measured concentrations, because the monitoring data were submitted to EPA in conformance with submittal guidance.

Although not mentioned, EPA has previously developed an Integrated Science Assessment for Lead as part of the NAAQS review process. The ISA includes causality determinations and information regarding adverse health effects from exposure to airborne lead. Three drafts of the ISA were reviewed by the EPA Clean Air Scientific Advisory Committee during the most recent review of the Lead NAAQS, completed in 2013.

Overall, it is not recommended for the Science Advisory Board to review this regulatory action, given that key elements already have undergone, or will undergo, peer review.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures

2. **RIN Number:** 2060-AT26

3. **EPA Office originating action:** Office of Air and Radiation/Office of Transportation and Air Quality

4. **Brief description of action and statement of need for the action:**

   This rulemaking follows on the EPA's final endangerment and cause or contribute findings for aircraft GHG emissions which were published on August 15, 2016 (81 FR 54422). As a result of these positive findings, the EPA is obligated under section 231 of the Clean Air Act to set emission standards applicable to GHG emissions from the classes of aircraft engines used in certain types of aircraft included in the contribution finding.

   The EPA and the Federal Aviation Administration (FAA) traditionally work within the standard-setting process of the International Civil Aviation Organization (ICAO). ICAO's Committee on Aviation Environmental Protection (CAEP) establishes international aircraft emission standards and related requirements, which individual nations later adopt into domestic law. On July 1, 2015, the EPA issued an Advance Notice of Proposed Rulemaking (80 FR 37758) to provide an overview and seek input on a variety of issues related to the setting of an international aircraft CO_2 standard at ICAO, and the potential use of section 231 of the Clean Air Act to adopt and implement corresponding aircraft engine CO_2 emission standards domestically.

   At its meeting in February of 2016, ICAO/CAEP agreed on the first-ever international standards to regulate CO_2 emissions from aircraft. The ICAO Assembly approved these CO_2 standards in October 2016, and then ICAO is expected to formally adopt these standards in March 2017. If ICAO formally adopts the final CO_2 standards in March 2017, the EPA's standards will need to be at least as stringent as the ICAO CO_2 aircraft standards for the United States to meet its treaty obligations under the Convention on International Civil Aviation. This rulemaking would meet these treaty obligations.

5. **Timetable:** As indicated in the 2016 Fall Regulatory Agenda, the EPA expects to issue a Notice of Proposed Rulemaking by January 2018 and a Final Rule by December 2018. The FAA would then adopt regulations to implement and enforce the standards. The EPA schedule has been developed in consultation with the FAA, and reflects the need for both Agencies to act prior to the January 2020 implementation date for the international aircraft CO_2 standards. We anticipate that once EPA has completed its rulemaking, FAA will then begin its rulemaking for the enforcement of the standards. Under section 232 of the Clean Air Act, FAA must enforce the emission standards that EPA sets under section 231 of the Clean Air Act. Therefore, EPA intends to complete the standard setting rulemaking by the end of 2018 in order to provide FAA sufficient time for it to finalize its rules by January 2020.

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6. **Scientific products that will inform the action and plans for peer review:**

6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
See section 6(c) below.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

See section 6(c) below.

6(c) For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
The EPA intends to use two scientific products to inform its decision-making in this rulemaking. Both of these products meet the definition of an influential scientific or technical work product.

The EPA is developing an aircraft GHG inventory to assess the emissions impact of this rulemaking. The aircraft GHG inventory will be based on detailed estimates of the U.S. and global fleet fuel burn and potential emission reductions, from 2010 to 2040, for different stringency and implementation timing options. The EPA utilizes an aircraft performance model, PIANO (Project Interactive Analysis and Optimization), in the development of the aircraft GHG inventory. PIANO is commercially available and widely used across the industry and academia. It contains non-manufacturer provided estimates of the performance of numerous aircraft. The EPA previously utilized PIANO as part of the EPA's technical work for the ICAO technical workgroups charged with assessing the stringency options for the international aircraft CO_2 standard.

In addition, as part of the rulemaking, the EPA is developing a technological feasibility and cost analysis that will be based on updating a March 2015 ICF report entitled, "Cost Analysis of CO_2-Reducing Technologies for Aircraft," which was a reference for the Advance Notice of Proposed Rulemaking. The new report will be an updated assessment of the latest aircraft technical improvements, their costs, and their fuel burn or emissions reduction potential. The EPA previously used the information from the March 2015 report as part of EPA's technical work for the ICAO technical workgroups tasked with assessing the technologies and costs of stringency options for the international aircraft CO_2 standard, and ICAO utilized information from this report in its analysis.

6(d). Peer review:
The EPA is developing a technical report that will document the EPA assumptions, data sources, and methods for the aircraft GHG inventory. Also, the updates to the ICF report, "Cost Analysis of CO_2- Reducing Technologies for Aircraft," will include documenting any assumptions, data sources, and methods for the technology and cost analysis.

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For both of the documents described above, the EPA is seeking an independent peer review of the assumptions, data sources, and methods provided in the documents. We plan to begin the peer review in the Spring of 2017, and we expect it to be completed by the end of the Summer of 2017, before the proposed rulemaking will be issued.

The letter peer review will be led and managed by a contractor. In selecting reviewers, the contractor will avoid any reviewer with actual or apparent conflict(s) of interest that would preclude an independent review. Three peer reviewers will be chosen to review each report (there will be different peer reviewers for each report, so there will be a total of six peer reviewers). Due to the complex nature of the subjects, EPA will request that the reviewers have one or more areas of relevant expertise in order to assure an effective peer review. The combined expertise of the selected reviewers will cover the following areas: aircraft emissions inventory assessment, aircraft engine fuel efficiency technology, airframe fuel efficiency technology, aircraft economics, and aircraft industry characterization. The contractor will distribute a charge letter and collect comments from the peer reviewers. The EPA will develop a response to the peer review comments and make revisions to the reports accordingly.

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Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures [RIN 2060-AT26]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"	X	
Is the action an extension of an existing initiative?		X

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties		X	
Involves major environmental risks	X		
Relates to emerging environmental issues	X		
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: The Work Group finds that the planned action is significant and would benefit from SAB advice and comment. The Work Group notes the temporal constraints on completing the rulemaking and recommends the SAB provide advice on this issue and at a minimum EPA should conduct a panel review that allows communication across the two proposed peer review panels in order to encourage synergistic understanding among the disciplines involved.

Rationale: While the underlying rule making will follow the lead of ICAO in setting emissions standards implementation of those standards through regulation will flow from an EPA led assessment of the aircraft GHG inventory, technological feasibility and cost analysis. The assessment of the underling science will determine the overall integrity of resulting regulations with respect to meeting the desired GHG goals. Given that these rules will impact a significant portion of the global aircraft industry and will provide the framework for any changes moving forward, ensuring the scientific integrity of these initial rules is of high importance. As is the case with development of any new rule it is critical to ensure that the range of scientific views from multiple perspectives are solicited in order to capture the

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collective understanding of the relevant science. Towards that end we encourage involving a greater number of reviewers in a more integrative process using a panel review. The SAB hopes that there is time under the constraint of a December 2018 deadline for completing the standard setting ruling making to undertake this more integrative approach to a scientific review.

It is important to make the work products of the review public. Transparency can stimulate further reflection on the key science issues involved as well as precipitating advancements in the associated areas of research.

Within the temporal constraints on completing the rulemaking the SAB wishes to provide advice on this issue or at a minimum the EPA should conduct a panel review that allows communication across the two proposed panels in order to encourage synergistic understanding among the disciplines involved.

The Work Group notes the SAB previously reviewed *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 Advanced Notice of Proposed Rulemaking* (2060-AS31) in the Fall 2014[10] Regulatory Review and found that subsequent steps in the regulatory process will involve substantive scientific issues that may warrant SAB consideration.

The Work Group anticipates that subsequent steps in the regulatory process will continue to involve substantive scientific issues that will warrant SAB consideration. It recommends that the SAB asks the agency to regularly inform the Board about the status of subsequent steps on this topic and also asks the EPA to provide it with briefings on the science underlying agency approaches to address greenhouse gas emissions and related climate change actions.

The Work Group submitted questions to the EPA as part of their research and fact-finding. The questions and agency responses directly follow in this attachment.

[10] SAB Discussions about EPA Planned Actions in the Fall 2014 Unified Agenda and their Supporting Science https://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/d78924048 1106d085257dc4005dcef6!OpenDocument

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Science Advisory Board Work Group's Fact-finding Questions on Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26)

Question: The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. Can the EPA elaborate on their portion of the schedule for the planned action that allows FAA to meet the ICAO deadlines?

Response: We do not yet have a schedule identified for this action.

Question: Has the agency initiated the peer review of the two documents, the "technical report documenting the assumptions, data sources, and methods for the aircraft GHG inventory" and the "Cost Analysis of CO2- Reducing Technologies for Aircraft" and are the documents available?

Response: The peer review of the two documents has not been initiated, and the technical reports are not yet available.

Question: Is there additional information the EPA can provide on the planned peer reviews at this time: What is the anticipated schedule for each review?

Response: The peer review of the two documents is expected to begin later this year.

Question: Are the two documents being reviewed separately by two different panels or will the reviewers be aware of peer review comments on both documents?

Response: The two documents are being reviewed separately by two different panels, who will be unaware of the peer review comments of the other panel.

Question: Will the reviewers be different for each report, or will some reviewers review both reports?

Response: The reviewers will be different for each report.

Question: Did the agency consider conducting a panel review rather than a letter review?

Response: We determined that a letter review was appropriate for a number of reasons including time and resource constraints. Both work products are looking for perspectives from individuals with unique expertise with little-to-no subject matter overlap. For the technologies and costs analysis, we requested peer review from three subject matter experts that cover the following areas: aircraft engine technology, airframe (or whole aircraft) technology, and aircraft economics. For the GHG aircraft inventory we are requesting 3 independent subject matter experts in the field of aircraft emissions inventory modeling and

stringency analysis. In each case we believe these analyses are less complex or novel than what would typically be the subject of panel review and therefore are appropriate for letter review.

Question: If initiated, when will the peer review report be available?

Response: As described earlier, the peer review of the two documents has not been initiated.

Question: Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?

Response: Although the peer review of the two documents has not been initiated, we expect that six peer reviewers in total, three for each peer review, will be sufficient for the subject matter in the documents.

Question: Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

Response: If EPA uses these reports in support of a future rulemaking, we would make both reports available to the public as well as the peer review comments and how they are addressed.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Emission Guidelines for the Existing Oil and Natural Gas Sector

2. **RIN Number:** 2060-AT29

3. **EPA Office originating action:** Office of Air and Radiation

4. **Brief description of action and statement of need for the action:**
   On June 3, 2016, EPA issued a New Source Performance Standard in the Crude Oil and Natural Gas Production source category, setting emission limits for volatile organic compounds and greenhouse gases, in the form of limitations on methane. As a result of establishing limits on non-criteria pollutants or air toxics, the NSPS triggered the Clean Air Act requirement to establish emission guidelines for this source category.

5. **Timetable:** To be determined

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   The EPA is undergoing a data collection effort from oil and natural gas companies through an ICR. The ICR seeks a broad range of information, such as how equipment and emissions controls are, or can be, configured, and what installing those controls entails.

   No other scientific work products have been planned at this time.

   6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

   The analysis plan for the ICR data has not yet been developed.

   6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
   To be determined

   6(d). Peer review:
   To be determined

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Emission Guidelines for the Existing Oil and Natural Gas Sector [2060-AT29]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency		X	
Addresses areas of substantial uncertainties		X	
Involves major environmental risks	X		
Relates to emerging environmental issues	X		
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: The SAB Work Group recommends that the SAB review the scientific and technical basis for the Emission Guidelines for the Existing Oil and Natural Gas Sector (2060 –AT29) when more information on the planned action is available and at that time determine if advice and comment is appropriate to provide to the Administrator. This action is still under development and the Work Group notes the agency has withdrawn the 2016 Information Collection Request[11] (ICR) from the oil and gas industry[12]. Thus at present there is insufficient information to review.

[11] Background on the Information Request for the Oil and Natural Gas Industry. https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-industry/background-information-request-oil-and

[12] Notice Regarding Withdrawal of Obligation To Submit Information (FR. 82, 43, p 12817). March 7, 2017. https://www.gpo.gov/fdsys/pkg/FR-2017-03-07/pdf/2017-04458.pdf

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Rationale: On March 10, 2016, the Administration and EPA announced the next step in reducing emissions of greenhouse gases (in the form of methane) from the oil and natural gas industry: moving to regulate emissions from existing sources. According to the US EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2015, published in April 2017, existing sources from the oil and gas industry make substantial contributions to national total methane emissions. Methane from the oil and gas industry comes packaged with other pollutants, including volatile organic compounds that contribute to the formation of ozone, a component of health, agriculture and ecosystem damaging smog, and a number of harmful pollutants known as air toxics.

This planned action follows from the New Source Performance Standards (NSPS) that set limits on new sources of emissions of greenhouse gases in the oil and gas sector. As a result of establishing limits on *new sources*, the NSPS triggered a requirement to establish emission guidelines for *existing sources* in this source category.

Although similar in type to the requirements for new sources, there are unique science questions associated with how emissions from existing sources are quantified. What type of data would best characterize leakage from existing active oil and gas extraction facilities (e.g. visual or spectrographic indication of leakage, quantitative determination of fluxes, concentration measurements above a threshold)? Would the data and measurement techniques be the same for on-shore and off-shore oil rigs? If not, how would they differ?

Scientific questions also exist on how leakage rates from existing sources would be determined, the accuracy of various measurement techniques, whether measurements would take place in close proximity to existing sources or be conducted using remote sensing instruments. Further, the current source definition does not appear to include abandoned facilities. Some abandoned oil and gas wells have been shown to emit substantial quantities of methane and other gases over multiple decades, while others emit none. Would these no longer operational or 'abandoned' wells be included in a review of existing sources of methane emissions?

Finally, an evaluation by the SAB of the scale of the impact of existing sources on: greenhouse gas emissions, volatile organic compounds that contribute to the formation of surface ozone (O_3) and have been shown to contribute to exceedance of O_3 standards, and emissions of air toxics, could also be beneficial.

Answering these science questions was intended to be informed by data provided by existing source owners through an ICR released on November 10, 2016, which sought information necessary to assist EPA in determining how to best reduce emissions of methane and other harmful emissions from existing sources in the oil and natural gas sector. However, the ICR was withdrawn by the EPA on March 7, 2017. Thus, at present there is neither data nor analysis requiring peer review.

Therefore, the SAB should evaluate the science supporting the planned action when more information about the proposed rule and the science supporting it are made available. At that time the SAB will determine whether it wishes to offer advice and comment to the Administrator. The Work Group made this decision because there was insufficient information provided by the agency to date about the scientific and technical basis for this planned action.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Stationary Combustion Turbine RTR

2. **RIN Number:** 2060-AT00

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each maximum achievable control technology (MACT) standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for stationary combustion turbines on March 5, 2004 (see 69 FR 10512). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/stationary-combustion-turbines-national-emission-standards.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled.

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.

The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB advisory is available at:

https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf

4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2
5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Stationary Combustion Turbine RTR [RIN 2060-AT00]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: EPA has previously developed "MACT standards" for many combinations of emission sources and hazardous air pollutants under the National Emission Standards for Hazardous Air Pollutants (NESHAP). The first phase of NESHAP consisted of setting technology-based standards that specified "maximum achievable control technology" (MACT) and are referred to as "MACT Standards." EPA is required to review the MACT standards every eight years and revise them as necessary taking into account developments in technical capability to control emissions. Furthermore, EPA is required to conduct a one-time "residual risk review" within eight years of the initial standard setting to determine if additional risk reductions are necessary to protect the public health. Thus, eight years after the promulgation of the initial standard, EPA must conduct both a risk and a technology review, referred to as "risk and technology review" (RTR). EPA states that "the risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews." EPA states that the RTR process has been reviewed "as a whole" rather than via each individual rulemaking. Furthermore, EPA states that "while the overall RTR

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risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not."

While the details of each RTR are unique to the sources and pollutants being evaluated, the general approaches and methodologies employed in EPA RTRs have become standardized, and have been subject to multiple peer reviews over the past 17 years. Since the last SAB review in 2009, there have been enhancements to the RTR methodology that are being used in EPA rules and actions; these relate to enhancements in multipathway risks, environmental risks, and inhalation methodologies. EPA lists the following significant RTR review milestones: (a) SAB reviewed EPA's Residual Report to Congress in 1999; (b) SAB conducted a peer review of the multi-pathway risk assessment method for RTR in 2000; (c) SAB provided a consultation on updated methods for developing emission inventories and characterizing human exposure in June 2007; (d) SAB reviewed updated and expanded RTR methods based on two RTR source categories in 2009; (e) dose-response estimates obtained from the EPA's Integrated Risk Information System (IRIS) and from databases of other agencies have been peer reviewed; and (f) EPA is seeking review by SAB of specific enhancements made to risk assessment methods used in RTR, especially for screening methods. This latter review is pending.

Rationale: The EPA summary of this action does not provide information specific to stationary combustion turbines. Stationary combustion turbines are used at facilities such as power plants, chemical and manufacturing plants, and pipeline compressor stations. The phase one MACT standard focused on formaldehyde, toluene, acetaldehyde, and benzene. According to EPA, "exposure to emissions of these air toxics may produce a wide variety of human health effects including irritation of the eyes, skin and mucous membranes, dysfunction of the central nervous system, and narcosis. Formaldehyde exposure has been associated with reproductive effects such as menstrual disorders and pregnancy problems. EPA has classified formaldehyde as a probable human carcinogen." The expected control technology is an oxidation catalyst positioned downstream of the turbine exhaust, but other technologies may be used if they meet the emission limits. As part of the technology review, EPA will have to identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Engine Test Cells NESHAP RTR

2. **RIN Number:** 2060-AT01

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for engine test cells/stands on May 27, 2003 (see 68 FR 28774). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/engine-test-cellsstands-national-emission-standards-hazardous-air.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

Scientific products that will inform the action and plans for peer review:
6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB

advisory is available at:
https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf

4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland Cement Manufacturing. The final SAB advisory is available at:
https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2
5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Engine Test Cells RTR

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative(i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to engine test cells. An engine test cell/stand is any apparatus used for testing uninstalled stationary or uninstalled mobile engines. EPA published MACT standards in 2003 for test cells/stands for internal combustion engines of 25 horsepower or more, internal combustion engines of less than 25 horsepower, combustion turbine engines; and rocket engines. However, the rule limits hazardous air emissions only from new or reconstructed engine test cells/stands used for testing internal combustion engines of 25 horsepower or more located at a facility considered a major source of air toxics emissions. The final rule was expected to reduce air toxic emissions by 66 tons per year using emission control devices such as a catalytic or thermal incinerator that treats the engine exhaust. As part of the technology review, EPA will have to

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identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards--Ethylene Production (Subparts XX and YY) RTR

2. **RIN Number:** 2060-AT02

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for ethylene production on July 12, 2002 (see 67 FR 46257). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/acetal-resins-acrylic-modacrylic-fibers-carbon-black-hydrogen.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

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6. **Scientific products that will inform the action and plans for peer review:**
6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB

advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf

4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2
5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards--Ethylene Production (Subparts XX and YY) [RIN 2060-AT02]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to ethylene production. In 2002, the EPA promulgated National Emission Standards for Hazardous Air Pollutants for Ethylene Production (subparts XX and YY). This action amended the list of emission source categories covered by "generic" MACT standards which provide a structural framework that allows source categories with similar emission types and MACT control requirements to be covered under one subpart. The ethylene production rule, amended in 2005 to clarify the applicable emission sources, applies to ethylene process vents, storage vessels, transfer racks, equipment, heat exchange systems and waste streams. The focus was on reducing emissions of benzene, 1,3-butadiene, hexane, toluene and

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naphthalene. These compounds include known and probable human carcinogens and compounds with a variety of other adverse health effects. Expected control actions included, but were not limited to: leak detection and repair (LDAR) for equipment leaks; closing process vents and routing to flares or closed combustion devices; floating roofs or closed vent systems with air toxics destruction, for storage vessels; and HAP reduction from waste treatment using suppression followed by steam stripping, biotreatment, or other treatment processes. The regulation was expected to reduce air toxics emissions from ethylene production by 1,090 tons annually, representing a 60 percent reduction from levels before the rule. As part of the technology review, EPA will have to identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** National Emission Standards for Hazardous Air Pollutants for Integrated Iron and Steel Manufacturing Facilities RTR

2. **RIN Number:** 2060-AT03

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for integrated iron and steel manufacturing facilities on May 20, 2003 (see 68 FR 27645). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/integrated-iron-and-steel-manufacturing-national-emission-standards.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

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6. **Scientific products that will inform the action and plans for peer review:**
6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB

advisory is available at:
https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf

4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland Cement Manufacturing. The final SAB advisory is available at:
https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2
5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Integrated Iron and Steel Manufacturing Facilities RTR [RIN 2060-AT03]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to integrated iron and steel manufacturing facilities. The phase one MACT standard focused on reducing air toxics emitted at a number of points at these facilities, including sinter plants that recover fine-sized materials, blast furnaces that produce iron, and basic oxygen process furnaces that produce steel. The toxic emissions of concern are metals (primarily manganese and lead with small quantities of other metals) and trace amounts of organic HAP (such as polycyclic organic matter, benzene, and carbon disulfide). According to EPA, "exposure to emissions of these air toxics is associated with cancer, central nervous system effects, kidney damage, and acute health disorders such as respiratory and skin irritation. As part of the

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RTR review, EPA will have to identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing Risk and Technology Review (RTR)

2. **RIN Number:** 2060-AT05

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for taconite iron ore processing on October 30, 2003 (see 68 FR 61867). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/taconite-iron-ore-processing-national-emission-standards-hazardous.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf
4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland

Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2

5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Taconite Iron Ore Processing RTR [RIN 2060- AT05]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further SAB consideration.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to taconite iron ore processing. A taconite iron ore processing facility separates and concentrates iron ore from taconite (a low-grade iron ore) and produces taconite pellets, which are approximately 60 percent iron. The toxic emissions of concern include compounds containing manganese, chromium, cobalt, arsenic, and lead. Health effects from these toxic pollutants include adverse effects on the blood, central nervous system, blood pressure, kidneys, irritation of the skin and mucus membranes, and lung cancer. As part of the RTR review, EPA will have to identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

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The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Rubber Tire Manufacturing Risk and Technology Review (RTR)

2. **RIN Number:** 2060-AT07

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for rubber tire manufacturing on July 9, 2002 (see 67 FR 45598). More information on the NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/rubber-tire-manufacturing-national-emission-standards-hazardous-air.

   For this action, as the second stage of the regulatory process, and as we have done for more than 40 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf
4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland

Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2

5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Rubber Tire Manufacturing RTR [RIN 2060-AT07]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative(i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to rubber tire manufacturing. In 2002, EPA published MACT standards applicable operations using solvents and cements at tire production facilities; tire cord production; and puncture sealant applications. The rule was intended to reduce emissions of volatile organic compounds. The rule was expected to reduce air toxic emissions from solvents, cements and coating material used in the tire manufacturing industry by approximately 1,100 tons annually. The air toxics reduced include hexane, toluene, formaldehyde, styrene and methanol, which are associated with a variety of adverse health effects. These effects include chronic health disorders (e.g., effects on the central nervous system and reproductive system) and acute health disorders (e.g., irritation of eyes, throat, mucous membranes, headache, nausea, and blurred vision). The rule was also expected reduce volatile organic compounds (VOCs), which

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contribute to the formation of ground-level ozone, the primary constituent of smog. Anticipated ways in which the standard could be met include reduced their air toxic emissions by installing controls required by state or federal new source performance standard regulations or through the elimination of, or substitution for, air toxics in cements, solvents and coating materials used as processing aides. As part of the technology review, EPA will have to identify whether new cements, solvents, coating materials, and technologies have emerged that can more effectively prevent or control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** Lime Manufacturing Risk and Technology Review (RTR)

2. **RIN Number:** 2060-AT08

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for lime manufacturing on January 5, 2004 (see 69 FR 393). More information on the Lime Manufacturing NESHAP can be found at https://www.epa.gov/stationary-sources-air-pollution/lime-manufacturing-plants-national-emission-standards-hazardous-air.

   For this action, as the second stage of the regulatory process, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
   The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf
4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland

Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2

5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Lime Manufacturing RTR [RIN 2060-AT08]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: In 2004, EPA promulgated a final rule to reduce toxic air pollutant emissions from new and existing lime manufacturing plants. This Lime Manufacturing NESHAP established emission limitations and work practice requirements based on maximum achievable control technology (MACT) for control of hazardous air pollutants (HAP) from kilns at new and existing lime manufacturing plants. The pollutants emitted from lime manufacturing kilns include metallic HAP, hydrogen chloride, particulate matter, sulfur dioxide, nitrogen oxides and carbon dioxide. These pollutants predominantly originate from the limestone feed material and the fuels used, and are formed from the combustion of fuels and the heating of feed material in the kiln. EPA standards are required to provide an ample margin of safety to protect public health or an adverse environmental effect. EPA is required to review and revise the

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MACT standards as necessary, taking into account developments in practices, processes and control technologies no less often than every 8 years. As part of the technology review, EPA will need to identify whether new approaches to lime manufacturing have emerged that can more effectively prevent or control the emission of these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, a cost analysis must also be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action

1. **Name of action:** National Emission Standard for Hazardous Air Pollutants (NESHAP) Risk and Technology Review: Reinforced Plastics Composites and Boat Manufacturing RTR

2. **RIN Number:** 2060-AT12

3. **EPA Office originating action:** EPA/OAR

4. **Brief description of action and statement of need for the action:**

   The Clean Air Act (Act) establishes a two-stage regulatory process for addressing emissions of hazardous air pollutants (HAP) from stationary sources. In the first stage, the Act requires the EPA to develop technology-based standards for categories of industrial sources. In the second stage of the regulatory process, EPA must review each MACT standard at least every eight years and revise them as necessary, "taking into account developments in practices, processes and control technologies." We call this requirement the "technology review." The EPA is also required to complete a one-time assessment of the health and environmental risks that remain after sources come into compliance with MACT. This residual risk review also must be done within eight years of setting the initial MACT standard. If additional risk reductions are necessary to protect public health with an ample margin of safety or to prevent adverse environmental effects, the EPA must develop standards to address the remaining risks. For each source category for which the EPA issued MACT standards, the residual risk stage must be completed within eight years of promulgation of the initial MACT standard. Since the initial technology review requirement coincides in deadline with the risk review requirement, the EPA generally combines these two requirements into one rulemaking activity, calling this the "risk and technology review" process, or RTR. In this way, results of the risk review can be potentially informative to the technology review process, and vice versa.

   The EPA issued national emission standards for hazardous air pollutants (NESHAP) for Reinforced Plastics Composites on April 21, 2003 (see 68 FR 19375) and Boat Manufacturing on August 22, 2001 (see 66 FR 44217). More information on the NESHAPs can be found at https://www.epa.gov/stationary-sources-air-pollution/reinforced-plastic-composites-production-national-emission and https://www.epa.gov/stationary-sources-air-pollution/boat-manufacturing-national-emission-standards-hazardous-air.

   For this action, as the second stage of the regulatory process for these categories, and as we have done for more than 55 source categories to date, we plan to conduct the residual risk review and initial technology review concurrently.

5. **Timetable:** Required proposal date and required final rule date not yet scheduled

6. **Scientific products that will inform the action and plans for peer review:**
   6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.

The risk analysis methodologies associated with the RTR process have undergone scientific peer reviews and have been used in numerous previous RTR reviews. There are no other scientific work products that have been or will be developed to inform this planned action.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).

Because RTR assessments are used for regulatory purposes, and because components of our risk analyses have evolved over time, we have, over the course of the program, conducted scientific peer reviews of the methodologies through the SAB. Through peer review of the RTR process as a whole, rather than each individual rulemaking effort, the agency is able to conduct consistent risk characterizations across all categories of industrial sources.

6(c). For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
While the overall RTR risk assessment methods meet the definition as "an influential scientific or technical work product", each individual RTR analysis does not.

6(d). Peer review:
Each RTR analysis follows a consistent risk characterization approach using methodologies that have undergone numerous peer reviews. Previous peer reviews have covered elements associated with the RTR process, or assessments with similar scopes or contexts. A brief summary of each peer review is provided:

1) The Residual Risk Report to Congress, a document describing the Agency's overall analytical and policy approach to setting residual risk standards, was issued to Congress in 1999 following an SAB peer review. Many of the design features of the RTR assessment methodology were described in this report, although individual elements have been improved over time. The Report to Congress and the final SAB advisory are available at: https://www.epa.gov/fera/residual-risk-report-congress-1999 and https://yosemite.epa.gov/sab/sabproduct.nsf/33598FF753C6342F852571AE0067B7D0/$File/ec9813.pdf
2) A peer review of multi-pathway risk assessment methodologies for RTR was conducted by the EPA's SAB in 2000. The final SAB advisory is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/1F1893E27059DB55852571B9004730F7/$File/ecadv05.pdf
3) A consultation on EPA's updated methods for developing emissions inventories and characterizing human exposure was conducted by SAB in December 2006. SAB provided its formal consultation in a letter to the Administrator in June 2007. The final SAB advisory is available at:

https://yosemite.epa.gov/sab/sabproduct.nsf/33152C83D29530F08525730D006C3ABF/$File/sab-07-009.pdf

4) A review of the updated and expanded risk assessment approaches and methods used in the RTR program was completed in 2009. This methodology was highlighted to the SAB utilizing two RTR source categories: Petroleum Refining Sources MACT I and Portland Cement Manufacturing. The final SAB advisory is available at: https://yosemite.epa.gov/sab/sabproduct.nsf/0/b031ddf79cffded38525734f00649caf!OpenDocument&TableRow=2.3#2
5) The individual dose-response assessment values used in the RTR assessment have themselves been the subject of peer reviews through the agencies that developed them (including EPA, through its Integrated Risk Information System, or IRIS; the California Environmental Protection Agency, or CalEPA, and the Agency for Toxic Substances and Disease Registry, or ATSDR).

EPA is currently seeking the Science Advisory Board's (SAB) input on specific enhancements made to our risk assessment methodologies, particularly with respect to screening methodologies, since the last SAB review was completed in 2009 (see above). EPA has recently submitted a draft updated methodology report to the SAB to help in panel formation. It is anticipated that an expert panel will be organized shortly and a meeting will convene by early 2017.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Boat Manufacturing RTR [RIN 2060-AT12]

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

Recommendation: This action does not merit further review by the SAB.

Background: The EPA uses a standard process to conduct risk and technology reviews for National Emissions Standards for Hazardous Air Pollutants. This process is explained in the Background section on pages B35 and B36.

Rationale: The EPA summary of this action does not provide information specific to boat manufacturing. In 2001, the EPA promulgated National Emission Standards for Hazardous Air Pollutants for Boat Manufacturing. The rule applies to resin and gel coat operations at fiberglass boat manufacturers, paint and coating operations at recreational aluminum boat manufacturers, and carpet and fabric adhesive operations at all boat manufacturers. The focus was on reducing emissions of styrene, methyl methacrylate, methylene chloride, toluene, xylene, and other air toxics. These compounds include possible and probable human carcinogens and compounds that cause health problems with the central nervous system, liver, and kidneys. Expected control actions included equipment and work practice requirements (e.g. use of non-spray technologies for applying resins) and

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limitations on the amount of air toxics in the materials used (e.g. resins, gel coats, paints and adhesives). The regulation was expected to reduce air toxics emissions from boat manufacturers by about 3,130 tons annually, representing a 35 percent reduction from levels before the rule. As part of the technology review, EPA will have to identify whether new technologies have emerged that can more effectively control these and other pollutants. Cost must also be considered when setting a MACT standard. Therefore, cost analysis must be conducted.

The Work Group finds that the RTR risk assessment screening methodology is broadly applicable to many source categories, and prior aspects of the data and methods identified have been subject to review by the SAB and others. The unique details of each RTR can include recommendations for new monitoring and MACTs. In general, these technologies are based on established scientific knowledge that has undergone extensive peer review. However, there can be exceptions, and the SAB encourages to EPA to continually assess and identify for SAB review any such technology recommendations that are based on new scientific knowledge. This planned RTR does not merit further review by the SAB.

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Description of Planned EPA Tier 1 or Tier 2 Action (EPA SUBMISSION)

1. Name of action: Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures

2. RIN Number: 2060-AT26

***3.* EPA Office originating action:** Office of Air and Radiation/Office of Transportation and Air Quality

4. Brief description of action and statement of need for the action:

This rulemaking follows on the EPA's final endangerment and cause or contribute findings for aircraft GHG emissions which were published on August 15, 2016 (81 FR 54422). As a result of these positive findings, the EPA is obligated under section 231 of the Clean Air Act to set emission standards applicable to GHG emissions from the classes of aircraft engines used in certain types of aircraft included in the contribution finding.

The EPA and the Federal Aviation Administration (FAA) traditionally work within the standard-setting process of the International Civil Aviation Organization (ICAO). ICAO's Committee on Aviation Environmental Protection (CAEP) establishes international aircraft emission standards and related requirements, which individual nations later adopt into domestic law. On July 1, 2015, the EPA issued an Advance Notice of Proposed Rulemaking (80 FR 37758) to provide an overview and seek input on a variety of issues related to the setting of an international aircraft CO_2 standard at ICAO, and the potential use of section 231 of the Clean Air Act to adopt and implement corresponding aircraft engine CO_2 emission standards domestically.

At its meeting in February of 2016, ICAO/CAEP agreed on the first-ever international standards to regulate CO_2 emissions from aircraft. The ICAO Assembly approved these CO_2 standards in October 2016, and then ICAO is expected to formally adopt these standards in March 2017. If ICAO formally adopts the final CO_2 standards in March 2017, the EPA's standards will need to be at least as stringent as the ICAO CO_2 aircraft standards for the United States to meet its treaty obligations under the Convention on International Civil Aviation. This rulemaking would meet these treaty obligations.

***5.* Timetable:** As indicated in the 2016 Fall Regulatory Agenda, the EPA expects to issue a Notice of Proposed Rulemaking by January 2018 and a Final Rule by December 2018. The FAA would then adopt regulations to implement and enforce the standards. The EPA schedule has been developed in consultation with the FAA, and reflects the need for both Agencies to act prior to the January 2020 implementation date for the international aircraft CO_2 standards. We anticipate that once EPA has completed its rulemaking, FAA will then begin its rulemaking for the enforcement of the standards. Under section 232 of the Clean Air Act, FAA must enforce the emission standards that EPA sets under section 231 of the Clean Air Act. Therefore, EPA intends to complete the standard setting rulemaking by the end of 2018 in order to provide FAA sufficient time for it to finalize its rules by January 2020.

6. Scientific products that will inform the action and plans for peer review:

6(a). Describe the scientific work products that have been or will be developed to inform decisions regarding the planned action.
See section 6(c) below.

6(b). For each work product, describe the approach the agency is taking to develop the needed science or analysis (e.g., any inter-agency collaboration, workshops to inform the analysis).
See section 6(c) below.

6(c) For each work product, identify whether the action relies on science that meets the EPA Peer Review Handbook definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"
The EPA intends to use two scientific products to inform its decision-making in this rulemaking. Both of these products meet the definition of an influential scientific or technical work product.
The EPA is developing an aircraft GHG inventory to assess the emissions impact of this rulemaking. The aircraft GHG inventory will be based on detailed estimates of the U.S. and global fleet fuel burn and potential emission reductions, from 2010 to 2040, for different stringency and implementation timing options. The EPA utilizes an aircraft performance model, PIANO (Project Interactive Analysis and Optimization), in the development of the aircraft GHG inventory. PIANO is commercially available and widely used across the industry and academia. It contains non-manufacturer provided estimates of the performance of numerous aircraft. The EPA previously utilized PIANO as part of the EPA's technical work for the ICAO technical workgroups charged with assessing the stringency options for the international aircraft CO_2 standard.

In addition, as part of the rulemaking, the EPA is developing a technological feasibility and cost analysis that will be based on updating a March 2015 ICF report entitled, "Cost Analysis of CO2-Reducing Technologies for Aircraft," which was a reference for the Advance Notice of Proposed Rulemaking. The new report will be an updated assessment of the latest aircraft technical improvements, their costs, and their fuel burn or emissions reduction potential. The EPA previously used the information from the March 2015 report as part of EPA's technical work for the ICAO technical workgroups tasked with assessing the technologies and costs of stringency options for the international aircraft CO2 standard, and ICAO utilized information from this report in its analysis.

6(d). Peer review:
The EPA is developing a technical report that will document the EPA assumptions, data sources, and methods for the aircraft GHG inventory. Also, the updates to the ICF report, "Cost Analysis of CO2-Reducing Technologies for Aircraft," will include documenting any assumptions, data sources, and methods for the technology and cost analysis.
For both of the documents described above, the EPA is seeking an independent peer review of the assumptions, data sources, and methods provided in the documents. We plan to begin the peer review in the Spring of 2017, and we expect it to be completed by the end of the Summer of 2017, before the proposed rulemaking will be issued.

The letter peer review will be led and managed by a contractor. In selecting reviewers, the contractor will avoid any reviewer with actual or apparent conflict(s) of interest that would preclude an

independent review. Three peer reviewers will be chosen to review each report (there will be different peer reviewers for each report, so there will be a total of six peer reviewers). Due to the complex nature of the subjects, EPA will request that the reviewers have one or more areas of relevant expertise in order to assure an effective peer review. The combined expertise of the selected reviewers will cover the following areas: aircraft emissions inventory assessment, aircraft engine fuel efficiency technology, airframe fuel efficiency technology, aircraft economics, and aircraft industry characterization. The contractor will distribute a charge letter and collect comments from the peer reviewers. The EPA will develop a response to the peer review comments and make revisions to the reports accordingly.

Excerpt From SAB Workgroup Report:

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures [RIN 2060-AT26]

Recommendation: The Work Group finds that the planned action is significant and would benefit from SAB advice and comment. The Work Group notes the temporal constraints on completing the rulemaking and recommends the SAB provide advice on this issue and at a minimum EPA should conduct a panel review that allows communication across the two proposed peer review panels in order to encourage synergistic understanding among the disciplines involved.

Rationale: While the underlying rule making will follow the lead of ICAO in setting emissions standards implementation of those standards through regulation will flow from an EPA led assessment of the aircraft GHG inventory, technological feasibility and cost analysis. The assessment of the underling science will determine the overall integrity of resulting regulations with respect to meeting the desired GHG goals. Given that these rules will impact a significant portion of the global aircraft industry and will provide the framework for any changes moving forward, ensuring the scientific integrity of these initial rules is of high importance. As is the case with development of any new rule it is critical to ensure that the range of scientific views from multiple perspectives are solicited in order to capture the collective understanding of the relevant science. Towards that end we encourage involving a greater number of reviewers in a more integrative process using a panel review. The SAB hopes that there is time under the constraint of a December 2018 deadline for completing the standard setting ruling making to undertake this more integrative approach to a scientific review.

It is important to make the work products of the review public. Transparency can stimulate further reflection on the key science issues involved as well as precipitating advancements in the associated areas of research.

Within the temporal constraints on completing the rulemaking the SAB wishes to provide advice on this issue or at a minimum the EPA should conduct a panel review that allows communication across the two proposed panels in order to encourage synergistic understanding among the disciplines involved.

The Work Group notes the SAB previously reviewed *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 Advanced Notice of Proposed Rulemaking* (2060-AS31) in the Fall 2014[10] Regulatory Review and found that subsequent steps in the regulatory process will involve substantive scientific issues that may warrant SAB consideration.
The Work Group anticipates that subsequent steps in the regulatory process will continue to involve substantive scientific issues that will warrant SAB consideration. It recommends that the SAB asks the agency to regularly inform the Board about the status of subsequent steps on this topic and also asks the EPA to provide it with briefings on the science underlying agency approaches to address greenhouse gas emissions and related climate change actions.

EPA Response to Work Group Submitted Questions to EPA

Question: The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. Can the EPA elaborate on their portion of the schedule for the planned action that allows FAA to meet the ICAO deadlines?
Response: We do not yet have a schedule identified for this action.

Question: Has the agency initiated the peer review of the two documents, the "technical report documenting the assumptions, data sources, and methods for the aircraft GHG inventory" and the "Cost Analysis of CO2- Reducing Technologies for Aircraft" and are the documents available?
Response: The peer review of the two documents has not been initiated, and the technical reports are not yet available.

Question: Is there additional information the EPA can provide on the planned peer reviews at this time: What is the anticipated schedule for each review?
Response: The peer review of the two documents is expected to begin later this year.

Question: Are the two documents being reviewed separately by two different panels or will the reviewers be aware of peer review comments on both documents?
Response: The two documents are being reviewed separately by two different panels, who will be unaware of the peer review comments of the other panel.

Question: Will the reviewers be different for each report, or will some reviewers review both reports?
Response: The reviewers will be different for each report.

Question: Did the agency consider conducting a panel review rather than a letter review?
Response: We determined that a letter review was appropriate for a number of reasons including time and resource constraints. Both work products are looking for perspectives from individuals with unique expertise with little-to-no subject matter overlap. For the technologies and costs analysis, we requested peer review from three subject matter experts that cover the following areas: aircraft engine technology, airframe (or whole aircraft) technology, and aircraft economics. For the GHG aircraft inventory we are requesting 3 independent subject matter experts in the field of aircraft emissions inventory modeling and stringency analysis. In each case we believe these analyses are

less complex or novel than what would typically be the subject of panel review and therefore are appropriate for letter review.

Question: If initiated, when will the peer review report be available?
Response: As described earlier, the peer review of the two documents has not been initiated.

Question: Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?
Response: Although the peer review of the two documents has not been initiated, we expect that six peer reviewers in total, three for each peer review, will be sufficient for the subject matter in the documents.

Question: Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?
Response: If EPA uses these reports in support of a future rulemaking, we would make both reports available to the public as well as the peer review comments and how they are addressed.

To: Iffland, JoNell[Iffland.JoNell@epa.gov]
Cc: Charmley, William[charmley.william@epa.gov]
From: Stewart, Gwen
Sent: Thur 2/5/2015 4:35:02 PM
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Good Morning:

May I please get the status of the below invitation?

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

From: Stewart, Gwen
Sent: Wednesday, January 14, 2015 11:46 AM
To: Charmley, William
Cc: Hengst, Benjamin; Cook, Leila; Iffland, JoNell
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Bill:

Ex. 5 - Deliberative Process

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

From: Charmley, William
Sent: Wednesday, January 14, 2015 11:42 AM
To: Stewart, Gwen
Cc: Hengst, Benjamin; Cook, Leila; Iffland, JoNell
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Gwen –

Ex. 5 - Deliberative Process

Thanks

Bill

From: Stewart, Gwen
Sent: Wednesday, January 14, 2015 10:18 AM
To: Charmley, William
Cc: Hengst, Benjamin; Cook, Leila; Iffland, JoNell

Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Good Morning Mr. Charmley:

Ex. 5 - Deliberative Process

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

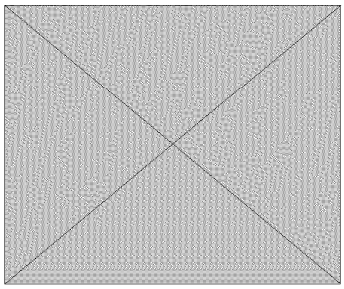
From: Grundler, Christopher
Sent: Wednesday, January 14, 2015 10:15 AM
To: Stewart, Gwen
Cc: Charmley, William
Subject: Fwd: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Pls reply to acknowledge receipt. Consult with Bill

Sent from my iPhone

Begin forwarded message:

From: "Young, Nancy" <NYoung@airlines.org>
To: "Grundler, Christopher" <grundler.christopher@epa.gov>
Cc: "Maurice, Lourdes" <lourdes.maurice@faa.gov>
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard



January 9, 2015

Submitted By Email to *Grundler.christopher@Epa.gov*

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

To: Charmley, William[charmley.william@epa.gov]
Cc: Sargeant, Kathryn[sargeant.kathryn@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Schenk, Ruth[schenk.ruth@epa.gov]
From: Samulski, Michael
Sent: Mon 6/19/2017 7:36:07 PM
Subject: FW: Questions regarding the GHG Emissions for aircraft

Bill,

The SAB has decided to discuss action on aircraft CO2 standards at their January 29th meeting

Ex. 5 - Deliberative Process

OAPPS will be setting up a call with us prior the June 29 SAB meeting to discuss preparations for the meeting and our next steps. I will try and get a spot on your calendar this week to discuss.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Sargeant, Kathryn
Sent: Monday, June 19, 2017 2:33 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Oh, wow. Thanks for pointing this out. I had missed the actual recommendations (I had just seen the meeting agenda). It looks like OAPPS is setting something up to discuss in advance.

In the meantime I think it would be good to discuss with Bill—have you already?

If not, I am happy to join you when you do.

Ex. 5 - Deliberative Process

From: Samulski, Michael
Sent: Monday, June 19, 2017 2:19 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: FW: Questions regarding the GHG Emissions for aircraft

Kathryn,

Ex. 5 - Deliberative Process

The SAB advice is to increase the number of peer reviewers, integrate the review of the ICF technology/cost work and David's white paper on inventory calculations, and the use of a panel review.

Here is the relevant text:

As is the case with development of any new rule it is critical to ensure that the range of scientific views from multiple perspectives are solicited in order to capture the collective understanding of the relevant science. Towards that end we encourage involving a greater number of reviewers in a more integrative process using a panel review. The SAB hopes that there is time under the constraint of a December 2018 deadline for completing the standard setting ruling making to undertake this more integrative approach to a scientific review.

It is important to make the work products of the review public. Transparency can stimulate further reflection on the key science issues involved as well as precipitating advancements in the associated areas of research.

Within the temporal constraints on completing the rulemaking the SAB wishes to provide advice on this issue or at a minimum the EPA should conduct a panel review that allows communication across the two proposed panels in order to encourage synergistic understanding among the disciplines involved.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Any advice on our next steps?

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Friday, June 16, 2017 2:39 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Shoaff, John <Shoaff.John@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Mike -

I wanted to give you a quick heads up that the Science Advisory Board will discuss action "Control of Air Pollution From Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26)" at their January 29 meeting (1:00pm – 5:00pm). I have attached the SAB agenda and an excerpt with the SAB recommendations on this action.

https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/ad66390a4cdc244a85258
06-29

We will be in touch next week to set up a time to discuss preparations for the meeting and our next steps. I will be out on annual leave next week (June 19-23) but John Shoaff will follow up to schedule.

Thanks,
Leif

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Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 01, 2017 3:17 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Thank you again for the quick turnaround on these responses. We confirmed with Sarah and I have attached the version that I will send to EPA's SAB coordinator momentarily.

Ex. 5 - Deliberative Process

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Samulski, Michael
Sent: Thursday, June 1, 2017 11:29:42 AM
To: Hockstad, Leif
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

I don't have any concerns with accepting Sarah's comment on the first question.

Ex. 5 - Deliberative Process

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 01, 2017 11:21 AM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Hello, some feedback from the OAR IO review of the SAB Work Group responses.

Ex. 5 - Deliberative Process

Please let me know if you can accept the suggested edit from the first comment. And also if the second comment makes sense with your current timelines.

Thanks,

Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 1, 2017 8:43:09 AM
To: Samulski, Michael
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Thank you for providing the responses in such a short timeline. I will coordinate a review of them by the OAR IO before sending them to our SAB Work Group contact.

If we provide written responses then there is not an immediate need for today's 1:00pm teleconference. The EPA contact on SAB reminded me that the teleconference provides an opportunity for a private conversation with the SAB Work Group on their questions if we want

to clarify any points. But I can tell our SAB contact to cancel the teleconference if you think it is unnecessary.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Samulski, Michael
Sent: Thursday, June 1, 2017 8:34:33 AM
To: Hockstad, Leif
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

Here are our responses to the questions from the SAB workgroup. Please let me know if you have any questions.

To be clear, does this written response remove the need for a 1:00 teleconference today?

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Friday, May 26, 2017 9:13 AM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Kathryn –

Yes, I will check on how we could balance the timing and need for a teleconference if written responses are provided.

Additionally, we will want to keep the IO up to date on our responses to the SAB. We have flagged this and will let you know what steps we will want to take next week on coordination.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Sargeant, Kathryn
Sent: Friday, May 26, 2017 7:51 AM
To: Hockstad, Leif <Hockstad.Leif@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Ex. 5 - Deliberative Process

From: Hockstad, Leif
Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Please note he is flexible on whether you all would prefer to discuss the questions on the conference call next Thursday or prefer to provide written responses.

Please let us know what you think and what we can do to support OTAQ's engagement with the SAB.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

Pasted in below and attached are the questions from the Work Group on the issues we have discussed on the Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26). I polled the Work Group looking for availability and have scheduled a teleconference for June 1, 2017 from 1- 2:30 pm.

Please let me know if the Office of Air prefers to discuss the questions on the teleconference or provide written responses and be available for any clarifications on the teleconference.

Ex. 5 - Deliberative Process

Best

Tom

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. Can the EPA elaborate on their portion of the schedule for the planned action that allows FAA to meet the ICAO deadlines?

Has the agency initiated the peer review of the two documents, the "technical report documenting the assumptions, data sources, and methods for the aircraft GHG inventory" and the "Cost Analysis of CO2- Reducing Technologies for Aircraft" and are the documents available?

Is there additional information the EPA can provide on the planned peer reviews at this time:

- What is the anticipated schedule for each review;

- Are the two documents being reviewed separately by two different panels or will the reviewers be aware of peer review comments on both documents;

- Will the reviewers be different for each report, or will some reviewers review both reports;

- Did the agency consider conducting a panel review rather than a letter review; and

- If initiated, when will the peer review report be available?

Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?

Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

To: Charmley, William[charmley.william@epa.gov]
Cc: ralph.iovinelli@faa.gov[ralph.iovinelli@faa.gov]
From: Samulski, Michael
Sent: Wed 2/10/2016 3:35:46 PM
Subject: FW: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Here's the email with the agenda.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Friday, January 29, 2016 5:43 PM
To: Ex. 6 - Personal Privacy
Lourdes.Maurice@faa.gov; Samulski, Michael; Manning, Bryan; McCabe, Janet;
Ex. 6 - Personal Privacy
Ex. 6 - Personal Privacy; Hengst, Benjamin; Charmley, William; LeFranc, Maurice;
Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson, Emily;
Ex. 6 - Personal Privacy gov; Arthur.Rypinski@dot.gov;
Ex. 6 - Personal Privacy Laszlo.Windhoffer@faa.gov;
maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

First, please pass this invitation to those I missed.

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

The objective of this meeting is to determine the most efficient way to support the domestic rulemaking process of the aircraft CO2 emission standard, with specific attention to the cost benefits analysis completed for the ICAO international aircraft CO2 emissions standard.

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Please do not hesitate to contact Chad Whiteman **Ex. 6 - Personal Privacy** myself with questions.

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

To: Lourdes.Maurice@faa.gov[Lourdes.Maurice@faa.gov]; Ralph.lovinelli@faa.gov[Ralph.lovinelli@faa.gov]
Cc: Manning, Bryan[manning.bryan@epa.gov]; Charmley, William[charmley.william@epa.gov]
From: Samulski, Michael
Sent: Wed 9/30/2015 12:18:16 PM
Subject: RE: Call on ICAO CO2 Standard this Thursday at 5pm
FAA-OST Breifing-ICAO CO2 Standard_2015-09-28_final review draft - epa comments.docx

Lourdes and Ralph,

Thank you for pulling together this document. It is helpful to have these ideas down on paper.

We do have a few comments, as noted in the attached document, which I believe are consistent with our past conversations on this topic.

Best regards,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Tuesday, September 29, 2015 12:23 PM
To: Charmley, William
Cc: Samulski, Michael; Ralph.Iovinelli@faa.gov
Subject: Re: Call on ICAO CO2 Standard this Thursday at 5pm

Sure. Midday tomorrow works. That gives us day or so to resolve any differences Will you respond to Kevin with a yes?

Cheers. Lourdes

Sent from my iPhone

On Sep 29, 2015, at 12:16 PM, Charmley, William <charmley.william@epa.gov> wrote:

> Dear Lourdes,
>
> Mike, Bryan and I can all make a 5pm call on Thursday.
>
> If we can get you comments back on the document you sent by noon tomorrow, will that work?
>
> Thanks
>
> Bill

From: Lourdes.Maurice@faa.gov [mailto:Lourdes.Maurice@faa.gov]
Sent: Tuesday, September 29, 2015 9:37 AM
To: Charmley, William
Cc: Samulski, Michael; Ralph.Iovinelli@faa.gov
Subject: FW: Call on ICAO CO2 Standard this Thursday at 5pm

Ex. 5 - Deliberative Process

Cheers Lourdes

From: Welsh, Kevin [Ex. 6 - Personal Privacy]
Sent: Tuesday, September 29, 2015 9:25 AM
To: Maurice, Lourdes (FAA); 'charmley.william@epa.gov'
Cc: Vahlsing, Candace
Subject: Call on ICAO CO2 Standard this Thursday at 5pm

Dear Lourdes and Bill,

Ex. 5 - Deliberative Process

Thanks,

Kevin

Call-in details to follow.

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Stewart, Gwen[Stewart.Gwen@epa.gov]
Cc: Samulski, Michael[samulski.michael@epa.gov]; Charmley, William[charmley.william@epa.gov]; Iffland, JoNell[Iffland.JoNell@epa.gov]; Miller, Debra L.[Miller.DebraL@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]; Hockstad, Leif[Hockstad.Leif@epa.gov]; Gunning, Paul[Gunning.Paul@epa.gov]
From: Manning, Bryan
Sent: Wed 10/22/2014 6:06:26 PM
Subject: Briefing Materials for Janet on ICAO Progress (Oct 23 at 11:00)
McCabe Update on ICAO progress October 23.docx

Hello,

Attached please find the briefing materials for Janet McCabe on ICAO Progress, which is scheduled for tomorrow (Oct 23) at 11:00. If possible, please print this briefing in color so that the plot on page 4 can be read properly.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Charmley, William[charmley.william@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Sargeant, Kathryn
Sent: Wed 5/31/2017 12:45:09 PM
Subject: RE: SAB Questions regarding the GHG Emissions for aircraft

Bill, thanks for highlighting it. Mike reached out to me yesterday and it's all worked out (Ruth Schenk has ok'd it too). I just forwarded you the email chain in case you're interested.

Hope the MSTRS meeting goes well!

From: Charmley, William
Sent: Wednesday, May 31, 2017 8:42 AM
To: Samulski, Michael <samulski.michael@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: Fwd: SAB Questions regarding the GHG Emissions for aircraft

Kathryn

I think mike may need your advice on some elements of our response, in particular regarding peer review.

If you 2 could talk today that would be great

Thanks

Bill

Sent from my iPhone

Begin forwarded message:

From: "Samulski, Michael" <samulski.michael@epa.gov>
Date: May 25, 2017 at 3:37:16 PM EDT
To: "Sargeant, Kathryn" <sargeant.kathryn@epa.gov>, "Hengst, Benjamin"

<Hengst.Benjamin@epa.gov>, "Charmley, William" <charmley.william@epa.gov>, "Manning, Bryan" <manning.bryan@epa.gov>, "Audette, Lucie" <audette.lucie@epa.gov>
Subject: RE: SAB Questions regarding the GHG Emissions for aircraft

We will start drafting responses to the peer review questions for your review.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Sargeant, Kathryn
Sent: Thursday, May 25, 2017 2:53 PM
To: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Charmley, William <charmley.william@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Cc: Burch, Julia <Burch.Julia@epa.gov>; Schenk, Ruth <schenk.ruth@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Cook, Rich <Cook.Rich@epa.gov>
Subject: SAB Questions regarding the GHG Emissions for aircraft
Importance: High

Below and attached are the questions from SAB. As you'll see, they are open to written responses rather than an actual call (and to me, these questions look well-suited to written responses).

From: Hockstad, Leif

Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Please note he is flexible on whether you all would prefer to discuss the questions on the conference call next Thursday or prefer to provide written responses.

Please let us know what you think and what we can do to support OTAQ's engagement with the SAB.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

Pasted in below and attached are the questions from the Work Group on the issues we have discussed on the Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26). I polled the Work Group looking for availability and have scheduled a teleconference for June 1, 2017 from 1- 2:30 pm.

Please let me know if the Office of Air prefers to discuss the questions on the teleconference or provide written responses and be available for any clarifications on the teleconference.

It may be helpful to review the SAB consideration of the science supporting the endangerment finding for GHG from aircraft emissions as part of the Fall 2014 Regulatory Agenda. The SAB noted that the topic was of high interest and that the subsequent steps to develop the action may warrant SAB consideration. The Work Group memorandum, letter to Administrator McCarthy, and the agency response are available on the SAB website for that activity.

Best

Tom

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. Can the EPA elaborate on their portion of the schedule for the planned action that allows FAA to meet the ICAO deadlines?

Has the agency initiated the peer review of the two documents, the "technical report documenting the assumptions, data sources, and methods for the aircraft GHG inventory" and the "Cost Analysis of CO2- Reducing Technologies for Aircraft" and are the documents available?

Is there additional information the EPA can provide on the planned peer reviews at this time:

- What is the anticipated schedule for each review;

- Are the two documents being reviewed separately by two different panels or will the reviewers be aware of peer review comments on both documents;

- Will the reviewers be different for each report, or will some reviewers review both reports;

- Did the agency consider conducting a panel review rather than a letter review; and

- If initiated, when will the peer review report be available?

Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?

Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]
From: Charmley, William
Sent: Wed 6/21/2017 9:13:38 PM
Subject: FW: Questions regarding the GHG Emissions for aircraft

In the email below from Leif Hockstad on June 1, Leif relayed to Mike Samulski comments from Sarah Dunham on the EPA written response to the questions we received from the SAB on the two aircraft analysis we have planned on having peer reviewed.

We incorporated/addressed both of Sarah's comments.

Ex. 5 - Deliberative Process

Thanks

Bill

From: Samulski, Michael
Sent: Thursday, June 01, 2017 11:30 AM
To: Hockstad, Leif <Hockstad.Leif@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

I don't have any concerns with accepting Sarah's comment on the first question.

With respect to the peer review timing. We could replace "summer" with "later this year" given that we still need to complete the documents… just to be safe.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 01, 2017 11:21 AM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Hello, some feedback from the OAR IO review of the SAB Work Group responses.

Sarah Dunham reviewed the draft responses. There was some concern expressed

Ex. 5 - Deliberative Process

Please let me know if you can accept the suggested edit from the first comment. And also if the second comment makes sense with your current timelines.

Thanks,

Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 1, 2017 8:43:09 AM
To: Samulski, Michael
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Thank you for providing the responses in such a short timeline. I will coordinate a review of them by the OAR IO before sending them to our SAB Work Group contact.

If we provide written responses then there is not an immediate need for today's 1:00pm teleconference. The EPA contact on SAB reminded me that the teleconference provides an opportunity for a private conversation with the SAB Work Group on their questions if we want to clarify any points. But I can tell our SAB contact to cancel the teleconference if you think it is unnecessary.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Samulski, Michael
Sent: Thursday, June 1, 2017 8:34:33 AM
To: Hockstad, Leif
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

Here are our responses to the questions from the SAB workgroup. Please let me know if you have any questions.

To be clear, does this written response remove the need for a 1:00 teleconference today?

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Friday, May 26, 2017 9:13 AM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Kathryn –

Yes, I will check on how we could balance the timing and need for a teleconference if written responses are provided.

Additionally, we will want to keep the IO up to date on our responses to the SAB. We have flagged this and will let you know what steps we will want to take next week on coordination.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Sargeant, Kathryn
Sent: Friday, May 26, 2017 7:51 AM
To: Hockstad, Leif <Hockstad.Leif@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Ex. 5 - Deliberative Process

From: Hockstad, Leif
Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Please note he is flexible on whether you all would prefer to discuss the questions on the conference call next Thursday or prefer to provide written responses.

Please let us know what you think and what we can do to support OTAQ's engagement with the SAB.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

Pasted in below and attached are the questions from the Work Group on the issues we have discussed on the Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG

Emissions Standards and Test Procedures (2060-AT26). I polled the Work Group looking for availability and have scheduled a teleconference for June 1, 2017 from 1- 2:30 pm.

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Best

Tom

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

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Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

To: Samulski, Michael[samulski.michael@epa.gov]
From: Charmley, William
Sent: Thur 6/1/2017 11:40:22 AM
Subject: Re: SAB Questions regarding the GHG Emissions for aircraft

Mike

I have a few comments.

If you are in the office you can call my cell phone

Thanks
Bill

Sent from my iPhone

On Jun 1, 2017, at 7:35 AM, Samulski, Michael <samulski.michael@epa.gov> wrote:

Bill,

Below is the same draft response to SAB I sent yesterday. I'm just copying it into an email to make it easier to read on your phone. OAR is looking for our draft response this morning. Do you have any comments?

Ex. 5 - Deliberative Process

Thanks,

Mike

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hengst, Benjamin
Sent: Wednesday, May 31, 2017 12:14 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: Re: SAB Questions regarding the GHG Emissions for aircraft

Ex. 5 - Deliberative Process

On May 31, 2017, at 10:19 AM, Samulski, Michael <samulski.michael@epa.gov> wrote:

Bill,

Here is the draft response to the SAB questions for your review. This was drafted by Bryan and Lucie, and has been reviewed by Kathryn, Ruth, and me.

Leif Hockstad (OAR-OAPPS) said that he would like to have it to the OAR front office to review this afternoon. (This written response replaces the meeting with SAB that was planned for tomorrow at 1:00). I know you are in meetings today, so if you can't review it by then please let me know so that I can get back to Leif.

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Charmley, William
Sent: Friday, May 26, 2017 6:18 AM
To: Samulski, Michael <samulski.michael@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: RE: SAB Questions regarding the GHG Emissions for aircraft

Mike,

Thank you, that sounds good. I spoke with Ben late yesterday regarding this, and I would like to review our draft response, and I think ASD should plan on sending forth our draft responses to OAR once we are all good with the responses. It seems very reasonable to respond to the SAB questions on peer.

Ex. 5 - Deliberative Process

Thanks

Bill

From: Samulski, Michael
Sent: Thursday, May 25, 2017 3:37 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Charmley, William <charmley.william@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: RE: SAB Questions regarding the GHG Emissions for aircraft

We will start drafting responses to the peer review questions for your review.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

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Sent: Thursday, May 25, 2017 2:53 PM
To: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Charmley, William <charmley.william@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Cc: Burch, Julia <Burch.Julia@epa.gov>; Schenk, Ruth <schenk.ruth@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Cook, Rich <Cook.Rich@epa.gov>
Subject: SAB Questions regarding the GHG Emissions for aircraft
Importance: High

Below and attached are the questions from SAB. As you'll see, they are open to written responses rather than an actual call (and to me, these questions look well-suited to written responses).

From: Hockstad, Leif
Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>

Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Please note he is flexible on whether you all would prefer to discuss the questions on the conference call next Thursday or prefer to provide written responses.

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Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

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Tom

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- Will the reviewers be different for each report, or will some reviewers review both reports;

- Did the agency consider conducting a panel review rather than a letter review; and

- If initiated, when will the peer review report be available?

Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?

Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

<EPA questions 2060-at26_EPA Response 5-30-17_v3.docx>

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
Cc: Stewart, Lori[Stewart.Lori@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]; Dunham, Sarah[Dunham.Sarah@epa.gov]
From: McCabe, Janet
Sent: Tue 6/9/2015 3:38:05 AM
Subject: RE: Aircraft package
Aircraft GHG- Response to Administrator comments 6-8-15 jm.docx

Update from me.

first of all, thank you for the work on this. **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

From: Hengst, Benjamin
Sent: Monday, June 8, 2015 3:12 PM
To: McCabe, Janet
Cc: Stewart, Lori; Grundler, Christopher; Dunham, Sarah
Subject: Aircraft package

Hi Janet,

Ex. 5 - Deliberative Process

Thanks
Ben

To: McCabe, Janet[McCabe.Janet@epa.gov]
Cc: Stewart, Lori[Stewart.Lori@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]; Dunham, Sarah[Dunham.Sarah@epa.gov]
From: Hengst, Benjamin
Sent: Mon 6/8/2015 7:12:13 PM
Subject: Aircraft package
Aircraft GHG- Response to Administrator comments 6-8-15.docx

Hi Janet,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks

Ben

To: Dunham, Sarah[Dunham.Sarah@epa.gov]
From: Gunning, Paul
Sent: Wed 4/22/2015 2:17:22 PM
Subject: FW: Draft Note From Chris to Janet on aircraft package

Sarah – just FYI……

From: Birnbaum, Rona
Sent: Wednesday, April 22, 2015 9:56 AM
To: Gunning, Paul; Kocchi, Suzanne; Friedman, Kristina; Krieger, Jackie
Cc: Jantarasami, Lesley; DeAngelo, Ben
Subject: Fwd: Draft Note From Chris to Janet on aircraft package

Ex. 5 - Deliberative Process

Sent from my iPhone

Begin forwarded message:

From: "Audette, Lucie" <audette.lucie@epa.gov>
Date: April 22, 2015 at 9:44:23 AM EDT
To: "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>, "Charmley, William" <charmley.william@epa.gov>, "Birnbaum, Rona" <Birnbaum.Rona@epa.gov>
Cc: "Samulski, Michael" <samulski.michael@epa.gov>, "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>
Subject: Draft Note From Chris to Janet on aircraft package

Ex. 5 - Deliberative Process

Janet,

I want to update you on the status of the aircraft package at OMB **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Dunham, Sarah[Dunham.Sarah@epa.gov]
From: Gunning, Paul
Sent: Fri 2/20/2015 1:58:52 PM
Subject: FW: OMB aircraft briefing
Aircraft GHG endangerment, OMB Briefing 2.20.15 final.pptx

Just FYI….Janet will not be attending. I am going over with Rona and Ben.

From: Hengst, Benjamin
Sent: Thursday, February 19, 2015 5:22 PM
To: Birnbaum, Rona; DeAngelo, Ben; Samulski, Michael; Williams, Melina; Orlin, David; Thrift, Mike; Audette, Lucie; Manning, Bryan
Cc: Charmley, William; Gunning, Paul; Jutras, Nathaniel
Subject: OMB aircraft briefing

Hi All,

Here are the final slides **Ex. 5 - Deliberative Process**
Ex. 5 - Deliberative Process

I'm having copies printed for the meeting. Janet won't be going.

Getting there: for those walking over, let's meet at 9:25 at the post office entrance (on Penn Ave, across from Del Frisco's Grille).

Thanks

Ben

To: Grundler, Christopher[grundler.christopher@epa.gov]; Dunham, Sarah[Dunham.Sarah@epa.gov]
Cc: Gunning, Paul[Gunning.Paul@epa.gov]; Charmley, William[charmley.william@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Hengst, Benjamin
Sent: Thur 2/19/2015 2:15:24 AM
Subject: Fw: Updated OMB Briefing for Friday Feb 20
OMB Briefing_2- 18-2015.pptx

Chris, Sarah--

(Sarah--you may have seen/know this already, in which case please ignore).

This Friday at 10am, OTAQ and OAP (with OGC) are briefing OMB on the aircraft GHG package (endangerment + ANPR). The list of invitees for the meeting has now expanded beyond just OMB -- it now includes Dan U., Rick Duke, CEQ people, etc. as well as Dom and others from OMB. Of course we have no idea if they'll show up, but they might.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

The briefing itself is short and fairly straightforward.

Ex. 5 - Deliberative Process

Ben

From: Audette, Lucie
Sent: Wednesday, February 18, 2015 3:31 PM
To: Hengst, Benjamin; Samulski, Michael; Birnbaum, Rona; DeAngelo, Ben; Manning, Bryan
Cc: Sutton, Tia; Scoville, Pat; Jutras, Nathaniel
Subject: Updated OMB Briefing for Friday Feb 20

To: Dunham, Sarah[Dunham.Sarah@epa.gov]
Cc: Krieger, Jackie[Krieger.Jackie@epa.gov]; VonDemHagen, Rebecca[VonDemHagen.Rebecca@epa.gov]
From: Gunning, Paul
Sent: Wed 7/20/2016 12:34:31 AM
Subject: Fwd: EO 12866 redline and clean versions of Agency changes in response to interagency comments on Endangerment/Cause Contribute Findings FRM (2060-AS31)
EO12866_AircraftEF 5773 FR FRN_20160719_redline.docx
ATT00001.htm
EO12866_AircraftEF 5773 FR FRN_20160719_clean.docx
ATT00002.htm

Fyi

Paul Gunning
202-251-1436
Sent from my iPhone

Begin forwarded message:

From: "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>
Date: July 19, 2016 at 8:13:53 PM EDT
To: "Gunning, Paul" <Gunning.Paul@epa.gov>, "Whiteman, Chad" Ex. 6 - Personal Privacy >
Cc: "Birnbaum, Rona" <Birnbaum.Rona@epa.gov>, "Schillo, Bruce" <Schillo.Bruce@epa.gov>, "Sarofim, Marcus" <Sarofim.Marcus@epa.gov>
Subject: EO 12866 redline and clean versions of Agency changes in response to interagency comments on Endangerment/Cause Contribute Findings FRM (2060-AS31)

Hello Chad,

As you requested, please find attached latest passback in redline and a clean version with all track changes accepted. Also as you asked for, here is a list of the minor edits to numbers in the contribution finding:

Ex. 5 - Deliberative Process

Let us know if any final edits are needed in the morning.

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

To: Dunham, Sarah[Dunham.Sarah@epa.gov]
From: Gunning, Paul
Sent: Tue 7/19/2016 5:03:57 PM
Subject: Fwd: status of aircraft endangerment
biogenic CO2 preamble text_071916.docx
ATT00001.htm

Paul Gunning
202-251-1436
Sent from my iPhone

Begin forwarded message:

From: "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>
Date: July 19, 2016 at 1:03:25 PM EDT
To: "McCabe, Janet" <McCabe.Janet@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>
Cc: "Kocchi, Suzanne" <Kocchi.Suzanne@epa.gov>
Subject: RE: status of aircraft endangerment

Here is the current preamble text on the biogenic issue. **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

From: McCabe, Janet

Sent: Tuesday, July 19, 2016 11:06 AM
To: Gunning, Paul <Gunning.Paul@epa.gov>
Cc: Grundler, Christopher <grundler.christopher@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; Vaught, Laura <Vaught.Laura@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: Re: status of aircraft endangerment

Ex. 5 - Deliberative Process

Sent from my iPhone

On Jul 19, 2016, at 9:18 AM, Gunning, Paul <Gunning.Paul@epa.gov> wrote:

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Tuesday, July 19, 2016 8:50 AM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Gunning, Paul <Gunning.Paul@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; Vaught, Laura <Vaught.Laura@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: Re: status of aircraft endangerment

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202/564-1682 (Washington DC)

734/214-4207 (Ann Arbor MI)

On Jul 19, 2016, at 8:40 AM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Ex. 5 - Deliberative Process

Thanks

Sent from my iPhone

On Jul 19, 2016, at 8:20 AM, Gunning, Paul <Gunning.Paul@epa.gov> wrote:

Janet

Ex. 5 - Deliberative Process

Paul

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Paul Gunning

202-251-1436

Sent from my iPhone

On Jul 18, 2016, at 3:41 PM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Ex. 5 - Deliberative Process

From: Gunning, Paul
Sent: Monday, July 18, 2016 11:24 AM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: RE: status of aircraft endangerment

Ex. 5 - Deliberative Process

Paul

Ex. 5 - Deliberative Process

From: Birnbaum, Rona
Sent: Friday, July 15, 2016 10:04 PM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Gunning, Paul <Gunning.Paul@epa.gov>
Subject: Re: status of aircraft endangerment

Ex. 5 - Deliberative Process

Rona

Sent from my iPhone

On Jul 15, 2016, at 8:24 PM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

> This issue is coming up everywhere….

Ex. 5 - Deliberative Process

> **From:** Hengst, Benjamin
> **Sent:** Friday, July 15, 2016 5:07 PM
> **To:** McCabe, Janet <McCabe.Janet@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>
> **Subject:** FW: status of aircraft endangerment

Ex. 5 - Deliberative Process

From: Birnbaum, Rona
Sent: Friday, July 15, 2016 5:04 PM
To: Gunning, Paul <Gunning.Paul@epa.gov>; VonDemHagen, Rebecca <VonDemHagen.Rebecca@epa.gov>; Krieger, Jackie <Krieger.Jackie@epa.gov>; Kocchi, Suzanne <Kocchi.Suzanne@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Orlin, David <Orlin.David@epa.gov>
Cc: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: RE: status of aircraft endangerment

Ex. 5 - Deliberative Process

Rona

To: Dunham, Sarah[Dunham.Sarah@epa.gov]
Cc: Krieger, Jackie[Krieger.Jackie@epa.gov]
From: Friedman, Kristina
Sent: Wed 4/27/2016 10:04:51 PM
Subject: FYI - Aircraft updated documents
5773 FR Preamble Aircraft EF 042716_track_v2.docx
5773 FR Preamble Aircraft EF 042716_clean.docx

Hi Sarah,

FYR - Attached please find the full redline and clean versions of the final aircraft endangerment findings we provided to the IO this evening.

Thanks,

Kristina

Kristina Friedman

Office of Atmospheric Programs

U.S. Environmental Protection Agency

Phone: (202) 343-9281

To: Goffman, Joseph[Goffman.Joseph@epa.gov]
Cc: Dunham, Sarah[Dunham.Sarah@epa.gov]; Gunning, Paul[Gunning.Paul@epa.gov]
From: Friedman, Kristina
Sent: Tue 4/26/2016 8:56:34 PM
Subject: Language for review
5773 GHG Aircraft_biogenicexcerpt.pdf
aircraft GHG finding FRM preamble_OAPtoJanet.docx

Hi Joe,

Ex. 5 - Deliberative Process

Thanks,

Kristina

Ex. 5 - Deliberative Process

Kristina Friedman

Office of Atmospheric Programs

U.S. Environmental Protection Agency

Phone: (202) 343-9281

To: Gunning, Paul[Gunning.Paul@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; Krieger, Jackie[Krieger.Jackie@epa.gov]
From: Dunham, Sarah
Sent: Mon 4/11/2016 3:14:00 PM
Subject: Fwd: Intersection between aircraft CO2 standards and the ICAO MBM process: recent Administrator McCarthy comments
image003.png
ATT00001.htm
Inside EPA, 4.7.2016, Administrator McCarthy on Aircraft.pdf
ATT00002.htm
DRAFT section US AIRCRAFT REGULATIONS AND INTERNATIONAL COMMUNITY.DOCX
ATT00003.htm

Ex. 5 - Deliberative Process

Sent from my iPhone

Begin forwarded message:

From: "Charmley, William" <charmley.william@epa.gov>
Date: April 11, 2016 at 11:01:58 AM EDT
To: "Grundler, Christopher" <grundler.christopher@epa.gov>, "Dunham, Sarah" <Dunham.Sarah@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>
Cc: "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>, "Samulski, Michael" <samulski.michael@epa.gov>
Subject: Intersection between aircraft CO2 standards and the ICAO MBM process: recent Administrator McCarthy comments

Dear Chris, Sarah, and Paul

Last week my staff and I heard both from FAA and from some industry players regarding information they had read in the press from Administrator McCarthy on aircraft CO2 standards.

We did not know what this was referring to, and then we saw the attached from InsideEPA. In indicates that in the past week the Administrator discussed aircraft emissions at two different venues:

- An April 5 breakfast hosted by the Christian Science Monitor

- An April 7 "event in Ottawa, Canada"

The article has the title "**McCarthy Warns EPA Could Issue Stronger Aircraft GHG Rule If Global Talks Slip**"

This article includes the following:

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Stewart, Lori
Sent: Thur 9/11/2014 1:54:49 PM
Subject: ICAO paper for the Administrator
ICAO Aviation GHG Announcement Background & Statement.docx

Chris, here is a one and a half pager directly pulled from the beginning of the roll-out strategy. I can send this forward to Amy Hambrick to get to the Administrator if you think it fits the bill for her request to Janet (below). Let me know - thanks.

From: Hengst, Benjamin
Sent: Thursday, September 11, 2014 9:31 AM
To: Stewart, Lori
Subject: Re: Airlines

Hi Lori, I think that should work but Chris should take a look first. Do you just want to send it to home first and make sure he is ok? Or let me know if you want me to do it. Either is fine. Thanks.

From: Stewart, Lori

Sent: Thursday, September 11, 2014 9:17 AM

To: McCabe, Janet; Grundler, Christopher

Cc: Hengst, Benjamin

Subject: RE: Airlines

I sent Amy the rollout plan, but the first two pages provide a good overview. We could extract those into a separate document and forward to the Administrator (thru Amy again). Chris/Ben, I can do that if you concur.

From: McCabe, Janet
Sent: Thursday, September 11, 2014 8:08 AM
To: Grundler, Christopher; Stewart, Lori
Subject: Fwd: Airlines

Chris, Lori--see Gina's note. I don't know if the paper we sent to Gwen last week will fit the bill for this--can you check and see please?

Thanks

Sent from my iPhone

Begin forwarded message:

From: "Ex. 6 - Personal Privacy" <Ex. 6 - Personal Privacy
Date: September 11, 2014 at 8:00:27 AM EDT
To: "McCabe, Janet" <McCabe.Janet@epa.gov>
Subject: Airlines

Janet I have lost track of the airline ghg emission issue. Can you have someone send me me a one pager?

Gina McCarthy

To: Grundler, Christopher[grundler.christopher@epa.gov]
From: McCabe, Janet
Sent: Wed 8/27/2014 1:13:06 PM
Subject: RE: EPA submission to ICAO on GHG endangerment finding/ANPRM

Right you are--my apologies. I was looking for an attachment. How about these few edits?

1. INTRODUCTION

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Wednesday, August 27, 2014 8:54 AM
To: McCabe, Janet
Subject: Re: EPA submission to ICAO on GHG endangerment finding/ANPRM

Keep scrolling and you will find the paper embedded in Bills email

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

[redacted]

[redacted]

sorry not to have responded....can someone please send me the 2 pager? I've looked back through my emails to July and can't find it.

I did have a chance to talk to the Administrator about it on friday evening, and I think we should be ok to send this along, but I'd like to look at it again, which I willdo in the morning. If you haven't already, can you please give Millett and Co a heads up about this--we'll want the third floor to know as well.

From: Grundler, Christopher
Sent: Tuesday, August 26, 2014 6:43 PM
To: McCabe, Janet
Cc: Charmley, William
Subject: Fw: EPA submission to ICAO on GHG endangerment finding/ANPRM

Janet, we'd like your go ahead to submit this paper. I believe the downside risks are low, and the FAA is with us.

C-

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

[redacted]

Chris –

We have until Thursday, and then we will have lost nine months in our time line within

Ex. 5 - Deliberative Process

Do you have any objection to having us do this? I have attached a copied the text of the paper below.

Thanks

Bill

==========

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Azoolin, Liel
Location: Administrator's Office
Importance: Normal
Subject: Finalizing US Position: ICAO– Aircraft GHG Standards
Categories: Red Category
Start Date/Time: Fri 10/30/2015 7:30:00 PM
End Date/Time: Fri 10/30/2015 8:30:00 PM
Administrator's form request - 10-5-15.docx

Ex. 5 - Deliberative Process

SCt: Liel Azoolin
Ct: Emily Atkinson, 202-564-1850

Staff:
Janet McCabe, Chris Grundler, Bill Charmley, Ben Hengst, Michael Samulski, Bryan Manning, David Orlin (OAR)
Mike Thrift (OGC)

Optional:
Gwen Stewart, Jonell Iffland (OAR/OTAQ)

Conference Line: Ex. 6 - Personal Privacy / Access Code: Ex. 6 - Personal Privacy

Video Conference Room:
Ann Arbor RM. C-174 DOD AA

Administrator's form request - 10-5-15.docx

To: Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
Cc: Sutton, Tia[sutton.tia@epa.gov]; Mylan, Christopher[Mylan.Christopher@epa.gov]; DeLuca, Isabel[DeLuca.Isabel@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]; Gunning, Barbara[Gunning.Barbara@epa.gov]
From: Birgfeld, Erin
Sent: Wed 6/10/2015 4:39:10 PM
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Hi everyone,

The web on aviation is LIVE. Congrats, and thanks for the quick review and help on all things comms! Now on to the press call….

http://www.epa.gov/otaq/aviation.htm

From: Manning, Bryan
Sent: Wednesday, June 10, 2015 12:24 PM
To: Audette, Lucie; Birgfeld, Erin; Hengst, Benjamin; Samulski, Michael; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Hello Lucie,

In a recent email, Erin said the web is unlikely to go live before 12:45 pm. She will sent out a note as soon as the web goes live.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Audette, Lucie
Sent: Wednesday, June 10, 2015 12:22 PM
To: Birgfeld, Erin; Manning, Bryan; Hengst, Benjamin; Samulski, Michael; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Erin, I'm getting emails aksing when the web goes live, are we now targeting 12:30? Thanks

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 12:08 PM
To: Manning, Bryan; Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Hi all,

We had some last minute OGC changes so the fact sheet is still in the process of being formatted,

and the web is unlikely to go live before 12:45.

I'll send a note out as soon as the web is live to this group.

In the meantime, here is an unformatted version of the final fact sheet for your information.

Also, pasted below is the final PR. Please DO NOT send this outside of the agency until after the website is live.

Thanks! Almost there ;)

Erin

Subject: EPA Takes First Steps to Address Greenhouse Gas Emissions from Aircraft

CONTACT
Christie St. Clair (news media only)
stclair.christie@epa.gov
202-564-2880

FOR IMMEDIATE RELEASE
June 10, 2015

EPA Takes First Steps to Address Greenhouse Gas Emissions from Aircraft

WASHINGTON – The U.S. Environmental Protection Agency (EPA) is proposing to find under the Clean Air Act that greenhouse gas (GHG) emissions from commercial aircraft contribute to the pollution that causes climate change endangering the health and welfare of Americans. At the same time, the agency is releasing information about the international process already underway by the International Civil Aviation Organization (ICAO) for developing carbon dioxide (CO2) standards for aircraft and EPA's participation in that process. EPA is now seeking public input to inform future steps by the agency.

For the past five years, ICAO — a specialized body of the United Nations with 191 member states — has been working with the aviation industry and other stakeholders to develop coordinated, international CO2 emissions

standards for aircraft. EPA and the Federal Aviation Administration, representing the United States, are participating in ICAO's process to ensure that any standards achieve meaningful CO2 emissions reductions through policies that are equitable across national boundaries.

The ICAO standards are expected to be adopted in early 2016. The items issued today by EPA lay the necessary foundation for the development and implementation of a domestic aircraft standard, in accordance with U.S. law and the ICAO process.

U.S. aircraft emit roughly 11 percent of GHG emissions from the U.S. transportation sector and 29 percent of GHG emissions from all aircraft globally. In 2009, EPA determined that GHG pollution from cars and light trucks threatens Americans' health and welfare by leading to long-lasting changes in our climate that can have a range of negative effects. Since then, the body of science on human-induced climate change has strengthened, supporting today's proposed finding — under a different section of the Clean Air Act — that GHGs emitted from aircraft engines contribute to pollution that causes climate change endangering public health and welfare. Today's action supports the goals of the President's Climate Action Plan to reduce emissions from large sources of carbon pollution.

Today's actions do not apply to small piston-engine planes (the type of plane often used for recreational purposes), or to military aircraft.

Once this action is published in the Federal Register, it will be open for a 60-day public comment period. Any future domestic actions toward aircraft engine standards would also be open to public comment and review before they could take effect.

For more information on the proposed contribution finding and the advance notice of proposed rulemaking, visit http://epa.gov/otaq/aviation.htm.

R137

If you would rather not receive future communications from Environmental Protection Agency, let us know by clicking here.
Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460 United States

From: Manning, Bryan
Sent: Wednesday, June 10, 2015 11:54 AM
To: Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Birgfeld, Erin; Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: Sent Email to Stakeholders and Final Fact Sheet

Hello Ben,

Ex. 5 - Deliberative Process

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Hengst, Benjamin
Sent: Wednesday, June 10, 2015 11:16 AM
To: Grundler, Christopher; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Manning, Bryan; Birnbaum, Rona; Gunning, Paul; DeAngelo, Ben
Cc: Charmley, William; Birgfeld, Erin; Mylan, Christopher; DeLuca, Isabel; Millett, John; StClair, Christie
Subject: Final Q&As

All: final Q&A doc is attached.

Chris – the end of this document has answers to the questions you gave us last night/this morning. They are also copied below.

Just as a reminder: here's the schedule:

12:30 pm - web goes live
1 pm - press release (to HQ Environmental, Top-Tier, Aircraft lists)

1:10 - external calls
2 pm - press call

Ben

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Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Grundler, Christopher[grundler.christopher@epa.gov]
From: McCabe, Janet
Sent: Mon 1/25/2016 11:22:59 PM
Subject: FW: Call with EU on ICAO
US Position-CO2 Standard dpc NSC.PPTX

I'll ask Candace to include you routinely, Chris.

-----Original Message-----
From: Vahlsing, Candace M. EOP/WHO Ex. 6 - Personal Privacy
Sent: Monday, January 25, 2016 6:10 PM
To: Welsh, Kevin W. EOP/NSC < Ex. 6 - Personal Privacy ; McCabe, Janet <McCabe.Janet@epa.gov>; Charmley, William <charmley.william@epa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>
Cc: Duke, Rick EOP/CEQ < Ex. 6 - Personal Privacy >
Subject: RE: Call with EU on ICAO

Janet/Lourdes,

We'd like to use the attached deck to walk through our position with the EU on the teleconference tomorrow, and are considering sending it to them a head of the meeting. Would be great if your team's could give it a look in the am.

-----Original Message-----
From: Welsh, Kevin Ex. 6 - Personal Privacy
Sent: Monday, January 25, 2016 5:10 PM
To: 'McCabe, Janet' <McCabe.Janet@epa.gov>; Charmley, William <charmley.william@epa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>
Cc: Duke, Rick EOP/CEQ < Ex. 6 - Personal Privacy ; Vahlsing, Candace M. EOP/WHO < Ex. 6 - Personal Privacy >
Subject: RE: Call with EU on ICAO

Will do. Thanks.

From: McCabe, Janet [mailto:McCabe.Janet@epa.gov]
Sent: Monday, January 25, 2016 4:55 PM
To: Welsh, Kevin Ex. 6 - Personal Privacy Charmley, William <charmley.william@epa.gov>; 'Lourdes.Maurice@faa.gov' <Lourdes.Maurice@faa.gov>
Cc: Duke, Rick < Ex. 6 - Personal Privacy >; Vahlsing, Candace < Ex. 6 - Personal Privacy >
Subject: RE: Call with EU on ICAO

Kevin. Please put Bill, Chris and me on the manifest for tomorrow's call. Thanks for getting it set up.

From: Welsh, Kevin Ex. 6 - Personal Privacy
Sent: Monday, January 25, 2016 4:02 PM
To: McCabe, Janet <McCabe.Janet@epa.gov <mailto:McCabe.Janet@epa.gov> >; Charmley, William <charmley.william@epa.gov <mailto:charmley.william@epa.gov> >; 'Lourdes.Maurice@faa.gov'

<Lourdes.Maurice@faa.gov <mailto:Lourdes.Maurice@faa.gov> >
Cc: Duke, Rick < Ex. 6 - Personal Privacy <mailto: Ex. 6 - Personal Privacy > >; Vahlsing, Candace Ex. 6 - Personal Privacy <mailto Ex. 6 - Personal Privacy > >
Subject: Call with EU on ICAO

Dear Janet, Bill and Lourdes,

We are confirmed for a teleconference with the EU for tomorrow at 11am. I will draft a short proposed agenda and provide a manifest for participation on our side to send to the EU tonight.

Here is a notional agenda:

ng

Ex. 5 - Deliberative Process

Please let me know if you have any additional suggestions to the above.

For the manifest, please confirm who will participate from EPA and FAA (we would prefer to keep numbers down). From the White House you will have Rick, Candace and me. I will follow-up with the dial-in number.

Thanks,

Kevin

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Hengst, Benjamin
Sent: Fri 10/30/2015 3:43:50 PM
Subject: final materials for ICAO brfing
CAEP 10 WP XX US CO2 Stringency_23 October EPA + FAA.docx
ICAO Aircraft CO2 Std_Gina briefing 10-30-15.pptx

Chris –

See attached. Both of these were in Gina's book last night.

I'm assuming **Mike**, or someone else he designates, will be doing the briefing.

We learned yesterday that Janet will be calling in from the road, as the meeting time is now 3:30.

Also, here are the opening TPs Mike drafted for your use in the meeting (based on our prebrief with Janet yesterday):

Talking Points for Chris to Introduce Aircraft Briefing to Gina

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Simon, Karl[Simon.Karl@epa.gov]; Blubaugh, Jim[Blubaugh.Jim@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Phillips, Anna
Sent: Wed 12/16/2015 3:13:00 PM
Subject: RE: Clearance for Wednesday please - USEU use of aviation language externally

Thanks, Chris – I'll respond to USEU with a cc: to you and the OTAQ team.

Note that it's possible (if not likely) that they will come back to us with a request for substitute language but let's see what happens.

Best,

Anna

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~~~

From: Grundler, Christopher
Sent: Tuesday, December 15, 2015 10:41 PM
To: Phillips, Anna <Phillips.Anna@epa.gov>
Cc: Simon, Karl <Simon.Karl@epa.gov>; Blubaugh, Jim <Blubaugh.Jim@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: Re: Clearance for Wednesday please - USEU use of aviation language externally

Ex. 5 - Deliberative Process

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202.564.1682 (Washington)

734.214.4207 (Ann Arbor)

www.epa.gov/otaq

On Dec 15, 2015, at 11:01 AM, Phillips, Anna <Phillips.Anna@epa.gov> wrote:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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Anna Phillips

Program Manager for Europe
U.S. Environmental Protection Agency (EPA)

Office of International & Tribal Affairs

Washington, D.C. 20460

Tel: (+1) 202.564.6419   Fax: (+1) 202.565.2427
E-mail: phillips.anna@epa.gov

http://www2.epa.gov/international-cooperation

~~~~~~

<image001.jpg>***Please consider the environment before printing this message.***

From: Robinson, Mark T (USEU) [mailto:RobinsonMT1@state.gov]
Sent: Tuesday, December 15, 2015 10:57 AM
To: Dunlap, Ellen M <DunlapEM@state.gov>; Tibbetts, Robert E <TibbettsRE@state.gov>; Rakestraw, Andrew R <RakestrawAR@state.gov>; Carnahan, Kimberly C <CarnahanKC@state.gov>; Phillips, Anna <Phillips.Anna@epa.gov>; Conlon, Steven M (USEU) <ConlonSM@state.gov>; Stacey, Tricia J (Dept of Transportation) <Tricia.Stacey@faa.gov>
Cc: Thomas, Erica K (USEU) <ThomasEK@state.gov>; Oosterloo, Hylko J (USEU)

<OosterlooHJ@state.gov>
Subject: Clearance for Wednesday please - USEU use of aviation language externally

Hello everyone,

Thanks to those of you who cleared last week on the memo to our Ambassador, and sorry to come back around—following a recent meeting at the European Parliament plenary, our

Ex. 5 - Deliberative Process

Look okay to you all? We'll of course send back anything we hear from the EP or others on aviation emissions.

(Also, Andrew and Kim, hope you guys are recovering from Paris okay. Huge congratulations!)

Thanks,

Mark

This email is UNCLASSIFIED.

<2015_1215_MEP Aviation Email_v2.docx>

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Mylan, Christopher[Mylan.Christopher@epa.gov]
From: Birgfeld, Erin
Sent: Tue 5/19/2015 12:01:00 AM
Subject: FW: Aircraft endangerment finding PR
Roll Out -Aviation Endagerment-NPRM v 4.docx
Aircraft End DRAFT Press Release v6 5-18 _LP_EB_clean for Chris.docx

Hi Chris,

Attached are the current drafts of the Press Release and Roll out for the Aviation Endangerment / NPRM action. Liz just weighed in tonight with edits on the PR so there are likely to be a few more tweaks from the team tomorrow as we work through them.

BUT, Millett is looking to provide Janet with the PR and roll out tomorrow so I wanted to be sure you see what is going up you to have a chance to review before it goes to her.

Thanks,

Erin

From: Birgfeld, Erin
Sent: Monday, May 18, 2015 5:46 PM
To: Purchia, Liz; Millett, John
Cc: Hengst, Benjamin; StClair, Christie; Mylan, Christopher; Isabel DeLuca; Rona Birnbaum
Subject: RE: Aircraft endagerment finding

Hi Liz,

Here are the working drafts of the PR, fact sheet and roll out with q and a's for you. The q and a's need a bit more polishing and we are working on that. Let me know if you have edits and we can incorporate for Janet tomorrow.

Thanks,

Erin

From: Purchia, Liz
Sent: Monday, May 18, 2015 10:52 AM
To: Birgfeld, Erin; Millett, John
Cc: Hengst, Benjamin; StClair, Christie; Mylan, Christopher
Subject: RE: Aircraft endagerment finding

Perfect, thanks.

From: Birgfeld, Erin
Sent: Monday, May 18, 2015 10:37 AM
To: Purchia, Liz; Millett, John
Cc: Hengst, Benjamin; StClair, Christie; Mylan, Christopher
Subject: RE: Aircraft endagerment finding

Hi Liz,

I can send you our working drafts this afternoon. (Just sent out the material for one final review by the team).

Chris Grundler and Janet will review tonight and tomorrow. Happy to send what we have later today with the understanding that they are working drafts and Janet and Chris Grundler still need to weigh in.

Is that OK?

-Erin

From: Purchia, Liz
Sent: Monday, May 18, 2015 10:24 AM
To: Millett, John
Cc: Hengst, Benjamin; StClair, Christie; Birgfeld, Erin
Subject: RE: Aircraft endagerment finding

Happy Monday.

Could someone please forward me the lastest rollout docs on aircraft? Or by COB? Thanks.

From: Millett, John
Sent: Thursday, May 14, 2015 8:47 AM
To: Purchia, Liz
Cc: Hengst, Benjamin; StClair, Christie; Birgfeld, Erin
Subject: Re: Aircraft endagerment finding

Sure thing. I'll open a line @ 3.

Ex. 6 - Personal Privacy

John Millett

202.510.1822

On May 14, 2015, at 8:26 AM, Purchia, Liz <Purchia.Liz@epa.gov> wrote:

Could you call my cell for this? Or I can call into a number. I'm working from home today.

Liz Purchia

U.S. EPA

202-564-6691

202-841-2230

On May 13, 2015, at 5:42 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

I can do 3, too. Yes let's plan on meeting in OTAQ.

On May 13, 2015, at 5:19 PM, Purchia, Liz <Purchia.Liz@epa.gov> wrote:

That's great to hear, thanks for the update.

My morning is pretty crazy, but could do the afternoon. Want to say like 3pm? We could meet in OTAQ?

From: Millett, John
Sent: Wednesday, May 13, 2015 5:18 PM
To: StClair, Christie; Purchia, Liz; Birgfeld, Erin
Cc: Hengst, Benjamin
Subject: RE: Aircraft endagerment finding

A very amiable conversation, indeed.

My sked tomorrow -- Morning and afternoon are pretty open – middle of the day is packed.

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~~~~~~~~~~~~~~~~~~

John Millett

Director, OAR Communications

Desk: 202-564-2903

Cell: 202-510-1822

From: StClair, Christie
Sent: Wednesday, May 13, 2015 5:12 PM
To: Purchia, Liz; Birgfeld, Erin
Cc: Hengst, Benjamin; Millett, John
Subject: RE: Aircraft endagerment finding

Liz,

The tour and call went smoothly.

We'll give you a full debrief when we talk tomorrow, but Aaron Kessler was "like a kid in a candy shop" at the lab. He got a controlled and fast-paced tour, and his only questions were to clarify what Dr. Haugen was telling him about the testing process, history, etc. Sounds like he was really lasered in on getting color.

He didn't really ask anything about Phase 2.

CG was very careful not to step on the announcement.

I'll check in with the reporter tonight and see if I can get a sense of where the story is heading.

Ben/John – when is good for a debrief/planning call tomorrow?

Christie

Christie St. Clair

Office of Public Affairs

Environmental Protection Agency

Washington, DC

o: 202-564-2880

m: 202-768-5780

From: Purchia, Liz
Sent: Wednesday, May 13, 2015 4:18 PM
To: Birgfeld, Erin
Cc: Hengst, Benjamin; Millett, John; StClair, Christie
Subject: RE: Aircraft endagerment finding

Please let me know how the NYT call goes.

Can we discuss this and timing tomorrow?

From: Birgfeld, Erin
Sent: Monday, May 11, 2015 3:04 PM
To: Purchia, Liz
Cc: Hengst, Benjamin; Millett, John; StClair, Christie
Subject: Re: Aircraft endagerment finding

OMB review is moving along on this one so as early as may 21 is possible. The week of the 25th may be more likely.

Sent from my iPhone

On May 11, 2015, at 3:01 PM, "Purchia, Liz" <Purchia.Liz@epa.gov> wrote:

Do we have any update on timing?

From: Birgfeld, Erin
Sent: Monday, April 20, 2015 1:24 PM
To: Purchia, Liz; Hengst, Benjamin; Millett, John
Subject: RE: Aircraft endagerment finding

HI Liz,

These were our key messages from the ICAO paper roll out which included our timeframe. I think reinforcing these with the reporter makes sense.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Purchia, Liz
Sent: Monday, April 20, 2015 12:25 PM
To: Hengst, Benjamin; Birgfeld, Erin; Millett, John
Subject: RE: Aircraft endagerment finding

Interesting timing given our conversation this morning. She's filing a story today for this week. It's basically a preview piece, looking ahead to what different groups will say about our endangerment finding.

She says she's basing it on a memo on our site about EPA working on this in relation to ICAO. She said she spoke to an airline group and EarthJustice.

Do we have any messaging we want to make sure is included? I know you mentioned you have some stuff already drafted. Obviously we won't say anything about what the endangerment says, but if we can provide some consistent language about why we're doing this it might be helpful.

From: Lauren Gardner [mailto:LaurenGardner@cqrollcall.com]
Sent: Monday, April 20, 2015 12:14 PM
To: Purchia, Liz
Subject: Aircraft endagerment finding

Hey Liz,

I'm writing a story about this and just wanted to check on timing. I think the original plan was for this to be out this month, but I noticed on EPA.gov its expected release date says May. Just wanted to check in with you to confirm when you're expecting it out at this point—thanks.

Lauren Gardner

Staff Writer

CQ Roll Call

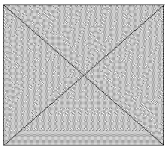
77 K St. NE

Washington, DC 20002

Office: 202 650 6708

Cell: 215 900 3779

laurengardner@cqrollcall.com



This e-mail may contain confidential material. If you are not an intended recipient, please notify the sender and delete all copies. It may also contain personal views which are not the views of CQ Roll Call or its owner, The Economist Group. We may monitor e-mail to and from our network. For company information go to http://legal.economistgroup.com.

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
Cc: Grundler, Christopher[grundler.christopher@epa.gov]
From: McCabe, Janet
Sent: Wed 2/17/2016 12:44:32 AM
Subject: Re: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Ok-thanks Ben

Sent from my iPhone

On Feb 16, 2016, at 5:33 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

Janet -- just confirming that both OTAQ and OP will be attending/calling into this meeting (OIRA, OMB on ICAO stds). Thanks, Ben

Begin forwarded message:

From: "Whiteman, Chad" <Ex. 6 - Personal Privacy>
Date: February 16, 2016 at 4:10:01 PM EST
To: "Ralph.Iovinelli@faa.gov" <Ralph.Iovinelli@faa.gov>, "Vahlsing, Candace" <Ex. 6 - Personal Privacy>, "Welsh, Kevin" Ex. 6 - Personal Privacy, "Lourdes.Maurice@faa.gov" <Lourdes.Maurice@faa.gov>, "samulski.michael@epa.gov" <samulski.michael@epa.gov>, "manning.bryan@epa.gov" <manning.bryan@epa.gov>, "McCabe.Janet@epa.gov" <McCabe.Janet@epa.gov>, "Utech, Dan G." Ex. 6 - Personal Privacy, "Duke, Rick" Ex. 6 - Personal Privacy "Zaidi, Ali" Ex. 6 - Personal Privacy "Bodnar, Paul" Ex. 6 - Personal Privacy "Hengst.Benjamin@epa.gov" <Hengst.Benjamin@epa.gov>, "charmley.william@epa.gov" <charmley.william@epa.gov>, "LeFranc.Maurice@epa.gov" <LeFranc.Maurice@epa.gov>, "Rich.Swayze@faa.gov" <Rich.Swayze@faa.gov>, "carl.burleson@faa.gov" <carl.burleson@faa.gov>, "shoshana.lew@dot.gov" <shoshana.lew@dot.gov>, "Atkinson.Emily@epa.gov" <Atkinson.Emily@epa.gov>, "Davidson.Ken@epa.gov" <Davidson.Ken@epa.gov>, "Leggett.Cullen@epa.gov" <Leggett.Cullen@epa.gov>
Cc: "Mohtadi, Shara" Ex. 6 - Personal Privacy "Arthur.Rypinski@dot.gov" <Arthur.Rypinski@dot.gov>, "Golden, Robert" <Ex. 6 - Personal Privacy>, WH Energy and Climate Change <Ex. 6 - Personal Privacy> "Laszlo.Windhoffer@faa.gov" <Laszlo.Windhoffer@faa.gov>, "maryalice.locke@faa.gov" <maryalice.locke@faa.gov>, "curtis.holsclaw@faa.gov" <curtis.holsclaw@faa.gov>
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Hi Ralph,

We have reserved Conference Room 1 over here at 1800 G Street (9th Floor) for the meeting. No clearance information is required to enter our building. We have space for quite a few people in that conference room.

Regards,

Chad

Chad Whiteman

Policy Analyst | Office of Information and Regulatory Affairs

Office of Management and Budget | Executive Office of the President

202.395.4718 | cwhiteman@omb.eop.gov

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Tuesday, February 16, 2016 3:59 PM
To: Vahlsing, Candace [redacted]>; Welsh, Kevin [redacted] samulski.michael@epa.gov; manning.bryan@epa.gov; McCabe.Janet@epa.gov; Utech, Dan G. [redacted] Duke, Rick [redacted] gov>; Zaidi, Ali [redacted] Bodnar, Paul [redacted] Hengst.Benjamin@epa.gov; charmley.william@epa.gov; LeFranc.Maurice@epa.gov; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson.Emily@epa.gov; Whiteman, Chad [redacted] Davidson.Ken@epa.gov; Leggett.Cullen@epa.gov
Cc: Mohtadi, Shara [redacted] Arthur.Rypinski@dot.gov; Golden, Robert [redacted]; WH Energy and Climate Change [redacted]; Laszlo.Windhoffer@faa.gov; maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

Several folks from out of town have requested a WebEx/telecon line for this meeting. Here is the information:

US toll-free call in and passcode: Ex. 6 - Personal Privacy

WEBEX
- Go to website >https://www.connectmeeting.att.com<
- Enter meeting number Ex. 6 - Personal Privacy
- Enter access cod Ex. 6 - Personal Privacy
- Enter user email

- Enter user first/last name
- (next screen)
- Select "Participant" and click submit
- Website will automatically run Webex files and open meeting; host can view documents and chat/raise hand

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Iovinelli, Ralph (FAA)
Sent: Friday, January 29, 2016 5:43 PM
To: 'Vahlsing, Candace M. EOP/WHO'; Welsh, Kevin W. EOP/NSC; Maurice, Lourdes (FAA); 'Samulski, Michael'; Manning, Bryan; McCabe.Janet@epa.gov; Utech, Dan G. EOP/WHO; Duke, Rick EOP/CEQ; Zaidi, Ali A. EOP/OMB; Bodnar, Paul N. EOP/NSC; Hengst, Benjamin; Charmley, William; LeFranc, Maurice; Swayze, Rich (FAA); Burleson, Carl (FAA); Lew, Shoshana (OST); Atkinson, Emily; 'Whiteman, Chad'
Cc: Mohtadi, Shara Z. EOP/OMB; Rypinski, Arthur (OST); Golden, Robert E. EOP/WHO; WH Energy and Climate Change; Windhoffer, Laszlo (FAA); Locke, Maryalice (FAA); Holsclaw, Curtis (FAA)
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

First, please pass this invitation to those I missed.

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

The objective of this meeting is to determine the most efficient way to support the domestic rulemaking process of the aircraft CO2 emission standard, with specific attention to the cost benefits analysis completed for the ICAO international aircraft CO2 emissions standard.

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Please do not hesitate to contact Chad Whiteman Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy or myself with questions.

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

To: Manning, Bryan[manning.bryan@epa.gov]
Cc: Grundler, Christopher[grundler.christopher@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Bill Hemmings
Sent: Mon 7/25/2016 4:13:08 PM
Subject: T&E PR;: EPA Finalizes First Steps to Address Greenhouse Gas Emissions from Aircraft Engines

Great news Bryan,

Its imperative that the EPA and enlightened voices in the EU work to abolish the perverse Option 3.

Why should the world suffer just so the KC46 and A380 problem aircraft can be accommodated? It's a sham and a scandal whose truth will come out.

The EASA Basic Regulation revision is key.

Regards Bill

EPA ruling an opportunity for EU and America to cooperate on aviation emissions

For immediate release – Brussels, 25 July 2016

Link to PR: http://bit.ly/2aqABLn

Today's finding by the US Environmental Protection Agency (EPA) that it will regulate US greenhouse gas emissions from aircraft is an opportunity for bilateral action between America and the EU to reduce aviation's growing climate impact, Transport & Environment has said. The Brussels-based sustainable transport group welcomed the EPA's decision to set a CO2 standard that is "at least" equivalent to the one agreed at UN-level.

A series of lawsuits by US NGOs forced the EPA to issue today's ruling that it must act to regulate US aviation GHG emissions. The ruling comes after agreement last february at the UN aviation body ICAO on a CO2 standard for new aircraft that will have no impact on reducing emissions. One of the possible courses of action for the EPA is to introduce a more effective US standard that would apply to US-built aircraft and other aircraft sold to US registered airlines.

Bill Hemmings, aviation director at Transport & Environment, said: *"We now have the real possibility of the EU and the US cooperating to fix the deeply-flawed UN aviation efficiency standard. The European transport commissioner Violeta Bulc should grab this opportunity with both hands."*

In contrast to this long-awaited first sign of US ambition on reducing aviation emissions, the EU transport decarbonisation strategy, published last week, was disappointingly silent on what will be done in Europe to reduce aviation's climate impact. However, the EPA ruling creates a possibility for effective EU-US cooperation. Both markets account for over half of global aviation emissions, and Boeing (US) and Airbus (EU) aircraft are

responsible for over 90% of global aviation CO2.

ENDS

For more information, contact:

Bill Hemmings,

Aviation director, Transport & Environment

bill.hemmings@transportenvironment.org

+32 (0)2 851 02 15 / +32 (0)487 582 706

From: Audette, Lucie [mailto:audette.lucie@epa.gov]
Sent: 25 July 2016 17:18
Cc: Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: EPA Finalizes First Steps to Address Greenhouse Gas Emissions from Aircraft Engines

To All Interested Parties:

The U.S. Environmental Protection Agency (EPA) today finalized findings under section 231 of the Clean Air Act that greenhouse gas (GHG) emissions from certain types of aircraft engines (primarily used on commercial aircraft) contribute to the pollution that causes climate change and endangers Americans' health and environment. These findings are for the six well-mixed GHGs that together represent the largest driver of human-caused climate change: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The EPA is not issuing standards for aircraft engines in this action.

The EPA's final endangerment and contribution findings for aircraft engine GHG emissions are an important step that EPA must take prior to adopting domestic GHG engine standards. The domestic rulemaking process for standards will provide opportunities for industry, NGOs, and other interested parties to provide their input through public review and comment.

Today's findings do not apply to small piston-engine planes (the type of plane often used for recreational purposes), or to military aircraft.

For more information on the final aircraft endangerment and cause or contribute findings, see the attached fact sheet or visit http://epa.gov/otaq/aviation.htm.

Sincerely yours,

Bryan Manning

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

Virus-free. www.avast.com

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Millett, John[Millett.John@epa.gov]
From: Birgfeld, Erin
Sent: Tue 7/19/2016 2:22:38 PM
Subject: FW: Aviation Comms Materials - roll out is now Friday
Roll Out_QAs_aircraft final findings_7_18 - clean.docx
Aircraft End Press Release_3 30 pm.docx
Aircraft End Fact Sheet_7 14-2016 + mkw.docx

Hi Chris,

Attached are the current Endangerment comms materials. Roll out is now Friday, per Nick's request. OMB has not yet cleared so tomorrow was unlikely anyway.

These are the latest and reflect Janet's comments over the weekend. Her comments were mostly on the Q and A document. The most substantive edit was around our wording on timing. Her request which we implemented throughout was to say..

Ex. 5 - Deliberative Process

Let us know if you have more edits. Thanks! (also, these should be printed for you shortly)

-Erin

From: Birgfeld, Erin
Sent: Tuesday, July 19, 2016 9:55 AM
To: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Isabel DeLuca <DeLuca.Isabel@epa.gov>; Millett, John <Millett.John@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Cc: Richards, David <Richards.David@epa.gov>; Sutton, Tia <sutton.tia@epa.gov>
Subject: Aviation Comms Materials

Hi all,

These are the drafts of the materials that we have now. I will send to Nick Conger who will coordinate with FAA. I know we are unclear about OMB timing, but I will note that we are still in a position to release tomorrow if OMB clears.

Thanks,

Erin

To: Grundler, Christopher[grundler.christopher@epa.gov]
From: Thrift, Mike
Sent: Thur 6/11/2015 2:41:23 PM
Subject: RE: OTAQ In the News

No worries, Chris. You are free to move about the cabin.

Mike Thrift

United States Environmental Protection Agency

Office of General Counsel

San Diego Border Office

610 West Ash Street

San Diego, CA 92101

Thrift.mike@epa.gov

619-321-1960

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 5:08 PM
To: Thrift, Mike
Cc: Orlin, David
Subject: Fwd: OTAQ In the News

Mike:

Please forgive me for neglecting to include you on this note. I appreciate all the support on aviation though the years. The next year will be exciting--fasten your seat belt

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. EPA

202-564-1682 (DC)

734-214-4207 (Ann Arbor)

Begin forwarded message:

From: "Grundler, Christopher" <grundler.christopher@epa.gov>
Date: June 10, 2015 at 6:04:03 PM EDT
To: OAR-OTAQ <OAROTAQ@epa.gov>
Cc: "Dunham, Sarah" <Dunham.Sarah@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>, "Birnbaum, Rona" <Birnbaum.Rona@epa.gov>, "DeAngelo, Ben" <DeAngelo.Ben@epa.gov>, "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>, "McCabe, Janet" <McCabe.Janet@epa.gov>, "Millett, John" <Millett.John@epa.gov>, "StClair, Christie" <StClair.Christie@epa.gov>, "Purchia, Liz" <Purchia.Liz@epa.gov>, "Reynolds, Thomas" <Reynolds.Thomas@epa.gov>
Subject: OTAQ In the News

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Below is a summary of stakeholder statements gathered so far, as well as coverage from the Washington Post. Many thanks to our outstanding communications team who once again put together a great roll-out despite the usual dynamic EPA environment.

-Chris

Industry/ Business

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Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

"Aviation is a global industry, making it critical that aircraft emissions standards continue

to be agreed upon at the international level," Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. "While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft."

The EPA's move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it's adequate. "Typically what ICAO does is a very weak standard," adds Margo Oge, former director of the EPA's Office of Transportation and Air Quality, and author of the book "Driving the Future: Combating Climate Change with Cleaner, Smarter Cars." "Aircraft are the least-regulated source of transportation when it comes to emissions."

But the EPA's Christopher Grundler, head of the agency's Office of Transportation and Air Quality, defended the international approach Wednesday, observing that "an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction."

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective:

“whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs.”

“The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines,” said the National Association of Clean Air Agencies’ Becker.

But the EPA did suggest that it could go further than the ICAO standards do. “Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO,” the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

“Automation would mean more efficient routing, and particularly less time spent going up and down as you’re coming to land,” said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Grundler, Christopher[grundler.christopher@epa.gov]
From: Williams, Melina
Sent: Thur 6/11/2015 1:33:14 PM
Subject: RE: OTAQ In the News

Chris,

No worries; thanks for forwarding this one and Janet's message. It's been a real pleasure working with the smart and dedicated folks in OTAQ and OAP on this package.

Melina

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

The contents of this e-mail and any attachments to it may contain deliberative-process, attorney-client, attorney work product, or otherwise privileged material. Do not distribute outside of EPA or DOJ.

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 11:20 PM
To: Williams, Melina
Subject: Fwd: OTAQ In the News

Melina

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Chris

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. EPA

202-564-1682 (DC)

734-214-4207 (Ann Arbor)

Begin forwarded message:

From: "Grundler, Christopher" <grundler.christopher@epa.gov>
Date: June 10, 2015 at 6:04:03 PM EDT
To: OAR-OTAQ <OAROTAQ@epa.gov>
Cc: "Dunham, Sarah" <Dunham.Sarah@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>, "Birnbaum, Rona" <Birnbaum.Rona@epa.gov>, "DeAngelo, Ben" <DeAngelo.Ben@epa.gov>, "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>, "McCabe, Janet" <McCabe.Janet@epa.gov>, "Millett, John" <Millett.John@epa.gov>, "StClair, Christie" <StClair.Christie@epa.gov>, "Purchia, Liz" <Purchia.Liz@epa.gov>, "Reynolds, Thomas" <Reynolds.Thomas@epa.gov>
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Washington Post:

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EPA moves toward limits on emissions from U.S. airlines

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By Chris Mooney June 10 at 3:11 PM

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To: Grundler, Christopher[grundler.christopher@epa.gov]
From: Gunning, Paul
Sent: Thur 6/11/2015 12:22:14 PM
Subject: FW: OTAQ In the News

Great note Chris. Thanks for sending this!

Paul

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 6:04 PM
To: OAR-OTAQ
Cc: Dunham, Sarah; Gunning, Paul; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley; McCabe, Janet; Millett, John; StClair, Christie; Purchia, Liz; Reynolds, Thomas
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[Press Release, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies. [Statement, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"With today's announcement, President Obama has a unique and extremely important opportunity to demonstrate leadership not only domestically but around the world." [Statement, 6/10/2015]

Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective

of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

“Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level,” Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. “While we believe that any regulatory action must be consistent with both the agency’s authority under the Clean Air Act and the future ICAO standard, today’s action reconfirms the EPA’s commitment to the ICAO process for achieving a global CO2 standard for new aircraft.”

The EPA’s move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

“This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled,” said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it’s adequate. “Typically what ICAO does is a very weak standard,” adds Margo Oge, former director of the EPA’s Office of Transportation and Air Quality, and author of the book “Driving the Future: Combating Climate Change with Cleaner, Smarter Cars.” “Aircraft are the least-regulated source of transportation when it comes to emissions.”

But the EPA’s Christopher Grundler, head of the agency’s Office of Transportation and Air Quality, defended the international approach Wednesday, observing that “an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction.”

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective: “whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs.”

“The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines,” said the National Association of Clean Air Agencies’ Becker.

But the EPA did suggest that it could go further than the ICAO standards do. “Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO,” the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

“Automation would mean more efficient routing, and particularly less time spent going up and down as you’re coming to land,” said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Grundler, Christopher[grundler.christopher@epa.gov]
Cc: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Sutton, Tia
Sent: Thur 6/11/2015 2:25:38 AM
Subject: Re: OTAQ In the News

Thanks, Chris!

On Jun 10, 2015, at 10:14 PM, Grundler, Christopher <grundler.christopher@epa.gov> wrote:

Thx. I got Mike. Did not know the others will do. Thx Tia

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. EPA
202-564-1682 (DC)
734-214-4207 (Ann Arbor)

On Jun 10, 2015, at 9:39 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

Chris, Tia correctly notes that David Orlin, Mike thrift, and Melina Williams, all in OGC, ought to be in your note too. You may want to send a quick note to them.

On Jun 10, 2015, at 6:04 PM, Grundler, Christopher <grundler.christopher@epa.gov> wrote:

Dear Colleagues

Today we reached an important milestone on our journey to address greenhouse gas emissions from aviation, a journey which began in a very cold Montreal, Canada (Matt Spears and I were there!) in 2010. Since that time, first under the leadership of Matt, and now with the leadership of Mike Samulski, we have been actively engaged in an international process that has established for the first time metrics and test procedures for CO2 from aircraft, and is now considering the stringency, timing, and applicability of standards. This process is happening at a specialized United Nations Agency, the International Civil Aviation Organization.

Aircraft account for 11% of U.S. transportation emissions, and 29% of global transport emissions, and are growing fast. Our Agency took the first step in establishing possible emissions standards for aircraft by announcing a proposed endangerment finding under the Clean Air Act. If the Administrator makes a final determination next spring that emissions from aircraft endanger public health and welfare, EPA has a duty to establish emission standards for aircraft engines. Today we also issued an Advanced Notice of Proposed Rulemaking that describes the ongoing international standard-setting process, and seeks public input to the decisions that will be made over the coming year. Mike and his team will be working hard, alongside our colleagues at the FAA, to make sure ICAO adopts a meaningful standard, one that achieves emission reductions beyond business as usual.

The announcement today is also the culmination of tremendous teamwork between OTAQ and the Office of Atmospheric Programs, where the EPA experts on the complex science of climate change do their heroic work. Rona Birnbaum and her team led the work to update their historic 2009 Endangerment finding, the finding that set the course for the light and heavy duty greenhouse gas standards that we are busy implementing now.

I want to thank the OTAQ-OAP Aviation team for their hard work, patience, and persistence. Working in an international forum is time-consuming, frustrating, and painfully slow. This is the nature of environmental diplomacy. But the rewards are great for those that can endure, as the results have such far-reaching impacts. I am confident that Mike and our team will.

Below is a summary of stakeholder statements gathered so far, as well as coverage from the Washington Post. Many thanks to our outstanding communications team who once again put together a great roll-out despite the usual dynamic EPA environment.

-Chris

Industry/ Business

Airlines for America | Nancy Young, Vice President, Environmental Affairs

"While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft." [Press release, 6/10/2015]

Environmental/Non-Profit Association

Environment America | Anna Aurilio, Director

"President Obama clearly views climate action as a priority, while polluters and their allies in Congress clearly view stopping climate action a priority. Since today's announcement will likely cause a fight in Congress, we hope the president makes this a fight worth having by requiring real cuts in airplane pollution. Bold action on climate should solve the problem of pollution from airplanes, not just acknowledge it." [Press Release, 6/10/2015]

Earth Justice | Sarah Burt, Attorney

"We commend EPA for completing this important first step in regulating carbon pollution from airplanes, but unfortunately, given the magnitude of aircraft's contribution to climate change, the tentative approach that EPA is considering is not up to the task. The EPA's Endangerment Finding confirms that aircraft are a significant source of climate pollution, emitting approximately 700 million metric tonnes per year. This makes global aviation, if it were equivalent to a country, the 7th largest global emitter, just below Germany and more than Korea and Canada. Instead of using its Clean Air Act authority to reduce these harmful emissions, EPA proposes to follow the lead of the International Civil Aviation Organization and set a 'business-as-usual' standard that will lock in emissions increases for decades to come. We strongly urge EPA to reconsider and to fulfill its Clean Air Act obligations by proposing a rule that accomplishes meaningful reductions in pollution from aircraft. The International Civil Aviation Organization's standard won't deliver substantial reductions because they are setting a standard that

90–95% of aircraft already meet. It won't apply it to existing aircraft, which have 20–30 year lifespan—only to new designs, which would push back the phase-in even more. The U.S. share of the problem is considerable, and a more robust U.S. action could help ratchet up the international standard." [Press Release, 6/10/2015]

Sierra Club | Joanne Spalding, Attorney

"President Obama is taking an important step on climate once again by finding that carbon pollution from airplanes poses the same danger to our climate as carbon pollution from other sources. This finding paves the way for action next year to create safeguards that will result in more efficient airplanes which pollute less while saving airlines and air travelers money on fuel costs. This commonsense finding comes in the context of the momentum building for international negotiations to tackle the climate crisis this year in Paris. The United States will soon be in a position to effectively curb carbon pollution from its biggest sources, whether from cars, trucks, planes, or the electric sector."

[Press Release, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

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“Automation would mean more efficient routing, and particularly less time spent going up and down as you’re coming to land,” said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Grundler, Christopher[grundler.christopher@epa.gov]
From: Hengst, Benjamin
Sent: Wed 11/11/2015 11:37:39 AM
Subject: Fwd: Canada climate and energy coordination
Transportation Collaboration paper for WH 11_2015.docx
ATT00001.htm

Here's the ICAO piece (I believe this is the one Janet refers to). It's pretty tame.

Begin forwarded message:

From: "Blubaugh, Jim" <Blubaugh.Jim@epa.gov>
Date: November 10, 2015 at 1:29:50 PM EST
To: "Niebling, William" <Niebling.William@epa.gov>, "Harnett, Bill" <Harnett.Bill@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>, "Krieger, Jackie" <Krieger.Jackie@epa.gov>, "Evarts, Dale" <Evarts.Dale@epa.gov>, "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>, "Tsirigotis, Peter" <Tsirigotis.Peter@epa.gov>, "Shoaff, John" <Shoaff.John@epa.gov>
Cc: "LeFranc, Maurice" <LeFranc.Maurice@epa.gov>, "Goffman, Joseph" <Goffman.Joseph@epa.gov>, "Cyran, Carissa" <Cyran.Carissa@epa.gov>
Subject: RE: Canada climate and energy coordination

William,

I have attached info describing OTAQ's work at ICAO, the ongoing transportation program collaboration and VW collaboration with Canada.

Thanks,

Jim

Jim Blubaugh, Director

International Programs

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

(202) 564-5403

From: Niebling, William
Sent: Monday, November 09, 2015 2:44 PM
To: Harnett, Bill <Harnett.Bill@epa.gov>; Gunning, Paul <Gunning.Paul@epa.gov>; Krieger, Jackie <Krieger.Jackie@epa.gov>; Evarts, Dale <Evarts.Dale@epa.gov>; Blubaugh, Jim <Blubaugh.Jim@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Tsirigotis, Peter <Tsirigotis.Peter@epa.gov>; Shoaff, John <Shoaff.John@epa.gov>
Cc: LeFranc, Maurice <LeFranc.Maurice@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Cyran, Carissa <Cyran.Carissa@epa.gov>
Subject: FW: Canada climate and energy coordination

Hi folks – I'm trying to get more information from Mark about deadline, agenda, anything, but in the meantime wanted to get you started as whatever deadline we get will be sooner than we wish.

Ex. 5 - Deliberative Process

Unfortunately, I don't know the timing yet, but I think it is reasonably likely that we'll be asked to get this to the third floor sometime tomorrow, so assume a short fuse. I will update you as I learn more.

Thanks!

-Wm.

From: Kasman, Mark
Sent: Monday, November 09, 2015 2:14 PM
To: Niebling, William <Niebling.William@epa.gov>
Subject: FW: Canada climate and energy coordination

Hi William,

Looks like we will need to get a quick turnaround to put together a briefing note for the Administrator to prepare Brian Deese for his climate/energy mission to Ottawa later this week. I believe that most of the equities will be yours, though we do have a point or two to raise here. Can you get some quick points together?

Thanks, Mark

Mark S. Kasman

Director

Office of Regional and Bilateral Affairs

Office of International and Tribal Affairs

U.S. Environmental Protection Agency

1300 Pennsylvania Avenue, N.W. (2650R)

Washington, D.C. 20460

202-564-2024

From: Nishida, Jane
Sent: Monday, November 09, 2015 12:28 PM
To: Kasman, Mark <Kasman.Mark@epa.gov>
Subject: FW: Canada climate and energy coordination

Can you coordinate with OAR/William to develop EPA's briefing paper, thanks.

From: Adm13McCarthy, Gina
Sent: Monday, November 09, 2015 12:19 PM
To: Nishida, Jane <Nishida.Jane@epa.gov>
Subject: Fwd: Canada climate and energy coordination

Jane we will need to scramble a bit in this. Sorry.

Sent from my iPhone

Begin forwarded message:

From: "Deese, Brian C. EOP/WHO" Ex. 6 - Personal Privacy
Date: November 9, 2015 at 6:49:06 AM CST
To: '"Adm13McCarthy.Gina@epa.gov"' <Adm13McCarthy.Gina@epa.gov>, '"monizej@hq.doe.gov"' <monizej@hq.doe.gov>, '"SternTD@state.gov"' <SternTD@state.gov>, '"FinerJJ@state.gov"' <FinerJJ@state.gov>, '"HigginbottomHA@state.gov"' <HigginbottomHA@state.gov>, "Duke, Rick EOP/CEQ" Ex. 6 - Personal Privacy "Utech, Dan G. EOP/WHO" Ex. 6 - Personal Privacy "Atkinson, Caroline M. EOP/WHO" gov>
Cc: "Rosenbaum, Amy D. EOP/WHO" Ex. 6 - Personal Privacy "Bodnar, Paul N. EOP/NSC" <[redacted]gov>, "Hornung, Daniel Z. EOP/WHO" <[redacted]>, Haines, Avril D. EOP/NSC" Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy Hoover, Zealan T. EOP/WHO" Ex. 6 - Personal Privacy y>

Subject: Canada climate and energy coordination

Folks:

Coming out of the President's call with PM Trudeau last week, I will be traveling up to Ottawa this coming Friday to meet with the PM's climate and energy team.

Ex. 5 - Deliberative Process

I want to make sure I fairly represent everyone's equities here. I will find a time to get us on the phone briefly to check signals but in advance if you can have your folks flag issues you'd like me to raise I'd appreciate it.

Thanks, Brian

To: Charmley, William[charmley.william@epa.gov]; Grundler, Christopher[grundler.christopher@epa.gov]
From: Hengst, Benjamin
Sent: Thur 6/22/2017 1:54:04 PM
Subject: RE: Questions regarding the GHG Emissions for aircraft

Good to see that email—I must have missed that one.

I agree it's worth raising with her today

From: Charmley, William
Sent: Wednesday, June 21, 2017 5:14 PM
To: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>
Subject: FW: Questions regarding the GHG Emissions for aircraft

In the email below from Leif Hockstad on June 1, Leif relayed to Mike Samulski comments from Sarah Dunham on the EPA written response to the questions we received from the SAB on the two aircraft analysis we have planned on having peer reviewed.

We incorporated/addressed both of Sarah's comments.

Ex. 5 - Deliberative Process

Thanks

Bill

From: Samulski, Michael
Sent: Thursday, June 01, 2017 11:30 AM
To: Hockstad, Leif <Hockstad.Leif@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

I don't have any concerns with accepting Sarah's comment on the first question.

With respect to the peer review timing. We could replace "summer" with "later this year" given that we still need to complete the documents… just to be safe.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 01, 2017 11:21 AM
To: Samulski, Michael <samulski.michael@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Hello, some feedback from the OAR IO review of the SAB Work Group responses.

Sarah Dunham reviewed the draft responses. There was some concern expressed about the first question's response. Her suggestion is to replace the first question response with "We do not yet have a schedule identified for this action."

Ex. 5 - Deliberative Process

Please let me know if you can accept the suggested edit from the first comment. And also if the second comment makes sense with your current timelines.

Thanks,

Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Hockstad, Leif
Sent: Thursday, June 1, 2017 8:43:09 AM
To: Samulski, Michael
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: Re: Questions regarding the GHG Emissions for aircraft

Mike -

Thank you for providing the responses in such a short timeline. I will coordinate a review of them by the OAR IO before sending them to our SAB Work Group contact.

If we provide written responses then there is not an immediate need for today's 1:00pm teleconference. The EPA contact on SAB reminded me that the teleconference provides an opportunity for a private conversation with the SAB Work Group on their questions if we want to clarify any points. But I can tell our SAB contact to cancel the teleconference if you think it is unnecessary.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Samulski, Michael
Sent: Thursday, June 1, 2017 8:34:33 AM
To: Hockstad, Leif
Cc: Charmley, William; Hengst, Benjamin; Manning, Bryan; Audette, Lucie; Sargeant, Kathryn
Subject: RE: Questions regarding the GHG Emissions for aircraft

Leif,

Here are our responses to the questions from the SAB workgroup. Please let me know if you have any questions.

To be clear, does this written response remove the need for a 1:00 teleconference today?

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hockstad, Leif
Sent: Friday, May 26, 2017 9:13 AM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Kathryn –

Ex. 5 - Deliberative Process

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Sargeant, Kathryn
Sent: Friday, May 26, 2017 7:51 AM
To: Hockstad, Leif <Hockstad.Leif@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>; Charmley, William <charmley.william@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Questions regarding the GHG Emissions for aircraft

Thanks, Leif. We would prefer to provide written responses. Does that obviate the need for a conference call? I see that Tom refers to us needing to be available for clarifications on the conference call. If that is the case, what is the timeframe in which we need to have responses back to OAR (for transmittal to SAB)? It seems like June 1 could be aggressive timing for us to prepare written responses and get them to SAB for them to further consider and discuss on a conference call. If it were possible to have any clarification questions be handled in writing also (and only have a conference call if it seems necessary based on the questions), that might be most efficient.

From: Hockstad, Leif
Sent: Thursday, May 25, 2017 1:53 PM
To: Sargeant, Kathryn <sargeant.kathryn@epa.gov>
Cc: Shoaff, John <Shoaff.John@epa.gov>; Mazza, Carl <Mazza.Carl@epa.gov>
Subject: Fw: Questions regarding the GHG Emissions for aircraft

Kathryn -

Attached and included in Tom's email below are the SAB Work Group's questions on the aircraft GHG action.

Please note he is flexible on whether you all would prefer to discuss the questions on the conference call next Thursday or prefer to provide written responses.

Please let us know what you think and what we can do to support OTAQ's engagement with the SAB.

Thanks,
Leif

****

Leif Hockstad

Office of Air and Radiation - OAPPS

U.S. Environmental Protection Agency

Phone: 202 343 9432

hockstad.leif@epa.gov

****

From: Carpenter, Thomas
Sent: Thursday, May 25, 2017 11:26 AM
To: Shoaff, John
Cc: Mazza, Carl; Hockstad, Leif
Subject: Questions regarding the GHG Emissions for aircraft

John

Pasted in below and attached are the questions from the Work Group on the issues we have discussed on the Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26). I polled the Work Group looking for availability and have scheduled a teleconference for June 1, 2017 from 1- 2:30 pm.

Please let me know if the Office of Air prefers to discuss the questions on the teleconference or provide written responses and be available for any clarifications on the teleconference.

Ex. 5 - Deliberative Process

Best

Tom

Science Advisory Board Work Group's Fact-finding Questions on

EPA Planned Actions in the Fall 2016 Regulatory Agenda

The Work Group notes that the planned action Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) will require coordination with the Federal Aviation Administration and work within the standard-setting process of the International Civil Aviation Organization. Can the EPA elaborate on their portion

of the schedule for the planned action that allows FAA to meet the ICAO deadlines?

Has the agency initiated the peer review of the two documents, the “technical report documenting the assumptions, data sources, and methods for the aircraft GHG inventory” and the “Cost Analysis of CO2- Reducing Technologies for Aircraft” and are the documents available?

Is there additional information the EPA can provide on the planned peer reviews at this time:

- What is the anticipated schedule for each review;

- Are the two documents being reviewed separately by two different panels or will the reviewers be aware of peer review comments on both documents;

- Will the reviewers be different for each report, or will some reviewers review both reports;

- Did the agency consider conducting a panel review rather than a letter review; and

- If initiated, when will the peer review report be available?

Has the agency considered expanding the number of members participating in the peer reviews (i.e., increasing the number of reviewers to address the complexity and disciplines needed)?

Does the EPA plan on posting on its website or including in the docket for the proposed Control of Air Pollution from Aircraft and Aircraft Engines: Proposed GHG Emissions Standards and Test Procedures (2060-AT26) the final peer review reports and disposition of the peer review comments?

To: Soth, Judith[Soth.Judith@epa.gov]
From: Grundler, Christopher
Sent: Fri 10/30/2015 3:52:09 PM
Subject: Fwd: final materials for ICAO brfing
CAEP 10 WP XX US CO2 Stringency_ 23 October EPA + FAA.docx
ATT00001.htm
ICAO Aircraft CO2 Std_Gina briefing 10-30-15.pptx
ATT00002.htm

Pls print ppt in color. Thx

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (Washington)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

Begin forwarded message:

From: "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>
Date: October 30, 2015 at 11:43:50 AM EDT
To: "Grundler, Christopher" <grundler.christopher@epa.gov>
Cc: "Manning, Bryan" <manning.bryan@epa.gov>, "Audette, Lucie" <audette.lucie@epa.gov>, "Samulski, Michael" <samulski.michael@epa.gov>
Subject: final materials for ICAO brfing

Chris –

See attached. Both of these were in Gina's book last night.

I'm assuming **Mike**, or someone else he designates, will be doing the briefing.

We learned yesterday that Janet will be calling in from the road, as the meeting time is now 3:30.

Also, here are the opening TPs Mike drafted for your use in the meeting (based on our prebrief with Janet yesterday):

Talking Points for Chris to Introduce Aircraft Briefing to Gina

Ex. 5 - Deliberative Process

•□□□□□□□□ At this time, we want to talk to you about what is in the draft paper

o Note that the US industry and NGOs (ICCT) will have a chance to see it as part of the Interagency Group on International Aviation (IGIA) process used for US positions conveyed to ICAO

To: Curtis, Rhonda[Curtis.Rhonda@epa.gov]
From: Grundler, Christopher
Sent: Wed 7/8/2015 3:51:53 PM
Subject: Fwd: ICAO documents for your review
FAA-EPA CO2 Standard briefing_7July2015_clean.docx
ATT00001.htm
Janet TPs for July 9 Utech_Duke Meeting v2.docx
ATT00002.htm

Pls print

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. EPA
202-564-1682 (DC)
734-214-4207 (Ann Arbor)

Begin forwarded message:

From: "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>
Date: July 8, 2015 at 11:41:47 AM EDT
To: "Grundler, Christopher" <grundler.christopher@epa.gov>
Cc: "Charmley, William" <charmley.william@epa.gov>
Subject: ICAO documents for your review

Chris—I'm attaching two documents:

Ex. 5 - Deliberative Process

We will need to send the talkers to Janet's office by 4pm tonight.

Thanks,

Ben

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Grundler, Christopher
Sent: Tue 2/16/2016 10:52:30 PM
Subject: Re: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

That all makes sense. Ex. 5 - Deliberative Process

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (Washington)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

On Feb 16, 2016, at 5:46 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

Ex. 5 - Deliberative Process

However I recognize I didn't fill you in on this from last week -- my bad. I will call you tomorrow to discuss

On Feb 16, 2016, at 5:41 PM, Grundler, Christopher <grundler.christopher@epa.gov> wrote:

Ex. 5 - Deliberative Process A

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (Washington)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

On Feb 16, 2016, at 5:33 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

Janet -- just confirming that both OTAQ and OP will be attending/calling into this meeting (OIRA, OMB on ICAO stds). Thanks, Ben

Begin forwarded message:

From: "Whiteman, Chad" Ex. 6 - Personal Privacy
Date: February 16, 2016 at 4:10:01 PM EST
To: "Ralph.Iovinelli@faa.gov" <Ralph.Iovinelli@faa.gov>, "Vahlsing, Candace" < Ex. 6 - Personal Privacy Welsh, Kevin" < Ex. 6 - Personal Privacy "Lourdes.Maurice@faa.gov" <Lourdes.Maurice@faa.gov>, "samulski.michael@epa.gov" <samulski.michael@epa.gov>, "manning.bryan@epa.gov" <manning.bryan@epa.gov>, "McCabe.Janet@epa.gov" <McCabe.Janet@epa.gov>, "Utech, Dan G." Ex. 6 - Personal Privacy >, "Duke, Rick" < Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy , "Zaidi, Ali" Ex. 6 - Personal Privacy , "Bodnar, Paul" < Ex. 6 - Personal Privacy , "Hengst.Benjamin@epa.gov" <Hengst.Benjamin@epa.gov>, "charmley.william@epa.gov" <charmley.william@epa.gov>, "LeFranc.Maurice@epa.gov" <LeFranc.Maurice@epa.gov>, "Rich.Swayze@faa.gov" <Rich.Swayze@faa.gov>, "carl.burleson@faa.gov" <carl.burleson@faa.gov>, "shoshana.lew@dot.gov" <shoshana.lew@dot.gov>, "Atkinson.Emily@epa.gov" <Atkinson.Emily@epa.gov>, "Davidson.Ken@epa.gov" <Davidson.Ken@epa.gov>, "Leggett.Cullen@epa.gov" <Leggett.Cullen@epa.gov>
Cc: "Mohtadi, Shara" Ex. 6 - Personal Privacy "Arthur.Rypinski@dot.gov" <Arthur.Rypinski@dot.gov>, "Golden, Robert" < Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy >, WH Energy and Climate Change Ex. 6 - Personal Privacy , "Laszlo.Windhoffer@faa.gov" <Laszlo.Windhoffer@faa.gov>, "maryalice.locke@faa.gov" <maryalice.locke@faa.gov>, "curtis.holsclaw@faa.gov" <curtis.holsclaw@faa.gov>
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Hi Ralph,

We have reserved Conference Room 1 over here at 1800 G Street (9th Floor) for the meeting. No clearance information is required to enter our building. We have space for quite a few people in that conference room.

Regards,

Chad

Chad Whiteman

Policy Analyst | Office of Information and Regulatory Affairs

Office of Management and Budget | Executive Office of the President

Ex. 6 - Personal Privacy

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Tuesday, February 16, 2016 3:59 PM
To: Vahlsing, Candace [Ex. 6 - Personal Privacy]; Welsh, Kevin [Ex. 6 - Personal Privacy] Lourdes.Maurice@faa.gov; samulski.michael@epa.gov; manning.bryan@epa.gov; McCabe.Janet@epa.gov; Utech, Dan G. [Ex. 6 - Personal Privacy] Duke, Rick [Ex. 6 - Personal Privacy]; Zaidi, Ali [Ex. 6 - Personal Privacy] Bodnar, Paul [Ex. 6 - Personal Privacy]; Hengst.Benjamin@epa.gov; charmley.william@epa.gov; LeFranc.Maurice@epa.gov; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson.Emily@epa.gov; Whiteman, Chad <[Ex. 6 - Personal Privacy] Davidson.Ken@epa.gov; Leggett.Cullen@epa.gov
Cc: Mohtadi, Shara [Ex. 6 - Personal Privacy]; Arthur.Rypinski@dot.gov; Golden, Robert <[Ex. 6 - Personal Privacy] WH Energy and Climate Change <[Ex. 6 - Personal Privacy]>; Laszlo.Windhoffer@faa.gov; maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

Several folks from out of town have requested a WebEx/telecon line for this meeting. Here is the information:

US toll-free call in and passcode [Ex. 6 - Personal Privacy]

WEBEX

- Go to website >https://www.connectmeeting.att.com<
- Enter meeting number [Ex. 6 - Personal Privacy]
- Enter access code [Ex. 6 - Personal Privacy]
- Enter user email

- Enter user first/last name
- (next screen)
- Select "Participant" and click submit
- Website will automatically run Webex files and open meeting; host can view documents and chat/raise hand

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Iovinelli, Ralph (FAA)
Sent: Friday, January 29, 2016 5:43 PM
To: 'Vahlsing, Candace M. EOP/WHO'; Welsh, Kevin W. EOP/NSC; Maurice, Lourdes (FAA); 'Samulski, Michael'; Manning, Bryan; McCabe.Janet@epa.gov; Utech, Dan G. EOP/WHO; Duke, Rick EOP/CEQ; Zaidi, Ali A. EOP/OMB; Bodnar, Paul N. EOP/NSC; Hengst, Benjamin; Charmley, William; LeFranc, Maurice; Swayze, Rich (FAA); Burleson, Carl (FAA); Lew, Shoshana (OST); Atkinson, Emily; 'Whiteman, Chad'
Cc: Mohtadi, Shara Z. EOP/OMB; Rypinski, Arthur (OST); Golden, Robert E.

EOP/WHO; WH Energy and Climate Change; Windhoffer, Laszlo (FAA); Locke, Maryalice (FAA); Holsclaw, Curtis (FAA)
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

First, please pass this invitation to those I missed.

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

The objective of this meeting is to determine the most efficient way to support the domestic rulemaking process of the aircraft CO2 emission standard, with specific attention to the cost benefits analysis completed for the ICAO international aircraft CO2 emissions standard.

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Please do not hesitate to contact Chad Whiteman **Ex. 6 - Personal Privacy** **Ex. 6 - Personal Privacy**) or myself with questions.

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

To: McCabe, Janet[McCabe.Janet@epa.gov]
From: Grundler, Christopher
Sent: Wed 6/10/2015 10:11:25 PM
Subject: RE: OTAQ In the News

Ja. Not thrilled

From: McCabe, Janet
Sent: Wednesday, June 10, 2015 6:07 PM
To: Grundler, Christopher
Subject: RE: OTAQ In the News

Nice.

You and Margo, together again in the WaPo.

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 6:04 PM
To: OAR-OTAQ
Cc: Dunham, Sarah; Gunning, Paul; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley; McCabe, Janet; Millett, John; StClair, Christie; Purchia, Liz; Reynolds, Thomas
Subject: OTAQ In the News

Dear Colleagues

Today we reached an important milestone on our journey to address greenhouse gas emissions from aviation, a journey which began in a very cold Montreal, Canada (Matt Spears and I were there!) in 2010. Since that time, first under the leadership of Matt, and now with the leadership of Mike Samulski, we have been actively engaged in an international process that has established for the first time metrics and test procedures for CO2 from aircraft, and is now considering the stringency, timing, and applicability of standards. This process is happening at a specialized United Nations Agency, the International Civil Aviation Organization.

Aircraft account for 11% of U.S. transportation emissions, and 29% of global transport emissions, and are growing fast. Our Agency took the first step in establishing possible emissions standards for aircraft by announcing a proposed endangerment finding under the Clean Air Act. If the Administrator makes a final determination next spring that emissions from aircraft endanger public health and welfare, EPA has a duty to establish emission standards for aircraft engines. Today we also issued an Advanced Notice of Proposed Rulemaking that describes the ongoing international standard-setting process, and seeks public input to the decisions that will be made over the coming year. Mike and his team will be working hard, alongside our colleagues at the FAA, to make sure ICAO adopts a meaningful standard, one that achieves emission reductions beyond business as usual.

The announcement today is also the culmination of tremendous teamwork between OTAQ and the Office of Atmospheric Programs, where the EPA experts on the complex science of climate change do their heroic work. Rona Birnbaum and her team led the work to update their historic 2009 Endangerment finding, the finding that set the course for the light and heavy duty greenhouse gas standards that we are busy implementing now.

I want to thank the OTAQ-OAP Aviation team for their hard work, patience, and persistence. Working in an international forum is time-consuming, frustrating, and painfully slow. This is the nature of environmental diplomacy. But the rewards are great for those that can endure, as the results have such far-reaching impacts. I am confident that Mike and our team will.

Below is a summary of stakeholder statements gathered so far, as well as coverage from the Washington Post. Many thanks to our outstanding communications team who once again put together a great roll-out despite the usual dynamic EPA environment.

-Chris

Industry/ Business

Airlines for America | Nancy Young, Vice President, Environmental Affairs

"While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft." [Press release, 6/10/2015]

Environmental/Non-Profit Association

Environment America | Anna Aurilio, Director

"President Obama clearly views climate action as a priority, while polluters and their allies in Congress clearly view stopping climate action a priority. Since today's announcement will likely cause a fight in Congress, we hope the president makes this a fight worth having by requiring real cuts in airplane pollution. Bold action on climate should solve the problem of pollution from airplanes, not just acknowledge it." [Press Release, 6/10/2015]

Earth Justice | Sarah Burt, Attorney

"We commend EPA for completing this important first step in regulating carbon pollution from airplanes, but unfortunately, given the magnitude of aircraft's contribution to climate change, the tentative approach that EPA is considering is not up to the task. The EPA's Endangerment Finding confirms that aircraft are a significant source of climate pollution, emitting approximately 700 million metric tonnes per year. This makes global aviation, if it were equivalent to a country, the 7th largest global emitter, just below Germany and more than Korea and Canada. Instead of using its Clean Air Act authority to reduce these harmful emissions, EPA proposes to follow the lead of the International Civil Aviation Organization and set a 'business-as-usual' standard that will lock in emissions increases for decades to come. We strongly urge EPA to reconsider and to fulfill its Clean Air Act obligations by proposing a rule that accomplishes meaningful reductions in pollution from aircraft. The International Civil Aviation Organization's standard won't deliver substantial reductions because they are setting a standard that 90–95% of aircraft already meet. It won't apply it to existing aircraft, which have 20–30 year lifespan—only to new designs, which would push back the phase-in even more. The U.S. share of the problem is considerable, and a more robust U.S. action could help ratchet up the international standard." [Press Release, 6/10/2015]

Sierra Club | Joanne Spalding, Attorney

"President Obama is taking an important step on climate once again by finding that carbon pollution from airplanes poses the same danger to our climate as carbon pollution from other sources. This finding paves the way for action next year to create safeguards that will result in more efficient airplanes which pollute less while saving airlines and air travelers money on fuel costs. This commonsense finding comes in the context of the momentum building for international negotiations to tackle the climate crisis this year in Paris. The United States will soon be in a position to effectively curb carbon pollution from its biggest sources, whether from cars, trucks, planes, or the electric sector."

[Press Release, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies. [Statement, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"With today's announcement, President Obama has a unique and extremely important opportunity to demonstrate leadership not only domestically but around the world." [Statement, 6/10/2015]

Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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Resize Text Print Article Comments 18

By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

"Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level," Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. "While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft."

The EPA's move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it's adequate. "Typically what ICAO does is a very weak standard," adds Margo Oge, former director of the EPA's Office of Transportation and Air Quality, and author of the book "Driving the Future: Combating Climate Change with Cleaner, Smarter Cars." "Aircraft are the least-regulated source of transportation when it comes to emissions."

But the EPA's Christopher Grundler, head of the agency's Office of Transportation and Air

Quality, defended the international approach Wednesday, observing that "an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction."

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective: "whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs."

"The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines," said the National Association of Clean Air Agencies' Becker.

But the EPA did suggest that it could go further than the ICAO standards do. "Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO," the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

"Automation would mean more efficient routing, and particularly less time spent going up and down as you're coming to land," said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Birgfeld, Erin[Birgfeld.Erin@epa.gov]
From: Grundler, Christopher
Sent: Wed 6/10/2015 9:13:10 PM
Subject: RE: OTAQ in the News: First steps on taking action to address GHG emissions from aircraft engines.

Thanks. I will send

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 5:09 PM
To: Grundler, Christopher
Subject: OTAQ in the News: First steps on taking action to address GHG emissions from aircraft engines.

Hi Chris,

Here is a crack at the OTAQ in the news for today's announcement. I was writing in your voice thinking that you could send, but let me know if you want me to(I will tweak appropriately).

I chose the AP article because it was quite accurate, and WP because we get a two-fer, both you and Margo Oge quoted. You may not approve of my choices so take a quick look.

Thanks,

Erin

Dear OTAQ,

Today was another good day for the environment.

After a few fits and starts, we successfully released the proposed endangerment finding under the Clean Air Act that would give EPA the authority to limit GHG emission from aircraft engines. At the same time we issued notice that sends a signal that the EPA is doing all we can to negotiate meaningful GHG emissions standards at the international level.

I want to thanks the Aviation team for their hard work so far. There is more to be done on this issue, and Iook forward to seeing this through.

Here are some clips from today's coverage.

-Chris

Associated Press:

http://www.wowktv.com/story/29287418/epa-says-it-intends-to-regulate-emissions-by-us-airliners

EPA says it intends to regulate emissions by US airliners

By JOAN LOWY Associated Press

WASHINGTON (AP) - The Obama administration proposed Wednesday to regulate aircraft emissions in much the same way as power plants, saying they are a threat to human health because they contain pollutants that help cause global warming.

Using its authority under The Clean Air Act, the Environmental Protection Agency finding of endangerment to human health clears the way for possible U.S. adoption of international emissions standards.

The International Civil Aviation Organization, or ICAO, a U.N. agency, has been working for several years on developing global aircraft emissions standards for the first time. Final agreement on those standards is expected in February of next year.

U.S. regulations would apply only to large planes like airliners and cargo jets and turboprop aircraft, and not to smaller jet aircraft, piston-engine planes, helicopters or military aircraft.

While negotiations on the standards are still underway, they aren't expected to go into effect until 2020 or afterward, and possibly as late as 2025, say environmentalists following the matter.

The ICAO standards are also not expected to apply to airliners in service today or those that might be purchased before the effective date, said Vera Pardee, an attorney with the Center for Biological Diversity. The center is one of several environmental groups that sued the EPA to force the agency to issue its finding that emissions endanger public health.

Airlines typically fly planes for 20 years or more before replacing them. That means it's likely to be decades before planes that meet the anticipated global standards are in widespread use.

Airline emissions account for about 2 percent of total annual global greenhouse gas emissions. That sounds small, but it's nearly as much as the emissions produced by Germany, the sixth-greatest greenhouse gas producing country, according to a study released last year by The International Council on Clean Transportation, an environmental group with offices in the U.S. and Germany.

Aircraft manufacturers have already made significant strides in increasing fuel efficiency. Since the early years of the jet age in the 1960s, the fuel efficiency of airliners has increased 70 percent, according to Boeing. There's plenty of incentive to be as efficient as possible: Fuel typically vies with labor as airlines' greatest expense.

The U.S. airline industry has a set a target of an average annual improvement in fuel efficiency of 1.5 percent, and so far has been successful in meeting that goal, said Nancy Young, vice

president for environmental affairs at Airlines for America, trade association for major carriers.

Alaska, Frontier and Spirit airlines were tied for most fuel-efficient U.S. airlines, the study found. The least fuel efficient was American, which operates a fleet of MD-80 airliners, an older design that is being phased out.

Changes in the operating strategies of airlines in recent years have also contributed to greater efficiency. Airlines are packing more people into fewer flights.

However, global aviation emissions are rising because there is more air travel overall. U.S. airlines, which include several of the world's largest carriers, account for about 29 percent of global airline carbon emissions if both domestic and international flights are included.

The world's two largest aircraft makers have recently introduced into service more fuel-efficient planes designed for long-distance international routes - the Boeing 787 and the Airbus A350.

Airlines, aircraft makers and the Federal Aviation Administration have also been working with biofuels companies to develop alternatives to jet fuel that could potentially reduce the aviation's industry's vulnerability to the ups and downs of oil supplies and prices, as well as reduce carbon emissions.

"We're not dragging our feet," said Tim Neale, a spokesman for Boeing. "We're hard at work on lighter airplanes, and GE is hard at work on more efficient engines. And we're working a lot of these operational issues with the carriers so they operate the planes more efficiently."

Boeing and airline industry officials say they support ICAO's effort to develop a single global standard, since airlines fly globally. But Pardee said environmentalists hope that if the ICAO standard turns out to be weak, the EPA will move forward with stronger standards for U.S. airlines.

—

Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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Resize Text Print Article Comments 18

By Chris Mooney June 10 at 3:11 PM

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The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

"Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level," Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. "While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft."

The EPA's move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it's adequate. "Typically what ICAO does is a very weak standard," adds Margo Oge, former director of the EPA's Office of Transportation and Air Quality, and author of the book "Driving the Future: Combating Climate Change with Cleaner, Smarter Cars." "Aircraft are the least-regulated source of transportation when it comes to emissions."

But the EPA's Christopher Grundler, head of the agency's Office of Transportation and Air Quality, defended the international approach Wednesday, observing that "an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction."

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective: "whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs."

"The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines," said the National Association of Clean Air Agencies' Becker.

But the EPA did suggest that it could go further than the ICAO standards do. "Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO," the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow

flights to take more fuel-efficient paths — something that NASA has been studying.

“Automation would mean more efficient routing, and particularly less time spent going up and down as you’re coming to land,” said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
Cc: Charmley, William[charmley.william@epa.gov]
From: Grundler, Christopher
Sent: Thur 4/23/2015 12:47:45 AM
Subject: Re: Aircraft: draft note for Janet

Will do

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. EPA
202-564-1682 (DC)
734-214-4207 (Ann Arbor)

On Apr 22, 2015, at 8:46 PM, Hengst, Benjamin <Hengst.Benjamin@epa.gov> wrote:

Chris--below is a note that the ASD team drafted (Bill has seen this) for you to send to Janet.

I briefly brought this up with Janet this evening so she's aware we plan on sending the passback to OMB tomorrow. Assuming you send this to Janet, you might want to copy Sarah Dunham.

(Bill--I made a few edits to Lucie's note, primarily to shorten it).

thanks,

Ben

Janet,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Airlines for America®
We Connect the World

January 9, 2015

Submitted By Email to Grundler.christopher@Epa.gov

Christopher Grundler
Director, Office of Transportation and Air Quality (OTAQ)
U.S. Environmental Protection Agency
Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

Nancy N. Young

Nancy N. Young
Vice President, Environmental Affairs

cc: Lourdes Maurice, FAA, via email Lourdes.maurice@faa.gov

[1] Besides being well-established for international standard-setting, the CAEP Terms of Reference and the ICAO/CAEP standard-setting process align well with the bases for the adoption of aircraft engine emission standards by EPA and FAA under Section 231 of the Clean Air Act.

1301 Pennsylvania Ave, NW, Suite 1100, Washington, DC 20004-1707 T: 202.626.4000 E: a4a@airlines.org W: airlines.org

To: Hengst, Benjamin[Hengst.Benjamin@epa.gov]
Cc: Samulski, Michael[samulski.michael@epa.gov]
From: Iffland, JoNell
Sent: Thur 2/5/2015 6:07:52 PM
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

I added Mike's call in number to the invitation.

JoNell L. Iffland

Assessment and Standards Division

U.S. Environmental Protection Agency

Direct ph. 734-214-4454

e-mail: iffland.jonell@epa.gov

From: Hengst, Benjamin
Sent: Wednesday, February 04, 2015 3:45 PM
To: Iffland, JoNell
Cc: Samulski, Michael
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Hi JoNell—it now looks like the odds of my being able to make it that day are slim. Can you please keep me on the invite? If I end up being able to join, I'll just join by phone, so perhaps you can just send me the conference line (or room phone line). Thank you. Ben

From: Iffland, JoNell
Sent: Wednesday, February 04, 2015 3:40 PM
To: Hengst, Benjamin
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

If you could reserve the room you need that would be great. I will make sure that video on our end is available.

Thanks,

JoNell L. Iffland

Assessment and Standards Division

U.S. Environmental Protection Agency

Direct ph. 734-214-4454

e-mail: iffland.jonell@epa.gov

From: Hengst, Benjamin
Sent: Saturday, January 31, 2015 8:09 AM
To: Iffland, JoNell
Subject: Re: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Video if possible; I can reserve 6524. thanks

From: Iffland, JoNell
Sent: Thursday, January 29, 2015 10:53 AM
To: Hengst, Benjamin
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Ben

I sent you an invitation for this meeting. Do you want to tie in via video or conference call?

Thanks,

JoNell L. Iffland

Assessment and Standards Division

U.S. Environmental Protection Agency

Direct ph. 734-214-4454

e-mail: iffland.jonell@epa.gov

From: Samulski, Michael
Sent: Thursday, January 22, 2015 10:29 AM
To: Iffland, JoNell
Cc: Charmley, William
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

JoNell,

When Bill sets this meeting up with Nancy Young, Ben is asking if he can tie in.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Hengst, Benjamin
Sent: Wednesday, January 14, 2015 12:04 PM
To: Samulski, Michael
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Mike—when you schedule this, do you mind if I sit in? I'd appreciate hearing the context. Ben

From: Grundler, Christopher
Sent: Wednesday, January 14, 2015 11:57 AM
To: Charmley, William
Cc: Hengst, Benjamin; Stewart, Gwen; Samulski, Michael
Subject: Re: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Thanks Bill. It's all yours

Sent from my iPhone

On Jan 14, 2015, at 11:41 AM, Charmley, William <charmley.william@epa.gov> wrote:

Chris (and Ben)

I would be fine taking this meeting that has been requested by Nancy Young at Airlines for America.

Her letter indicates their association would like to discuss two topics;

- They would like to provide us with an update on their views regarding the ICAO CO2 standards development process

- They would like to hear from EPA regarding the Proposed Endangerment Finding for aircraft CO2

I don't believe you need to do this, I am happy to do so. However, if you want to have this Association meet with you, that is of course okay.

Let me know your thoughts.

Thanks

Bill

From: Hengst, Benjamin
Sent: Monday, January 12, 2015 3:56 PM
To: Charmley, William; Samulski, Michael
Cc: Stewart, Gwen
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Bill, Michael: please advise on whether this should be a meeting with Chris, or whether ASD will cover it. Ben

From: Young, Nancy [mailto:NYoung@airlines.org]
Sent: Friday, January 09, 2015 5:35 PM
To: Grundler, Christopher
Cc: Maurice, Lourdes
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

January 9, 2015

Submitted By Email to *Grundler.christopher@Epa.gov*

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the

final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

<image001.png>

Nancy N. Young

Vice President, Environmental Affairs

cc: Lourdes Maurice, FAA, via email Lourdes.maurice@faa.gov

Nancy N. Young

Vice President, Environmental Affairs

Airlines for America

We Connect the World

1301 Pennsylvania Ave, NW, Suite 1100

Washington, DC 20004

Phone: (202) 626-4207

email: nyoung@airlines.org

<image002.jpg>
<image003.jpg><image004.jpg><image005.jpg><image006.jpg><image007.jpg><image008.jpg>

[1] Besides being well-established for international standard-setting, the CAEP Terms of Reference and the ICAO/CAEP standard-setting process align well with the bases for the adoption of aircraft engine emission standards by EPA and FAA under Section 231 of the Clean Air Act.

To: Birgfeld, Erin[Birgfeld.Erin@epa.gov]; Hengst, Benjamin[Hengst.Benjamin@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
Cc: Sutton, Tia[sutton.tia@epa.gov]; Mylan, Christopher[Mylan.Christopher@epa.gov]; DeLuca, Isabel[DeLuca.Isabel@epa.gov]
From: Leggett, Cullen
Sent: Wed 6/10/2015 5:14:08 PM
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

http://www.nytimes.com/2015/06/11/business/energy-environment/epa-says-it-will-set-rules-for-airplane-emissions.html?emc=edit_na_20150610&nlid=63603583&_r=0

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 1:12 PM
To: Hengst, Benjamin; Samulski, Michael; Manning, Bryan; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Ex. 5 - Deliberative Process

From: Hengst, Benjamin
Sent: Wednesday, June 10, 2015 1:08 PM
To: Samulski, Michael; Birgfeld, Erin; Manning, Bryan; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Ex. 5 - Deliberative Process

From: Samulski, Michael
Sent: Wednesday, June 10, 2015 1:04 PM
To: Birgfeld, Erin; Manning, Bryan; Hengst, Benjamin; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Ex. 5 - Deliberative Process

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 12:08 PM
To: Manning, Bryan; Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen;

Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

Hi all,

We had some last minute OGC changes so the fact sheet is still in the process of being formatted, and the web is unlikely to go live before 12:45.

I'll send a note out as soon as the web is live to this group.

In the meantime, here is an unformatted version of the final fact sheet for your information.

Also, pasted below is the final PR. Please DO NOT send this outside of the agency until after the website is live.

Thanks! Almost there ;)

Erin

Subject: EPA Takes First Steps to Address Greenhouse Gas Emissions from Aircraft

CONTACT
Christie St. Clair (news media only)
stclair.christie@epa.gov
202-564-2880

FOR IMMEDIATE RELEASE
June 10, 2015

EPA Takes First Steps to Address Greenhouse Gas Emissions from Aircraft

WASHINGTON – The U.S. Environmental Protection Agency (EPA) is proposing to find under the Clean Air Act that greenhouse gas (GHG) emissions from commercial aircraft contribute to the pollution that causes climate change endangering the health and welfare of Americans. At the same time, the agency is ~~releasing~~ providing information about the international process already underway by the International Civil Aviation Organization (ICAO) for developing carbon dioxide (CO2) standards for aircraft and EPA's participation in that process. EPA is now seeking public input to inform future steps by the agency.

For the past five years, ICAO — a specialized body of the United Nations with 191 member states — has been working with the aviation industry and other stakeholders to develop coordinated, international CO2 emissions standards for aircraft. EPA and the Federal Aviation Administration, representing the United States, are participating in ICAO's process to ensure that any standards achieve meaningful CO2 emissions reductions through policies that are equitable across national boundaries.

The ICAO standards are expected to be adopted in early 2016. The items issued today by EPA lay the necessary foundation for the development and implementation of a domestic aircraft standard, in accordance with U.S. law and the ICAO process.

U.S. aircraft emit roughly 11 percent of GHG emissions from the U.S. transportation sector and 29 percent of GHG emissions from all aircraft globally. In 2009, EPA determined that GHG pollution from cars and light trucks threatens Americans' health and welfare by leading to long-lasting changes in our climate that can have a range of negative effects. Since then, the body of science on human-induced climate change has strengthened, supporting today's proposed finding — under a different section of the Clean Air Act — that GHGs emitted from aircraft engines contribute to pollution that causes climate change endangering public health and welfare. Today's action supports the goals of the President's Climate Action Plan to reduce emissions from large sources of carbon pollution.

Today's actions do not apply to small piston-engine planes (the type of plane often used for recreational purposes), or to military aircraft.

Once this action is published in the Federal Register, it will be open for a 60-day public comment period. Any future domestic actions toward aircraft engine standards would also be open to public comment and review before they could take effect.

For more information on the proposed contribution finding and the advance notice of proposed rulemaking, visit http://epa.gov/otaq/aviation.htm.

R137

If you would rather not receive future communications from Environmental Protection Agency, let us know by clicking here.
Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460 United States

From: Manning, Bryan
Sent: Wednesday, June 10, 2015 11:54 AM
To: Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Birgfeld, Erin; Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: Sent Email to Stakeholders and Final Fact Sheet

Hello Ben,

Ex. 5 - Deliberative Process

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Hengst, Benjamin
Sent: Wednesday, June 10, 2015 11:16 AM
To: Grundler, Christopher; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Manning, Bryan; Birnbaum, Rona; Gunning, Paul; DeAngelo, Ben
Cc: Charmley, William; Birgfeld, Erin; Mylan, Christopher; DeLuca, Isabel; Millett, John; StClair, Christie
Subject: Final Q&As

All: final Q&A doc is attached.

Chris – the end of this document has answers to the questions you gave us last night/this morning. They are also copied below.

Just as a reminder: here's the schedule:

12:30 pm - web goes live
1 pm - press release (to HQ Environmental, Top-Tier, Aircraft lists)

1:10 - external calls
2 pm - press call

Ben

******

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Birgfeld, Erin[Birgfeld.Erin@epa.gov]
From: Hengst, Benjamin
Sent: Wed 6/10/2015 4:20:25 PM
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

We are keeping it real with PDFs.

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 12:18 PM
To: Hengst, Benjamin
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

The FS thing…you can't change text in pdfs quickly or easily. So it's best to start formatting from scratch when there are significant edits. Which we had from OGC.

We also have some people in AA who do not like to cut corners.

From: Hengst, Benjamin
Sent: Wednesday, June 10, 2015 12:15 PM
To: Birgfeld, Erin
Subject: RE: Sent Email to Stakeholders and Final Fact Sheet

I still don't understand why changing the fact sheet takes so long…?? OTAQ loves fact sheets!

Also—do we need to make sure the PR doesn't go out before the web is live?

From: Birgfeld, Erin
Sent: Wednesday, June 10, 2015 12:08 PM

To: Manning, Bryan; Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
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CONTACT
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stclair.christie@epa.gov
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R137

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Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460 United States

From: Manning, Bryan
Sent: Wednesday, June 10, 2015 11:54 AM
To: Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley
Cc: Birgfeld, Erin; Sutton, Tia; Mylan, Christopher; DeLuca, Isabel
Subject: Sent Email to Stakeholders and Final Fact Sheet

Hello Ben,

Yesterday, I believe we agreed that we can send the email to stakeholders after the web goes live at 12:30 pm, but before the press release at 1:00 pm. Is this still correct? Also, we plan to attach the fact sheet to the email to stakeholders. I am not sure I have the final version of the fact sheet, and thus, could you, Tia, or Erin send me the final version of the fact sheet?

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

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Sent: Wednesday, June 10, 2015 11:16 AM
To: Grundler, Christopher; Samulski, Michael; Audette, Lucie; Leggett, Cullen; Manning, Bryan; Birnbaum, Rona; Gunning, Paul; DeAngelo, Ben
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Ben

******

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

To: Ben Hengst Ex. 6 - Personal Privacy
From: Hengst, Benjamin
Sent: Mon 7/25/2016 1:57:17 AM
Subject: Fw: Aircraft endangerment materials
Aircraft End Press Release_FINAL 7.24.16 930pm.docx
Roll Out_QAs_aircraft final findings_7_24 930pm.docx
Feb 2016, ICAO CO2 Standard Q and A_2-8-16 final.docx

forwarding to personal email address due to home IT issues with computer

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From: Hengst, Benjamin
Sent: Sunday, July 24, 2016 9:56 PM
To: Conger, Nick; Millett, John; Birgfeld, Erin
Subject: Aircraft endangerment materials

Attaching:

1. Hopefully final PR (all I did was accept Nick's edits)

2. Revised roll-out/Q&A (after reviewing, I didn't make the edit Candace suggested as it was a bit clunky and we had a Q&A that explained that issue)

3. A document that I think was final, and that was used at the ICAO announcement back in Feb. This can be sent to the internal EPA team just as reference. I'm attaching per Janet's request.

Nick/Erin/John--these should be final. I'll let one of you send these out to the team, whether that's tonight or tomorrow in the morning is up to you. I'd rather have the final set of materials come from someone on the coms team. Thanks,

Ben

To: Audette, Lucie[audette.lucie@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Hengst, Benjamin
Sent: Wed 8/27/2014 7:06:19 PM
Subject: Fw: EPA submission to ICAO on GHG endangerment finding/ANPRM

[redacted]

Lucie and Mike will work with Erin. We of course have a desk statement and internal Q&As. Lucie thinks we shared this with Erin, but it might have been a long time ago. We will ask Erin to work with John M.

Thanks

Bill

From: Grundler, Christopher
Sent: Wednesday, August 27, 2014 9:05 AM
To: Charmley, William
Subject: Re: EPA submission to ICAO on GHG endangerment finding/ANPRM

She now has it three times as I sent it last night again. Pls work with Erin to alert OAR and EPA press folks

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)

www.epa.gov/otaq

From: Charmley, William

Sent: Wednesday, August 27, 2014 6:27 AM

To: McCabe, Janet; Grundler, Christopher

Subject: Re: EPA submission to ICAO on GHG endangerment finding/ANPRM

Dear Janet,

The text of the draft EPA submission is at the end of the email that I sent to Chris below. It is about 1 page long. I also have attached the ICAO formatted draft as well.

Thanks

Bill

Bill Charmley, US EPA
Assessment and Standards Division
Office of Transportation and Air Quality
Ann Arbor, Michigan
Desk ph = 734-214-4466
Mobile ph = 734-545-0333
Email = charmley.william@epa.gov

From: McCabe, Janet

Sent: Tuesday, August 26, 2014 11:12 PM

To: Grundler, Christopher

Cc: Charmley, William

Subject: RE: EPA submission to ICAO on GHG endangerment finding/ANPRM

sorry not to have responded....can someone please send me the 2 pager? I've looked back through my emails to July and can't find it.

I did have a chance to talk to the Administrator about it on friday evening, and I think we should be ok to send this along, but I'd like to look at it again, which I willdo in the morning. If you haven't already, can you please give Millett and Co a heads up about this--we'll want the third floor to know as well.

From: Grundler, Christopher
Sent: Tuesday, August 26, 2014 6:43 PM
To: McCabe, Janet
Cc: Charmley, William
Subject: Fw: EPA submission to ICAO on GHG endangerment finding/ANPRM

Ex. 5 - Deliberative Process

C-

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

From: Charmley, William <charmley.william@epa.gov>

Sent: Tuesday, August 26, 2014 1:03 PM

To: Grundler, Christopher

Cc: Hengst, Benjamin

Subject: EPA submission to ICAO on GHG endangerment finding/ANPRM

Chris –

Ex. 5 - Deliberative Process

Do you have any objection to having us do this? I have attached a copied the text of the paper below.

Thanks

Bill

==========

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Audette, Lucie[audette.lucie@epa.gov]
From: Hengst, Benjamin
Sent: Thur 8/14/2014 4:24:29 PM
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Whew ☺

From: Audette, Lucie
Sent: Thursday, August 14, 2014 12:23 PM
To: Hengst, Benjamin
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ben, your note is fine as is.

From: Hengst, Benjamin
Sent: Thursday, August 14, 2014 11:40 AM
To: Audette, Lucie
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thanks, Lucie. That's helpful. Chris thought it would be helpful to have an additional note go to Janet – since he hasn't heard back from her – and we need to make a decision now on the reg agenda item.

Hopefully nothing in the note I sent contradicted your thinking—right?!

From: Audette, Lucie
Sent: Thursday, August 14, 2014 11:31 AM
To: Hengst, Benjamin; DeAngelo, Ben; Thrift, Mike; Samulski, Michael
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ben,

Two additional points regarding placing our proposed rule on the Reg Agenda:

Ex. 5 - Deliberative Process

From: Grundler, Christopher <grundler.christopher@epa.gov>

Sent: Friday, July 11, 2014 4:43 PM

To: McCabe, Janet

Cc: Charmley, William; Dunham, Sarah

Subject: Aircraft GHG Endangerment Communications

Janet:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

C.

(1)

From: Hengst, Benjamin
Sent: Thursday, August 14, 2014 9:28 AM
To: DeAngelo, Ben; Thrift, Mike; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thanks, Ben.

Ex. 5 - Deliberative Process

for forwarding to Janet. Ben

From: DeAngelo, Ben
Sent: Thursday, August 14, 2014 9:23 AM
To: Hengst, Benjamin; Thrift, Mike; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ex. 5 - Deliberative Process

-Ben

From: Hengst, Benjamin
Sent: Wednesday, August 13, 2014 10:00 PM
To: Thrift, Mike; DeAngelo, Ben; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thanks, all. Mike, in response to your question of other avenues to raise this publicly, I have another question:

Chris Grundler's original note to Sarah below mentioned that the team (OAP/OGC) was

Ex. 5 - Deliberative Process

thanks

Ben

From: Thrift, Mike
Sent: Wednesday, August 13, 2014 6:05 PM
To: DeAngelo, Ben; Hengst, Benjamin; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ex. 5 - Deliberative Process

Mike Thrift

United States Environmental Protection Agency

Office of General Counsel

Air and Radiation Law Office (2344-A)

1200 Pennsylvania Ave., N.W.

Washington D.C. 20460

202-564-5596

From: DeAngelo, Ben
Sent: Wednesday, August 13, 2014 5:50 PM
To: Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Thrift, Mike
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley

Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thank you Ben. This note generally looks fine to me; made minor suggestions below. Am also including Mike Thrift here from OGC who I'd like to quickly review before you forward to Janet.

From: Hengst, Benjamin
Sent: Wednesday, August 13, 2014 5:36 PM
To: Samulski, Michael; DeAngelo, Ben; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul
Subject: Draft note on: Aircraft GHG Endangerment Communications

Mike, Ben: any objections to this draft note? Also—please feel free to forward to anyone in OGC that needs to see this as a heads-up. Thanks, Ben

Janet:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Please let us know if you need further information or have any questions. Thanks.

From: Grundler, Christopher <grundler.christopher@epa.gov>

Sent: Friday, July 11, 2014 4:43 PM

To: McCabe, Janet

Cc: Charmley, William; Dunham, Sarah

Subject: Aircraft GHG Endangerment Communications

Janet:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

C.

To: DeAngelo, Ben[DeAngelo.Ben@epa.gov]
From: Hengst, Benjamin
Sent: Thur 8/14/2014 3:59:27 PM
Subject: Re: Draft note on: Aircraft GHG Endangerment Communications

Got it. Thanks.

[redacted]

Ex. 5 - Deliberative Process

From: Hengst, Benjamin
Sent: Thursday, August 14, 2014 9:55 AM
To: DeAngelo, Ben
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Nope-no need. I think I'm good.

Ex. 5 - Deliberative Process

From: DeAngelo, Ben
Sent: Thursday, August 14, 2014 9:42 AM
To: Hengst, Benjamin
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thanks Ben, that sounds good to me. Saw you called – am on a call and should be getting off shortly if you still want to talk.

From: Hengst, Benjamin
Sent: Thursday, August 14, 2014 9:28 AM
To: DeAngelo, Ben; Thrift, Mike; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thanks, Ben.

Ex. 5 - Deliberative Process

From: DeAngelo, Ben
Sent: Thursday, August 14, 2014 9:23 AM
To: Hengst, Benjamin; Thrift, Mike; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

-Ben

From: Hengst, Benjamin
Sent: Wednesday, August 13, 2014 10:00 PM
To: Thrift, Mike; DeAngelo, Ben; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ex. 5 - Deliberative Process

thanks

Ben

From: Thrift, Mike
Sent: Wednesday, August 13, 2014 6:05 PM
To: DeAngelo, Ben; Hengst, Benjamin; Samulski, Michael; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Ex. 5 - Deliberative Process

Mike Thrift

United States Environmental Protection Agency

Office of General Counsel

Air and Radiation Law Office (2344-A)

1200 Pennsylvania Ave., N.W.

Washington D.C. 20460

202-564-5596

From: DeAngelo, Ben
Sent: Wednesday, August 13, 2014 5:50 PM
To: Hengst, Benjamin; Samulski, Michael; Audette, Lucie; Thrift, Mike
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul; Jantarasami, Lesley
Subject: RE: Draft note on: Aircraft GHG Endangerment Communications

Thank you Ben. This note generally looks fine to me; made minor suggestions below. Am also including Mike Thrift here from OGC who I'd like to quickly review before you forward to Janet.

From: Hengst, Benjamin
Sent: Wednesday, August 13, 2014 5:36 PM
To: Samulski, Michael; DeAngelo, Ben; Audette, Lucie
Cc: Birnbaum, Rona; Charmley, William; Gunning, Paul
Subject: Draft note on: Aircraft GHG Endangerment Communications

Mike, Ben: any objections to this draft note? Also—please feel free to forward to anyone in OGC that needs to see this as a heads-up. Thanks, Ben

Janet:

Ex. 5 - Deliberative Process

Please let us know if you need further information or have any questions. Thanks.

From: Grundler, Christopher <grundler.christopher@epa.gov>

Sent: Friday, July 11, 2014 4:43 PM

To: McCabe, Janet

Cc: Charmley, William; Dunham, Sarah

Subject: Aircraft GHG Endangerment Communications

Janet:

Ex. 5 - Deliberative Process

To: Samulski, Michael[samulski.michael@epa.gov]
Cc: Sargeant, Kathryn[sargeant.kathryn@epa.gov]
From: Hengst, Benjamin
Sent: Sat 1/30/2016 12:46:42 AM
Subject: Re: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Ex. 5 - Deliberative Process

On Jan 29, 2016, at 6:13 PM, Samulski, Michael <samulski.michael@epa.gov> wrote:

Bill asked that you be kept in the loop on this. As you know, he does not think EPA should participate in this meeting

Mike

Sent from my iPhone

Begin forwarded message:

From: <Ralph.Iovinelli@faa.gov>
Date: January 29, 2016 at 5:43:21 PM EST
To: Ex. 6 - Personal Privacy
<Lourdes.Maurice@faa.gov>, <samulski.michael@epa.gov>,
<manning.bryan@epa.gov>, <McCabe.Janet@epa.gov>,
Ex. 6 - Personal Privacy
<Hengst.Benjamin@epa.gov>, <charmley.william@epa.gov>,
<LeFranc.Maurice@epa.gov>, <Rich.Swayze@faa.gov>, <carl.burleson@faa.gov>,
<shoshana.lew@dot.gov>, <Atkinson.Emily@epa.gov>,
Ex. 6 - Personal Privacy ov>, <Arthur.Rypinski@dot.gov>,
Ex. 6 - Personal Privacy
<Laszlo.Windhoffer@faa.gov>, <maryalice.locke@faa.gov>,
<curtis.holsclaw@faa.gov>
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

First, please pass this invitation to those I missed.

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

The objective of this meeting is to determine the most efficient way to support the domestic rulemaking process of the aircraft CO2 emission standard, with specific attention to the cost benefits analysis completed for the ICAO international aircraft CO2 emissions standard.

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Please do not hesitate to contact Chad Whiteman (**Ex. 6 - Personal Privacy**) or myself with questions.

Best Regards,

Ralph Iovinelli
Manager, Emissions Division (AEE-300)
Office of Environment and Energy
Federal Aviation Administration
800 Independence Ave., SW
Washington, DC 20591

+1-202-267-3566 office
+1-202-288-6372 mobile
ralph.iovinelli@faa.gov

To: DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
From: Hengst, Benjamin
Sent: Thur 6/4/2015 5:02:15 PM
Subject: Fwd: Follow up on aircraft endangerment/ANPR

Begin forwarded message:

From: "Sierawski, Clare S" <SierawskiCS@state.gov>
Date: June 3, 2015 at 10:04:10 AM EDT
To: "LeFranc, Maurice" <LeFranc.Maurice@epa.gov>, "Hengst, Benjamin" <Hengst.Benjamin@epa.gov>, "Meisel, Julia S" <MeiselJS@state.gov>, "Carnahan, Kimberly C" <CarnahanKC@state.gov>
Cc: "Audette, Lucie" <audette.lucie@epa.gov>, "Sutton, Tia" <sutton.tia@epa.gov>, "Samulski, Michael" <samulski.michael@epa.gov>
Subject: RE: Follow up on aircraft endangerment/ANPR

Hi Maurice! Thank you for checking! We raised this with Todd last week, and I think there are no questions on our end. Julia/Kim?

-----Original Message-----
From: LeFranc, Maurice [mailto:LeFranc.Maurice@epa.gov]
Sent: Wednesday, June 03, 2015 9:30 AM
To: Sierawski, Clare S; Hengst, Benjamin; Meisel, Julia S; Carnahan, Kimberly C
Cc: Audette, Lucie; Sutton, Tia; Samulski, Michael
Subject: RE: Follow up on aircraft endangerment/ANPR

Clare:

This is being finalized now (maybe as early as Friday). If anyone has questions it would be good to get back to Ben and others as soon as possible.

Maurice

-----Original Message-----
From: Sierawski, Clare S [http://redirect.state.sbu/?url=mailto:SierawskiCS@state.gov]
Sent: Friday, May 22, 2015 11:58 AM
To: Hengst, Benjamin; LeFranc, Maurice; Meisel, Julia S; Carnahan, Kimberly C
Cc: Audette, Lucie; Sutton, Tia; Samulski, Michael
Subject: RE: Follow up on aircraft endangerment/ANPR

Thank you for the information Maurice and Ben - we will flag this for Todd. We continue to be impressed with all of the great work that EPA is doing.

Thank you again for the information and the head-up!

Best,
Clare

-----Original Message-----
From: Hengst, Benjamin [http://redirect.state.sbu/?url=mailto:Hengst.Benjamin@epa.gov]
Sent: Friday, May 22, 2015 11:49 AM
To: LeFranc, Maurice; Sierawski, Clare S; Meisel, Julia S; Carnahan, Kimberly C
Cc: Audette, Lucie; Sutton, Tia; Samulski, Michael
Subject: RE: Follow up on aircraft endangerment/ANPR

Hi Everyone -

Just a quick follow up to Maruice's email. While we are targeting next week, it's now looking increasingly likely that this will slip to the 1st week of June. I'll make sure folks know when we have a firm date. Thanks, Ben

-----Original Message-----
From: LeFranc, Maurice
Sent: Friday, May 22, 2015 11:05 AM
To: SierawskiCS@state.gov; Meisel, Julia S; Carnahan, Kimberly C
Cc: Hengst, Benjamin; Audette, Lucie; Sutton, Tia; Samulski, Michael
Subject: RE: Follow up on aircraft endangerment/ANPR

Clare:

I hope you are doing well.

I am writing to make sure you (and therefore Todd) are aware of an EPA aircraft action coming up shortly. May 27 is the tentative signature date for the aircraft GHG endangerment NPRM/ANPR. The package for this announcement is described below:

"The EPA is proposing to determine that greenhouse gas concentrations in the atmosphere endanger the public health and welfare of current and future generations within the meaning of section 231(a) of the Clean Air Act. The Administrator is also proposing to find that greenhouse gas emissions from certain classes of engines used in aircraft are contributing to air pollution which endangers public health and welfare under section 231(a) of the Clean Air Act. This proposed action responds to a citizen petition the EPA received in December 2007 requesting the EPA issue an endangerment finding and standards under section 213(a)((of the Act for the GHG emissions from aircraft.

Concurrent with these proposed findings, the EPA is issuing an Advance Notice of Proposed Rulemaking to provide an overview of and seek input on a variety of issues

related to setting an international CO2 standard for aircraft at the International Civil Aviation Organization (ICAO), ICAO's progress in establishing global aircraft standards that achieve meaningful reductions in CO2 emissions, and (provided the EPA promulgates final endangerment and cause and contribute findings for aircraft engine GHG emissions) the potential use of section 231 of the Clean Air Act to adopt and implement corresponding aircraft engine GHG emission standards domestically, ensuring transparency and the opportunity for public comment."

Let us know if you have any questions or need anything else from us regarding this announcement.

Take care
Maurice

To: OTAQ Materials[OTAQMaterials@epa.gov]
Cc: Samulski, Michael[samulski.michael@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Kathryn Sargeant[Sargeant.Kathryn@epa.gov]
From: Hengst, Benjamin
Sent: Fri 6/27/2014 6:20:23 PM
Subject: Early guidance briefing on Monday: aircraft endangerment/ANPRM
Early Guidance_Aircraft for Janet McCabe 6 30 14.pptx

Chris –

Attached is the current draft of the briefing for Monday with Janet. I should have sent this to you last night but we were making edits over the past 24 hours based on further review of the slides.

This will be going to Janet later today. We can make further edits, however, if you have them and we can just send an updated version.

Ex. 5 - Deliberative Process

Thanks,

Ben

To: Audette, Lucie[audette.lucie@epa.gov]
From: Hengst, Benjamin
Sent: Tue 2/10/2015 9:14:42 PM
Subject: RE: responding to Janet's 2 Questions on aircraft endangerment

Super--thanks

From: Audette, Lucie
Sent: Tuesday, February 10, 2015 10:15 AM
To: Hengst, Benjamin
Cc: Samulski, Michael; Manning, Bryan; Jantarasami, Lesley; Leggett, Cullen; Birnbaum, Rona; Orlin, David; Thrift, Mike; Williams, Melina
Subject: RE: responding to Janet's 2 Questions on aircraft endangerment

Ben, Just got OGC's input, so the updated responses below are now ready to go to Janet.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Hengst, Benjamin
Sent: Monday, February 09, 2015 8:01 PM
To: Audette, Lucie
Cc: Samulski, Michael
Subject: Re: responding to Janet's 2 Questions on aircraft endangerment

Lucie -- let me know if I can send forward (Chris was asking). thanks--Ben

---

From: Audette, Lucie
Sent: Monday, February 9, 2015 11:44 AM
To: Orlin, David; Thrift, Mike; Williams, Melina
Cc: Sutton, Tia; Charmley, William; Samulski, Michael; Hengst, Benjamin
Subject: RE: responding to Janet's 2 Questions on aircraft endangerment

OGA, see my suggested responses to Janet's 2 questions. Please let us know if you are OK with these responses. Thanks. Lucie

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

From: Hengst, Benjamin
Sent: Monday, February 09, 2015 11:02 AM
To: Samulski, Michael; Audette, Lucie
Cc: Orlin, David; Sutton, Tia; Charmley, William
Subject: FW: aircraft endangerment

FYI—see below.

Mike, Lucie, David: please follow up on the questions, then I can send it back to Chris/Janet.

Thanks,

Ben

From: Grundler, Christopher
Sent: Monday, February 09, 2015 10:22 AM
To: McCabe, Janet
Cc: Stewart, Lori; Knapp, Kristien; Hengst, Benjamin

Subject: Re: aircraft endangerment

Good questions, and the answer is I'm not sure. I will check

Ben: pls follow up with team/OGC

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. EPA

202-564-1682 (DC)

734-214-4207 (Ann Arbor)

On Feb 9, 2015, at 9:20 AM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Chris---as I said this weekend, the package is looking really good. I'll pass it back to Kristien with a handful of typo sorts of nits. Two substantive questions—

Ex. 5 - Attorney Client

Thanks.

To: Samulski, Michael[samulski.michael@epa.gov]
From: Hengst, Benjamin
Sent: Wed 1/14/2015 3:38:51 PM
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard
image002.png
ATT00001.htm
ATT00002.htm
ATT00003.htm
image005.jpg
ATT00004.htm
image006.jpg
ATT00005.htm
image007.jpg
ATT00006.htm
ATT00007.htm
image009.jpg
ATT00008.htm
Letter to Chris Grundler re Meeting 1-9-15.pdf
ATT00009.htm

Fyi only

From: Stewart, Gwen
Sent: Wednesday, January 14, 2015 10:18 AM
To: Charmley, William
Cc: Hengst, Benjamin; Cook, Leila; Iffland, JoNell
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Good Morning Mr. Charmley:

Ex. 5 - Deliberative Process

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

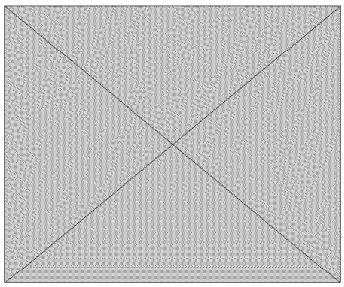
From: Grundler, Christopher
Sent: Wednesday, January 14, 2015 10:15 AM
To: Stewart, Gwen
Cc: Charmley, William
Subject: Fwd: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Pls reply to acknowledge receipt. Consult with Bill

Sent from my iPhone

Begin forwarded message:

From: "Young, Nancy" <NYoung@airlines.org>
To: "Grundler, Christopher" <grundler.christopher@epa.gov>
Cc: "Maurice, Lourdes" <lourdes.maurice@faa.gov>
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard



January 9, 2015

Submitted By Email to Grundler.christopher@Epa.gov

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

_____

_____

AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

FEDERAL REGISTER

Vol. 81 Monday,
No. 157 August 15, 2016

Part V

Environmental Protection Agency

40 CFR Parts 87 and 1068
Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 87 and 1068

[EPA–HQ–OAR–2014–0828; FRL–9950–15–OAR]

RIN 2060–AS31

Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: In this action, the Administrator finds that elevated concentrations of greenhouse gases in the atmosphere endanger the public health and welfare of current and future generations within the meaning of section 231(a)(2)(A) of the Clean Air Act (CAA, or Act). She makes this finding specifically with respect to the same six well-mixed greenhouse gases—carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—that together were defined as the air pollution in the 2009 Endangerment Finding under section 202(a) of the CAA and that together constitute the primary cause of the climate change problem. The Administrator also finds that emissions of those six well-mixed greenhouse gases from certain classes of engines used in certain aircraft are contributing to the air pollution—the aggregate group of the same six greenhouse gases—that endangers public health and welfare under CAA section 231(a)(2)(A).

DATES: These findings are effective on September 14, 2016.

ADDRESSES: The EPA has established a docket for this rulemaking under Docket ID No. EPA–HQ–OAR–2014–0828. All documents in the docket are listed in the *www.regulations.gov* Web site. Although listed in the index, some information is not publicly available, *e.g.,* confidential business information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy in the EPA's docket. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the Air and Radiation Docket and Information Center, EPA/DC, EPA WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Lesley Jantarasami, Office of Atmospheric Programs, Climate Change Division, Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Mail Code 6207–A, Washington, DC 20460; Telephone number: (202) 343–9990; Email address: *ghgendangerment@epa.gov*. For additional information regarding these final findings, please go to the Web site *http://www3.epa.gov/otaq/climate/regs-aviation.htm.*

SUPPLEMENTARY INFORMATION:

Judicial Review

Under CAA section 307(b)(1), judicial review of this final action is available only by filing a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit by October 14, 2016. This final action is a nationally applicable action because it triggers the EPA's statutory duty to promulgate aircraft engine emission standards under CAA section 231, which are nationally applicable regulations and for which judicial review will be available only in the U.S. Court of Appeals for the District of Columbia Circuit. In the alternative, even if this action were considered to be only locally or regionally applicable, the Administrator determines that it has nationwide scope and effect within the meaning of CAA section 307(b)(1) both because of the obligation to establish standards under CAA section 231 that it triggers and because it concerns risks from GHG pollution and contributions to such pollution that occur across the nation. Under CAA section 307(d)(7)(B), only an objection to this final action that was raised with reasonable specificity during the period for public comment can be raised during judicial review. This section also provides a mechanism for us to convene a proceeding for reconsideration, ''[i]f the person raising an objection can demonstrate to [EPA] that it was impracticable to raise such objection within [the period for public comment] or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of this rule.'' Any person seeking to make such a demonstration to us should submit a Petition for Reconsideration to the Office of the Administrator, Environmental Protection Agency, Room 3000, William Jefferson Clinton Building, 1200 Pennsylvania Ave. NW., Washington, DC 20460, with a copy to the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section, and the Associate General Counsel for the Air and Radiation Law Office, Office of General Counsel (Mail Code 2344–A) Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460.

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I. General Information

A. Does this action apply to me?

These final findings trigger new duties that apply to the EPA but do not themselves apply new requirements to other entities outside the federal government. Specifically, in issuing these final findings that emissions of the six well-mixed GHGs from certain classes of engines used in certain aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, the EPA becomes subject to a duty under CAA section 231 to propose and promulgate aircraft engine emission standards applicable to emissions of that air pollutant from those classes of engines. We are anticipating indicating an expected timeline for proposed GHG emission standards for the classes of aircraft engines included in the contribution finding in EPA's Unified Agenda of Federal Regulatory and Deregulatory Actions. Only those future standards will apply to and have an effect on other entities outside the federal government. Entities potentially interested in this final action include those that manufacture and sell aircraft engines and aircraft in the United States. Categories that may be regulated in a future regulatory action include:

Category	NAICS [a] Code	SIC [b] Code	Examples of Potentially Affected Entities [1]
Industry	3364412	3724	Manufacturers of new aircraft engines.
Industry	336411	3721	Manufacturers of new aircraft.

[a] North American Industry Classification System (NAICS).
[b] Standard Industrial Classification (SIC) code.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be interested in this final action. This table lists the types of entities that the EPA is now aware could potentially have an interest in this final action. By issuing these final findings under CAA section 231(a)(2)(A) regarding emissions of greenhouse gases from aircraft engines, the EPA is now required to undertake a separate notice and comment rulemaking to propose and issue emission standards applicable to greenhouse gas emissions from the classes of aircraft engines subject to the findings, and the Federal Aviation Administration (FAA) is to prescribe regulations to ensure compliance with EPA's future emissions standards pursuant to CAA section 232. Other types of entities not listed in the table could also be interested and potentially affected by subsequent actions at some future time. If you have any questions regarding the scope of this final action, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

II. Introduction: Overview and Context for This Final Action

A. Summary

Pursuant to CAA section 231(a)(2)(A), the Administrator finds that emissions of the six well-mixed [2] greenhouse gases (GHGs) from certain classes of aircraft engines used in certain types of aircraft (referred to interchangeably as ''covered aircraft'' or ''US covered aircraft'' throughout this document) contribute to air pollution that may reasonably be anticipated to endanger the public health and welfare of current and future generations. This final action follows the Administrator's proposed findings,[3] and responds to public comments submitted to the EPA following that proposal. It is based on careful consideration of the scientific evidence, as well as a thorough review of the public comments. In light of the large number of comments received and overlap between many comments, EPA has not responded to each comment individually. Instead, EPA has summarized and provided responses to each significant argument, assertion and question contained within the totality of these comments. Covered aircraft are those aircraft to which the International Civil Aviation Organization (ICAO) has agreed the recently recommended international CO_2 standard will apply [4]: Subsonic jet aircraft with a maximum takeoff mass (MTOM) greater than 5,700 kilograms and subsonic propeller-driven (*e.g.,* turboprop) aircraft with a MTOM greater than 8,618 kilograms. Examples of covered aircraft include smaller jet aircraft such as the Cessna Citation CJ3+ and the Embraer E170, up to and including the largest commercial jet aircraft—the Airbus A380 and the Boeing 747. Other examples of covered aircraft include larger turboprop aircraft, such as the ATR 72 and the Bombardier Q400.

In this final action, the EPA is informed by and places considerable weight on the extensive scientific and technical evidence in the record supporting the 2009 Endangerment and Cause or Contribute Findings under CAA section 202(a) (hereafter, collectively referred to as the 2009 Endangerment Finding).[5] This includes the major, peer-reviewed scientific assessments that were used to address the question of whether elevated concentrations of GHGs in the

[1] Manufacturers of new aircraft engines refers to manufacturers of new type engines and in-production engines, and manufacturers of new aircraft refers to manufacturers of new type aircraft and in-production aircraft.

[2] The term ''well-mixed GHGs''—used both in the definition of ''air pollution'' in the endangerment finding and in the definition of ''air pollutant'' in the cause or contribute finding—is based on the fact that these gases are sufficiently long lived in the atmosphere such that, once emitted, concentrations of each gas become well mixed throughout the entire global atmosphere. These shared attributes are one of five primary reasons that the EPA considers the six gases as an aggregate group rather than as individual gases. See section IV.B for more information on the definition of ''air pollution'' and section V.A for more information on the definition of the ''air pollutant.''

[3] U.S. EPA, 2015: *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; Proposed Rule,* 80 **Federal Register** (FR) 37758 (July 1, 2015).

[4] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO2 Emissions Standards,* Circular (Cir) 337, 40 pp, AN/192, Available at: *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed May 9, 2016). The ICAO Circular 337 is found on page 87 of the catalog and is copyright protected; Order No. CIR337.

[5] U.S. EPA, 2009: *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule,* 74 FR 66496 (December 15, 2009).

atmosphere endanger public health and welfare under CAA section 202(a), as well as the analytical framework and conclusions upon which the EPA relied in making that finding. The Administrator's view is that the body of scientific evidence amassed in the record for the 2009 Endangerment Finding also compellingly supports an endangerment finding under CAA section 231(a)(2)(A). Furthermore, this finding under section 231(a)(2)(A) reflects the EPA's careful consideration not only of the scientific and technical record for the 2009 Endangerment Finding, but also of science assessments released since 2009, which, as illustrated below, strengthen and further support the judgment that GHGs in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future generations. No information or assessments published since late 2009 suggest that it would be reasonable for the EPA to now reach a different or contrary conclusion for purposes of CAA section 231(a)(2)(A) than the Agency reached for purposes of section 202(a).

The Administrator defines the ''air pollution'' referred to in section 231(a)(2)(A) of the CAA to be the combined mix of CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (henceforth the six ''well-mixed GHGs''). This is the same definition that was used for the finding for purposes of section 202(a). It is the Administrator's judgment that the total body of scientific evidence compellingly supports a positive endangerment finding that elevated concentrations of the six well-mixed GHGs constitute air pollution that endangers both the public health and welfare of current and future generations within the meaning of CAA section 231(a)(2)(A). The Administrator is not at this time making a finding regarding whether other substances emitted from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.

Under CAA section 231(a)(2)(A), the Administrator must also determine whether emissions of any air pollutant from a class or classes of aircraft engines cause or contribute to the air pollution that may reasonably be anticipated to endanger public health or welfare. Following the rationale outlined in the 2009 Endangerment Finding, the Administrator in this action is using the same definition of the air pollutant as was used for purposes of section 202(a) for purposes of making the cause or contribute determination under section 231(a)(2)(A)—that is, the aggregate group of the same six well-mixed GHGs. With respect to this pollutant, based on the data summarized in section V.B, the Administrator finds that emissions of the six well-mixed GHGs from aircraft engines used in covered aircraft contribute to the air pollution that endangers public health and welfare under section 231(a)(2)(A). The Administrator is not at this time making a cause or contribute finding regarding GHG emissions, or emissions of other substances, from engines used in non-covered aircraft.

The Administrator's final findings come in response to a citizen petition submitted by Friends of the Earth, Oceana, the Center for Biological Diversity, and Earthjustice (Petitioners) requesting that the EPA issue an endangerment finding and standards under CAA section 231(a)(2)(A) for the GHG emissions from aircraft. Further, the EPA anticipates that the 39th ICAO Assembly will approve a final CO_2 emissions standard in October 2016, and that subsequently, ICAO will formally adopt the final CO_2 emissions standard in March 2017. These final endangerment and cause or contribute findings for aircraft engine GHG emissions are also part of preparing for a subsequent domestic rulemaking process under CAA section 231. If an international standard is approved and finalized by ICAO, member states that wish to use aircraft in international transportation will then be required under the Chicago Convention [6] to adopt standards that are of at least equivalent stringency to those set by ICAO. Section II.D provides additional discussion of the international aircraft standard-setting process. This document does not take action or respond to comments on the 2015 U.S. EPA Aircraft Greenhouse Gas Emissions Advance Notice of Proposed Rulemaking (henceforth the ''2015 ANPR''),[7] which discussed such standards. Technical issues and comments for the 2015 ANPR would be addressed in a future notice of proposed rulemaking related to such standards.

B. Background Information Helpful to Understanding This Final Action

1. Greenhouse Gases and Their Effects

GHGs in the atmosphere have the effect of trapping some of the Earth's heat that would otherwise escape to space. GHGs are both naturally occurring and anthropogenic. The primary GHGs directly emitted by human activities include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Of these six gases, two (CO_2 and nitrous oxide) are emitted by aircraft engines.

These six gases, once emitted, remain in the atmosphere for decades to centuries. Thus, they become well mixed globally in the atmosphere, and their concentrations accumulate when emissions exceed the rate at which natural processes remove them from the atmosphere. Observations of the Earth's globally averaged combined land and ocean surface temperature over the period 1880 to 2012 show a warming of 0.85 degrees Celsius or 1.53 degrees Fahrenheit.[8] The Intergovernmental Panel on Climate Change's (IPCC) 2013–2014 Fifth Assessment Report concluded that heating effect caused by the human-induced buildup of these and other GHGs in the atmosphere, plus other human activities (*e.g.,* land use change and aerosol emissions), is extremely likely (>95 percent likelihood) to be the cause of most of the observed global warming since the mid-20th century.[9] Further information about climate change and its impact on health, society, and the environment is included in the record for the 2009 Endangerment Finding. The relevant scientific information from that record has also been included in the docket for this determination under CAA section 231(a)(2)(A) (EPA–HQ–OAR–2014–0828). Section IV of this preamble discusses this information, as well as information from the most recent scientific assessments, in the context of the Administrator's endangerment finding under CAA section 231.

The U.S. transportation sector constitutes a meaningful part of total U.S. and global anthropogenic GHG emissions. In 2014, aircraft remained the single largest GHG-emitting transportation source not yet subject to any GHG standards. Aircraft clearly contribute to U.S. transportation emissions, accounting for 12 percent of all U.S. transportation GHG emissions and representing more than 3 percent of total U.S. GHG emissions in 2014.[10]

[6] ICAO, 2006: *Convention on International Civil Aviation, Ninth Edition,* Document 7300/9, 114 pp. Available at: *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed May 9, 2016).

[7] 80 FR 37758 (July 1, 2015).

[8] IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[9] Ibid.

[10] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–

Globally, U.S. aircraft GHG emissions represent 29 percent of all global aircraft GHG emissions and 0.5 percent of total global GHG emissions. Section V of this preamble provides detailed information on aircraft GHG emissions in the context of the Administrator's cause or contribute finding under CAA section 231(a)(2)(A).

2. Statutory Basis for This Final Action

Section 231(a)(2)(A) of the CAA states that "The Administrator shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare."

Before the Administrator may propose and issue final standards addressing emissions of an air pollutant under section 231, the Administrator must satisfy a two-step test. First, the Administrator must decide whether, in her judgment, the air pollution under consideration may reasonably be anticipated to endanger public health or welfare. Second, the Administrator must decide whether, in her judgment, emissions of an air pollutant from certain classes of aircraft engines cause or contribute to this air pollution.[11] If the Administrator answers both questions in the affirmative, she must propose and issue final standards under section 231. *See Massachusetts* v. *EPA,* 549 U.S. 497, 533 (2007) (interpreting analogous provision in CAA section 202). Section III of this document summarizes the legal framework for this final action under CAA section 231. Typically, past endangerment and cause or contribute findings have been proposed and promulgated concurrently with proposed and promulgated standards under various sections of the CAA, including section 231. In those actions, public comment was taken on the proposed findings as part of the notice and comment process for the proposed emission standards. *See, e.g.,* Rulemaking for non-road compression-ignition engines under section 213(a)(4) of the CAA, Proposed Rule at 58 FR 28809, 28813–14 (May 17, 1993), Final Rule at 59 FR 31306, 31318 (June 17, 1994); Rulemaking for highway heavy-duty diesel engines and diesel sulfur fuel under sections 202(a) and 211(c) of the CAA, Proposed Rule at 65 FR 35430 (June 2, 2000), and Final Rule at 66 FR 5002 (January 18, 2001). However, there is no requirement that the Administrator propose or finalize the endangerment and cause or contribute findings concurrently with the related standards. See 74 FR 66502 (December 15, 2009). As explained in the 2009 Endangerment Finding, nothing in section 202(a) requires the EPA to propose or issue endangerment and cause or contribute findings in the same rulemaking, and Congress left the EPA discretion to choose an approach that satisfied the requirements of section 202(a). See id. The same analysis applies to section 231, which is analogous to section 202(a). The EPA is choosing to finalize these findings at this time for a number of reasons, including its previous commitment to issue such findings in response to a 2007 citizens' petition.[12]

The Administrator has applied the rulemaking provisions of CAA section 307(d) to this action, pursuant to CAA section 307(d)(1)(V), which provides that the provisions of 307(d) apply to "such other actions as the Administrator may determine." [13] CAA section 307(d) provides specific procedural requirements for the EPA to follow in taking certain rulemaking actions under the CAA, that apply in lieu of the otherwise applicable provisions of the Administrative Procedure Act, 5 U.S.C. 553–557, and 706. *See,* CAA section 307(d)(1). Any standard-setting rulemaking under section 231 will also be subject to the notice and comment rulemaking procedures under 307(d), as provided in CAA section 307(d)(1)(F) (applying the provisions of 307(d) to the promulgation or revision of any aircraft emission standard under section 231). Thus, these findings were subject to the same rulemaking procedures and requirements, as applicable, as would have applied if they had been part of a standard-setting rulemaking.

C. The EPA's Responsibilities Under the Clean Air Act

The CAA provides broad authority to combat air pollution to protect public health and welfare and the environment. Cars, trucks, construction equipment, airplanes, and ships, as well as a broad range of electricity generation, industrial, commercial and other facilities, are subject to various CAA programs. Many of these programs are targeted at ensuring protection of public health and welfare with a margin of safety, others are directed at encouraging improved industrial emissions performance and use of lesser polluting technologies and processes, and some address the prevention of adverse environmental effects. Implementation of the Act over the past four decades has resulted in significant reductions in air pollution that have benefited human health and the environment. The EPA's duties regarding aircraft air pollution emissions under CAA section 231 reflect a combination of the CAA's goals to protect public health and welfare and encourage improved emissions performance. This is shown by section 231(a)(2)(A)'s directive that EPA first identify whether emissions of aircraft engine air pollutants cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare (which is broadly defined in section 302(h) of the CAA).[14] This is also shown by section 231(b)'s subsequent requirement that EPA's standards, which may require improved emissions performance over the *status quo,* provide sufficient time for the development and application of requisite technology to meet emission standards, after consideration of costs.

1. The EPA's Regulation of Greenhouse Gases

In *Massachusetts* v. *EPA,* 549 U.S. 497 (2007), the Supreme Court found that GHGs are air pollutants that can be regulated under the CAA. The Court held that the Administrator must determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution which may

16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[11] To clarify the distinction between air pollution and air pollutant, in the context of GHGs, the air pollution is the atmospheric concentrations and can be thought of as the total, cumulative stock of GHGs in the atmosphere. The air pollutant, on the other hand, is the emissions of GHGs and can be thought of as the flow that changes the size of the total stock.

[12] Center for Biological Diversity, Center for Food Safety, Friends of the Earth, International Center for Technology Assessment, and Oceana, 2007: Petition for Rulemaking Under the Clean Air Act to Reduce the Emissions of Air Pollutants from Aircraft the Contribute to Global Climate Change, December 31, 2007. Available at *http://www3.epa.gov/otaq/aviation.htm* (last accessed April 8, 2016). EPA, 2012: Response to the Petition for Rulemaking Under the Clean Air Act to Reduce the Emission of Air Pollutants from Aircraft that Contribute to Global Climate Change, June 14, 2012. Available at *http://www3.epa.gov/otaq/aviation.htm* (last accessed April 8, 2016).

[13] As the Administrator is applying the provisions of section 307(d) to this rulemaking under section 307(d)(1)(V), we need not determine whether those provisions would apply to this action under section 307(d)(1)(F).

[14] Previously the EPA has made the prerequisite endangerment and cause or contribute findings under CAA section 231(A) that formed the basis to begin addressing the issue of various aircraft pollutants including NO_X aircraft pollution. U.S. EPA, "Control of Air Pollution from Aircraft and Aircraft Engines, Emission Standards and Test Procedures for Aircraft." Final Rule, 38 FR 19088 (July 17, 1973). See also section IV.B.7.d of this preamble for a discussion of previous NO_X section 231(A) findings.

reasonably be anticipated to endanger public health and/or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the Administrator was bound by the provisions of section 202(a) of the CAA. The Supreme Court decision resulted from a petition for rulemaking under section 202(a) filed by more than a dozen environmental, renewable energy, and other organizations.

Following the Supreme Court decision, the EPA proposed (74 FR 18886, April 24, 2009) and then finalized (74 FR 66496, December 15, 2009) the 2009 Endangerment Finding, which can be summarized as follows:

• Endangerment Finding: The Administrator found that the then-current and projected concentrations of the combined mix in the atmosphere of the six well-mixed GHGs—CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—endanger the public health and welfare of current and future generations.

• Cause or Contribute Finding: The Administrator found that the combined emissions of the six well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

The Administrator made both of these findings with respect to the six well-mixed GHGs, recognizing that CAA section 202(a) sources emit only four of the six substances. The findings did not themselves impose any requirements on industry or other entities. However, these findings compelled the EPA to promulgate GHG emission standards for new motor vehicles under section 202(a). Subsequently, in May 2010 the EPA, in collaboration with the National Highway Traffic Safety Administration (NHTSA), finalized Phase 1 GHG emission standards for light-duty vehicles (2012–2016 model years).[15] This was followed in August 2011 by adoption of the first-ever GHG emission standards for heavy-duty engines and vehicles (2014–2018 model years).[16] On August 29, 2012, the EPA finalized the second phase of the GHG emission standards for light-duty vehicles (2017–2025 model years), further reducing GHG emissions from light-duty vehicles.[17] In 2014, the President directed the EPA and the Department of Transportation to set standards in 2016 that further increase fuel efficiency and reduce GHG emissions from medium- and heavy-duty vehicles.[18]

The GHG rules for cars and trucks have been supported by a broad range of stakeholders, including states, major automobile and truck manufacturers, and environmental and labor organizations. Together these new standards for cars and trucks are resulting in significant reductions in GHG emissions, and over the lifetime of these vehicles GHG emissions will have been reduced more than 6.25 billion metric tons.[19] [20]

On June 25, 2013, President Obama announced a Climate Action Plan that set forth a series of executive actions to further reduce GHGs, prepare the U.S. for the impacts of climate change, and lead international efforts to address global climate change.[21] As part of the Climate Action Plan, the President issued a Presidential Memorandum directing the EPA to work expeditiously to complete carbon pollution standards for the power sector.[22] In August 2015, after notice and comment rulemaking, the EPA finalized two carbon pollution rulemakings: One for new, modified, and reconstructed electric utility generating units[23] and another for existing power plants.[24]

In the Climate Action Plan, the President also indicated that the United States was working internationally to make progress in a variety of areas and specifically noted the progress being made by ICAO to develop global CO_2 emission standards for aircraft.[25] The final endangerment and cause or contribute findings for aircraft GHG emissions under section 231(a)(2)(A) of the CAA are a preliminary but necessary first step to begin to address GHG emissions from the aviation sector, the highest-emitting category of transportation sources that the EPA has not yet addressed. As presented in more detail in Section V of this document, total U.S. aircraft GHG emissions in 2014 represented 12 percent of GHG emissions from the U.S. transportation sector,[26] and in 2010, the latest year with complete global emissions data, U.S. aircraft GHG emissions represented 29 percent of global aircraft GHG emissions.[27] [28] U.S. aircraft GHG emissions are projected to increase by 43 percent over the next two decades.[29]

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[15] U.S. EPA, 2010: *Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule,* 75 FR 25324 (May 7, 2010).

[16] U.S. EPA, 2011: *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rule,* 76 FR 57106 (September 15, 2011).

[17] U.S. EPA, 2012: *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule,* 77 FR 62623 (October 15, 2012).

[18] Executive Office of the President, 2014: *Remarks by the President on Fuel Efficiency Standards of Medium and Heavy-Duty Vehicles,* Office of the Press Secretary, February 18. Available at: *https://www.whitehouse.gov/the-press-office/2014/02/18/remarks-president-fuel-efficiency-standards-medium-and-heavy-duty-vehicl* (last accessed April 27, 2016).

[19] U.S. EPA, 2012: *EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017–2025 Cars and Light Trucks.* Document No. EPA–420–F–12–051, 10 pp. Available at *http://www.epa.gov/otaq/climate/documents/420f12051.pdf* (last accessed April 27, 2016). See also Table 7.4–2 in U.S. EPA, 2012: *Regulatory Impact Analysis: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporation Average Fuel Economy Standards,* EPA–420–R–12–016, 555 pp. Available at: *https://www3.epa.gov/otaq/climate/documents/420r12016.pdf* (last accessed April 27, 2016).

[20] U.S. EPA, 2011: *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium-and Heavy-Duty Engines and Vehicles; Final Rule,* 76 FR 57106 (September 15, 2011).

[21] Executive Office of the President, 2013: *The President's Climate Action Plan,* June 25, 21 pp. Available at: *http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf* (last accessed April 8, 2016).

[22] Executive Office of the President, 2013: *Presidential Memorandum—Power Sector Carbon Pollution Standards,* Office of the Press Secretary, June 25. Available at: *http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards* (last accessed April 8, 2016).

[23] U.S. EPA, 2015: *Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units; Final Rule,* 80 FR 64510 (October 23, 2015).

[24] U.S. EPA, 2014: *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule,* 80 FR 64661 (October 23, 2015). On February 9, 2016 the Supreme Court stayed this rule pending judicial review. The Court's stay order does not articulate a basis for the stay and does not address the merits of the rule.

[25] Executive Office of the President, 2013: *The President's Climate Action Plan, June 25, 21 pp.* Available at *http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf* (last accessed April 8, 2016).

[26] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014.* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[27] Ibid.

[28] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change.* Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, pp. 599–670.

[29] As discussed in section V.B.4.c, fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 43 percent from 2010 to 2036, and this provides a scaling factor for growth in GHG emissions which would increase at a similar rate as the fuel burn by 2030, 2036, and 2040. FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_*

See section V of this preamble for more information about the data sources that comprise the aircraft GHG emissions inventory.

2. Background on the Aircraft Petition, the 2008 Advance Notice of Proposed Rulemaking, and the D.C. District Court Decision

Section 231(a)(2)(A) of the CAA directs the Administrator of the EPA to, from time to time, propose aircraft engine emissions standards applicable to the emission of any air pollutant from any classes of aircraft engines which in her judgment causes or contributes to air pollution which may reasonably be anticipated to endanger public health or welfare.

On December 5, 2007, Friends of the Earth, Oceana, the Center for Biological Diversity, Earthjustice, and others (Petitioners) sent a letter to the EPA petitioning the Agency to undertake rulemaking regarding GHG emissions from aircraft.[30] Specifically, Petitioners requested that the EPA make a finding that GHG emissions from aircraft engines "may reasonably be anticipated to endanger public health and welfare" and that the EPA promulgate standards for GHG emissions from aircraft.

Following the Supreme Court's decision in *Massachusetts* v. *EPA* in 2007, the EPA issued an advance notice of proposed rulemaking (ANPR) in 2008 presenting information relevant to potentially regulating GHGs under the Act and soliciting public comment on how to respond to the Court's ruling and the potential ramifications of the Agency's decision to regulate GHGs under the CAA. This ANPR described and solicited comment on numerous petitions the Agency had received to regulate GHG emissions from both stationary and mobile sources, including aircraft. 73 FR 44354, 44468–73 (July 30, 2008). With regard to aircraft, the Agency sought comment on the impact of aircraft operations on GHG emissions and the potential for reductions in GHG emissions from these operations.

On July 31, 2008, Earthjustice, on behalf of Petitioners, notified the EPA of its intent to file suit under CAA section 304(a) against the EPA for the Agency's alleged unreasonable delay in responding to its aircraft petition and in making an endangerment finding under section 231. On June 11, 2010, Petitioners filed a complaint against the EPA in the U.S. District Court for the District of Columbia claiming that, among other things, the EPA had unreasonably delayed because it had failed to answer the 2007 Petition and to determine whether GHG emissions from aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health and/or welfare.

The District Court found that while CAA section 231 generally confers broad discretion to the EPA in determining what standards to promulgate, section 231(a)(2)(A) imposed a nondiscretionary duty on the EPA to make a finding with respect to endangerment from aircraft GHG emissions. *Center for Biological Diversity, et al.* v. *EPA,* 794 F. Supp. 2d 151 (D.D.C. 2011). This ruling was issued in response to the EPA's motion to dismiss the case on jurisdictional grounds and did not address the merits of the Plaintiffs' claims regarding the Agency's alleged unreasonable delay. Therefore, it did not include an order for the EPA to make such a finding by a certain date. In a subsequent ruling on the merits, the Court found that the Plaintiffs had not shown that the EPA had unreasonably delayed in making an endangerment determination regarding GHG emissions from aircraft. *Center for Biological Diversity, et al.* v. *EPA,* No. 1:10–985 (D.D.C. March, 20, 2012). Thus, the Court did not find the EPA to be liable based on the Plaintiffs' claims and did not place the Agency under a remedial order to make an endangerment finding or to issue standards. The Plaintiffs did not appeal this ruling to the U.S. Court of Appeals for the District of Columbia Circuit (also called the "D.C. Circuit" in this document).

The EPA issued a Response to the Aircraft Petition[31] on June 27, 2012, stating our intention to move forward with a proposed endangerment finding for aircraft GHG emissions under section 231, while explaining that it would take the Agency significant time to complete this action. The EPA explained that the Agency would not begin this effort until after the U.S. Court of Appeals completed its then-pending review of the previous section 202 Endangerment Finding, since the then-awaited ruling might provide important guidance for the EPA in conducting future GHG endangerment findings. The EPA further explained that after receiving the Court of Appeal's ruling, it would take at least 22 months from that point for the Agency to conduct an additional finding regarding aircraft GHG emissions.

Meanwhile, the Court of Appeals upheld the EPA's section 202 findings in a decision of a three-judge panel on June 26, 2012, and denied petitions for rehearing of that decision on December 20, 2012. *Coalition for Responsible Regulation, Inc.,* v. *EPA,* 684 F.3d 102 (D.C. Cir. 2012), reh'g denied 2012 U.S. App. LEXIS 26315, 25997 (D.C. Cir 2012).[32] Given these rulings, we are proceeding with these findings regarding aircraft engine GHG emissions as a further step toward responding to the 2007 Petition for Rulemaking.

D. U.S. Aircraft Regulations and the International Community

The EPA and the FAA traditionally work within the standard-setting process of ICAO's Committee on Aviation Environmental Protection (CAEP or the Committee) to establish international emission standards and related requirements, which individual nations later adopt into domestic law in fulfillment of their obligations under the Convention on International Civil Aviation (Chicago Convention). Historically, under this approach, international emission standards have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings under CAA section 231 to establish domestic standards that are at least as stringent as ICAO's standards. This approach has been affirmed as a reasonable way to implement the Agency's duties under CAA section 231 by the U.S. Court of Appeals for the D.C. Circuit. *Nat'l Ass'n of Clean Air Agencies (NACAA)* v. *EPA,* 489 F.3d 1221, 1230–32 (D.C. Cir. 2007). After EPA promulgates aircraft engine emissions standards, CAA section 232 requires the FAA to issue regulations to ensure compliance with these standards when issuing certificates under its authority under Title 49 of the United

Aerospace_Forecast.pdf (last accessed April 8, 2016).

[30] Center for Biological Diversity, Center for Food Safety, Friends of the Earth, International Center for Technology Assessment, and Oceana, 2007: *Petition for Rulemaking Under the Clean Air Act to Reduce the Emissions of Air Pollutants from Aircraft the Contribute to Global Climate Change,* December 5, 26 pp. Available at *http://www.epa.gov/otaq/aviation.htm* (last accessed April 8, 2016) and Docket EPA–HQ–OAR–2014–0828.

[31] U.S. EPA, 2012: *Memorandum in Response to Petition Regarding Greenhouse Gas Emissions from Aircraft,* June 14, 11 pp. Available at *http://www.epa.gov/otaq/aviation.htm* (last accessed April 8, 2016) and Docket EPA–HQ–OAR–2014–0828.

[32] Petitions for *certiorari* were filed in the Supreme Court, and the Supreme Court granted six of those petitions but "agreed to decide only one question: 'Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.'" *Utility Air Reg. Group* v. *EPA,* 134 S. Ct. 2427, 2438 (2014); *see also Virginia* v. *EPA,* 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA,* 134 S. Ct. 418 (2013), and *CRR,* 134 S. Ct. 468 (2013) (all denying cert.). Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding.

States Code. These final endangerment and cause or contribute findings for aircraft GHG emissions are in preparation for this domestic emissions standards rulemaking process.

1. International Regulations and U.S. Obligations

The EPA has worked with the FAA since 1973, and later with ICAO, to develop domestic and international standards and other recommended practices pertaining to aircraft engine emissions. ICAO is a United Nations (UN) specialized agency, established in 1944 by the Chicago Convention, ''in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically.'' [33] ICAO sets international standards and regulations for aviation safety, security, efficiency, capacity, and environmental protection and serves as the forum for cooperation in all fields of international civil aviation. ICAO works with the Chicago Convention's member states and global aviation organizations to develop international Standards and Recommended Practices (SARPs), which member states reference when developing their legally enforceable national civil aviation regulations. The United States is currently one of 191 participating ICAO member states.[34] [35]

In the interest of global harmonization and international air commerce, the Chicago Convention urges its member states to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures and organization. The Chicago Convention also recognizes that member states may adopt standards that are more stringent than those agreed upon by ICAO. Any member state which finds it impracticable to comply in all respects with any international standard or procedure, or that deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, is required to give immediate notification to ICAO of the differences between its own practice and that established by the international standard.[36]

ICAO's work on the environment focuses primarily on those problems that benefit most from a common and coordinated approach on a worldwide basis, namely aircraft noise and engine emissions. SARPs for the certification of aircraft noise and aircraft engine emissions are covered by Annex 16 of the Chicago Convention. To continue to address aviation environmental issues, in 2004, ICAO established three environmental goals: (1) Limit or reduce the number of people affected by significant aircraft noise; (2) limit or reduce the impact of aviation emissions on local air quality; and (3) limit or reduce the impact of aviation GHG emissions on the global climate.

The Chicago Convention has a number of other features that govern international commerce. First, member states that wish to use aircraft in international transportation must adopt emissions standards and other recommended practices that are at least as stringent as ICAO's standards. Member states may ban the use of any aircraft within their airspace that does not meet ICAO standards.[37] Second, the Chicago Convention indicates that member states are required to recognize the airworthiness certificates of any state whose standards are at least as stringent as ICAO's standards.[38] Third, to ensure that international commerce is not unreasonably constrained, a member state which elects to adopt more stringent domestic emission standards is obligated to notify ICAO of the differences between its standards and ICAO standards.[39]

ICAO's CAEP, which consists of members and observers from states, intergovernmental and non-governmental organizations representing aviation industry and environmental interests, undertakes ICAO's technical work in the environmental field. The Committee is responsible for evaluating, researching, and recommending measures to the ICAO Council that address the environmental impacts of international civil aviation. CAEP's terms of reference indicate that ''CAEP's assessments and proposals are pursued taking into account: Technical feasibility; environmental benefit; economic reasonableness; interdependencies of measures (for example, among others, measures taken to minimize noise and emissions); developments in other fields; and international and national programs.'' [40] The ICAO Council reviews and adopts the recommendations made by CAEP. It then reports to the ICAO Assembly, the highest body of the Organization, where the main policies on aviation environmental protection are adopted and translated into Assembly Resolutions. If ICAO adopts a CAEP proposal for a new environmental standard, it then becomes part of ICAO standards and recommended practices (Annex 16 to the Chicago Convention).[41] [42]

At CAEP meetings, the United States is represented by the FAA and plays an active role.[43] The EPA has historically been a principal participant in various ICAO/CAEP working groups and other international venues, assisting and advising FAA on aviation emissions, technology, and environmental policy matters. In turn, the FAA assists and advises the EPA on aviation environmental issues, technology and certification matters.

The first international standards and recommended practices for aircraft engine emissions were recommended by CAEP's predecessor, the Committee on Aircraft Engine Emissions (CAEE), and

[33] ICAO, 2006: *Convention on International Civil Aviation, Ninth Edition,* Document 7300/9, 114 pp. Available at: *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed April 20, 2016).

[34] Members of ICAO's Assembly are generally termed member states or contracting states. These terms are used interchangeably throughout this preamble.

[35] There are currently 191 contracting states according to ICAO's Web site: *www.icao.int* (last accessed April 8, 2016).

[36] ICAO, 2006: *Doc 7300-Convention on International Civil Aviation, Ninth Edition,* Document 7300/9, 114 pp. Available at *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed April 8, 2016).

[37] ICAO, 2006: *Convention on International Civil Aviation, Article 87, Ninth Edition,* Document 7300/9, 114 pp. Available at *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed April 8, 2016).

[38] ICAO, 2006: *Convention on International Civil Aviation, Article 33, Ninth Edition,* Document 7300/9, 114 pp. Available at *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed April 8, 2016).

[39] ICAO, 2006: *Convention on International Civil Aviation, Article 38, Ninth Edition,* Document 7300/9, 114 pp. Available at *http://www.icao.int/publications/Documents/7300_9ed.pdf* (last accessed April 8, 2016).

[40] ICAO: CAEP Terms of Reference. Available at *http://www.icao.int/environmental-protection/Pages/Caep.aspx#ToR* (last accessed April 27, 2016).

[41] ICAO, 2008: *Aircraft Engine Emissions,* International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Third Edition, July, 110 pp. Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. AN16–2.

[42] CAEP develops new emission standards based on an assessment of the technical feasibility, cost, and environmental benefit of potential requirements.

[43] Pursuant to the President's memorandum of August 11, 1960 (and related Executive Order No. 10883 from 1960), the Interagency Group on International Aviation (IGIA) was established to facilitate coordinated recommendations to the Secretary of State on issues pertaining to international aviation. The DOT/FAA is the chair of IGIA, and as such, the FAA represents the U.S. on environmental matters at CAEP.

adopted by ICAO in 1981.[44] These standards limited aircraft engine emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO_X). The 1981 standards applied to newly manufactured engines, which are those engines built after the effective date of the regulations—also referred to as in-production engines. In 1993, ICAO adopted a CAEP/2 proposal to tighten the original NO_X standard by 20 percent and amend the test procedures.[45] These 1993 standards applied both to newly certified turbofan engines, which are those engine models that received their initial type certificate after the effective date of the regulations—also referred to as newly certified engines or new engine designs—and to in-production engines, but with different effective dates for newly certified engines and in-production engines. In 1995, CAEP/3 recommended a further tightening of the NO_X standards by 16 percent and additional test procedure amendments, but in 1997 the ICAO Council rejected this stringency proposal and approved only the test procedure amendments. At the CAEP/4 meeting in 1998, the Committee adopted a similar 16 percent NO_X reduction proposal, which ICAO approved in 1998. The CAEP/4 standards applied only to new engine designs certified (or newly certified engines) after December 31, 2003 (*i.e.,* unlike the CAEP/2 standards, the CAEP/4 requirements did not apply to in-production engines). In 2004, CAEP/6 recommended a 12 percent NO_X reduction, which ICAO approved in 2005.[46] [47] The CAEP/6 standards applied to new engine designs certified after December 31, 2007. In 2010, CAEP/8 recommended a further tightening of the NO_X standards by 15 percent for new engine designs certified after December 31, 2013.[48] [49] The Committee also recommended that the CAEP/6 standards be applied to in-production engines (eliminating the production of CAEP/4 compliant engines with the exception of spare engines), and ICAO approved these recommendations in 2011.[50]

2. The International Civil Aviation Organization's Reasons for Addressing Aircraft GHG Emissions

In October 2010, the 37th Assembly (Resolution A37–19) of ICAO requested the development of an ICAO CO_2 emissions standard.[51] The Resolution provided a framework towards the achievement of an environmentally sustainable future for international aviation. With this Resolution, the ICAO Assembly agreed to a global aspirational goal for international aviation of improving annual fuel efficiency by two percent up to the year 2050, and stabilizing CO_2 emissions at 2020 levels.[52] Reducing climate impacts of international aviation is a critical element of ICAO's strategic objective of achieving environmental protection and sustainable development of air transport. ICAO is currently pursuing a comprehensive set of measures to reduce aviation's climate impact, including lower-carbon alternative fuels, CO_2 emissions technology-based standards, operational improvements, and market based measures. The development and adoption of a CO_2 emissions standard is an important part of ICAO's comprehensive set of measures.

3. EPA's Regulation of Aircraft Emissions and the Relationship of the Final Endangerment and Cause or Contribute Findings to International Aircraft Standards

As required by the CAA, the EPA has been engaged in reducing harmful air pollution from aircraft engines for over 40 years, regulating gaseous exhaust emissions, smoke, and fuel venting from aircraft engines.[53] We have periodically revised these regulations. In a 1997 rulemaking, for example, we made our emission standards and test procedures more consistent with those of ICAO's CAEP for turbofan engines used in commercial aviation with rated thrusts greater than 26.7 kilonewtons.[54] These ICAO requirements are generally referred to as CAEP/2 standards.[55] The 1997 rulemaking included new NO_X emission standards for newly manufactured commercial turbofan engines (as described earlier, those engines built after the effective date of the regulations that were already certified to pre-existing standards—also referred to as in-production engines)[56] and for newly certified commercial turbofan engines (as described earlier, those engine models that received their initial type certificate after the effective date of the regulations—also referred to as new engine designs).[57] It also included a CO emission standard for in-production commercial turbofan engines.[58] In 2005, we promulgated more stringent NO_X emission standards for newly certified commercial turbofan

[44] ICAO, 2008: *Aircraft Engine Emissions: Foreword,* International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Third Edition, July, 110 pp. Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. AN16–2.

[45] CAEP conducts its work over a period of years. Each work cycle is numbered sequentially and that identifier is used to differentiate the results from one CAEP to another by convention. The first technical meeting on aircraft emission standards was CAEP's successor, *i.e.,* CAEE. The first meeting of CAEP, therefore, is referred to as CAEP/2.

[46] CAEP/5 did not address new aircraft engine emission standards.

[47] ICAO, 2008: *Aircraft Engine Emissions,* Annex 16, Volume II, Third Edition, July 2008, Amendment 5 effective on July 11, 2005, 110 pp. Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. AN16–2.

[48] CAEP/7 did not address new aircraft engine emission standards.

[49] ICAO, 2010: *Committee on Aviation Environmental Protection (CAEP), Report of the Eighth Meeting, Montreal, February 1–12, 2010,* CAEP/8–WP/80 Available in Docket EPA–HQ–OAR–2010–0687.

[50] ICAO, 2014: *Aircraft Engine Emissions,* Annex 16, Volume II, Third Edition, July 2008, Amendment 8, 108 pp. CAEP/8 corresponds to Amendment 7 effective on July 18, 2011. Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Annex 16 Volume II is found on page 19 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. AN16–2/E/11.

[51] A consolidated statement of continuing policies and practices related to environmental protection (known as Assembly Resolutions) is revised and updated by the Council every three years for adoption by the ICAO Assembly. ICAO, 2010: *Resolutions Adopted by the Assembly, 37th Session, Montreal, September 29–October 8, 2010,* Provisional Edition, November 2010.

[52] The global aspirational goal for international aviation of improving annual fuel efficiency by 2 percent is for the annual international civil aviation in-service fleet. Fuel efficiency is measured on the basis of the volume of fuel used per revenue tonne kilometer performed. ICAO CAEP, 2009: *Aspirational Goals and Implementation Options,* Working Paper HLM–ENV/09–WP/5, 5 pp. Available at *http://www.icao.int/Meetings/AMC/MA/High%20Level%202009/hlmenv_wp005_en.pdf* (last accessed April 8, 2015).

[53] U.S. EPA, 1973: *Emission Standards and Test Procedures for Aircraft; Final Rule,* 38 FR 19088 (July 17, 1973).

[54] U.S. EPA, 1997: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test rocedures; Final Rule,* 62 FR 25355 (May 8, 1997).

[55] The full CAEP membership meets every three years and each session is denoted by a numerical identifier. For example, the second meeting of CAEP is referred to as CAEP/2, and CAEP/2 occurred in 1994.

[56] This does not mean that in 1997 we promulgated requirements for the re-certification or retrofit of existing in-use engines.

[57] In the existing EPA regulations, 40 CFR part 87, newly certified aircraft engines are described as engines of a type or model of which the date of manufacture of the first individual production model was after the implementation date. Newly manufactured aircraft engines are characterized as engines of a type or model for which the date of manufacturer of the individual engine was after the implementation date.

[58] U.S. EPA, 1997: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 62 FR 25355 (May 8, 1997).

engines.[59] That final rule brought the U.S. standards closer to alignment with ICAO CAEP/4 requirements that became effective in 2004. In 2012, we issued more stringent two-tiered NO_X emission standards for newly certified and in-production commercial and non-commercial turbofan aircraft engines, and these NO_X standards align with ICAO's CAEP/6 and CAEP/8 requirements that became effective in 2013 and 2014, respectively.[60] [61] The EPA's actions to regulate certain pollutants emitted from aircraft engines come directly from the authority in section 231 of the CAA, and we have aligned the U.S. emissions requirements with those promulgated by ICAO. All of these previous emission standards have generally been considered anti-backsliding standards (most aircraft engines meet the standards), which are technology-following.

In addressing CO_2 emissions, ICAO has moved to regulating a whole aircraft. ICAO explained its decision to regulate pollutant emissions from the whole aircraft in a 2013 ICAO circular.[62] Several factors are considered when addressing whole-aircraft CO_2 emissions, as CO_2 emissions are influenced by aerodynamics, weight, and engine technology. Since the aircraft-specific characteristics of aerodynamics and weight affect fuel consumption, they ultimately affect CO_2 engine exhaust emissions. Rather than viewing CO_2 as a measurable emission from the engine alone, ICAO addresses CO_2 emissions as an aircraft-specific characteristic based on fuel consumption.

The EPA has worked diligently over the past six years within the ICAO/CAEP process on a range of technical issues regarding aircraft CO_2 emission standards. The 2015 ANPR discussed the issues arising from those international proceedings and requested public comment on a variety of issues to assist the Agency in developing its position with regard to these issues, to help ensure transparency and obtain views on aircraft engine GHG emission standards that it might potentially adopt under the CAA.

As described in the 2015 ANPR, in 2013 CAEP agreed on a metric[63] to compare CO_2 emissions from aircraft. The CO_2 metric value is a comparative metric meant to differentiate between generations of aircraft and to equitably capture improvements in aerospace technology that contribute to a reduction in the airplane CO_2 emissions. The CO_2 metric is not intended for use as a direct measure of CO_2 emissions rates or operational fuel burn, rather it is a comparative measure of technology on different aircraft.

Using this metric, CAEP considered and analyzed 10 different stringency levels for both in-production and new type standards, comparing aircraft with a similar level of technology on the same stringency level. These levels were generically referred to numerically from ''1'' as the least stringent to ''10'' as the most stringent, which correspond to the upper and lower lines of constant technology, respectively, from the 2015 ANPR. The 2015 ANPR described the range of stringency levels under consideration at CAEP as falling into three categories as follows: (1) CO_2 stringency levels that could impact[64] only the oldest, least efficient aircraft in-production around the world, (2) middle range CO_2 stringency levels that could impact many aircraft currently in-production and comprising much of the current operational fleet, and (3) CO_2 stringency levels that could impact aircraft that have either just entered production or are in final design phase but will be in-production by the time the international CO_2 standards becomes effective.[65]

At its meeting in February of 2016, CAEP agreed on an initial set of international standards to regulate CO_2 emissions from aircraft.[66] It was agreed that these international standards should apply to both new type and in-production aircraft. The applicability date for the in-production standard was agreed to be later than for the new type standard. CAEP explained that this will allow manufacturers and certification authorities additional preparation time to accommodate the standards. The new type and in-production stringency levels for smaller and larger aircraft were agreed to be set at different levels to reflect the range of technology being used and the availability of new fuel burn reduction technologies that vary across aircraft of differing size and weight. Table II.1 provides a brief overview of the applicability dates and stringency levels of the standards agreed to at ICAO/CAEP. As described earlier, CAEP considered and analyzed 10 different stringency levels for both in-production and new type standards (from 1 as the least stringent to 10 as the most stringent).

[59] U.S. EPA, 2005: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 70 FR 69664 (November 17, 2005).

[60] U.S. EPA, 2012: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 77 FR 36342 (June 18, 2012).

[61] While ICAO's standards were not limited to ''commercial'' aircraft engines, our 1997 standards were explicitly limited to commercial engines, as our finding that NO_X and carbon monoxide emissions from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare was so limited. See 62 FR 25358 (May 8, 1997). In the 2012 rulemaking, we expanded the scope of that finding and of our standards pursuant to CAA section 231(a)(2)(A) to include such emissions from both commercial and non-commercial aircraft engines based on the physical and operational similarities between commercial and noncommercial civilian aircraft and to bring our standards into full alignment with ICAO's.

[62] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard,* Circular (Cir) 337, 40 pp, AN/192. Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Circular 337 is found on page 87 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. CIR337.

[63] The CO_2 metric is the average of three cruise test points normalized by a dimensionless parameter representing aircraft fuselage size. The units of the metric value are kilograms of fuel burned per kilometer flown. However, because the metric is a normalized value it cannot be used to estimate operational fuel burn or emission rates of aircraft. The metric value is described in detail in both ICAO Circular 337 and in section D of the 2015 ANPR. ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard,* Circular (Cir) 337, 40 pp., AN/192, Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 27, 2016). The ICAO Circular 337 is found on page 87 of the catalog and is copyright protected; Order No. CIR337.

[64] As described in the 2015 ANPR, the aircraft shown in [Figure II.1 and II.2] are in-production and current in-development. These aircraft could be impacted by an in-production standard in that, if they were above the standard, they would need to either implement a technology response or go out of production. For a new type only standard there will be no regulatory requirement for these aircraft to respond.

[65] 80 FR at 37797.

[66] Further, the EPA anticipates that the 39th ICAO Assembly will approve these CO_2 emissions standards in October 2016, and that subsequently, ICAO will formally adopt these CO_2 emissions standards in March 2017.

TABLE II.1—STRINGENCY LEVELS AND APPLICABILITY DATES FOR ICAO/CAEP CO_2 EMISSION STANDARDS

	Aircraft MTOM thresholds (kg)	New type aircraft[67] maximum permitted CO_2 metric value	In-production aircraft maximum permitted CO_2 metric value
Stringency Level	>5,700 to <60,000	[A] 5	[B] 3
	Horizontal Transition[68]	[C]	[D]
	60,000 to ~70,000		
	> ~70,000	[E] 8.5	[F] 7
Applicability Date	Application for a new type certificate or a change to an existing type certificate.	2020 (2023 for planes with less than 19 seats)	2023
	Production Cut Off	n/a	2028

[A] Equation of ICAO Stringency Option #5: $MV = 10^{\text{¥}\,2.73780\ \partial\,(0.681310*\log\ 10(MTOM))\ \partial\,(\text{¥}\,0.0277861*(\log\ 10(MTOM))^{2})}$
[B] Equation of ICAO Stringency Option #3: $MV = 10^{\text{¥}\,2.57535\ \partial\,(0.609766*\log\ 10(MTOM))\ \partial\,(\text{¥}\,0.0191302*(\log\ 10(MTOM))^{2})}$
[C] Equation of New Type transition—60,000 to 70,395 kg: $MV = 0.764$
[D] Equation of In-production transition—60,000 to 70,107 kg: $MV = 0.797$
[E] Equation of ICAO Stringency Option #8.5: $MV = 10^{\text{¥}\,2.57535\ \partial\,(0.609766*\log\ 10(MTOM))\ \partial\,(\text{¥}\,0.0191302*(\log\ 10(MTOM))^{2})}$
[F] Equation of ICAO Stringency Option #7: $MV = 10^{\text{¥}\,1.39353\ \partial\,(\text{¥}\,0.020517*\log\ 10(MTOM))\ \partial\,(0.0593831*(\log\ 10(MTOM))^{2})}$

Figures II.1 and II.2 show a graphical depiction of both the new type and in-production standards compared against the lines of constant technology described in the 2015 ANPR and CO_2 metric value levels of current (as of February 2016) in-production and in-development[69] aircraft. The aircraft data shown were generated by the EPA using a commercially available aircraft modeling tool called PIANO.[70] It should be noted that a number of the aircraft currently shown as in-production are expected to go out of production and be replaced by known in-development aircraft prior to both the new type and the in-production CO_2 standards going into effect internationally.

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[67] "In Development" aircraft shown in Figures II.1 and II.2 are the aircraft that were in development by manufacturers at the time the 2015 ANPR was published.

[68] Stringency lines above and below 60,000 kilograms (MTOM) are connected by a horizontal transition starting at 60,000 kilograms (MTOM) and continuing right (increasing mass) until it intersects with the next level.

[69] Aircraft that are currently in-development but will be in production by the applicability dates. These could be new types or significant partial redesigned aircraft.

[70] PIANO (Project Interactive Analysis and Optimization), Aircraft Design and Analysis Software by Dr. Dimitri Simos, Lissys Limited, UK, 1990–present; Available at *www.piano.aero* (last accessed April 8, 2016). This is a commercially available aircraft design and performance software suite used across the industry and academia. This model contains non-manufacturer provided estimates of performance of various aircraft.

FIGURE II.1

ICAO CO_2 EMISSION STANDARDS (MTOM IN KILOGRAMS)

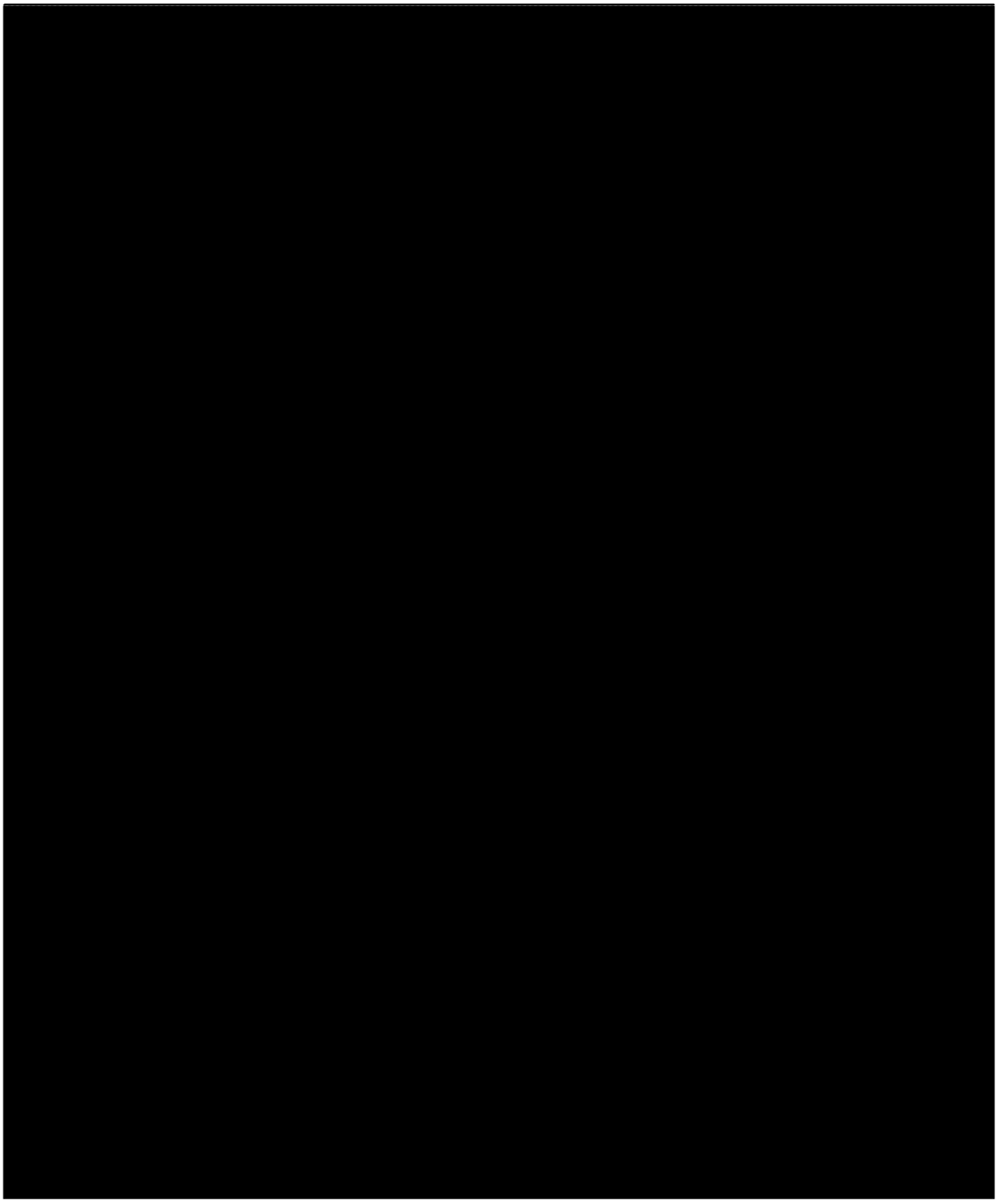
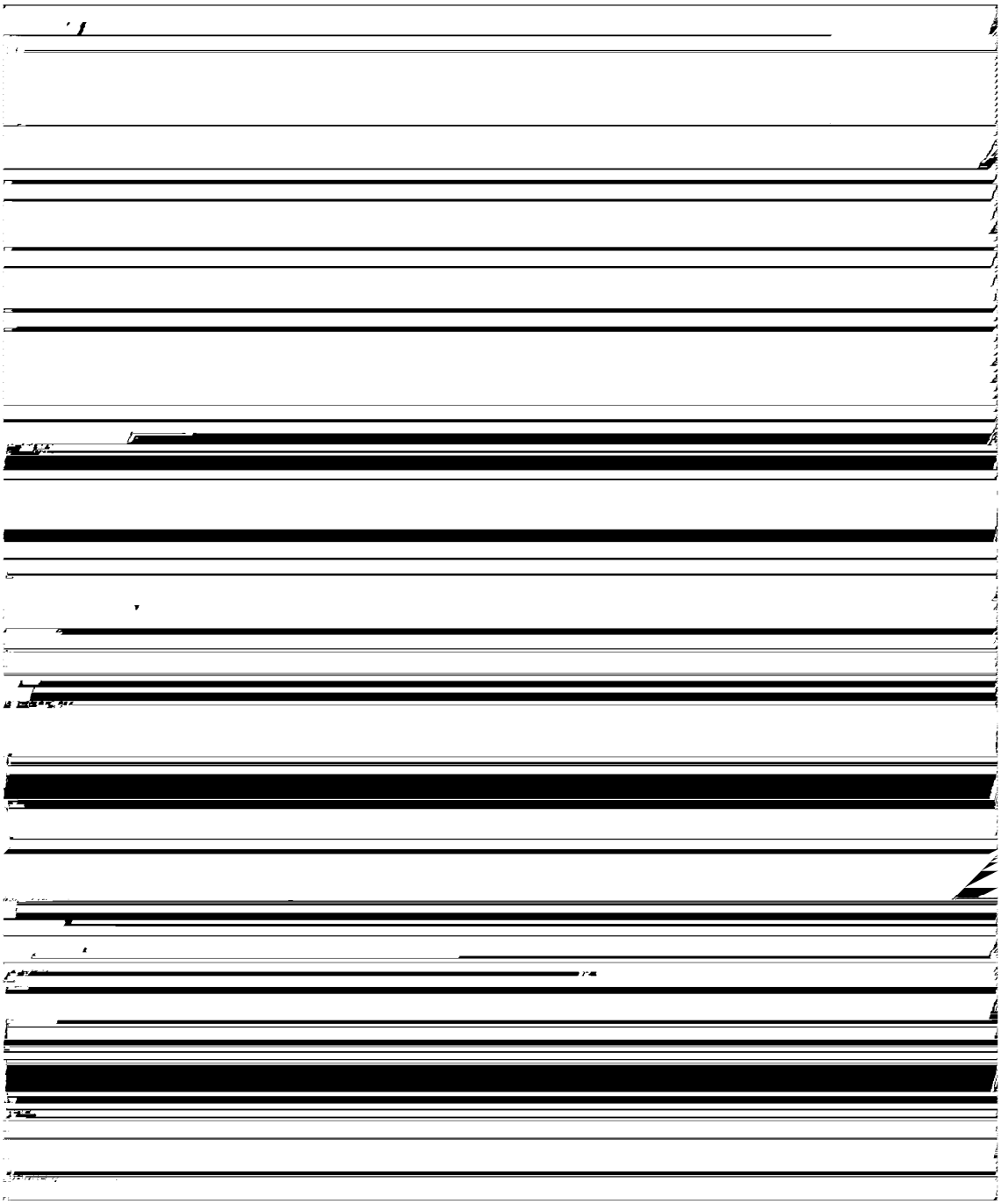


FIGURE II.2

ICAO CO_2 EMISSION STANDARDS (Zoomed to show <100,000 MTOM IN KILOGRAMS)



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In this final action, the EPA is promulgating findings under section 231(a)(2) that emissions of the six well-mixed GHGs from certain classes of engines used in covered aircraft cause or contribute to endangering air pollution. The EPA is not yet issuing proposed or final emission standards, nor is the EPA taking final action that prejudges what future standards will be. Instead, the EPA's final endangerment and cause or contribute findings for aircraft GHG emissions are in preparation for a subsequent, expected domestic

rulemaking process to adopt future GHG emissions standards. If the ICAO Assembly, in October 2016, approves the final CO_2 standards and subsequently ICAO formally adopts the final CO_2 standards in March 2017, the EPA's standards will need to be at least as stringent as the ICAO CO_2 aircraft standards for the United States to meet its treaty obligations under the Chicago Convention. As a result of these positive findings, the EPA is obligated under section 231 of the CAA to set emission standards applicable to GHG emissions from the classes of aircraft engines included in the contribution finding, no matter the outcome of ICAO's future actions in October 2016 and March 2017.

III. Legal Framework for This Action

The EPA has previously made an endangerment finding for GHGs under Title II of the CAA, in the 2009 Endangerment Finding for section 202(a) source categories. In the 2009 Endangerment Finding, the EPA explained its legal framework for making an endangerment finding under section 202(a) of the CAA (74 FR 18886, 18890–94 (April 24, 2009), and 74 FR 66496, 66505–10 (December 15, 2009)). The text in section 202(a) that was the basis for the 2009 Endangerment Finding addresses ''the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in [the Administrator's] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' Similarly, section 231(a)(2)(A) concerns ''the emission of any air pollutant from any class or classes of aircraft engines which in [the Administrator's] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' Thus, the text of the CAA section concerning aircraft emissions in section 231(a)(2)(A) mirrors the text of CAA section 202(a) that was the basis for the 2009 Endangerment Finding.

The EPA's approach in the 2009 Endangerment Finding (described below in sections III.A and III.B) was affirmed by the U.S. Court of Appeals for the D.C. Circuit in *Coalition for Responsible Regulation, Inc.* v. *EPA,* 684 F.3d 102 (D.C. Cir. 2012), *reh'g denied* 2012 U.S. App. LEXIS 26313, 26315, 25997 (D.C. Cir. 2012) (*CRR*). In particular, the D.C. Circuit ruled that the 2009 Endangerment Finding (including the Agency's denial of petitions for reconsideration of that Finding) was not arbitrary or capricious, was consistent with the U.S. Supreme Court's decision in *Massachusetts* v. *EPA* and the text and structure of the CAA, and was adequately supported by the administrative record. *CRR,* 684 F.3d at 116–128. The D.C. Circuit found that the EPA had based its decision on ''substantial scientific evidence'' and noted that the EPA's reliance on major scientific assessments was consistent with the methods that decision-makers often use to make a science-based judgment. *Id.* at 120–121. Petitions for *certiorari* were filed in the Supreme Court, and the Supreme Court granted six of those petitions but ''agreed to decide only one question: 'Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.''' *Utility Air Reg. Group* v. *EPA,* 134 S. Ct. 2427, 2438 (2014); see also *Virginia* v. *EPA,* 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA,* 134 S. Ct. 418 (2013), and *CRR,* 134 S. Ct. 468 (2013) (all denying cert.). Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding. Accordingly, the Agency finds that it is reasonable to use that same approach under section 231(a)(2)(A)'s similar endangerment text, and as explained in the following discussion, is acting consistently with that judicially sanctioned framework for purposes of this final section 231 finding.

Two provisions of the CAA govern this final action. Section 231(a)(2)(A) sets forth a two-part predicate for regulatory action under that provision: Endangerment and cause or contribute. Section 302 of the Act contains definitions of the terms ''air pollutant'' and ''welfare'' used in section 231(a)(2)(A). These statutory provisions are discussed below.

A. Section 231(a)(2)(A)—Endangerment and Cause or Contribute

As noted above, section 231(a)(2)(A) of the CAA (like section 202(a)) calls for the Administrator to exercise her judgment and make two separate determinations: first, whether the relevant kind of air pollution—here, the six well-mixed GHGs—may reasonably be anticipated to endanger public health or welfare, and second, whether emissions of any air pollutant from classes of the sources in question (aircraft engines under section 231 and new motor vehicles or engines under section 202) cause or contribute to this air pollution.[71]

The Administrator interprets the two-part test required under section 231(a)(2)(A) as being the same as that explained in the 2009 Endangerment Finding. *See* 74 FR 66505–06. As in the section 202(a) context, this analysis entails a scientific judgment by the Administrator about the potential risks posed by GHG emissions to public health and welfare. *See CRR,* 684 F.3d at 117–118.[72]

In making this scientific judgment, the Administrator is guided by five principles. First, the Administrator is required to protect public health and welfare. She is not asked to wait until harm has occurred but instead must be ready to take regulatory action to prevent harm before it occurs.[73] The Administrator is thus to consider both current and future risks.

Second, the Administrator is to exercise judgment by weighing risks, assessing potential harms, and making reasonable projections of future trends and possibilities. It follows that when exercising her judgment the Administrator balances the likelihood and severity of effects. This balance involves a sliding scale: on one end the severity of the effects may be significant, but the likelihood low, while on the other end the severity may be less significant, but the likelihood high.[74] At different points along this scale, the Administrator is permitted to find endangerment. Accordingly, the Administrator need not set a precise or minimum threshold of risk or harm as part of making an endangerment finding, but rather may base her determination on '''a lesser risk of greater harm . . . or a greater risk of lesser harm' or any combination in between.'' *CRR,* 684 F.3d at 123 (quoting *Ethyl Corp.* v. *EPA,* 541 F.2d, 1, 18 (D.C. Cir. 1976)).

Third, because scientific knowledge is constantly evolving, the Administrator may be called upon to make decisions while recognizing the uncertainties and limitations of the data or information available, as risks to public health or

[71] *See CRR,* 684 F.3d at 117 (explaining two-part analysis under section 202(a)).

[72] When agencies such as the EPA make determinations based on review of scientific data within their technical expertise, those decisions are given an ''extreme degree of deference'' by the courts. As the D.C. Circuit noted in reviewing the 2009 Endangerment Finding, ''although we perform a searching and careful inquiry into the facts underlying the agency's decisions, we will presume the validity of the agency action as long as a rational basis for it is presented.'' *CRR,* 684 F.3d at 120 (internal citations and marks omitted).

[73] *See id.* at 121–122.

[74] *See id.* at 122–123 (noting that the §202(a)(1) inquiry ''necessarily entails a case-by-case, sliding scale approach'' because endangerment is '''composed of reciprocal elements of risk and harm, or probability and severity''' (quoting *Ethyl Corp.* v. *EPA,* 541 F.2d, 1, 18 (D.C. Cir. 1976)).

welfare may involve the frontiers of scientific or medical knowledge.[75] At the same time, the Administrator must exercise reasoned decision making, and avoid speculative inquiries.

Fourth, the Administrator is to consider the cumulative impact of sources of a pollutant in assessing the risks from air pollution, and is not to look only at the risks attributable to a single source or class of sources. We additionally note that in making an endangerment finding, the Administrator is not limited to considering only those impacts that can be traced to the amount of air pollution directly attributable to the subject source classes. Such an approach would collapse the two prongs of the test by requiring that any climate change impacts upon which an endangerment determination is made result solely from the GHG emissions of aircraft. *See* 74 FR at 66542 (explaining the same point in the context of analogous language in section 202(a)). Similarly, the Administrator is not, in making the endangerment and cause or contribute findings, to consider the effect of emissions reductions from the resulting standards.[76] The threshold endangerment and cause or contribute criteria are separate and distinct from the standard setting criteria that apply if the threshold findings are met, and they serve a different purpose. Indeed, the more serious the endangerment to public health and welfare, the more important it may be that action be taken to address the actual or potential harm even if no one action alone can solve the problem, and a series of actions is called for.

Fifth, the Administrator is to consider the risks to all parts of our population, including those who are at greater risk for reasons such as increased susceptibility to adverse health and welfare effects. If vulnerable subpopulations are especially at risk, the Administrator is entitled to take that point into account in deciding the question of endangerment. Here too, both likelihood and severity of adverse effects are relevant. As explained previously in the 2009 Endangerment Finding and as reiterated below for this section 231 finding, vulnerable subpopulations face serious health and welfare risks as a result of climate change.

As the Supreme Court recognized in *Massachusetts* v. *EPA,* 549 U.S. at 534, the EPA may make an endangerment finding despite the existence of ''some residual uncertainty'' in the scientific record. *See also CRR,* 684 F. 2d at 122. Thus, this framework recognizes that regulatory agencies such as the EPA must be able to deal with the reality that ''[m]an's ability to alter his environment has developed far more rapidly than his ability to foresee with certainty the effects of his alterations.'' *Ethyl Corp* v. *EPA,* 541 F.2d 1, 6 (D.C. Cir.), cert. denied 426 U.S. 941 (1976). Both ''the Clean Air Act 'and common sense . . . demand regulatory action to prevent harm, even if the regulator is less than certain that harm is otherwise inevitable.'''' *Massachusetts* v. *EPA,* 549 U.S. at 506, n.7 (citing *Ethyl Corp.*); *see also CRR,* 684 F.3d at 121–122.

In the 2009 Endangerment Finding, the Administrator recognized that the scientific context for an action addressing climate change was unique at that time because there was a very large and comprehensive base of scientific information that had been developed over many years through a global consensus process involving numerous scientists from many countries and representing many disciplines. 74 FR at 66506. That informational base has since grown. The Administrator also previously recognized that there are varying degrees of uncertainty across many of these scientific issues, which remains true. It is in this context that she is exercising her judgment and applying the statutory framework in this final section 231 finding. Further discussion of the language in section 231(a)(2)(A), and parallel language in 202(a), is provided below to explain more fully the basis for this interpretation, which the D.C. Circuit upheld in the 202(a) context.

1. The Statutory Language

The interpretation described above flows from the statutory language itself. The phrase ''may reasonably be anticipated'' and the term ''endanger'' in section 231(a)(2)(A) (as in section 202(a)) authorize, if not require, the Administrator to act to prevent harm and to act in conditions of uncertainty. They do not limit her to merely reacting to harm or to acting only when certainty has been achieved; indeed, the references to anticipation and to endangerment imply that to fail to look to the future or to less than certain risks would be to abjure the Administrator's statutory responsibilities. As the D.C. Circuit explained, the language ''may reasonably be anticipated to endanger public health or welfare'' in CAA section 202(a) requires a ''precautionary, forward-looking scientific judgment about the risks of a particular air pollutant, consistent with the CAA's precautionary and preventive orientation.'' *CRR,* 684 F.3d at 122 (internal citations omitted). The court determined that ''[r]equiring that EPA find 'certain' endangerment of public health or welfare before regulating GHGs would effectively prevent EPA from doing the job that Congress gave it in [section] 202(a)—utilizing emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm.'' *Id.* The same language appears in section 231(a)(2)(A), and the same interpretation applies in that context.

Moreover, by instructing the Administrator to consider whether emissions of an air pollutant cause or contribute to air pollution in the second part of the two-part test, the Act makes clear that she need not find that emissions from any one sector or class of sources are the sole or even the major part of an air pollution problem. The use of the term ''contribute'' clearly indicates that such emissions need not be the sole or major cause of the pollution. In addition, the absence of the term ''significantly'' or any other word that modifies ''contribute'' shows that the EPA need not find that contributing emissions cross a minimum percentage- or mass-based threshold to be cognizable. The phrase ''in [her] judgment'' authorizes the Administrator to weigh risks and to consider projections of future possibilities, while also recognizing uncertainties and extrapolating from existing data. Finally, when exercising her judgment in making both the endangerment and cause or contribute findings, the Administrator balances the likelihood and severity of effects. Notably, the phrase ''in [her] judgment'' modifies both ''may reasonably be anticipated'' and ''cause or contribute.''

2. How the Origin of the Current Statutory Language Informs the EPA's Interpretation of Section 231(a)(2)(A)

In the proposed and final 2009 Endangerment Finding, the EPA explained that when Congress revised the section 202(a) language that governed that finding, along with other provisions, as part of the 1977 amendments to the CAA, it was responding to decisions issued by the D.C. Circuit in *Ethyl Corp.* v. *EPA* regarding the pre-1977 version of section 211(c) of the Act. 74 FR at

[75] See *id.* at 121–122.

[76] As the D.C. Circuit explained in reviewing the 2009 Endangerment Finding under analogous language in section 202(a): ''At bottom, §202(a)(1) requires EPA to answer only two questions: whether particular 'air pollution'—here, greenhouse gases—'may reasonably be anticipated to endanger public health or welfare,' and whether motor-vehicle emissions 'cause, or contribute to' that endangerment.'' *CRR,* 648 F.3d at 117.

18891; *see also* 74 FR at 66506. The legislative history of those amendments, particularly the report by the House Committee on Interstate and Foreign Commerce, demonstrates that the EPA's interpretation of the section 231(a)(2)(A) language as set forth here in support of the Agency's section 231 finding is fully consistent with Congress' intention in crafting these provisions. See H.R. Rep. 95–294 (1977), as reprinted in 4 A Legislative History of the Clean Air Act Amendments of 1977 (1978) at 2465 (hereinafter LH). The committee explained that its action addressed not only section 211(c)(1)(A) but rather the entirety of the proposed legislative amendments, and stated that the committee's bill would thus apply the interpretation of section 211(c)(1)(A) in the *en banc* decision in *Ethyl Corp.* to all other sections of the Act relating to public health protection. 4 LH at 2516. It also noted that it had used the same basic formulation in section 202 and section 231, as well as in other sections. *Id.* at 2517. As both CAA sections 231 and 202 were included in the 1977 amendments, the Agency's discussion for the 2009 Endangerment Finding regarding the history of section 202 and how it supports the EPA's approach is also relevant for section 231. EPA's interpretation of section 231 is the same as its interpretation of the parallel language in section 202(a), which is explained in the 2009 Endangerment Finding. *See* 74 FR at 18891; *see also* 74 FR at 66506.

The legislative history clearly indicates that the House Committee believed the *Ethyl Corp.* decisions posed several ''crucial policy questions'' regarding the protection of public health and welfare. H.R. Rep. 95–294 at 48, 4 LH at 2515.[77] The following paragraphs summarize the *en banc* decision in *Ethyl Corp.* v. *EPA* and describe how the House Committee revised the endangerment language in the 1977 amendments to the CAA to serve several purposes consistent with that decision. In particular, the language: (1) Emphasizes the preventive or precautionary nature of the CAA;[78] (2) authorizes the Administrator to reasonably project into the future and weigh risks; (3) assures the consideration of the cumulative impact of all sources; (4) instructs that the health of susceptible individuals, as well as healthy adults, should be part of the analysis; and (5) indicates an awareness of the uncertainties and limitations in information available to the Administrator. H.R. rep. 95–294 at 49–50, 4 LH 2516–17.[79]

In revising the statutory language, Congress relied heavily on the *en banc* decision in *Ethyl Corp.* v. *EPA,* which reversed a three-judge panel opinion regarding an EPA rule restricting the content of lead in leaded gasoline.[80] After reviewing the relevant facts and law, the full court evaluated the statutory language at issue to see what level of ''certainty [was] required by the Clean Air Act before EPA may act.'' 541 F.2d at 7.

The petitioners argued that the statutory language ''will endanger'' required proof of actual harm, and that the actual harm had to come from emissions from the fuels in and of themselves. *Id.* at 12, 29. The *en banc* court rejected this approach, finding that the term ''endanger'' allowed the Administrator to act when harm is threatened, and did not require proof of actual harm. *Id.* at 13. ''A statute allowing for regulation in the face of danger is, necessarily, a precautionary statute.'' *Id.* Optimally, the court found, regulatory action would not only precede, but prevent, a perceived threat. *Id.*

The court also rejected petitioners' argument that any threatened harm must be ''probable'' before regulation was authorized. Specifically, the court recognized that danger ''is set not by a fixed probability of harm, but rather is composed of reciprocal elements of risk and harm, or probability and severity.'' *Id.* at 18. Next, the court held that the EPA's evaluation of risk is necessarily an exercise of judgment, and that the statute did not require a factual finding. *Id.* at 24. Thus, ultimately, the Administrator must ''act, in part on 'factual issues,' but largely 'on choices of policy, on an assessment of risks, [and] on predictions dealing with matters on the frontiers of scientific knowledge . . .'' *Id.* at 29 (citations omitted). Finally, the *en banc* court agreed with the EPA that even without the language in section 202(a) (which is also in section 231(a)(2)(A)) regarding ''cause or contribute to,'' it was appropriate for the EPA to consider the cumulative impact of lead from numerous sources, not just the fuels being regulated under section 211(c). *Id.* at 29–31.

The dissent in the original *Ethyl Corp.* decision and the *en banc* opinion were of ''critical importance'' to the House Committee which proposed the revisions to the endangerment language in the 1977 amendments to the CAA. H.R. Rep. 95–294 at 48, 4 LH at 2515. The Committee addressed those questions with the language that now appears in section 231(a)(2)(A) and several other CAA provisions—''emission of any air pollutant . . . which in [the Administrator's] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.''

As noted above in section III.A.1, the phrase ''in [her] judgment'' calls for the Administrator to make a comparative assessment of risks and projections of future possibilities, consider uncertainties, and extrapolate from limited data. Thus, the Administrator must balance the likelihood of effects with the severity of the effects in reaching her judgment. The Committee emphasized that the Administrator's exercise of ''judgment''[81] may include making projections, assessments and estimates that are reasonable, as opposed to a speculative or '''crystal ball' inquiry.'' Moreover, procedural safeguards apply to the exercise of judgment, and final decisions are subject to judicial review. Also, the phrase ''in [her] judgment'' modifies both the phrases ''cause and contribute'' and ''may reasonably be anticipated,'' as discussed above. H.R. Rep. 95–294 at 50–51, 4 LH at 2517–18.

As the Committee further explained, the phrase ''may reasonably be anticipated'' points the Administrator in the direction of assessing current and future risks rather than waiting for proof of actual harm. This phrase is also intended to instruct the Administrator to consider the limitations and

[77] The Supreme Court recognized that the current language in section 202(a)(1), which uses the same formulation as that in section 231(a)(2)(A), is ''more protective'' than the 1970 version that was similar to the section 211 language before the D.C. Circuit in *Ethyl Corp. Massachusetts* v. *EPA,* 549 U.S. at 506, fn 7.

[78] *See* H.R. Rep. 95–294 at 49, 4 LH at 2516 (''To emphasize the preventive or precautionary nature of the Act, *i.e.* to assure that regulatory action can effectively prevent harm before it occurs'').

[79] Congress also standardized this language across the various sections of the CAA which address emissions from both stationary and mobile sources. H.R. Rep. 95–294 at 50, 4 LH at 2517; section 401 of the CAA Amendments of 1977.

[80] At the time of the 1973 rules requiring the reduction of lead in leaded gasoline, section 211(c)(1)(A) of the CAA stated that the Administrator may promulgate regulations that: ''control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle or motor vehicle engine (A) if any emissions product of such fuel or fuel additive will endanger the public health or welfare . . .'' CAA section 211(c)(1)(A) (1970).

[81] Throughout this document under CAA section 231, as throughout the previous notices concerning the 2009 Endangerment Finding under section 202, the judgments on endangerment and cause or contribute are described as a finding or findings. This is for ease of reference only, and is not intended to imply that the Administrator's judgment is solely a fact finding exercise; rather, the Administrator's exercise of judgment is to consider and weigh multiple factors when applying the scientific information to the statutory criteria.

difficulties inherent in information on public health and welfare. H.R. Rep. 95–294 at 51, 4 LH at 2518.[82]

Finally, the phrase ''cause or contribute'' ensures that all sources of the contaminant which contribute to air pollution are considered in the endangerment analysis (*e.g.,* not a single source or category of sources). It is also intended to require the Administrator to consider all sources of exposure to a pollutant (for example, food, water, and air) when determining risk. *Id.*

3. Additional Considerations for the Cause or Contribute Analysis

By instructing the Administrator to consider whether emissions of an air pollutant cause or contribute to air pollution, the statute is clear that she need not find that emissions from any one sector or class of sources are the sole or even the major part of an air pollution problem. The use of the term ''contribute'' clearly indicates a lower threshold than the sole or major cause.

Moreover, like the section 202(a) language that governed the 2009 Endangerment Finding, the statutory language in section 231(a)(2)(A) does not contain a modifier on its use of the term ''contribute.'' This contrasts with other CAA provisions that expressly require ''significant'' contribution. *Compare, e.g.,* CAA sections 110(a)(2)(D)(i)(I); 111(b); 213(a)(2), (4). In the absence of specific language regarding the degree of contribution, the Administrator is to exercise her judgment in determining contribution. Congress clearly authorized regulatory controls to address air pollution even if the air pollution problem results from a wide variety of sources. While the endangerment test looks at the entire air pollution problem and the risks it poses, the cause or contribute test is designed to authorize the EPA to identify and then address what may well be many different sectors, classes, or groups of sources that are each part of the problem.

As explained for the 2009 Endangerment Finding, the D.C. Circuit has discussed the concept of contribution in the CAA, and its case law supports the EPA's interpretation that the level of contribution in this context need not be significant. 74 FR at 66542. In *Catawba County* v. *EPA,* 571 F.3d 20 (D.C. Cir. 2009), the court upheld EPA's $PM_{2.5}$ attainment and nonattainment designation decisions, analyzing CAA section 107(d), which requires EPA to designate an area as nonattainment if it ''contributes to ambient air quality in a nearby area'' that does not meet the national ambient air quality standards. *Id.* at 35. The court noted that it had previously held that the term ''contributes'' is ambiguous in the context of CAA language. *See EDF* v. *EPA,* 82 F.3d 451, 459 (D.C. Cir. 1996). ''[A]mbiguities in statutes within an agency's jurisdiction to administer are delegations of authority to the agency to fill the statutory gap in reasonable fashion.'' 571 F.3d at 35 (citing *Nat'l Cable & Telecomms. Ass'c* v. *Brand X Internet Servs,* 545 U.S. 967, 980 (2005)). The court then proceeded to consider and reject petitioners' argument that the verb ''contributes'' in CAA section 107(d) necessarily connotes a significant causal relationship. Specifically, the D.C. Circuit again noted that the term is ambiguous, leaving it to EPA to interpret in a reasonable manner. In the context of this discussion, the court noted that ''a contribution may simply exacerbate a problem rather than cause it . . .'' 571 F.3d at 39.

This is consistent with the D.C. Circuit's discussion of the concept of contribution in the context of CAA section 213 and rules for nonroad vehicles in *Bluewater Network* v. *EPA,* 370 F.3d 1 (D.C. Cir. 2004). In that case, industry argued that section 213(a)(3) requires a finding of a significant contribution from classes of new nonroad engines or vehicles to ozone or carbon monoxide concentrations before the EPA can regulate those engines or vehicles, while the EPA's view was that the CAA requires a finding only of contribution. *Id.* at 13. Section 213(a)(3)'s regulatory authority for specific classes of nonroad engines or vehicles, like that of section 231(a)(2)(A) for classes of aircraft engines, is triggered by a finding that certain sources ''cause, or contribute to,'' air pollution, whereas an adjacent provision, section 213(a)(2), is triggered by a finding of a ''significant'' contribution from all new and existing nonroad engines and vehicles. The court looked at the ''ordinary meaning of 'contribute''' when upholding the EPA's reading of section 213(a)(3). After referencing dictionary definitions of ''contribute,'' the court also noted that ''[s]tanding alone, the term has no inherent connotation as to the magnitude or importance of the relevant 'share' in the effect; certainly it does not incorporate any 'significance' requirement.'' 370 F.3d at 13.[83] The court found that the bare ''contribute'' language in section 213(a)(3) invests the Administrator with discretion to exercise judgment regarding what constitutes a sufficient contribution for the purpose of making a cause or contribute finding. *Id.* at 14.[84]

Like the statutory language considered in *Catawba County* and *Bluewater Network,* as well as the section 202(a) language that governed the Agency's previous findings for GHGs emitted by other types of mobile sources, section 231(a)(2)(A) refers to contribution and does not specify that the contribution must be significant before an affirmative finding can be made. To be sure, any finding of a ''contribution'' requires some measureable amount of pollutant emissions to be resulting from the analyzed source category; a truly trivial or *de minimis* ''contribution'' might not count as such (although such a small level is not presented by the facts of today's findings). The Administrator therefore has ample discretion in exercising her reasonable judgment and determining whether, under the circumstances presented, the cause or contribute criterion has been met.[85] As noted above, in addressing provisions in section 202(a), the D.C. Circuit has explained that the Act at the endangerment finding step did not require the EPA to identify a precise numerical value or ''a minimum threshold of risk or harm before determining whether an air pollutant endangers.'' *CRR,* 684 F.3d at 122–123. Accordingly, EPA ''may base an endangerment finding on 'a lesser risk of greater harm . . . or a greater risk of lesser harm' or any combination in between.'' *Id.* (quoting *Ethyl Corp.,* 541 F.2d at 18). Recognizing the substantial record of empirical data and scientific evidence that the EPA relied upon in the 2009 Endangerment Finding, the court determined that its ''failure to

[82] Thus, the statutory language does not require that the EPA prove the effects of climate change ''beyond a reasonable doubt.'' Indeed, such an approach is inconsistent with the concepts of reasonable anticipation and endangerment embedded in the statute. *See also CRR,* 684 F.3d at 121–122.

[83] Specifically, the decision noted that '''contribute' means simply 'to have a share in any act or effect,' Webster's Third New International Dictionary 496 (1993), or 'to have a part or share in producing,' 3 Oxford English Dictionary 849 (2d ed. 1989).'' *Id.* at 13.

[84] The court explained, ''[t]he repeated use of the term 'significant' to modify the contribution required for all nonroad vehicles, coupled with the omission of this modifier from the 'cause, or contribute to' finding required for individual categories of new nonroad vehicles, indicates that Congress did not intend to require a finding of 'significant contribution' for individual vehicle categories.'' *Id.* at 13.

[85] Section V discusses the evidence in this case that supports the finding of contribution. The EPA need not determine at this time the circumstances in which emissions would be trivial or *de minimis* and would not warrant a finding of contribution.

distill this ocean of evidence into a specific number at which greenhouse gases cause 'dangerous' climate change is a function of the precautionary thrust of the CAA and the multivariate and sometimes uncertain nature of climate science, not a sign of arbitrary or capricious decision-making.'' *Id.* at 123. As the language in section 231(a)(2)(A) is analogous to that in section 202(a), it is clearly reasonable to apply this interpretation to the endangerment determination under section 231(a)(2)(A). Moreover, the logic underlying this interpretation supports the general principle that under CAA section 231 the EPA is not required to identify a specific minimum threshold of contribution from potentially subject source categories in determining whether their emissions ''cause or contribute'' to the endangering air pollution. The reasonableness of this principle is further supported by the fact that section 231 does not impose on the EPA a requirement to find that such contribution is ''significant,'' let alone the sole or major cause of the endangering air pollution. This context further supports the EPA's interpretation that section 231(a)(2)(A) does not require some level of contribution that rises to a pre-determined numerical level or percentage- or mass-based portion of the overall endangering air pollution.

In addition, when exercising her judgment in making a cause or contribute determination, the Administrator not only considers the cumulative impact, but also looks at the totality of the circumstances and weight of evidence (*e.g.,* the air pollutant, the air pollution, the nature of the endangerment, the type or classes of sources at issue, the number of sources in the source sector or class, and the number and type of other source sectors or categories that may emit the air pollutant) when determining whether the emissions ''justify regulation'' under the CAA. *See Catawba County,* 571 F.3d at 39 (discussing EPA's interpretation of the term ''contribute'' under CAA section 107(d) and finding it reasonable for the agency to apply a totality of the circumstances approach); *see also* 74 FR at 66542. Further discussion of this issue can be found in sections IV and V of this preamble.

4. Summary of Responses to Key Legal Comments on the Interpretation of the CAA Section 231(a) Endangerment and Cause or Contribute Test

Here we summarize key public comments regarding the legal interpretation of CAA section 231(a)(2)(A) that supports this finding and the Agency's response. The Response to Comments document contains the Agency's full response to comments on this topic.

Some commenters strongly supported the proposed findings. These comments stated, for example, that the proposed findings were clearly authorized under CAA section 231(a)(2)(A) and further noted that the U.S. Supreme Court had upheld EPA's authority under section 202(a) of the CAA to make an endangerment finding with regard to GHG emissions from motor vehicles and that the findings required under section 202(a)(1) are the same as the findings required under section 231(a)(2)(A). Another commenter, however, questioned the EPA's authority to make endangerment and cause or contribute findings for GHGs, stating that the EPA had not sufficiently explained its authority to address pollutants other than NAAQS under CAA section 231. This commenter made the following points in support of this view. First, the comment pointed to the use of the term ''air quality control regions'' in CAA sections 231(a)(1)(A) and 231(a)(3) as suggesting that Congress intended to authorize EPA to issue standards only for pollutants for which a NAAQS has been established. Second, the comment stated that the EPA should address this issue in light of a recent Supreme Court case, *Utility Air Regulatory Grp.* v. *EPA,* 134 S.Ct. 2427 (2014).

After consideration of these comments, we disagree with the argument that Congress intended to only authorize the EPA to address NAAQS pollutants under section 231(a)(2)(A). That provision of the Act requires the EPA to issue standards ''applicable to the emission *of any air pollutant* from any class or classes of aircraft engines which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' CAA section 231(a)(2)(A) (emphasis added). Looking to that plain language, there is nothing that limits the scope of the air pollutants that can be found to contribute to possible endangerment, and therefore which the EPA may be required to regulate, under that section to NAAQS pollutants. To the contrary, the language is clear that the EPA would be required to regulate aircraft engine emissions of ''any air pollutant'' as long the pre-requisite endangerment and cause or contribute findings are made. ''Air pollutant'' is not defined in section 231; instead, the definition under CAA section 302(g) applies, which states in relevant part that '''air pollutant' means *any* air pollutant agent or combination of such agents, including *any* physical, chemical . . . substance or matter which is emitted into or otherwise enters ambient air.'' CAA section 302(g) (emphasis added). Interpreting this provision in *Massachusetts* v. *EPA,* the U.S. Supreme Court observed that ''[o]n its face, the definition embraces all airborne compounds of whatever stripe, and underscores that intent through the repeated use of the word 'any.'''' 549 U.S. 497, 529 (2007). It further stated that ''[b]ecause greenhouse gases fit well within'' this ''capacious definition of 'air pollutant'''' the EPA has the statutory authority to regulate the emission of such gases from new motor vehicles under CAA section 202(a)(2). *Id.* at 532. As noted above, sections 231(a)(2)(A) and 202(a)(1) have parallel structures, use substantially the same language, and use the same definition of air pollutant. As that definition is ''unambiguous'' in its inclusion of GHGs, *Massachusetts,* 549 U.S. at 529, the Act clearly authorizes the EPA to make these findings for GHGs under CAA section 231(a)(2)(A). Moreover, one U.S. District Court has also ruled that the EPA has a duty to determine whether aircraft engine emissions of GHGs cause or contribute to endangerment, and that ruling was not appealed to the D.C. Circuit. *Center for Biological Diversity, et al.* v. *EPA,* 794 F. Supp. 2d 151 (D.D.C. 2011). Consequently, the statutory language imposing the EPA's duties under section 231(a)(2)(A), and relevant case law in the GHG context, do not support the commenter's limited reading of the EPA's authority under that language.

The commenter points to the use of the term ''air quality control regions'' in nearby paragraphs of CAA sections 231(a)(1)(A) and (a)(3) to support its suggestion that Congress intended to limit the EPA's analysis and regulatory authority to NAAQS pollutants in section 231(a)(2)(A). That argument is flawed for several reasons. The commenter points to section 231(a)(1), which relates to a study the EPA was to conduct of emissions of air pollutants from aircraft, and to section 231(a)(3), which requires the EPA to hold public hearings with respect to proposed standards under section 231(a)(2) in ''air quality control regions . . . most seriously affected by aircraft emissions'' to the extent practicable. These obligations are imposed in addition to those imposed by section 231(a)(2)(A), and their separate establishment does not by that fact narrow the EPA's scope of authority regarding its obligations imposed under section 231(a)(2)(A). They are additive, not subtractive, duties. Moreover, one of those added

duties, to investigate the extent to which aircraft emissions affect air quality in air quality control regions under section 231(a)(1)(A), was a one-time duty that corresponded to NAAQS that have long-since been revised, whereas the EPA's duty to propose and promulgate aircraft emission standards is a continuing one to be conducted ''from time to time'' under section 231(a)(2)(A). The commenter provides no reasoning to explain why these provisions imposing additional duties should be read to limit the scope of section 231(a)(2) beyond their proximity. Sections 231(a)(1) and (a)(3) do not speak to what pollutants may be addressed under section 231(a)(2). Further, there is no incompatibility between the use of the term ''air quality control regions'' in those provisions to identify geographic areas where certain activities are to occur and making the endangerment and cause or contribute findings for GHGs that are finalized in this action. In fact, the EPA long ago discharged its one-time duty under CAA section 231(a)(1)(A)[86] and, after proposing new aircraft engine emission standards, could also meet its obligations to hold public hearings in the air quality control regions most seriously affected by aircraft emissions, to the extent practicable, all while meeting its obligations under section 231(a)(2)(A). Accordingly, the EPA does not interpret sections 231(a)(1) and (a)(3) to limit the scope of the duties and authority established by section 231(a)(2) to NAAQS pollutants. Further, the EPA has previously implemented section 231(a)(2) to reach air pollutants for which no NAAQS exists and has applied that provision to establish standards for non-NAAQS pollutants, such as smoke. *See, e.g.,* 40 CFR 87.21(a)–(c), (e), 87.23(a)–(c), and 87.31(a)–(c) emission standards for smoke. The EPA's regulation of non-NAAQS smoke emissions from aircraft engines has never been judicially challenged. Finally, even if the Act were ambiguous, which it is not, the EPA's interpretation of section 231(a)(2) to include authority to address GHGs, is reasonable for the reasons described above.

The U.S. Supreme Court's opinion in *UARG* cited by the commenter does not change this analysis. The commenter misinterprets the *UARG* decision to mean that for purposes of determining applicability of the CAA's Prevention of Significant Deterioration (PSD) preconstruction permitting program, ''air pollutant'' meant only pollutants for which NAAQS had been established. The *UARG* decision, however, does not limit PSD applicability to only NAAQS pollutants. In fact, the Court recognized that such theories had been advanced during the course of that litigation but expressly declined to consider them in its decision. *See* 134 S.Ct. 2427, 2442 n.6 (2014). Rather, in *UARG,* the Court's holding pertained only to GHGs. More specifically, the Court held that the EPA may not treat GHGs as an air pollutant for the specific purpose of determining whether a source is a major source (or a modification thereof) and thus required to obtain a PSD permit or an operating permit under title V of the CAA. *Id.* at 2449.

Further, the regulatory context that was addressed in *UARG* is distinguishable from that of this action. In *UARG,* the Court explained that *Massachusetts* does not prevent an Agency from using statutory context to infer that in some provisions ''air pollutant'' refers only to those airborne substances that ''may sensibly be encompassed within the particular regulatory program.'' 134 S.Ct. at 2441. However, the commenter offers no reason why GHG emissions from U.S. covered aircraft could not ''sensibly be encompassed'' under CAA section 231; nor is the EPA aware of any such reasons. In fact, *UARG* itself recognizes a distinction between the statutory scheme of the CAA permitting programs at issue in that case and the mobile source programs under Title II of the Act which were at issue in *Massachusetts.* Namely, the *UARG* opinion notes that part of the Court's reasoning in *Massachusetts* was based on its understanding that ''nothing in the Act suggested that regulating greenhouse gases under [Title II] would conflict with the statutory design. Title II would not compel EPA to regulate in any way that would be 'extreme,' 'counterintuitive,' or contrary to 'common sense.' . . . At most, it would require EPA to take the modest step of adding greenhouse-gas standards to the roster of new-motor-vehicle emission regulations.'' 134 S.Ct. at 2441 (quoting *Massachusetts,* 549 U.S. at 531). Like *Massachusetts,* the statutory provisions for this action are found in Title II, and closely parallel the structure and language of the statutory program at issue in *Massachusetts.*[87] *Compare* CAA section 231(a)(2)(A) *with* 202(a)(1). Nor will reading the Title II provision section 231(a)(2)(A) to extend to GHGs result in a regulatory outcome that would be extreme, counterintuitive or contrary to common sense. Instead, as the D.C. Circuit has previously ruled, the EPA's discretion when establishing reasonable standards under section 231 is exceptionally broad. *See NACAA,* 489 F.3d at 1230–32. In short, the *UARG* opinion in no way precludes the EPA's interpretation that ''air pollutant'' as used in CAA section 231(a)(2)(A) includes GHGs, but rather supports that interpretation.

To the extent that the commenter is suggesting that the EPA should exercise its discretion to interpret CAA section 231(a)(2)(A) to exclude GHGs, the EPA declines to do so. The commenter has provided no persuasive reason for such an exclusion. Moreover, to make the threshold findings in this action, the EPA must, fundamentally, answer only two questions: Whether the particular ''air pollution''—here, the six well-mixed GHGs—''may reasonably be anticipated to endanger public health or welfare,'' and whether emissions of those six well-mixed GHGs from U.S. covered aircraft engines ''cause, or contribute to'' that endangerment. *See CRR,* 648 F.3d at 117 (interpreting analogous provisions in CAA section 202(a)). Because the EPA answers both of these questions in the affirmative for emissions of the six well-mixed GHGs from U.S. covered aircraft engines—based on extensive scientific evidence and emissions information, as explained in detail in sections IV and V below—it is appropriate and reasonable to make both endangerment and cause or contribute findings under section 231(a)(2)(A) in this action.

In sum, after considering all of the relevant information, including that in public comments, the EPA interprets section 231(a)(2)(A) to include authority to address GHGs from U.S. covered aircraft engines. This interpretation is consistent with both its own and with judicial interpretations that the EPA's authority under the analogous section 202(a) unambiguously extends to GHGs.

B. Air Pollutant, Public Health and Welfare

The CAA defines both ''air pollutant'' and ''welfare.'' Air pollutant is defined as: ''any air pollution agent or combination of such agents, including any physical, chemical, biological,

[86] USEPA, 1973: Aircraft Emissions: Impact On Air Quality And Feasibility Of Control. U.S. Environmental Protection Agency, 102 pp. Available at *http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=2000T6Z0.txt* (last accessed April 26, 2016).

[87] Although this comment asserts that section 202(a) does not include mention of ''air quality control region'' as other provisions of section 231(a) do, that distinction is immaterial. As described above, the use of that term in other paragraphs imposing additional duties beyond those established by section 231(a)(2)(A) does not affect what pollutants may be addressed under section 231(a)(2)(A).

radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air. Such term includes any precursors to the formation of any air pollutant, to the extent the Administrator has identified such precursor or precursors for the particular purpose for which the term 'air pollutant' is used.'' CAA section 302(g). GHGs fit well within this capacious definition. *See Massachusetts* v. *EPA,* 549 U.S. at 532. They are ''without a doubt'' physical chemical substances emitted into the ambient air. *Id.* at 529. Section V below contains further discussion of the term ''air pollutant'' for purposes of this section 231(a)(2)(A) contribution finding, which uses the same definition of air pollutant as the one the EPA adopted for purposes of the 2009 Endangerment Finding.

Regarding ''welfare,'' the CAA states that ''[a]ll language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants.'' CAA section 302(h). This definition is quite broad. Importantly, it is not an exclusive list due to the use of the term ''includes, but is not limited to . . .'' Effects other than those listed here may also be considered effects on welfare.

Moreover, the terms contained within the definition are themselves expansive. For example, deterioration to property could include damage caused by extreme weather events. Effects on vegetation could include impacts from changes in temperature and precipitation as well as from the spreading of invasive species or insects. Prior welfare effects evaluated by the EPA in other contexts include impacts on vegetation, as well as reduced visibility, changes in nutrient balance and acidity of the environment, soiling of buildings and statues, and erosion of building materials. *See, e.g.,* Final Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur, 77 FR 20218 (April 3, 2012); Control of Emissions from Nonroad Large Spark Ignition Engines and Recreational Engines (Marine and Land-Based), 67 FR 68242 (November 8, 2002); Final Heavy-Duty Engine and Vehicle Standards and Highway Diesel Sulfur Control Requirements, 66 FR 5002 (January 18, 2001).

Although the CAA defines ''effects on welfare'' as discussed above, there is no definition of ''public health'' in the Clean Air Act. The Supreme Court has discussed the concept of ''public health'' in the context of whether costs can be considered when setting NAAQS. *Whitman* v. *American Trucking Ass'n,* 531 U.S. 457 (2001). In *Whitman,* the Court imbued the term with its most natural meaning: ''the health of the public.'' *Id.* at 466. When considering public health, the EPA has looked at morbidity, such as impairment of lung function, aggravation of respiratory and cardiovascular disease, and other acute and chronic health effects, as well as mortality. *See, e.g.,* Final National Ambient Air Quality Standard for Ozone, 73 FR 16436 (March 27, 2008).

IV. The Administrator's Finding Under CAA Section 231 That Greenhouse Gases Endanger Public Health and Welfare

The Administrator finds, for purposes of CAA section 231(a)(2)(A), that elevated concentrations of the six well-mixed GHGs constitute air pollution that may reasonably be anticipated to endanger both the public health and welfare of current and future generations. The Administrator is making this finding specifically with regard to the same definition of the ''air pollution'' under CAA section 231(a)(2) as that used under CAA section 202(a)(1), namely the combined mix of CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which together are the root cause and best understood drivers of human-induced climate change and the resulting impacts on public health and welfare. The EPA received public comments on this definition of air pollution from the proposed findings, and summarizes responses to some of those key comments below; fuller responses to public comments can be found in EPA's Response to Comments document included in the docket. The Administrator addresses other climate-forcing agents both in the 2009 Endangerment Finding[88] and in this action; however, these substances are not included in the air pollution definition used in this action for the reasons discussed below in section IV.B.7.

Section IV.A below discusses the EPA's approach to evaluating the scientific evidence before it. Section IV.B discusses the scope and nature of the relevant air pollution for the endangerment finding under CAA section 231(a)(2)(A), including a discussion of other substances with climate effects that were addressed but not included in the definition of air pollution. Section IV.C summarizes the scientific evidence that the air pollution is reasonably anticipated to endanger both public health and welfare. Section IV.D summarizes the Administrator's conclusion for purposes of section 231(a)(2)(A), in light of the evidence, analysis, and conclusions that led to the 2009 Endangerment Finding as well as more recent evidence and consideration of public comments, that emissions of the six well-mixed GHGs in the atmosphere may reasonably be anticipated to endanger public health and welfare.

A. The Science Upon Which the Agency Relied

This finding under section 231(a)(2)(A) reflects the EPA's careful consideration not only of the scientific and technical record for the 2009 Endangerment Finding, but also of science assessments released since 2009, which, as illustrated below, strengthen and further support the judgment that the six well-mixed GHGs in the atmosphere may reasonably be anticipated to endanger public health and welfare. The Administrator's view is that the body of scientific evidence amassed in the record for the 2009 Endangerment Finding compellingly supports an endangerment finding for the six well-mixed GHGs under CAA section 231(a)(2)(A). While the EPA is providing a summary of newer scientific assessments below, the EPA is also relying on the same scientific and technical evidence discussed in the notices for the 2009 Endangerment Finding in these final findings for purposes of CAA section 231(a)(2)(A).[89]

The EPA is following the same approach toward technical and scientific information in this finding under section 231(a)(2)(A) as it used in the 2009 Endangerment Finding. More specifically, in the 2009 Endangerment Finding the EPA's approach to providing the technical and scientific information to inform the Administrator's judgment regarding the question of whether GHGs endanger public health and welfare was to consider the recent, major assessments by the U.S. Global Change Research Program (USGCRP), the IPCC, and the National Research Council of the

[88] 74 FR at 66519–21.

[89] See sections III of the 2009 Proposed Endangerment Finding and sections III and IV of the 2009 Endangerment Finding. 74 FR at 18894–18904 and 74 FR at 66510–36.

National Academies of Sciences, Engineering, and Medicine (referred to interchangeably as NRC or NAS) as the primary scientific and technical basis informing the endangerment finding. These assessments draw synthesis conclusions across thousands of individual peer-reviewed studies that appear in scientific journals, and the reports themselves undergo additional peer review. The EPA has considered the processes and procedures employed by the USGCRP, IPCC, and the NRC in terms of factors such as their objectivity, integrity, utility, and transparency, including how they have employed rigorous peer review processes. The EPA considers these assessments to represent the best available science that maintains the highest level of adherence to Agency guidelines for information quality.[90] These assessments have been adequately peer reviewed in a manner commensurate with the EPA's Peer Review Policy[91] and guidance in the EPA's Peer Review Handbook.[92]

The EPA is giving careful consideration to all of the scientific and technical information in the record. However, the Administrator considers the major scientific assessments as the primary scientific and technical basis of her endangerment decision. This provides assurance that the Administrator is basing her judgment on the best available, well-vetted science that reflects the consensus of the climate science research community. These assessments addressed the scientific issues that the EPA was required to examine, were comprehensive in their coverage of the GHG and climate change issues, and underwent rigorous and exacting peer review by the expert community, as well as rigorous levels of U.S. government review, in which the EPA took part. The major findings of the USGCRP, IPCC, and NRC assessments support the Administrator's determination that elevated concentrations of GHGs in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future generations. The EPA presented this scientific support at length in the comprehensive record for the 2009 Endangerment Finding.

The EPA reviewed ten administrative petitions for reconsideration of the 2009 Endangerment Finding in 2010.[93] In the Reconsideration Denial, the Administrator denied those petitions on the basis of the Petitioners' failure to provide substantial support for their argument that the EPA should revise the 2009 Endangerment Finding and their objections' lack of ''central relevance'' to the Finding.[94] The EPA prepared an accompanying three-volume Response to Petitions document to provide additional information, often more technical in nature, in response to the arguments, claims, and assertions by the Petitioners to reconsider the Endangerment Finding.[95]

The 2009 Endangerment Finding and the 2010 Reconsideration Denial were challenged in a lawsuit before the D.C. Circuit.[96] On June 26, 2012, the D.C. Circuit upheld the Endangerment Finding and the Reconsideration Denial, ruling that the Finding (including the Reconsideration Denial) was not arbitrary or capricious, was consistent with the U.S. Supreme Court's decision in *Massachusetts* v. *EPA* (which affirmed the EPA's authority to regulate GHGs)[97] and the text and structure of the CAA, and was adequately supported by the administrative record.[98] The D.C. Circuit also agreed with the EPA that the Petitioners had ''not provided substantial support for their argument that the Endangerment Finding should be revised.''[99] It found that the EPA had based its decision on ''substantial scientific evidence,'' observing that ''EPA's scientific evidence of record included support for the proposition that greenhouse gases trap heat on earth that would otherwise dissipate into space; that this 'greenhouse effect' warms the climate; that human activity is contributing to increased atmospheric levels of greenhouse gases; and that the climate system is warming,'' as well as providing extensive scientific evidence for EPA's determination that anthropogenically induced climate change threatens both public health and welfare.[100] The D.C. Circuit further noted that the EPA's reliance on assessments was consistent with the methods decision-makers often use to make a science-based judgment.[101] Moreover, it supported the EPA's reliance on the major scientific assessment reports conducted by USGCRP, IPCC, and NRC and found:

> The EPA evaluated the processes used to develop the various assessment reports, reviewed their contents, and considered the depth of the scientific consensus the reports represented. Based on these evaluations, the EPA determined the assessments represented the best source material to use in deciding whether GHG emissions may be reasonably anticipated to endanger public health or welfare . . . It makes no difference that much of the scientific evidence in large part consisted of ''syntheses'' of individual studies and research. Even individual studies and research papers often synthesize past work in an area and then build upon it. This is how science works. The EPA is not required to re-prove the existence of the atom every time it approaches a scientific question.[102]

In addition, the EPA's consideration of the major assessments to inform the Administrator's judgment allowed for full and explicit recognition of scientific uncertainty regarding the endangerment posed by the atmospheric buildup of GHGs. The Administrator considered the fact that ''some aspects of climate change science and the projected impacts are more certain than others.''[103] The D.C. Circuit

[90] Applicable guidance includes U.S. EPA 2012: *Addendum to A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information,* 9 pp. Available at *https://www.epa.gov/risk/guidance-evaluating-and-documenting-quality-existing-scientific-and-technical-information* (last accessed July 11, 2016) and U.S. EPA, 2002: *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the EPA,* 61 pp. Available at *https://www.epa.gov/quality/guidelines-ensuring-and-maximizing-quality-objectivity-utility-and-integrity-information* (last accessed July 11, 2016).

[91] U.S. EPA, 2006: *Memorandum on Peer Review and Peer Involvement at the U.S. EPA,* 4 pp. Available at *https://www.epa.gov/osa/memorandum-peer-review-and-peer-involvement-epa* (last accessed April 12, 2016).

[92] U.S. EPA, 2015: *EPA Peer Review Handbook, Fourth Edition,* 248 pp. Available at *https://www.epa.gov/osa/peer-review-handbook-4th-edition-2015-0* (last accessed April 12, 2016). Also, the EPA Science Advisory Board reviewed this approach to the underlying technical and scientific information supporting this action, and concluded that the approach had precedent and the action will be based on well-reviewed information. A copy of this letter and all other relevant EPA peer review documentation is located in the docket for today's final action (EPA–HQ–OAR–2014–0828).

[93] Administrative petitions are available from *www3.epa.gov/climatechange/endangerment/petitions.html* (last accessed June 21, 2016), and in the docket for the 2009 Endangerment Finding: EPA–HQ–OAR–2009–0171.

[94] U.S. EPA, 2010: *Denial of the Petitions to Reconsider the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under section 202(a) of the Clean Air Act,* 75 FR 49557 (August 13, 2010) (''Reconsideration Denial''). In that notice, the EPA thoroughly considered the scientific and technical information relevant to the petitions. In addition to the other information discussed in the present notice, the EPA is also relying on the scientific and technical evidence discussed in that prior notice for purposes of its proposed determination under CAA section 231. See section III of the Reconsideration Denial.

[95] The Response to Petitions document is available from *www3.epa.gov/climatechange/endangerment/petitions.html* (last accessed June 21, 2016), and in the docket for the 2009 Endangerment Finding: EPA–HQ–OAR–2009–0171.

[96] *Coalition for Responsible Regulation, Inc.* v. *Environmental Protection Agency,* 684 F.3d 102 (D.C. Cir. 2012), *reh'g en banc denied,* 2012 U.S. App. LEXIS 25997, 26313, 26315 (D.C. Cir. 2012) (*CRR*).

[97] 549 U.S. 497 (2007).

[98] *CRR,* 684 F.3d at 117–27.

[99] *Id.* at 125.

[100] *Id.* at 120–121.

[101] *Id.* at 121.

[102] *Id.* at 120.

[103] 74 FR at 66524.

subsequently noted that ''the existence of some uncertainty does not, without more, warrant invalidation of an endangerment finding.'' [104]

As noted above, the Supreme Court granted some of the petitions for *certiorari* that were filed, while denying others, but agreed to decide only the question: ''Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.'' [105] Thus, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding.

Since the closure of the administrative record concerning the 2009 Endangerment Finding (including the denial of petitions for reconsideration), a number of new major, peer-reviewed scientific assessments have been released. The EPA carefully reviewed the updated scientific conclusions in these assessments, largely to evaluate whether they would lead the EPA in this CAA section 231(a)(2)(A) finding to use a different interpretation of, or place more or less weight on, the major findings reflected in the previous assessment reports that underpinned the Administrator's judgment that the six well-mixed GHGs endanger public health and welfare. The EPA reviewed the following new major peer-reviewed scientific assessments:

- IPCC's 2013–2014 Fifth Assessment Report (AR5) [106]
- IPCC's 2012 ''Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation'' (SREX) [107]
- USGCRP's 2014 ''Climate Change Impacts in the United States: the Third National Climate Assessment'' (NCA3) [108]
- NRC's 2010 ''Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean'' (Ocean Acidification) [109]
- NRC's 2011 ''Climate Change, the Indoor Environment, and Health'' (Indoor Environment) [110]
- NRC's 2011 ''Report on Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia'' (Climate Stabilization Targets) [111]
- NRC's 2011 ''National Security Implications for U.S. Naval Forces'' (National Security Implications) [112]
- NRC's 2011 ''Understanding Earth's Deep Past: Lessons for Our Climate Future'' (Understanding Earth's Deep Past) [113]
- NRC's 2012 ''Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future'' (Sea Level Rise) [114]
- NRC's 2013 ''Climate and Social Stress: Implications for Security Analysis'' (Climate and Social Stress) [115]
- NRC's 2013 ''Abrupt Impacts of Climate Change'' (Abrupt Impacts) [116]
- NRC's 2014 ''The Arctic in the Anthropocene: Emerging Research Questions'' (Arctic) [117].

From its review, the EPA finds that these new assessments are largely consistent with, and in many cases strengthen and add to, the already compelling and comprehensive scientific evidence detailing the role of the six well-mixed GHGs in driving climate change, explained in the 2009 Endangerment Finding.

1. Response to Key Comments on the EPA's Approach to the Science

Here we summarize key public comments regarding the approach to the science—see the Response to Comments document for the Agency's full responses to comments. Several commenters agreed and no commenters disagreed with the EPA's approach to the science for making an endangerment decision specifically with respect to the six well-mixed GHGs (see section IV.B.7 for a summary of key public comments and our responses to commenters who argued that the science supports expanding the scope of the endangerment finding to include other climate forcers beyond the six well-mixed GHGs). They specifically mentioned their support for the EPA's approach to considering the scientific and technical information in the record of the 2009 Endangerment Finding—primarily the recent, major assessments by the USGCRP, the IPCC, and the NRC—as well as the most recent scientific assessments for additional support and justification. For the reasons stated in section IV.A above, the EPA agrees with the commenters that this approach ensures that the Administrator considers the best available scientific and technical information.

B. The Air Pollution Consists of Six Key Well-Mixed Greenhouse Gases

The Administrator must define the scope and nature of the relevant air pollution for the endangerment finding under CAA section 231(a)(2)(A). In this

[104] *CRR*, 684 F.3d at 121.

[105] *Utility Air Reg. Group* v. *EPA*, 134 S. Ct. 2427, 2438 (2014) (internal marks and citations omitted). *See also Virginia* v. *EPA*, 134 S. Ct. 418 (2013), *Pac. Legal Found.* v. *EPA*, 134 S. Ct. 418 (2013), and *CRR*, 134 S. Ct. 468 (2013) (all denying cert.).

[106] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, 1535 pp, doi:10.1017/CBO9781107415324; IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, 1132 pp; IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, 688 pp; and IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change.* Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

[107] IPCC, 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 [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. Midgley (eds.)]. Cambridge University Press, 582 pp.

[108] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, 841 pp.

[109] NRC, 2010: *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean.* The National Academies Press, 188 pp.

[110] NRC Institute of Medicine, 2011: *Climate Change, the Indoor Environment, and Health.* Washington, DC: The National Academies Press, 272 pp.

[111] NRC 2011: *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia.* The National Academies Press, 298 pp.

[112] NRC, 2011: *National Security Implications of Climate Change for U.S. Naval Forces.* The National Academies Press, 226 pp.

[113] NRC, 2011: *Understanding Earth's Deep Past: Lessons for Our Climate Future.* The National Academies Press, 212 pp.

[114] NRC, 2012: *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.* The National Academies Press, 201 pp.

[115] NRC, 2013: *Climate and Social Stress: Implications for Security Analysis.* The National Academies Press, 280 pp.

[116] NRC, 2013: *Abrupt Impacts of Climate Change: Anticipating Surprises.* The National Academies Press, 250 pp.

[117] NRC, 2014: *The Arctic in the Anthropocene: Emerging Research Questions.* The National Academies Press, 220 pp.

final action, the Administrator finds that the air pollution is the combined mix of six well-mixed GHGs, which together are the root cause and best understood drivers of human-induced climate change and the resulting impacts on public health and welfare. These six GHGs—CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—are considered an aggregate group for purposes of this finding. The Administrator's definition of air pollution for purposes of section 231(a)(2)(A) is made in light of (1) the evidence, analysis, and conclusions that led to the 2009 Endangerment Finding; (2) more recent evidence from scientific assessments published since 2009; and (3) consideration of public comments, for which key comments and responses are summarized in sections IV.B.6 and 7 below. The Administrator considered five primary reasons in the 2009 Endangerment Finding for focusing on this aggregate group as the air pollution: (1) They share common physical properties that influence their climate effects; (2) on the basis of these common physical properties, they have been determined to be the root cause of human-induced climate change, are the best-understood driver of climate change, and are expected to remain the primary driver of future climate change; (3) they are the common focus of climate change science research and policy analyses and discussions; (4) using the combined mix of these gases as the definition (versus an individual gas-by-gas approach) is consistent with the science, because risks and impacts associated with GHG-induced climate change are not assessed on an individual gas-by-gas basis; and (5) using the combined mix of these gases is consistent with past EPA practice, where separate substances from different sources, but with common properties, may be treated as a class (*e.g.,* oxides of nitrogen, particulate matter, volatile organic compounds).[118] After consideration of all information before her, including public comments, as explained below, the Administrator maintains her view that these five reasons for defining the scope and nature of the air pollution to be these six well-mixed GHGs remain valid and well supported by the current science and are therefore reasonable bases for adopting the same definition of "air pollution" in this section 231(a)(2)(A) finding as that under section 202(a)(1). The following subsections summarize the five reasons detailed in the 2009 Endangerment Finding and as appropriate, summarize additional supporting information from the recent scientific assessments published since 2009.

1. Common Physical Properties of the Six Greenhouse Gases

The six GHGs share common physical properties that are relevant to the climate change problem. They all are sufficiently long lived in the atmosphere such that, once emitted, concentrations of each gas become globally well mixed in the atmosphere.[119] A well-mixed gas has relatively uniform concentrations in the atmosphere anywhere around the globe, with little local or regional variation except immediately next to sources or sinks. A given amount of a well-mixed gas emitted anywhere will have similar impacts on global concentrations regardless of the geographic location of emission. All six GHGs trap outgoing heat that would otherwise escape to space, and all are directly emitted from a source as a GHG rather than becoming a GHG in the atmosphere after emission of a precursor gas. This fundamental scientific understanding of the intrinsic physical, chemical, and atmospheric properties of the six GHGs has not changed and remains supported by the more recent climate change assessments.

2. The Six Well-Mixed Greenhouse Gases Are the Primary and Best Understood Driver of Current and Projected Climate Change

The Administrator judges that the scientific evidence is compelling that together the six well-mixed GHGs constitute the largest anthropogenic driver of climate change. In addition, the six well-mixed GHGs are the best-understood driver of climate change because they have well-understood physical properties as described above that govern their climate effect (*e.g.,* their radiative forcing, a measure of their total net effect on the global energy balance). As explained in more detail in the 2009 Endangerment Finding,[120] the Administrator made the judgment that the scientific evidence is compelling that elevated concentrations of heat-trapping GHGs are the root cause of recently observed climate change and that the scientific record showed that most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. The attribution of observed climate change to anthropogenic activities was based on multiple lines of evidence. The first line of evidence arises from our basic physical understanding of the effects of changing concentrations of GHGs, natural factors, and other human impacts on the climate system. The second line of evidence arises from indirect, historical estimates of past climate changes that suggest that the changes in global surface temperature over the last several decades are unusual. The third line of evidence arises from the use of computer-based climate models to simulate the likely patterns of response of the climate system to different forcing mechanisms (both natural and anthropogenic). Observed increases in global average air temperatures are driving observed climate impacts like widespread melting of snow and ice and rising global average sea level. The Administrator also considered these observed changes as additional evidence of the unequivocal warming of the climate system driven primarily by elevated atmospheric GHG concentrations because the consistency of these observed changes in physical and biological systems and the observed significant warming cannot be explained entirely due to natural variability or other confounding non-climate factors.

[118] 74 FR at 66517–19.

[119] The properties "long lived" and "well mixed" used in this document mean that the gas has a lifetime in the atmosphere sufficient to become globally well mixed throughout the entire atmosphere, which requires a minimum atmospheric lifetime of about one year. Atmospheric lifetime is a measure of how long a type of molecule is likely to remain in the atmosphere before it breaks down, reacts with other gases, or is absorbed by Earth's surface. The IPCC often refers interchangeably to the six well-mixed GHGs as long-lived GHGs; however, the IPCC and others in the international climate change community, such as the United Nations Environment Programme, also refer to methane and some HFCs as "near-term climate forcers," "short-lived climate forcers," or "short-lived climate pollutants." These terms refer to those compounds whose impacts on Earth's climate occurs primarily with the first decade after their emission. According to the IPCC AR5 (2014), methane has an atmospheric lifetime of about 12 years. One of the most commonly used hydrofluorocarbons (HFC–134a) has a lifetime of about 13 years. Thus, methane and some HFCs are both short- and long-lived GHGs—*i.e.,* they have lifetimes long enough to become globally well mixed in the atmosphere, but short enough to primarily affect Earth's climate within a decade after their emission. For comparison, nitrous oxide has a lifetime of around 130 years; sulfur hexafluoride over 3,000 years; and some perfluorocarbons up to 10,000 to 50,000 years. CO_2 is sometimes approximated as having a lifetime of roughly 100 years, but for a given amount of CO_2 emitted, a better description is that some fraction of the atmospheric increase in concentration is quickly absorbed by the oceans and terrestrial vegetation, some fraction of the atmospheric increase will only slowly decrease over a number of years, and a small portion of the increase will remain for many centuries or more.

[120] 74 FR at 66517–18.

In addition, as described in more detail in the 2009 Endangerment Finding,[121] the Administrator made the judgment that the scientific evidence is compelling that six GHGs are expected to remain the primary driver of future climate change and that, without substantial and near-term efforts to significantly reduce emissions, it can be expected that atmospheric concentrations of the six GHGs will continue to climb and thus lead to ever greater rates of climate change. Given the long atmospheric lifetime of the six well-mixed GHGs, which range from roughly a decade to centuries, future atmospheric GHG concentrations for the remainder of this century and beyond will be influenced not only by future emissions but indeed by present-day and near-term emissions. Consideration of future plausible scenarios, and how our current GHG emissions essentially commit present and future generations to cope with an altered atmosphere and climate, reinforces the Administrator's judgment that it is appropriate to define the combination of the six key greenhouse gases as the air pollution. Most future scenarios that assume no explicit GHG mitigation actions (beyond those already enacted) project increasing global GHG emissions over the century, which in turn result in climbing GHG concentrations. Concentrations of the six well-mixed GHGs increase even for those scenarios where annual emissions toward the end of the century are assumed to be lower than current annual emissions.

The EPA has also carefully reviewed the recent assessments of the IPCC, USGCRP, and NRC. The EPA finds that these recent assessments support and strengthen the evidence cited in the 2009 Endangerment Finding that current atmospheric GHG concentrations are now at elevated and essentially unprecedented levels primarily as a result of both historic and current anthropogenic emissions. The 2014 USGCRP NCA3 states, ''Atmospheric levels measured at Mauna Loa in Hawai'i and at other sites around the world reached 400 parts per million in 2013, higher than the Earth has experienced in over a million years.'' [122] Such concentrations are the primary driver of observed changes in Earth's climate system, namely increased global average temperatures that drive climate impacts like widespread melting of snow and ice and rising global average sea level (discussed in more detail in section IV.C). The recent assessments of the IPCC, USGCRP, and NRC also describe how these six well-mixed GHGs play a dominant role in future warming of the climate system. The USGCRP NCA3 makes the following finding with very high confidence: ''The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases emitted globally, and how sensitive the Earth's climate is to those emissions.'' [123] Key findings from the recent assessments regarding global and U.S. trends are described briefly below.

a. Key Observed Trends Driven Primarily by the Six Well-Mixed GHGs

According to the IPCC AR5, observations of the Earth's globally averaged combined land and ocean surface temperature over the period 1880 to 2012 show a warming of 0.85 [0.65 to 1.06] degrees Celsius or 1.53 [1.17 to 1.91] degrees Fahrenheit.[124] The IPCC AR5 concludes that the increase in atmospheric GHG concentrations since 1750, plus other human activities (*e.g.,* land use change and aerosol emissions), has had a radiative forcing effect estimated to be 2.3 Watts per square meter (W/m^2) in 2011.[125] Radiative forcing is a measure of a substance's total net effect on the global energy balance for which a positive number represents a warming effect and a negative number represents a cooling effect. The IPCC's estimate is an increase from the previous 2007 IPCC Fourth Assessment Report (AR4) total net estimate of 1.6 W/m^2 that was referred to in the record for the 2009 Endangerment Finding. The reasons for this increase include continued increases in GHG concentrations, as well as reductions in the estimated negative forcing due to aerosol particles. The IPCC AR5 rates the level of confidence [126] in their radiative forcing estimates as ''high'' for methane and ''very high'' for CO_2 and nitrous oxide.

The new assessments also have greater confidence since the 2009 Endangerment Finding in attributing recent warming to human causes. The IPCC AR5 stated that it is extremely likely (>95 percent likelihood) that human influences have been the dominant cause of warming since the mid-20th century, which is an even stronger statement than the AR4 conclusion that it is very likely (>90 percent likelihood) that most of the increase in temperature since the mid-20th century was due to the observed increase in anthropogenic GHG concentrations. The AR4 conclusion was referred to in the record for the 2009 Endangerment Finding. In addition, the IPCC AR5 found that concentrations of CO_2 and several other of the major GHGs are higher than they have been in at least 800,000 years. This is an increase from what was reported in IPCC AR4, which found higher concentrations than in at least 650,000 years.

The USGCRP NCA3 states that there is very high confidence [127] that the global climate change of the past 50 years is primarily due to human activities. Human activities are affecting climate through increasing atmospheric levels of heat-trapping GHGs, through changing levels of various particles that can have either a heating or cooling influence on the atmosphere, and through activities such as land use changes that alter the reflectivity of the Earth's surface and cause climatic warming and cooling effects. The USGCRP concludes that ''considering all known natural and human drivers of climate since 1750, a strong net warming from long-lived greenhouse gases produced by human activities dominates the recent climate record.'' [128]

These recent and strong conclusions attributing recent observed global warming to human influence have been made despite what some have termed a

[121] 74 FR at 66518–19.

[122] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 739.

[123] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p.20. See also p. 736: ''Past emissions of heat-trapping gases have already committed the world to a certain amount of future climate change. How much more the climate will change depends on future emissions and the sensitivity of the climate system to those emissions.''

[124] ''IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[125] Ibid.

[126] The IPCC expresses levels of confidence using five qualifiers: Very low, low, medium, high, and very high. These levels are based on a qualitative evaluation of the robustness of the evidence (considering the type, amount, quality, and consistency of evidence such as data, mechanistic understanding, theory, models, and expert judgment) and the degree of agreement among the findings.

[127] The NCA expresses levels of confidence using four qualifiers: low, medium, high, and very high. These levels are based on the strength and consistency of the observed evidence; the skill, range, and consistency of model projections; and insights from peer-reviewed sources.

[128] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 741.

warming slowdown or ''hiatus'' over the past 15 years or so. The IPCC AR5 notes that global mean surface temperature exhibits substantial natural decadal and interannual variability. Short-term variability does not alter conclusions about the long-term climate trend that the IPCC AR5 finds after its review of independently verified observational records: ''Each of the past three decades has been successively warmer at the Earth's surface than all the previous decades in the instrumental record, and the first decade of the 21st century has been the warmest.'' [129] [130]

Temperature trends at the global level have also been observed regionally and in the United States. In the Northern Hemisphere, the IPCC AR5 finds that the last 30 years were likely the warmest 30-year period of the last 1400 years. The USGCRP NCA3 states with very high confidence that ''U.S. average temperature has increased by 1.3 °F to 1.9 °F since record keeping began in 1895; most of this increase has occurred since about 1970. The most recent decade was the nation's warmest on record.'' [131] The USGCRP also notes that the rate of U.S. temperature increase over the past 4 to 5 decades has been greater than the rate observed in earlier decades.

b. Key Projections Based Primarily on Future Scenarios of the Six Well-Mixed GHGs

Future temperature changes will depend on what path the world follows with respect to GHG emissions and associated levels of GHG concentrations in the atmosphere. The NRC Climate Stabilization Targets assessment concludes that CO_2 emissions are currently altering the atmosphere's composition and will continue to alter Earth's climate for thousands of years. The NRC Understanding Earth's Deep Past assessment finds that ''the magnitude and rate of the present greenhouse gas increase place the climate system in what could be one of the most severe increases in radiative forcing of the global climate system in Earth history.'' [132] A key future projection of this assessment is that by the end of the century, if no emissions reductions are made, CO_2 concentrations are projected to increase to levels that Earth has not experienced for more than 30 million years. In its high emission scenario, the IPCC AR5 projects that global temperatures by the end of the century will likely be 2.6 to 4.8 degrees Celsius (4.7 to 8.6 degrees Fahrenheit) warmer than today. Temperatures on land and in northern latitudes will likely warm even faster than the global average.

For the United States, the USGCRP NCA3 concludes, ''Warming is ultimately projected for all parts of the nation during this century. In the next few decades, this warming will be roughly 2 °F to 4 °F in most areas. By the end of the century, U.S. warming is projected to correspond closely to the level of global emissions: roughly 3 °F to 5 °F under lower emissions scenarios (B1 or RCP 4.5) involving substantial reductions in emissions, and 5 °F to 10 °F for higher emissions scenarios (A2 or RCP 8.5) that assume continued increases in emissions; the largest temperature increases are projected for the upper Midwest and Alaska.'' [133]

3. The Six Well-Mixed GHGs Are Currently the Common Focus of the Climate Change Science and Policy Communities

The six well-mixed GHGs are currently the common focus of climate science and policy analyses and discussions. Grouping them is consistent with the focus of international and domestic climate science research enterprises like the IPCC and USGCRP. The IPCC and USGCRP assessment reports assess the climate change effects on health, society, and the environment as a result of human-induced climate change driven primarily by the group of six gases.

Grouping them is also consistent with the focus of climate policy. The United Nations Framework Convention on Climate Change (UNFCCC), signed and ratified by the United States in 1992, requires its signatories to ''develop, periodically update, publish and make available . . . national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies . . .'' [134] To date, the primary focus of UNFCCC actions and discussions has been on the six well-mixed GHGs, including the recent Paris Agreement in which Parties agreed to undertake nationally determined contributions to achieving the goal of ''global peaking of GHG emissions as soon as possible'' in order to reach a long-term global temperature target.[135] Domestically, the EPA has been developing standards for GHG emissions from mobile and stationary sources under the Clean Air Act since finalizing the 2009 Endangerment Finding.

4. Defining Air Pollution as the Aggregate Group of Six GHGs Is Consistent With Evaluation of Risks and Impacts Due to Human-Induced Climate Change

Based on her review of the science described in detail above in section IV.B.2, the Administrator judges that the six well-mixed GHGs constitute the largest anthropogenic driver of climate change and play a dominant role in observed and projected changes in Earth's climate system. Thus, the Administrator finds, as she did in the 2009 Endangerment Finding, that because the six well-mixed GHGs are collectively the primary driver of current and projected human-induced climate change, the current and future risks (here described in section IV.C below) due to human-induced climate change—whether these risks are associated with increases in temperature, changes in precipitation, a rise in sea levels, changes in the frequency and intensity of weather events, or more directly with the elevated GHG concentrations themselves—can be associated with this definition of air pollution. Due to the cumulative purpose of the statutory language, even if the Administrator were to look at the atmospheric

[129] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, p. 161.

[130] Furthermore, we note that according to both NOAA and NASA, 2015 was the warmest year in the modern instrumental record for globally averaged surface temperature, breaking the record previously held by 2014. This now means that the last fifteen years have been fifteen of the sixteen warmest years on record. Available at *http://www.ncdc.noaa.gov/sotc/global/201513* (last accessed April 11, 2016).

[131] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 28.

[132] NRC, 2011: *Understanding Earth's Deep Past: Lessons for Our Climate Future.* The National Academies Press, p. 138.

[133] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 29.

[134] United Nations Framework Convention on Climate Change, 1992: Article 4(1)(a) of the United Nations Framework Convention on Climate Change, p. 10. Available at *https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf* (last accessed April 11, 2016).

[135] United Nations Framework Convention on Climate Change, 2015: *Adoption of the Paris Agreement Conference of the Parties Twenty-first session Paris,* FCCC/CP/2015/L.9/Rev.1, 12 December 2015, Available at: *https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf* (last accessed April 8, 2016).

concentration of each GHG individually, she would still consider the impact of the concentration of a single GHG in combination with that caused by the other GHGs.

5. Defining Air Pollution as the Aggregate Group of Six GHGs Is Consistent With Past EPA Practice

Treating the air pollution as the aggregate of the well-mixed GHGs is consistent with other provisions of the CAA and previous EPA practice under the CAA, where separate emissions from different sources but with common properties may be treated as a class (*e.g.,* particulate matter (PM)). This approach addresses the total, cumulative effect that the elevated concentrations of the six well-mixed GHGs have on climate and, thus, on different elements of health, society, and the environment. The EPA treats, for example, PM as a common class of air pollution; PM is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

6. Response to Key Comments on Defining the Air Pollution as the Aggregate Group of the Six Well-Mixed Greenhouse Gases

Many commenters agreed with the EPA that the ''air pollution'' for purposes of the endangerment finding under section 231(a)(2)(A) of the CAA should be defined as the six well-mixed GHGs. Several commenters discussed the fact that aircraft engines emit only two of the six well-mixed GHGs. Commenters pointed out that the majority of aircraft emissions are CO_2, while nitrous oxide emissions are described as ''nominal (<1%)'' or ''trace.'' Some commenters ultimately concluded that the EPA's approach to defining the air pollution as an aggregate group of six gases is acceptable, but that the scope of future regulations should be limited to CO_2. One commenter agreed with the Agency's evaluation of the six GHGs based on their common attributes, but questioned the EPA's decision to aggregate the six gases rather than considering them individually for purposes of making the findings. Other commenters disagreed with the EPA and requested limiting the definition of air pollution in this action to CO_2 or to CO_2 and nitrous oxide.

The EPA disagrees with comments regarding changing the definition of the air pollution to limit it to only those GHGs that are emitted from aircraft or to CO_2 only. The EPA has explained both in the 2009 Endangerment Finding and in the proposed findings under CAA section 231(a)(2)(A) that the definition of the air pollution is based on shared characteristics and common attributes relevant to climate change science and policy [136]—which is not affected by the identity of the source(s) of the emissions contributing to the air pollution. The EPA recognized in the proposed findings that aircraft emit two of the six well-mixed GHGs but stated that nonetheless it is entirely reasonable and appropriate, and in keeping with the 2009 Endangerment Finding and past EPA practice, for the Administrator to group into a single class those substances that possess shared relevant properties, even though they are not all emitted from the classes of sources before her.[137] After considering all the comments, this continues to be the EPA's view. Moreover, this approach to defining air pollution (and air pollutant, as described below) as a grouping of many substances is not unique to GHGs but rather is common practice under the CAA, for example for particulate matter and volatile organic compounds.

The five primary reasons for grouping the six well-mixed GHGs are explained in detail above in sections IV.B.1 through IV.B.5. Because the well-mixed GHGs are collectively the primary driver of current and projected human-induced climate change, all current and future risks due to human-induced climate change can be associated with this definition of air pollution. Thus, this grouping is consistent with evaluation of the scientific issues that the EPA is required to examine in this endangerment finding, namely the risks and impacts due to human-induced climate change. As discussed above, the key scientific evidence and observations that are the basis of this finding focus on the combined six well-mixed GHGs, and did not assess risks and impacts associated with greenhouse gas-induced climate change using an individual gas approach. Accordingly, we are not undertaking a separate endangerment analysis for each of the six well-mixed gases individually.

The question of limits to the scope of future regulations is outside of the scope of this action because the EPA has neither proposed nor is finalizing in this action any such regulatory standards. This final action does not itself impose any requirements on source categories under CAA section 231. Thus, the EPA anticipates that this question could be raised and considered, as needed, in the standard-setting phase of the regulatory process, and the EPA will consider comments submitted on the issue of the appropriate form of emission standards in response to EPA's anticipated future notice of proposed rulemaking on standards. Although this final action establishes a duty for the EPA to promulgate standards for the GHG emissions from engines used by covered aircraft, the findings do not pre-judge the form that such standards may take.

Another commenter expressed concern about EPA's proposed endangerment finding because it does not differentiate between CO_2 emissions that result from combustion of fossil fuels and those that result from ''combustion of biomass or biofuels derived from herbaceous crops or crop residues, as well as biogenic CO_2 emissions associated with the production, gathering and processing of crops or crop residues used in bio-based products including fuels.'' [138] The commenter argues that such crop-related biogenic CO_2 emissions should be excluded from the endangerment finding because the CO_2 released back to the atmosphere when emitted from crop-derived biogenic sources contains the same carbon that was previously removed or sequestered from CO_2 in the atmosphere and thus does not contribute to elevated atmospheric concentrations of the six well-mixed GHGs.

The EPA reiterates that the Administrator defines the relevant air pollution considered in the endangerment finding as the aggregate group of the six well-mixed GHGs based on shared physical characteristics and common attributes relevant to climate change science and policy, which is not affected by consideration of the sources of the emissions contributing to the air pollution. In the record for the 2009 Endangerment Finding, the Agency stated that ''all CO_2 emissions, regardless of source, influence radiative forcing equally once it reaches the atmosphere and therefore there is no distinction between biogenic and non-biogenic CO_2 regarding the CO_2 and the other well-mixed GHGs within the definition of air pollution that is reasonably anticipated to endanger public health and welfare.'' [139] The EPA continues to hold that position in these

[137] 80 FR at 37774, 37785 and 37787.

[138] Biogenic CO_2 Coalition, 2015: Comments on EPA's Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare, 80 FR 37757 (July 1, 2015). Docket ID number EPA–HQ–OAR–2014–0828–0916. Available at *www.regulations.gov* (last accessed April 11, 2016).

[139] EPA, 2009. Response to Comments document, Volume 9: The Endangerment Finding, EPA–HQ–OAR–2009–0171–11676. Available at *www.regulations.gov* (last accessed April 11, 2016).

findings, which is supported by the evidence before it. First, the fact that these CO_2 emissions originate from combustion of carbon-based fuels created through different processes is not relevant to defining the air pollution that is reasonably anticipated to endanger public health and welfare. The origin and constitution of a fuel prior to its combustion and subsequent emission into the atmosphere has no bearing on the fact that CO_2 and the other well-mixed GHGs are all sufficiently long lived to become well mixed in the atmosphere, directly emitted, of well-known radiative forcing, and generally grouped and considered together in climate change scientific and policy forums as the primary driver of climate change. Moreover, as explained in section IV.C of this document, the endangerment arises from the elevated concentrations of the six well-mixed GHGs in the atmosphere. A molecule of biogenic CO_2 has the same radiative forcing effect as a molecule of fossil-fuel derived CO_2. In other words, no matter the original source of the CO_2, the behavior of the CO_2 molecules in the atmosphere in terms of radiative forcing, chemical reactivity, and atmospheric lifetime is effectively the same. Any differential treatment of biogenic CO_2 in the context of the endangerment finding would be inconsistent with the primary scientific basis for the grouping of the six well-mixed GHGs as a single class for purposes of identifying the air pollution (and air pollutant, as explained below). A more detailed response to the issues raised in this comment can be found in the Response to Comments document in the docket.

7. Other Climate Forcers Not Being Included in the Definition of Air Pollution for This Finding

Both in the 2009 Endangerment Finding and in this action, the Administrator recognizes that there are other substances in addition to the six well-mixed GHGs that are emitted from human activities and that affect Earth's climate (referred to as climate forcers). However, as described in more detail in the 2009 Endangerment Finding and in the proposed findings under CAA section 231(a)(2)(A),[140] these substances do not fit within one or more of the five primary reasons for focusing on this aggregate group as the air pollution. As described in the following subsections, we received comments on the omission of water vapor, NO_X, and aerosol particles emitted from aircraft from the proposed definition of air pollution for this finding, but not on the omission of other climate forcers. After considering public comments and additional information in the new assessments regarding the climate-relevant substances outside the group of the six well-mixed GHGs, it is the Administrator's view that the reasons stated in the 2009 Endangerment Finding[141] for not including these substances in the scope of the GHG air pollution still apply at this time.

As the EPA acknowledged in the proposed findings,[142] some short-lived substances—namely water vapor, NO_X emitted at high altitude, and aerosol particles including black carbon—have physical properties that result in their having different, and often larger, climate effects when emitted at high altitudes. For example, the assessment literature indicates that aerosol particles, including black carbon, emitted at high altitudes have more interactions with clouds and therefore have different effects on the global energy balance than do particles emitted at the surface. However, the very properties that lead to differential climate effects depending on the altitude of emission—properties that are different from those of the six well-mixed GHGs—lead to more uncertainty in the scientific understanding of these short-lived substances' total effect on Earth's climate. The short-lived nature of these substances means that, unlike GHGs that are sufficiently long lived to become well mixed in the atmosphere, the climatic impact of the substance is dependent on a number of factors such as the location and time of its emission. The magnitude, and often the direction (positive/warming or negative/cooling), of the globally averaged climate impact will differ depending on the location of the emission due to the local atmospheric conditions (*e.g.,* due to differing concentrations of other compounds with which the emissions can react, background humidity levels, or the presence or absence of clouds). In addition, for emissions at any given location, the spatial and temporal pattern of the climate forcing will be heterogeneous, again often differing in direction (for example, in the case of NO_X emissions, the near-term effect in the hemisphere in which the emissions occur is usually warming due to increased ozone concentrations, but the longer term effects, and effects in the other hemisphere, are often cooling due to increased destruction of methane). More detail on the uncertainties relating to the climate effects of these short-lived substances is provided in the subsections below in response to public comments and in the Response to Comments document.

Overall, the state of the science as represented in the assessment literature at present continues to highlight significant scientific uncertainties regarding the total net forcing effect of water vapor, NO_X, and aerosol particles when emitted at high altitudes. The dependence of the effects on where the substance is emitted, and the complex temporal and spatial patterns that result, mean that the current level of understanding regarding these short-lived substances is much lower than for the six well-mixed GHGs. Given the aforementioned scientific uncertainties at present, the Agency is not including these constituents in the definition of air pollution for purposes of the endangerment finding under section 231(a)(2)(A) of the CAA.

Many public comments either supported or opposed inclusion of other substances in addition to the six well-mixed GHGs in the definition of air pollution, and some specifically suggested water vapor, NO_X, and aerosol particles as additional substances to include in that definition. The Agency's full responses to those comments can be found in the Response to Comments document; key comments and responses are summarized below.

a. Response to Key Comments on Including Other Climate Forcers in the Definition of Air Pollution

Some commenters argued that the proposed findings under CAA section 231(a)(2)(A) did not demonstrate careful examination of the scientific issues with regard to those short-lived substances that have different climate effects when emitted at high altitudes, and that a more thorough analysis should lead the EPA to conclude that water vapor, NO_X, and black carbon also drive climate change in addition to the six well-mixed GHGs. These comments stated that the EPA should have quantified and included the effect of high-altitude water vapor, NO_X, and black carbon in the Agency's discussion of drivers of climate change. Another commenter argued that the EPA should include metal particulates (specifically lead, barium, and aluminum) in the definition of air pollution for this finding because of their role in aviation-induced cloudiness, which the commenter argues has a larger effect on climate change than the six well-mixed GHGs.

Although the EPA is not at this time taking final action to determine whether these other climate forcers should be found to represent air pollution within

[140] 74 FR at 66519–21 and 80 FR at 37781–84.

[141] 74 FR at 66519–21.

[142] 80 FR at 37781–84.

the meaning of CAA section 231(a)(2)(A), the EPA disagrees with these comments suggesting that the Agency did not carefully examine the scientific issues and information supporting its current endangerment finding in regard to these substances. Consistent with the approach described in the proposed findings and for the reasons discussed above, the Administrator considers the major peer-reviewed scientific assessments of the IPCC and NRC as the primary scientific and technical basis informing the endangerment finding and providing the current state of scientific understanding of the differential climate effects that water vapor, NO_X, and aerosols such as black carbon have when emitted at high altitudes. The EPA has considered the following assessment reports to obtain the best estimates of these substances' net impact on the climate system, which is generally discussed in terms of radiative forcing: The IPCC AR5, the IPCC 2007 Fourth Assessment Report (AR4),[143] the IPCC Special Report: Aviation and the Global Atmosphere (IPCC 1999),[144] the NRC's Advancing the Science of Climate Change (NRC 2010),[145] and the NRC's Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project (NRC 1999).[146] The USGCRP assessments have not dealt specifically with emissions at high altitude.

As described previously in section IV.A of this document, the Administrator's consideration of the major scientific assessments provides assurance that the Administrator is basing her judgment on the best available, well-vetted science that reflected the consensus of the climate science research community. These scientific assessments addressed the scientific issues that the EPA was required to examine, were comprehensive in their coverage of the GHG and climate change issues, and underwent rigorous and exacting peer review by the expert community, as well as rigorous levels of U.S. government review, in which the EPA took part. The commenters provide no compelling arguments against this approach, which underwent judicial review and was upheld as described in section IV.A of this document. The assessments synthesize literally thousands of individual studies to convey the consensus conclusions on what the body of scientific literature tells us, and the commenters did not provide evidence that we had missed or mischaracterized conclusions of the assessments regarding aviation impacts.

The state of the science as represented in the assessment literature supports the EPA's reasons for defining the air pollution as the aggregate group of the six well-mixed GHGs, which include their common physical properties relevant to climate change (*i.e.,* directly emitted and sufficiently long lived to become well mixed in the atmosphere), the fact that these gases are considered the primary drivers of climate change, and the fact that these gases remain the best understood drivers of anthropogenic climate change. Water vapor, NO_X, aerosol particles, or aviation-induced cloudiness associated with metal particulates do not share these common attributes, and are each associated with substantial scientific uncertainty. Accordingly, although the EPA is not making a final determination on whether these additional substances should be found to be air pollution within the meaning of CAA section 231(a)(2)(A), the EPA is not at this time changing or expanding the definition of the air pollution to include these additional substances. The following subsections provide additional discussion of the state of the science as represented in the assessment literature regarding the climatic effects of these substances when emitted at high altitudes.

b. Responses to Key Comments on Changes in Clouds From High Altitude Emissions of Water Vapor and Particles

Some commenters supported the EPA's summary of the scientific assessment literature and agreed that there are substantial scientific uncertainties regarding net climate effects of aviation-induced cloudiness from high altitude emissions of water vapor and particles. Other commenters disagreed and argued that there is clear scientific evidence that aviation-induced cloudiness associated with high altitude emissions of water vapor drives climate change and should be included in the definition of air pollution. One commenter disagrees and argues that, due to their effect on aviation-induced cloudiness and climate change, metal particulates should be included in the definition of air pollution.

The EPA disagrees with the comments regarding changing or expanding the definition of the air pollution employed in this endangerment finding to include these additional substances. For the reasons stated above, the Administrator considers the scientific assessment literature as the primary scientific and technical basis informing the endangerment finding and providing the state of climate science on aviation-induced cloudiness. Section IV.B.4 of the proposed findings under CAA section 231(a)(2)(A)[147] explained that aviation-induced cloudiness (sometimes called AIC) refers to all changes in cloudiness associated with aviation operations, which are primarily due to the effects of high altitude emissions of water vapor and particles (primarily sulfates and black carbon). Changes in cloudiness affect the climate by both reflecting solar radiation (cooling) and trapping outgoing longwave radiation (warming). Unlike the warming effects associated with GHGs that are sufficiently long lived to become well mixed in the atmosphere, the climate effects associated with changes in cloud cover are more regional and temporal in nature. The assessment literature describes three main components of aviation-induced cloudiness—persistent contrails, contrail-induced cirrus, and induced cirrus. Aircraft engine emissions of water vapor at high altitudes during flight can lead to the formation of condensation trails, or contrails, under certain conditions such as ice-supersaturated air masses with specific humidity levels and temperature.

The NRC estimated that persistent contrails increased cloudiness above the United States by two percent between 1950 and 1988, with similar results reported over Europe.[148] As stated above, clouds can have both warming and cooling effects, and persistent contrails were once considered to have significant net warming effects. However, more recent estimates suggest a smaller overall climate forcing effect of persistent contrails. The IPCC AR5 best estimate for the global mean radiative forcing from contrails is 0.01 W/m^2 (medium confidence and with an uncertainty range of 0.005 to 0.03 W/m^2).[149] To put both the magnitude and

[143] IPCC, 2007: *Climate Change 2007: The Physical Scientific Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)] Cambridge University Press, 996 pp.

[144] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J.Dokken, M.McFarland (eds.)] Cambridge University Press, 373 pp.

[145] NRC, 2010: *Advancing the Science of Climate Change.* The National Academies Press, 528 pp.

[146] NRC, 1999: *Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project.* The National Academies Press, 54 pp.

[147] 80 FR at 37782–83.

[148] NRC, 1999: *Atmospheric Effects of Aviation: A Review of NASA's Subsonic Assessment Project.* The National Academies Press, 54 pp.

[149] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the

large uncertainty range of this number for the first of the three components of aviation-induced cloudiness into context, some examples of other IPCC AR5 best estimates for global mean radiative forcing include: 1.68 W/m^2 for CO_2 (very high confidence and with an uncertainty range of 1.33 to 2.03 W/m^2), 0.97 W/m^2 for methane (high confidence and with an uncertainty range of 0.74 to 1.20 W/m^2), and 0.17 W/m^2 for nitrous oxide (very high confidence and with an uncertainty range of .013 to 0.21 W/m^2).[150] In addition, the NRC (2010) assessment suggested that contrails may affect regional diurnal temperature differences, but this has been called into question by the recent findings presented in the IPCC AR5, which suggests that aviation contrails do not have an effect on mean or diurnal range of surface temperatures (medium confidence).

Persistent contrails also sometimes lose their linear form and develop into cirrus clouds, an effect referred to as contrail-induced cirrus. Studies to date have been unable to isolate this second of three main climate forcing components of aviation-induced cloudiness, but the IPCC AR5 provides a combined contrail and contrail-induced cirrus best estimate of 0.05 W/m^2 (low confidence and with an uncertainty range of 0.02 and 0.15 W/m^2).[151]

Particles emitted or formed in the atmosphere as a result of aircraft emissions (primarily sulfates and black carbon) may also act as ice nuclei and modify naturally forming cirrus clouds, an effect referred to as ''induced cirrus.'' This third of three main climate forcing components of aviation-induced cloudiness is an area of active research, and there are significant challenges in estimating the climatic impacts of cirrus cloud modification. Neither IPCC AR4 nor AR5 provided global or regional estimates related to this forcing, with the AR5 stating that ''it is deemed too uncertain to be further assessed here.''[152] The 2007 IPCC AR4 characterizes our knowledge of the natural freezing modes in cirrus conditions as ''poor'' and notes that cirrus cloud processes are not well represented in global models.[153]

Given differences in scientific understanding of the three main components of aviation-induced cloudiness, the more recent assessments have not provided quantitative estimates of the overall net climate forcing effect of changes in clouds from high altitude emissions of water vapor and particles. Going back to the 1999 IPCC assessment's quantitative estimates, the science is characterized as ''very uncertain'' with a range for the best estimate between 0 to 0.040 W/m^2.[154] Thus, based on its consideration of the scientific evidence and all the comments on this issue, the EPA agrees with those commenters that indicate there are substantial scientific uncertainties regarding net effects of the three components of aviation-induced cloudiness on the climate system. These uncertainties result in the Agency's not being prepared at this time to determine whether these additional substances are air pollution within the meaning of CAA section 231(a)(2)(A) and not including them within the definition of ''air pollution'' being employed in this endangerment finding.

c. Responses to Key Comments on Direct Radiative Forcing Effects of High Altitude Particle Emissions

Some commenters supported the EPA's summary of the scientific uncertainties regarding the net direct radiative forcing effects of aviation-induced particles including black carbon. Other commenters disagreed and argued that there is clear scientific evidence that black carbon in particular drives climate change and should be included in the definition of air pollution.

The EPA disagrees with comments regarding changing or expanding the definition of the air pollution employed in this endangerment finding to include aviation-induced particles like black carbon. For the reasons stated above, the Administrator considers the scientific assessment literature as the primary scientific and technical basis informing the endangerment finding and providing the state of climate science regarding the direct radiative forcing effects of high altitude emissions of the two primary aviation-induced particles, sulfates and black carbon. Section IV.B.4 of the proposed findings under CAA section 231(a)(2)(A)[155] explained that aircraft emit precursor gases that convert to sulfate particles in the atmosphere, such as sulfur dioxide. Sulfate particles have direct effects on the climate by scattering solar radiation, which is a negative radiative forcing that ultimately results in cooling. The more recent assessments have not identified a quantitative best estimate for this negative radiative forcing effect specifically from aviation, as it is an active area of scientific study with large uncertainties. Going back to the 1999 IPCC assessment's quantitative estimates, the direct radiative forcing effect of sulfate aerosols from aviation for the year 1992 is estimated at ¥0.003 W/m^2 with an uncertainty range between ¥0.001 and ¥0.009 W/m^2.[156]

Similarly, the proposed findings under CAA section 231(a)(2)(A) explained that black carbon emissions from aviation, which are produced by the incomplete combustion of jet fuel, primarily absorb solar radiation and heat the surrounding air, resulting in a warming effect (positive radiative forcing). The more recent assessments have not identified a quantitative best estimate for this effect specifically from aviation, as it is an area of active scientific study with large uncertainties. Going back to the 1999 IPCC assessment's quantitative estimates, the global mean radiative forcing of black carbon emissions from aircraft is estimated to be 0.003 W/m^2 with uncertainty spanning 0.001 to 0.009 W/m^2.[157] The IPCC 1999 assessment suggests that because the contribution of black carbon in the stratosphere (which actually contributes to cooling of the Earth's surface rather than warming) was not included in its calculations, its estimates of radiative forcing were likely to be too high.

In addition, the 2009 Endangerment Finding did not include aerosols in the

Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, 1535 pp.

[150] IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 29 pp.

[151] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, 1535 pp.

[152] Ibid.

[153] IPCC, 2007: *Climate Change 2007: The Physical Scientific Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)] Cambridge University Press, 996 pp.

[154] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J.Dokken, M.McFarland (eds.)] Cambridge University Press, 373 pp.

[155] 80 FR at 37783.

[156] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J.Dokken, M.McFarland (eds.)] Cambridge University Press, 373 pp.

[157] Ibid.

definition of air pollution, noting that much of the uncertainty range surrounding the best estimate of total net forcing due to all human activities was due to uncertainties about the cooling and warming effects of aerosols[158] (though from all sources, not just aircraft). The 2009 Endangerment Finding also stated that the magnitude of aerosol effects can vary immensely with location and season of emissions, noting that estimates of its total climate forcing effect have a large uncertainty range.[159] Regarding black carbon specifically, the 2009 Endangerment Finding noted that it does not share common physical and chemical attributes with the six well-mixed GHGs because it is an aerosol particle (not a gas) that has different physical, chemical, and atmospheric properties. Black carbon affects the climate differently than GHGs that are sufficiently long lived to become well mixed in the atmosphere. In contrast to its indirect warming and cooling effects via clouds, black carbon causes a direct warming effect primarily by absorbing incoming and reflected sunlight (whereas GHGs that are sufficiently long lived to become well mixed in the atmosphere cause warming by trapping outgoing, infrared heat), and by darkening bright surfaces such as snow and ice, which reduces reflectivity. Black carbon is short-lived, remaining in the atmosphere for only about a week, and does not become well-mixed in the atmosphere. There are also concerns in the international climate science and policy communities about how to treat the short-lived black carbon emissions alongside GHGs—for example, what are the appropriate metrics to compare the warming and/or climate effects of the different substances, given that, unlike GHGs that are sufficiently long lived to become well mixed in the atmosphere, the magnitude of aerosol effects can vary immensely with location and season of emissions.

Thus, although the EPA is not at this time prepared to make a final determination on whether black carbon should be found to be air pollution within the meaning of CAA section 231(a)(2)(A), based on its consideration of the scientific evidence and all the comments on this issue, and consistent with its conclusion in the 2009 Endangerment Finding, the EPA disagrees with commenters that ask for black carbon to be included in the definition of the air pollution as part of this endangerment finding. Because aerosols such as black carbon and sulfates are fundamentally different from and do not share the relevant properties that support grouping the six well-mixed GHGs together as a class, and scientific uncertainties remain regarding the net radiative forcing effects of these substances (whether in general or when emitted at high altitudes), the EPA is not at this time including them in the definition of air pollution employed in this finding. However, because of these uncertainties the Agency is not at this time taking final action to determine whether these additional substances should be found to represent air pollution within the meaning of CAA section 231(a)(2)(A).

d. Responses to Key Comments on Changes in Atmospheric Chemistry From High Altitude Nitrogen Oxides Emissions

Most commenters supported the EPA's summary of the scientific uncertainties regarding the changes in atmospheric chemistry from high altitude NO_X emissions. At least one commenter disagreed and argued that there is clear scientific evidence that the effects of NO_X emissions on ozone production have a significant climate forcing effect. They concluded that NO_X should therefore be included in an endangerment finding.

The EPA disagrees with comments to the extent that they suggest including NO_X in this endangerment finding by changing or expanding the definition of the air pollution. NO_X emissions have different, and potentially larger, climate effects when emitted at high altitudes and about 90 percent of aircraft NO_X is emitted in flight (not during landing and takeoff),[160] meaning its relevance for climate change is primarily in relation to emissions at high altitude. The atmospheric lifetime of NO_X emitted near the surface is on the order of a few hours, while in the upper troposphere, or roughly the cruise altitude for jet aircraft, it is on the order of several days.

Section IV.B.4 of the proposed findings under CAA section 231(a)(2)(A)[161] explained that emissions of NO_X do not themselves have warming or cooling effects, but affect the climate through catalyzing changes in the chemical equilibrium of the atmosphere. High altitude emissions of NO_X increase the concentration of ozone, which has a warming effect in the short term. Elevated NO_X concentrations also lead to an increased rate of destruction of methane, which has a cooling effect in the long-term. The reduced methane concentrations eventually contribute to decreases in ozone, which also decreases the long-term net warming effect. Thus, the net radiative impact of NO_X emissions depends on the balance between the reductions in methane versus the production of ozone, which in turn depends on the time scale under consideration.

For the reasons stated above, the Administrator considers the scientific assessment literature as the primary scientific and technical basis informing the endangerment finding and providing the state of climate science regarding how emissions of NO_X affect the climate system. Quantifying these impacts is an area of active scientific study with large uncertainties. The quantification of the net global effect of NO_X is difficult because the atmospheric chemistry effects are heavily dependent on highly localized atmospheric properties and mixing ratios. Because the background atmospheric concentration of NO_X is important for quantifying the impact of NO_X emissions on ozone and methane concentrations, the location of aircraft emissions is an important additional factor. Going back to the IPCC 1999 assessment since no more recent quantitative estimates are available, the globally averaged radiative forcing estimates for high-altitude aircraft emissions of NO_X in 1992 were 0.023 W/m^2 for ozone-induced changes (uncertainty range of 0.011 to 0.046 W/m^2), and ¥0.014 W/m^2 for methane-induced changes (uncertainty range of ¥0.005 to ¥0.042 W/m^2).[162]

The IPCC AR5 presents the impact of aviation high-altitude NO_X emissions using a different metric, global warming potential (GWP), which is a measure of the warming impact of a pulse of emissions of a given substance over 100 years relative to the same mass of CO_2. The AR5 presents a range from ¥21 to +75 for GWP of aviation NO_X.[163] The uncertainty in sign indicates uncertainty

[158] 74 FR at 66517.

[159] 74 FR at 66520.

[160] FAA, *System for Assessing Aviation's Global Emissions, Version 1.5, Global Aviation Emissions Inventories for 2000 through 2004,* FAA–EE–2005–02, September 2005, revised March 2008, available at *http://www.faa.gov/about/office_org/headquarters_offices/apl/researc/models/sage/* (Last accessed April 14, 2016).

[161] 80 FR at 37783–84.

[162] IPCC, 1999: *Aviation and the Global Atmosphere,* Special Report to the Intergovernmental Panel on Climate Change [Penner, J.E., D.H. Lister, D.J. Griggs, D.J. Dokken, M. McFarland (eds.)] Cambridge University Press, 373 pp.

[163] IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, 1535 pp.

whether the net effect is one of warming or cooling. This report further suggests that at cruise altitude there is strong regional sensitivity of ozone and methane to NO_X, particularly notable at low latitudes.

Thus, although the EPA is not prepared to determine whether NO_X emissions at high altitude should be found to be air pollution within the meaning of CAA section 231(a)(2)(A), based on its consideration of the scientific evidence and all the comments on this issue, and consistent with its conclusion in the 2009 Endangerment Finding, the EPA disagrees with commenters that assert that NO_X should be included at this time in the definition of the air pollution for this finding. NO_X does not share the relevant properties that support grouping the six well-mixed GHGs together as a class. NO_X is not classified as a GHG because it influences the climate system indirectly through production of ozone rather than directly through trapping outgoing heat. In addition, NO_X does not have a sufficiently long atmospheric lifetime to become well-mixed in the atmosphere and significant scientific uncertainties remain regarding its net radiative forcing effects.

The Administrator notes that NO_X emissions are already regulated under the EPA's rules implementing CAA section 231, at 40 CFR part 87, due to their impacts during landing and take-off operations (LTO). The prerequisite endangerment and cause or contribute findings that formed the basis for these standards, however, did not rely upon any conclusions regarding the climate forcing impacts of NO_X, but rather the role of LTO NO_X emissions as a precursor to ozone formation in areas that did not meet the NAAQS for ozone.[164] The continuing significant uncertainties regarding high altitude NO_X emissions, which are emitted during cruise operations rather than during LTO, as a climate forcer do not undermine the Agency's prior conclusion under CAA section 231(a)(2)(A) that emissions of NO_X from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare due to their contribution to ozone concentrations that exceed the NAAQS. This final finding does not revise or reopen the Agency's prior findings under CAA section 231(a)(2)(A) that emissions of NO_X from aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare due to their contribution to ozone concentrations that exceed the NAAQS.

C. The Air Pollution is Reasonably Anticipated To Endanger Both Public Health and Welfare

The Administrator finds that elevated atmospheric concentrations of the six well-mixed GHGs may reasonably be anticipated to endanger the public health and welfare of current and future generations within the meaning of CAA section 231(a)(2)(A). This section describes the major pieces of scientific evidence supporting the Administrator's endangerment finding, discusses both the public health and welfare aspects of the endangerment finding, and addresses a number of key issues the Administrator considered when evaluating the state of the science.

The EPA is informed by and places considerable weight on the extensive scientific and technical evidence in the record supporting the 2009 Endangerment Finding, including the major, peer-reviewed scientific assessments used to address the question of whether GHGs in the atmosphere endanger public health and welfare, and on the analytical framework and conclusions upon which the EPA relied in making that finding. This final finding under CAA section 231(a)(2)(A) accounts for the EPA's careful consideration of the scientific and technical record for the 2009 Endangerment Finding, of the new, major scientific assessments issued since closing the administrative record for the 2009 Endangerment Finding, and of public comments. No recent information or assessments published since late 2009 or provided by commenters suggest that it would be reasonable for the EPA to now reach a different or contrary conclusion for purposes of CAA section 231(a)(2)(A) than the one the EPA reached in 2009 under CAA section 202(a). Rather, they provide further support for this final finding under section 231(a)(2)(A). In particular, the new assessments discussed in this document provide additional detail regarding public health impacts, particularly on groups and people especially vulnerable to climate change, including children, the elderly, low-income communities and individuals, indigenous groups, and communities of color.

Following the same decision framework and analysis that we followed for the 2009 Endangerment Finding, as detailed in section IV.B of that finding,[165] here we summarize the general approach used by the Administrator in reaching the judgment that a positive endangerment finding should be made for purposes of CAA section 231(a)(2)(A), as well as the specific rationale for finding that the GHG air pollution may reasonably be anticipated to endanger both public health and welfare. First, the Administrator finds the scientific evidence linking anthropogenic emissions and resulting elevated atmospheric concentrations of the six well-mixed GHGs to observed global and regional temperature increases and other climate changes to be sufficiently robust and compelling. The Administrator is basing her finding on the total weight of scientific evidence and what the science has to say regarding the nature and potential magnitude of the risks and impacts across all climate-sensitive elements of public health and welfare, now and projected out into the foreseeable future. The Administrator has considered the state of the science on how anthropogenic emissions and the resulting elevated atmospheric concentrations of the six well-mixed GHGs may affect each of the major risk categories, include human health, air quality, food production and agriculture, forestry, water resources, sea level rise and coastal areas, the energy sector, infrastructure and settlements, and ecosystems and wildlife. The Administrator understands that the nature and potential severity of impacts can vary across these different elements of public health and welfare, and that they can vary by region, as well as over time.

The Administrator is therefore aware that, because human-induced climate change has the potential to be far-reaching and multi-dimensional, not all risks and potential impacts can be characterized with a uniform level of quantification or understanding, nor can they be characterized with uniform metrics. Thus, the Administrator is not necessarily placing the greatest weight on those risks and impacts which have been the subject of the most study or quantification. Rather, given this variety in not only the nature and potential magnitude of risks and impacts, but also in our ability to characterize, quantify and project into the future such impacts, the Administrator must use her judgment to weigh the threat in each of the risk categories, weigh the potential benefits where relevant, and ultimately to judge whether these risks and

[164] U.S. EPA, "Control of Air Pollution from Aircraft and Aircraft Engines, Emission Standards and Test Procedures for Aircraft." Final Rule, 38 FR 19088 (July 17, 1973).

[165] 74 FR at 66523–36.

benefits, when viewed in total, endanger public health and/or welfare.

First, the Administrator has not established a specific threshold metric for the different categories of risk and impacts, which are referred to as impact sectors. The potential for both adverse and beneficial effects is considered, as well as the relative magnitude of such effects, to the extent that the relative magnitudes can be quantified or characterized. Furthermore, given the multiple ways in which the buildup of anthropogenic GHG emissions in the atmosphere can cause effects (*e.g.,* via elevated CO_2 concentrations, temperature increases, precipitation increases, sea level rise, and changes in extreme events), these multiple pathways are considered. The Administrator has balanced and weighed the varying risks and effects for each impact sector. She has judged whether there is a pattern across the sector that supports or does not support an endangerment finding, and if so whether the support is of more or less weight. In cases where there is a potential for both benefits and risks of harm, the Administrator has balanced these factors by determining whether there appears to be any directional trend in the overall evidence that would support placing more weight on one than the other, taking into consideration all that is known about the likelihood of the various risks and effects and their seriousness. In all of these cases, the judgment is largely qualitative in nature and is not reducible to precise metrics or quantification.

Regarding the timeframe for the endangerment test, it is the Administrator's view that both current and future conditions must be considered. The Administrator is thus taking the view that the endangerment period of analysis extend from the current time to the next several decades and in some cases to the end of this century. This consideration is also consistent with the timeframes used in the underlying scientific assessments. The future timeframe under consideration is consistent with the atmospheric lifetime and climate effects of the six well-mixed GHGs and also with our ability to make reasonable and plausible projections of future conditions. The Administrator acknowledges that some aspects of climate change science and the projected impacts are more certain than others. Our state of knowledge is strongest for recently observed, large-scale changes. Uncertainty tends to increase in characterizing changes at smaller (regional) scales relative to large (global) scales. Uncertainty also increases as the temporal scales move away from the present, either backward or more importantly forward in time. Nonetheless, the current state of knowledge of observed and past climate changes and their causes enables projections of plausible future changes under different scenarios of anthropogenic forcing for a range of spatial and temporal scales. The subsections below summarize the scientific information on climate change impacts to public health and welfare that inform the Administrator's judgment, as well as the key public comments and Agency responses. The Agency's full responses to public comments can be found in the Response to Comments document.

1. The Air Pollution is Reasonably Anticipated To Endanger Public Health

The Administrator finds under CAA section 231(a)(2)(A) that the well-mixed GHG air pollution is reasonably anticipated to endanger public health, for both current and future generations. The Administrator finds that the public health of current generations is endangered and that the threat to public health for both current and future generations will mount over time as GHGs continue to accumulate in the atmosphere and result in ever greater rates of climate change. The Administrator continues to find robust scientific evidence in the assessment literature that climate change can increase the risk of morbidity and mortality and believes that these public health impacts can and should be considered when determining endangerment to public health under CAA section 231(a)(2)(A). As described in section IV.B.1 of the 2009 Endangerment Finding, the Administrator is not limited to only considering whether there are any direct health effects such as respiratory or toxic effects associated with exposure to GHGs.

Here we summarize information from the scientific assessment literature cited in the 2009 Endangerment Finding showing that climate change resulting from anthropogenic GHG emissions threatens multiple aspects of public health.[166] In determining that the well-mixed GHG air pollution is reasonably anticipated to endanger public health for current and future generations under CAA section 202(a), the Administrator noted her view that climate change can increase the risk of morbidity and mortality. In making that public health determination, the Administrator considered direct temperature effects, air quality effects, the potential for changes in vector-borne diseases, and the potential for changes in the severity and frequency of extreme weather events. In addition, the Administrator considered whether and how susceptible populations may be particularly at risk. As explained in more detail in the 2009 Endangerment Finding, with respect to direct temperature effects, by raising average temperatures, climate change increases the likelihood of heat waves, which are associated with increased deaths and illnesses. Climate change is also expected to lead to reductions in cold-related mortality. The 2009 Endangerment Finding, while noting uncertainty about how heat and cold related mortality would change in the future, also pointed to a USGCRP assessment report discussion that increases in heat-related mortality due to global warming in the United States were unlikely to be compensated for by decreases in cold-related mortality. With regard to air quality effects, climate change is expected to increase ozone pollution over broad areas of the country, including large metropolitan population centers, and thereby increase the risks of respiratory infection, aggravation of asthma, and premature death. Other public health threats stem from the potential for increased deaths, injuries, infectious and waterborne diseases, stress-related disorders, and other adverse effects associated with increased hurricane intensity and increased frequency of intense storms and heavy precipitation associated with climate change. In addition, climate change is expected to be associated with an increased risk of food-, water-, and vector-borne diseases in susceptible populations. Climate change also has the potential to change aeroallergen production (for example, through lengthening the growing season for allergen-producing plants), and subsequent human exposures could increase allergenic illnesses. Children, the elderly, and the poor are among the most vulnerable to climate-related health risks and impacts. The Administrator placed weight on the fact that these certain groups are most vulnerable to these climate-related health effects.

The EPA concludes that the 2009 Endangerment Finding's discussion under CAA section 202(a) is equally persuasive for purposes of CAA section 231(a)(2)(A). In addition, the EPA has carefully reviewed the key conclusions in the recent assessments regarding public health risks and the current and projected health impacts from human-

[166] 74 FR at 66524–30.

induced climate change. The EPA finds that the new assessments are consistent with or strengthen the underlying science considered in the 2009 Endangerment Finding regarding public health effects from changes in temperature, air quality, extreme weather, and climate-sensitive diseases and aeroallergens, further supporting an endangerment finding under CAA section 231(a)(2)(A). These key findings are described briefly here.

The USGCRP NCA3 finds that, ''Climate change threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and diseases carriers such as mosquitoes and ticks. Some of these health impacts are already underway in the United States.'' [167] Regarding temperature effects, the USGCRP NCA3 states, ''The effects of temperature extremes on human health have been well documented for increased heat waves, which cause more deaths, hospital admissions and population vulnerability.'' [168] The conclusions of the assessment literature cited in the 2009 Endangerment Finding were uncertain with respect to the balance of future heat- versus cold-related mortality associated with climate change, but they noted that the available evidence suggested that the increased risk from heat would exceed the decreased risk from cold in a warming climate. The most recent assessments now have greater confidence that increases in heat-related mortality likely will be larger than the decreases in cold-related mortality, further supporting this endangerment finding under CAA section 231(a)(2)(A). The USGCRP NCA3 concludes, ''While deaths and injuries related to extreme cold events are projected to decline due to climate change, these reductions are not expected to compensate for the increase in heat-related deaths.'' [169] The IPCC AR5 also notes a potential benefit of climate change could include ''modest reductions in cold-related mortality and morbidity in some areas due to fewer cold extremes (low confidence),'' [170] but that, ''[o]verall, we conclude that the increase in heat-related mortality by mid-century will outweigh gains due to fewer cold periods.'' [171]

Regarding air quality effects, the assessment literature cited in the 2009 Endangerment Finding concluded that climate change is expected to increase regional ozone pollution, with associated risks in respiratory illnesses and premature death, but that the directional effect of climate change on ambient particulate matter levels was less certain. One of the more recent assessments, the USGCRP NCA3, similarly concludes, ''Climate change is projected to harm human health by increasing ground-level ozone and/or particulate matter air pollution in some locations. . . . There is less certainty in the responses of airborne particles to climate change than there is about the response of ozone.'' [172] The IPCC AR5 finds that ozone and particulate matter have been associated with adverse health effects in many locations in North America, and that ozone concentrations could increase under future climate change scenarios if emissions of precursors were held constant. For particulate matter, both the USGCRP NCA3 and IPCC AR5 discuss increasing wildfire risk under climate change and explain that wildfire smoke exposure can lead to various respiratory and cardiovascular impacts. The USGCRP NCA3 states, ''The effects of wildfire on human health have been well documented with increases in wildfire frequency, leading to decreased air quality and negative health impacts.'' [173] The NRC Indoor Environment assessment identifies potential adverse health risks associated with climate change-induced alterations in the indoor environment, including possible exposure to air pollutants due to changes in outdoor air quality. Other risks include potential for alterations in indoor allergens due to climate change-related increases in outdoor pollen levels, potential chemical exposures due to greater use of pesticides to address changes in geographic ranges of pest species, and dampness/mold associated symptoms and illness due to potential flooding and water damage in buildings from projected climate change-related increases in storm intensity and extreme precipitation events in some regions of the United States. Each of these assessments further supports finding endangerment under CAA section 231(a)(2)(A).

Regarding extreme weather events (*e.g.,* storms, heavy precipitation, and, in some regions of the United States, floods and droughts), the conclusions of the assessment literature cited in the 2009 Endangerment Finding found potential for increased deaths, injuries, infectious and waterborne diseases, and stress-related disorders. The more recent assessments further support this conclusion for purposes of CAA section 231(a)(2)(A). The USGCRP NCA3 finds that ''Heavy downpours are increasing nationally, especially over the last three to five decades. Largest increases are in the Midwest and Northeast. Increases in the frequency and intensity of extreme precipitation events are projected for all U.S. regions.'' [174] The USGCRP NCA3 identifies that: ''Elevated waterborne disease outbreaks have been reported in the weeks following heavy rainfall, although other variables may affect these associations. Water intrusion into buildings can result in mold contamination that manifests later, leading to indoor air quality problems.'' [175] Other risks include mortality associated with flooding and impacts on mental health, such as anxiety and post-traumatic stress disorder. The IPCC AR5 also discusses increased risk of death and injury in coastal zones and regions vulnerable to inland flooding. The USGCRP NCA3 and the IPCC AR5 both find that climate change may increase exposure to health risks associated with drought conditions, which includes impacts from wildfires, dust storms, extreme heat events, and flash flooding. Droughts can lead to reduced water quantity and degraded water quality, thereby increasing the risk of water-related diseases. The IPCC SREX assessment projects further increases in some extreme weather and climate events during this century, and it specifically notes that changes in extreme weather events have implications for disaster risk in the health sector.

The potential for changes in climate-sensitive diseases was also cited in the 2009 Endangerment Finding. This included an increase in the spread of several food and water-borne pathogens,

[167] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 221.

[168] Ibid at p. 252.

[169] Ibid at p. 224.

[170] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 713.

[171] Ibid. at p. 721.

[172] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 222.

[173] Ibid at p. 252.

[174] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 36.

[175] Ibid at p. 224–225.

which can affect susceptible populations. Also noted was the potential for range expansion of some zoonotic disease carriers such as the Lyme disease-carrying tick. The new assessment literature similarly focuses on increased exposure risk for some diseases under climate change, finding that increasing temperatures may expand or shift the ranges of some disease vectors like mosquitoes, ticks, and rodents. The IPCC AR5 notes that climate change may influence the ''growth, survival, persistence, transmission, or virulence of pathogens'' [176] that cause food and water-borne disease. The USGCRP NCA3 notes that uncertainty remains regarding future projections of increased human burden of vector-borne disease, given complex interacting factors such as ''local, small-scale differences in weather, human modification of the landscape, the diversity of animal hosts, and human behavior that affects vector-human contact, among other factors.'' [177] This new assessment literature further supports finding endangerment under CAA section 231(a)(2)(A).

Regarding aeroallergens, the assessment literature cited in the 2009 Endangerment Finding found potential for climate change to affect the prevalence and severity of allergy symptoms, but definitive data or conclusions were lacking on how climate change might impact aeroallergens in the United States. Further supporting an endangerment finding under CAA section 231(a)(2)(A), the most recent assessments now express greater confidence that climate change influences the production of pollen, which in turn could affect the incidence of asthma and other allergic respiratory illnesses such as allergic rhinitis, as well as effects on conjunctivitis and dermatitis. Both the USGCRP NCA3 and the IPCC AR5 found that increasing temperature has lengthened the allergenic pollen season for ragweed, and that increased CO_2 by itself can elevate production of plant-based allergens. The IPCC AR5 concludes that in North America, there is high confidence that ''warming will lead to further changes in the seasonal timing of pollen release.'' [178]

a. Health Impacts of Climate Change on Vulnerable Populations

In the 2009 Endangerment Finding, the EPA cited the assessment literature's conclusions regarding the fact that certain populations, including children, the elderly, and the poor, are most vulnerable to climate change-related health effects. The 2009 Endangerment Finding also described climate change impacts facing indigenous peoples in the United States, particularly Alaska Natives. The new assessment literature strengthens these conclusions and further supports an endangerment finding under CAA section 231(a)(2)(A) by providing more detailed findings regarding these populations' vulnerabilities and the projected impacts they may experience. In addition, the most recent assessment reports provide new analysis about how some populations defined jointly by ethnic/racial characteristics and geographic location may be vulnerable to certain climate change health impacts. The following paragraphs summarize information from the most recent assessment reports on these vulnerable populations.

The USGCRP NCA3 finds, ''Climate change will, absent other changes, amplify some of the existing health threats the nation now faces. Certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.'' [179] 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. Low-income populations also face higher prevalence of chronic health conditions than higher income groups, which increases their vulnerability to the health effects of climate change.

According to the USGCRP NCA3 and IPCC AR5, some populations defined jointly by ethnic/racial characteristics and geographic location are more vulnerable to certain health effects of climate change due to factors such as existing health disparities (*e.g.,* higher prevalence of chronic health conditions), increased exposure to health stresses, and social factors that affect local resilience and ability to recover from impacts.

The USGCRP NCA3 also finds that climate change, in addition to chronic stresses such as extreme poverty, is affecting indigenous peoples' health in the United States through impacts such as reduced access to traditional foods, decreased water quality, and increasing exposure to health and safety hazards. The IPCC AR5 finds that climate change-induced warming in the Arctic and resultant changes in environment (*e.g.,* permafrost thaw, effects on traditional food sources) have significant observed and projected impacts on the health and well-being of Arctic residents, especially indigenous peoples. Small, remote, predominantly indigenous communities are especially vulnerable given their ''strong dependence on the environment for food, culture, and way of life; their political and economic marginalization; existing social, health, and poverty disparities; as well as their frequent close proximity to exposed locations along ocean, lake, or river shorelines.'' [180] In addition, increasing temperatures and loss of Arctic sea ice increases the risk of drowning for those engaged in traditional hunting and fishing.

The USGCRP NCA3 concludes that ''Children, primarily because of physiological and developmental factors, will disproportionately suffer from the effects of heat waves, air pollution, infectious illness, and trauma resulting from extreme weather events.'' [181] As noted above, the IPCC AR5 finds that in North America, climate change will influence production of pollen, and that this affects asthma and other allergic respiratory diseases to which children are among those especially susceptible.

[176] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 726.

[177] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 225.

[178] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, pp. 1465–1466.

[179] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 221.

[180] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1581.

[181] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p.228.

The IPCC AR5 also identifies children as a susceptible population to health effects associated with heat waves, storms, and floods.

Both the USGCRP and IPCC conclude that climate change increases health risks facing the elderly. Older people are at much higher risk of mortality during extreme heat events. Pre-existing health conditions also make older adults susceptible to cardiac and respiratory impacts of air pollution and to more severe consequences from infectious and waterborne diseases. Limited mobility among older adults can also increase health risks associated with extreme weather and floods.

Accordingly, as discussed above, all of these recent assessments further support finding endangerment under CAA section 231(a)(2)(A).

b. Responses to Key Comments on Endangerment to Public Health

Public comments supported the EPA's summary of the scientific information and finding that the well-mixed GHG air pollution is reasonably anticipated to endanger public health of current and future generations under CAA section 231(a)(2)(A). Commenters cited a number of examples of climate impacts relevant to public health including changes in outdoor and indoor air quality, extreme temperatures, floods, fires, and hurricanes. Some commenters also agreed with the EPA's summary of health impacts to certain vulnerable populations and emphasized that certain populations like the elderly, poor, very young, and indigenous groups are more vulnerable to the health impacts of climate change for various reasons. No commenters disagreed with the EPA's summary of the scientific information or with its conclusion on endangerment to public health. The EPA agrees with the commenters that this endangerment finding is well supported by the scientific assessment literature; that it covers a range of health risks associated with climate change-induced changes in air quality, increases in temperatures, changes in extreme weather events, increases in food and water borne pathogens, and changes in aeroallergens; and that certain populations are more vulnerable to climate change health risks and impacts.

2. The Air Pollution Is Reasonably Anticipated To Endanger Welfare

The Administrator finds under CAA section 231(a)(2)(A) that the air pollution comprised of the six well-mixed GHGs is reasonably anticipated to endanger welfare, for both current and future generations. As with public health, the Administrator considered the multiple pathways in which the GHG air pollution and resultant climate change affect climate-sensitive sectors and the impact this may have on welfare. These sectors include food production and agriculture; forestry; water resources; sea level rise and coastal areas; energy, infrastructure, and settlements; and ecosystems and wildlife. The Administrator examined each climate-sensitive sector individually, informed by the scientific information in the major assessments contained in the administrative record for the 2009 Endangerment Finding as well as the newer assessments in the record for this action, and weighed the extent to which the risks and impacts within each sector support or do not support a positive endangerment finding in her judgment. The Administrator then viewed the full weight of evidence looking across all sectors to reach her decision regarding endangerment to welfare. For each of these sectors, the evidence indicates that the risk and the severity of adverse impacts on welfare are expected to increase over time, providing compelling support for a finding of endangerment to welfare. The Administrator also considered impacts on the U.S. population from climate change effects occurring outside of the United States, such as national security concerns for the United States that may arise as a result of climate change impacts in other regions of the world, and finds that this provides additional support to the finding of endangerment to welfare of current and future generations of the United States population.

The 2009 Endangerment Finding summarized information from the scientific assessment literature showing that climate change resulting from anthropogenic GHG emissions also threatens multiple aspects of welfare under CAA section 202(a).[182] In determining that the well-mixed GHG air pollution is reasonably anticipated to endanger welfare for current and future generations, the Administrator considered the multiple pathways by which GHG air pollution and resultant climate change affect welfare by evaluating the numerous and far-ranging risks and impacts associated with food production and agriculture; forestry; water resources; widespread snow and ice melt, sea level rise and coastal areas; energy, infrastructure, and settlements; and ocean acidification, ecosystems, and wildlife. The Administrator also considered observed and projected risks and impacts on the U.S. population from climate change effects occurring outside of the United States. As explained in more detail in the 2009 Endangerment Finding, the potential serious adverse impacts of extreme events, such as wildfires, flooding, drought, and extreme weather conditions provided strong support for the determination. Water resources across large areas of the country are at serious risk from climate change, with effects on water supplies, water quality, and adverse effects from extreme events such as floods and droughts. The severity of risks and impacts is likely to increase over time with accumulating GHG concentrations and associated temperature increases and precipitation changes. Coastal areas are expected to face increased risks from storm and flooding damage to property, as well as adverse impacts from rising sea level such as land loss due to inundation, erosion, wetland submergence and habitat loss. Climate change is expected to result in an increase in electricity production for peak electricity demand, and extreme weather from climate change threatens energy, transportation, and water resource infrastructure. Climate change may exacerbate existing environmental pressures in certain settlements. In Alaska, indigenous communities are likely to experience disruptive impacts. Climate change is also very likely to fundamentally change U.S. ecosystems over the 21st century and to lead to predominantly negative consequences for biodiversity, ecosystem goods and services, and wildlife. Though there may be some benefits for agriculture and forestry in the next few decades, the body of evidence points towards increasing risks of net adverse impacts on U.S. food production, agriculture and forest productivity as average temperature continues to rise. Looking across all sectors discussed above, the risk and the severity of adverse impacts on welfare are expected to increase over time. Lastly, these impacts are global and may exacerbate problems outside the United States that raise humanitarian, trade, and national security issues for the United States.

The Administrator concludes that the discussion in the 2009 Endangerment Finding under CAA section 202(a) is equally compelling to support an endangerment finding under CAA section 231(a)(2)(A). In addition, the EPA has carefully reviewed the recent scientific conclusions in the assessments regarding human-induced

[182] 74 FR at 66530–36.

climate change impacts on welfare.[183] The EPA finds that they further support finding endangerment under CAA section 231(a)(2)(A), as they are largely consistent with or strengthen the underlying science supporting the 2009 Endangerment Finding regarding observed and projected climate change risks and impacts to food production and agriculture; forestry; water resources; widespread snow and ice melt, sea level rise, and coastal areas; energy, infrastructure, and settlements; ocean acidification, ecosystems, and wildlife; and impacts on the U.S. population from climate change effects occurring outside of the United States. These key findings are described briefly here.

Regarding agriculture, the assessment literature cited in the 2009 Endangerment Finding found potential for increased CO_2 levels to benefit yields of certain crops in the short term, but with considerable uncertainty. The body of evidence pointed towards increasing risk of net adverse impacts on U.S. food production and agriculture over time, with the potential for significant disruptions and crop failure in the future. The most recent assessments now have greater confidence that climate change will negatively affect U.S. agriculture over this century, and support finding endangerment under CAA section 231(a)(2)(A). Specifically, the USGCRP NCA3 concludes, ''While some U.S. regions and some types of agricultural production will be relatively resilient to climate change over the next 25 years or so, others will increasingly suffer from stresses due to extreme heat, drought, disease, and heavy downpours. From mid-century on, climate change is projected to have more negative impacts on crops and livestock across the country.'' [184] The IPCC AR5 concludes, ''Overall yields of major crops in North America are projected to decline modestly by mid-century and more steeply by 2100 among studies that do not consider adaptation (very high confidence).'' [185] The IPCC AR5 notes that in the absence of extreme events, climate change may benefit certain regions and crops, but that in North America significant harvest losses have been observed due to recent extreme weather events. In addition, the IPCC SREX assessment specifically notes that projected changes in extreme weather events will increase disaster risk in the agriculture sector.

Regarding forestry, the assessment literature cited in the 2009 Endangerment Finding found that near-term benefits to forest growth and productivity in certain parts of the country from elevated CO_2 concentrations and temperature increases to date are offset by longer-term risks from wildfires and the spread of destructive pests and disease that present serious adverse risks for forest productivity. The most recent assessments provide further support for finding endangerment under CAA section 231(a)(2)(A). Both the USGCRP NCA3 and the IPCC AR5 conclude that climate change is increasing risks to forest health from fire, tree disease and insect infestations, and drought. The IPCC AR5 also notes risks to forested ecosystems associated with changes in temperature, precipitation amount, and CO_2 concentrations, which can affect species and ecological communities, leading to ecosystem disruption, reorganization, movement or loss. The NRC Arctic assessment states that climate change is likely to have a large negative impact on forested ecosystems in the high northern latitudes due to the effects of permafrost thaw and greater wildfire frequency, extent, and severity. The NRC Climate Stabilization Targets assessment found that for an increase in global average temperature of 1 to 2 °C above pre-industrial levels, the area burnt by wildfires in western North America will likely more than double.

Regarding water resources, the assessment literature cited in the 2009 Endangerment Finding concluded that increasing temperatures and increased variability in precipitation associated with climate change is expected to have adverse impacts on water quality and is likely to further constrain water quantity through changes in snowpack, increased risk of floods, drought, and other concerns such as water pollution. Similarly, the new assessments further support projections of water resource impacts associated with increased floods and short-term drought in most U.S. regions, and therefore support an endangerment finding under CAA section 231(a)(2)(A). The USGCRP NCA3 also finds that, ''[c]limate change is expected to affect water demand, groundwater withdrawals, and aquifer recharge, reducing groundwater availability in some areas.'' [186] The IPCC AR5 finds that in part of the western United States, ''water supplies are projected to be further stressed by climate change, resulting in less water availability and increased drought conditions.'' [187] The IPCC AR5 states, ''Throughout the eastern USA, water supply systems will be negatively impacted by lost snowpack storage, rising sea levels contributing to increased storm intensities and saltwater intrusion, possibly lower streamflows, land use and population changes, and other stresses.'' [188] The IPCC AR5 also synthesizes recent studies that project a range of adverse climate impacts in North America to surface water quality (including to the Great Lakes), drinking water treatment/distribution, and sewage collection systems.

The assessment literature cited in the 2009 Endangerment Finding found that the most serious potential adverse effects to coastal areas are the increased risk of storm surge and flooding in coastal areas from current and projected rates of sea level rise and more intense storms. Coastal areas also face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding, and support finding endangerment under CAA section 231(a)(2)(A). The USGCRP NCA3 finds, ''Sea level rise, combined with coastal storms, has increased the risk of erosion, storm surge damage, and flooding for

[183] The CAA states that ''[a]ll language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants.'' CAA section 302(h). This language is quite broad. Importantly, it is not an exclusive list due to the use of the term ''includes, but is not limited to . . .'' Effects other than those listed here may also be considered effects on welfare.

[184] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, p. 16.

[185] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, p. 1462.

[186] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, p. 70.

[187] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, pp. 1456–1457.

[188] Ibid at p. 1457.

coastal communities, especially along the Gulf Coast, the Atlantic seaboard, and in Alaska.'' [189]

The IPCC AR5 found that global sea levels rose 0.19 m (7.5 inches) from 1901 to 2010. Contributing to this rise was the warming of the oceans and melting of land ice from glaciers and ice sheets. It is likely that 275 gigatons per year of ice melted from land glaciers (not including ice sheets) from 1993–2009, and that the rate of loss of ice from the Greenland and Antarctic ice sheets increased substantially in recent years, to 215 gigatons per year and 147 gigatons per year respectively from 2002–2011. For context, 360 gigatons of ice melt is sufficient to cause global sea levels to rise one millimeter.

The IPCC AR5, the USGCRP NCA3, and three of the new NRC assessments provide estimates of projected global average sea level rise. These estimates, while not always directly comparable as they assume different emissions scenarios and baselines, are at least 40 percent larger than, and in some cases more than twice as large as, the projected rise estimated in the IPCC AR4 assessment, which was referred to in the 2009 Endangerment Finding.[190] The NRC Sea Level Rise assessment projects a global average sea level rise of 0.5 to 1.4 meters by 2100. Change of this magnitude would be sufficient to lead to a relative rise in sea level even around the northern coasts of Washington State, where the land is still rebounding from the disappearance of the great ice sheets.[191] The NRC National Security Implications assessment suggests that ''the Department of the Navy should expect roughly 0.4 to 2 meters global average sea-level rise by 2100.'' [192] The NRC Climate Stabilization Targets assessment states that a global average temperature increase of 3 °C will lead to a global average sea level rise of 0.5 to 1 meter by 2100. While these NRC and IPCC assessments continue to recognize and characterize the uncertainty inherent in accounting for melting ice sheets in sea level rise projections, these revised estimates are consistent with the assessments underlying the 2009 Endangerment Finding, and support finding endangerment under CAA section 231(a)(2)(A).

Regarding climate impacts on energy, infrastructure and settlements, the 2009 Endangerment Finding cited the assessment literature's findings that temperature increases will change heating and cooling demand; that declining water quantity may adversely impact the availability of cooling water and hydropower in the energy sector; and that changes in extreme weather events will threaten energy, transportation, water, and other key societal infrastructure, particularly on the coast. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding, to support finding endangerment under CAA section 231(a)(2)(A). For example, the USGCRP NCA3 finds, ''Coastal infrastructure, including roads, rail lines, energy infrastructure, airports, port facilities, and military bases, are increasingly at risk from sea level rise and damaging storm surges.'' [193] The NRC Arctic assessment identifies threats to human infrastructure in the Arctic from increased flooding, erosion, and shoreline ice pile-up, or *ivu,* associated with summer sea ice loss and the increasing frequency and severity of storms.

Regarding ecosystems and wildlife, the assessment literature cited in the 2009 Endangerment Finding discussed a number of impacts. These include a high confidence finding that substantial changes in the structure and functioning of terrestrial ecosystems are very likely to occur with a global warming greater than 2 to 3 °C above pre-industrial levels, with predominantly negative consequences for biodiversity and the provisioning of ecosystem goods and services. In addition, climate change and ocean acidification will likely impair a wide range of planktonic and other marine calcifiers such as corals. The recent assessments published since 2009 provide additional support for finding endangerment under CAA section 231(a)(2)(A). The USGCRP NCA3 concluded that ''The oceans are currently absorbing about a quarter of the carbon dioxide emitted to the atmosphere annually and are becoming more acidic as a result, leading to concerns about intensifying impacts on marine ecosystems . . . Over the last 250 years, the oceans have absorbed 560 billion tons of CO2, increasing the acidity of surface waters by 30%. Although the average oceanic pH can vary on interglacial timescales, the current observed rate of change is roughly 50 times faster than known historical change.'' [194]

The NRC Arctic assessment states that major marine and terrestrial biomes will likely shift poleward, with significant implications for changing species composition, food web structures, and ecosystem function. The NRC Climate Stabilization Targets assessment found that coral bleaching events will likely increase in frequency and severity due warming sea surface temperatures and that ocean acidification will likely reduce coral shell and skeleton growth and increase erosion of coral reefs. The NRC Understanding Earth's Deep Past assessment notes four of the five major coral reef crises of the past 500 million years were caused by GHG-induced ocean acidification and warming that followed releases of GHGs of similar magnitude to the emissions increases expected over the next hundred years. Similarly, the NRC Ocean Acidification assessment finds that ''[t]he chemistry of the ocean is changing at an unprecedented rate and magnitude due to anthropogenic CO_2 emissions; the rate of change exceeds any known to have occurred for at least the past hundreds of thousands of years.'' [195] The assessment notes that the full range of consequences is still unknown, but the risks ''threaten coral reefs, fisheries, protected species, and other natural resources of value to society.'' [196] The IPCC AR5 also projects biodiversity losses in marine ecosystems, especially in the Arctic and tropics.

The IPCC AR5 found that annual mean Arctic sea ice has been declining at 3.5 to 4.1 percent per decade, and Northern Hemisphere snow cover extent has decreased at about 1.6 percent per decade for March and 11.7 percent per decade for June. The USGCRP NCA3 finds that ''rising temperatures across the U.S. have reduced lake ice, sea ice, glaciers, and seasonal snow cover over the last few decades.'' [197] These changes

[189] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 9.

[190] The 2007 IPCC AR4 assessment cited in 2009 Endangerment Finding estimated a projected sea level rise of between 0.18 and 0.59 meters by the end of the century, relative to 1990. It should be noted that in 2007, the IPCC stated that including poorly understood ice sheet processes could lead to an increase in the projections.

[191] Sea level does not rise uniformly due to changes in winds, temperature patterns, land uplift or subsidence, and other factors. Therefore, relative sea level rise along any given point on the coast can vary from the global average.

[192] NRC, 2011: *National Security Implications of Climate Change for U.S. Naval Forces.* The National Academies Press, p. 28.

[193] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 9.

[194] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program, p. 48.

[195] NRC, 2010: *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean.* The National Academies Press, p. 5.

[196] Ibid.

[197] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts*

Continued

are projected to continue, threatening seasonal water availability and ecosystems reliant on ice and snow cover.

a. Welfare Impacts of Climate Change on Vulnerable Populations

In general, climate change impacts related to welfare are expected to be unevenly distributed across different regions of the United States and are expected to have a greater impact on certain populations, such as indigenous peoples and the poor. The USGCRP NCA3 finds climate change impacts such as the rapid pace of temperature rise, coastal erosion and inundation related to sea level rise and storms, ice and snow melt, and permafrost thaw are affecting indigenous people in the United States. Particularly in Alaska, critical infrastructure and traditional livelihoods are threatened by climate change, and ''[i]n parts of Alaska, Louisiana, the Pacific Islands, and other coastal locations, climate change impacts (through erosion and inundation) are so severe that some communities are already relocating from historical homelands to which their traditions and cultural identities are tied.'' [198] The IPCC AR5 notes, ''Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty (high confidence). Climate-related hazards affect poor people's lives directly through impacts on livelihoods, reductions in crop yields, or destruction of homes and indirectly through, for example, increased food prices and food insecurity.'' [199]

b. Other Considerations Regarding Endangerment to Welfare

In the 2009 Endangerment Finding, the Administrator considered impacts on the U.S. population from climate change effects occurring outside of the United States, such as national security concerns that may arise as a result of climate change impacts in other regions of the world. The most recent assessments provide further evidence in line with the science supporting the 2009 Endangerment Finding, and further support finding endangerment under CAA section 231(a)(2)(A). The NRC Climate and Social Stress assessment found that it would be ''prudent for security analysts to expect climate surprises in the coming decade . . . and for them to become progressively more serious and more frequent thereafter.'' [200] The NRC National Security Implications assessment recommends preparing for increased needs for humanitarian aid; responding to the effects of climate change in geopolitical hotspots, including possible mass migrations; and addressing changing security needs in the Arctic as sea ice retreats.

In addition, the NRC Abrupt Impacts report examines the potential for tipping points, thresholds beyond which major and rapid changes occur in the Earth's climate system, as well as in natural and human systems that are impacted by the changing climate. The Abrupt Impacts report did find less cause for concern than some previous assessments regarding some abrupt events within the next century, such as disruption of the oceanic Atlantic Meridional Overturning Circulation (AMOC) and sudden releases of high-latitude methane from hydrates and permafrost. But, the same report found that the potential for abrupt changes in ecosystems, weather and climate extremes, and groundwater supplies critical for agriculture now seem more likely, severe, and imminent. The assessment found that some abrupt changes were already underway (*e.g.,* Arctic sea ice retreat and increases in extinction risk due to the speed of climate change), and cautioned that even abrupt changes such disruption to the AMOC that are not expected in this century can have severe impacts if/when they happen, such as interference with the global transport of oceanic heat, salt, and carbon.

c. Responses to Key Comments on Endangerment to Welfare

Public comments supported the EPA's summary of the scientific information and finding that the well-mixed GHG air pollution is reasonably anticipated to endanger welfare under CAA section 231(a)(2)(A). Commenters cited a number of examples of climate impacts relevant to welfare including sea level rise and coastal erosion, species range changes and extinctions, and reduced water availability due to changes in snowpack and timing of snow melt. Some commenters also agreed with the EPA's summary of welfare impacts to certain vulnerable populations and emphasized that certain populations are more vulnerable to the welfare impacts of climate change, in particular tribes and indigenous groups. No commenters disagreed with the EPA's summary of the scientific information or with its conclusion on endangerment to welfare. The EPA agrees with the commenters that this finding of endangerment to welfare under CAA section 231(a)(2)(A) is well supported by the scientific assessment literature; that it covers a range of risks associated with climate change threats to food production and agriculture, forestry, water resources, sea level rise and coastal areas, energy, infrastructure, and settlements, and ecosystems and wildlife; and that certain populations are more vulnerable to climate change welfare risks and impacts.

D. Summary of the Administrator's Endangerment Finding Under CAA Section 231

In sum, the Administrator finds, for purposes of CAA section 231(a)(2)(A), that elevated atmospheric concentrations of the six well-mixed GHGs constitute air pollution that endangers both public health and welfare of current and future generations. In this final action under CAA section 231(a)(2)(A), the EPA is informed by and places considerable weight on the extensive scientific and technical evidence in the record supporting the 2009 Endangerment Finding under CAA section 202(a), including the major, peer-reviewed scientific assessments used to address the question of whether GHGs in the atmosphere endanger public health and welfare, and on the analytical framework and conclusions upon which the EPA relied in making that finding. This final finding under section 231(a)(2)(A) accounts for the EPA's careful consideration of the scientific and technical record for the 2009 Endangerment Finding, and of the new, major scientific assessments issued since closing the administrative record for the 2009 Endangerment Finding, and consideration of public comments. No recent information or assessments published since late 2009 suggest that it would be reasonable for the EPA to now reach a different or contrary conclusion for purposes of CAA section 231(a)(2)(A) than the Agency reached for purposes of section 202(a); instead, the new, major scientific assessments

in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, p. 46.

[198] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, p. 17.

[199] IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, p. 796.

[200] NRC, 2013: *Climate and Social Stress: Implications for Security Analysis*. The National Academies Press, p. 18.

further support finding endangerment under CAA section 231(a)(2)(A). In making this finding for purposes of section 231(a)(2)(A), we are not reopening or revisiting the 2009 Endangerment Finding under CAA section 202(a). To the contrary, in light of the recent judicial decisions upholding that finding, the EPA believes the 2009 Endangerment Finding is firmly established and well settled.[201] Moreover, there is no need for the EPA to reopen or revisit that finding for purposes of CAA section 202(a) in order for the Administrator to rely on its analyses and conclusions, supported by more recent studies, in support of making an additional endangerment finding under section 231(a)(2)(A) of the CAA. Today's final endangerment finding, although significantly informed by the scientific information and the EPA's prior discussion of that information in the 2009 Endangerment Finding, is solely for purposes of CAA section 231(a)(2)(A).

V. The Administrator's Cause or Contribute Finding for Greenhouse Gases Emitted by Certain Classes of Engines Used by Covered Aircraft Under CAA Section 231

As noted above, the Administrator defines the air pollution for purposes of the endangerment finding under CAA section 231(a)(2)(A) to be the aggregate of six well-mixed GHGs in the atmosphere, and finds that such air pollution endangers public health and welfare of current and future generations. The second step of the two-part endangerment test for this finding is for the Administrator to determine whether the emission of any air pollutant from certain classes of aircraft engines used by certain aircraft causes or contributes to this endangering air pollution. This is referred to as the cause or contribute finding, and is the second finding by the Administrator in this action under CAA section 231(a)(2)(A).

Section V.A of this document describes the Administrator's reasoning for using under CAA section 231(a)(2) the same definition and scope of the GHG air pollutant that was used in the 2009 Endangerment Finding under CAA section 202(a). Section V.B puts forth the Administrator's finding that emissions of well-mixed GHGs from certain classes of aircraft engines used in covered aircraft contribute to the air pollution which endangers public health and welfare under CAA section 231(a)(2)(A). The EPA's responses to some of the most significant comments for the cause or contribute finding are provided later in section V.C. Responses to all significant issues raised by the comments on the cause or contribute finding are contained in the Response to Comments document, which is organized by subject area (found in docket EPA–HQ–OAR–2014–0828).

A. The Air Pollutant

1. Definition of Air Pollutant

Under section 231(a)(2)(A), the Administrator is to determine whether *emissions of any air pollutant* from any class or classes of aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. As with the 2009 Endangerment Finding that the EPA conducted for purposes of CAA section 202(a), when making a cause or contribute finding under section 231(a)(2), the Administrator must first define the air pollutant being evaluated. The Administrator has considered the logical relationship between the GHG air pollution and air pollutant: While the air pollution is the concentration (*e.g.,* stock) of the well-mixed GHGs in the atmosphere, the air pollutant is the same combined grouping of the well-mixed GHGs, the emissions of which are analyzed for contribution (*e.g.,* the flow into the stock). See 74 FR at 66536 (similar discussion with respect to the finding for CAA section 202(a)). For purposes of section 231(a)(2)(A), the Administrator is defining the air pollutant as the same combined grouping of the six well-mixed GHGs that comprises the air pollution. Accordingly, the Administrator is using the same definition of the air pollutant that was used in the 2009 Endangerment Finding for purposes of CAA section 202(a), namely, the aggregate group of the same six well-mixed GHGs: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. See 74 FR at 66536–37 (discussing the definition of the GHG air pollutant with respect to the finding for CAA section 202(a)). That is, as was done for the 2009 Endangerment Finding, the Administrator is defining a single air pollutant made up of these six GHGs in this action under CAA section 231(a)(2)(A).

To reiterate what the Agency has previously stated on this subject, this collective approach for the contribution test is consistent with the treatment of GHGs by those studying climate change science and policy, where it is common practice to evaluate GHGs on a collective, CO_2-equivalent basis.[202] This collective approach to defining the air pollutant is not unique; grouping of many substances with common attributes as a single pollutant is common practice under the CAA, for example with particulate matter and volatile organic compounds (VOC). As noted in section IV.B, these six substances share common attributes that support their grouping to define the air pollution for purposes of the endangerment finding. These same common attributes also support the Administrator grouping these six well-mixed GHGs for purposes of defining the air pollutant for this cause or contribute finding under CAA section 231(a)(2)(A).

The Administrator recognizes that in this case, the aircraft engines covered by this document emit two of the six gases, but not the other four gases. Nonetheless, it is entirely appropriate, and in keeping with the 2009 Endangerment Finding and past EPA practice, for the Administrator to define the air pollutant under CAA section 231(a)(2)(A) in a manner that recognizes the shared relevant properties of all these six gases, even though they are not all emitted from the classes of sources before her.[203] For example, a source may emit only 20 of the possible 200-plus chemicals that meet the definition of VOC in the EPA's regulations, but that source is evaluated based on its emissions of VOC and not on its emissions of the 20 chemicals by name. The fact that these six substances within the definition of GHGs share common, relevant attributes is true regardless of the type of sources being evaluated for

[201] *CRR*, 684 F.3d at 117 (D.C. Cir. 2012), reh'g en banc denied, 2012 U.S. App. LEXIS 25997, 26313, 26315 (D.C. Cir. 2012); *see also Utility Air Reg. Group* v. *EPA*, 134 S. Ct. at 2438 (2014).

[202] As detailed in the 2009 Endangerment Finding proposal (74 FR at 18904) and continuing today, the UNFCCC, the U.S. and other Parties report their annual emissions of the six GHGs in CO_2-equivalent units. This facilitates comparisons of the multiple GHGs from different sources and from different countries, and provides a measure of the collective warming potential of multiple GHGs. Emissions of different GHGs are compared using GWPs, which as described in section IV.B of this document are measures of the warming impact of a pulse of emissions of a given substance over 100 years relative to the same mass of CO_2. Therefore, GWP-weighted emissions are measured in teragrams of CO_2 equivalent (Tg CO_2eq). One teragram (Tg) = 1 million metric tons = 1 megatonne (Mt). 1 metric ton = 1,000 kilograms = 1.102 short tons = 2,205 lbs. The EPA's Greenhouse Gas Reporting Program (*http://www.epa.gov/ghgreporting/index.html* (last accessed April 8, 2016)) also reports GHG emissions on a CO_2-equivalent basis, recognizing the common and collective treatment of these six well-mixed GHGs.

[203] In the 2009 Endangerment Finding, the Administrator found that four of the six gases that were included in the definition of the air pollutant were emitted by section 202 sources. 74 FR at 66537.

contribution. Moreover, the reasonableness of grouping these chemicals as a single air pollutant does not turn on the particular source category. By using the definition of the air pollutant as comprised of the six GHGs with common attributes, the Administrator is taking account of these shared attributes and how they are relevant to the air pollution that endangers public health and welfare.

In fact, as explained in the 2009 Endangerment Finding, Congress has given the EPA broad discretion to determine that appropriate combinations of compounds should be treated as a single air pollutant. 74 FR at 66537. Section 302(g) of the CAA defines ''air pollutant'' as ''any air pollutant agent or combination of such agents. . . .'' Thus, it is clear that the term ''air pollutant'' is not limited to individual chemical compounds. Moreover, in determining that GHGs are within the scope of this definition, the Supreme Court described section 302(g) as a ''sweeping'' and ''capacious'' definition that unambiguously included GHGs, which are ''unquestionably 'agents' of air pollution.'' *Massachusetts* v. *EPA,* 549 U.S. at 528, 532, 529 n. 26. Although the Court did not interpret the term ''combination of'' air pollution agents, there is no reason to interpret this phrase more narrowly in this context. Congress used the term ''any'' and did not qualify the kind of combinations that EPA could define as a single air pollutant.

2. The Definition of Air Pollutant May Include Substances Not Emitted by CAA Section 231(a)(2) Sources.

Similar to the discussion in section IV.B.6 for the definition of ''air pollution'' for purposes of the endangerment finding under CAA section 231(a)(2)(A), many commenters highlighted the fact that aircraft engines emit only two of the six well-mixed GHGs that together are defined as the ''air pollutant'' for purposes of the cause or contribute finding under section 231(a)(2)(A) of the CAA. Commenters point out that the majority of emissions are CO_2, while nitrous oxide emissions are described as ''nominal (<1%)'' or ''trace.'' Some commenters ultimately concluded that the EPA's approach to defining the air pollutant as an aggregate group of six gases is acceptable, but that the scope of future regulations should be limited to CO_2. One commenter agreed with the Agency's evaluation of the six GHGs based on their common attributes, but questioned the EPA's decision to aggregate the six gases rather than considering them individually for purposes of making the findings. Other commenters disagreed with the EPA and requested limiting the definition of air pollutant in this action to CO_2 or to CO_2 and nitrous oxide.

The EPA disagrees with comments regarding changing the definition of the air pollutant to limit it to only those GHGs that are emitted from aircraft or to CO_2 only. The EPA has explained both in the 2009 Endangerment Finding under CAA section 202(a) and in the proposed findings under CAA section 231(a)(2)(A) that it is reasonable and appropriate for the EPA to consider the logical relationship between the GHG air pollution and air pollutant when defining the air pollutant. The purpose of this cause or contribute inquiry is to determine whether emissions of an air pollutant from certain aircraft engines cause or contribute to the endangering GHG air pollution. As described in section IV.B of this document, the endangering GHG air pollution under consideration is defined as the aggregate group of the six well-mixed GHGs based on shared characteristics and common attributes relevant to climate change science and policy''[204]—a rationale that does not take into consideration emission source(s). Similarly, the definition of the air pollutant in this cause or contribute inquiry establishes well-mixed GHGs as a single air pollutant comprised of six substances with common attributes. The Administrator is giving effect to the shared attributes of the six well-mixed GHGs and how they are relevant to the air pollution to which they contribute. Thus, it is also reasonable for the EPA to evaluate contribution for those gases in the aggregate, rather than individually, to ensure a like-to-like comparison of aggregate emissions contributing to an aggregate stock (atmospheric concentration) of endangering GHG air pollution.

The EPA recognized in the proposed findings that aircraft emit two of the six well-mixed GHGs, but stated that nonetheless it is entirely reasonable and appropriate, and in keeping with the 2009 Endangerment Finding under CAA section 202(a) and other past EPA practice, for the Administrator to group into a single class those substances that possess shared relevant properties, even though they are not all emitted from the classes of sources before her.[205] The fact that these six substances share these common, relevant attributes is true regardless of the source category being evaluated for contribution. After considering all the comments, this continues to be the EPA's view.

[204] 74 FR at 66517–19; 80 FR at 37774–85.

[205] 80 FR at 37774–85, and 37787.

Moreover, this approach to defining an air pollutant as a grouping of many substances is not unique to GHGs, but rather is common practice under the CAA. For example, the EPA has heavy-duty truck standards applicable to VOCs and PM, but it is highly unlikely that heavy-duty trucks emit every substance that is included in the group defined as VOC or PM. See 40 CFR 51.100(s) (defining volatile organic compound (VOC) as ''any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions''; a list of exemptions are also included in the definition); 40 CFR 51.100(oo) (defining particulate matter (PM) as ''any airborne finely divided solid or liquid material with an aerodynamic diameter smaller than 100 micrometers'').

Grouping these six substances as one air pollutant is just as reasonable for the contribution analysis undertaken for CAA section 231(a)(2) sources that emit one subset of the six substances as it was for the category of sources that emits another subset under CAA section 202(a). In other words, it is not necessarily the source category, motor vehicles or aircraft engines, being evaluated for contribution that determines the reasonableness of defining a group air pollutant based on the shared attributes of the group's constituent substances. Even if the EPA defined the air pollutant as the group of two compounds emitted by CAA section 231(a)(2) sources, it would not change the result. The Administrator would make the same contribution finding (as described later in section V.B.), as it would have no material effect on the emissions comparisons discussed in section V.B.

The question of limits to the scope of future regulations is outside of the scope of this action because the EPA has neither proposed nor is finalizing in this action any such regulatory standards. This final action does not itself impose any requirements on source categories under CAA section 231. Thus, the EPA anticipates that this question could be raised and considered, as needed, in the standard-setting phase of the regulatory process, and invites potential commenters to submit their views on this issue in response to EPA's anticipated future notice of proposed rulemaking on standards.

Another commenter expressed concern about the EPA's proposed contribution finding because it does not differentiate between CO_2 emissions that result from combustion of fossil

fuels and those that result from ''combustion of biomass or biofuels derived from herbaceous crops or crop residues, as well as biogenic CO_2 emissions associated with the production, gathering and processing of crops or crop residues used in bio-based products including fuels.'' [206] The commenter argues that such crop-related biogenic CO_2 emissions should be excluded from the contribution finding because the CO_2 released back to the atmosphere when emitted from crop-derived biogenic sources contains the same carbon that was previously removed or sequestered from CO_2 in the atmosphere, and thus does not contribute to elevated atmospheric concentrations of the six well-mixed GHGs.

Consistent with the previously discussed response to the commenter in the discussion of the definition of air pollution being used under CAA section 231(a)(2)(A), the EPA reiterates that the Administrator defines the relevant air pollutant considered in the contribution finding as the aggregate group of the six well-mixed GHGs based on shared physical characteristics and common attributes relevant to climate change science and policy, and does not include consideration of the source of the air pollutant. In the record for the 2009 Endangerment Finding under CAA section 202(a), the Agency stated that ''all CO_2 emissions, regardless of source, influence radiative forcing equally once it reaches the atmosphere and therefore there is no distinction between biogenic and non-biogenic CO_2 regarding the CO_2 and the other well-mixed GHGs within the definition of air pollution that is reasonably anticipated to endanger public health and welfare.'' [207] The EPA continues to hold that position in these findings under CAA section 231(a)(2)(A), which is supported by the evidence before it. First, the fact that these CO_2 emissions originate from combustion of carbon-based fuels created through different processes is not relevant to defining the air pollutant that contributes to the endangering air pollution. The origin and constitution of a fuel prior to its combustion and subsequent emission into the atmosphere has no bearing on the fact that CO_2 and the other well-mixed GHGs are all sufficiently long lived to become well mixed in the atmosphere, directly emitted, of well-known radiative forcing, and generally grouped and considered together in climate change scientific and policy forums as the primary driver of climate change. A molecule of biogenic CO_2 has the same radiative forcing effect as a molecule of fossil-fuel derived CO_2. In other words, no matter the original source of the CO_2, the behavior of the CO_2 molecules in the atmosphere in terms of radiative forcing, chemical reactivity, and atmospheric lifetime is effectively the same. Any differential treatment of biogenic CO_2 in the context of the contribution finding under CAA section 231(a)(2)(A) would be inconsistent with the primary scientific basis for the grouping of the six well-mixed GHGs as a single class for purposes of identifying the air pollutant (and air pollution, as explained in section IV.B.1). A more detailed response to the issues raised in this comment can be found in the Response to Comments document in the docket.

B. The Administrator's Finding Under CAA Section 231(a)(2)(A) That Greenhouse Gas Emissions From Certain Classes of Aircraft Engines Used in Certain Aircraft Cause or Contribute to Air Pollution That May Be Reasonably Anticipated To Endanger Public Health and Welfare

Under CAA section 231(a)(2)(A), the Administrator finds that emissions of the six well-mixed GHGs from classes of engines used in U.S. covered aircraft, which are subsonic jet aircraft with a maximum takeoff mass (MTOM) greater than 5,700 kilograms and subsonic propeller driven (*e.g.,* turboprop) aircraft with a MTOM greater than 8,618 kilograms, contribute to the air pollution that endangers public health and welfare. The Administrator is not at this time making a contribution finding regarding GHG emissions from engines not used in covered aircraft (*i.e.,* those used in smaller turboprops, smaller jet aircraft, piston-engine aircraft, helicopters and military aircraft), or regarding the emission of other substances emitted by aircraft engines. A detailed discussion of covered aircraft and their GHG emissions data is provided below in section V.B.4.

The Administrator reached her decision after reviewing emissions data on the contribution of covered aircraft under CAA section 231(a) relative to both U.S. GHG and global GHG emissions inventories. It is the Administrator's judgment that the collective GHG emissions from the classes of engines used in U.S. covered aircraft clearly contribute to endangering GHG pollution, whether the comparison is—as described later in Tables V.1 and V.3 of sections V.B.4.a and V.B.4.b respectively—to domestic GHG inventories (10 percent of all U.S. transportation GHG emissions, representing 2.8 percent of total U.S. emissions), to global GHG inventories (26 percent of total global aircraft GHG emissions representing 2.7 percent of total global transportation emissions and 0.4 percent of all global GHG emissions), or if using a combination of domestic and global inventory comparisons. Both domestic and global comparisons, independently and jointly, support the contribution finding under CAA section 231(a)(2)(A).[208 209 210] Making this cause or contribute finding for engines used in U.S. covered aircraft results in the vast majority (89 percent) of total U.S. aircraft GHG emissions being included in this determination (as described later in Table V.1 of section V.B.4.a.). Covered U.S. aircraft GHG emissions are from aircraft that operate in and from the U.S. and thus contribute to emissions in the U.S. This includes emissions from U.S. domestic flights, and emissions from U.S. international bunker flights (emissions from the combustion of fuel used by aircraft departing the U.S., regardless of whether they are a U.S. flagged carrier—also described as emissions from combustion of U.S. international bunker fuels [211]). In addition, the Administrator based her decision on all the information in the record for this finding, including the public comments received on the proposed finding.

[206] Biogenic CO_2 Coalition, 2015: Comments on EPA's Proposed Finding That Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May Reasonably Be Anticipated To Endanger Public Health and Welfare, 80 FR 37757 (July 1, 2015). Docket ID number EPA–HQ–OAR–2014–0828–0916. Available at *www.regulations.gov* (last accessed April 11, 2016).

[207] EPA, 2009. Response to Comments document, Volume 9: The Endangerment Finding, EPA–HQ–OAR–2009–0171–11676. Available at *www.regulations.gov* (last accessed April 11, 2016).

[208] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[209] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

[210] The domestic inventory comparisons are for the year 2014, and global inventory comparisons are for the year 2010. The rationale for the different years is discussed later in section V.B.4.

[211] For example, a flight departing Los Angeles and arriving in Tokyo, regardless of whether it is a U.S. flagged carrier, is considered a U.S. international bunker flight. A flight from London to Hong Kong is not.

1. The Administrator's Approach in Making This Finding

As it did for the 2009 Endangerment Finding under CAA section 202(a), and consistent with prior practice and current science, under this CAA section 231(a)(2)(A) contribution finding the EPA uses annual emissions as a reasonable proxy for contributions to the endangering air pollution, *i.e.,* the elevated atmospheric concentrations of the six well-mixed GHGs. Cumulative anthropogenic emissions are primarily responsible for the observed change in GHG concentrations in the atmosphere (*i.e.,* the fraction of a country's or an economic sector's cumulative emissions compared to global GHG emissions over a long time period will be roughly equal to the fraction of the change in concentrations attributable to that country or economic sector); likewise, annual GHG emissions are a reasonable proxy for annual incremental changes in atmospheric GHG concentrations.

There are a number of possible ways of assessing whether a source's emissions of air pollutants cause or contribute to the endangering air pollution, and no single approach is required or has been used exclusively in previous determinations under the CAA. Because under this CAA section 231(a)(2)(A) action the air pollution against which the contribution of air pollutant emissions is being evaluated is the six well-mixed GHGs, one reasonable starting point for a contribution analysis is a comparison of the emissions of the air pollutant from the aircraft under consideration to the total U.S. and total global emissions of these six GHGs. The Administrator recognizes that there are other valid comparisons that can be considered in evaluating whether emissions of the air pollutant cause or contribute to the combined concentration of these six GHGs. To inform the Administrator's assessment, section V.B.4 presents the following types of simple and straightforward comparisons of covered U.S. aircraft GHG emissions:

- As a share of current total U.S. GHG emissions;
- As a share of current U.S. transportation GHG emissions;
- As a share of current total global GHG emissions; and
- As a share of the current global transportation GHG emissions.

All annual GHG emissions data are reported on a CO_2-equivalent (CO_2eq) basis, which as described above is a commonly used metric to convert GHG emissions into standard units so they can be compared. This approach is consistent with how the EPA determined contribution for GHGs under section 202(a) of the CAA in 2009.

2. Details of the Administrator's Approach in Making This Cause or Contribute Finding

The Administrator believes that consideration of the global context is important for the cause or contribute finding under CAA section 231(a)(2)(A), but that the analysis should not solely consider the global context. GHG emissions from engines used in U.S. covered aircraft will become globally well-mixed in the atmosphere, and thus will have an effect not only on the U.S. regional climate but also on the global climate as a whole, for many decades to come. It is the Administrator's view that it is reasonable for the cause or contribute analysis conducted under CAA section 231(a)(2)(A) for GHGs emitted by covered U.S. aircraft engines to be consistent with the reasoning supporting the 2009 GHG cause or contribute finding under CAA section 202, as the relevant statutory provisions are parallel and as the pollutant is the same. Accordingly, the Administrator finds a positive cause or contribute finding for GHG emissions from engines used in U.S. covered aircraft is justified whether only the domestic context is considered, only the global context is considered, or both the domestic and global GHG emissions comparisons are viewed in combination. Both domestic and global comparisons, independently and jointly, are equally important for the finding.

In the 2009 CAA section 202(a) cause or contribute finding, the Administrator considered the totality of the circumstances in order to best understand the role played by CAA section 202(a) source categories in emitting air pollutants that contribute to endangering GHG air pollution, consistent with Congress' intention for EPA to consider the cumulative impact of all emissions from sources to the endangering air pollution. In that context, the global nature of the air pollution problem and the breadth of countries and sources emitting GHGs meant that no single country or source category dominated contribution to the endangering air pollution on the global scale.[212] As was the case in 2009, it is still true that no single country or GHG source category dominates contribution to the collective stock of endangering GHG air pollution on the global scale, and contributions from individual GHG source categories may appear small in comparison to the total stock, when, in fact, they are very important contributors in terms of both absolute emissions or in comparison to GHG emissions from other source categories, globally or within the United States. That is, because climate change is a global problem that results from global GHG emissions, it is more the result of numerous and varied sources each emitting what may seem to be smaller percentages of GHG pollutants compared to the total stock of GHG pollution, than typically might be encountered when tackling solely regional or local environmental issues for different kinds of pollutants that may have more of a direct impact on receptors located in the relative vicinity of the polluting sources (such as emissions of lead, for example, or sulfur dioxide without consideration of its role as possible precursor to particulate matter). It is reasonable for the Administrator to take these circumstances into account in making a contribution determination regarding emissions from sources of GHGs, as the impacts from GHGs are not spatially or temporally limited.[213] Therefore, in order to address the risks associated with global climate change, it is less likely that a single "majority" contributing source category could be identified and controlled such that the risks could be eliminated, without the need to consider contributions to the endangering stock of air pollution from "minority" source categories that may present smaller percentages of contribution than may sometimes be encountered when tackling regional or local environmental threats presented by a single or limited set of dominant sources. Thus, in addressing GHG risks, it will be, as the Supreme Court suggested in *Massachusetts* v. *EPA,* necessary for agencies to take an incremental approach to resolving the larger GHG endangerment issue, as "[a]gencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop. . . . They instead whittle away at them over time, refining their preferred approach as circumstances change and as they develop a more nuanced understanding of how best to proceed." 549 U.S. 497, 524 (2007) (citations omitted). The Administrator continues to believe that the unique, global aspects of the climate change problem—including that from a percentage perspective there are no dominating sources or countries for GHG emissions contributing to the endangering GHG air pollution and that the global problem is due more to the GHG emissions contributed from

[212] 74 FR at 66538.

[213] 74 FR at 66543.

numerous and varied sources—justify consideration of contribution to the endangering air pollution at lower percentage levels than the EPA typically might encounter when analyzing contribution towards a more localized air pollution problem. This is not to suggest, however, that all or even most local or regional air pollution problems are due to a single or small set of sources. For example, regional haze and ambient concentrations of concern for ozone, carbon monoxide, and particulate matter are commonly the result of a variety and great number of contributing sources, and the EPA has frequently approached such problems by incrementally regulating a set of sources that, in isolation, is not contributing the dominant share of air pollutants to the stock of air pollution, but is contributing a meaningful share. This approach has been affirmed by reviewing courts as reasonable and lawful under the CAA. *See, e.g., Bluewater Network* v. *EPA,* 370 F.3d 1 (D.C. Cir. 2004). Thus, the Administrator, similar to the approach taken in the 2009 GHG cause or contribute finding under CAA section 202(a), is under CAA section 231(a)(2)(A) placing weight on the fact that engines used in U.S. covered aircraft, as discussed in detail in sections V.B.4.a of this document, contribute the single largest share of GHG emissions from transportation sources in the United States that have not yet been regulated for GHG emissions, and that such GHG emissions from U.S. covered aircraft are a meaningful contribution to total U.S. and total global GHG emissions inventories.

3. Additional Considerations

The Administrator also considered information that showed that reasonable estimates of GHG emissions from engines used in U.S. covered aircraft are projected to grow over the next 20 to 30 years, in making her contribution finding under CAA section 231(a)(2)(A). Given the projected growth in aircraft emissions compared to other sectors, it is reasonable for the Administrator to consider future emissions projections as further supporting her assessment of historical annual emissions (recent emissions from the current fleet) and informing her contribution determination. As described with further detail later in section V.B.4.c, recent FAA projections reveal that by 2036 GHG emissions from all aircraft and from U.S. covered aircraft are likely to increase by 43 percent (from 191 Tg CO_2eq to 272 Tg CO_2eq for the years 2010 to 2036).[214] By contrast, it is estimated that by 2036 the light-duty vehicle sector is projected to see a 25 percent reduction in GHG emissions (1,133 Tg CO_2eq to 844 Tg CO_2eq) from the 2010 baseline, while the freight trucks sector is projected to experience a 23 percent increase in GHG emissions (390 Tg CO_2eq to 478 Tg CO_2eq) from the 2010 baseline (this projected increase does not reflect the impact of GHG reductions on the freight trucks sector anticipated from the Phase 2 heavy-duty GHG standards that have not yet been promulgated). In addition, by 2036 the rail sector is projected to experience a 3 percent reduction in GHG emissions (44 Tg CO_2eq to 43 Tg CO_2eq) from the 2010 baseline.[215] Because the projected growth in aircraft engine GHG emissions from U.S. covered aircraft through 2036 is more than 80 Tg CO_2eq,[216] this consideration of projected future emissions adds further support to the Administrator's finding under CAA section 231(a)(2)(A) that emissions of the six well-mixed greenhouse gases from classes of engines used in U.S. covered aircraft contribute to the GHG air pollution that endangers public health and welfare.[217]

4. Overview of Greenhouse Gas Emissions

Atmospheric concentrations of CO_2 and other GHGs are now at essentially unprecedented levels compared to the distant and recent past.[218] This is the unambiguous result of human-activity emissions of these gases. See section IV.B.2 for more information on elevated atmospheric GHG concentrations and anthropogenic drivers of climate change. Global emissions of well-mixed GHGs have been increasing, and are projected to continue increasing for the foreseeable future. According to the IPCC AR5, total global (when using inventories from all anthropogenic emitting sources including forestry and other land use) emissions of GHGs in 2010 were 49,000 Tg CO_2eq.[219] This represents an increase in global GHG emissions of 29 percent since 1990 and of 23 percent since 2000. In 2010, total U.S. GHG emissions were responsible for 13 percent of global GHG emissions (when comparing inventories from all anthropogenic emitting sources including forestry and other land use).[220]

We are also providing 2012 estimates from other widely used and recognized global datasets, the World Resources Institute's (WRI) Climate Analysis Indicators Tool (CAIT) and the International Energy Agency (IEA).[221] We are providing these data for several reasons; first, there is value in looking at multiple data sources to see if estimates are generally in line with one another. Second, there are more recent

[214] As discussed in section V.B.4.c, fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 43 percent from 2010 to 2036 and this provides a scaling factor for growth in projected GHG emissions, which are projected to increase at a similar rate as the fuel burn by 2030, 2036, and 2040.

FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

[215] U.S. Energy Information Administration (EIA), 2015: *Annual Energy Outlook (AEO) 2015 with projections to 2040,* DOE/EIA–0383, 154 pp. For the years 2010 to 2014, the baseline emissions for each sector are from the 2016 *Inventory of U.S. Greenhouse Gas Emissions and Sinks Report,* and after 2014 we utilize projections from the 2015 EIA AEO report. Available at *http://www.eia.gov/forecasts/aeo/* (last accessed May 12, 2015).

[216] In addition, we expect aircraft engine GHG emissions from U.S. covered aircraft to continue contributing to the endangering pollution in the future and to be a bigger percentage of transportation emissions, since these emission are projected to increase at a faster rate than other transportation sources.

[217] In 2010, U.S covered aircraft were responsible for 10 percent of U.S. transportation sector GHG emissions, and in 2036, U.S. covered aircraft are projected to be the source of 15 percent of U.S. transportation GHG emissions. In 2010, light-duty vehicles were responsible for 58 percent of U.S. transportation GHG emissions, and in 2036 they are projected to be the source of 46 percent of such emissions. In 2010, heavy-duty vehicles emitted 20 percent of U.S. transportation GHG emissions, and in 2036, they are projected to emit 26 percent (this projection does not reflect the impact from the Phase 2 heavy-duty GHG standards that have not yet been promulgated). In 2010, the rail sector contributed 2 percent of U.S. transportation GHG emissions, and in 2036, they are projected to contribute the same percentage.

[218] IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, p. 11.

[219] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

[220] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 351–411 pp.

[221] World Resources Institute (WRI) Climate Analysis Indicators Tool (CAIT) Data Explorer (Version 2.0). Available at *http://cait.wri.org* (last accessed January 19, 2016). International Energy Agency, Data Services. Available at *http://data.iea.org* (last accessed January 21, 2016).

data available in the WRI/CAIT and IEA datasets (2010 IPCC data vs. 2012 WRI/CAIT and IEA data). Third and finally, these other datasets provide additional utility for examining different disaggregations of the data (by country, sector, and with or without forestry and other land use emissions). Unless otherwise noted, we are presenting data points from these other datasets without including data regarding forestry and other land use inventories to enable straightforward comparisons of gross emission estimates from transportation sources specifically. The total global GHG emissions in 2012 from WRI/CAIT were 44,816 Tg of CO_2eq, representing an increase in global GHG emissions of 47 percent since 1990 and 32 percent since 2000. In comparison, WRI/CAIT's estimate of total global GHG emissions in 2012 when including forestry and other land use inventories were 47,599 Tg of CO_2eq (representing an increase in global GHG emissions of 40 percent since 1990 and 30 percent since 2000). In past years, WRI/CAIT estimates have generally been consistent with those of IPCC. In 2012, WRI/CAIT data indicate that total U.S. GHG emissions were responsible for 15 percent of global emissions, which is also generally in line with the percentages using IPCC's 2010 estimate described above. According to WRI/CAIT, current U.S. GHG emissions rank only behind China's, and China was responsible for 24 percent of total global GHG emissions.

As described earlier in section IV.A, in the proposed finding and this final finding, the Administrator considers the recent, major scientific assessments of the IPCC, USGCRP, and the NRC as the primary scientific and technical basis informing her judgment. Thus, the Administrator is informed by and places considerable weight upon the IPCC's data on global GHG emissions. She also considers but places less emphasis on the WRI/CAIT and IEA emissions data, which in comparison have a different aggregation of underlying data but are available for more recent years (2010 IPCC data vs. 2012 WRI/CAIT and IEA data).

The approach of considering the major scientific assessments, including IPCC's assessment, provides assurance that the Administrator's judgment is informed by the best available, well-vetted science that reflects the consensus of the climate science research community. The major findings of the assessments, including IPCC's assessment, support the Administrator's findings in this action. While the EPA uses the IPCC data as the primary data source for informing this contribution finding, it has reasonably used additional data sources from widely used and recognized global datasets to provide context and information from more recent years. These additional data supplement and confirm the IPCC data, as they are generally in line with IPCC. Comparing their 2010 total global GHG emissions, IPCC data are 49,000 Tg CO_2eq, and WRI/CAIT data indicates 42,968 Tg CO_2eq (a 12 percent difference).[222] Also, comparing their 2010 global aircraft GHG emissions estimates, IPCC data are 743 Tg CO_2eq, and IEA data indicate 749 Tg CO_2eq (a 1 percent difference).[223] Ultimately, whether the Agency utilizes the IPCC data alone or the WRI/CAIT dataset (and IEA data) alone, or both datasets together, it would have no material effect on the emissions comparisons discussed in section V.B and the Administrator would make the same contribution finding.

The *Inventory of U.S. Greenhouse Gas Emissions and Sinks Report*[224] (hereinafter ''U.S. Inventory''), in which 2014 is the most recent year for which data are available, indicates that total U.S. GHG emissions increased by 7.3 percent from 1990 to 2014 (or by 7.8 percent when using inventories that include forestry and other land use), and emissions increased from 2013 to 2014 by 1.1 percent.[225] This 2013 to 2014 increase was attributable to multiple factors including an increase in vehicle miles traveled and vehicle fuel use, a colder winter resulting in an increased demand for heating fuel, and an increase in industrial production across multiple sectors. The U.S. Inventory also shows that while overall U.S. GHG emissions grew between 1990 and 2014, transportation GHG emissions grew at a significantly higher rate, 16 percent, more rapidly than any other U.S. sector. Within the transportation sector, aircraft remain the single largest source of GHG emissions not yet subject to any GHG regulations (U.S. covered aircraft GHG emissions grew by 15 percent between 1990 and 2014, and total U.S. aircraft GHG emissions decreased by 3 percent over this same time period).[226]

Section V.B.4.a which follows describes U.S. aircraft GHG emissions within the domestic context, while section V.B.4.b describes these same GHG emissions in the global context. Section V.B.4.c addresses future projections of aircraft GHG emissions.

a. U.S. Aircraft GHG Emissions Relative to U.S. GHG Transportation and Total U.S. GHG Inventory

Relying on data from the U.S. Inventory, we compare total U.S. aircraft GHG emission and U.S. covered aircraft GHG emissions to the transportation sector and to total U.S. GHG emissions as an indication of the role this source plays in the total domestic portion of the air pollution that is endangering by causing climate change. We are providing information about total U.S. aircraft GHG emissions for purposes of giving context for the discussion of GHG emissions from U.S. covered aircraft, which are included in this contribution finding under CAA section 231(a)(2)(A). As explained in more detail below, the contribution finding under CAA section 231(a)(2)(A) in this action does not include GHG emissions from all aircraft that operate in and from the U.S. and thus emit GHGs in the U.S.

In 2014, total U.S. GHG emissions from all sources were 6,975 Tg CO_2eq. As stated above, total U.S. GHG emissions have increased by 7.3 percent

[222] Comparing their 2010 total global GHG emissions, IPCC data are 49,000 Tg CO_2eq, and WRI/CAIT data, including forestry and land use inventories, indicates 45,748 Tg CO_2eq (a 7 percent difference).

[223] Comparing 2012 WRI/CAIT to 2010 IPCC data, WRI/CAIT data for total global GHG emissions indicates 44,816 Tg CO_2eq for 2012 (a 9 percent difference), and including forestry and land use inventories WRI/CAIT data indicates 47,599 Tg CO_2eq for 2012 (a 3 percent difference). Comparing 2012 IEA data to 2010 IPCC data, IEA data for global aircraft GHG emissions indicates 775 Tg CO_2eq for 2012 (a 4 percent difference).

[224] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016). The EPA has determined that the U.S. Inventory has been adequately reviewed in accordance with the EPA's Peer Review Handbook. For the presentation of emissions inventory information in this contribution finding, the EPA disaggregated the existing data in one area of the U.S. Inventory (for the General Aviation Jet Fuel Category) and had the disaggregation methodology peer reviewed in accordance with the EPA's Peer Review Handbook. The EPA Science Advisory Board reviewed this approach to the underlying technical and scientific information supporting this action, and concluded that the approach had precedent and the action will be based on well-reviewed information. All relevant peer review documentation is located in the docket for today's final action (EPA–HQ–OAR–2014–0828).

[225] As described later in detail, total U.S. GHG emissions, include emissions from combustion of U.S. international bunker fuels, which are fuels used for transport activities from aviation (both commercial and military) and marine sources.

[226] As described later in detail, total U.S. GHG emissions, U.S. transportation GHG emissions, total U.S. aircraft GHG emissions, and U.S. covered aircraft GHG emissions include emissions from combustion of U.S. international bunker fuels. More specifically, total U.S. aircraft GHG emissions include international bunker fuel emissions from both commercial and military aviation. U.S. covered aircraft GHG emissions include international bunker fuel emissions from only commercial aviation.

between 1990 and 2014, while U.S. transportation GHG emissions from all categories have grown 16 percent since 1990. The U.S. transportation sector was the second largest GHG-emitting sector (behind electricity generation), contributing 1,919 Tg CO_2eq or 28 percent of total U.S. GHG emissions in 2014. This sectoral total and the total U.S. GHG emissions include emissions from combustion of U.S. international bunker fuels, which are fuels used for transport activities from aviation (both commercial and military) and marine sources. Following the IPCC guidelines for common and consistent accounting and reporting of GHGs, the UNFCCC requires countries to report both total national GHG emissions and international bunker fuel emissions (aviation and marine international bunker fuel emissions), and though these emissions are reported separately, both are assigned to the reporting country. In meeting the UNFCCC reporting requirements, the U.S. Inventory calculates international bunker fuel GHG emissions in a consistent manner with domestic GHG emissions. In this final contribution finding, the EPA maintains its approach used in the proposed findings to include aviation international bunker fuel emissions attributable to the United States with the national emissions number from the U.S. Inventory as reported to the UNFCCC. It is the EPA's view that it is reasonable and appropriate for the analysis in the contribution finding to reflect the full contribution of U.S. emissions from certain classes of aircraft engines, including those from domestic flights of U.S. aircraft and those associated with international aviation bunker fuel emissions. Consistent with IPCC guidelines for common and consistent accounting and reporting of GHGs under the UNFCCC, the ''U.S. international aviation bunker fuels'' category includes emissions from combustion of fuel used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier. Total U.S. aircraft GHG emissions (which include emissions from international commercial and military aviation bunker fuels) clearly are included in the U.S. transportation sector's GHG emissions, accounting for 222 Tg CO_2eq or 12 percent of such emissions (see Table V.1). In 2014, total U.S. aircraft GHG emissions (222 Tg CO_2eq) were the third largest transportation source of GHGs within the United States, behind GHG emissions from light-duty vehicles and medium- and heavy-duty trucks (totaling 1,508 Tg CO_2eq).

For purposes of making this cause or contribute finding, the EPA includes a set of aircraft engine classes used in types of aircraft as described below, which corresponds to the scope of the international CO_2 emissions standard agreed to by ICAO. These emissions are from what we have previously described as ''covered aircraft'' (which include emissions from international commercial aviation bunker fuels).

As mentioned earlier in section II.D, traditionally the U.S. government (EPA and FAA) participates at ICAO in the development of international standards, and then where appropriate, the EPA establishes domestic aircraft engine emission standards under CAA section 231 of at least equivalent stringency to ICAO's standards. An international CO_2 emissions standard was agreed to in February 2016, and we expect to proceed with proposing emissions standards of at least equivalent stringency domestically as soon as is practicable. The thresholds of applicability for the international CO_2 emissions standard are based on weight as follows: For subsonic jet aircraft, a maximum takeoff mass (MTOM) greater than 5,700 kilograms; and for subsonic propeller driven (*e.g.,* turboprop) aircraft, a MTOM greater than 8,618 kilograms.[227] Applying these weight thresholds, our contribution finding applies to GHG emissions from classes of engines used in covered aircraft that meet these MTOM criteria. For purposes of the contribution finding, examples of covered aircraft include smaller jet aircraft such as the Cessna Citation CJ3+ and the Embraer E170, up to the largest commercial jet aircraft—the Airbus A380 and the Boeing 747. Other examples of covered aircraft include larger turboprop aircraft, such as the ATR 72 and the Bombardier Q400. The scope of the contribution finding corresponds to the aircraft engine GHG emissions that are from aircraft that match the applicability thresholds for the international aircraft CO_2 standard. We have also identified aircraft that are not covered aircraft for purposes of this contribution finding. That includes aircraft that fall below the international applicability thresholds: Smaller turboprop aircraft, such as the Beechcraft King Air 350i, and smaller jet aircraft, such as the Cessna Citation M2. In addition, ICAO (with U.S. participation) has agreed to exclude ''piston-engine aircraft,'' ''helicopters,'' and ''military aircraft''[228] from the types of aircraft that will be subject to the ICAO standards.[229] As these aircraft will not be subject to the ICAO standards, in this contribution finding we are also not including GHG emissions from classes of engines used in these types of aircraft. We stress that our exclusion of these aircraft does not reflect a final scientific or technical determination regarding their GHG emissions. Rather, consistent with how the endangerment finding does not include various other climate forcers within the scope of the ''air pollution'' defined in this final action, we are not prepared to make final decisions regarding the GHG emissions from these excluded aircraft.

The majority of the GHG emissions from all classes of aircraft engines are within the scope of this contribution finding, which corresponds to that agreed to by ICAO. Below we describe the contribution of these U.S. covered aircraft GHG emissions to U.S. GHG emissions, and later in section V.B.4.b we discuss the contribution of these U.S. covered aircraft emissions to global GHG emissions, in support of our conclusion that GHG emissions from engines used by U.S. covered aircraft contribute to endangering GHG air pollution.

In 2014, GHG emissions from U.S. covered aircraft (197 Tg CO_2eq), which includes non-military GHG emissions from combustion of U.S. international aviation bunker fuels,[230] comprised 89 percent of total U.S. aircraft GHG emissions[231] (222 Tg CO_2eq) and 10 percent of total U.S. transportation sector GHG emissions (1,919 Tg CO_2eq) (See Table V.1). Overall, U.S. covered aircraft comprised the third largest source of GHG emissions in the U.S. transportation sector behind only the light-duty vehicle and medium- and heavy-duty truck sectors (totaling 1,508 Tg CO_2eq),[232] which is the same ranking

[227] ICAO, 2013: *CAEP/9 Agreed Certification Requirement for the Aeroplane CO_2 Emissions Standard,* Circular (Cir) 337, 40 pp., AN/192, Available at *http://www.icao.int/publications/catalogue/cat_2016_en.pdf* (last accessed April 8, 2016). The ICAO Circular 337 is found on page 87 of the ICAO Products & Services 2016 catalog and is copyright protected; Order No. CIR337.

[228] ICAO regulations only apply to civil aviation (aircraft and aircraft engines); consequently, ICAO regulations do not apply to military aircraft.

[229] The applicability of the international CO_2 standard is limited to subsonic aircraft, and does not extend to supersonic aircraft.

[230] U.S. covered aircraft does not include military aircraft that use U.S. international bunker fuels.

[231] Eastern Research Group, Incorporated (ERG), 2015: *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds,* Final Report, EPA Contract Number EP–D–11–006, 38 pp.

[232] In 2014, the U.S. light-duty vehicle (passenger cars and light-duty trucks) GHG emissions were 1,101 Tg CO_2eq and the medium- and heavy-duty truck GHG emissions were 407 Tg CO_2eq.

as total U.S. aircraft.[233] The U.S. covered aircraft also represent 2.8 percent of total U.S. GHG emissions (6,975 Tg CO_2eq), which is approximately equal to the contribution from total U.S. aircraft of 3.2 percent (Table V.1).[234] Also, in Table V.2 for background information and context, we provide similar information, but excluding GHG emissions from aviation combustion of U.S. international bunker fuels.[235]

It is important to note that in regard to the six well-mixed GHGs (CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride), only two of these gases—CO_2 and nitrous oxide—are reported as non-zero emissions for total aircraft and covered aircraft.[236] CO_2 represents 99 percent of all GHGs from both total U.S. aircraft (220 Tg CO_2eq) and U.S. covered aircraft (195 Tg CO_2eq), and nitrous oxide represents 1 percent from total aircraft (2.1 Tg CO_2eq) and covered aircraft (1.9 Tg CO_2eq). Modern aircraft do not emit methane,[237] and hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are not products of aircraft engine combustion.

TABLE V.1 [238] [239]—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL U.S. TRANSPORTATION AND TOTAL U.S. GHG EMISSIONS

	1990	2000	2005	2010	2012	2013	2014
Total U.S. Aircraft GHG emissions (Tg CO_2eq)	228	262	254	216	212	216	222
Share of U.S. Transportation	14%	13%	12%	11%	11%	11%	12%
Share of total U.S. Inventory	3.5%	3.6%	3.4%	3%	3.1%	3.1%	3.2%
U.S. Covered Aircraft GHG emissions (Tg CO_2eq)	171	223	218	191	190	195	197
Share of U.S. aircraft GHG emissions	75%	85%	86%	88%	90%	90%	89%
Share of U.S. Transportation	10%	11%	10%	9.8%	10%	10%	10%
Share of total U.S. Inventory	2.6%	3%	2.9%	2.7%	2.8%	2.8%	2.8%
U.S. Transportation GHG emissions (Tg CO_2eq)	1,659	2,029	2,119	1,950	1,891	1,895	1,919
Share of total U.S. Inventory	26%	28%	28%	28%	28%	28%	28%
Total U.S. GHG emissions *(Tg CO_2eq)*	6,502	7,362	7,493	7,104	6,750	6,901	6,975

TABLE V.2 [240] [241]—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL U.S. TRANSPORTATION AND TOTAL U.S. GHG EMISSIONS—EXCLUDING U.S. INTERNATIONAL BUNKER FUELS [242]

	1990	2000	2005	2010	2012	2013	2014
Total U.S. Aircraft GHG emissions (Tg CO_2eq)	190	200	194	155	147	151	152
Share of U.S. Transportation	12%	10%	9.7%	8.5%	8.2%	8.4%	8.4%
Share of total U.S. Inventory	3%	2.8%	2.6%	2.2%	2.2%	2.2%	2.2%
U.S. Covered Aircraft GHG emissions (Tg CO_2eq)	141	166	162	133	128	132	130
Share of U.S. aircraft GHG emissions	74%	83%	84%	86%	87%	88%	86%
Share of U.S. Transportation	9%	8.6%	8.1%	7.3%	7.2%	7.4%	7.2%
Share of total U.S. Inventory	2.2%	2.3%	2.2%	1.9%	1.9%	1.9%	1.9%
U.S. Transportation GHG emissions (Tg CO_2eq)	1,554	1,927	2,004	1,832	1,784	1,794	1,815
Share of total U.S. Inventory	24%	27%	27%	26%	27%	26%	26%
Total U.S. GHG emissions *(Tg CO_2eq)*	6,397	7,259	7,379	6,986	6,643	6,800	6,871

[233] Compared independently, total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions are both ranked the third largest source in the U.S. transportation sector, behind only light-duty vehicle and medium- and heavy-duty truck sectors.

[234] Total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions were from 12 to 31 percent greater in 2000 and 2005 than in 1990. These increases in aircraft GHG emissions are primarily because aircraft operations (or number of flights) grew by similar amounts during this time period. Also, total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions were from 10 to 15 percent greater in 2000 and 2005 than in 2014. These decreases in aircraft GHG emissions are partly because aircraft operations decreased by similar amounts during this time period. In addition, the decreases in aircraft emissions are due in part to improved operational efficiency that results in more direct flight routing, improvements in aircraft and engine technologies to reduce fuel burn and emissions, and the accelerated retirement of older, less fuel efficient aircraft. Also, the U.S. transportation GHG emissions were changing at similar rates as total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions for these same time periods, and thus, the aircraft GHG emissions share of U.S. Transportation remains approximately constant (over these time periods). (U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 558 pp. Available at *http://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf* (last accessed April 22, 2016)).

[235] For Table V.2, total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions exclude emissions from aviation combustion of U.S. international bunker fuels. The U.S. transportation sector GHG emissions and total U.S. GHG emissions (in Table V.2) exclude emissions from both aviation and marine combustion of U.S. international bunker fuels.

[236] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[237] Emissions of methane from jet fuels are no longer considered to be emitted (based on the latest studies) across the time series from aircraft gas turbine engines burning jet fuel A at higher power settings (EPA, *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet and Turboprop Engines,* EPA–420–R–09–901, May 27, 2009 (see *https://www3.epa.gov/otaq/regs/nonroad/aviation/420r09901.pdf* (last accessed April 22, 2016)). Based on this data, methane emissions factors for jet aircraft were reported as zero to reflect the latest emissions testing data. Also, the 2006 IPCC Guidelines indicate the following: ''Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines.'' (IPCC, 2006: *IPCC Guidelines for National Greenhouse Gas Inventories,* The National Greenhouse Gas Inventories Programme, The Intergovernmental Panel on Climate Change, H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara, and K. Tanabe (eds.). Hayama, Kanagawa, Japan.) The EPA uses an emissions factor of zero to maintain consistency with the IPCC reporting guidelines, while continuing to stay abreast of the evolving research in this area. For example, one recent study has indicated that modern aircraft jet engines operating at higher power modes consume rather than emit methane (Santoni et al., 2011: *Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment,* Environ. Sci. Technol., 45 pp. 7075–7082).

[238] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[239] ERG, 2015: *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds,* Final Report, EPA Contract Number EP–D–11–006, 38 pp.

[240] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

b. U.S. Aircraft GHG Emissions Relative to Global Aircraft GHG Inventory and the Total Global GHG Inventory

For background information and context, we first provide information on the portion of GHG emissions from global aircraft and the global transportation sector to total global GHG emissions, and describe how this compares to the emissions from aircraft covered by the ICAO CO_2 standard. We then compare U.S. aircraft GHG emissions to the global aircraft sector, to the global transport sector, and to total global GHG emissions as an indication of the role this source plays in the total global portion of the air pollution that is causing climate change. As in the preceding section, we present comparisons from both total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions.

According to IPCC AR5, global aircraft GHG emissions in 2010 were 11 percent of global transport GHG emissions and 1.5 percent of total global GHG emissions. Data from ICAO's 2013 Environmental Report indicate that the vast majority of global emissions from the aircraft sector are emitted by the types of aircraft that are covered by the ICAO CO_2 standard (''ICAO covered aircraft''), which was agreed to in February 2016.[243] When compared to global data from IPCC AR5, worldwide GHG emissions from ICAO covered aircraft represented 93 percent (688 Tg CO_2eq) of global aircraft GHG emissions,[244] 9.8 percent of global transport GHG emissions, and 1.4 percent of total global GHG emissions in 2010.

Comparing data from the U.S. Inventory to IPCC AR5, we find that total U.S. aircraft GHG emissions represented 29 percent of global aircraft GHG emissions, 3.1 percent of global transport GHG emissions, and 0.5 percent of total global GHG emissions in 2010 (see Table V.3). U.S. covered aircraft in 2010 GHG emissions represented 26 percent of global aircraft GHG emissions, 2.7 percent of global transport GHG emissions, and 0.4 percent of total global GHG emissions (see Table V.3).[245] For reasons described above in section V.B.4, we also made comparisons using 2012 estimates from WRI/CAIT and the IEA and found that they yield very similar results.[246] Also, in Table V.4 for background information and context in regard to the global GHG inventory, we provide similar information, but excluding aviation GHG emissions from combustion of U.S. international bunker fuels.

TABLE V.3[247]—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL GLOBAL GREENHOUSE GAS EMISSIONS IN 2010

	2010 (Tg CO_2 eq)	Total U.S. aircraft share (%)	U.S. covered aircraft share (%)[248]	Global aircraft share (%)
Global Aircraft GHG emissions	743	29	26	.....
Global Transport GHG emissions	7,000	3.1	2.7	11
Total Global GHG emissions	49,000	0.5	0.4	1.5

TABLE V.4[249]—COMPARISONS OF U.S. AIRCRAFT GHG EMISSIONS TO TOTAL GLOBAL GREENHOUSE GAS EMISSIONS IN 2010—EXCLUDING AVIATION GHG EMISSIONS FROM COMBUSTION OF U.S. INTERNATIONAL BUNKER FUELS FROM THE U.S. AIRCRAFT GHG EMISSIONS

	2010 (Tg CO_2 eq)	Total U.S. aircraft share (%)	U.S. covered aircraft share (%)[250]	Global aircraft share (%)
Global Aircraft GHG emissions	743	21	18	.....
Global Transport GHG emissions	7,000	2.2	1.9	11
Total Global GHG emissions	49,000	0.4	0.3	1.5

[241] ERG, 2015: *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds*, Final Report, EPA Contract Number EP–D–11–006, 38 pp.

[242] International bunker fuels emissions are emissions resulting from the combustion of fuels used for international transport activities, which includes aviation and marine. U.S. international bunker fuels includes aviation and marine bunker fuels allocated to the U.S. The U.S. international aviation bunker fuels category includes emissions from combustion of fuel used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier. The U.S. international marine bunker fuels category includes emissions from the combustion of fuel used by vessels of all flags (that are engaged in international water-borne navigation) departing from the United States.

[243] ICAO CAEP, 2013: *ICAO Environmental Report 2013, Aviation and Climate Change,* 224 pp. Available at *http://cfapp.icao.int/Environmental-Report-2013/* (last accessed April 8, 2016).

[244] Worldwide GHG emissions from ICAO covered aircraft include emissions from both international and domestic aircraft operations around the world.

[245] We are providing information about total U.S. aircraft GHG emissions for purposes of giving context for the discussion of GHG emissions from U.S. covered aircraft, which are included in this contribution finding under CAA section 231(a)(2)(A). As explained in more detail below, the contribution finding under CAA section 231(a)(2)(A) in this action does not include GHG emissions from all aircraft that operate in and from the U.S and thus emit GHGs in the U.S.

[246] Data from WRI/CAIT (that excludes forestry and other land use inventories) and IEA show that, in 2012, total U.S. aircraft emissions represented 27 percent of global aircraft GHG emissions, 2.9 percent of global transport GHG emissions, and 0.5 percent of total global GHG emissions. U.S. covered aircraft represented 25 percent of global aircraft GHG emissions, 2.6 percent of global transport GHG emissions, and 0.4 percent of total global GHG emissions in 2012.

[247] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp.

U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[248] ERG, 2015: *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds*, Final Report, EPA Contract Number EP–D–11–006, 38 pp.

[249] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 1435 pp. U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[250] ERG, 2015: *U.S. Jet Fuel Use and CO_2 Emissions Inventory for Aircraft Below ICAO CO_2 Standard Thresholds*, Final Report, EPA Contract Number EP–D–11–006, 38 pp.

For additional background information and context, we used 2012 WRI/CAIT and IEA data to make comparisons between the aircraft sector and the emissions inventories of entire countries and regions. When compared to entire countries, total global aircraft GHG emissions in 2012 ranked 8th overall, behind only China, United States, India, Russian Federation, Japan, Brazil, and Germany, and ahead of about 177 other countries. Total U.S. aircraft GHG emissions have historically been and continue to be by far the largest contributor to global aircraft GHG emissions. Total U.S. aircraft GHG emissions are about 6 times higher than aircraft GHG emissions from China, which globally is the second ranked country for aircraft GHG emissions, and about 4 times higher than aircraft GHG emissions from all of Asia. U.S. covered aircraft GHG emissions are about 5 times more than total aircraft GHG emissions from China, and about 4 times more than total aircraft GHG emissions from all of Asia. If U.S. covered aircraft emissions of GHGs were ranked against total GHG emissions for entire countries, these covered aircraft emissions would rank ahead of Belgium, Czech Republic, Ireland, Sweden, Switzerland and about 150 other countries in the world.

c. Aircraft GHG Emissions Are Projected To Increase in the Future

Global and U.S. covered aircraft GHG emissions have increased between 1990 and 2010, and are predicted to continue to increase in future years. While overall GHG emissions from U.S. covered aircraft increased by 12 percent from 1990 to 2010, the portion attributable to combustion of U.S. international aviation bunker fuels[251] increased by 91 percent.[252] During this same time period, global aircraft GHG emissions grew by 40 percent, and the portion attributable to combustion of global international aviation bunker fuels increased by 80 percent.[253] [254] Notwithstanding the substantial growth in GHG emissions from combustion of U.S. international aviation bunker fuels, U.S. covered aircraft emissions have not increased as much as global aircraft emissions from 1990 to 2010, primarily because the U.S. aviation market was relatively mature compared to the markets in Europe and other emergent markets, and because during this time period the U.S. commercial air carriers suffered several major shocks that reduced demand for air travel.[255] In fact, U.S. covered aircraft emissions decreased from 2000 to 2010 (13 percent), but then have increased from 2010 to 2014 (3 percent).[256] After consolidation and restructuring in recent years, the U.S. commercial air carriers have regained profitability and are forecasted by the FAA to grow more over the next 20 to 30 years.[257] With regard to global aircraft GHG emissions, the aviation markets in Asia/Pacific, Europe (where airline deregulation has stimulated significant new demands in this period), and the Middle East (and other emerging markets) have been growing rapidly, and the global market is expected to continue to grow significantly over the next 20 to 30 years.[258]

Recent studies estimate that both ICAO covered aircraft and U.S. covered aircraft will experience substantial growth over the next 20 to 30 years in their absolute fuel burn,[259] and that this will translate into increased GHG emissions. ICAO estimates that the global fuel burn from ICAO covered aircraft will increase by about 120 percent from 2010 to 2030 and by about 210 percent from 2010 to 2040 (for a scenario with moderate technology and operational improvements).[260] The FAA projects that the fuel consumption from U.S. air carriers and general aviation aircraft operating on jet fuel will grow by 43 percent from 2010 to 2036, corresponding to an average annual increase rate in fuel consumption of 1.4 percent.[261] These aircraft groups (U.S. air carriers and general aviation aircraft operating on jet fuel) are of similar scope to the U.S. covered aircraft whose engine GHG emissions are the subject of this contribution finding. Using fuel burn growth rates provided above as a scaling factor for growth in GHG emissions (globally and nationally), it is estimated that GHG emissions from ICAO covered aircraft and U.S. covered aircraft will increase at a similar rate as the fuel burn by 2030, 2036, and 2040.

C. Response to Key Comments on the Administrator's Cause or Contribute Finding

EPA received numerous comments regarding the Administrator's proposed cause or contribute finding. Below is a brief discussion of some of the key comments. Responses to comments on

[251] The U.S. international aviation bunker fuels category includes emissions from combustion of fuel used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier. GHG emissions from U.S. international aviation bunker fuels are a subset of GHG emissions from U.S. covered aircraft. From 1990 to 2010, GHG emissions from U.S. covered aircraft increased from 171 to 191 Tg CO_2eq, and GHG emissions from the portion attributable to U.S. international aviation bunker fuels grew from 30 to 58 Tg CO_2eq during this same time period. From 1990 to 2011, GHG emissions from U.S. covered aircraft increased from 171 to 193 Tg CO_2eq (13 percent), and GHG emissions from the portion attributable to U.S. international aviation bunker fuels grew from 30 to 62 Tg CO_2eq (110 percent). From 1990 to 2012, GHG emissions from U.S. covered aircraft increased from 171 to 190 Tg CO_2eq (11 percent), and GHG emissions from the portion attributable to U.S. international aviation bunker fuels grew from 30 to 62 Tg CO_2eq (110 percent).

[252] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[253] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, pp. 599–670.

[254] According to IEA, from 1990 to 2012, global aircraft GHG emissions grew by 53 percent, and global international aviation bunker fuels increased by 86 percent. International Energy Agency Data Services, Available at *http://data.iea.org* (last accessed January 21, 2016).

[255] According to the *FAA Aerospace Forecast 2014–2034,* these shocks include the September 11, 2001, terror attacks, significant increases in fuel prices, debt restructuring in Europe and U.S., and a global recession. FAA, 2014: *FAA Aerospace Forecast Fiscal Years 2014–2034,* 129 pp. Available at *http://www.faa.gov/data_research/aviation/aerospace_forecasts/media/2014_faa_aerospace_forecast.pdf* (last accessed April 8, 2016).

[256] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventory report.html* (last accessed June 14, 2016).

[257] According to the *FAA Aerospace Forecast 2016–2036,* in 2015 U.S. air carriers were profitable for the sixth consecutive year.

FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

[258] According to the *FAA Aerospace Forecast 2014–2034,* the International Air Transport Association (IATA) reports that world air carriers (including U.S. airlines) are expected to register an operating profit for 2013. Based on financial data compiled by ICAO and IATA, between 2004 and 2013 world airlines produced cumulative operating profits (with nine years out of ten posting gains) and net profits (with six years out of ten posting gains).

[259] FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

ICAO CAEP, 2013: *ICAO Environmental Report 2013, Aviation and Climate Change,* 224 pp. Available at *http://cfapp.icao.int/Environmental-Report-2013/* (last accessed April 8, 2016).

[260] ICAO CAEP, 2013: *ICAO Environmental Report 2013, Aviation and Climate Change,* 224 pp. Available at *http://cfapp.icao.int/Environmental-Report-2013/* (last accessed April 8, 2016).

[261] FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

this topic (and further details for the key comments) are also contained in the Response to Comments document.

1. The Administrator Reasonably Defined the Scope of the Cause or Contribute Finding

a. Applicability Weight Thresholds Match Those of International CO_2 Standard

Several commenters stated that the EPA should undertake another cause or contribute finding for a broader range of aircraft not covered in our proposed finding, including smaller turboprop aircraft (such as the Beechcraft King Air 350i), smaller jet aircraft (such as the Cessna Citation M2), piston-engine aircraft, and helicopters. These commenters stated, however, that this comment did not affect the validity of the conclusions in the proposed finding. Numerous commenters stated their support for our proposed finding's scope matching the applicability (weight or MTOM) thresholds of the international CO_2 standard.

As described earlier, at this time and for the purposes of this cause or contribute finding under CAA section 231(a)(2)(A), the EPA is including emissions of the six well-mixed greenhouse gases from classes of engines used in U.S. covered aircraft which are subsonic jet aircraft with a maximum takeoff mass (MTOM) greater than 5,700 kilograms and subsonic propeller driven (*e.g.,* turboprop) aircraft with a MTOM greater than 8,618 kilograms. We are not at this time taking final action with respect to the GHG emissions from aircraft other than those included in the scope of this finding.[262] The cause or contribute finding is a prerequisite under CAA section 231 for EPA to adopt standards that are of at least equivalent stringency to those set by ICAO. Accordingly, in this finding, the EPA is focusing on matching the scope of our contribution finding to the applicability thresholds of the international standard. The covered aircraft match the applicability (or MTOM) thresholds of the international aircraft CO_2 standard. This is a reasonable approach for this first finding regarding the contribution of aircraft GHG emissions to the endangering air pollution, as the vast majority of U.S. emissions from all classes of aircraft engines (89 percent of U.S. aircraft GHG emissions) will be covered by this scope of applicability, which corresponds to 26 percent of global aircraft GHG emissions. This approach is also consistent with our past practice in promulgating aircraft engine NO_X standards. In ruling on a petition for judicial review of the 2005 rule for further stringency of aircraft engine NO_X standards,[263] the D.C. Circuit held that the EPA's approach in that action of tracking the applicability criteria of the ICAO standards was reasonable and permissible under the CAA. *NACAA* v. *EPA,* 489 F.3d 1221, 1230–32 (D.C. Cir. 2007). (The Court also held that section 231 of the CAA confers a broad degree of discretion on the EPA to adopt aircraft emission standards that the Agency determines are reasonable. *Id.*) Also, by using the phrase ''any class or classes of aircraft engines which in [her] judgment causes, or contributes to,'' the endangering air pollution, section 231(a)(2)(A) gives the EPA discretion to determine which class or classes of aircraft engines to evaluate in making a cause or contribute finding, and whether to focus on a single class or multiple classes of aircraft engines in satisfying the requirements of section 231(a)(2)(A).

In response to the commenters who asked the EPA to undertake an additional cause and contribute finding regarding GHG emissions from non-covered U.S. aircraft, the Agency will take that request under advisement and consideration among its other duties and priorities, but is not prepared at this time to either reject or grant that request. At this point, given the nearly complete process for ICAO's adoption of an international standard, which will under the Chicago Convention trigger the duties of the U.S. and other member states to adopt domestically standards that are of at least equal stringency, it is most important for the EPA to prepare for having to meet that nearly certain duty by expeditious completion of the pre-requisite endangerment and cause or contribute findings, without possibly delaying final action to consider the possibility of proposing a broader cause or contribute finding before taking final action.

b. The Administrator Reasonably Defined U.S. Covered Aircraft

A commenter stated that they understand that the scope of the finding corresponds to the aircraft engine GHG emissions that are from aircraft that match the applicability thresholds (or MTOM thresholds) for the international aircraft CO_2 standard; however, they requested clarification on the difference between ''U.S. covered aircraft'' and non-U.S. covered aircraft. This commenter requested clarification on whether U.S. covered aircraft means aircraft made in the U.S., registered in the U.S., operated by an entity holding an air carrier certificate issued by the U.S., operated by an air carrier in the National Air Space, or operated by anyone in the U.S. (National) Air Space. The commenter expressed that the EPA must explain the basis for its definition, and its claimed authority to regulate U.S. covered aircraft.

As described earlier in section V.B.4, U.S. covered aircraft for this cause or contribute finding refers to aircraft that are a subset of all aircraft that meet the applicability thresholds of the international aircraft CO_2 standard, namely those that fly domestically with starting and ending points within the U.S. and those that depart the U.S. for international destinations. U.S. covered aircraft include aircraft that operate in the U.S., and thus contribute to GHG emissions in the U.S. This includes emissions from U.S. domestic flights of these aircraft. In addition, the scope of this finding reaches GHG emissions from non-military aircraft combusting U.S. international bunker fuels departing the U.S., regardless of whether they are a U.S. flagged carrier—also described as emissions from combustion of U.S. international bunker fuels.[264] Similar to statements earlier in section V.B.4, in defining U.S. covered aircraft for this specific contribution finding, in advance of needing to meet the expected duties imposed by the ICAO standards, the EPA is focused on the GHG emissions that the atmosphere receives as a result of aviation activities occurring inside the U.S. and originating from the U.S., in order to capture the full contribution of covered aircraft to U.S. GHG emissions, consistent with the scope of the ICAO international standard. It is important for the EPA's finding to reach the subset of aircraft that meet the definition of U.S. covered aircraft, and that subset

[262] Consequently, this final action does not restrict the EPA's future discretion to address GHG emissions from aircraft that are not included in the scope of this finding, or prejudge how the Agency would respond to a petition to address those GHG emissions should one be submitted in the future.

[263] U.S. EPA, 2005: *Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures; Final Rule,* 70 FR 69664 (November 17, 2005).

In 2005, we promulgated more stringent NO_X emission standards for newly certified commercial turbofan engines. That final rule brought the U.S. standards closer to alignment with ICAO CAEP/4 requirements that became effective in 2004.

[264] For example, a flight departing Los Angeles and arriving in Tokyo—regardless of whether it is a U.S. flagged carrier—is considered a U.S. international bunker flight. A flight from London to Hong Kong is not.

will not necessarily be covered by any other member state with responsibilities to meet the ICAO standard under the Chicago Convention. For U.S. covered aircraft, the EPA has chosen to combine GHG emissions from all flights both domestic and those reflected in international bunker fuel inventories to determine the contribution of U.S. covered aircraft GHG emissions to the endangering air pollution. We additionally note that the IPCC and UNFCCC guidance states that for an international bunker flight the entire flight's emissions are calculated and reported (for the country from where the flight departed), and the GHG emission calculation methodologies are the same for both domestic and international aviation bunker fuel flights. We have followed this guidance in our calculation methodologies for this contribution finding.[265] Ultimately, GHG emissions inventories from U.S. covered aircraft with or without GHG emissions from combustion of U.S. international aviation bunker fuels are sufficient to support the Administrator's cause or contribute finding in this action, whether we consider the inventories both together, or just the inventory from domestic flights of U.S. covered aircraft.

In response to the comment that EPA must explain its claimed authority to regulate U.S. covered aircraft, as described earlier, the endangerment and cause or contribute findings are a prerequisite under CAA section 231(a)(2)(A) for EPA to adopt standards (that are of at least equivalent stringency to those set by ICAO). If the Administrator makes these findings in the affirmative, she must issue standards under section 231(a)(2)(A).

c. It Is Reasonable for the Administrator To Limit the Contribution Finding to U.S. Covered Aircraft

Some commenters stated that the EPA should issue a broader contribution finding and wait until the standard setting phase to exercise discretion as to what classes of aircraft engines should be covered by standards. These commenters stated that the EPA has authority to set aircraft engine GHG emission standards, following a cause or contribute finding, that do not impose requirements on every engine or class of aircraft engine within the scope of that finding. They also argued that in this instance there does not seem to be a sufficiently reasoned basis for EPA to exclude the non-covered aircraft for purposes of making the cause or contribute finding.

As described earlier in section III, the endangerment and contribution findings for aircraft GHG emissions under section 231(a)(2)(A) of the CAA are a necessary first step to begin to address GHG emissions from the aviation sector, the highest-emitting category of transportation GHG sources that the EPA has not yet addressed. As presented in more detail in section V.B.4 of this preamble, covered U.S. aircraft GHG emissions in 2014 represented 10 percent of GHG emissions from the U.S. transportation sector,[266] and in 2010, the latest year with complete global emissions data, U.S. covered aircraft GHG emissions represented 26 percent of global aircraft GHG emissions.[267] [268] U.S. covered aircraft GHG emissions are projected to increase by 43 percent over the next two decades.[269]

Section III of this preamble summarizes the legal framework for this action under CAA section 231. As discussed there, section 231(a)(2)(A) of the CAA states that "The Administrator shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare." Before the Administrator may issue standards addressing emissions of GHGs under section 231, the Administrator must satisfy a two-step test. First, the Administrator must decide whether, in her judgment, the air pollution under consideration may reasonably be anticipated to endanger public health or welfare. Second, the Administrator must decide whether, in her judgment, emissions of an air pollutant from the classes of aircraft engines under consideration cause or contribute to this air pollution.[270] If the Administrator answers both questions in the affirmative, she must issue standards under section 231. While we agree that the EPA has significant discretion in the standard-setting phase, we disagree with the comment to the extent that it suggests the standard-setting phase is the only appropriate place for the EPA to exercise discretion as to the scope of covered aircraft engine classes in this first instance of findings regarding aircraft GHG emissions. By using the phrase "any class or classes of aircraft engines which in [her] judgment causes, or contributes to," the endangering air pollution, section 231(a)(2)(A) gives the EPA discretion to determine which class or classes of aircraft engines to evaluate in making a cause or contribute finding, and whether to focus on a single class or multiple classes of aircraft engines in satisfying the requirements of section 231(a)(2)(A). Because the scope of the first international CO_2 standard adopted by ICAO is limited to aircraft over the specified MTOM levels, and the U.S. will have a duty to set domestic standards in order to meet its obligations under the Chicago Convention, it is reasonable in this case to similarly limit the scope of and issue this first aircraft GHG contribution

[265] As described earlier, following the IPCC guidelines for common and consistent accounting and reporting of GHGs, the UNFCCC requires countries to report both total national GHG emissions and international bunker fuel emissions (aviation and marine international bunker fuel emissions), and though these emissions are reported separately, both are assigned to the reporting country. In meeting the UNFCCC reporting requirements, the U.S. Inventory calculates international bunker fuel GHG emissions in a consistent manner with domestic GHG emissions. In this final contribution finding, the EPA maintains its approach used in the proposed findings to include aviation international bunker fuel emissions attributable to the United States with the national emissions number from the U.S. Inventory as reported to the UNFCCC. It is the EPA's view that it is reasonable and appropriate for the analysis in the contribution finding to reflect the full contribution of U.S. emissions from certain classes of aircraft engines, including those from domestic flights of U.S. aircraft and those associated with international aviation bunker fuel emissions. Consistent with IPCC guidelines for common and consistent accounting and reporting of GHGs under the UNFCCC, the "U.S. international aviation bunker fuels" category includes emissions from combustion of fuel used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier.

[266] U.S. EPA, 2016: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014,* 1,052 pp., U.S. EPA Office of Air and Radiation, EPA 430–R–16–002, April 2016. Available at: *www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html* (last accessed June 14, 2016).

[267] Ibid.

[268] IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change.* Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, 599–670 pp.

[269] As discussed in section V.B.4.c, fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 43 percent from 2010 to 2036, and this provides a scaling factor for growth in GHG emissions which would increase at a similar rate as the fuel burn by 2030, 2036, and 2040. FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

[270] To clarify the distinction between air pollution and air pollutant, the air pollution is the atmospheric concentrations and can be thought of as the total, cumulative stock of GHGs in the atmosphere. The air pollutants, on the other hand, are the emissions of GHGs and can be thought of as the flow that changes the size of the total stock.

finding and not delay this determination in order to possibly additionally consider and re-propose our finding to reach a broader scope. We do not necessarily disagree with the commenters who suggested that we could issue a broader contribution finding and then narrow the scope of future standards at that stage, but doing so in this action would require further analysis and development of an additional proposed finding, which could impede expeditious final issuance of the finding we proposed and thereby possibly impede prompt development of domestic standards that are of at least equivalent stringency as ICAO's. We expect to proceed with promulgating a domestic CO_2 standard (or GHG standard) of at least equivalent stringency to the international CO_2 standard as soon as it is practicable, and to begin to take action along this expected path, we are exercising our discretion in matching the applicability thresholds of the international CO_2 standard. The majority of the GHG emissions from all classes of aircraft engines would be covered by these applicability thresholds. We are not making either positive or negative contribution findings regarding GHG emissions from engines used in non-covered aircraft at this time, but nothing prevents us from doing so in the future.

2. The Administrator's Cause or Contribute Analysis Is Reasonable

a. It Is Reasonable To Include GHG Emissions From Combustion of International Aviation Bunker Fuels in the U.S. Aircraft GHG Inventory

Some commenters stated that the EPA's choice of data for the cause or contribute analysis was selective and biased. They contended that emissions resulting from combustion of the international aviation bunker fuels should not be part of the U.S. covered aircraft GHG inventory or of the total U.S. aircraft GHG inventory, since the EPA's own U.S. inventory for UNFCCC reporting purposes does not include emissions from combustion of these fuels in the national GHG totals and reports them separately to the UNFCCC, pursuant to UNFCCC inventory reporting guidelines.[271] Consequently, they asserted that the total emissions from domestic commercial aircraft accounts for less than 2 percent (1.7%) of total U.S. aircraft GHG emissions. Because of this, commenters believe that EPA inappropriately specified that the U.S. covered aircraft GHG emissions represent 3 percent of the total U.S. GHG emissions.

The EPA disagrees with this comment. As stated earlier in this section, U.S. covered aircraft GHG emissions[272] (and total U.S. aircraft GHG emissions) in this cause or contribute finding include those GHG emissions resulting from combustion of international aviation bunker fuel because we want to capture the full contribution of GHG emissions from aircraft that are attributable to covered aircraft activity in or originating from the U.S. In tracking aircraft GHG emissions, the EPA is focused on the U.S.'s contributions from this sector to the atmosphere. Accordingly, the EPA includes GHG emissions for all aircraft departing from U.S. airports in a calendar year (domestic and international flights) in determining total U.S. GHG emissions and total U.S. aircraft GHG emissions. Thus, consistent with that practice, for assessing GHG emissions from U.S. covered aircraft, EPA has chosen to combine all flights, both those with domestic takeoff and landing points, and those with domestic takeoff points and international landing points. In addition, guidance from the IPCC and UNFCCC states that for an international bunker fuel-combusting flight the entire flight's emissions are calculated and reported, and the GHG emission calculation methodologies are the same for both domestic and international bunker fuel-combusting flights. The U.S. calculates and reports emissions resulting from combustion of international bunker fuels in accordance with this guidance. However, pursuant to UNFCCC reporting guidelines, emissions from combustion of international bunker fuels are reported separately from other aircraft emissions in the U.S. Inventory, in order to meet the reporting commitments under the UNFCCC. We follow the IPCC and UNFCC guidance in our calculation and reporting methodologies.[273]

b. The Administrator Does Not Need To Find Significant Contribution, or Establish a Bright Line

One comment letter stated that aircraft GHG emissions are extremely small relative to both domestic and global GHG emissions in the aggregate, and questioned whether there is a reasoned basis for EPA to find that GHG emissions from U.S. aircraft cause or contribute to air pollution that endangers public health and welfare when assessed not only relative to contributions from other sectors, but also relative to climate impacts. For example, this commenter indicated the EPA estimates that total U.S. aircraft GHG emissions accounted for about 0.5 percent of total global GHG emissions in 2010. Thus, the commenter stated that the total U.S. aircraft GHG emission contributions from the U.S. aviation sector are extremely small relative to total global GHG emissions, or negligible as a percentage of total global GHG emissions.

The EPA disagrees with this comment and has fully explained the reasoning for this contribution finding in section V.B. In addition, the Administrator interprets CAA section 231(a)(2)(A) to require some level of contribution that, while more than *de minimis* or trivial, does not need to rise to the level of significance to support a contribution finding. By its terms, section 231(a)(2)(A) does not contain a modifier on its use of the term ''contribute,'' which contrasts with some other provisions of the CAA, such as sections 213(a)(2) and (4), and 110(a)(2)(D)(i)(I), that expressly require a ''significant'' contribution. The Administrator's interpretation is consistent with the interpretation of parallel language in CAA section 202(a), which was described in the 2009 Findings,[274] and is also supported by past court decisions. For example, the D.C. Circuit's opinion in *Catawba County* v. *EPA,* 571 F.3d 20 (D.C. Cir. 2009),

[271] EPA GHG Emissions Inventory at A–31 (reporting and methods) is available at: *http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Annex-2-Emissions-Fossil-Fuel-Combustion.pdf* (last accessed April 8, 2016).

[272] As described earlier in section V.B.4, U.S. covered aircraft do not include military aircraft that use U.S. international aviation bunker fuels.

[273] As described earlier, following the IPCC guidelines for common and consistent accounting and reporting of GHGs, the UNFCCC requires countries to report both total national GHG emissions and international bunker fuel emissions (aviation and marine international bunker fuel emissions), and though these emissions are reported separately, both are assigned to the reporting country. In meeting the UNFCCC reporting requirements, the U.S. Inventory calculates international bunker fuel GHG emissions in a consistent manner with domestic GHG emissions. In this final contribution finding, the EPA maintains its approach used in the proposed findings to include aviation international bunker fuel emissions attributable to the United States with the national emissions number from the U.S. Inventory as reported to the UNFCCC. It is the EPA's view that it is reasonable and appropriate for the analysis in the contribution finding to reflect the full contribution of U.S. emissions from certain classes of aircraft engines, including those from domestic flights of U.S. aircraft and those associated with international aviation bunker fuel emissions. Consistent with IPCC guidelines for common and consistent accounting and reporting of GHGs under the UNFCCC, the ''U.S. international aviation bunker fuels'' category includes emissions from combustion of fuel used by aircraft departing from the United States, regardless of whether they are a U.S. flagged carrier.

[274] 74 FR at 66541–42.

discusses the concept of contribution in the area designations context under section 107(d)(1)(A), which, like section 231(a)(2)(A), does not include the term ''significant'' to modify ''contribute.'' This decision, along with others, supports the Administrator's interpretation that CAA section 231(a)(2)(A) does not require a significant contribution, but rather, in the absence of specific language regarding the degree of contribution, provides the EPA discretion such that a positive finding may be based on a determination that the air pollutant emissions from the relevant class or classes of aircraft engines merely ''contribute to'' the air pollution which may reasonably be anticipated to endanger public health or welfare. In addition, similar to the interpretation of section 202(a) described in the 2009 Findings, the Administrator is not required under section 231(a)(2)(A) to establish a bright-line, objective test for contribution, but is to exercise her judgment in determining contribution.[275] As explained above, and similar to the approach used in the 2009 Findings, when exercising her judgment under section 231(a)(2)(A), in this context the Administrator considers both the cumulative impact and also the totality of the circumstances. It is reasonable for the Administrator to apply a '''totality-of-the-circumstances test to implement a statute that confers broad discretionary authority, even if the test lacks a definite 'threshold' or 'clear line of demarcation to define an open-ended term.''' *Id.* at 39 (citations omitted).

In *Catawba County* the D.C. Circuit upheld the EPA's $PM_{2.5}$ area designation decisions and analyzed CAA section 107(d), which requires the EPA to designate an area as nonattainment if it ''contributes to ambient air quality in a nearby area'' not meeting the national ambient air quality standards. *Id.* at 35. CAA section 107(d)(1), as mentioned above, like section 231(a)(2)(A), does not use the term ''significant'' in establishing this duty, or set forth any other bright-line benchmark that must be met for the EPA to find ''contribution.'' The court noted that it had previously held that the term ''contributes'' is ambiguous in the context of CAA language. *See EDF* v. *EPA,* 82 F.3d 451, 459 (D.C. Cir. 1996). ''[A]mbiguities in statutes within an agency's jurisdiction to administer are delegations of authority to the agency to fill the statutory gap in reasonable fashion.'' 571 F.3d at 35 (citing *Nat'l Cable & Telecomms. Ass'c* v. *Brand X Internet Servs,* 545 U.S. 967, 980 (2005)).

The D.C. Circuit then proceeded to consider and reject petitioners' argument that the verb ''contributes'' in CAA section 107(d) necessarily connotes a significant causal relationship. Specifically, the court again noted that the term is ambiguous, leaving it to the EPA to interpret in a reasonable manner. In the context of this discussion, the court noted that ''a contribution may simply exacerbate a problem rather than cause it . . .'' 571 F.3d at 39. This is consistent with the D.C. Circuit's decision in *Bluewater Network* v. *EPA,* 370 F.3d 1 (D.C. Cir. 2004), in which the court, in evaluating EPA's judgment that emissions from a specific class or category of nonroad engines contribute to air pollution for which findings of ''significant'' contribution had already been made with respect to nonroad engines' emissions in the aggregate, noted that the term ''contribute'' in CAA section 213(a)(3) ''[s]tanding alone, . . . has no inherent connotation as to the magnitude or importance of the relevant 'share' in the effect; certainly it does not incorporate any 'significance' requirement.'' 370 F.3d at 13. In that context, the court found that the bare term ''contribute'' invests the Administrator with discretion to exercise judgment regarding what constitutes a sufficient contribution for the purpose of making a contribution finding. *Id.* at 14.

Finally, in *Catawba County,* the D.C. Circuit also rejected ''petitioners' argument that the EPA violated the statute by failing to articulate a quantified amount of contribution that would trigger'' the regulatory action. 571 F.3d at 39. Although petitioners preferred that the EPA establish a bright-line test, the court recognized that the statute did not require that EPA ''quantify a uniform amount of contribution.'' *Id.*

Given this context, it is entirely reasonable for the Administrator to interpret CAA section 231(a)(2)(A) to require some level of contribution that, while more than *de minimis* or trivial, need not be significant. It is also reasonable for the EPA to find contribution without establishing a ''bright-line 'objective' test of contribution.'' 571 F.3d at 39. As in the 2009 Endangerment Finding, when exercising her judgment under CAA section 231(a)(2)(A), the Administrator not only considers the cumulative impact, but also looks at the totality of the circumstances (*e.g.,* the air pollutant, the air pollution, the nature of the endangerment, the type of source category, the number of sources in the source category, and the number and type of other source categories that may emit the air pollutant) when determining whether the emissions justify regulation under the CAA. *See id.* (finding it reasonable for an agency to adopt a totality-of-the-circumstances test under similar circumstances). In the context of GHG emissions, which come from many different sectors no single one of which is primarily responsible as their source, and which aggregate together into a common pollution stock that itself impacts public health and welfare, it is particularly reasonable to address those emissions from contributing sectors, even if looked at individually a sector may not be considered dominant. Therefore, in the specific context of making a contribution finding regarding GHG emissions from aircraft engines under CAA section 231, it is reasonable for the EPA to interpret that provision to not require some level of contribution that rises to a pre-determined numerical level or percentage- or mass-based portion of the overall endangering GHG air pollution.

In addition, the EPA disagrees with the assertion that we do not have a reasoned basis to make this contribution finding. As described earlier in section V.B.4, the collective GHG emissions from the classes of engines used in U.S. covered aircraft (197 Tg CO2eq) clearly contribute to the endangering GHG air pollution, whether the comparison is domestic (89 percent of total U.S. aircraft GHG emissions, 10 percent of all U.S. transportation GHG emissions, representing 2.8 percent of total U.S. GHG emissions), global (26 percent of total global aircraft GHG emissions representing 2.7 percent of total global transportation GHG emissions and 0.4 percent of all global GHG emissions), or a combination of domestic and global. Both domestic and global comparisons, independently and jointly, support the finding. Moreover, these comparisons also support the finding even if GHG emissions from combustion of U.S. international aviation bunker fuels are excluded. Making this cause or contribute finding for engines used in U.S. covered aircraft will result in the vast majority of total U.S. aircraft GHG emissions being included in this determination.

Also, even if the EPA were required to determine that a contribution met or exceeded a level of significance to make a contribution finding, for the reasons discussed above, the EPA would find that the contribution to the U.S. and global stocks of GHG air pollution from GHG emissions from classes of engines

[275] 74 FR at 66542.

used in U.S. covered aircraft is significant. As discussed in more detail above, their GHG emissions are larger than those from the great majority of emitting countries, they are larger than those of several major emitting countries, and they constitute one of the largest remaining unregulated contributing parts of the U.S. GHG emissions inventory.

Finally, in response to the suggestion in the comments that a positive contribution finding is not supportable unless the EPA finds that GHG emissions from covered aircraft themselves cause climate impacts, without consideration of the impacts caused by the larger aggregate stock of GHG air pollution, we stress that the comment conflates the endangerment and contribution steps of the analysis. In making the contribution finding, the EPA need not additionally and separately find whether the contribution alone causes endangerment. That endangerment finding has already been made with respect to the stock of GHG air pollution to which covered aircraft GHG emissions contribute. The only remaining issue at the second step of the analysis is whether the analyzed GHG source sector in fact emits GHG air pollutants that contribute to the air pollution that has already been found to endanger public health and welfare. The covered aircraft, as we have shown and explained, clearly do emit GHG air pollutants that measurably contribute to that stock.

c. The Administrator Reasonably Provided Context in Comparing Aircraft GHG Emissions to Other Sector GHG Emissions

Some commenters asserted that the EPA did not show important context in comparing covered aircraft GHG emissions to other mobile source categories' GHG emissions. The EPA does not describe the very low level of aircraft emissions in general relative to emissions from other sources. The commenters assert that, for example, the EPA does not point out that the growth in emissions from U.S. medium-duty and heavy-duty trucks since 1990 is 53 percent greater than the GHG emissions from the U.S. commercial aircraft sector today, and 18 percent higher than the total U.S. aircraft (or entire U.S. aviation sector) GHG emissions today.

In the proposed finding and this final finding, the EPA provides context for covered aircraft GHG emissions relative to other sectors' GHG emissions, including other categories within the transportation sector. As described earlier in section V.B.4, from a national perspective, the EPA provided tables to compare total U.S. aircraft and U.S. covered aircraft GHG emissions to U.S. transportation and total U.S. inventory GHG emissions, over an extended timeframe (1990–2014). We also noted that overall U.S. covered aircraft comprised the third largest source of GHG emissions in the U.S. transportation sector behind only the light-duty vehicle sector and medium- and heavy-duty truck sectors. This is the same ranking as total U.S. aircraft, if U.S. covered aircraft and total U.S. aircraft are compared to the other transportation sectors independent of one another. Finally, we note that the U.S. inventory also shows that while overall U.S. GHG emissions grew between 1990 and 2014, transportation GHG emissions grew at a notably higher rate, 16 percent, more rapidly than any other U.S. sector. U.S. covered aircraft GHG emissions grew by 15 percent in this time period.[276] Within the transportation sector, aircraft remain the single largest source of GHG emissions not yet subject to any GHG standards.

In our proposal and again in this finding in section V.B.4, the Administrator also stated her concern that recent projections indicate that by 2036 GHG emissions both from all aircraft and from U.S. covered aircraft are likely to increase by 43 percent (from 191 Tg CO_2eq to 272 Tg CO_2eq for the years 2010 to 2036).[277] This was contrasted with projections of GHG emissions changes in other transportation sectors in the same timeframe. For example, projections estimate that by 2036 the light-duty vehicle sector is projected to see a 25 percent reduction in GHG emissions (from 1,133 Tg CO_2eq to 844 Tg CO_2eq) from the 2010 baseline, while the freight trucks sector is projected to experience a 23 percent increase in GHG emissions (from 390 Tg CO_2eq to 478 Tg CO_2eq) from the 2010 baseline. (However, this projected increase does not reflect the impact of GHG reductions on the freight trucks sector anticipated from the Phase 2 heavy-duty GHG standards that have not yet been promulgated.) In addition, by 2036 the rail sector is projected to experience a 3 percent reduction in GHG emissions (44 Tg CO_2eq to 43 Tg CO2eq) from the 2010 baseline.[278] Therefore, in the context of projected growth it appears that U.S. covered aircraft GHG emissions through 2036 are estimated to increase by more than 80 Tg CO2eq.[279] [280]

Also, the EPA provided a global perspective by showing how total U.S. aircraft and U.S. covered aircraft GHG emissions compare to global aircraft, global transport, and total global GHG emissions. In addition, the EPA shows the ranking of the total U.S. aircraft and U.S. covered GHG emissions relative to other global transportation sectors and entire country GHG emissions.

One commenter stated that it is inappropriate and misleading to compare U.S. aircraft GHG emissions with those of other, individual countries. They indicated that to fairly compare the U.S. airlines' GHG emissions contribution, EPA should analyze, as ICAO does, contributions from other world regions with comparable land masses and levels of economic activity. (In terms of landmass, the U.S. ranks third globally, behind only Russia and Canada.) The EPA disagrees with this comment. The language of CAA section 231(a)(2)(A) is silent regarding how the Administrator is to make her contribution analysis. While it requires that the Administrator assess whether emissions of an air pollutant cause or contribute to air pollution which may reasonable be anticipated to endanger public health or

[276] Total U.S. aircraft GHG emissions decreased by 3 percent from 1990 to 2014. U.S. non-covered aircraft GHG emissions decreased by 56 percent in this same time period.

[277] As discussed in section V.B.4.c, fuel burn growth rates for air carriers and general aviation aircraft operating on jet fuel are projected to grow by 43 percent from 2010 to 2036 and this provides a scaling factor for growth in GHG emissions which would increase at a similar rate as the fuel burn by 2030, 2036, and 2040.

FAA, 2016: *FAA Aerospace Forecast Fiscal Years 2016–2036,* 94 pp. Available at *https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf* (last accessed March 29, 2016).

[278] U.S. Energy Information Administration (EIA), 2015: *Annual Energy Outlook (AEO) 2015 with projections to 2040,* DOE/EIA–0383, 154 pp. For the years 2010 to 2014, the baseline emissions for each sector are from the 2016 *Inventory of U.S. Greenhouse Gas Emissions and Sinks Report,* and after 2014 we utilize projections from the 2015 EIA AEO report. Available at *http://www.eia.gov/forecasts/aeo/* (last accessed April 8, 2016).

[279] As described earlier in section V.B.3, in 2010, U.S. covered aircraft were 10 percent of U.S. transportation sector GHG emissions, and in 2036, U.S. covered aircraft are projected to be 15 percent of U.S. transportation GHG emissions. In 2010, light-duty vehicles were 58 percent of U.S. transportation GHG emissions, and in 2036 they are projected to be 46 percent. In 2010, heavy-duty vehicles were 20 percent of U.S. transportation GHG emissions, and in 2036, they are projected to be 26 percent (does not reflect the impact from the Phase 2 heavy-duty GHG standards that have not been promulgated). In 2010, the rail sector was 2 percent of U.S. transportation GHG emissions, and in 2036, they are projected to be the same percentage.

[280] Some commenters stated that section 231(a)(2)(A) of the CAA does not give the EPA the authority to legally base the contribution finding on future emission projections. As described earlier in section V.B, the EPA considered future emission projections as information to further support our assessment of annual actual emissions (recent emissions from the current fleet) for the contribution finding.

welfare, it does not limit how she may undertake that assessment. It surely is reasonable that the Administrator look at how total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions compare to U.S. and global GHG emissions on an absolute and relative basis, including ranking compared to other transportation sectors and entire country emissions. It is entirely appropriate for the Administrator to decide that part of understanding how a U.S. source category emitting GHGs fits into the bigger picture of global climate change is to determine how that source category fits into the contribution from the United States as a whole (including U.S. transportation and total U.S. inventory GHG emissions), where the United States as a country is a major emitter of GHGs. Knowing how total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions rank compared to entire country GHG emissions is relevant to understanding what role they play in the global problem and hence whether they ''contribute'' to the global problem. Moreover, the Administrator is looking at these emissions comparisons as appropriate under the applicable science, facts, and law. Therefore, the EPA appropriately compared and provided sufficient context for total U.S. aircraft GHG emissions and U.S. covered aircraft GHG emissions.

d. The Administrator Reasonably Utilized Multiple Databases for Global GHG Emissions

Some commenters stated that the mix of data from different years utilizing emissions data from IPCC, WRI/CAIT, and IEA was confusing and potentially misleading. The EPA acknowledges that we presented data from a variety of sources, but the EPA does not agree that the analysis and presentation was misleading. We note that the global analysis for this covered aircraft contribution finding is consistent with the analytical approach originally developed and used in the 2009 Endangerment Finding. As described earlier in section IV.A, in the proposed finding and this final finding, the Administrator considers the recent, major scientific assessments of the IPCC, USGCRP, and the NRC as the primary scientific and technical basis informing her judgment. Thus, the Administrator is informed by and places considerable weight upon the IPCC's data on global GHG emissions. She places less emphasis on the WRI/CAIT and IEA emissions data, which in comparison have a different aggregation of underlying data but are available for more recent years (in comparison to the IPCC data). As described earlier in section V.B.4, the WRI/CAIT data are generally in line with the IPCC data. For 2010 total global GHG emissions, IPCC data are 49,000 Tg CO_2eq, and WRI/CAIT indicates 42,968 Tg CO_2eq (a 12 percent difference).[281] Also, for 2010 global aircraft GHG emissions, IPCC data are 743 Tg CO_2eq, and IEA data indicate 749 Tg CO_2eq (a 1 percent difference).[282]

The approach of considering the major scientific assessments, including IPCC's assessment, provides assurance that the Administrator's judgment is informed by the best available, well-vetted science that reflects the consensus of the climate science research community. The major findings of the assessments, including IPCC's assessment, support the Administrator's findings in this action. While the EPA uses the IPCC data as the primary data source for this contribution finding, it has reasonably used additional data sources from widely used and recognized global datasets to provide context and information from more recent years. These additional data supplement and confirm the IPCC data. Ultimately, whether the Agency utilizes the IPCC data alone or the WRI/CAIT dataset (and IEA data) alone, or both datasets together, it would have no material effect on the emissions comparisons discussed in section V.B and the Administrator would make the same contribution finding.

VI. Statutory Authority and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is a significant regulatory action because it raises novel policy issues. Accordingly, it was submitted to the Office of Management and Budget (OMB) for review. This action finalizes a finding that GHG emissions from aircraft cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare. Any changes made in response to OMB recommendations have been documented in the docket for this action.

B. Paperwork Reduction Act (PRA)

This action does not impose an information collection burden under the PRA. The endangerment and cause or contribute findings under CAA section 231(a)(2)(A) do not contain any information collection activities.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. The endangerment and cause or contribute findings under CAA section 231(a)(2)(A) do not in-and-of-themselves impose any new requirements but rather set forth the Administrator's determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare. Accordingly, this action affords no opportunity for the EPA to fashion for small entities less burdensome compliance or reporting requirements or timetables or exemptions from all or part of the findings.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or tribal governments or the private sector.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. The final endangerment and cause or contribute findings under CAA section 231(a)(2)(A) do not in-and-of-themselves impose any new requirements but rather set forth the Administrator's determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered

[281] Comparing their 2010 total global GHG emissions, IPCC data are 49,000 Tg CO_2eq, and WRI/CAIT data, including forestry and land use inventories, indicates 45,748 Tg CO_2eq (a 7 percent difference).

[282] Comparing 2012 WRI/CAIT to 2010 IPCC data, WRI/CAIT data for total global GHG emissions indicates 44,816 Tg CO_2eq for 2012 (a 9 percent difference), and including forestry and land use inventories WRI/CAIT data indicates 47,599 Tg CO_2eq for 2012 (a 3 percent difference). Comparing 2012 IEA data to 2010 IPCC data, IEA data for global aircraft GHG emissions indicates 775 Tg CO_2eq for 2012 (a 4 percent difference).

aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This action is not subject to Executive Order 13045 because it is not economically significant as defined in Executive Order 12866. The Administrator considered climate change risks to children as part of the endangerment and cause or contribute findings under CAA section 231(a)(2)(A). This action's discussion of climate change impacts on public health and welfare is found in section IV of this preamble. Specific discussion with regard to children is contained in sections IV.C.1.a of the preamble. A copy of all documents pertaining to the impacts on children's health from climate change have been placed in the public docket for this action.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution or Use

This action is not a ''significant energy action'' because it is not likely to have a significant adverse effect on the supply, distribution or use of energy. Further, we have concluded that this action is not likely to have any adverse energy effects because the endangerment and cause or contribute findings under section 231(a)(2)(A) do not in-and-of themselves impose any new requirements but rather set forth the Administrator's determination that GHG emissions from certain classes of aircraft engines—those used in U.S. covered aircraft—cause or contribute to air pollution that may be reasonably anticipated to endanger public health and welfare.

I. National Technology Transfer and Advancement Act (NTTAA)

This action does not involve technical standards.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-income, or indigenous populations because this action does not affect the level of protection provided to human health or the environment. The Administrator considered climate change risks to minority, low-income, and indigenous populations as part of these endangerment and cause or contribute findings under CAA section 231(a)(2)(A). This action's discussion of climate change impacts on public health and welfare is found in section IV.C of the preamble. Specific discussion with regard to minority, low-income, and indigenous populations are found in sections IV.C.1.a and IV.C.2.a of this preamble. A copy of all documents pertaining to the impacts on these communities from climate change have been placed in the public docket for this action.

K. Congressional Review Act (CRA)

The EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is not a ''major rule'' as defined by 5 U.S.C. 804(2).

L. Determination Under Section 307(d)

Section 307(d)(1)(V) of the CAA provides that the provisions of section 307(d) apply to ''such other actions as the Administrator may determine.'' Pursuant to section 307(d)(1)(V), the Administrator determines that this action is subject to the provisions of section 307(d).

VII. Statutory Provisions and Legal Authority

Statutory authority for this action comes from 42 U.S.C. 7571, 7601 and 7607.

List of Subjects

40 CFR Part 87

Environmental protection, Air pollution control, Aircraft, Aircraft engines.

40 CFR Part 1068

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements, Warranties.

Dated: July 25, 2016.

Gina McCarthy,

Administrator.

[FR Doc. 2016–18399 Filed 8–12–16; 8:45 am]

BILLING CODE 6560–50–P

To: Samulski, Michael[samulski.michael@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
Cc: Leggett, Cullen[Leggett.Cullen@epa.gov]
From: Manning, Bryan
Sent: Thur 8/31/2017 6:17:03 PM
Subject: RE: For your review: Q&As on Aircraft Endangerment for OCIR AA binder
Aircraft Endangerment Draft QA 8.29 +BM.docx

....
,,,,
Hi,

Ex. 5 - Deliberative Process

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, August 31, 2017 1:10 PM
To: Samulski, Michael ; Manning, Bryan ; Audette, Lucie
Cc: Leggett, Cullen
Subject: FW: For your review: Q&As on Aircraft Endangerment for OCIR AA binder

Hi all,

As part of the effort for the OCIR AA, Troy Lyons, getting up to speed on EPA issues (for when

an OAR AA is nominated), we have now been asked to review draft Q&As. These Q&As were drafted for us to decrease the workload and OAP has reviewed & edited, but is sending our way to give it a quick review (they will then send to OGC).

Please take a look at the attached draft, and send any edits you may have by **noon on Friday, 9/1** (or earlier if at all possible).

If you have any questions on any of this or need more background, please let me know. And please of course loop in others as you see fit (including Bill, once you've made edits/okayed).

Thanks,

Tia

To: Sutton, Tia[sutton.tia@epa.gov]
Cc: Leggett, Cullen[Leggett.Cullen@epa.gov]; Charmley, William[charmley.william@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Manning, Bryan
Sent: Thur 8/31/2017 10:06:09 PM
Subject: RE: For your review: Q&As on Aircraft Endangerment for OCIR AA binder
Aircraft Endangerment Draft QA 8.29 +ASD com.docx

;;;;
Hi Tia,

Attached please find our comments. Bill okay'd these comments. Let us know if you have any questions. Note, Mike, Lucie, Cullen, and I will be out of the office tomorrow.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, August 31, 2017 2:26 PM
To: Samulski, Michael ; Manning, Bryan ; Audette, Lucie
Cc: Leggett, Cullen
Subject: RE: For your review: Q&As on Aircraft Endangerment for OCIR AA binder

Hi all,

Lucie just flagged for me that OTAQ folks didn't see/write the one-pager I mentioned below, so I've attached the one-pager that went to the OCIR AA here, in case it's helpful for your review of the Q&As that I sent.

(And apologies on that one – my counterpart in OAP is new and didn't realize that we should've gotten at least a chance to review, so I unfortunately didn't know that Aircraft GHG had been flagged as an item until I happened to notice this in the Q&A list and the one-pager itself was

already in the hands of the OCIR AA; so I did let her know we needed to at least get review on the Q&As.)

Thanks,

Tia

From: Sutton, Tia
Sent: Thursday, August 31, 2017 1:10 PM
To: Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Cc: Leggett, Cullen <Leggett.Cullen@epa.gov>
Subject: FW: For your review: Q&As on Aircraft Endangerment for OCIR AA binder

Hi all,

As part of the effort for the OCIR AA, Troy Lyons, getting up to speed on EPA issues (for when an OAR AA is nominated), we have now been asked to review draft Q&As. These Q&As were drafted for us to decrease the workload and OAP has reviewed & edited, but is sending our way to give it a quick review (they will then send to OGC).

Please take a look at the attached draft, and send any edits you may have by **noon on Friday, 9/1** (or earlier if at all possible).

If you have any questions on any of this or need more background, please let me know. And please of course loop in others as you see fit (including Bill, once you've made edits/okayed).

Thanks,

Tia

To: Manning, Bryan[manning.bryan@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Samulski, Michael
Sent: Tue 5/24/2016 12:40:15 PM
Subject: FW: Just circulated EPA's aircraft endangerment finding for OMB review
EO12866_Review-EPA Aircraft Endangerment Finding - Final Rule_5_6_2016_FAAv5.docx

Here's an early look at FAA's comments on the FRM.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Monday, May 23, 2016 4:09 PM
To: Samulski, Michael <samulski.michael@epa.gov>
Subject: FW: Just circulated EPA's aircraft endangerment finding for OMB review

Hi Mike,

FYI. Attached are the comments FAA submitted to OMB today. Should be no surprises, per our discussion last week. We reformatted Table II.1 to show the accurate outcomes of the CAEP decisions – with the ugly equations and all – and the A,B,C,D notes below the table connect the stringency options to the descriptions in the ANPRM. Hope this works.

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Iovinelli, Ralph (FAA)
Sent: Monday, May 23, 2016 4:00 PM
To: 'Whiteman, Chad'
Subject: RE: Just circulated EPA's aircraft endangerment finding for OMB review

Dear Chad,

Ex. 5 - Deliberative Process

ct

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Whiteman, Chad [mailto:Chad_S_Whiteman@omb.eop.gov]
Sent: Monday, May 09, 2016 11:07 AM
To: Iovinelli, Ralph (FAA)
Subject: Re: Just circulated EPA's aircraft endangerment finding for OMB review

Comments are due the 23rd to me. Scheduling the interagency briefing and will notify folks once it is on the calendar.

Sent from my BlackBerry 10 smartphone on the Verizon Wireless 4G LTE network.

From: Ralph.Iovinelli@faa.gov

Sent: Monday, May 9, 2016 10:13 AM

To: Whiteman, Chad

Subject: RE: Just circulated EPA's aircraft endangerment finding for OMB review

Chad,

Quick question --- what is the schedule for review? Any interagency telecon/WebEx planned or expected? When does everything need to be returned to OMB? We want to make sure we are timely.

Thanks,

Ralph

From: Whiteman, Chad Ex. 5 - Deliberative Process
Sent: Friday, May 06, 2016 5:34 PM
To: Iovinelli, Ralph (FAA)
Subject: Just circulated EPA's aircraft endangerment finding for OMB review

Ralph,

How are you doing?

I wanted to send a quick note that I just circulated for review EPA's Aircraft Endangerment Finding final rule.

Regards,

Chad

Chad Whiteman

Policy Analyst | Office of Information and Regulatory Affairs

Office of Management and Budget | Executive Office of the President

Ex. 6 - Personal Privacy

To: Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; Schillo, Bruce[Schillo.Bruce@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]; Benner, Tim[Benner.Tim@epa.gov]; Dutton, Steven[Dutton.Steven@epa.gov]; McDow, Stephen[McDow.Stephen@epa.gov]; Sarofim, Marcus[Sarofim.Marcus@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Wolverton, Ann[Wolverton.Ann@epa.gov]; Yen, David[Yen.David@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Gordon, Jessica M[Gordon.Jessica@epa.gov]; Hockstad, Leif[Hockstad.Leif@epa.gov]
Cc: Doster, Brian[Doster.Brian@epa.gov]; Zenick, Elliott[Zenick.Elliott@epa.gov]; Jordan, Scott[Jordan.Scott@epa.gov]; Orlin, David[Orlin.David@epa.gov]; Lee, Michael[lee.michaelg@epa.gov]
From: Williams, Melina
Sent: Fri 11/7/2014 1:14:55 PM
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Hi all,

I'll take a stab at the Tailoring Rule question, but I'm also looping in a few others from OGC who have been much more involved with that issue, and with the 111 rules.

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A
| phone: (202) 564-3406 | fax: (202) 564-5603

The contents of this e-mail and any attachments to it may contain deliberative-process, attorney-client, attorney work product, or otherwise privileged material. Do not distribute outside of EPA or DOJ.

From: Jantarasami, Lesley
Sent: Thursday, November 06, 2014 4:45 PM
To: Schillo, Bruce; Manning, Bryan; Audette, Lucie; Birnbaum, Rona; Samulski, Michael;

DeAngelo, Ben; Thrift, Mike; Benner, Tim; Dutton, Steven; McDow, Stephen; Sarofim, Marcus; Leggett, Cullen; Wolverton, Ann; Yen, David; Maeroff, Bruce; Gordon, Jessica M; Hockstad, Leif; Williams, Melina
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Hello everyone,

Sorry we had to cancel the workgroup meeting this morning; I was selected for jury duty but then it ended up that this afternoon the judge dismissed the case. So I'm back in the office now, catching up on the email traffic. Bryan and I talked, and our responses to Bruce's comments and questions are in red text below. Hope this helps clarify--we are open to additional wording suggestions, so just let us know.

Thanks,

Lesley

From: Schillo, Bruce
Sent: Wednesday, November 05, 2014 5:51 PM
To: Manning, Bryan; Audette, Lucie; Birnbaum, Rona; Samulski, Michael; DeAngelo, Ben; Thrift, Mike; Benner, Tim; Dutton, Steven; McDow, Stephen; Sarofim, Marcus; Leggett, Cullen; Wolverton, Ann; Yen, David; Maeroff, Bruce; Gordon, Jessica M; Hockstad, Leif; Williams, Melina; Jantarasami, Lesley
Subject: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Here are my comments or questions on four topics:

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Bruce Schillo | Policy & Regulatory Analysis Division | Office of Policy | EPA
1200 Pennsylvania Avenue, NW | Mail Code 1803, WJC-N 3512-a | Washington, DC 20460
202-564-6552 | 202-564-7322 (fax) | schillo.bruce@epa.gov

To: Manning, Bryan[manning.bryan@epa.gov]
Cc: Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Audette, Lucie
Sent: Thur 2/4/2016 5:54:44 PM
Subject: RE: One more thing: aircraft GHG endangerment FRM (Docketing questions)

Yes, I think that was a new piece of the puzzle. Thanks for the forward! Lucie

From: Manning, Bryan
Sent: Thursday, February 04, 2016 12:54 PM
To: Audette, Lucie <audette.lucie@epa.gov>
Cc: Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Subject: One more thing: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Deliberative Process

From: Manning, Bryan
Sent: Thursday, February 04, 2016 12:50 PM
To: Audette, Lucie <audette.lucie@epa.gov>
Cc: Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Subject: FW: aircraft GHG endangerment FRM (Docketing questions)

Hello Lucie,

Sorry, you were not looped into the earlier response from Mike Thrift on this question. See below. Thanks. Bryan

From: Thrift, Mike
Sent: Thursday, January 21, 2016 11:28 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Attorney Client

From: Manning, Bryan
Sent: Thursday, January 21, 2016 6:53 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Subject: aircraft GHG endangerment FRM (Docketing questions)

Hello Mike,

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Manning, Bryan[manning.bryan@epa.gov]
From: Samulski, Michael
Sent: Mon 2/22/2016 12:45:45 PM
Subject: FW: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

FYI. Here's a short summary of the call with had on Friday with OMB, FAA, DOT, and some WH staff.

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Davidson, Ken
Sent: Friday, February 19, 2016 12:13 PM
To: Samulski, Michael; Charmley, William
Cc: Hengst, Benjamin
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ken

Kenneth Davidson

U.S. Environmental Protection Agency

Office of Transportation and Air Quality/Region 9 Air Division

75 Hawthorne St. (AIR-6)

San Francisco, CA 94105

Phone: 415-972-3633

FAX: 415-947-3583

From: Samulski, Michael
Sent: Friday, February 19, 2016 7:51 AM
To: Charmley, William <charmley.william@epa.gov>
Cc: Davidson, Ken <Davidson.Ken@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>
Subject: Re: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Ex. 5 - Deliberative Process

Mike

Sent from my iPhone

On Feb 19, 2016, at 9:12 AM, Charmley, William <charmley.william@epa.gov> wrote:

Really sorry I missed this one, especially slides 2 and 5.

Mike and Ken,

Can you send me by mid next week a short summary of how this meeting went.

Thanks

Bill

Sent from my iPhone

Begin forwarded message:

From: "Whiteman, Chad" Ex. 6 - Personal Privacy
Date: February 18, 2016 at 10:38:36 AM EST
To: "'Ralph.Iovinelli@faa.gov'" <Ralph.Iovinelli@faa.gov>, "Vahlsing, Candace" Ex. 6 - Personal Privacy v>, "Welsh, Kevin" Ex. 6 - Personal Privacy Lourdes.Maurice@faa.gov'" <Lourdes.Maurice@faa.gov>, "'samulski.michael@epa.gov'" <samulski.michael@epa.gov>, "'manning.bryan@epa.gov'" <manning.bryan@epa.gov>, "'McCabe.Janet@epa.gov'" <McCabe.Janet@epa.gov>, "Utech, Dan G." Ex. 6 - Personal Privacy Duke, Rick" < Ex. 6 - Personal Privacy Zaidi, Ali" Ex. 6 - Personal Privacy "Bodnar, Paul" < Ex. 6 - Personal Privacy "'Hengst.Benjamin@epa.gov'" <Hengst.Benjamin@epa.gov>, "'charmley.william@epa.gov'" <charmley.william@epa.gov>, "'LeFranc.Maurice@epa.gov'" <LeFranc.Maurice@epa.gov>, "'Rich.Swayze@faa.gov'" <Rich.Swayze@faa.gov>, "'carl.burleson@faa.gov'" <carl.burleson@faa.gov>, "'shoshana.lew@dot.gov'" <shoshana.lew@dot.gov>, "'Atkinson.Emily@epa.gov'" <Atkinson.Emily@epa.gov>, "'Davidson.Ken@epa.gov'" <Davidson.Ken@epa.gov>, "'Leggett.Cullen@epa.gov'" <Leggett.Cullen@epa.gov>
Cc: "Mohtadi, Shara" Ex. 6 - Personal Privacy "'Arthur.Rypinski@dot.gov'" <Arthur.Rypinski@dot.gov>, "Golden, Robert" Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy, WH Energy and Climate Change "'Laszlo.Windhoffer@faa.gov'" <Laszlo.Windhoffer@faa.gov>, "'maryalice.locke@faa.gov'" <maryalice.locke@faa.gov>, "'curtis.holsclaw@faa.gov'" <curtis.holsclaw@faa.gov>
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

All, Attached are the slides for the OIRA portion of today's discussion. Chad

From: Whiteman, Chad
Sent: Tuesday, February 16, 2016 4:10 PM
To: Ralph.Iovinelli@faa.gov; Vahlsing, Candace Ex. 6 - Personal Privacy Welsh, Kevin <Kevin_W_Welsh@nsc.eop.gov>; Lourdes.Maurice@faa.gov; samulski.michael@epa.gov; manning.bryan@epa.gov; McCabe.Janet@epa.gov; Utech, Dan G. < Ex. 6 - Personal Privacy Duke, Rick Ex. 6 - Personal Privacy v>; Zaidi, Ali < Ex. 6 - Personal Privacy; Bodnar, Paul engst.Benjamin@epa.gov; charmley.william@epa.gov; LeFranc.Maurice@epa.gov; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson.Emily@epa.gov; Davidson.Ken@epa.gov; Leggett.Cullen@epa.gov
Cc: Mohtadi, Shara ov>; Arthur.Rypinski@dot.gov; Golden, Robert Ex. 6 - Personal Privacy WH Energy and Climate Change Ex. 6 - Personal Privacy; Laszlo.Windhoffer@faa.gov; maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Hi Ralph,

We have reserved Conference Room 1 over here at 1800 G Street (9th Floor) for the meeting. No clearance information is required to enter our building. We have space for quite a few people in that conference room.

Regards,

Chad

Chad Whiteman

Policy Analyst | Office of Information and Regulatory Affairs

Office of Management and Budget | Executive Office of the President

Ex. 6 - Personal Privacy

From: Ralph.Iovinelli@faa.gov [mailto:Ralph.Iovinelli@faa.gov]
Sent: Tuesday, February 16, 2016 3:59 PM
To: Vahlsing, Candace < Ex. 6 - Personal Privacy ; Welsh, Kevin Ex. 6 - Personal Privacy ; Lourdes.Maurice@faa.gov; samulski.michael@epa.gov; manning.bryan@epa.gov; McCabe.Janet@epa.gov; Utech, Dan G Ex. 6 - Personal Privacy uke, Rick Ex. 6 - Personal Privacy >; Zaidi, Ali < Ex. 6 - Personal Privacy Bodnar, Paul ngst.Benjamin@epa.gov; charmley.william@epa.gov; LeFranc.Maurice@epa.gov; Rich.Swayze@faa.gov; carl.burleson@faa.gov; shoshana.lew@dot.gov; Atkinson.Emily@epa.gov; Whiteman, Chad < Ex. 6 - Personal Privacy Davidson.Ken@epa.gov; Leggett.Cullen@epa.gov
Cc: Mohtadi, Shara < ov>; Arthur.Rypinski@dot.gov; Golden, Robert Ex. 6 - Personal Privacy x. 6 - Personal Privacy WH Energy and Climate Change Ex. 6 - Personal Privacy Laszlo.Windhoffer@faa.gov; maryalice.locke@faa.gov; curtis.holsclaw@faa.gov
Subject: RE: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

Several folks from out of town have requested a WebEx/telecon line for this meeting. Here is the information:

US toll-free call in and passcode: Ex. 6 - Personal Privacy

WEBEX

- Go to website >https://www.connectmeeting.att.com<
- Enter meeting number Ex. 6 - Personal Privacy
- Enter access code Ex. 6 - Personal Privacy
- Enter user email

- Enter user first/last name
- (next screen)
- Select "Participant" and click submit
- Website will automatically run Webex files and open meeting; host can view documents and chat/raise hand

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

From: Iovinelli, Ralph (FAA)
Sent: Friday, January 29, 2016 5:43 PM
To: 'Vahlsing, Candace M. EOP/WHO'; Welsh, Kevin W. EOP/NSC; Maurice, Lourdes (FAA); 'Samulski, Michael'; Manning, Bryan; McCabe.Janet@epa.gov; Utech, Dan G. EOP/WHO; Duke, Rick EOP/CEQ; Zaidi, Ali A. EOP/OMB; Bodnar, Paul N. EOP/NSC; Hengst, Benjamin; Charmley, William; LeFranc, Maurice; Swayze, Rich (FAA); Burleson, Carl (FAA); Lew, Shoshana (OST); Atkinson, Emily; 'Whiteman, Chad'
Cc: Mohtadi, Shara Z. EOP/OMB; Rypinski, Arthur (OST); Golden, Robert E. EOP/WHO; WH Energy and Climate Change; Windhoffer, Laszlo (FAA); Locke, Maryalice (FAA); Holsclaw, Curtis (FAA)
Subject: Int'l Aircraft CO2 Emissions Standard to US Domestic Regulation

Dear All,

First, please pass this invitation to those I missed.

This email follows-up on the action item and discussions from the EOP telecon on Tuesday, 1/26 at 530pm. There will be a joint OIRA/EPA/FAA meeting at the OIRA offices located at **1800 G Street, NW, 9th floor** on **Thursday, February 18** from **11am to 12:30pm**.

The objective of this meeting is to determine the most efficient way to support the domestic rulemaking process of the aircraft CO2 emission standard, with specific attention to the cost benefits analysis completed for the ICAO international aircraft CO2 emissions standard.

DRAFT AGENDA:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Please do not hesitate to contact Chad Whiteman Ex. 5 - Deliberative Process Ex. 5 - Deliberative Process or myself with questions.

Best Regards,

Ralph Iovinelli

Manager, Emissions Division (AEE-300)

Office of Environment and Energy

Federal Aviation Administration

800 Independence Ave., SW

Washington, DC 20591

+1-202-267-3566 office

+1-202-288-6372 mobile

ralph.iovinelli@faa.gov

<OMB Regulatory Planning and Analysis - 2_18_2016.pdf>

To: Manning, Bryan[manning.bryan@epa.gov]
From: Davidson, Ken
Sent: Tue 11/10/2015 4:42:15 PM
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Hi Bryan,

Just catching up on email this morning, and I'm obviously a few minutes too late! Let me know how the discussion goes…

Ken

Kenneth Davidson

U.S. Environmental Protection Agency

Office of Transportation and Air Quality/Region 9 Air Division

75 Hawthorne St. (AIR-6)

San Francisco, CA 94105

Phone: 415-972-3633

FAX: 415-947-3583

From: Manning, Bryan
Sent: Tuesday, November 10, 2015 8:08 AM
To: Davidson, Ken <Davidson.Ken@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>
Subject: FW: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Hi Ken,

See below. We plan on talking with Charles (NCEE) at 11:30 am eastern today. If you are interested in tieing in, let me know. I do not have a call-in number yet, but when I receive one, I will forward it to you (if you are interested).

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Griffiths, Charles
Sent: Tuesday, November 10, 2015 10:49 AM
To: Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thanks for the email this morning, Lesley. As Kate said, NCEE would be interested in providing technical comments on the FAA information paper.

I would also like to get a better handle on how this paper relates to the ICAO standards decision and how it might impact the EPA rulemaking on aviation engine standards. Would you and Bryan be available to have a very quick chat to make sure I understand how this paper fits into

the EPA efforts. We are going to brief our new AA, Laura Vaught, on this issue and I would like to make sure I fully understand the ICAO and EPA timeline and the impact of this paper on our EPA.

Leslie and Bryan, would you both be available for a quick conversation at 11:30 today? I can conference you both in.

Thanks,

Charles

****
Charles Griffiths
National Center for Environmental Economics
Room 4334B, WJC West, Mail Code 1809T
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460
Phone: 202/566-2288 Fax: 202/566-2338
Email: griffiths.charles@epamail.epa.gov
****

From: Shouse, Kate
Sent: Tuesday, November 10, 2015 10:27 AM
To: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thanks, Lesley. I was just in a meeting with Charles and his NCEE colleagues. NCEE is interested in providing technical comments (climate science and economics) and will coordinate

those comments with OAP and OTAQ. (We haven't discussed specifics but I'm happy to consolidate if we don't have time to stagger commenters.)

Charles will be in touch with you and Bryan soon to discuss questions about the ICAO process and implications for EPA's endangerment finding work.

From: Jantarasami, Lesley
Sent: Tuesday, November 10, 2015 9:59 AM
To: Griffiths, Charles <Griffiths.Charles@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>
Subject: FW: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)
Importance: High

Hi Charles,

Ex. 5 - Deliberative Process

It would be great if everyone interested in reviewing and providing comment on these papers from the SCC perspective could coordinate their reviews. Kate, have you heard anything about a process for coordinating comments between OP and OAR?

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

From: Manning, Bryan
Sent: Tuesday, November 10, 2015 8:14 AM
To: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>
Cc: Yen, David <Yen.David@epa.gov>; Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Subject: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)
Importance: High

Hello,

See below/attached. We have finally received the US draft information papers (IP) with FAA/MIT's cost-benefit analysis (from FAA). As you may recall, they have a global IP and US IP (or global and US cost-benefit analyses). Comments are due back to FAA by November 20. I realize you all are working the four main issues already (non-CO2 benefits, discount rates, SCC, and non-GHG criteria pollutant impacts/benefits), but let me know if you have any comments on these attached IPs. If needed, I will arrange a call for us to coordinate on our feedback to FAA on these IPs. Let me know if you have any questions. Many thanks for your help.

Kind regards,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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manning.bryan@epa.gov

From: Laszlo.Windhoffer@faa.gov [mailto:Laszlo.Windhoffer@faa.gov]
Sent: Monday, November 09, 2015 6:34 PM
To: Manning, Bryan <manning.bryan@epa.gov>; Leggett, Cullen <Leggett.Cullen@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Cc: Ralph.Iovinelli@faa.gov
Subject: CO2 Standard Cost-Benefit Analyses (EPA Review)
Importance: High

Dear Mike, Bryan, Cullen,

For your review, attached are the Global and US-only cost-benefit analyses of the CO_2 standard. The documents are in information paper format for the upcoming CAEP/10 meeting. Please share with your EPA colleagues who can also provide feedback.

Please note that while the documents have gone through a number of rounds of review, and although they are now ready to be shared with you, they are not final. These versions are undergoing further reviews by FAA.

Although the papers are long, if at all possible I would **appreciate your feedback within the next 2 weeks (by latest Friday Nov 20)**. This would leave approximately 2-3 weeks (prior to the 12/4 deadline) in order to address any comments you may have, and potentially allow for another short review.

Looking forward to your feedback.

Thank you

László Windhoffer
Federal Aviation Administration
Office of Environment & Energy
800 Independence Avenue, S.W.
Washington, DC 20591
T: +1-202-267-4741

To: Akram, Assem[Akram.Assem@epa.gov]
Cc: Manning, Bryan[manning.bryan@epa.gov]
From: Maeroff, Bruce
Sent: Thur 9/3/2015 2:42:34 PM
Subject: Comments for EPA-HQ-OAR-2014-0828
FW: Attention Docket ID No. EPA–HQ–OAR–2014–0828: Comments from the National Tribal Air Association
FW: Attention Docket ID No. EPA-HQ-OAR-2014-0828 (AIA comments)
FW: EPA-HQ-OAR-2014-0828;
FW: EPA-HQ-OAR-2014-0828
FW: FYI, Comment on Proposed Aircraft Endangerment
FW: NACAA's comments on aircraft GHG proposal
FW: New FYI Control AX-15-001-2614 - Concern - Reduce Carbon Emissions from Jet Aircraft
FW: Office of Transportation and Air Quality
FW: Please submit these into record... From Eric Cypher
FW: REFERENCE NUMBER: EPA-HQ-OAR-2014-0828; FRL 9924-06-OAR

Hi Assem,

As we discussed, please add these comments to the Docket EPA-HQ-OAR-2014-0828. Files are contained within the attached notes.

Some number of these maybe duplicates of existing comments or comments still in the process of loading to Regulations.gov.

Thank You,

Bruce Maeroff

Senior Service America, Inc.

Supporting the U.S. EPA through a Cooperative

Agreement under the SEE Program,

Assessment and Standards Division,

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105 U.S.A.

Cube N130

ph (734) 214-4304 fax (734) 214-4816

maeroff.bruce@epa.gov

To: Samulski, Michael[samulski.michael@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Leggett, Cullen[Leggett.Cullen@epa.gov]; Yen, David[Yen.David@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
From: Manning, Bryan
Sent: Mon 8/31/2015 8:24:51 PM
Subject: FW: Attention Docket ID No. EPA-HQ-OAR-2014-0828 (AIA comments)
2015_08_31_AIA EPA ANPRM Endangerment Comments.pdf

FYI, see the attached comments from AIA. Thanks. Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Riegle, Leslie [mailto:leslie.riegle@aia-aerospace.org]
Sent: Monday, August 31, 2015 3:40 PM
To: Manning, Bryan
Cc: Lourdes.Maurice@faa.gov; Ralph.Iovinelli@faa.gov; Donald.Scata@faa.gov
Subject: FW: Attention Docket ID No. EPA-HQ-OAR-2014-0828

FYI.

Thank you,

Leslie

Leslie Riegle

Director of Environmental Policy

Aerospace Industries Association

1000 Wilson Boulevard, Suite 1700

Arlington, VA 22209-3928

leslie.riegle@aia-aerospace.org

703.358.1088

From: Riegle, Leslie
Sent: Monday, August 31, 2015 3:38 PM
To: 'A-and-R-Docket@epamail.epa.gov'
Subject: Attention Docket ID No. EPA-HQ-OAR-2014-0828

Please see the attached comments on behalf of the Aerospace Industries Association (AIA). In addition, these comments have been entered at: *http://www.regulations.gov*.

Thank you for your consideration,

Leslie

Leslie Riegle

Director of Environmental Policy

Aerospace Industries Association

1000 Wilson Boulevard, Suite 1700

Arlington, VA 22209-3928

leslie.riegle@aia-aerospace.org

703.358.1088

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To: Audette, Lucie[audette.lucie@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Iffland, JoNell
Sent: Wed 8/12/2015 7:51:26 PM
Subject: FW: Attention Docket ID No. EPA–HQ–OAR–2014–0828: Comments from the National Tribal Air Association
NTAA Comment on Aircraft GHG Finding8.12.15.pdf

JoNell L. Iffland

Assessment and Standards Division

U.S. Environmental Protection Agency

Direct ph. 734-214-4454

e-mail: iffland.jonell@epa.gov

From: Andy Bessler [mailto:Andy.Bessler@nau.edu]
Sent: Wednesday, August 12, 2015 3:46 PM
To: A-AND-R-DOCKET
Cc: Iffland, JoNell
Subject: Attention Docket ID No. EPA–HQ–OAR–2014–0828: Comments from the National Tribal Air Association

Please find the attached letter and official comment on U.S. EPA's 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; Proposed Rule submitted by the National Tribal Air Association.

Thank you.

Andy Bessler

Project Director

National Tribal Air Association

P.O. Box 15004

Flagstaff, AZ 86011-5004

Office: 928-523-0526

Cell: 928-380-7808

Fax: 928-523-1266

www.ntaatribalair.org

To: Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Simon, Joseph
Sent: Wed 9/2/2015 7:06:53 PM
Subject: FW: FYI, Comment on Proposed Aircraft Endangerment
Alan Epstein_Pratt & Whitney_incoming.pdf

FYI

This one is on Proposed Aircraft Endangerment

Joe Simon

Senior Service America, Inc.

Supporting the USEPA through a Cooperative Agreement

under the Senior Environmental (SEE) Program

Assessment and Standards Division

Direct line 734-214-4835

Email: Simon.Joseph@epa.gov

From: Meekins, Tanya
Sent: Wednesday, September 02, 2015 2:20 PM
To: Simon, Joseph
Subject: RE: FYI, Comment on Proposed Aircraft Endangerment

OK, let's try again.

From: Simon, Joseph
Sent: Wednesday, September 02, 2015 2:14 PM
To: Meekins, Tanya
Subject: FW: FYI, Comment on Proposed Aircraft Endangerment

Tanya

This doesn't look like anything to do with Proposed Aircraft Endangerment.

Maybe HD Diesel Engines?

Joe Simon

Senior Service America, Inc.

Supporting the USEPA through a Cooperative Agreement

under the Senior Environmental (SEE) Program

Assessment and Standards Division

Direct line 734-214-4835

Email: Simon.Joseph@epa.gov

From: Meekins, Tanya
Sent: Wednesday, September 02, 2015 1:44 PM
To: Simon, Joseph
Subject: FYI, Comment on Proposed Aircraft Endangerment

Hi Joe

I've sent this to the air docket. Can you share a copy with the appropriate staff.

Thanks

Tanya Meekins

Office of Transportation

And Air Quality

202-564-6002

To: Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Manning, Bryan
Sent: Mon 8/31/2015 2:01:35 PM
Subject: FW: NACAA's comments on aircraft GHG proposal
NACAA-Aircraft_GHG_Comments-08-1-1-1.28.15.pdf

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Nancy Kruger [mailto:nkruger@4cleanair.org]
Sent: Friday, August 28, 2015 12:07 PM
To: Charmley, William; Manning, Bryan; Samulski, Michael; Audette, Lucie; Wysor, Tad; Jantarasami, Lesley
Subject: NACAA's comments on aircraft GHG proposal

All,

Attached are NACAA's comments on EPA's aircraft GHG proposal. These comments were submitted to the EPA docket this morning.

Thanks for all your work on this important issue. We look forward to collaborating with you as you move ahead.

Have a nice weekend.

-Nancy

Nancy Kruger
Deputy Director
National Association of Clean Air Agencies
444 North Capitol Street, NW
Suite 307
Washington, DC 20001
tel: (202) 624-7864
fax: (202) 624-7863
nkruger@4cleanair.org

To: Maeroff, Bruce[Maeroff.Bruce@epa.gov]
Cc: Simon, Joseph[Simon.Joseph@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]
From: Samulski, Michael
Sent: Wed 8/26/2015 4:49:45 PM
Subject: FW: New FYI Control AX-15-001-2614 - Concern - Reduce Carbon Emissions from Jet Aircraft
AX-15-001-2614 FYI Correspondence.pdf

Bruce,

Please make sure this gets in the docket.

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Simon, Joseph
Sent: Wednesday, August 26, 2015 11:50 AM
To: Samulski, Michael; Manning, Bryan
Subject: New FYI Control AX-15-001-2614 - Concern - Reduce Carbon Emissions from Jet Aircraft

Please see attached FYI Control AX-15-001-2614.

No response is required from our office.

Joe Simon

Senior Service America, Inc.

Supporting the USEPA through a Cooperative Agreement

under the Senior Environmental (SEE) Program

Assessment and Standards Division

Direct line 734-214-4835

Email: Simon.Joseph@epa.gov

To: Audette, Lucie[audette.lucie@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]
Cc: France, Jennifer[france.jennifer@epa.gov]
From: Iffland, JoNell
Sent: Fri 8/21/2015 6:32:19 PM
Subject: FW: Office of Transportation and Air Quality

Lucie:

Here is another one that needs to be added to the docket.

Thanks,

JoNell L. Iffland

Assessment and Standards Division

U.S. Environmental Protection Agency

Direct ph. 734-214-4454

e-mail: iffland.jonell@epa.gov

From: EarthGuardians Vermont [mailto:earthguardiansvt@gmail.com]
Sent: Sunday, August 16, 2015 10:22 AM
To: Iffland, JoNell
Cc: OTAQ
Subject: Office of Transportation and Air Quality

To: Ms. JoNell Iffland
Office of Transportation and Air Quality
Assessment and Standards Division (ASD)
Environmental Protection Agency
Telephone number: (734) 214-4454
Email address: Iffland.jonell@epa.gov.

CC: otaq@epa.gov due to the statement in the right margin of this page
http://www.epa.gov/otaq/aviation.htm

FROM: Earth Guardians of Vermont – Youth for a Sustainable Future

My name is Nicole Mardin. I started a group for youth concerned about the environment in my state of Vermont. We are affiliated with Xiuhtezcatl Roske-Martinez, the founder of Earth Guardians and Our Children's Trust, the organization that just launched a lawsuit against the US Gov. for refusing to take action against climate change.

Our related organizations can be found here: http://www.earthguardians.org/crews

The following information just came to my attention: The EPA Administrator is proposing to determine that greenhouse gas concentrations in the atmosphere endanger the public health and welfare of current and future generations within the meaning of section 231(a) of the Clean Air Act. Public comments are being taken until august 31st.

First, I want to thank you for taking action against one of the greatest carbon polluters – aircraft. A single KC-10 will burn 2,050 gallons of highly toxic jet fuel every hour, and the military puts more than 48 billion tons of carbon dioxide into the air every year. This is such a critical contributor to the overall greenhouse gas problem and a very noble cause to fight. I really do thank the EPA for taking this on and I hope you bite into this project with all you've got. We don't fight these battles because we expect to win them. We fight them because it's the right thing to do. Earth Guardians can only be grateful to see you taking these steps on behalf of life.

We have a bit of a problem with the statement that is made in the right margin of the website page mentioned above. You wrote "The EPA is not aware of any deliberate actions to release chemical or biological agents into the atmosphere". This statement just isn't true, and it should be changed. The fact is that for years Shasta County California has been raising the alarm about geoengineering, filing reports, demanding investigations and attending town hall meetings in an effort to bring awareness and put a stop to the spraying. You can find one of their town hall meetings here: https://youtu.be/O4WhYKP83zo and it is a real insult that you would overlook several states today taking action against geoengineering, including legislation against it. Several states have come forward to speak out about geoengineering yet you refuse to listen or even acknowledge this is happening. In doing so you have separated yourself from the people that you serve.

We are very savvy about the geoengineering agenda to reduce sunlight and heat, and to refreeze

the arctic. John Nissen of the Arctic Methane Emergency Group, speaking at a press release here https://youtu.be/s2w0q6gxNiU ranted and raved for all of this broadcast that in the absence of geoengineering it is game over for the arctic, and that geoengineering is just harmless sulfur and the public are a bunch of idiots for not jumping on it right away. And because of people like John, we are now unsolicited test subjects in the money driven game of climate manipulation and geoengineered aerosol spraying of our atmosphere.

We know this, because we are paying attention to our environment. Like the Shasta County residents, here in Vermont we see the dead trees everywhere, the loss of wildlife, and we ourselves are constantly sick with heart palpitations, migraine headaches, nosebleeds, and constant ear ringing. We know this because we have been campaigning all over Vermont and the US to bring awareness – one of many of our petitions can be found here,

https://petitions.whitehouse.gov/petition/stop-toxic-spraying-our-skies-we-do-not-consent-genocide

signed by Xiuhtezcatl Roske-Martinez who ironically was awarded the young environmental activist award by Obama himself.

Humanity has a very big knife in its back and that's a very hard understanding for adults to digest, nevermind our youth. Yet Earth Guardians crews are doing more to save humanity than all of the federal government organizations combined.

Many years ago, a very brave Severn Suzuki spoke at the United Nations. She begged the big polluters – that if they couldn't fix our planet, to please – stop breaking it. https://youtu.be/TQmz6Rbpnu0

Today, you are still breaking it. And now we have Xiuhtezcatl Roske-Martinez speaking at the United Nations with the same message and nothing has changed. https://youtu.be/qeXLuywliFI

It is the moral, ethical and civil duty of the EPA to protect the people of the United States against toxic compounds being intentionally sprayed into the atmosphere. Geoengineering is ongoing, and you have given it your stamp of approval – by your silence and inaction, and without our consent.

On a personal level, I have a daughter who is eleven years old. I am forced to explain to her what

the white grid marks are in the sky and why we can't go out on heavy spray days. Our life – our world has been turned upside down by this. There are so many aspects of what is unraveling right now, from the end game Fukushima global disaster to the Fema Camps and coffins and JADE drills. We know it all. We know it's bad. Real bad. But we would never, ever agree to add more fuel to the fire in the way that geoengineering is doing. It isn't working. It is ending us all a whole lot faster, and robbing Mother Earth of any chance of recovery.

As a mother, and caretaker of this planet, and a true citizen of these United States, I am pleading with you. If all you can consider is that geoengineering is somehow a lifeline, then I am asking you with compassion and full understanding of the consequences involved. On behalf of humanity – of those who know the difference between right and wrong. Please. Pull the plug. Make it stop.

Thank you.

Nicole and Earth Guardians Youth of Vermont

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August 31, 2015

Air and Radiation Docket and Information Center
U.S. Environmental Protection Agency
Mail Code: 28221T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Docket ID No. EPA-HQ-OAR-2014-0828: 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

Electronic Submission: http://www.regulations.gov

To the Docket:

The Aerospace Industries Association (AIA) appreciates the opportunity to provide comments on the U.S. Environmental Protection Agency's ("EPA's") *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*, published in the Federal Register ("FR") on July 1, 2015. 80 Fed. Reg. 37758 (July 1, 2015), Docket EPA-HQ-OAR-2014-0828.

Background and Introduction

AIA is the largest aerospace trade association representing the nation's major aerospace and defense manufacturers. We represent more than 300 U.S. manufacturing companies with nearly one million skilled employees.

Our aerospace members are firmly committed to achieving the industry's progressive environmental goals by continuously improving engines, airframes, and aircraft systems with new and innovative technologies. The commercial aviation industry is proud of its strong environmental track record, including steady technology improvements in reducing aircraft greenhouse gas emissions (GHGs) over time.

Today's commercial aircraft are 70 percent more fuel efficient than aircraft fifty years ago. Greater fuel efficiency translates into reductions in aircraft fuel consumption and GHGs. The commercial aviation industry has achieved greater fuel efficiency, and lower emissions,

even as it has grown. Today, five percent of the nation's gross domestic product (GDP) is supported by aviation, yet only two percent of U.S. CO_2 emissions are attributable to aviation.

The industry has long been committed to playing a role to address climate change as a serious global environmental challenge that requires credible action. In 2008, prior to any mandatory GHG regulations of any sector in the United States, the industry proactively agreed to a set of environmental targets to reduce carbon emissions. They include: improving fuel efficiency by an average of 1.5 percent per year from 2009 to 2020; stabilizing emissions from 2020 with carbon-neutral growth; and reducing net carbon emissions from aviation by 50 percent by 2050 compared to 2005 levels. The industry will meet these goals through improved aircraft fuel efficiency – such as the introduction of new aircraft models and propulsion systems; operational efficiencies – air traffic management (ATM) system modernization and improvements such as the Next Generation Air Transportation System (NextGen); and greater use of sustainable aviation biofuels. With consistent technology improvements, increased operational efficiencies, deployment of a modernized infrastructure and the commercialization of sustainable aviation fuels, ambitious targets are achievable.

The aviation industry began pursuing these aggressive emission reduction goals prior to mandatory EPA regulations. It is critical that regulators acknowledge these early action efforts, as well as the unique nature of the aerospace industry itself before mandating further requirements. The aviation industry is uniquely complex, with a number of aircraft manufacturers who work with a large amount of component manufacturers to design and manufacture aircraft. All of these parties must work together first and foremost to develop and ensure the safety of aircraft that enter into service. In this industry, airworthiness and safety are always paramount and must be the top consideration in all decision making. Thus, the design of new aircraft types and significant modifications to existing aircraft types are relatively uncommon in comparison to other industry sectors and require a multi-year iterative process before a design can be completed, tested, and submitted to regulatory agencies for approval. This process is ongoing for many new aircraft types that may not be ready for regulatory approval for years, if not decades. Thus, it has been critical for industry to utilize its expertise both in airworthiness and in environmental design to develop new aircraft types that help achieve the emission reduction goals that the industry has established. Imposing further mandatory requirements without a clear demonstration that those standards can be met with proven technology that ensures airworthiness could lead to insurmountable burdens on the aviation industry. Further, such mandates may lead to disruptions in the supply of new aircraft at a time when the industry is already taking aggressive action to reduce its carbon footprint.

Proposed Scope of Endangerment Finding and ANPRM

In regards to FR Sections II, III, IV, V, and VI:

GHG Emissions

Consistent with EPA's endangerment determination for mobile sources, EPA's proposal addresses a group of six pollutants that EPA defines as GHGs: CO_2, methane (CH_4), nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. AIA does not dispute EPA's endangerment determination but, as described below, has concerns with the scope and timing of the decision.

First, it is important to recognize that not all of the six pollutants that are subject to the endangerment determination are associated with aircraft. Consistent with EPA's past practice, we urge the agency to limit any future regulation of GHGs in the aviation sector to those pollutants which are emitted in significant quantities from aircraft. There is such precedent in other EPA rulemakings; for example, EPA's regulation of GHG emissions from automobiles only addresses four of the six GHGs, 75 FR page: 25399 (May 7, 2010). Likewise, EPA's recently finalized regulations for GHG emissions from power plants only address CO_2. *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, prepublication version at 1556; Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units at 757-58; *see also* 79 FR page: 11445 (Jan. 8, 2014) ("The fact that we are not regulating the other five GHGs in this rulemaking does not mean that we are required to identify the pollutant as CO_2 alone, rather than the mix of six GHGs. This is consistent with EPA's past actions.").

Thus, AIA supports EPA's suggestion that any regulation issued in response to the aircraft endangerment determination be limited to CO_2, *see, e.g.*, FR page: 37790 (discussing potential CO_2 standard for aircraft). As EPA explains, the other pollutants defined as GHGs are either not contained in aircraft engine emissions or are emitted in such small amounts that regulation would yield few, if any emission reductions. AIA urges EPA to maintain this position in the event that the endangerment finding is finalized and the agency moves forward with a rulemaking to regulate GHG emission from the aviation sector.

Hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride need not be regulated because they are not emitted by aircraft. At present, there is a limited understanding of N_2O emissions from aircraft. The available peer reviewed literature indicates that N_2O is emitted in very small quantities, therefore we agree with the approach to not include or account for N_2O in the International Civil Aviation Organization (ICAO) standard and EPA's rulemaking.

AIA notes that there is no need for EPA to directly regulate methane emissions as these emissions are indirectly controlled by the existing aircraft engine hydrocarbon (HC) standards. As EPA states on FR page: 37787 "(m)odern aircraft do not emit methane,176 and hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are not products of aircraft engine combustion". We also note that any atmospheric methane that passes through the core of the gas turbines will in fact be burnt at all higher power conditions, meaning that aircraft could have a net positive effect on atmospheric methane concentration.

And finally, AIA agrees with the EPA that "black carbon," "NOx," and "water vapor" should not be included in a rulemaking. As EPA notes, the climate impacts of black carbon, NOx and anthropogenic water vapor are highly uncertain. Also, NOx is already regulated under ICAO and FAA standards.

Covered Aircraft

AIA agrees with the scope of the ICAO and EPA covered aircraft (in various places in the Endangerment Finding and ANPRM, e.g. FR page: 37787) and exclusion of piston-engine aircraft, helicopters, and military aircraft.

Responsibility under ICAO/CAEP

In regards to FR Section II.D and Section VI:

Through the International Coordinating Council of Aerospace Industries Associations (ICCAIA), members of AIA have been working tirelessly alongside industry partners, government, and non-governmental organizations (NGOs) within the ICAO's Committee on Aviation Environmental Protection (CAEP) to produce a meaningful CO_2 standard for aircraft.

All of the business-sensitive data input, analyses and considerations under various CAEP working groups have been conducted only after signing non-disclosure agreements within these respective groups. In addition, the negotiations under ICAO in these work groups are complicated, time-intensive, and intended to be closed discussions. The ANPRM includes references to many sensitive topics, including stringency levels, in-production applicability, etc. that are currently being considered under CAEP. A release of information from the CAEP working groups before agreement on a final standard tampers the negotiation process. The EPA does not have the authority to share selected elements of these open-discussions for public input.

The United States has agreed, as one of the 191 parties to the Convention on International Aviation (the "Chicago Convention"), that ICAO has the authority to establish environmental standards for commercial aircraft. EPA's practice has been to adopt ICAO's standards as its own for new commercial aircraft engines. The Federal Aviation

Administration (FAA), with support from EPA and other federal agencies, has followed a similar approach in setting aircraft noise standards.

Traditionally, international emission standards for aircraft engines have first been adopted by ICAO, and subsequently the EPA has initiated rulemakings to establish domestic standards that are of equal stringency as ICAO's engine standards. *While, as EPA points out, the Chicago Convention, which established ICAO, recognizes that ICAO member states may adopt their own unique standards that are more stringent than ICAO standards, this must be taken in the broader context of the Chicago Convention.* It is readily apparent that the exercise of this authority of member states is not to be the norm, but the exception.

Article 37 of the Chicago Convention provides in part:

> *Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation.*

Thus, it is expected that member states will attempt to achieve "the highest practicable degree of uniformity," thereby avoiding patchwork regulations.

Article 38 of the Chicago Convention then goes on to provide for exceptions, while providing context for the circumstances of member state's decision to derogate from the ICAO standard:

> *Any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organization of the differences between its own practice and that established by the international standard.*

Therefore, considering Articles 37 and 38 of the Chicago Convention, it is clear that the intent is for uniform international standards absent exceptional circumstances that might warrant a member state's deviation. This is in accord with the Preamble to the Chicago Convention which sets out as its purpose to foster cooperation among nations, and to promote an atmosphere where international civil aviation could be developed in a safe and orderly manner on the basis of equality of opportunity while being operated soundly and economically.

The Purpose of a CO_2 Standard

In regards to FR Sections VI.A., VI.B., VI.C.:

Aviation is truly a global industry. Given the international nature of aircraft, with a single vessel capable of entering numerous nations' airspace in a given day, if not a matter of hours, ICAO has been setting uniform global aviation standards for environment and safety for over fifty years. ICAO is the only international body in which aviation-specific technical feasibility, economic viability, environmental benefit and interdependencies, can be evaluated together in shaping policy. It takes a consistent and comprehensive approach to respond to the environmental challenges facing the commercial aviation industry, including aircraft CO_2 emissions standards. These interdependencies are critical to consider when any new regulation is proposed and is incorporated into domestic law.

EPA must not adopt a technology-forcing CO_2 standard that is based on aircraft designs or control technologies that have not been approved as airworthy by the FAA and demonstrated through use on existing aircraft. Airworthiness and safety in aviation are at the center of AIA's mission and also at the center of Section 231 of the Clean Air Act. Specifically, Section 231 directs EPA to consult with the FAA before establishing standards, CAA § 231(a)(2)(B)(i), prohibits EPA from changing standards in a manner that would "adversely affect safety," *id.* § 231(a)(2)(B)(ii), and allows the President to suspend any standard that the Secretary of Transportation finds would "create a hazard to aircraft safety," *Id.* § 231(c).

The central importance of airworthiness is evident in current and past ICAO standards. ICAO has consistently avoided basing aircraft emission standards on unproven technology and instead has relied on emission control measures that have already been established within the aviation sector and proven safe and effective. There is no reason for EPA or ICAO to deviate from that precedent here.

In the United States, the FAA plays a central role in the approval of any new aircraft equipment or design. Airworthiness is rigorously evaluated by the FAA during the aircraft certification process and the FAA record is replete with otherwise promising aircraft designs that have been disqualified in the certification process due to airworthiness concerns. Thus, if EPA were to impose technology-forcing standards based on technologies and designs that have not yet gone through the FAA review process, there is a significant risk that safety issues could arise that would prevent FAA from approving the anticipated technology that could be used to achieve the standard.

In addition, it is important that neither the global CO_2 standard being established by ICAO nor an EPA standard established under Section 231 causes market disruptions. A global CO_2 standard will ensure all future designs across the world will meet a set of uniform standards, promoting a high degree of environmental performance consistent with

airworthiness, economic viability, and interdependencies. ICAO standards have been shown to increase in stringency over time when technologically feasible and cost-effective, while ensuring that commercial aircraft remain safe. These standards that have been implemented across the globe have been effective in driving efficiency over the long term to accomplish our common environmental goals and objectives. "Technological feasibility" is not satisfied if only a few aircraft meet the proposed standard.

The CAEP definition of technological feasibility refers to a "technology demonstrated to be safe and airworthy proven to Technology Readiness Level (TRL) TRL8, and available for application in the short term over a sufficient range of newly certificated aircraft." Therefore, when determining technological feasibility, EPA and ICAO must consider whether a standard might be achievable only by one or a small fraction of manufacturers. Adopting such a narrowly achievable standard would limit market availability and cause significant market distortions. It is critical to consider such consequences when assessing whether to apply this CO_2 standard to in-production aircraft and, if so, what stringency level should be applied in which timeframe. Therefore, AIA urges the EPA to focus exclusively on technology that has already been approved by the FAA and meets the TRL8 technology readiness level.

Further, we urge EPA to carefully consider the complex tradeoffs that must necessarily occur between several other EPA and FAA requirements such as noise, non-GHG emission standards, and other environmental requirements such as recyclability, along with reliability, operability and maintainability requirements. Product designs must also address market requirements such as payload, range and takeoff field length capabilities and imposing extreme emphasis on any one design requirement frequently results in an 'unbalanced' design. A design that maximizes fuel efficiency may pose challenges for achieving other EPA and FAA environmental standards. Also, an over-aggressive standard may create unintended market distortion among or within different aviation sectors due to applicability and availability of certain technologies and available design space. Thus, EPA cannot evaluate the GHG standards in a vacuum and must ensure that the standard selected will allow aircraft to achieve it, and all environmental standards, without jeopardizing airworthiness.

Finally, AIA urges the EPA to consider the steps and commitments that the aviation industry has already made to improve fuel efficiency and thus to reduce GHG emissions from aircraft. As explained above, the aviation sector has already adopted goals to reduce GHG emissions by 50 percent by 2050 compared to 2005 levels, and currently manufacturing aircraft that are 70 percent more fuel efficient than 50 years prior. Thus the trajectory for the industry is one which will drive impressive reductions in GHG emissions over time. For an industry with such a strong commitment, financial incentive and track record for improved fuel efficiency and reduced GHG emissions, there is no clear need to demand emissions reductions through technology-forcing requirements.

AEROSPACE INDUSTRIES ASSOCIATION

In-Production Applicability

In regards to FR Section VI.B.:

Given the concerns about airworthiness discussed above and the significant design challenges associated with modifying existing aircraft designs, EPA and ICAO should impose GHG emissions standards *only* on new aircraft types. This will give aircraft manufacturers maximum flexibility to incorporate emission reducing design features at the outset. In contrast, for in-production aircraft, many of the most effective technologies may be foreclosed by prior design features that cannot be changed without impacting airworthiness without an unreasonable cost. Given the practically insurmountable cost of attempting to re-design in-production types consistent with airworthiness (as referenced to on FR page: 37795) and the limited emissions reductions likely to be achieved, AIA urges EPA to focus exclusively on new aircraft types.

However, in the alternative, if ICAO and the EPA believe that it is necessary to incorporate in-production aircraft into the standard, those requirements must be significantly less stringent (in terms of regulatory level and applicability date) than a new-type standard, equally account for all global manufacturers, and take into consideration all possible implications beyond purely environmental benefit, such as economic impact on manufacturers, their industrial base, supply chain and local communities. In addition, equivalent compliance procedures must be established to minimize undue burden to manufacturers and certificating authorities (e.g. no flight test). Aircraft have long production life cycles (20-30 years or more) and it is common practice for manufacturers to anticipate potential regulations and proactively develop designs to address such regulations for the life of the product. As a result, the amount of cost-effective improvement that is feasible in existing in-production designs is modest compared with that achievable in a new design. We urge EPA to fully take these limitations into account and avoid setting in-production standards that are so stringent that they effectively preclude continued production of certain aircraft types which may in fact be the most fuel efficient for a given market segment.

Timing of Applicability

In regards to FR Section VI.B.:

EPA requests comment on (FR page: 37793) "the timeframes described above for introducing new aircraft types and their subsequent penetration into the fleet". AIA believes it is likely that an ICAO standard will set an effective date from 2020 or 2023 onwards. Such timing provides aircraft manufacturers with sufficient lead time to incorporate new standards and, if necessary, different technology into the design for new aircraft type certificates. We are concerned, however, that a 2020 implementation date for new types will not give the EPA and the FAA sufficient time to incorporate the ICAO/CAEP

standard into U.S. domestic regulations. Such a scenario could place U.S. manufacturers at a competitive disadvantage if overseas competitors are able to get new type certifications from their domestic agencies, while U.S. manufacturers must await rulemaking before getting new type certifications. Once the standard is implemented it will ensure that all new aircraft types delivered will be designed with technology meeting or exceeding these emissions standards established by EPA and ICAO.

Metric System

In regards to FR Section VI.D:

The ICAO CO_2 standard metric system has been accepted by consensus for a certification standard. The metric equitably rewards advancements in aircraft technologies which contribute to reductions in these emissions and differentiates between aircraft with different generations of these technologies. In addition, the metric accommodates the full range of technologies and designs which manufacturers can employ to reduce these emissions. The metric was designed to take into account four key elements associated with aircraft technology and design: cruise point, fuel use, aircraft size, and aircraft weight.

Based on the agreed-upon ICAO CO_2 metric system, the CO_2 standard will reduce emissions from an aircraft engine by encouraging the integration of fuel efficient technologies into aircraft design and development. It has been developed such that effective improvements observed through the CO_2 standard will correlate with reductions of CO_2 emissions during day-to-day operations.

Stringency

In regards to FR Section VI.E:

AIA strongly believes that this active ICAO consideration is one of many elements intrinsically coupled within the work to complete the CO_2 standard, and the decision-making should rest within the parameters of the well-established ICAO standard-making process.

Modeling – Cost Impact

In regards to FR Section VI.F:

The EPA requests comments (FR page: 37804) on how to model cost impacts. ICAO, with EPA's direct involvement, has developed models of CO_2 stringency standards. We recognize that there are restrictions on the release of ICAO modeling and hence understand why EPA included alternative illustrative plots in the ANPRM, however, we are concerned that the modeling relied on by EPA to create the illustrative plots may include errors and are taken out of context of CAEP. Specifically, the PIANO tool used by EPA may be reasonable for older, in-service aircraft but is less accurate for newer aircraft and would be

even less accurate for in-development aircraft. As a result we request any future use of this modeling be presented in a neutral manner.

Timing of EPA Standard

The timing of these impending regulations is the most critical factor to achieving the goals of airworthiness and uniformity around the world. Given the ongoing ICAO proceedings it is essential that EPA postpone finalizing its proposed endangerment determination or proposing a new CO_2 standard under Section 231 until after ICAO has adopted final standards for GHG emissions from aircraft. AIA shares EPA's view that ICAO will complete its process and adopt a final CO_2 emission standard in September 2016. The work leading up to a first-of-a-kind standard was time-intensive, thorough, and has been conducted in the same method as any other standard under ICAO. In light of the United States' direct involvement in the ICAO process, we strongly urge EPA to defer further administrative action until that regulatory process is complete and international standards are in place.

As a legal matter, EPA is under no mandatory obligation to complete the endangerment finding or propose regulations under Section 231 by a certain date. Instead, the Clean Air Act gives EPA discretion to decide when to make an endangerment determination and begin the process of issuing regulations. At the same time, issuing an endangerment determination prematurely before the ICAO process is complete could result in the EPA finalizing its own regulation in the United States before international consensus is realized. Such an undue risk and pressure could frustrate the ultimate success of the ICAO process at this late stage of negotiations. While issuing a proposed endangerment finding and ANPR has positioned EPA to act quickly once the ICAO process is complete, EPA must avoid acting prematurely and in advance of the conclusion of the ICAO process. Pushing ahead before such international agreement could impose obligations on the U.S. aerospace industry in advance of the ICAO process being resolved, leading to patchwork regulations around the world.

Reporting Requirements

ICAO's CAEP is currently considering elements of a reporting system for aircraft covered under the EPA's ANPRM. EPA's reporting requirements should not go beyond those elements necessary to show compliance with the ICAO CAEP CO_2 standard (airplane model series, maximum takeoff mass, and metric value). It is important that the reporting requirements not require public disclosure of sensitive trade secret information as such information generally loses its trade secret protection once it is publically disclosed.

Conclusion

AIA encourages the EPA's focus on the global CO_2 emissions standard for new type aircraft at ICAO. There is no reason to deviate from this well-established practice in addressing aircraft emissions standards, and doing so could cause damaging market-disruptions.

CAEP is expected to adopt a final aircraft CO_2 emissions standard in February 2016 with full ratification by the ICAO Council and endorsement from the ICAO Assembly in September 2016. As it has in the past, EPA should follow this well-established path and adopt the ICAO standard into U.S. domestic law under section 231 of the Clean Air Act. This will ensure that U.S. aerospace manufacturers are not placed at a competitive disadvantage to their international competitors.

AIA is appreciative of the opportunity to make comment to this proposed rulemaking, and look forward to any questions or concerns you may have.

Best regards,

Leslie Riegle
Director of Environmental Policy
Aerospace Industries Association (AIA)

To: Manning, Bryan[manning.bryan@epa.gov]
From: Maeroff, Bruce
Sent: Thur 1/21/2016 6:56:45 PM
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Hi Bryan,

I called Assem Akram Ex. 6 - Personal Privacy Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

t

Bruce Maeroff

Senior Service America, Inc.

Supporting the U.S. EPA through a Cooperative

Agreement under the SEE Program,

Assessment and Standards Division,

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105 U.S.A.

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ph (734) 214-4304 fax (734) 214-4816

maeroff.bruce@epa.gov

From: Manning, Bryan
Sent: Thursday, January 21, 2016 11:46 AM
To: Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Subject: FW: aircraft GHG endangerment FRM (Docketing questions)

Bruce,

See the message below. Could you check with the docket and see how they handle CBI materials?

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Thrift, Mike
Sent: Thursday, January 21, 2016 11:45 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Deliberative Process

From: Manning, Bryan
Sent: Thursday, January 21, 2016 8:41 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Attorney Client

Thanks again,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Thrift, Mike
Sent: Thursday, January 21, 2016 11:28 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Attorney Client

From: Manning, Bryan
Sent: Thursday, January 21, 2016 6:53 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Subject: aircraft GHG endangerment FRM (Docketing questions)

Hello Mike,

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Manning, Bryan[manning.bryan@epa.gov]
From: Maeroff, Bruce
Sent: Tue 9/1/2015 4:38:02 PM
Subject: FW: Draft Transcript for EPA Public Hearing on the Aircraft Endangerment Finding
59380.doc

I found my notes:

Page 27 Line 4, 5, 6, 7 -- is this referring to ground APUs or the aircraft APUs? I am assuming ground APUs. They say "not part of an aircraft"

Page 28 Line 21, 22 – "Speak" (missing word) into the mike?…

Stopped at page 36, line 2

Bruce Maeroff

Senior Service America, Inc.

Supporting the U.S. EPA through a Cooperative

Agreement under the SEE Program,

Assessment and Standards Division,

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105 U.S.A.

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maeroff.bruce@epa.gov

From: Brunner, Christine

Sent: Tuesday, August 25, 2015 12:43 PM
To: Manning, Bryan; Jantarasami, Lesley
Cc: Audette, Lucie; Maeroff, Bruce
Subject: FW: Draft Transcript for EPA Public Hearing on the Aircraft Endangerment Finding

FYI and your review.

Please let me know either way - if you have comments/corrections (and what they are), or if you have none.

Thanks,

Chris

From: Barbara J. Bauer [mailto:Barbara_Bauer@abtassoc.com]
Sent: Tuesday, August 25, 2015 12:37 PM
To: Brunner, Christine
Subject: Draft Transcript for EPA Public Hearing on the Aircraft Endangerment Finding

Hi Chris,

Attached is the DC draft transcript file for your review. Please let me know if you require any edits.

Also, I believe that I sent you the Chicago transcript for review on August 21. Other than the incorrect name of the rulemaking on the cover page, are there any edits? I have the vendor's invoice, but don't want to submit it for payment until we get edits made and the final transcript in hand.

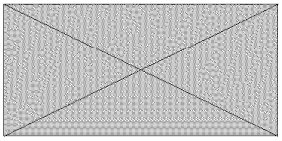
Thanks,

Barbara

Barbara Bauer | Associate | Abt Associates

5001 South Miami Blvd, Suite 210| Durham, NC 27703

O: 919-294-7781 | F: 301-828-9715| www.abtassociates.com



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To: Shouse, Kate[Shouse.Kate@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Rennert, Kevin[Rennert.Kevin@epa.gov]; McGartland, Al[McGartland.Al@epa.gov]; Griffiths, Charles[Griffiths.Charles@epa.gov]
Cc: Kopits, Elizabeth[Kopits.Elizabeth@epa.gov]; Davidson, Ken[Davidson.Ken@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; Sarofim, Marcus[Sarofim.Marcus@epa.gov]; Wolverton, Ann[Wolverton.Ann@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]
From: Williams, Melina
Sent: Mon 12/14/2015 9:24:36 PM
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Thanks, Kate. With that explanation, Ex. 5 - Attorney Client

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

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From: Shouse, Kate
Sent: Monday, December 14, 2015 4:19 PM
To: Williams, Melina <Williams.Melina@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; McGartland, Al <McGartland.Al@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>
Cc: Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Thanks,
Kate

From: Williams, Melina
Sent: Monday, December 14, 2015 3:58 PM
To: Manning, Bryan <manning.bryan@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; McGartland, Al <McGartland.Al@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>
Cc: Shouse, Kate <Shouse.Kate@epa.gov>; Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Ex. 5 - Attorney Client

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

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From: Manning, Bryan
Sent: Monday, December 14, 2015 3:35 PM
To: Williams, Melina <Williams.Melina@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; McGartland, Al <McGartland.Al@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>
Cc: Shouse, Kate <Shouse.Kate@epa.gov>; Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Sorry to bother everyone again. The Executive Office of the President (EOP) has weighed in on the OMB-OIRA edits, and below are EOP's comments on the revised disclaimer. See the

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Williams, Melina
Sent: Monday, December 14, 2015 3:05 PM
To: Rennert, Kevin <Rennert.Kevin@epa.gov>; McGartland, Al <McGartland.Al@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>
Cc: Shouse, Kate <Shouse.Kate@epa.gov>; Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

There are others on this email much more familiar with this issue than I am, so if someone else can improve on my language, please chime in.

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

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From: Rennert, Kevin
Sent: Monday, December 14, 2015 1:30 PM
To: McGartland, Al <McGartland.Al@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>
Cc: Shouse, Kate <Shouse.Kate@epa.gov>; Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Nor I.

From: McGartland, Al
Sent: Monday, December 14, 2015 1:29 PM
To: Griffiths, Charles
Cc: Shouse, Kate; Kopits, Elizabeth; Manning, Bryan; Davidson, Ken; Thrift, Mike; Jantarasami, Lesley; Sarofim, Marcus; Williams, Melina; Wolverton, Ann; Samulski, Michael;

Rennert, Kevin
Subject: Re: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Me too.

Sent from my iPhone

On Dec 14, 2015, at 1:27 PM, Griffiths, Charles <Griffiths.Charles@epa.gov> wrote:

Agreed. I have no problem with the edits

From: Shouse, Kate
Sent: Monday, December 14, 2015 1:20 PM
To: Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Cc: McGartland, Al <McGartland.Al@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Likewise, I think the edits look good. Thanks, Bryan.

From: Kopits, Elizabeth
Sent: Monday, December 14, 2015 1:07 PM
To: Manning, Bryan <manning.bryan@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Cc: McGartland, Al <McGartland.Al@epa.gov>; Rennert, Kevin

<Rennert.Kevin@epa.gov>
Subject: RE: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Hi Bryan,

OMB's edits to the overall disclaimer below look good to me.

Thanks,

Elizabeth

From: Manning, Bryan
Sent: Monday, December 14, 2015 1:01 PM
To: Shouse, Kate <Shouse.Kate@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>; Thrift, Mike <thrift.mike@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Kopits, Elizabeth <Kopits.Elizabeth@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>; Wolverton, Ann <Wolverton.Ann@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Subject: Info Papers FAA/MIT CBA: OMB OIRA comments on Disclaimer - PLEASE REVIEW

Hello,

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

I am very sorry for the late notice on these suggested edits. We just learned about these OMB-OIRA comments.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Birnbaum, Rona[Birnbaum.Rona@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Orlin, David[Orlin.David@epa.gov]
Cc: Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; Friedman, Kristina[Friedman.Kristina@epa.gov]; Gunning, Paul[Gunning.Paul@epa.gov]; Kocchi, Suzanne[Kocchi.Suzanne@epa.gov]; Thrift, Mike[thrift.mike@epa.gov]
From: Williams, Melina
Sent: Wed 10/14/2015 1:37:53 PM
Subject: RE: For your quick review: Reg Agenda entry for aircraft endangerment
Reg Plan Entry 5773 Oct 13 15 + mkw.docx

Thanks, Rona. Lesley let me know last night that you'd been able to secure an extension – thank you. The extra time to review was helpful. I've attached suggested edits – it should all be self-explanatory, but just let me know if there's anything here you would like to discuss.

Thanks,

Melina

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

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From: Birnbaum, Rona
Sent: Tuesday, October 13, 2015 2:50 PM
To: Manning, Bryan; Williams, Melina; Audette, Lucie; Orlin, David
Cc: Jantarasami, Lesley; Friedman, Kristina; Gunning, Paul; Kocchi, Suzanne
Subject: For your quick review: Reg Agenda entry for aircraft endangerment

Hi everyone,

If you could please have a quick look at the attached draft language for the Reg Plan Entry, we

would appreciate it. We took language from various previously developed documents like our preamble and fact sheets for the proposal. This is due today or possibly we may get an extension until tomorrow.

Thanks,

Rona & Lesley

To: Manning, Bryan[manning.bryan@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Sarofim, Marcus[Sarofim.Marcus@epa.gov]
Cc: Audette, Lucie[audette.lucie@epa.gov]
From: Birnbaum, Rona
Sent: Thur 11/6/2014 9:13:18 PM
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

My sense is, at this point, best to wait to see if any further changes are made after tomorrow's prebrief so that the workgroup doesn't have to keep reviewing numerous versions.

Thanks Bryan!

From: Manning, Bryan
Sent: Thursday, November 06, 2014 4:06 PM
To: Jantarasami, Lesley; DeAngelo, Ben; Birnbaum, Rona; Sarofim, Marcus
Cc: Audette, Lucie
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Thank you, Lesley. Should we send the revised pre-brief (that I just sent up to Janet) to the workgroup as well? Or should we wait until after tomorrow's briefing with Janet -- where we may need to make more changes (based on Janet's input)?

Thanks again,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Jantarasami, Lesley
Sent: Thursday, November 06, 2014 3:42 PM
To: DeAngelo, Ben; Manning, Bryan; Birnbaum, Rona; Sarofim, Marcus
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

I will send this combined Ben/Bryan response note to the workgroup.

Thanks,

Lesley

From: DeAngelo, Ben
Sent: Thursday, November 06, 2014 3:41 PM
To: Manning, Bryan; Birnbaum, Rona; Sarofim, Marcus; Jantarasami, Lesley
Subject: Re: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Fine to fwd by me, am not in my office now. But we can edit slightly for option selection.

Sent from my BlackBerry 10 smartphone on the Verizon Wireless 4G LTE network.

From: Manning, Bryan

Sent: Thursday, November 6, 2014 3:38 PM

To: DeAngelo, Ben; Birnbaum, Rona; Sarofim, Marcus; Jantarasami, Lesley

Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Lesley,

Below in bold red font is my response to Bruce Schillo for the reporting requirement questions (last question) – added to Ben's responses. I do not think we need to revise the Janet pre-brief based on these questions. I hope you agree.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: DeAngelo, Ben
Sent: Thursday, November 06, 2014 1:57 PM
To: Birnbaum, Rona; Sarofim, Marcus; Manning, Bryan; Jantarasami, Lesley
Subject: FW: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Proposed responses below…

From: Schillo, Bruce

Sent: Wednesday, November 05, 2014 5:51 PM
To: Manning, Bryan; Audette, Lucie; Birnbaum, Rona; Samulski, Michael; DeAngelo, Ben; Thrift, Mike; Benner, Tim; Dutton, Steven; McDow, Stephen; Sarofim, Marcus; Leggett, Cullen; Wolverton, Ann; Yen, David; Maeroff, Bruce; Gordon, Jessica M; Hockstad, Leif; Williams, Melina; Jantarasami, Lesley
Subject: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Here are my comments or questions on four topics:

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Bruce Schillo | Policy & Regulatory Analysis Division | Office of Policy | EPA
1200 Pennsylvania Avenue, NW | Mail Code 1803, WJC-N 3512-a | Washington, DC 20460
202-564-6552 | 202-564-7322 (fax) | schillo.bruce@epa.gov

To: Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; Birnbaum, Rona[Birnbaum.Rona@epa.gov]
Cc: Thrift, Mike[thrift.mike@epa.gov]; Orlin, David[Orlin.David@epa.gov]
From: Williams, Melina
Sent: Tue 10/13/2015 7:15:00 PM
Subject: FW: For your quick review: Reg Agenda entry for aircraft endangerment
Reg Plan Entry 5773.Oct.13.15.docx

I will take a look. Just out of curiosity, did we get any significant pushback in the comments on the endangerment finding?

Melina Williams | US EPA | Office of General Counsel | Air and Radiation Law Office | Mail Code 2344A | phone: (202) 564-3406 | fax: (202) 564-5603

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From: Birnbaum, Rona
Sent: Tuesday, October 13, 2015 2:50 PM
To: Manning, Bryan; Williams, Melina; Audette, Lucie; Orlin, David
Cc: Jantarasami, Lesley; Friedman, Kristina; Gunning, Paul; Kocchi, Suzanne
Subject: For your quick review: Reg Agenda entry for aircraft endangerment

Hi everyone,

If you could please have a quick look at the attached draft language for the Reg Plan Entry, we would appreciate it. We took language from various previously developed documents like our preamble and fact sheets for the proposal. This is due today or possibly we may get an extension until tomorrow.

Thanks,

Rona & Lesley

To: Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Samulski, Michael
Sent: Tue 1/13/2015 1:56:11 PM
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

FYI

From: Hengst, Benjamin
Sent: Monday, January 12, 2015 4:18 PM
To: Samulski, Michael
Cc: Charmley, William
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Hi Mike,

On the ANPR, I had comments on an earlier draft, and I plan to take a look at the current draft tonight. However, I won't be a bottleneck, and if I have any comments they can be integrated when you are addressing the workgroup's comments.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Any thoughts on that approach?

Ben

From: Samulski, Michael
Sent: Monday, January 12, 2015 4:03 PM
To: Hengst, Benjamin
Cc: Charmley, William
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Ben,

I will talk to Bill about this. I wanted to ask you about this and have 2 other questions…

1) Do you plan to have comments on the ANPR? Our schedule is to get this to Workgroup tomorrow by 3:00, which means pens-down around 1:00.

Ex. 5 - Deliberative Process

Thanks,

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

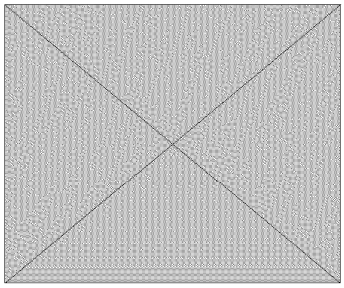
From: Hengst, Benjamin
Sent: Monday, January 12, 2015 3:56 PM
To: Charmley, William; Samulski, Michael
Cc: Stewart, Gwen
Subject: RE: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Friday, January 09, 2015 5:42 PM
To: Charmley, William; Hengst, Benjamin; Samulski, Michael
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Here they come!

From: Young, Nancy [mailto:NYoung@airlines.org]
Sent: Friday, January 09, 2015 5:35 PM
To: Grundler, Christopher
Cc: Maurice, Lourdes
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard



January 9, 2015

Submitted By Email to *Grundler.christopher@Epa.gov*

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

Nancy N. Young

Vice President, Environmental Affairs

cc: Lourdes Maurice, FAA, via email Lourdes.maurice@faa.gov

Nancy N. Young

Vice President, Environmental Affairs

Airlines for America

We Connect the World

1301 Pennsylvania Ave, NW, Suite 1100

Washington, DC 20004

Phone: (202) 626-4207

email: nyoung@airlines.org

VISIT US:

[1] Besides being well-established for international standard-setting, the CAEP Terms of Reference and the ICAO/CAEP standard-setting process align well with the bases for the adoption of aircraft engine emission standards by EPA and FAA under Section 231 of the Clean Air Act.

To: Manning, Bryan[manning.bryan@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
Cc: Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Sarofim, Marcus[Sarofim.Marcus@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
From: Birnbaum, Rona
Sent: Thur 11/6/2014 2:21:01 PM
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Ex. 5 - Deliberative Process

Talk to you later…email is fine.

From: Manning, Bryan
Sent: Thursday, November 06, 2014 9:18 AM
To: Birnbaum, Rona; Audette, Lucie
Cc: Jantarasami, Lesley; DeAngelo, Ben; Sarofim, Marcus; Jantarasami, Lesley
Subject: RE: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Okay, Rona. Many thanks for your message. I am around all day except for a noon meeting. Let me know when we need to chat (or maybe email exchanges will suffice). It sounds like you are planning on revising the Options Selection briefing (a few slides) for the pre-brief with Janet tomorrow. Correct?

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Birnbaum, Rona
Sent: Thursday, November 06, 2014 8:42 AM
To: Manning, Bryan; Audette, Lucie
Cc: Jantarasami, Lesley; DeAngelo, Ben; Sarofim, Marcus; Jantarasami, Lesley
Subject: FW: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

deliberative

Ex. 5 - Deliberative Process

Thanks, Rona

From: Schillo, Bruce
Sent: Wednesday, November 05, 2014 5:51 PM
To: Manning, Bryan; Audette, Lucie; Birnbaum, Rona; Samulski, Michael; DeAngelo, Ben; Thrift, Mike; Benner, Tim; Dutton, Steven; McDow, Stephen; Sarofim, Marcus; Leggett, Cullen; Wolverton, Ann; Yen, David; Maeroff, Bruce; Gordon, Jessica M; Hockstad, Leif; Williams, Melina; Jantarasami, Lesley
Subject: OP comments on Options Selection briefing for Janet (Aircraft GHG endangerment/ANPR)

Here are my comments or questions on four topics:

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

To: Audette, Lucie[audette.lucie@epa.gov]
Cc: Mylan, Christopher[Mylan.Christopher@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]
From: Birgfeld, Erin
Sent: Wed 8/20/2014 2:01:09 AM
Subject: Re: Aircraft Endangerment Finding: Moving Out

Thanks Lucie. Let's hope Janet agrees. It will be nice to be able to answer these questions. Thanks for keeping us in the loop.

Sent from my iPhone

On Aug 19, 2014, at 4:47 PM, "Audette, Lucie" <audette.lucie@epa.gov> wrote:

From: Charmley, William
Sent: Tuesday, August 19, 2014 6:05 AM
To: Manning, Bryan; Audette, Lucie; Samulski, Michael; Passavant, Glenn
Subject: Fw: Aircraft Endangerment Finding: Moving Out

Bill Charmley, US EPA
Assessment and Standards Division
Office of Transportation and Air Quality
Ann Arbor, Michigan
Desk ph = 734-214-4466
Mobile ph = 734-545-0333
Email = charmley.william@epa.gov

From: Grundler, Christopher <grundler.christopher@epa.gov>

Sent: Monday, August 18, 2014 11:04 PM

To: McCabe, Janet

Cc: Charmley, William; Hengst, Benjamin; Dunham, Sarah

Subject: Aircraft Endangerment Finding: Moving Out

Janet:

Ex. 5 - Deliberative Process

From: Grundler, Christopher <grundler.christopher@epa.gov>

Sent: Friday, July 11, 2014 4:43 PM

To: McCabe, Janet

Cc: Charmley, William; Dunham, Sarah

Subject: Aircraft GHG Endangerment Communications

Janet:

Ex. 5 - Deliberative Process

C.

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

To: Manning, Bryan[manning.bryan@epa.gov]; Jantarasami, Lesley[Jantarasami.Lesley@epa.gov]
Cc: Audette, Lucie[audette.lucie@epa.gov]; DeAngelo, Ben[DeAngelo.Ben@epa.gov]; Hockstad, Leif[Hockstad.Leif@epa.gov]
From: Birnbaum, Rona
Sent: Wed 11/5/2014 7:30:05 PM
Subject: RE: Aircraft endangerment (Option Selection comments from Janet)
Draft Options Selection Aircraft for Janet McCabe 11-5-14 rb bjd.pptx

Bryan. See our comments on slides 3, 5, and 9. Let me know if you have any questions.
Thanks, Rona

-----Original Message-----
From: Manning, Bryan
Sent: Wednesday, November 05, 2014 11:30 AM
To: Birnbaum, Rona; Jantarasami, Lesley
Cc: Audette, Lucie; DeAngelo, Ben; Hockstad, Leif
Subject: RE: Aircraft endangerment (Option Selection comments from Janet)

Hello Lesley and Rona,

Attached please find a few revisions to the Option Selection briefing based on Janet's comments below.
See red and strike out font on slides 3 and 9 (note, **Ex. 5 - Deliberative Process**
Ex. 5 - Deliberative Process Let me know if you have any comments on these changes.
Thank you,

Bryan

Bryan Manning
U.S. EPA Office of Transportation and Air Quality Large Marine and Aviation Center
2000 Traverwood Drive
Ann Arbor, MI 48105
(ph) 734-214-4832 (fax) 734-214-4816
manning.bryan@epa.gov

-----Original Message-----
From: Birnbaum, Rona
Sent: Wednesday, November 05, 2014 8:33 AM
To: Manning, Bryan; Jantarasami, Lesley
Cc: Audette, Lucie; DeAngelo, Ben; Hockstad, Leif
Subject: RE: Aircraft endangerment (Option Selection comments from Janet)

Ok, I just got the comments through my chain as well. If you want to go ahead and make suggested changes and please send to both Leif Hockstad and Ben DeAngelo as well.
Thanks Bryan!

Rona

-----Original Message-----
From: Manning, Bryan
Sent: Wednesday, November 05, 2014 8:30 AM
To: Jantarasami, Lesley
Cc: Birnbaum, Rona; Audette, Lucie
Subject: FW: Aircraft endangerment (Option Selection comments from Janet)

Hello Lesley,

See the below email from Janet. As I recall, I believe you are at jury duty today so I will make these changes (based on Janet's comments) and send a revised version to you (and Rona).

Thank you,

Bryan

Bryan Manning
U.S. EPA Office of Transportation and Air Quality Large Marine and Aviation Center
2000 Traverwood Drive
Ann Arbor, MI 48105
(ph) 734-214-4832 (fax) 734-214-4816
manning.bryan@epa.gov

-----Original Message-----
From: Hengst, Benjamin
Sent: Wednesday, November 05, 2014 7:55 AM
To: Samulski, Michael
Cc: Charmley, William; Audette, Lucie; Manning, Bryan
Subject: Fw: Aircraft endangerment

I'm sure you'll get this from Chris, too....
Original Message
From: McCabe, Janet <McCabe.Janet@epa.gov>
Sent: Wednesday, November 5, 2014 7:50 AM
To: Grundler, Christopher; Dunham, Sarah; Hengst, Benjamin
Cc: Niebling, William
Subject: Aircraft endangerment

Ex. 5 - Deliberative Process

Thanks
Sent from my iPhone

To: Scoville, Pat[Scoville.Pat@epa.gov]; Ghanta, Venu[Ghanta.Venu@epa.gov]
Cc: Samulski, Michael[samulski.michael@epa.gov]; Manning, Bryan[manning.bryan@epa.gov]
From: Audette, Lucie
Sent: Thur 5/15/2014 4:58:33 PM
Subject: Changes to the RegDaRRT Data Sheet for proposed GHG Aircraft Endangerment.
Reg DaRRT Data Sheet Aircraft GHG 5773_ text changes 5-15-2014.docx

Pat and Venu, Not sure if you need proposed thess changes to the info sheet at this time since we are not ready to have this posted on the RegDart website. But just in case, please see the attached updated form. Both OAP and OGC have weighed in and we are in agreement with these changes. Thanks. Lucie

To: Sutton, Tia[sutton.tia@epa.gov]
Cc: Leggett, Cullen[Leggett.Cullen@epa.gov]; Charmley, William[charmley.william@epa.gov]; Samulski, Michael[samulski.michael@epa.gov]; Audette, Lucie[audette.lucie@epa.gov]
From: Manning, Bryan
Sent: Thur 8/31/2017 10:06:09 PM
Subject: RE: For your review: Q&As on Aircraft Endangerment for OCIR AA binder
Aircraft Endangerment Draft QA 8.29 +ASD com.docx

Hi Tia,

Attached please find our comments. Bill okay'd these comments. Let us know if you have any questions. Note, Mike, Lucie, Cullen, and I will be out of the office tomorrow.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, August 31, 2017 2:26 PM
To: Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Cc: Leggett, Cullen <Leggett.Cullen@epa.gov>
Subject: RE: For your review: Q&As on Aircraft Endangerment for OCIR AA binder

Hi all,

Lucie just flagged for me that OTAQ folks didn't see/write the one-pager I mentioned below, so I've attached the one-pager that went to the OCIR AA here, in case it's helpful for your review of the Q&As that I sent.

(And apologies on that one – my counterpart in OAP is new and didn't realize that we should've gotten at least a chance to review, so I unfortunately didn't know that Aircraft GHG had been flagged as an item until I happened to notice this in the Q&A list and the one-pager itself was already in the hands of the OCIR AA; so I did let her know we needed to at least get review on the Q&As.)

Thanks,

Tia

From: Sutton, Tia
Sent: Thursday, August 31, 2017 1:10 PM
To: Samulski, Michael <samulski.michael@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Cc: Leggett, Cullen <Leggett.Cullen@epa.gov>
Subject: FW: For your review: Q&As on Aircraft Endangerment for OCIR AA binder

Hi all,

As part of the effort for the OCIR AA, Troy Lyons, getting up to speed on EPA issues (for when an OAR AA is nominated), we have now been asked to review draft Q&As. These Q&As were drafted for us to decrease the workload and OAP has reviewed & edited, but is sending our way to give it a quick review (they will then send to OGC).

Please take a look at the attached draft, and send any edits you may have by **noon on Friday, 9/1** (or earlier if at all possible).

If you have any questions on any of this or need more background, please let me know. And please of course loop in others as you see fit (including Bill, once you've made edits/okayed).

Thanks,

Tia

To: Zaremski, Sara[zaremski.sara@epa.gov]; Greuel, Justin[Greuel.Justin@epa.gov]
From: Manning, Bryan
Sent: Wed 3/9/2016 8:33:38 PM
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Hello Sara,

Ex. 5 - Deliberative Process

I hope this is helpful. Let me know if you have any other questions.

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Zaremski, Sara
Sent: Tuesday, March 08, 2016 2:08 PM
To: Greuel, Justin <Greuel.Justin@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Bryan,

Ex. 5 - Deliberative Process

sara

From: Greuel, Justin
Sent: Monday, March 07, 2016 8:14 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Zaremski, Sara <zaremski.sara@epa.gov>
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Perfect. Thanks for the quick confirmation.

Justin

From: Manning, Bryan
Sent: Monday, March 07, 2016 8:14 AM

To: Greuel, Justin <Greuel.Justin@epa.gov>
Cc: Zaremski, Sara <zaremski.sara@epa.gov>
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Justin,

Ex. 5 - Deliberative Process

Thanks,

Bryan

Bryan Manning

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(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Greuel, Justin
Sent: Friday, March 04, 2016 2:42 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Zaremski, Sara <zaremski.sara@epa.gov>
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Bryan,

Ex. 5 - Deliberative Process

Thanks for the help,

Justin

From: Manning, Bryan
Sent: Thursday, March 03, 2016 8:50 AM
To: Greuel, Justin <Greuel.Justin@epa.gov>
Subject: RE: OTAQ In the News: First Ever CO2 Standard for Aircraft

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

I hope this helps some.

Thanks again,

Bryan

Bryan Manning

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(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Greuel, Justin
Sent: Thursday, March 03, 2016 8:24 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: FW: OTAQ In the News: First Ever CO2 Standard for Aircraft

Bryan,

Ex. 5 - Deliberative Process

Thanks,

Justin

From: Grundler, Christopher
Sent: Tuesday, February 16, 2016 10:43 AM
To: OAR-OTAQ <OAROTAQ@epa.gov>
Subject: OTAQ In the News: First Ever CO2 Standard for Aircraft

Dear Colleagues:

I am sharing a note from Bill Charmley to ASD about another first in transportation emissions control accomplished by some of our peers in OTAQ. As Janet McCabe pointed out to our aviation team, some things take a long time and are really difficult. Sometimes they involve other parties who have different ideas about the outcome they want. Both of those sentences are true about the recently concluded international aviation negotiations where the member countries agreed--after a week of tense negotiations but literally years to get there--for the first time ever to set CO2 emission standards for new and in production aircraft. Both Janet and I know without a doubt that this outcome is both a game changer and would not have happened but for the work of the EPA team.

Chris

From: Charmley, William
Sent: Tuesday, February 16, 2016 8:35 AM
To: OAR-OTAQ-ASD <OAROTAQASD@epa.gov>
Cc: Grundler, Christopher <grundler.christopher@epa.gov>
Subject: ASD takes Montreal by storm!

Dear all,

Last week in Montreal, Canada something amazing happened, and I want all of you to know about it.

The International Civil Aviation Organization (ICAO)'s Committee on Aviation Environmental Protection (CAEP) agreed to the first ever international CO2 standards for aircraft. Leading the way for the world was the United States, who was represented by EPA and the Federal Aviation Administration. Our very own Mike Samulski and Bryan Manning represented EPA.

This decision by CAEP to establish CO2 standards is a significant accomplishment, and the work by the dedicated ASD staff was central to the final agreement. Over the past 6 years ASD made important contributions to the underlying science and decision making process used by this United Nations sanctioned organization. At CAEP nearly every nation is represented by their transportation and/or aircraft industry. Environmental protection is not a priority for most of these nations – growing their airline industry and domestic manufacturing industry is the priority.

I would like to thank all of the members of our aircraft team for their hard work and dedication to this project:

Mike Samulski

Bryan Manning

Cullen Leggett

David Yen

John Mueller

Bob Giannelli

Michael Aldridge

Lucie Audette

Bruce Maeroff

Matt Spears (Matt spend 2010/2011 helping to get this project started)

The ASD aircraft team developed a strategy of embedding themselves into each of the 3 major working groups assigned to develop these standards. They became expert in all of the major analytical tools and modeling systems which allowed them to argue the points based on the merits of the data. And, for the first time in the 30+ year history of CAEP, US EPA developed unique data and analysis which had to be considered by CAEP. In the past, all data on technology performance and costs had only come from the industry. This was just one of many firsts that became a reality because of the EPA teams involvement – including the first ever standards by CAEP that will apply to the future production of existing designs of aircraft, not just newly designed aircraft.

Below is an opinion from the Editorial Board of the New York Times which summarizes the decision by CAEP and puts it into perspective. This is a huge first step, which we will be building on over the next 2 years as we work to adopt new CO2 standards for aircraft under our

authority in the Clean Air Act through a notice-and-comment pubic rulemaking.

I will not be in the office this week to talk to them in person – but for those of you who are please take a minute to congratulate our colleagues on this important accomplishment.

Thanks

Bill

http://www.nytimes.com/2016/02/14/opinion/jets-will-no-longer-get-a-free-ride-on-carbon-emissions.html?smprod=nytcore-iphone&smid=nytcore-iphone-share

Editorial

Jets Will No Longer Get a Free Ride on Carbon Emissions

By THE EDITORIAL BOARD

FEB. 13, 2016

It has been almost 50 years since the federal government began setting standards for automobile emissions. It is also about a half-century since the introduction of wide-body jets set off a runaway expansion of the aviation industry. About 3.8 billion people are expected to fly this year, 50 times as many as 50 years ago — making planes the fastest-growing source of carbon dioxide emissions, although they have faced none of the limits set on cars or trucks. That is, until last week, when the International Civil Aviation Organization, a United Nations agency, finally proposed the first binding limits on aircraft emissions.

This is a welcome development, even if it has left many environmental groups disappointed. They have argued, not unreasonably, that the agency set the bar far too low. Existing planes wouldn't have to improve their efficiency, and aircraft under development would need do no more than meet the emissions goals set by manufacturers. Automakers in the United States, by contrast, must nearly double their fuel economy by 2025.

But planes are not cars; they take far longer to develop and are less adaptable to the sorts of electric or hybrid power sources that are reshaping the auto industry. That's not to say it can't happen — the budget carrier easyJet announced plans this month to test the use of a hybrid system when an aircraft is taxiing.

For now, however, what is important is that an industry that accounts for almost 2 percent of global carbon dioxide emissions — about the same as Germany — and that is projected to double the number of passengers and flights by 2030 will finally join other major sources of greenhouse gas pollution that are subject to international emissions controls.

The proposed standards will at the least prevent airlines from backsliding on emissions as tens of thousands of large new aircraft enter service. The standards would require a 4 percent reduction in fuel consumption from 2015 levels for planes delivered in 2028 and beyond. And there are limits based on the size of the aircraft for planes already in production that are to be delivered after 2023.

The history of pollution controls has shown that the first step, however modest, is often the most important in raising confidence and creating momentum toward greater change. In this case, the timing is important, since the clock is running out on the Obama administration.

The United States accounts for half of all carbon dioxide emissions from planes, and limiting aviation emissions has been high on President Obama's environmental agenda. But the international agreement took more than six years to negotiate, and it still needs approval from the group's larger council and then its full assembly, followed by laws or regulations in each of the 36 member states. Mr. Obama has the authority to set the standards. That is about all he can hope to achieve on this front in his remaining months, and if it happens, it will be no mean feat.

To: Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Manning, Bryan
Sent: Wed 2/3/2016 3:53:19 PM
Subject: FW: aircraft GHG endangerment FRM (Docketing questions)

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, January 21, 2016 11:46 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>
Subject: Re: aircraft GHG endangerment FRM (Docketing questions)

Whoa- that was a very long "yes"! :-)

Ex. 5 - Deliberative Process

Sent from my iPhone

On Jan 21, 2016, at 11:38 AM, Manning, Bryan <manning.bryan@epa.gov> wrote:

Hello Tia,

Ex. 5 - Deliberative Process

Boeing: Peter Pagano, Sean Newsum, Dan Allyn, and Bob Peterson

EPA: Janet, Chris, Bill, Mike, Lucie, and Bryan

If you have different information on the participants, let me know.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Thrift, Mike
Sent: Thursday, January 21, 2016 11:28 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Attorney Client

From: Manning, Bryan
Sent: Thursday, January 21, 2016 6:53 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Subject: aircraft GHG endangerment FRM (Docketing questions)

Hello Mike,

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Manning, Bryan
Sent: Wed 2/3/2016 3:52:36 PM
Subject: FW: aircraft GHG endangerment FRM (Docketing questions)
4_Tier 3 Phone Log.doc
3_Tier 3 Meeting Log.doc

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, January 21, 2016 2:05 PM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

See attached!

Ex. 5 - Deliberative Process

And I'll pass on the Jan 5th meeting sign-in as soon as I get it.

From: Manning, Bryan

Sent: Thursday, January 21, 2016 12:08 PM
To: Sutton, Tia <sutton.tia@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Thank you for the suggestion, Tia. Yes, I would like to see the sample version of the mtg log.

Thanks again,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Sutton, Tia
Sent: Thursday, January 21, 2016 11:46 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Cc: Samulski, Michael <samulski.michael@epa.gov>
Subject: Re: aircraft GHG endangerment FRM (Docketing questions)

Whoa- that was a very long "yes"! :-)

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process st ou

Sent from my iPhone

On Jan 21, 2016, at 11:38 AM, Manning, Bryan <manning.bryan@epa.gov> wrote:

Hello Tia,

Ex. 5 - Deliberative Process at

Boeing: Peter Pagano, Sean Newsum, Dan Allyn, and Bob Peterson

EPA: Janet, Chris, Bill, Mike, Lucie, and Bryan

If you have different information on the participants, let me know.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Thrift, Mike
Sent: Thursday, January 21, 2016 11:28 AM
To: Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: aircraft GHG endangerment FRM (Docketing questions)

Ex. 5 - Attorney Client

From: Manning, Bryan
Sent: Thursday, January 21, 2016 6:53 AM
To: Thrift, Mike <thrift.mike@epa.gov>
Subject: aircraft GHG endangerment FRM (Docketing questions)

Hello Mike,

Ex. 5 - Attorney Client

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

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2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

To: Griffiths, Charles[Griffiths.Charles@epa.gov]
From: Manning, Bryan
Sent: Tue 11/10/2015 4:20:37 PM
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Ok, Charles. That is fine.

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Griffiths, Charles
Sent: Tuesday, November 10, 2015 11:19 AM
To: Manning, Bryan <manning.bryan@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

I'll call you, if that is ok.

From: Manning, Bryan

Sent: Tuesday, November 10, 2015 11:09 AM
To: Griffiths, Charles <Griffiths.Charles@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Charles, is there a call-in number for the 11:30?

Thanks,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Griffiths, Charles
Sent: Tuesday, November 10, 2015 11:08 AM
To: Manning, Bryan <manning.bryan@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thank you.

From: Manning, Bryan
Sent: Tuesday, November 10, 2015 11:06 AM
To: Griffiths, Charles <Griffiths.Charles@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thank you for the message, Charles. 11:30 today works for me. I look forward to talking with you.

Thanks again,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Griffiths, Charles
Sent: Tuesday, November 10, 2015 10:49 AM
To: Shouse, Kate <Shouse.Kate@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thanks for the email this morning, Lesley. As Kate said, NCEE would be interested in providing technical comments on the FAA information paper.

I would also like to get a better handle on how this paper relates to the ICAO standards decision and how it might impact the EPA rulemaking on aviation engine standards. Would you and Bryan be available to have a very quick chat to make sure I understand how this paper fits into the EPA efforts. We are going to brief our new AA, Laura Vaught, on this issue and I would like to make sure I fully understand the ICAO and EPA timeline and the impact of this paper on our EPA.

Leslie and Bryan, would you both be available for a quick conversation at 11:30 today? I can conference you both in.

Thanks,

Charles

****
Charles Griffiths
National Center for Environmental Economics
Room 4334B, WJC West, Mail Code 1809T
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460
Phone: 202/566-2288 Fax: 202/566-2338
Email: griffiths.charles@epamail.epa.gov
****

From: Shouse, Kate
Sent: Tuesday, November 10, 2015 10:27 AM

To: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Griffiths, Charles <Griffiths.Charles@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>
Subject: RE: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)

Thanks, Lesley. I was just in a meeting with Charles and his NCEE colleagues. NCEE is interested in providing technical comments (climate science and economics) and will coordinate those comments with OAP and OTAQ. (We haven't discussed specifics but I'm happy to consolidate if we don't have time to stagger commenters.)

Charles will be in touch with you and Bryan soon to discuss questions about the ICAO process and implications for EPA's endangerment finding work.

From: Jantarasami, Lesley
Sent: Tuesday, November 10, 2015 9:59 AM
To: Griffiths, Charles <Griffiths.Charles@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>
Subject: FW: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)
Importance: High

Hi Charles,

Ex. 5 - Deliberative Process

It would be great if everyone interested in reviewing and providing comment on these papers from the SCC perspective could coordinate their reviews. Kate, have you heard anything about a process for coordinating comments between OP and OAR?

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

From: Manning, Bryan
Sent: Tuesday, November 10, 2015 8:14 AM
To: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Shouse, Kate <Shouse.Kate@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>; Davidson, Ken <Davidson.Ken@epa.gov>
Cc: Yen, David <Yen.David@epa.gov>; Maeroff, Bruce <Maeroff.Bruce@epa.gov>
Subject: FAA/MIT Aircraft CO2 Standard Cost-Benefit Analyses (for EPA Review)
Importance: High

Hello,

See below/attached. We have finally received the US draft information papers (IP) with FAA/MIT's cost-benefit analysis (from FAA). As you may recall, they have a global IP and US IP (or global and US cost-benefit analyses). Comments are due back to FAA by November 20. I realize you all are working the four main issues already (non-CO2 benefits, discount rates, SCC, and non-GHG criteria pollutant impacts/benefits), but let me know if you have any comments on these attached IPs. If needed, I will arrange a call for us to coordinate on our feedback to FAA on these IPs. Let me know if you have any questions. Many thanks for your help.

Kind regards,

Bryan

Bryan Manning

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(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Laszlo.Windhoffer@faa.gov [mailto:Laszlo.Windhoffer@faa.gov]
Sent: Monday, November 09, 2015 6:34 PM
To: Manning, Bryan <manning.bryan@epa.gov>; Leggett, Cullen <Leggett.Cullen@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>
Cc: Ralph.Iovinelli@faa.gov
Subject: CO2 Standard Cost-Benefit Analyses (EPA Review)
Importance: High

Dear Mike, Bryan, Cullen,

For your review, attached are the Global and US-only cost-benefit analyses of the CO_2 standard. The documents are in information paper format for the upcoming CAEP/10 meeting. Please share with your EPA colleagues who can also provide feedback.

Please note that while the documents have gone through a number of rounds of review, and although they are now ready to be shared with you, they are not final. These versions are undergoing further reviews by FAA.

Although the papers are long, if at all possible I would **appreciate your feedback within the next 2 weeks (by latest Friday Nov 20)**. This would leave approximately 2-3 weeks (prior to the 12/4 deadline) in order to address any comments you may have, and potentially allow for another short review.

Looking forward to your feedback.

Thank you

László Windhoffer
Federal Aviation Administration
Office of Environment & Energy
800 Independence Avenue, S.W.
Washington, DC 20591
T: +1-202-267-4741

To: Waltzer, Sam[Waltzer.sam@epa.gov]
From: Manning, Bryan
Sent: Thur 6/11/2015 1:21:15 PM
Subject: RE: Congratulations! -- OTAQ In the News

Many thanks, Sam. It is much appreciated. Yes, there is still a lot of work to do.

Best regards,

Bryan

Bryan Manning

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Large Marine and Aviation Center

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(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Waltzer, Sam
Sent: Thursday, June 11, 2015 8:52 AM
To: Manning, Bryan
Subject: Congratulations! -- OTAQ In the News

Congratulations on getting the aviation work past this milestone! Very technically and politically challenging. Take an extra 15 minute coffee break and then get to work on those standards!

- Sam

Sam Waltzer

SmartWay Technology

USEPA

waltzer.sam@epa.gov

(202) 343-9175

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 6:04 PM
To: OAR-OTAQ
Cc: Dunham, Sarah; Gunning, Paul; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley; McCabe, Janet; Millett, John; StClair, Christie; Purchia, Liz; Reynolds, Thomas
Subject: OTAQ In the News

Dear Colleagues

Today we reached an important milestone on our journey to address greenhouse gas emissions from aviation, a journey which began in a very cold Montreal, Canada (Matt Spears and I were there!) in 2010. Since that time, first under the leadership of Matt, and now with the leadership of Mike Samulski, we have been actively engaged in an international process that has established for the first time metrics and test procedures for CO2 from aircraft, and is now considering the stringency, timing, and applicability of standards. This process is happening at a specialized United Nations Agency, the International Civil Aviation Organization.

Aircraft account for 11% of U.S. transportation emissions, and 29% of global transport emissions, and are growing fast. Our Agency took the first step in establishing possible emissions standards for aircraft by announcing a proposed endangerment finding under the Clean Air Act. If the Administrator makes a final determination next spring that emissions from aircraft endanger public health and welfare, EPA has a duty to establish emission standards for aircraft engines. Today we also issued an Advanced Notice of Proposed Rulemaking that describes the ongoing international standard-setting process, and seeks public input to the

decisions that will be made over the coming year. Mike and his team will be working hard, alongside our colleagues at the FAA, to make sure ICAO adopts a meaningful standard, one that achieves emission reductions beyond business as usual.

The announcement today is also the culmination of tremendous teamwork between OTAQ and the Office of Atmospheric Programs, where the EPA experts on the complex science of climate change do their heroic work. Rona Birnbaum and her team led the work to update their historic 2009 Endangerment finding, the finding that set the course for the light and heavy duty greenhouse gas standards that we are busy implementing now.

I want to thank the OTAQ-OAP Aviation team for their hard work, patience, and persistence. Working in an international forum is time-consuming, frustrating, and painfully slow. This is the nature of environmental diplomacy. But the rewards are great for those that can endure, as the results have such far-reaching impacts. I am confident that Mike and our team will.

Below is a summary of stakeholder statements gathered so far, as well as coverage from the Washington Post. Many thanks to our outstanding communications team who once again put together a great roll-out despite the usual dynamic EPA environment.

-Chris

Industry/ Business

Airlines for America | Nancy Young, Vice President, Environmental Affairs

"While we believe that any regulatory action must be consistent with both the agency's authority under the Clean Air Act and the future ICAO standard, today's action reconfirms the EPA's commitment to the ICAO process for achieving a global CO2 standard for new aircraft." [Press release, 6/10/2015]

Environmental/Non-Profit Association

Environment America | Anna Aurilio, Director

"President Obama clearly views climate action as a priority, while polluters and their allies in Congress clearly view stopping climate action a priority. Since today's announcement will likely cause a fight in Congress, we hope the president makes this a fight worth having by requiring real cuts in airplane pollution. Bold action on climate should solve the problem of pollution from airplanes, not just acknowledge it." [Press Release, 6/10/2015]

Earth Justice | Sarah Burt, Attorney

"We commend EPA for completing this important first step in regulating carbon pollution from airplanes, but unfortunately, given the magnitude of aircraft's contribution to climate change, the tentative approach that EPA is considering is not up to the task. The EPA's Endangerment Finding confirms that aircraft are a significant source of climate pollution, emitting approximately 700 million metric tonnes per year. This makes global aviation, if it were equivalent to a country, the 7th largest global emitter, just below Germany and more than Korea and Canada. Instead of using its Clean Air Act authority to reduce these harmful emissions, EPA proposes to follow the lead of the International Civil Aviation Organization and set a 'business-as-usual' standard that will lock in emissions increases for decades to come. We strongly urge EPA to reconsider and to fulfill its Clean Air Act obligations by proposing a rule that accomplishes meaningful reductions in pollution from aircraft. The International Civil Aviation Organization's standard won't deliver substantial reductions because they are setting a standard that 90–95% of aircraft already meet. It won't apply it to existing aircraft, which have 20–30 year lifespan—only to new designs, which would push back the phase-in even more. The U.S. share of the problem is considerable, and a more robust U.S. action could help ratchet up the international standard." [Press Release, 6/10/2015]

Sierra Club | Joanne Spalding, Attorney

"President Obama is taking an important step on climate once again by finding that carbon pollution from airplanes poses the same danger to our climate as carbon pollution from other sources. This finding paves the way for action next year to create safeguards that will result in more efficient airplanes which pollute less while saving airlines and air travelers money on fuel costs. This commonsense finding comes in the context of the momentum building for international negotiations to tackle the climate crisis this year in Paris. The United States will soon be in a position to effectively curb carbon pollution from its biggest sources, whether from

cars, trucks, planes, or the electric sector."

[Press Release, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies. [Statement, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"With today's announcement, President Obama has a unique and extremely important opportunity to demonstrate leadership not only domestically but around the world." [Statement, 6/10/2015]

Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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Resize Text Print Article Comments 18

By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

“Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level,” Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. “While we believe that any regulatory action must be consistent with both the agency’s authority under the Clean Air Act and the future ICAO standard, today’s action reconfirms the EPA’s commitment to the ICAO process for achieving a global CO2 standard for new aircraft.”

The EPA’s move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

“This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled,” said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it’s adequate. “Typically what ICAO does is a very weak standard,” adds Margo Oge, former director of the EPA’s Office of Transportation and Air Quality, and author of the book “Driving the Future: Combating Climate Change with Cleaner, Smarter Cars.” “Aircraft are the least-regulated source of transportation when it comes to emissions.”

But the EPA’s Christopher Grundler, head of the agency’s Office of Transportation and Air Quality, defended the international approach Wednesday, observing that “an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction.”

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the

latter. In its news release, the EPA asks for comment on which approach is effective: “whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs.”

“The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines,” said the National Association of Clean Air Agencies’ Becker.

But the EPA did suggest that it could go further than the ICAO standards do. “Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO,” the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

“Automation would mean more efficient routing, and particularly less time spent going up and down as you’re coming to land,” said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Yen, David[Yen.David@epa.gov]; Maeroff, Bruce[Maeroff.Bruce@epa.gov]
From: Manning, Bryan
Sent: Mon 1/12/2015 4:29:22 PM
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard
Letter to Chris Grundler re Meeting 1-9-15.pdf

From: Samulski, Michael
Sent: Monday, January 12, 2015 10:32 AM
To: Manning, Bryan; Audette, Lucie; Leggett, Cullen
Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Nancy Young requested a meeting with Chris Grundler. I haven't heard if/when this meeting will take place.. I expect we will need to pull together a 1-pager for Chris.

Mike

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

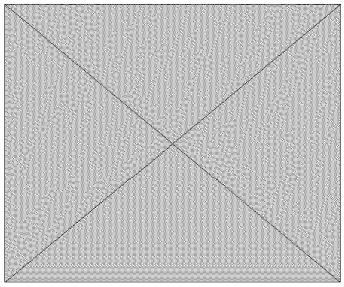
****

From: Grundler, Christopher
Sent: Friday, January 09, 2015 5:42 PM
To: Charmley, William; Hengst, Benjamin; Samulski, Michael

Subject: FW: A4A Request for a Meeting to Discuss the ICAO CO2 Standard

Here they come!

From: Young, Nancy [mailto:NYoung@airlines.org]
Sent: Friday, January 09, 2015 5:35 PM
To: Grundler, Christopher
Cc: Maurice, Lourdes
Subject: A4A Request for a Meeting to Discuss the ICAO CO2 Standard



January 9, 2015

Submitted By Email to *Grundler.christopher@Epa.gov*

Christopher Grundler

Director, Office of Transportation and Air Quality (OTAQ)

U.S. Environmental Protection Agency

Washington, DC

Re: Request for a Meeting to Discuss Progress on Development of an ICAO Aircraft Certification Standard for Carbon Dioxide and the Predicates for Adoption into U.S. Law

Dear Chris:

I write to request a meeting with you within the coming weeks to discuss the progress at the International Civil Aviation Organization (ICAO) to develop an aircraft certification standard for carbon dioxide (CO_2) for approval at the February 2016 meeting of the ICAO Committee on Aviation Environmental Protection (CAEP) and action the U.S. government plans to take under Section 231 of the Clean Air Act to prepare for adoption of such a standard under U.S. law.

As you know, Airlines for America (A4A) and our members remain committed to the development of an appropriate CO_2 standard meeting the CAEP Terms of Reference.[1] We are pleased with the progress being made at ICAO. As the CAEP Members and Observers now are working to focus the final stages of the analysis, we thought it would be a good time to touch base with you again on the status of the ICAO process and the Agency's efforts to prepare to promulgate conforming regulations.

In particular, we understand from the Information Paper that the U.S. submitted at the CAEP Steering Group last September that the Agency plans to issue proposed "endangerment" and "cause or contribute" findings for the U.S. regulation of aircraft greenhouse gas emissions this spring. We concur with the observation the U.S. made in the CAEP Information Paper that such findings are a prerequisite to U.S. adoption of the expected ICAO standard. Accordingly, we would like to discuss with you the Agency's plans to proceed with this consistent with the timing of the ICAO process. Of course, we are keen to ensure that EPA keeps the U.S. airlines' strong record of fuel efficiency improvements and CO_2 emissions savings squarely in focus and look forward to the opportunity to refresh on these issues as well.

I would appreciate it if someone in your office could contact me about potential dates and times for meeting within the next several weeks. I can be reached at (202) 626-4207 or nyoung@airlines.org. Alternatively, I will plan to follow up with your office to explore potential dates. Thank you for your consideration.

Sincerely yours,

Nancy N. Young

Vice President, Environmental Affairs

cc: Lourdes Maurice, FAA, via email Lourdes.maurice@faa.gov

Nancy N. Young

Vice President, Environmental Affairs

Airlines for America

We Connect the World

1301 Pennsylvania Ave, NW, Suite 1100

Washington, DC 20004

Phone: (202) 626-4207

email: nyoung@airlines.org

VISIT US:

[1] Besides being well-established for international standard-setting, the CAEP Terms of Reference and the ICAO/CAEP standard-setting process align well with the bases for the adoption of aircraft engine emission standards by EPA and FAA under Section 231 of the Clean Air Act.

To: Thrift, Mike[thrift.mike@epa.gov]
From: Manning, Bryan
Sent: Wed 2/19/2014 7:37:02 PM
Subject: FW: FOR REIVEW: Revised TIERING FORM for Aircraft Endangerment & ANPR
Agency Action TieringAircraft Endangerment_ANPR 02-19-14track.docx

Hello Mike,

Ex. 5 - Attorney Client

Thank you,

Bryan

Bryan Manning

U.S. EPA Office of Transportation and Air Quality

Large Marine and Aviation Center

2000 Traverwood Drive

Ann Arbor, MI 48105

(ph) 734-214-4832 (fax) 734-214-4816

manning.bryan@epa.gov

From: Jantarasami, Lesley
Sent: Wednesday, February 19, 2014 2:32 PM
To: Audette, Lucie; Birnbaum, Rona; Thrift, Mike; Hengst, Benjamin; Samulski, Michael; Ghanta, Venu
Cc: Manning, Bryan; Leggett, Cullen
Subject: RE: FOR REIVEW: Revised TIERING FORM for Aircraft Endangerment & ANPR

Hi everyone,

Ex. 5 - Deliberative Process

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

From: Audette, Lucie
Sent: Friday, February 14, 2014 4:43 PM
To: Jantarasami, Lesley; Birnbaum, Rona; Thrift, Mike; Hengst, Benjamin; Samulski, Michael; Ghanta, Venu
Cc: Manning, Bryan; Leggett, Cullen; Audette, Lucie
Subject: FOR REIVEW: Revised TIERING FORM for Aircraft Endangerment & ANPR

Hello everyone,

Thanks so much for your quick responses to the first draft of the tiering form. I'm sending it back much improved!

Ex. 5 - Deliberative Process

If you could let Bryan Manning and myself know what your next steps are and the timeframe for getting the needed sign-offs that would be helpful.

Proposed Timeframe:

Ex. 5 - Deliberative Process

-

I'll be on Annual Leave Tuesday through Thursday next week (Feb. 18-20) so if you have any questions during that time please contact Bryan Manning.

Thanks everyone, Lucie

To: McCabe, Janet[McCabe.Janet@epa.gov]
From: Stewart, Lori
Sent: Thur 6/4/2015 3:58:45 PM
Subject: FW: Aircraft package for the Administrator
Aircraft Endang Finding & ANPRM for Administrator.docx

From: Stewart, Lori
Sent: Thursday, June 04, 2015 10:09 AM
To: Emerson, Michael
Subject: FW: Aircraft package for the Administrator
Importance: High

Michael, here is the latest version, and likely the final version. Can you please share the note below with the Administrator along with the rule. Let me know if you need help printing this. Thanks.

From: Sutton, Tia
Sent: Thursday, June 04, 2015 10:05 AM
To: Stewart, Lori
Cc: Hengst, Benjamin
Subject: Aircraft package for the Administrator
Importance: High

Hi Lori—here's the clean aircraft package.

Ex. 5 - Deliberative Process

Thanks,

Ben

To: Hambrick, Amy[Hambrick.Amy@epa.gov]
Cc: McCabe, Janet[McCabe.Janet@epa.gov]
From: Stewart, Lori
Sent: Thur 9/4/2014 8:23:14 PM
Subject: FW: GHG Standards from Aircraft - ICAO Announcement
ICAO Aviation GHG Announcement - Roll out - v8 - FINAL.docx

Amy, I heard from Janet that Gwen is looking for a summary of the background/description of the ICAO paper on EPA's aircraft GHG endangerment finding plans. The roll-out paper with a summary of the events that led up to this and future plans is attached. It also includes Qs&As that may be more than she needs, but I thought I would go ahead and include the whole paper. If you want to narrow it down, the first 2 pages should cover what she needs. Can you please share this with Gwen? Thanks very much.

To: McCabe, Janet[McCabe.Janet@epa.gov]; Goffman, Joseph[Goffman.Joseph@epa.gov]
From: Millett, John
Sent: Wed 8/27/2014 8:36:42 PM
Subject: FW: Comms for Aircraft GHG Emissions, Endangerment Finding
Desk Statement and Q & As 8-25-14 draft final.docx
CAEPSG 20142 IP xx US GHG Endangerment_ANPR 8-19-14.docx

Hi Janet and Joe – very sorry to bother you with this, but this seems like it needs too complex of a rollout to accomplish in a few days. Liz and I spoke briefly and she has the same concern. I also spoke to Ben, who foresaw Liz's and my reaction . . .

Thanks for your guidance . . .

John

~~~~~~~~~~~~~~~~~

John Millett

Director, OAR Communications

Desk: 202-564-2903

Cell: 202-510-1822

From: Mylan, Christopher
Sent: Wednesday, August 27, 2014 4:01 PM
To: McMichael, Nate; Millett, John; Purchia, Liz
Cc: Birgfeld, Erin
Subject: Comms for Aircraft GHG Emissions, Endangerment Finding
Importance: High

Hello All,
~~~~~~~~~~~~~~~~~

Wanted to bring to your attention that in the next few days we are announcing that EPA is moving forward with a rulemaking for a proposed endangerment finding regarding aircraft GHG emissions and a concurrent ANPRM to provide an overview of the International Civil Aviation Organization's (ICAO) efforts to develop international aircraft CO2 emissions standards and progress to date.

Janet is making final comments on the package now and we expect to send to ICAO as early as Friday. ICAO may or may not make it public as soon as they receive it, but once they do we expect a considerable amount of media attention. To help answer such questions, attached is a desk statement, Q/As, and an information paper.

Ex. 5 - Deliberative Process

Please give me a call if you would like to discuss further.

Thanks,

Christopher Mylan

U.S. EPA

Office of Transportation and Air Quality

Phone: 202-564-7411

To: McCabe, Janet[McCabe.Janet@epa.gov]
Cc: Stewart, Lori[Stewart.Lori@epa.gov]; Atkinson, Emily[Atkinson.Emily@epa.gov]; Jones, Marlene[Jones.Marlene@epa.gov]
From: Knapp, Kristien
Sent: Fri 6/27/2014 9:37:26 PM
Subject: FW: McCabe, Janet Calendar
McCabe Janet Calendar.ics
June 30 - July 4.pdf
draft Janet McCabe Cookstoves Briefing 6-30-14.pptx
OG White Paper Update for Janet McCabe6 30 2014_revised.pptx
McCabe briefing on CAAAC actions June2014_final.pptx
O3 Pre-brief Administrator (6-30-2014) v3.pptx
OEWG Briefing 6-30-14.pptx
Early Guidance Aircraft 6-30-14.pptx

Janet - Below is your jam-packed calendar for Monday, with all the briefing materials pasted within. Also Emily pdf'ed your week's calendar so you can see how it looks since our scheduling meeting yesterday.

Have a good weekend!
Kristien

From: Atkinson, Emily
Sent: Friday, June 27, 2014 4:07 PM
To: Knapp, Kristien; Jones, Marlene
Subject: McCabe, Janet Calendar

McCabe, Janet Calendar
McCabe.Janet@epa.gov
On Monday, June 30, 2014 Time zone

:
(UTC-05:00) Eastern Time (US & Canada) (Adjusted for Daylight Saving Time)

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ne 20

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Busy | Tentative | Free

Out of Office | Working Elsewhere | Outside of Working Hours

June 2014

Mon, Jun 30

	Before 6:05 AM	**Free**
	6:05 AM - 7:45 AM	SW Flight to BWI

	8:30 AM - 9:09 AM	MARC Train #421 from BWI to Union Station
	At 9:00 AM	Call Motorpool Directly On Their BB If You Catch An Earlier Train | 240-286-9695 | Office 202-564-2931
	9:05 AM - 9:30 AM	Motorpool from Union Station to EPA Hot Dog Stand
	9:30 AM - 10:00 AM	Management Roundtable
	10:00 AM - 11:00 AM	Supreme Court Decision Discussion [OGC will provide, probably not until Monday]
	11:00 AM - 11:30 AM	Montreal Protocol Open-Ended Working Group (OEWG) meeting
	11:30 AM - 12:15 PM	Clean Air Act Advisory Committee (CAAAC) Actions
	12:15 PM - 12:30 PM	**Free**
	12:30 PM - 1:00 PM	Cookstoves Briefing
	1:00 PM - 2:00 PM	Senior Staff
	2:00 PM - 3:00 PM	Oil and Gas White Papers
	3:00 PM - 4:00 PM	Pre-Brief Ozone NAAQS Options Selection
	4:00 PM - 5:00 PM	Early Guidance Meeting for Aircraft Endangerment
	5:00 PM - 5:30 PM	No Meetings / Executive Time
	5:30 PM - 6:15 PM	General Discussion*
	After 6:15 PM	**Free**

To: McCabe, Janet[McCabe.Janet@epa.gov]; Vahlsing, Candace M. EOP/WHO Ex. 5 - Deliberative Process
Cc: Benenati, Frank J. EOP/WHO Ex. 5 - Deliberative Process Hengst, Benjamin[Hengst.Benjamin@epa.gov]
From: Millett, John
Sent: Fri 7/22/2016 3:54:13 PM
Subject: RE: Aircraft Q and A
Roll Out_QAs_aircraft final findings_7_22.docx

Thanks, Janet, and Hi, Candace -- questions 8-12 in the attachment address timing and stringency.

-----Original Message-----
From: McCabe, Janet
Sent: Friday, July 22, 2016 11:31 AM
To: Vahlsing, Candace M. EOP/WH Ex. 5 - Deliberative Process gov>
Cc: Benenati, Frank J. EOP/WHO < Millett, John <Millett.John@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>
Subject: Re: Aircraft Q and A

+ John and Ben.

Sent from my iPhone

> On Jul 22, 2016, at 11:14 AM, Vahlsing, Candace M. EOP/WHO <Candace_M_Vahlsing@who.eop.gov> wrote:
>
> Good morning.
>
> Can you guys send the Q and A for the aircraft rollout on Monday when you have a second. Most interested in our answers on the the timing and the stringency of the CO2 standard.

To: McCabe, Janet[McCabe.Janet@epa.gov]; Gunning, Paul[Gunning.Paul@epa.gov]
Cc: Kocchi, Suzanne[Kocchi.Suzanne@epa.gov]
From: Jantarasami, Lesley
Sent: Tue 7/19/2016 5:03:25 PM
Subject: RE: status of aircraft endangerment
biogenic CO2 preamble text_071916.docx

Here is the current preamble text on the biogenic issue. The language appears in both the endangerment and contribution sections because the public commenter made the same requests for both findings.

Thanks,

Lesley

Lesley Jantarasami

U.S. EPA, Climate Change Division

jantarasami.lesley@epa.gov

(202)-343-9929

From: McCabe, Janet
Sent: Tuesday, July 19, 2016 11:06 AM
To: Gunning, Paul <Gunning.Paul@epa.gov>
Cc: Grundler, Christopher <grundler.christopher@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; Vaught, Laura <Vaught.Laura@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: Re: status of aircraft endangerment

Ex. 5 - Deliberative Process

Sent from my iPhone

On Jul 19, 2016, at 9:18 AM, Gunning, Paul <Gunning.Paul@epa.gov> wrote:

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Tuesday, July 19, 2016 8:50 AM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Gunning, Paul <Gunning.Paul@epa.gov>; Rennert, Kevin <Rennert.Kevin@epa.gov>; Vaught, Laura <Vaught.Laura@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: Re: status of aircraft endangerment

I am concerned about addressing this for a number of reasons:

Ex. 5 - Deliberative Process

Christopher Grundler, Director

Office of Transportation and Air Quality

U.S. Environmental Protection Agency

202/564-1682 (Washington DC)

734/214-4207 (Ann Arbor MI)

On Jul 19, 2016, at 8:40 AM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Ex. 5 - Deliberative Process

Rob Johannson emailed me this morning, so we should consider the issue elevated...

Please let me know what you think. If there's an acceptable choice, I don't need to talk to rob, but if we canmt get there, I will.

Thanks

Sent from my iPhone

On Jul 19, 2016, at 8:20 AM, Gunning, Paul <Gunning.Paul@epa.gov> wrote:

Janet

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Paul

Ex. 5 - Deliberative Process

Sent from my iPhone

On Jul 18, 2016, at 3:41 PM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Ex. 5 - Deliberative Process

Dom also knows that we plan to sign Wednesday morning.

From: Gunning, Paul
Sent: Monday, July 18, 2016 11:24 AM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Sarofim, Marcus <Sarofim.Marcus@epa.gov>
Subject: RE: status of aircraft endangerment

Ex. 5 - Deliberative Process

Paul

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Birnbaum, Rona
Sent: Friday, July 15, 2016 10:04 PM
To: McCabe, Janet <McCabe.Janet@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Gunning, Paul <Gunning.Paul@epa.gov>
Subject: Re: status of aircraft endangerment

Janet, OMB has forwarded the comments. I'll follow up in a little while with

Ex. 5 - Deliberative Process

Will follow up to this email.

Rona

Sent from my iPhone

On Jul 15, 2016, at 8:24 PM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

> This issue is coming up everywhere….

Ex. 5 - Deliberative Process

From: Hengst, Benjamin
Sent: Friday, July 15, 2016 5:07 PM
To: McCabe, Janet <McCabe.Janet@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>
Subject: FW: status of aircraft endangerment

FYI. Janet,I'm sure you'll hear this from OAP directly, too, with more detail on the remaining issue, but thought I'd pass this along.

From: Birnbaum, Rona
Sent: Friday, July 15, 2016 5:04 PM
To: Gunning, Paul <Gunning.Paul@epa.gov>; VonDemHagen, Rebecca <VonDemHagen.Rebecca@epa.gov>; Krieger, Jackie <Krieger.Jackie@epa.gov>; Kocchi, Suzanne <Kocchi.Suzanne@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Samulski, Michael <samulski.michael@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Williams, Melina <Williams.Melina@epa.gov>; Orlin, David <Orlin.David@epa.gov>
Cc: Jantarasami, Lesley <Jantarasami.Lesley@epa.gov>; Manning, Bryan <manning.bryan@epa.gov>; Audette, Lucie <audette.lucie@epa.gov>
Subject: RE: status of aircraft endangerment

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Rona

To: Adm13McCarthy, Gina[Adm13McCarthy.Gina@epa.gov]
From: McCabe, Janet
Sent: Mon 10/31/2016 8:17:38 PM
Subject: Re: DON"T READ UNTIL AFTER WEDDING--not urgent

Thanks

Sent from my iPhone

On Oct 31, 2016, at 4:16 PM, Adm13McCarthy, Gina <Adm13McCarthy.Gina@epa.gov> wrote:

> That sound fine Janet.
>
> *Sent from my iPhone*
>
> On Oct 28, 2016, at 2:41 PM, McCabe, Janet <McCabe.Janet@epa.gov> wrote:

Ex. 5 - Deliberative Process

> We'll proceed on this track, but please let me know if you need more information or have questions or concerns.
>
> --Janet

To: Distefano, Nichole[DiStefano.Nichole@epa.gov]; Niebling, William[Niebling.William@epa.gov]; Goffman, Joseph[Goffman.Joseph@epa.gov]
From: McCabe, Janet
Sent: Fri 10/28/2016 6:43:35 PM
Subject: FW: DON"T READ UNTIL AFTER WEDDING--not urgent

Nichole, William—heads up on a biomass related issue. I was briefed today on the petition for reconsideration that the Coalition has filed on the Aircraft GHG Endangerment finding. This is a

Ex. 5 - Deliberative Process

--Janet

From: McCabe, Janet
Sent: Friday, October 28, 2016 2:42 PM
To: Adm13McCarthy, Gina <Adm13McCarthy.Gina@epa.gov>
Subject: DON"T READ UNTIL AFTER WEDDING--not urgent

Ex. 5 - Deliberative Process

We'll proceed on this track, but please let me know if you need more information or have questions or concerns.

--Janet

To: Beauvais, Joel[Beauvais.Joel@epa.gov]
From: McCabe, Janet
Sent: Wed 8/27/2014 1:21:31 PM
Subject: FW: EPA submission to ICAO on GHG endangerment finding/ANPRM

Ex. 5 - Deliberative Process

From: McCabe, Janet
Sent: Wednesday, August 27, 2014 9:13 AM
To: Grundler, Christopher
Subject: RE: EPA submission to ICAO on GHG endangerment finding/ANPRM

Right you are--my apologies. I was looking for an attachment. How about these few edits?

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Wednesday, August 27, 2014 8:54 AM
To: McCabe, Janet
Subject: Re: EPA submission to ICAO on GHG endangerment finding/ANPRM

Keep scrolling and you will find the paper embedded in Bills email

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
202.564.1682 (DC)
734.214.4207 (Ann Arbor)
www.epa.gov/otaq

[redacted]

sorry not to have responded....can someone please send me the 2 pager? I've looked back through my emails to July and can't find it.

Ex. 5 - Deliberative Process

From: Grundler, Christopher
Sent: Tuesday, August 26, 2014 6:43 PM
To: McCabe, Janet
Cc: Charmley, William
Subject: Fw: EPA submission to ICAO on GHG endangerment finding/ANPRM

Janet, we'd like your go ahead to submit this paper. I believe the downside risks are low, and the FAA is with us.

C-

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
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734.214.4207 (Ann Arbor)
www.epa.gov/otaq

[redacted]

Chris –

Ex. 5 - Deliberative Process

Do you have any objection to having us do this? I have attached a copied the text of the paper below.

Thanks

Bill

==========

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: McCabe, Janet[McCabe.Janet@epa.gov]
From: McCabe, Janet
Sent: Tue 6/9/2015 1:23:18 PM
Subject: Aircraft GHG- Response to Administrator comments 6-8-15 jm.docx
Aircraft GHG- Response to Administrator comments 6-8-15 jm.docx

1, 140 or so….

To: Janet McCabe
From: McCabe, Janet
Sent: Thur 10/15/2015 3:23:57 AM
Subject: Fw: E-Folder for Thursday, October 15th

Ex. 6 - Personal Privacy

Agenda IPC Aircraft CO2 Standard 10-15-15.docx
Annotated Agenda and Draft Talking Points for NN CPP Meeting_r1013_clean....docx
Proposed Federal Plan.pptx
CPP Final Rule Summary.pptx
CPP High Level Overview.pptx
2015_1013 Internal Background for Navajo consultation.docx
OAR Shout out on Feds feed families oct14.docx
Oct 15 2015 attendees_10-14-15.docx
10 15 15 GM Remarks - WH HFC Roundtable.docx
10 15 15 GM Remarks - DOE coolant tech expo.docx
WH HFC Event background.docx
Draft Fact Sheet 101315.docx
FRPub -- messaging tick-tock.docx
151014 Research Annual Mtg Pre-Brief.pptx
10 15 2015 GM blog HFCs_clean.docx
HFC pr.docx

From: McCoy, Britney
Sent: Wednesday, October 14, 2015 5:24 PM
To: McCabe, Janet
Cc: Stewart, Lori
Subject: E-Folder for Thursday, October 15th

Hi Janet,

Please find your calendar below for Thursday, October 15th and documents for your review. Marlene will have your actual folder tomorrow morning when you arrive.

HFC Blog Post & Press Release (Plan to post and release tomorrow afternoon)

Draft Shout Out

8:00 am – 8:30 am **General Discussion – 5400**

8:30 am – 9:00 am **Management Roundtable – 5400**

9:00 am – 9:15 am **Refrigerant Management Rule Signing – Administrator's Office**

9:15 am – 9:30 am **One-On-One with Debbie Jordan – 5406**

9:30 am – 10:00 am **Motorpool with the Administrator to the WH**

10:00 am – 12:15 pm White House HFC Event – EEOB Room 430

12:15 pm – 12:30 pm Motorpool with the Administrator to EPA

12:30 pm – 1:00 pm One-On-One with Betsy Shaw – 5400

1:00 pm – 1:30 pm Navajo Call with R9 – 5400

1:30 pm – 2:15 pm CPP Check In – 5400

2:15 pm – 3:00 pm Pre-brief for Annual Research Meeting with Tom Burke – 5400

3:00 pm – 4:00 pm NACAA/AAPCA/ECOS Clean Power Plan Technical Call Series – Leakage – 5400

3:15 pm – 3:45 pm Meet with Trevor Reuschel, USDA – 5400

4:00 pm – 4:30 pm Motorpool from EPA Hot Dog Stand to EEOB

4:30 pm – 5:30 pm RFS Meeting – EEOB Room 170

5:30 pm – 6:00 pm HOLD

6:00 pm – 7:00 pm ICAO Meeting – EEOB Room 208

Have a safe flight back to The District!

Britney

To: Samulski, Michael[samulski.michael@epa.gov]
From: Nam, Ed
Sent: Wed 6/10/2015 10:31:53 PM
Subject: RE: OTAQ In the News

Sounds like all those difficult meetings finally paid off!

Congrats!

-Ed

From: Grundler, Christopher
Sent: Wednesday, June 10, 2015 6:04 PM
To: OAR-OTAQ
Cc: Dunham, Sarah; Gunning, Paul; Birnbaum, Rona; DeAngelo, Ben; Jantarasami, Lesley; McCabe, Janet; Millett, John; StClair, Christie; Purchia, Liz; Reynolds, Thomas
Subject: OTAQ In the News

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-Chris

Industry/ Business

Airlines for America | Nancy Young, Vice President, Environmental Affairs

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Environmental/Non-Profit Association

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[Press Release, 6/10/2015]

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Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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Resize Text Print Article Comments 18

By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

“Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level,” Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. “While we believe that any regulatory action must be consistent with both the agency’s authority under the Clean Air Act and the future ICAO standard, today’s action reconfirms the EPA’s commitment to the ICAO process for achieving a global CO2 standard for new aircraft.”

The EPA’s move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

“This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled,” said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it’s adequate. “Typically what ICAO does is a very weak standard,” adds Margo Oge, former director of the EPA’s Office of Transportation and Air Quality, and author of the book “Driving the Future: Combating Climate Change with Cleaner, Smarter Cars.” “Aircraft are the least-regulated source of transportation when it comes to emissions.”

But the EPA’s Christopher Grundler, head of the agency’s Office of Transportation and Air Quality, defended the international approach Wednesday, observing that “an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction.”

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective: “whether

the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs."

"The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines," said the National Association of Clean Air Agencies' Becker.

But the EPA did suggest that it could go further than the ICAO standards do. "Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO," the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

"Automation would mean more efficient routing, and particularly less time spent going up and down as you're coming to land," said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.

To: Nam, Ed[nam.ed@epa.gov]
From: Samulski, Michael
Sent: Thur 6/11/2015 11:25:40 AM
Subject: RE: OTAQ In the News

Thanks Ed. The team still has lots of hard meetings ahead of it.

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

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Sent: Wednesday, June 10, 2015 6:32 PM
To: Samulski, Michael
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Sent: Wednesday, June 10, 2015 6:04 PM

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Resize Text Print Article Comments 18

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To: Bunker, Byron[bunker.byron@epa.gov]
From: Samulski, Michael
Sent: Thur 6/11/2015 11:25:07 AM
Subject: RE: OTAQ In the News

Thanks Byron. The aircraft team has been working hard on this and will continue to do so

****

Michael Samulski

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

Director, Large Marine and Aircraft Center

1 (734) 214-4532

samulski.michael@epa.gov

****

From: Bunker, Byron
Sent: Wednesday, June 10, 2015 6:21 PM
To: Samulski, Michael; Matt Spears
Cc: Charmley, William
Subject: Fwd: OTAQ In the News

Congratulations! I know how hard you and your teams through too many years have worked to make this happen. You should feel incredibly proud to see these actions. More than well done.

Byron

Byron Bunker

US EPA

NVFEL Office Phone (734) 214-4155

DC Office Phone (202) 343-9283

Cell Phone (734) 353-9623

Sent from my cell phone.

Begin forwarded message:

From: "Grundler, Christopher" <grundler.christopher@epa.gov>
Date: June 10, 2015 at 6:04:03 PM EDT
To: OAR-OTAQ <OAROTAQ@epa.gov>
Cc: "Dunham, Sarah" <Dunham.Sarah@epa.gov>, "Gunning, Paul" <Gunning.Paul@epa.gov>, "Birnbaum, Rona" <Birnbaum.Rona@epa.gov>, "DeAngelo, Ben" <DeAngelo.Ben@epa.gov>, "Jantarasami, Lesley" <Jantarasami.Lesley@epa.gov>, "McCabe, Janet" <McCabe.Janet@epa.gov>, "Millett, John" <Millett.John@epa.gov>, "StClair, Christie" <StClair.Christie@epa.gov>, "Purchia, Liz" <Purchia.Liz@epa.gov>, "Reynolds, Thomas" <Reynolds.Thomas@epa.gov>
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"President Obama clearly views climate action as a priority, while polluters and their allies in Congress clearly view stopping climate action a priority. Since today's announcement will likely cause a fight in Congress, we hope the president makes this a fight worth having by requiring real cuts in airplane pollution. Bold action on climate should solve the problem of pollution from airplanes, not just acknowledge it." [Press Release, 6/10/2015]

Earth Justice | Sarah Burt, Attorney

"We commend EPA for completing this important first step in regulating carbon pollution from airplanes, but unfortunately, given the magnitude of aircraft's contribution to climate change, the tentative approach that EPA is considering is not up to the task. The EPA's Endangerment Finding confirms that aircraft are a significant source of climate pollution, emitting approximately 700 million metric tonnes per year. This makes global aviation, if it were equivalent to a country, the 7th largest global emitter, just below Germany and more than Korea and Canada. Instead of using its Clean Air Act authority to reduce these harmful emissions, EPA proposes to follow the lead of the International Civil Aviation Organization and set a 'business-as-usual' standard that will lock in emissions increases for decades to come. We strongly urge EPA to reconsider and to fulfill its Clean Air Act obligations by proposing a rule that accomplishes meaningful reductions in pollution from aircraft. The International Civil Aviation Organization's standard won't deliver substantial reductions because they are setting a standard that 90–95% of aircraft already meet. It won't apply it to existing aircraft, which have 20–30 year lifespan—only to new designs, which would push back the phase-in even more. The U.S. share of the problem is considerable, and a more robust U.S. action could help ratchet up the international standard." [Press Release, 6/10/2015]

Sierra Club | Joanne Spalding, Attorney

"President Obama is taking an important step on climate once again by finding that carbon pollution from airplanes poses the same danger to our climate as carbon pollution from other sources. This finding paves the way for action next year to create safeguards that will result in more efficient airplanes which pollute less while saving airlines and air travelers money on fuel costs. This commonsense finding comes in the context of the momentum building for international negotiations to tackle the climate crisis this year in Paris. The

United States will soon be in a position to effectively curb carbon pollution from its biggest sources, whether from cars, trucks, planes, or the electric sector."

[Press Release, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled," said William Becker, executive director of the National Association of Clean Air Agencies. [Statement, 6/10/2015]

National Association of Clean Air Agencies | William Becker, Executive Director

"With today's announcement, President Obama has a unique and extremely important opportunity to demonstrate leadership not only domestically but around the world." [Statement, 6/10/2015]

Washington Post:

http://www.washingtonpost.com/news/energy-environment/wp/2015/06/10/epa-moves-toward-limits-on-emissions-from-u-s-airlines/

EPA moves toward limits on emissions from U.S. airlines

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By Chris Mooney June 10 at 3:11 PM

The U.S. Environmental Protection Agency moved Wednesday to start the process of regulating greenhouse gas emissions from the nation's fleet of commercial aircraft, a long-desired objective of environmental groups. But some fear the ultimate approach may prove too weak.

The agency released a proposed "endangerment finding," meaning that it is suggesting that aircraft engines may "contribute to the air pollution that causes climate change and endangers public health and welfare." That's what the EPA has found for emissions from an even larger transportation-related contributor to global warming: cars.

The EPA also gave notice that it is considering regulations on aircraft engines. But rather than moving ahead on its own, the agency plans to continue to work on with the United Nations' International Civil Aviation Organization (ICAO), which is expected to create its own global rules in early 2016. The EPA called Wednesday's announcement "an initial step in the process for EPA to adopt CO2 standards promulgated by ICAO in the future."

What has some environmental groups worried is this apparent deferral to an international body. "Passing the buck to an international organization that's virtually run by the airline industry won't protect our planet from these rapidly growing emissions," Vera Pardee, attorney for the Center for Biological Diversity, said in a statement.

According to the EPA, commercial aircraft contribute 11 percent of emissions from the U.S. transportation sector, and overall, 3 percent of U.S. emissions. That may sound relatively small, and in comparison to cars or power plants, it definitely is.

But car emissions are already regulated, and power plant emissions would be soon under the proposed Clean Power Plan. If the airline industry grows substantially while remaining unregulated, its emissions as a percentage of the U.S. or global total will also grow.

Major growth in the domestic and global airline industry is indeed expected. The FAA projects that consumption of fuel will grow 49 percent in these aircraft from 2010 to 2035, with a corresponding increase in emissions.

“Aviation is a global industry, making it critical that aircraft emissions standards continue to be agreed upon at the international level,” Nancy Young, environmental affairs vice president for the he U.S. airlines trade group Airlines for America, said in a statement Wednesday. “While we believe that any regulatory action must be consistent with both the agency’s authority under the Clean Air Act and the future ICAO standard, today’s action reconfirms the EPA’s commitment to the ICAO process for achieving a global CO2 standard for new aircraft.”

The EPA’s move was long in coming; environmental groups including the Center for Biological Diversity and Earthjustice petitioned for it in 2007, and then sued over it in 2010.

“This is a prod to the industry, saying, your emissions are important enough from a health and welfare standpoint that they deserve to be controlled, but we are going to work with you, both domestically and internationally, to determine the extent to which they should be controlled,” said William Becker, executive director of the National Association of Clean Air Agencies.

The proposed endangerment finding does not cover military planes or smaller planes, such as turboprops.

The key focus now will be on the ICAO process and whether it’s adequate. “Typically what ICAO does is a very weak standard,” adds Margo Oge, former director of the EPA’s Office of Transportation and Air Quality, and author of the book “Driving the Future: Combating Climate Change with Cleaner, Smarter Cars.” “Aircraft are the least-regulated source of transportation when it comes to emissions.”

But the EPA’s Christopher Grundler, head of the agency’s Office of Transportation and Air Quality, defended the international approach Wednesday, observing that “an international standard would cover far more aircraft than simply a domestic standard, and would cover far more greenhouse gas reduction.”

The precise concern about ICAO, said Oge, is that new regulations may only apply to new aircraft designs, rather than to all new aircraft. The former is a much narrower group than the latter. In its news release, the EPA asks for comment on which approach is effective: "whether the aircraft CO2 standard should apply to in-production aircraft…or whether the aircraft CO2 standard should apply only to completely new aircraft type designs."

"The fear is that this will allow the continuation of older engines, because they can escape tougher requirements, and create a disincentive for any of these manufacturers to redesign their engines," said the National Association of Clean Air Agencies' Becker.

But the EPA did suggest that it could go further than the ICAO standards do. "Once an international standard is finalized by ICAO, member states are then required to adopt standards that are of at least equivalent stringency to those set by ICAO," the agency noted.

There are also other intriguing ideas to reduce aircraft emissions that go beyond what anyone is proposing. One involves adding more automation for air traffic control, which could allow flights to take more fuel-efficient paths — something that NASA has been studying.

"Automation would mean more efficient routing, and particularly less time spent going up and down as you're coming to land," said Graham Spinardi, a social scientist at the University of Edinburgh who published a study on the idea — and why it has not caught on — last year in the journal Energy Research & Social Science.