Message

**From:** Harvard Kennedy School [exed@hks.harvard.edu]
**Sent:** 1/28/2022 5:16:43 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Don't Miss Harvard's On-Campus Program to Address Climate Change

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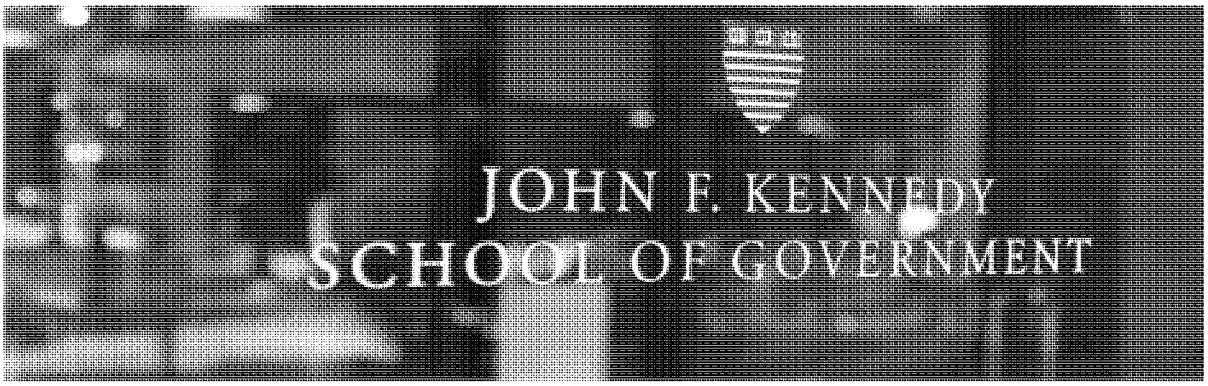


## Climate Change and Energy: Policymaking for the Long Term

March 13-18, 2022

The application deadline is approaching for Harvard Kennedy School's executive program *Climate Change and Energy: Policymaking for the Long Term* (On-Campus). Apply by January 31, 2022 to secure your spot and discover the science, economics, and policy of climate change.

Led by Faculty Chair Robert Stavins, this six-day, on-campus executive program convenes public-policy makers and corporate leaders from around the world. Immerse yourself in an intellectually-stimulating, in-person learning environment to gain greater insight into climate change and the policy challenges it presents. Lectures, class discussions, case studies and group work will examine new

**Faculty Chair:** Robert Stavins

**Application Deadline:** January 31, 2022

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For more information, please contact the program director, Ariana Diaz at ariana_diaz@hks.harard.edu.

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This message sent to goffman.joseph@epa.gov from

exed@hks.harvard.edu | +1 617.496.9000
Harvard Kennedy School | Harvard Kennedy School
79 JFK Street , Cambridge, MA 02138

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 3/17/2021 5:24:26 PM
**To**: Hoffer, Melissa [Hoffer.Melissa@epa.gov]
**Subject**: Just sayin'

https://eelp.law.harvard.edu/2020/04/why-congress-should-repeal-the-congressional-review-act/

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/10/2021 4:25:40 AM
**To**: Grundler, Christopher [grundler.christopher@epa.gov]
**CC**: Harvey, Reid [Harvey.Reid@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]
**Subject**: Re: Check out bullet 3 on slide 4

Academics, alas!

Sent from my iPhone

On Feb 9, 2021, at 11:13 PM, Grundler, Christopher <grundler.christopher@epa.gov> wrote:

Thx for sharing. And yet the authors suggest on slide 11 (bullet 3) we should've done more with markets...

Christopher Grundler, Director
Office of Atmospheric Programs
U.S. Environmental Protection Agency
(202) 343-9140 (Office)
(734) 645-5221 (Mobile)

On Feb 9, 2021, at 10:39 PM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

https://heep.hks.harvard.edu/files/heep/files/currie_50_years_of_caa_-_shorter_210111_1649.pdf

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/24/2021 3:46:54 AM
**To**: Lambert, Kathleen Fallon [klambert@hsph.harvard.edu]
**Subject**: RE: Letter to the record for House Energy Subcommittee hearing

Hi, Kathy. Thanks so much for looping me in on this; it's great that you sent this letter to House Energy leadership. I will inquire with colleagues here as to whether they would benefit from a briefing. Great work, in any event.

Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Lambert, Kathleen Fallon <klambert@hsph.harvard.edu>
**Sent:** Tuesday, February 23, 2021 8:50 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Letter to the record for House Energy Subcommittee hearing

Dear Joe,

I am reaching out to share a letter to the record that Dr. Charley Driscoll and I submitted last week for the House Energy and Commerce Subcommittee hearing on "A Smarter Investment: Pathways to a Clean Energy Future". We would be happy to answer any questions or brief EPA officials on this work. Two of the key take-aways are:

Reaching Zero Emissions in the Electricity Sector is Achievable at Modest Costs
The Clean Energy Futures project shows that several clean energy policies, including clean energy standards, carbon prices, and a national cap and trade policy can achieve low or zero carbon emissions in the electricity sector using existing technology at a cost of only about 15% above baseline.

Clean Energy Delivers Climate and Health Benefits That Far Outweigh Policy Costs
All of the clean energy policies that we examined deliver climate benefits that exceed policy costs. In addition, virtually the entire coterminous U.S. is projected to experience better air quality. Improvements are most striking in the eastern U.S., particularly in areas experiencing chronic air quality impairment. For a 100% Clean Energy Standard by 2040 approximately 11,000 premature deaths could be avoided annually in 2030.

Kathy Fallon Lambert
Senior Advisor, Center for Climate, Health and the Global Environment (C-CHANGE)
Harvard T.H. Chan School of Public Health
Co-founder, Science Policy Exchange
Tel. 802-436-1000
Twitter @kflambert
skype name kathleen.lambert31

For information and updates on the Transportation, Equity, Climate and Health (TRECH) Study, visit:
https://www.hsph.harvard.edu/c-change/news/trechstudy/

For stories of climate hope and action, subscribe to *The Climate Optimist* newsletter: https://hsph.me/ClimateOptimist

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/10/2021 6:18:35 PM
**To**: Just, Robin L [rjust@law.harvard.edu]
**Subject**: RE: looking for Joe Goffman email address

Thanks, Robin.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Wednesday, February 10, 2021 12:51 PM
**To:** Tim Searchinger <Tim.Searchinger@wri.org>
**Subject:** Re: looking for Joe Goffman email address

Hi Tim,

I'll forward Joe your email.

Warmly,
Robin

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | rjust@law.harvard.edu
Pronouns: she/her

---

**From:** Tim Searchinger <Tim.Searchinger@wri.org>
**Sent:** Wednesday, February 10, 2021 12:04 PM
**To:** Just, Robin L <rjust@law.harvard.edu>
**Subject:** looking for Joe Goffman email address

Greetings,

I am an old colleague of Joe Goffman. I wondered if you had a forwarding email address for him now that he has joined the Administration. I would be happy with an official email address if you have it.

Many thanks,

Tim Searchinger

--

Timothy D. Searchinger
Senior Research Scholar
Princeton School of Public & International Affairs
Princeton University
tsearchi@princeton.edu
(202) 465-2074

Senior Fellow & Technical Director Food Program
World Resources Institute

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 3/26/2021 5:31:17 PM
**To**: Millett, John [Millett.John@epa.gov]; DeLuca, Isabel [DeLuca.Isabel@epa.gov]
**Subject**: RE: WaPo story

No worries whatsoever. "Personal clipping service" for the Acting AA (aka "Harvard scholar" lol) is not necessarily part of either of your job descriptions.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Millett, John <Millett.John@epa.gov>
**Sent:** Friday, March 26, 2021 1:28 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** RE: WaPo story

I'm sorry, too. I should be flagging that stuff for you from the get-go.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Friday, March 26, 2021 1:19 PM
**To:** Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** RE: WaPo story

Thank you, both. Sorry to make you do this; I guess really do need to read this story straight through rather than skim.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Millett, John <Millett.John@epa.gov>
**Sent:** Friday, March 26, 2021 1:12 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** RE: WaPo story

The Washington Post Story –

https://www.washingtonpost.com/climate-environment/interactive/2021/biden-environmental-justice-refinery-st-croix/

A little over midway through. As you scroll down, it's the first paragraph after the pictures of the ecologist walking the beach.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Friday, March 26, 2021 12:37 PM

**To:** Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** FW: WaPo story

What story did this come from? Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Carbonell, Tomas <Carbonell.Tomas@epa.gov>
**Sent:** Friday, March 26, 2021 10:23 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** WaPo story

Shortly afterward, three air policy experts published a blistering Harvard Law School paper attacking how the Trump administration had interpreted these provisions of the law, singling out Limetree Bay as an example. The paper's authors included Joseph Goffman, EPA's acting assistant administrator for air, who is now with the Biden administration and has been reviewing Limetree's permit.

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/24/2021 1:35:04 PM
**To**: Grundler, Christopher [grundler.christopher@epa.gov]
**Subject**: RE: Addendum:Re: Letter to the record for House Energy Subcommittee hearing

Thanks for following up on this, Chris. I meet with them a few months ago while still in my previous job and they were still in the work-in-progress stage. Agree that it makes sense for your team not to do a rerun.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Grundler, Christopher <grundler.christopher@epa.gov>
**Sent:** Wednesday, February 24, 2021 8:23 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Addendum:Re: Letter to the record for House Energy Subcommittee hearing

I just read the letter and noticed the collaborators inc Dr Driscoll —I think he and his team briefed us on this work a couple months ago. Am checking

_____
Christopher Grundler, Director
Office of Atmospheric Programs
U.S. Environmental Protection Agency
(202) 343-9140 (Office)
(734) 645-5221 (Mobile)

On Feb 24, 2021, at 8:18 AM, Grundler, Christopher <grundler.christopher@epa.gov> wrote:

Yes. It would be good to compare analyses. I will followup directly with Dr Lambert if that's okay

_____
Christopher Grundler, Director
Office of Atmospheric Programs
U.S. Environmental Protection Agency
(202) 343-9140 (Office)
(734) 645-5221 (Mobile)

On Feb 23, 2021, at 10:47 PM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

Anyone on the team have any interest in this, or being briefed by them? Thanks.

Joseph Goffman
Acting Assistant Administrator

Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Lambert, Kathleen Fallon <klambert@hsph.harvard.edu>
**Sent:** Tuesday, February 23, 2021 8:50 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Letter to the record for House Energy Subcommittee hearing

Dear Joe,

I am reaching out to share a letter to the record that Dr. Charley Driscoll and I submitted last week for the House Energy and Commerce Subcommittee hearing on "A Smarter Investment: Pathways to a Clean Energy Future". We would be happy to answer any questions or brief EPA officials on this work. Two of the key take-aways are:

Reaching Zero Emissions in the Electricity Sector is Achievable at Modest Costs
The Clean Energy Futures project shows that several clean energy policies, including clean energy standards, carbon prices, and a national cap and trade policy can achieve low or zero carbon emissions in the electricity sector using existing technology at a cost of only about 15% above baseline.

Clean Energy Delivers Climate and Health Benefits That Far Outweigh Policy Costs
All of the clean energy policies that we examined deliver climate benefits that exceed policy costs. In addition, virtually the entire coterminous U.S. is projected to experience better air quality. Improvements are most striking in the eastern U.S., particularly in areas experiencing chronic air quality impairment. For a 100% Clean Energy Standard by 2040 approximately 11,000 premature deaths could be avoided annually in 2030.

Kathy Fallon Lambert
Senior Advisor, Center for Climate, Health and the Global Environment (C-CHANGE)
Harvard T.H. Chan School of Public Health
Co-founder, Science Policy Exchange
Tel. 802-436-1000
Twitter @kflambert
skype name kathleen.lambert31

For information and updates on the Transportation, Equity, Climate and Health (TRECH) Study, visit:
https://www.hsph.harvard.edu/c-change/news/trechstudy/

For stories of climate hope and action, subscribe to *The Climate Optimist* newsletter: https://hsph.me/ClimateOptimist

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 3/3/2021 1:29:32 PM
**To**: Harvey, Reid [Harvey.Reid@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Kim, Eun [Kim.Eun@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]
**CC**: Tsirigotis, Peter [Tsirigotis.Peter@epa.gov]; Grundler, Christopher [grundler.christopher@epa.gov]; Kocchi, Suzanne [Kocchi.Suzanne@epa.gov]
**Subject**: RE: Kicking Ash paper out!

I read an early draft of the paper almost a year and a half ago, and I what I remember is that the period of time his review covered ended before the full effect of MATS registered. Now, I see he asserts that he examined the period of time through 2016, but I wonder if what he was actually looking at still somehow failed to extend long enough to cover all of the MATS effects. All in all, I share your surprise.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Harvey, Reid <Harvey.Reid@epa.gov>
**Sent:** Wednesday, March 3, 2021 8:26 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Kim, Eun <Kim.Eun@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>
**Cc:** Tsirigotis, Peter <Tsirigotis.Peter@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Kocchi, Suzanne <Kocchi.Suzanne@epa.gov>
**Subject:** RE: Kicking Ash paper out!

Thanks for sharing this Joe. When I looked for the paper yesterday, it was behind the publication firewall. The study is interesting, in that it runs counter to the prevailing view that abundant natural gas supply and MATS were the two dominant forces driving coal plant closures. It's surprising to me that MATS doesn't play a larger role in their study, particularly given that the three-year litigation delay from 2012 to 2015 in starting CSAPR resulted in much less of an economic impact than originally anticipated.

Reid

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Tuesday, March 2, 2021 7:06 PM
**To:** Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Kim, Eun <Kim.Eun@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>
**Cc:** Tsirigotis, Peter <Tsirigotis.Peter@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Kocchi, Suzanne <Kocchi.Suzanne@epa.gov>; Harvey, Reid <Harvey.Reid@epa.gov>
**Subject:** FW: Kicking Ash paper out!

Piece I mentioned at our General, Tomas, Ale, and Eunjung.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Tuesday, March 2, 2021 1:07 PM
**To:** Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Kicking Ash paper out!

It's pre-publication, but here it is! We get a nice mention in the acknowledgements. I love that my original idea for this was that the Sierra Club was overstating their impact in coal closures, and they seem to be a primary driver (Nilles was taking credit for EVERY closure, though, which was my beef). Federal regs are high up there as well.

It's nice this is finally seeing the light of day after all this time. Woot! Hana, we have access through Hollis, you have to search for POMS.

David's tweet https://twitter.com/OpsStrategy/status/1366807740467716097

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | **rjust@law.harvard.edu**
Pronouns: she/her

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 3/3/2021 12:03:41 AM
**To**: Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Just, Robin L [rjust@law.harvard.edu]
**Subject**: RE: Kicking Ash paper out!

Me, too. Nice that EELP and Qingyang got recognition – and nice that the piece finally got out. Am going to circulate it here at the OAR Ranch. Hope you guys are doing well. Miss everyone.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Vizcarra, Hana V. <hvizcarra@law.harvard.edu>
**Sent:** Tuesday, March 2, 2021 1:09 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** RE: Kicking Ash paper out!

Thanks Robin! Looking forward to checking this out.

**Hana V. Vizcarra**
Staff Attorney

617.496.5934 | hvizcarra@law.harvard.edu | @HanaVizcarra

Harvard Law School Environmental and Energy Law Program
6 Everett Street, Suite 4119 | Cambridge, MA 02138

eelp.law.harvard.edu

HARVARD LAW SCHOOL | ENVIRONMENTAL & ENERGY LAW PROGRAM

---

**From:** Just, Robin L
**Sent:** Tuesday, March 2, 2021 1:07 PM
**To:** Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Kicking Ash paper out!

It's pre-publication, but here it is! We get a nice mention in the acknowledgements. I love that my original idea for this was that the Sierra Club was overstating their impact in coal closures, and they seem to be a primary driver (Nilles was taking credit for EVERY closure, though, which was my beef). Federal regs are high up there as well.

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David's tweet https://twitter.com/OpsStrategy/status/1366807740467716097

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | **rjust@law.harvard.edu**
Pronouns: she/her

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/10/2021 6:31:33 PM
**To**: Just, Robin L [rjust@law.harvard.edu]
**Subject**: RE: Future of work; deadly pollution; LaTosha Brown; minimum wage

Yeah. Pretty amazing work to uncover a really distressing reality. Really appreciate your flagging.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Wednesday, February 10, 2021 7:49 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Fwd: Future of work; deadly pollution; LaTosha Brown; minimum wage

Hi Joe, I assume you've read this but if not the Gazette story really reports it well. This is shocking. I'm amazed it was partially EPA funded, that must have happened pre-45.

Sent from my iPhone

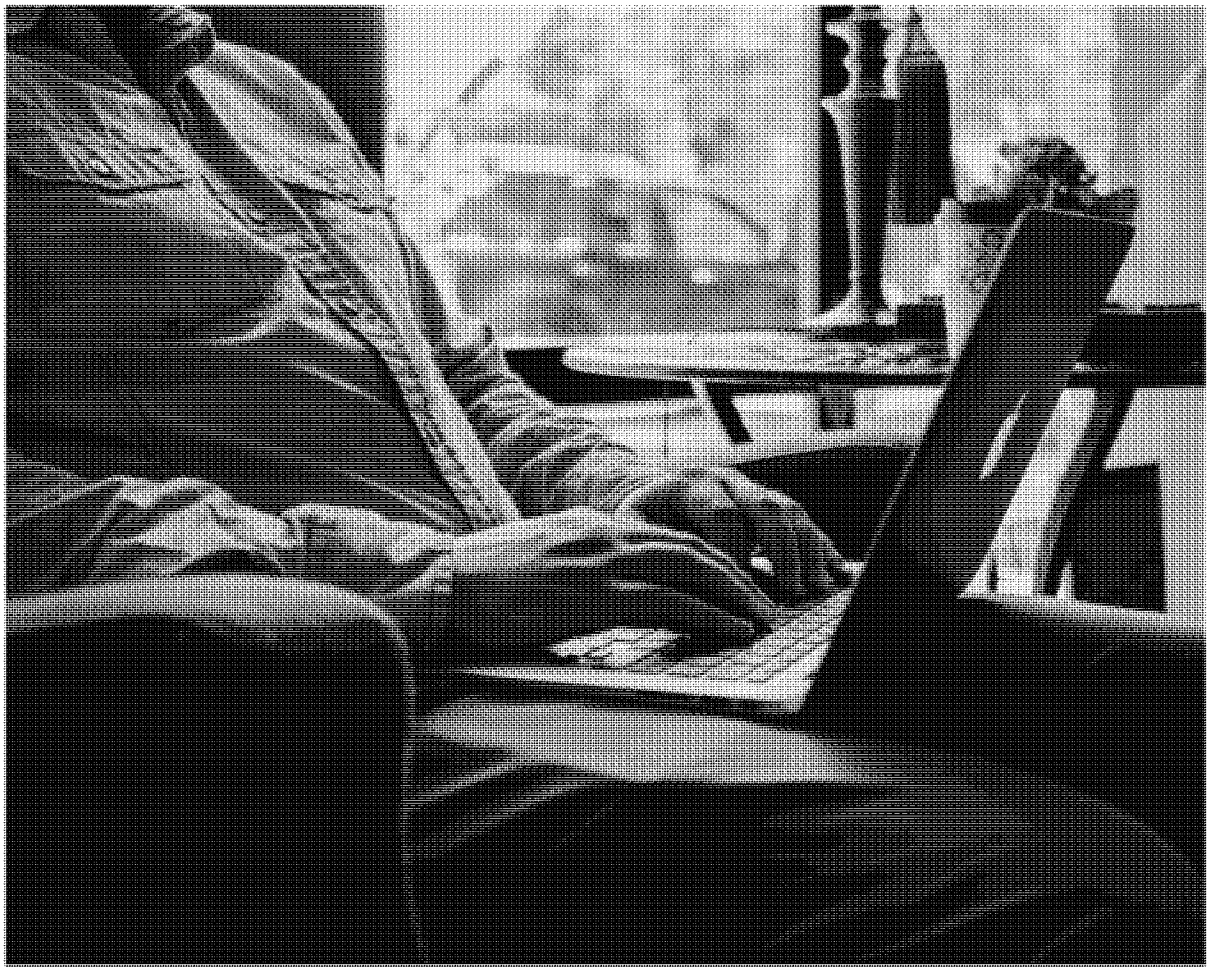
Begin forwarded message:

**From:** The Harvard Gazette <gazette@u.harvard.edu>
**Date:** February 10, 2021 at 6:03:03 AM EST
**To:** "Just, Robin L" <rjust@law.harvard.edu>
**Subject: Future of work; deadly pollution; LaTosha Brown; minimum wage**
**Reply-To:** digitalcomms@harvard.edu

The Harvard Gazette

# Today's Headlines

February 10, 2021



# How COVID is shaping the workplace of the future

Employees and employers are rethinking everything from the five-day work week to mental health care, say Business School faculty.

# 1 in 5 deaths caused by fossil fuel emissions, study finds

Significantly more people are dying from air pollution than previously thought, according to Harvard researchers.

**THE QUEST FOR RACIAL JUSTICE**

Follow the Gazette's coverage of the ongoing protest and movement against systemic racism in the nation.

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# What to Know

# The promise and peril of a $15 minimum wage

The Shorenstein Center rounds up research on the pay boost's prospects for lifting millions out of poverty and its risks for driving job loss.

## Featured Events

WEATHERHEAD CENTER FOR INTERNATIONAL AFFAIRS
### The Limits of Meritocracy
Noon, via Zoom.

HARVARD KENNEDY SCHOOL
### Jon Meacham – Healing a House Divided
2 p.m., via Zoom.

THE NORTON LECTURES
### Laurie Anderson: Spending the War Without You
5 p.m., via Zoom.

## Gazette Topics

ARTS & HUMANITIES
BUSINESS & ECONOMY
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NEWS & ANNOUNCEMENTS
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The Harvard Gazette, 114 Mt. Auburn Street, 6th Floor, Cambridge, MA 02138

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 3/30/2021 4:13:49 PM
**To**: Arroyo, Victoria [Arroyo.Victoria@epa.gov]
**CC**: Marten, Alex [Marten.Alex@epa.gov]; McGartland, Al [McGartland.Al@epa.gov]
**Subject**: RE: AI and public comment on regulatory proposals

Thank you, Vicki, Al and Alex.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Arroyo, Victoria <Arroyo.Victoria@epa.gov>
**Sent:** Tuesday, March 30, 2021 7:23 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** RE: AI and public comment on regulatory proposals

Good morning Joe! Yes, Al McGartland and Alex Marten in OP would be happy to connect with Joe and his student on this project. Feel free to send Joe Aldy their way (as they know each other!).
Best,
Vicki

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Monday, March 29, 2021 7:54 PM
**To:** Arroyo, Victoria <Arroyo.Victoria@epa.gov>
**Subject:** FW: AI and public comment on regulatory proposals

Is this something OP would know about? Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Aldy, Joseph Edgar <joseph_aldy@hks.harvard.edu>
**Sent:** Monday, March 29, 2021 10:43 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Nagarajan, Shruti <shruti_nagarajan@hks.harvard.edu>
**Subject:** AI and public comment on regulatory proposals

Hi Joe,

I hope you are doing well. I suspect that you are very busy trying to save the planet, so let me cut to the chase. I have a favor to ask.

Shruti Nagarajan, cc'd, is one of my HKS MPP students working on a policy analysis of natural language processing and broadly artificial intelligence in rulemaking. Through Ignite, an internal innovation program run out of the

HHS IDEA Lab, teams at the Department of Health and Human Services and the Environmental Protection Agency tackled the comment review process by beta testing NLP software to review comments received. Has the EPA conducted an evaluation of this (and potentially other) application(s) of AI in the processing of public comments on major regulatory proposals? For example, has the agency assessed the cost-savings and efficiencies that stem from the utilization of NLP in comment review and analysis? Given your role on the Clean Power Plan -- and the many many comments received on that proposal, I thought you might have a sense of this or would know who to direct Shruti to who would be familiar with this.

Thanks in advance for any assistance you can offer.

Best,

Joe

Joseph E. Aldy
Professor of the Practice of Public Policy
Harvard Kennedy School
Ofer 403, Mailbox 114
79 JFK Street
Cambridge, MA 02138
V: 617-496-7213
E: joseph_aldy@hks.harvard.edu
I: scholar.harvard.edu/jaldy/
T: @josephaldy

Faculty Chair, Regulatory Policy Program
Mossavar-Rahmini Center for Business and Government
I: www.hks.harvard.edu/centers/mrcbg/programs/rpp

University Fellow
Resources for the Future
I: https://www.rff.org/people/joseph-e-aldy/

Faculty Research Fellow
National Bureau of Economic Research
I: www.nber.org/people/joseph_aldy

Senior Adviser
Center for Strategic and International Studies
I: csis.org/expert/joseph-aldy

[ SEQ CHAPTER \h \r 1]**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Washington, D.C. 20460

OFFICE OF
AIR AND RADIATION

**MEMORANDUM**

SUBJECT: Recusal Statement

FROM: Joseph Goffman
Acting Assistant Administrator

TO: Michael S. Regan
Administrator

I have consulted with the Office of General Counsel/Ethics (OGC/Ethics) and been advised about my ethics obligations. This memorandum formally notifies you of my continuing obligation to recuse myself from participating personally and substantially in certain matters in which I have a financial interest, or a personal or business relationship. I also understand that I have obligations pursuant to Executive Order 13989 and President Biden's Ethics Pledge that I signed.

*OBLIGATIONS UNDER EXECUTIVE ORDER 13989*

Pursuant to Section 1, Paragraph 2 of the Executive Order, I understand that I am prohibited from participating in any particular matter involving specific parties in which my former employer, **Harvard University,** is a party or represents a party. I understand that my recusal will last for two years from the date that I joined federal service. This recusal will end after January 20, 2023.

I have been advised by OGC/Ethics that, for the purposes of this pledge obligation, the term "particular matters involving specific parties" is broadened to include any meetings or other communication relating to the performance of my official duties, unless the communication applies to a particular matter of general applicability and participation in the meeting or other event is open to all interested parties. I am further advised that the term "open to all interested parties" means that the meeting should include a multiplicity of parties. If, for example, there is "a meeting with five or more stakeholders regarding a given policy or piece of legislation, [then I] could attend such a meeting even if one of the stakeholders is a former employer or former client."[1] Such a meeting must also include a diversity of interests. Should a question arise as to whether a specific forum qualifies as "open to all interested parties," then I will consult with

[1] *See* Office of Government Ethics (OGE) Advisory DO-09-011 (3/26/09), which applies to Exec. Order 13989 pursuant to OGE Legal Advisories LA-21-03 (1/22/21) and LA-21-05 (2/23/21).

OGC/Ethics.

*FINANCIAL CONFLICTS OF INTEREST*

As required by 18 U.S.C. § 208(a), I will not participate personally and substantially in any particular matter in which I know that I have a financial interest directly and predictably affected by the matter, or in which I know that a person whose interests are imputed to me has a financial interest directly and predictably affected by the matter, unless I first obtain a written waiver, pursuant to 18 U.S.C. § 208(b)(1), or qualify for a regulatory exemption, pursuant to 18 U.S.C. § 208(b)(2). I understand that the interests of the following persons are imputed to me: any spouse or minor child of mine; any general partner of a partnership in which I am a limited or general partner; any organization in which I serve as officer, director, trustee, general partner or employee; and any person or organization with which I am negotiating or have an arrangement concerning prospective employment.

*Particular Matters Involving Specific Parties*

Because of the current level of financial ownership, I am disqualified from participating personally and substantially in any particular matter that affects any of following entities as a specific party:

| RECUSAL LIST – SPECIFIC PARTY MATTERS | | | |
|---|---|---|---|
| Abbot Laboratories | Abbvie | Accenture PLC | Agilent Technologies |
| Alphabet Inc | Altria Group | Amazon | American Express |
| Ameriprise Financial | Apple, Inc. | Arthur J Gallagher | AT&T |
| Becton Dickinson | Broadcom Inc | Canadian National RY | Centene Corp |
| Champion X Corp | Charter Communications | Cisco Systems | Colgate Palmolive |
| Comcast | Costco | Danaher Corp | Deere & Co. |
| Discover Financial | Disney | Dollar Tree Inc | Dover Corp |
| Eaton Corp | Ecolab Inc. | Facebook | Fidelity |
| First Rep Bank | Fortive Corp. | Glaxo Smith Kline | Home Depot |
| IBM | Intel Corp | Johnson & Johnson | JP Morgan Chase |
| Lab Co of America Holding | Markel Corp | Martin Marietta Materials Inc | Meditronic PLC |
| Merck & Co. | Mettler Toledo Intl | Microsoft | Mondelez International |
| Monster Beverage | Nestle S.A. | Nike | Novartis AG |
| NVIDIA Corp | Omnicom Group | PayPal | PepsiCo |
| Pfizer Inc. | Philip Morris | Proctor & Gamble Co. | PNC Financial |
| Qualcomm INC | Roche Holding AG | Roper Technologies | SalesForce |
| Sherwin Williams | Skyworks Solutions | Spotify | Starbucks Corp |
| State Street | Texas Instruments | TJX | Truist Financial Corp |
| United Health Group | US Bancorp | Verizon Comm | Visa |
| Wells Fargo | Zoetis, Inc. | | |

*Particular Matters of General Applicability*

I am also disqualified from participating personally and substantially in any particular matter of general applicability that is focused on the interests of any individual discrete and identifiable class of "persons" (identified as "sectors" below). This prohibition extends to each class (or sector) individually. If a matter affects all sectors or if a particular matter affects a combination of sectors, including the ones listed below, then I understand that I do not have a financial conflict of interest.

| RECUSAL LIST – INDIVIDUAL SECTORS | | |
|---|---|---|
| Advertising | Apparel | Banking |
| Communications Equipment | Credit Services | Discount Stores |
| Entertainment | Farm & Heavy Construction Machinery | Footwear |
| Healthcare Plans | Home Improvement Retail | Household & Personal Products |
| Information Technology Services | Insurance | Internet Content |
| Internet Retail | Non-Alcoholic Beverages | Packaged Foods |
| Paint | Pharmaceuticals & Drug Manufacturing | Restaurants |
| Scientific & Technical Instruments | Semiconductors | Snack Food |
| Snack Food | Software | Specialty Chemicals |
| Specialty Industrial Machinery | Specialty Industrial Machinery | Telecom Services |
| Tobacco | | |

*Corporate Bonds*

I am recused from participating in any particular matter that will have a direct and predictable financial effect upon the ability and willingness of the following bond issuers to honor their obligations or that will affect their bond ratings:

| RECUSAL LIST – BONDS | | | |
|---|---|---|---|
| Amgen, Inc. | Anthem, Inc. | Apple, Inc. | Comcast Corporation |
| General Dynamics Corporation | Morgan Stanley | Starbucks Corporation | State Street Corporation |

*Certificate of Divestiture*

I intend to seek a certificate of divestiture and will update this recusal statement when my financial situation changes.

*SCREENING ARRANGEMENT*

In order to ensure that I do not participate in matters relating to any of the entities listed above, I will instruct Ann Ferrio, Chief of Staff, to assist in screening EPA matters directed to my attention that involve my former employer or my former clients. All inquiries and comments involving the entities or issue areas on my recusal list should be directed to the Chief of Staff without my knowledge or involvement.

If the Chief of Staff determines that a particular matter will directly involve any of the entities or issue areas on my recusal list, then she will refer it for action or assignment to another, without my knowledge or involvement. In the event that she is unsure whether an issue is a particular matter from which I am recused, then she will consult with OGC/Ethics for a determination. I will provide a copy of this memorandum to my principal subordinates and a copy to Justina Fugh, Director, Ethics Office.

*UPDATE AS NECESSARY*

In consultation with OGC/Ethics, I will revise and update my recusal statement whenever warranted by changed circumstances, including changes in my financial interests, changes in my personal or business relationships, or any changes to my EPA duties. In the event of any changes, I will provide a copy of the revised recusal statement to you and OGC/Ethics.

cc: Elizabeth Shaw, Deputy Assistant Administrator
Tomás Carbonell, Deputy Assistant Administrator for Stationary Sources
Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources
Ann (Campbell) Ferrio. Chief of Staff
Eunjung Kim, Special Assistant
Justina Fugh, Director, Ethics Office

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 4/8/2021 4:56:53 PM
**To**: Just, Robin L [rjust@law.harvard.edu]; Peskoe, Ari [apeskoe@law.harvard.edu]; Perls, Hannah [hperls@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]; Davies, Kyra [kdavies@law.harvard.edu]
**Subject**: RE: Jody and Richard first 100 days presentation

Thank you. Had nurtured a hope that I could watch, but briefing we were doing ran way long.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Thursday, April 8, 2021 12:53 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Re: Jody and Richard first 100 days presentation

Yes! I'll send you the link when it's up. It's good.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, April 8, 2021 12:52 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

Any chance that a video of this will be posted? Not in the cards today for me to catch it live. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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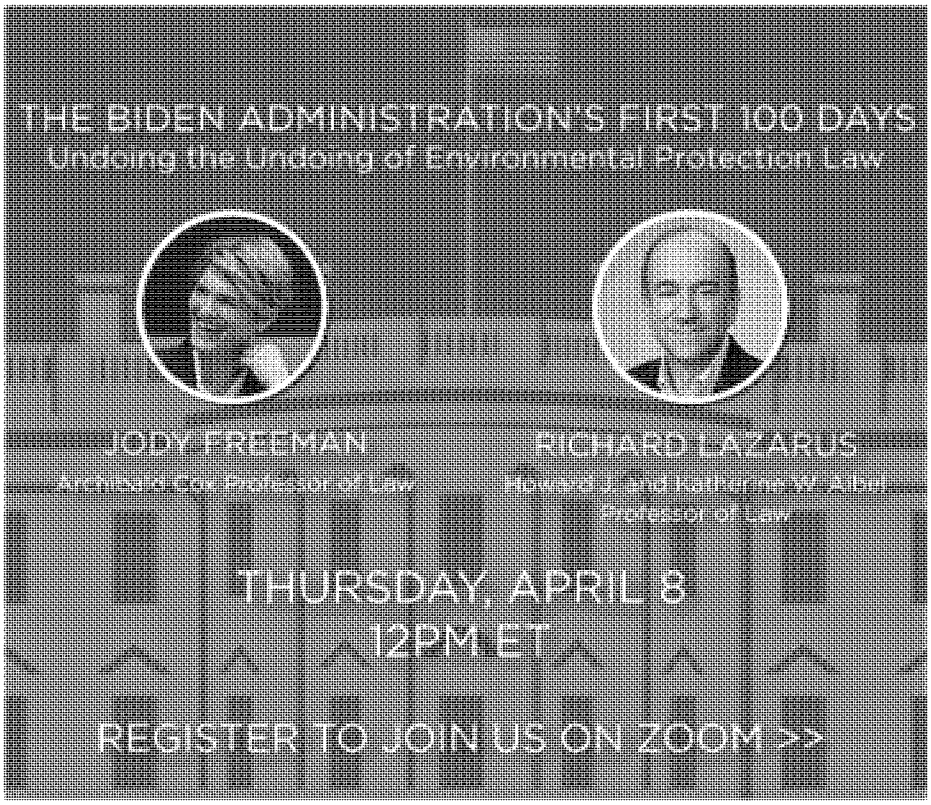
**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Tuesday, March 30, 2021 2:51 PM
**To:** Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Jody and Richard first 100 days presentation

ICYMI, hosted by HUCE, April 8th. Open to all. Sign up here if you're interested https://t.co/J7pd08rV7J?amp=1




ELI | ENVIRONMENTAL & ENERGY LAW PROGRAM

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Center for the Environment

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | **rjust@law.harvard.edu**
Pronouns: she/her

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 4/20/2021 11:39:13 PM
**To**: Campbell, Ann [Campbell.Ann@epa.gov]
**Subject**: RE: Mercury science

In fact, as I recall from our Ethics training last week, the very act of recommending that colleagues meeting with former Harvard colleagues is prohibited. Hence my note to Victoria and Justina about curing this. Thanks again for catching.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Campbell, Ann <Campbell.Ann@epa.gov>
**Sent:** Tuesday, April 20, 2021 7:37 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: Mercury science

Yes, if I understand your recusal correctly.

Ann (Campbell) Ferrio
Chief of Staff
Office of Air and Radiation
(202) 566-1370

On Apr 20, 2021, at 7:24 PM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

Because of the Harvard connection? Thanks for the catch.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Campbell, Ann <Campbell.Ann@epa.gov>
**Sent:** Tuesday, April 20, 2021 7:23 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: Mercury science

Joe, I'll need to consult Ethics. Per your recusal, I don't think you can do this meeting.

Ann (Campbell) Ferrio
Chief of Staff
Office of Air and Radiation
(202) 566-1370

On Apr 20, 2021, at 6:25 PM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

Please provide the usual response, but I think we should do this one. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Lambert, Kathleen Fallon <klambert@hsph.harvard.edu>
**Sent:** Thursday, April 15, 2021 8:11 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Mercury science

Joe,

Would it be possible to get on your schedule for a 30-minute meeting on mercury science update with Drs. Elsie Sunderland (Harvard), Charles Driscoll (Syracuse) and myself on April 29, 30, or May 3, 4, or 5?

Thank you,

Kathy Fallon Lambert
Senior Advisor, Center for Climate, Health and the Global Environment (C-CHANGE)
Harvard T.H. Chan School of Public Health
Co-founder, Science Policy Exchange
Tel. 802-436-1000
Twitter @kflambert
skype name kathleen.lambert31

For information and updates on the Transportation, Equity, Climate and Health (TRECH) Study, visit: https://www.hsph.harvard.edu/c-change/news/trechstudy/

For stories of climate hope and action, subscribe to *The Climate Optimist* newsletter: https://hsph.me/ClimateOptimist

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 5/6/2021 9:18:37 PM
**To**: Millett, John [Millett.John@epa.gov]
**CC**: DeLuca, Isabel [DeLuca.Isabel@epa.gov]
**Subject**: RE: Media Inquiry: E&E profile to run soon -- one last question

Dying for the latter, but do you really want to deal with the follow-up? OK to confirm 66, "but as a Boomer it's an article of faith that middle-age lasts until 75".

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Millett, John <Millett.John@epa.gov>
**Sent:** Thursday, May 6, 2021 5:16 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** RE: Media Inquiry: E&E profile to run soon -- one last question

Thanks – should we confirm 66, then? Or should we have some fun and say, "he could neither confirm nor deny his age [due to pending litigation against his birth certificate]."

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, May 6, 2021 5:13 PM
**To:** Millett, John <Millett.John@epa.gov>
**Cc:** DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** RE: Media Inquiry: E&E profile to run soon -- one last question

I don't care one way or the other, but I really do appreciate your sensitivity. Thank you.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Millett, John <Millett.John@epa.gov>
**Sent:** Thursday, May 6, 2021 5:11 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** FW: Media Inquiry: E&E profile to run soon -- one last question

Hi Joe – it looks like that E&E piece is due to run soon, and Sean was looking to confirm your age for his readers.

I pushed back because I thought the question was unnecessary, albeit innocuous . . .

Enesta, our press officer, advises: "**In their profile pieces, they generally include ages. Not in all cases. That said. Joe can decline to provide his age if he so chooses.**"

Thanks!

---

**From:** Jones, Enesta <Jones.Enesta@epa.gov>
**Sent:** Thursday, May 6, 2021 4:57 PM
**To:** Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>
**Subject:** Media Inquiry: E&E re Joe

**Re-upping to ensure this was received.**
**Please confirm Joe's age.**

**From:** Sean Reilly <sreilly@eenews.net>
**Date:** May 6, 2021 at 3:03:09 PM EDT
**To:** "Jones, Enesta" <Jones.Enesta@epa.gov>
**Cc:** Press <Press@epa.gov>
**Subject: Re: Questions related to story on your first three months at OAR**

Hi Enesta:

It looks like the story on Mr. Goffman will run in the next day or two; if there have been any developments related to my previous questions (or anything else worth noting), please me know. Also, can you confirm that Mr. Goffman is 66? My deadline is 9 a.m. tomorrow.

Thanks,
Sean

Sean Reilly
Reporter
E&E News/Politico
202-316-4596 (Cell)
Skype: Sreilly_69
sreilly@eenews.net
Twitter: @SeanatGreenwire

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**From:** Sean Reilly
**Sent:** Wednesday, April 21, 2021 10:09 AM
**To:** Jones, Enesta <Jones.Enesta@epa.gov>
**Cc:** Press <Press@epa.gov>
**Subject:** Re: Questions related to story on your first three months at OAR

Received, Enesta.

Thanks,
Sean

Sent from my iPhone

On Apr 21, 2021, at 10:07 AM, Jones, Enesta <Jones.Enesta@epa.gov> wrote:

**EXTERNAL SENDER**: Use caution with links and attachments.

Hi Sean,
Please see our responses below.

**The attached amicus brief, filed in pending litigation over the 2020 ozone NAAQS rule, alleges that in your prior position at Harvard, you coordinated with Democratic state attorneys general on a legal strategy intended (if I understand Mr. Horner correctly) to ultimately regulate greenhouse gases under the NAAQS umbrella. As I far as I can tell, EPA has not yet responded to these allegations in court. Given that the brief names you directly, however, do you have any comment on whether you share that goal with the plaintiffs or on Energy Policy Advocates' allegations more generally?**

**A.** From Joe Goffman: I cannot comment as this falls under pending litigation. I can say that EPA will follow science and the law to ensure that the environment and public health are protected.

**According to your February calendar, you had informational discussions on Feb. 11 and Feb. 23 with Bill Wehrum and Anne Austin, respectively. Did those discussions take place, were they initiated at your request and, if so, what was the purpose, given that you're already seeking to undo some of the initiatives undertaken during their respective tenures at OAR?**

**A.** From Joe Goffman: It's routine for incoming OAR leadership to touch base with their predecessors. The meetings were collegial and cordial.

**Have you been told by the Biden administration whether you will be nominated to be assistant administrator of OAR on a Senate-confirmed basis and, if so, what were you told? If not, what's your understanding of the administration's plans in that regard and do you want the position on a Senate-confirmed basis?**

**A.** From Nick Conger: We refer you to the White House for questions about potential future nominations. Joe Goffman is pleased to serve in his current role.

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 6/14/2021 11:52:04 AM
**To**: Kim, Eunjung [Kim.Eun@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]; Shoaff, John [Shoaff.John@epa.gov]; Lubetsky, Jonathan [Lubetsky.Jonathan@epa.gov]
**Subject**: RE: QFR Follow Up from Dan

Thanks, Eunjung. I'm not entirely clear as to what is Dan looking for. I think the question does refer to the WSJ editorial, but, as you say, the email production was made by the NY AG's office and included an email or emails from my Gmail account circa 2019, when I was employed by Harvard University, not by a government agency. I am not really able to make out what the WSJ editorial's theory of the case is either on its own terms or in terms of what the email exchange was, to the extent that I even remember it, was really about. Thanks, again.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Kim, Eunjung <Kim.Eun@epa.gov>
**Sent:** Friday, June 11, 2021 1:04 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>
**Subject:** QFR Follow Up from Dan
**Importance:** High

Hey Joe,
We wanted to flag this follow up from Dan on a QFR. He is asking for background on this FOIA request referenced in the QFR about your emails. OAPPS is still searching for the specific FOIA request and hoping to get information to Dan by EOD on Monday. The QFRs aren't being held up or anything, but just wanted to make sure you knew he was inquiring about this specific question.

We believe that this QFR is actually referencing this article that mentions your emails from 2019. Therefore it would not be a FOIA request from EPA or your current tenure.

Please let me know if you have any questions. Thanks!

Capito 32—There's also a specific request to flag this for Joe/OAR—make sure folks see this response and how it's changed—and ask for some background on the FOIA production. I'm skeptical that it's being fairly characterized in the question but haven't been able to go throw that production; a summary and explanation would help.

Question: According to emails obtained through a Freedom of Information Act (FOIA) request, Democratic Attorneys General consulted with EPA Office of Air and Radiation (OAR) Acting Assistant Administrator Joseph Goffman on using a more stringent ozone National Ambient Air Quality Standard (NAAQS) as a "backdoor" method to regulate greenhouse gas (GHG) emissions. Do you believe the NAAQS program should be used as a "backdoor" to directly or secondarily regulate greenhouse gases?

**Response: When considering future regulatory policies related air pollution, EPA will adhere to science and the law, including our obligations to protect public health under the Clean Air Act**

Eunjung Kim
Special Assistant
Office of Air and Radiation
Environmental Protection Agency
(202) 815-7252

Appointment

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 6/17/2021 9:14:51 PM
**To**: Just, Robin L [rjust@law.harvard.edu]

**Subject**: Accepted: Farewell from EELP to Kathy!

**Start**: 6/28/2021 5:30:00 PM
**End**: 6/28/2021 6:30:00 PM

**Recurrence**: (none)

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 1/21/2021 5:08:52 PM
**To**: Just, Robin L [rjust@law.harvard.edu]
**Subject**: RE: Draft Announcement

Of course. As I said, you and your team are at the core of EELP.

Thanks for handling this.

---

**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Thursday, January 21, 2021 12:06 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: Draft Announcement

This is perfect! Thank you so much for including your comms team in there, what a thoughtful move.

I'll get our post/tweet all teed up for the big EPA reveal. I'll let Jody know this is coming, but won't share it with her or anyone else until it's official.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, January 21, 2021 12:04 PM
**To:** Just, Robin L <rjust@law.harvard.edu>
**Subject:** RE: Draft Announcement

Shortened it a bit, just FYI. Will let you know when this goes live on the EPA website, etc. Thanks.

**Joseph Goffman, Principal Deputy Assistant Administrator, Office of Air and Radiation**

Joe Goffman returns to EPA after serving from 2009 – 2017 as the Associate Assistant Administrator for Climate and Senior Counsel in the Office of Air and Radiation, where he provided policy and legal counsel on a wide range of climate policy and Clean Air Act regulatory and implementation issues and rulemakings. Since 2017 he has served as the Executive Director of the Environmental and Energy Law Program at Harvard Law School where he led a team of attorneys and communications specialists providing information and analysis to stakeholders, government decision makers and the media, and offering innovative responses on emerging issues in the areas of federal, state and municipal energy and electricity law and environmental and administrative law as well as in selected areas of corporate law. Joe also worked on the U.S. Senate Committee on Environment and Public Works as the Democratic Chief Counsel and Majority Senior Counsel. He holds B.A. and J.D. degrees from Yale University.

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**From:** Goffman, Joseph
**Sent:** Thursday, January 21, 2021 11:56 AM
**To:** Just, Robin L <rjust@law.harvard.edu>
**Subject:** Draft Announcement

**Joseph Goffman, Principal Deputy Assistant Administrator, Office of Air and Radiation**

Joe Goffman returns to EPA after serving from 2009 – 2017 as the Associate Assistant Administrator for Climate in the Office of Air and Radiation, providing policy and legal counsel on a wide range of climate policy and Clean Air Act regulatory and implementation issues and rulemakings and their legal defense in federal court. Since 2017 he has served as the Executive Director of the Environmental and Energy Law Program at Harvard Law School where he led and managed a team of legal researchers and communications specialists focusing on developing and disseminating information to stakeholders, government decision makers and the media, innovative responses to emerging issues in the areas of federal, state and municipal energy and electricity law and environmental and administrative law as well as in selected areas of corporate law. Joe also worked in the U.S. Senate, Committee on Environment and Public Works as the Democratic Chief Counsel and Majority Senior Counsel. He holds B.A. and J.D. degrees from Yale University.

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 1/21/2021 8:02:25 PM
**To**: Hamilton, Lindsay [Hamilton.Lindsay@epa.gov]
**Subject**: RE: PLEASE REVIEW: Draft Personnel Announcement -- revised and shortened a bit. *Thank you!*

Low priority given everything, but if you can think of it, please ping me when the announcement is posted or launched. I promised my previous employer that I would let them know when this goes out. Thanks.

**From:** Hamilton, Lindsay <Hamilton.Lindsay@epa.gov>
**Sent:** Thursday, January 21, 2021 12:10 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** RE: PLEASE REVIEW: Draft Personnel Announcement -- revised and shortened a bit. *Thank you!*

Updated, thanks.

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, January 21, 2021 12:03 PM
**To:** Hamilton, Lindsay <Hamilton.Lindsay@epa.gov>
**Subject:** RE: PLEASE REVIEW: Draft Personnel Announcement -- revised and shortened a bit. *Thank you!*

**Joseph Goffman, Principal Deputy Assistant Administrator, Office of Air and Radiation**

Joe Goffman returns to EPA after serving from 2009 – 2017 as the Associate Assistant Administrator for Climate and Senior Counsel in the Office of Air and Radiation, where he provided policy and legal counsel on a wide range of climate policy and Clean Air Act regulatory and implementation issues and rulemakings. Since 2017 he has served as the Executive Director of the Environmental and Energy Law Program at Harvard Law School where he led a team of attorneys and communications specialists providing information and analysis to stakeholders, government decision makers and the media, and offering innovative responses on emerging issues in the areas of federal, state and municipal energy and electricity law and environmental and administrative law as well as in selected areas of corporate law. Joe also worked on the U.S. Senate Committee on Environment and Public Works as the Democratic Chief Counsel and Majority Senior Counsel. He holds B.A. and J.D. degrees from Yale University.

**From:** Hamilton, Lindsay <Hamilton.Lindsay@epa.gov>
**Sent:** Thursday, January 21, 2021 11:52 AM
**To:** Arroyo, Victoria <Arroyo.Victoria@epa.gov>; Adhar, Radha <Adhar.Radha@epa.gov>; Fox, Radhika <Fox.Radhika@epa.gov>; Blythers, Dorien <Blythers.Dorien@epa.gov>; Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Cassady, Alison <Cassady.Alison@epa.gov>; Chaudhary, Dimple <Chaudhary.Dimple@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Enobakhare, Rosemary <Enobakhare.Rosemary@epa.gov>; Fine, Philip <Fine.Philip@epa.gov>; Fox, Radhika <Fox.Radhika@epa.gov>; Harris, Sincere <Harris.Sincere@epa.gov>; Hoffer, Melissa <Hoffer.Melissa@epa.gov>; Katims, Casey <Katims.Casey@epa.gov>; Lucey, John <Lucey.John.D@epa.gov>; Utech, Dan <Utech.Dan@epa.gov>
**Subject:** PLEASE REVIEW: Draft Personnel Announcement

All,

Attached is the draft personnel announcement we will issue today. **Please review your bio and respond to me with any changes as soon as possible**.

In some cases, this might be the short bio you provided to us and in others it is distilled from a longer version or other sources.

If you have changes to your bio, please send me your updated version in the body of an email. No need to track changes in the document, we will copy and paste it back into the central version. Please be mindful of length.

This will also be copy edited after the updates are made.

Thank you,
Lindsay

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 9/7/2021 1:56:19 PM
**To**: Fugh, Justina [Fugh.Justina@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]
**Subject**: RE: Poorly devised regulation lets firms pollute with abandon

That was the concern. I was a little surprised to see her identified that way. She does not appear as a member of the Harvard program's staff or affiliates, and indeed I thought she no longer identified herself that way after I left since I was her one connection to the program and apart from a grant in 2018 she received no compensation. Thanks, Justina.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Fugh, Justina <Fugh.Justina@epa.gov>
**Sent:** Tuesday, September 7, 2021 9:49 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>
**Subject:** RE: Poorly devised regulation lets firms pollute with abandon

Hi Joe,
Well, I read the transcript, and I wonder if your concern has to do with the interviewee's recommendation of Cynthia Giles' blog post. If so, then I have no concerns. The fact that Cynthia is affiliated with your former employer does not raise any pledge issues for you. Your forwarding the article itself is not an endorsement of her blog post nor does it constitute any participation by you in any particular matter in which Harvard is a party or represents a party. So if that's your concern, then I see no reason for a call.
Justina

Justina Fugh (she/her) | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

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**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Sunday, September 5, 2021 4:57 PM
**To:** Fugh, Justina <Fugh.Justina@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>
**Subject:** FW: Poorly devised regulation lets firms pollute with abandon

The item in the link makes a reference that I was unaware of before I sent the link to colleagues since I sent the link before reading the transcript. Perhaps we can set up a call with week to discuss the issue. Thanks.

Joseph Goffman
Acting Assistant Administrator

Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Goffman, Joseph
**Sent:** Sunday, September 5, 2021 4:44 PM
**To:** Koerber, Mike <Koerber.Mike@epa.gov>; Wayland, Richard <Wayland.Richard@epa.gov>
**Cc:** Carbonell, Tomas <Carbonell.Tomas@epa.gov>; 'Alejandra Nunez (Nunez.Alejandra@epa.gov)' <Nunez.Alejandra@epa.gov>; 'Millett, John' <Millett.John@epa.gov>
**Subject:** RE: Poorly devised regulation lets firms pollute with abandon

https://www.resources.org/resources-radio/cracking-the-case-of-the-vanishing-air-pollution-data-with-eric-zou/

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Goffman, Joseph
**Sent:** Sunday, September 5, 2021 9:08 AM
**To:** Koerber, Mike <Koerber.Mike@epa.gov>; Wayland, Richard <Wayland.Richard@epa.gov>
**Cc:** Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Alejandra Nunez (Nunez.Alejandra@epa.gov) <Nunez.Alejandra@epa.gov>; Millett, John <Millett.John@epa.gov>
**Subject:** Poorly devised regulation lets firms pollute with abandon

https://twitter.com/adam_tooze/status/1434486474100002820

https://www.economist.com/graphic-detail/2021/09/04/poorly-devised-regulation-lets-firms-pollute-with-abandon

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 1/25/2021 2:17:45 AM
**To**: dave@consultgreenlight.com; jgoffman@law.harvard.edu
**Subject**: RE: congrats!

Thanks, Dave. Really appreciate it.

---

**From:** dave@consultgreenlight.com <dave@consultgreenlight.com>
**Sent:** Friday, January 22, 2021 11:05 AM
**To:** jgoffman@law.harvard.edu; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** congrats!

Congratulations on your return to EPA, Joe! Thanks for serving again – and fighting to make things better.

Best,
Dave

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Dave Grossman
Green Light Consulting
(301) 495-3710
dave@consultgreenlight.com
www.ConsultGreenLight.com
Twitter: @GreenLightDaveG

Message

**From:** Wohl, Daniel [dwohl@hks.harvard.edu]
**Sent:** 3/3/2022 8:39:29 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** MPP/MBA Graduate Student Interested in EPA OAR

Hi Joseph,

Hope this finds you well. My name is Daniel Wohl, and I'm a joint MPP/MBA graduate student at Harvard Kennedy School (HKS) and Harvard Business School (HBS). I'm reaching out because I'm interested in opportunities for graduate students to contribute to EPA's Office of Air and Radiation over the summer. I'm specifically curious about the ongoing process to design the 2026+ Light Duty Vehicle GHG Emissions Standards and have access to funding through school. Would you have a moment to discuss your experience at EPA and whether there could be summer opportunities for graduate students?

A few sentences on my background: Before coming to HBS and HKS, I spent four years at Tesla – two in Finance where I was responsible for all financial planning & analysis and product pricing for the used car business and the residential charging businesses, and two in Business Development & Government Affairs where I ran regulatory credit trading operations (ZEV, GHG, CAFE, LCFS, etc.). While operating the credit desk, I negotiated and executed over 100 regulatory credit transactions, including one with a top five global automaker culminating in a $2B deal. Before Tesla, I worked with the U.S. Senate Committee on Energy & Natural Resources and was a professional basketball player in Israel.

Thanks,

**Daniel Wohl**
MBA Candidate | HARVARD **BUSINESS** SCHOOL | Class of 2024
MPP Candidate | HARVARD **KENNEDY** SCHOOL | Class of 2024
Email: dwohl@hks.harvard.edu
Mobile: +1 (818) 434-9971

Message

**From:** Justin Giannantonio [Giannantonio@co2efficient.com]
**Sent:** 3/3/2022 2:30:28 PM
**To:** Justin Giannantonio [Giannantonio@co2efficient.com]
**CC:** Tom Hassenboehler [Hassenboehler@CoefficientPSI.com]; Melanie Steele [Steele@co2efficient.com]; Tom Lawler [lawler@co2efficient.com]; Sean McGinnis [Mcginnis@co2efficient.com]
**Subject:** COEFFICIENT Releases Methane Transparency Report
**Attachments:** Methane Tech Report_FINAL.pdf

Good Morning,

As you know, Russia's recent unprovoked invasion of Ukraine is impacting myriad political, economic, energy, and environmental policies. This devastating tragedy is also demonstrating the linkage between energy security, national security, and climate security.

Yesterday, COEFFICIENT released the attached report titled, *"Methane Quantification: Toward Differentiated Gas"*, which highlights the **opportunity for policymakers and oil and gas operators to move from the mindset of leak detection to a mindset of emissions measurement and quantification.**

In the report, we reviewed **6 categories** of technologies to measure, monitor, and quantify methane emissions. Most technologies include a **hardware** component (sensor and other devices or vehicles) and a **software** component (data analytics and cloud-based platforms). Often, images and data are gathered by hardware and then analyzed by software to **quantify** methane.

Based on our analysis, almost all the companies/technologies we profiled have the capability to quantify methane emissions and integrate with digital monitoring, reporting, and verification (MRV) systems, today. However, our sense is that most oil and gas operators are not utilizing these technologies to measure and quantify methane emissions; instead, many operators are focused on regulatory compliance under EPA OOOOa rather than taking the next steps toward measurement and quantification.

If we drive emissions quantification, we have an opportunity to provide our allies with greater energy security while also making significant progress toward the Global Methane Pledge.

**We would welcome the opportunity to meet and discuss this report and our policy recommendations. Is there a time that would work for you?** If so, please let me know what may work for you, and I can send over proposed times.

Thank you,

Justin

**Justin Giannantonio**

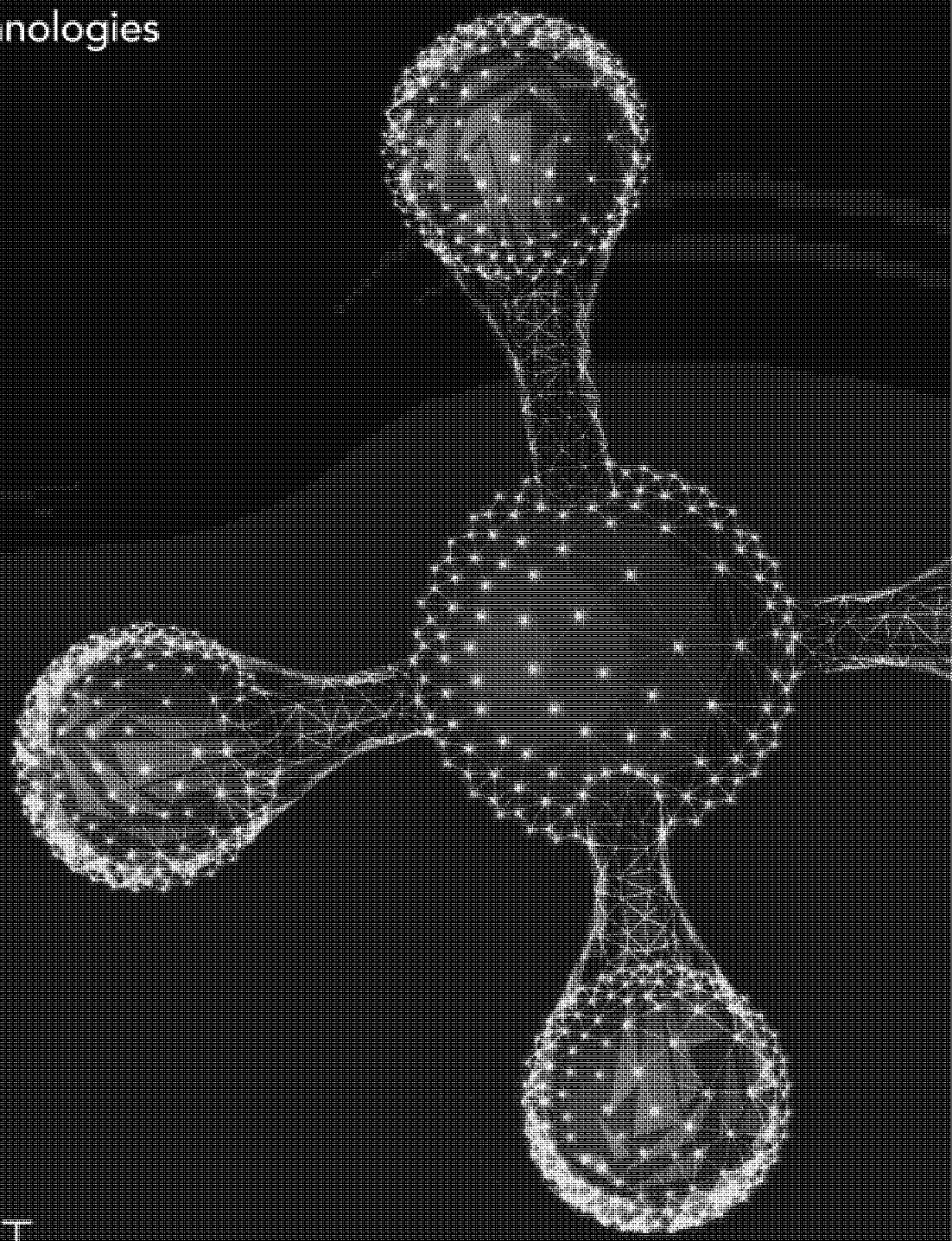
COEFFICIENT | Policy and Advocacy Manager

Phone: 484.948.0324 | Email: giannantonio@co2efficient.com

*MARCH 2022*

# METHANE QUANTIFICATION: TOWARD DIFFERENTIATED GAS

## An Assessment of Methane Measurement and Monitoring Technologies



COEFFICIENT

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## Acknowledgements

This report was developed by CO2EFFICIENT LLC (COEFFICIENT) for Sempra. COEFFICIENT would like to thank individuals from the following organizations for providing valuable perspectives and feedback regarding the issues covered in this report. However, none of the content or conclusions in this report should be attributed to any organization listed here.

Baker Hughes

Bechtel

The Center on Global Energy Policy at Columbia University SIPA

Colorado School of Mines Payne Institute for Public Policy

ConocoPhillips

ExxonMobil

Eurogas

Gas Technology Institute

Jonah Energy

Mitsubishi

ONE Future Coalition

Project Canary

Sempra

SYSTEMIQ

Xpansiv

## About COEFFICIENT

COEFFICIENT is a mission-based strategic consultancy focused on advancing public policy and market solutions in the energy and environmental sectors. Located in Washington, D.C., COEFFICIENT is a leader in developing transformational 21st century climate policies that integrate environmental sustainability and corporate governance with digital technology solutions. Learn more at www.co2efficient.com.

## Technical Terms Used in Methane Detection and Measurement

The following are common terms you may encounter in discussions regarding methane detection and measurement technologies, including in this report.

**ATMOSPHERIC COLUMN:** The body of air above a specified area; measurements of methane are often referred to as "column measurements," "column methane," or measurement of the "methane column."

**CONSTELLATION:** A group of satellites that work together as a system.

**GEOLOCATED:** Ability to associate a device connected to the internet with a specific geographic location.

**GEOREFERENCED:** Ability to associate an aerial digital image or video with a specific geographic location on the ground. Also referred to as **geotagged**.

**LEAK DETECTION AND REPAIR (LDAR):** A set of practices designed to identify methane leaks for repair.

**LIGHT DETECTION AND RANGING (LIDAR):** A remote sensing method that uses light in the form of a pulsed laser to measure distances to the ground and generate precise, three-dimensional information about features on the ground. Airplanes and helicopters are the most common platforms for acquiring lidar data over broad areas.

**MASS SPECTROMETRY:** An analytical technique that is used to measure the mass-to-charge ratio of ions.

**METHANE EMISSIONS QUANTIFICATION**: An emerging set of practices for measuring actual emissions from the source (equipment, well, facility, or site) and calculating those measurements in a way that provides useful information to industry and other stakeholders, including regulators.

**MINIMUM DETECTION LEVEL (MDL):** Measurement of the mass of emissions over time that can be detected under optimal conditions. MDL is typically expressed in kilograms (kg) or grams (g) per hour (h). A lower MDL represents better detection capabilities.

**OPTICAL GAS IMAGING (OGI):** A thermal imaging technology that utilizes high sensitivity infrared cameras to detect emissions of industrial gases. OGI cameras are widely used by industry for LDAR activities.

**OPTICAL SPECTROMETRY:** A technique for measuring the distribution of light across the optical spectrum, from the ultraviolet spectral region to the visible and infrared.

**SUPER-EMITTER:** A site or piece of equipment that produces a disproportionate share of total emissions. NASA has defined a methane super-emitter as a source that produces more than 10 kilograms of methane per hour.

**UNMANNED AERIAL VEHICLE (UAV):** An aircraft without any human pilot, crew, or passengers; also called a drone. The Federal Aviation Administration (FAA) uses the term **unmanned aerial system (UAS)** to refer to any system that include a UAV or drone as well as a ground-based controller and/or communication system.

## Introduction

### The Problem: Accelerating Risk for Natural Gas

The August 2021 report by the UN Intergovernmental Panel on Climate Change (IPCC) included many dire warnings regarding global temperature rise and new policy and actions that should be taken; however, one recommendation that garnered some of the most significant attention was the panel's urgent call for action on methane emissions. The panel identified methane emissions as a fundamental driver of climate change, representing the first time a major climate report has recognized the need to address methane emissions as part of the pathway to limiting global warming.

Even before the report's release, several governments were already accelerating new regulations to tackle methane. An early draft of legislation in Europe states that "the EU will consider enforcing an effective stop of all routine venting and flaring in the EU energy sector by 2025". The actual proposal, released in December 2021, would in fact ban venting and flaring practices except in narrowly defined circumstances. The proposal also would require companies to measure and quantify their asset-level methane emissions at source and carry out comprehensive surveys to detect and repair methane leaks in their operations. With regard to natural gas imports, the proposal will require importers to provide detailed information about methane emissions measurement, reporting, and verification (MRV) and calls for consideration of stronger measures to restrict fossil fuel imports in 2025. (More information about the proposal can be found here.)

In the U.S., the Environmental Protection Agency (EPA) is currently developing new, more ambitious regulation of methane leaks from the oil and gas industry that are expected to be released this fall. Several states, including Colorado and New Mexico are already implementing regulation on methane. The U.S. Congress has flirted with the idea of imposing a fee on methane emissions as soon as 2023, regardless of EPA's action. And, the U.S. Securities and Exchange Commission (SEC) is expected to release a new rulemaking on climate disclosures and ESG risks in 2022, after receiving over 5,500 comments on the topic last year. Environmental groups have called for at least a 50% reduction in U.S. methane emissions by 2030.

With these and other actions, it has become clear that risk for natural gas is accelerating. Nonetheless, with emerging technologies, the oil and gas industry has an opportunity to reimagine the future of natural gas in ways that promote transparency, trust, and transactability in differentiated gas markets.

### The Vision: Transparency, Trust, Transactability

The current environment has created a compelling leadership opportunity for the oil and gas sector to get ahead of regulator and investor expectations on methane emissions through quantification and reduction. A small number of companies are already pursuing this opportunity by adopting three principles for methane emissions measurement, monitoring, reporting, and verification, namely: Transparency, Trust, and Transactability.

Transparency begins with a recognition that companies must go beyond leak detection and repair to quantification of methane emissions. This will necessarily involve making accurate, granular measurements and frequent monitoring. To achieve transparency of methane emissions, companies will need to understand the measurement capabilities of various technologies; pilot and deploy technologies to measure emissions; and create a baseline emissions measurement against which to compare future reductions.

Trust involves ensuring that regulators, investors, and other stakeholders have confidence in emissions data and can rely on such data to make policy and investment decisions. This will require verification of emissions data not just by industry or environmental NGOs, but by independent third parties or data platforms. To achieve trust, companies can identify and work with third parties to validate emissions measurements. In addition, all stakeholders will need to come to consensus about standard baseline emissions measurement methodologies (which in the near term could be a "hybrid" of measurements and emissions factors as proposed by the GTI Veritas program) and standards for reporting baseline emissions and regular updates.

Transactability means that customers can buy and sell products based on emissions data, ultimately creating new markets for differentiated gas products. This will require that data is interoperable across multiple systems and the development of standard, secure certification processes for products.

Development of a framework that promotes strong performance metrics for all segments of the gas supply chain and a market for differentiated natural gas must connect the dots between transparency, trust, and transactability. A strong and robust future for natural gas will require high quality data and rigorous MRV to gain credibility in the eyes of NGOs and policymakers. In addition, it will require the integration of methane emissions data with financial performance data that can help provide the currently missing link between ESG reporting and data-driven climate accounting.

We have an opportunity to ensure a strong future for natural gas with real emissions reductions, consumer trust, and new markets for differentiated products. This assessment addresses a critical piece of achieving this future.

## How Do We Get There?

Experts have noted that there are at least 600,000 methane leaks in the U.S. today, and even this large number may represent an undercount.[1] Up until recently, most companies have focused on leak detection and repair (LDAR)—an undoubtedly worthy goal, but not one that results in a full picture of a site's emissions.

Quantifying emissions is challenging because there are so many potential point sources—myriad facilities, equipment, and small components of equipment at each site. How can companies measure these potential sources in an accurate, timely, and cost-effective way?

Traditional approaches for LDAR have typically involved optical gas imaging (OGI) cameras that provide a visual of methane leaks at various resolutions and distances. However, the shift from LDAR to measurement will require more sophisticated sensors that do not only detect, but also quantify methane emissions.

Sensor technologies have expanded rapidly in recent years and promise to enable increasingly cost-effective methane solutions. Sensors are generally mounted or integrated with other technologies, and these technologies each have strengths and limitations for measuring methane emissions.

### Scope of this Tech Assessment

This assessment reviews leading and emerging technologies that are being deployed with sensors for methane measurement and monitoring, specifically:

[1] Cate Haight, "The Fight Against Methane," *Columbia Energy Exchange podcast*, July 13, 2021, https://www.energypolicy.columbia.edu/fight-against-methane.

1. The measurement capabilities of various technology categories;
2. How specific technologies have been piloted or deployed in the field; and
3. Leading technology initiatives that have integrated multiple technologies, and in some cases, implemented approaches for independent verification of emissions and certification of differentiated gas.

This assessment will describe six technology categories and more than 30 detailed profiles of leading methane emissions technologies.

This assessment also highlights "Technologies in Action"— leading technology initiatives where multiple stakeholders have collaborated to integrate multiple measurement and monitoring technologies in the field and validate the resulting data for use in reporting and certification.

## Profiles of Technology Providers and Initiatives

The profiles focus on leading technology solutions and collaborative projects specifically focused on measuring and monitoring methane emissions. Technology solutions typically include a hardware component (sensor and other devices or vehicles) and a software component (data analytics and cloud-based platforms). In many cases, images are gathered by hardware and then analyzed by software to quantify methane.

This set of profiles may not include every possible technology provider, but seeks to assess leading, known, and emerging technologies that may be of interest to oil and gas companies. We reviewed a number of additional companies for which there was a lack of quality information available in the public domain, including: Aerometrix, Luxmux, Modis, Nevada Nano, Oiler, Surface Solutions, Orbital Sidekick, and others. These companies and technologies were excluded from this assessment but may be revisited in a future phase of this project.

The profiles are organized into six technology categories. For each category we have assessed the overall strengths and weaknesses, which reflect industry and stakeholder learnings to date about the most effective ways to deploy technologies from each category.

All profiles are organized in a template, by category and alphabetical within categories. Each profile generally includes information outlined in TABLE 1. A summary of the profiles included in this assessment are listed in TABLE 2.

TABLE 1
Information Provided in Each Profile

| Field | Description |
|---|---|
| **NAME(S) AND LOCATION** | Name of the company and/or technology and location of headquarters or operations |
| **PARTNERS OR INVESTORS** | High-profile organizations involved in funding or piloting/deploying the technology |
| **TECHNOLOGY DESCRIPTION** | Description of the technology, its key functionality, and its state of development or deployment |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Key technical specs, including minimum detection level (MDL), if available and other relevant performance specifications[2] |
| **NOTEWORTHY DISTINCTIONS** | Any additional details that differentiate the technology from others in the category or across categories |
| **RECENT PROJECT(S)** | High-profile projects where the technology has been tested or deployed (if any) |

[2] Note that in this Tech Assessment, the technical specifications listed are publicly available information and may not have been validated in the field.

**TABLE 2**
Summary of Profiles

| Category | # | Profiles | |
|---|---|---|---|
| **SATELLITES** | 9 | • Bluefield<br>• GHGSat<br>• JAXA GOSAT<br>• MERLIN<br>• MethaneSAT | • NASA Geocarb<br>• PRISMA<br>• Satlantis<br>• TROPOMI |
| **AIRCRAFT** | 4 | • Ball Aerospace<br>• Bridger Photonics | • Kairos Aerospace<br>• Scientific Aviation |
| **DRONES** | 4 | • ABB HoverGuard<br>• Baker Hughes LUMEN Sky | • Scientific Aviation<br>• SeekOps |
| **MOBILE (OTHER/CROSS-CUTTING)** | 5 | • Aeris<br>• LaSen<br>• mAIRsure | • Picarro<br>• University of Calgary PoMELO |
| **HANDHELD** | 3 | • Distran<br>• Providence Photonics<br>• Sensia Solutions | |
| **STATIONARY** | 12 | • Baker Hughes LUMEN Terrain<br>• Cleanconnect.ai<br>• Honeywell Rebellion GCI<br>• Kuva Systems<br>• Longpath Technologies<br>• MIRICO | • Sensirion Nubo Sphere<br>• Project Canary<br>• QLM Technology<br>• Quanta3<br>• Sensia Solutions<br>• Scientific Aviation SOOFIE |
| **TOTAL** | **37** | | |

### Satellites

Satellites are typically used for frequent, low-cost measurements over large areas. They are often used to identify super-emitters, monitor facilities over time, and verify other sources of methane estimates or measurements. Several satellites specifically focused on or relevant for methane are already in operation or planned for launch in the next few years. Sensors on satellites measure methane in the total atmospheric column; they are typically not able to identify a specific emissions source.

TABLE 3 highlights the overall strengths and limitations of satellites.

**TABLE 3**
Satellites: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Most satellites are operated by governments and/or nonprofits, and as a result, the data collected is publicly accessible<br>• Satellites are useful for identifying (and/or verifying) large emissions sources, including super-emitters<br>• Satellites enable very wide area surveys<br>• Some satellites make daily observations | • The granularity of data from satellites is relatively low because of their distance from the ground<br>• Satellites are more limited in detecting smaller emissions sources and have limited capabilities for localizing the source of emissions<br>• The timeliness of data availability varies by technology; it is often several days before data is available |

Bluefield

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| Field | Description |
|---|---|
| **NAME** | Bluefield Technologies |
| **HQ/LOCATION** | Palo Alto, CA |
| **PARTNERS/INVESTORS** | • Ground Squirrel Ventures<br>• Operator Partners, an early-stage venture capital firm<br>• Unshackled Ventures |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Bluefield is a startup developing "CubeSats," backpack-sized microsatellites with optical sensors to detect methane. The company was founded in 2016 and as of 2019 had raised a total of $2.5M. Bluefield plans to build 22 satellites and develop other infrastructure including sensors and an artificial intelligence (AI) platform that would provide monitoring and analytics for methane emissions. The start-up is in a prototype stage and plans its first launch in 2022.<br><br>Bluefield also has developed a data algorithm and analysis tool called BFX-2 that analyzes data from other satellites. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 70 kg/h (according to the *Carbon Limits* report)<br><br>The company claims that its satellite will offer 20 m precision (compared to 20 km precision offered by Tropomi) |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | In 2020, Bluefield's BFX-2 tool was used to identify a significant methane leak in Florida. |

GHGSAT

Back to TOC

| Field | Description |
|---|---|
| **NAME** | GHGSat |
| **HQ/LOCATION** | Montreal, Canada |
| **PARTNERS/INVESTORS** | * ABB<br>* Chevron<br>* ExxonMobil<br>* Investissement Quebec, a business and financial consultancy for companies in Quebec<br>* Oil and Gas Climate Initiative (OGCI)<br>* Space Capital<br>* Shell<br>* Total |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | GHGSat provides high-resolution remote sensing of GHGs from space. It currently operates three satellites that measure greenhouse gases (including methane): GHGSat-D or Claire (launched in 2016); GHGSat-C1 or Iris (launched in 2020); and Hugo (launched in January 2021). Iris represents the first satellite of a larger "constellation" that will include up to 10 satellites by the end of 2022.<br><br>GHGSat uses sensors with a resolution 100X higher than any other satellite today. A 2020 paper published by authors from Harvard University states that GHGSat has the highest spatial resolution and spectral resolution of any satellite, so that "to this day GHGSat-D remains the only gas sensing satellite with such high spectral and spatial resolution." It is the leading example of a satellite designed to measure large emission sources from specific point sources. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 1,000 kg/h for Claire; 70-250 kg/h for Iris (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | In February of 2021, GHGSat was able to identify leaks from at least eight natural gas pipelines and unit flares, which if gone undetected would have had the same impact as 250,000 gasoline-powered cars.<br><br>In October 2020, GHGSat announced that Iris had detected the smallest methane emission to date from space, a controlled release from a facility in Alberta, Canada with an emissions rate of 260 kg/h. |
| **RECENT PROJECT(S)** | GHGSat has partnered with Shell, Chevron, and Total Energies SE to track methane emissions from offshore oil and gas platforms in the North Sea and the Gulf of Mexico. GHGSat has also signed an agreement with ABB to deliver the payloads – the component of a satellite responsible for its communication functions – for the satellite companies next three methane satellites.<br><br>In 2020, ExxonMobil announced it is conducting field trials of eight emerging methane detection technologies, including GHGSat, at nearly 1,000 sites in Texas and New Mexico. |

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| Field | Description |
|---|---|
| **NAME** | NASA Geostationary Carbon Observatory (GeoCarb) |
| **HQ/LOCATION** | NASA Jet Propulsion Laboratory, Pasadena, CA |
| **PARTNERS/INVESTORS** | • Colorado State University<br>• Lockheed Martin Advanced Technology Center<br>• SES Government Solutions Company, a provider of commercial satellite communication solutions to the U.S. government<br>• University of Oklahoma |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | GeoCarb is a space-based mission for NASA's Earth Science Division that will use a satellite flying in "geostationary orbit" to map daily concentrations of carbon dioxide, methane, and carbon monoxide over North America and South America. The satellite will contain a spectrometer instrument developed by Lockheed Martin and the University of Oklahoma that measures the wavelengths of incoming light to determine the composition of gas. It is expected to launch in summer 2022 and stay in orbit for three years. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 4,000 kg/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | NASA states that GeoCarb will be GeoCarb will be the first U.S. satellite to measure methane near Earth's surface. |
| **RECENT PROJECT(S)** | |

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| Field | Description |
|---|---|
| **NAME** | Japan's GOSAT and GOSAT-2 (also called Ibuki and Ibuki-2) |
| **HQ/LOCATION** | • Japan Aerospace Exploration Agency (JAXA), Tokyo, Japan<br>• Ministry of the Environment (MOE), Tokyo, Japan<br>• National Institute for Environmental Studies (NIES), Tsukuba, Japan |
| **PARTNERS/INVESTORS** | • Mitsubishi Electric Corporation |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | GOSAT was the world's first satellite mission dedicated to GHG monitoring. Its mission is to monitor the global distribution of GHGs, estimate CO2 sources and sinks on a sub-continental scale, and verify GHG emissions reductions The mission also aims to observe methane on the same spatial and temporal scales as CO2 and with an accuracy higher than 2%.<br><br>The first GOSAT (Ibuki) was launched in 2009; it had a planned operational period of five years but was extended in 2014 and is still operating today. GOSAT-2 (Ibuki-2) was launched in 2018 with improved measurement precision. Japan is currently working with Mitsubishi to develop instruments for the GOSAT-GW (formerly known as GOSAT-3) including a new sensor for more accurate observation of GHG concentrations. The new satellite will also have enhanced geophysical quantity observation for improved water cycle and meteorological monitoring. GOSAT-GW is expected to launch in 2023 or 2024. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 7,100 kg/h for GOSAT; 4,000 kg/h for GOSAT-2 (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | GOSAT measures CO2 and methane from 56,000 locations on the Earth's surface, including the atmosphere over open seas. |
| **RECENT PROJECT(S)** | In 2019, the World Meteorological Organization's World Data Centre for Greenhouse Gases began posting GHG data from GOSAT; the data can be accessed here. |

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| Field | Description |
|---|---|
| **NAME** | Methane Remote Sensing Lidar Mission (MERLIN) |
| **HQ/LOCATION** | * German Aerospace Center (DLR), Cologne, Germany<br>* National Centre for Space Studies (CNES), Paris, France |
| **PARTNERS/INVESTORS** | * Ferdinand-Braun-Institut, a research institute in Berlin<br>* Fraunhofer Institute for Laser Technology, a research institute in Aachen, Germany focused on lasers and optics |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | MERLIN is a satellite under development by German and French space agencies focused on global methane emissions. It is expected to be the first lidar in space for the measurement of GHGs, and is expected to launch in 2024 or 2025 and operate for at least three years. Its Methane Integrated Path Differential Absorption (IPDA) lidar will fire laser beams towards Earth's surface and then analyze the signal bounced back to deduce the amount of methane in the sounded atmospheric column. Germany is developing and building the methane Light Detection and Ranging (LIDAR) instrument, and France is providing the satellite platform and the satellite control center. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | |

MethaneSAT™

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| Field | Description |
|---|---|
| **NAME** | Environmental Defense Fund (EDF)'s MethaneSAT |
| **HQ/LOCATION** | Austin, TX |
| **PARTNERS/INVESTORS** | • Ball Aerospace<br>• Blue Canyon Technologies<br>• Harvard University<br>• Smithsonian Astrophysical Observatory (SAO)<br>• Rocket Lab, an American aerospace manufacturer and launch service provider that will manage, and operate the Mission Operations and Control Center (MOCC) for MethaneSAT in Auckland, New Zealand<br>• SpaceX<br>• New Zealand Ministry of Business, Innovation, and Employment (MBIE), which includes the New Zealand Space Agency |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | EDF is currently developing MethaneSAT, a satellite focused on providing regular monitoring (intervals under seven days) of approximately 50 major regions accounting for more than 80% of global oil and gas production. The satellite is expected to have the capability to identify the location of methane emissions and quantify the emissions rate. It is expected to cover a 200-kilometer (124-mile) view path, passing over target regions every few days; detect methane concentrations as low as 2 parts per billion (ppb); and focus in on areas as small as 100 m. Data collected will be transmitted back to Earth and processed using an analytical software platform that will make data available in days rather than weeks or months. All data will be available to the public at no cost. MethaneSAT is currently on schedule for a launch window that opens October 1, 2022. In 2021, MethaneSAT announced a contract with SpaceX to deliver its satellite into orbit aboard a Falcon 9 rocket. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 200 kg/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | While other satellites typically either identify emissions across large geographic areas or measure them at predetermined locations, MethaneSAT will do both. |
| **RECENT PROJECT(S)** | |

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| Field | Description |
|---|---|
| **NAME** | PRecursore IperSpettrale della Missione Applicativa (PRISMA) |
| **HQ/LOCATION** | * Italian Space Agency Fucino Space Centre, Ortucchio, Italy (mission control center)<br>* Italian Space Agency Matera Space Center, Matera, Italy (data acquisition and image data processing) |
| **PARTNERS/INVESTORS** | * European Space Agency (ESA)<br>* Leonardo, Italian technology developer for aerospace, defense, and industrial equipment)<br>* OHB-Italia, a major European satellite systems integrator |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | PRISMA is the Italian Space Agency's (ASI) first hyperspectral spacecraft that was launched into orbit in 2019 onboard the VEGA rocket, jointly built by the Italian and European Space Agency (ESA). The satellite contains two instruments, a hyperspectral sensor with a medium-resolution panchromatic camera (sensitive to all colors of light), both of which are intended for environmental monitoring, pollution control, crop classification, and natural resources management. These instruments enable the satellite to distinguish both the characteristics of observed objects and trace the chemical-physical composition of the area under observation.<br><br>The PRISMA mission was initially conceived by the ASI to test Italian-made hyperspectral space sensor technologies, and not intended for specific applications for methane emissions monitoring. Although PRISMA has the potential to map methane point emissions, the dedicated applications to detect and quantify methane plumes has only been extrapolated through scientific studies thus far. Researchers have studied imagery and datasets (satellite imaging spectroscopy data) derived from the PRISMA satellite to isolate individual sources of methane in the Permian Basin. This data is not publicly available on a database, but users can request data through the PRISMA portal. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Data extrapolated from PRISMA in this study identified methane with emissions rates >500 kg/h |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | In a June 2021 study conducted by researchers from Harvard University, California Institute of Technology, Environmental Defense Fund, and several European academic and research, analysis of imagery from the PRISMA satellite revealed methane hotspots in the Permian Basin. |

SATLANTIS

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| Field | Description |
|---|---|
| **NAME** | GEI-SAT Precursor |
| **HQ/LOCATION** | Bilbao, Spain (Originally founded in Gainesville, FL) |
| **PARTNERS/INVESTORS** | • AXIS-ICO, Spain-based venture fund for start-up technologies<br>• Basque Government and Bizkaia Government<br>• Centre for the Development of Industrial Technology (CDTI), a government agency supporting technology development in Spain<br>• Firefly Aerospace, a Texas-based provider of launch vehicles, spacecraft, and in-space services<br>• Enagas, a Spanish natural gas company<br>• ORZA, Basque pension fund-based investment firm<br>• Sepides, a Spanish state holding company promoting energy entrepreneurship<br>• Science and Innovation Link (SILO), Spanish consulting firm for technology innovation<br>• University of Florida |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | GEI-SAT Precursor is intended to be the first of a constellation of satellites dedicated to methane detection and quantification being developed by the Spanish start-up company Satlantis. The firm develops satellite payload technologies for Earth observation and remote sensing. The GEI-SAT Precursor will employ Satlantis's proprietary iSIM technology, a multispectral binocular imaging camera that allows for concurrent observations in the visible, near-infrared (VNIR) and shortwave-infrared (SWIR) spectral ranges, which in combination, provide more precise geolocation and accurate identification of methane emission sources, according to the company. The technology can be provided in microsatellite and CubeSat formats. The GEI-SAT Precursor is under development and expected to launch in Q3 2023; it will be the company's fifth satellite flight. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | In March 2021, Satlantis closed its second investment round (14 million Euros) headed by Enagás and accompanied by current investors AXIS-ICO and ORZA, among others. In November 2021, CDTI joined the investment round with an additional 3.5 million Euros. |
| **RECENT PROJECT(S)** | |

**TROPOMI**

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| Field | Description |
|---|---|
| **NAME** | European Space Agency and Netherlands Space Office Copernicus Sentinel-5 Precursor (S5P) with the TROPOspheric Monitoring Instrument (TROPOMI) |
| **HQ/LOCATION** | Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands |
| **PARTNERS/INVESTORS** | * Airbus Defense and Space<br>* California Institute of Technology<br>* German Aerospace Center (DLR)<br>* Max Planck Institut, a research institute in Munich, Germany<br>* Netherlands Institute for Space Research (SRON)<br>* National Aeronautics and Space Agency (NASA)<br>* Norwegian Institute for Air Research (NILU)<br>* Royal Belgian Institute for Space Aeronomy (BIRA-IASB)<br>* Royal Netherlands Meteorological Institute (KNMI)<br>* S[&]T Corp, a data solutions company in Europe<br>* Science and Technology Facilities Council, a government research agency in the UK<br>* University of Breman, Germany |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | TROPOMI is an advanced multispectral imaging spectrometer that monitors methane and other gases, aiming provide methane column concentrations with high sensitivity to the Earth's surface, good spatiotemporal coverage, and sufficient accuracy to facilitate inverse modeling of sources and sinks. The satellite makes global observations daily, and data is available within a few days. TROPOMI was launched in 2017 with a planned mission of seven years.<br><br>TROPOMI's data is cross-referenced and validated by NASA with data from JAXA's GOSAT and the ground-based Total Carbon Column Observing Network (TCCON) at the California Institute of Technology. All TROPOMI data can be accessed here. Methane data from the satellite can be accessed here. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 4,200 kg/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | A 2020 study authored by scientists from Environmental Defense Fund (EDF), Harvard University, Georgia Tech, and the Netherlands Institute for Space Research (SRON) quantified methane emissions from the Permian Basin using TROPOMI satellite data. |

### Aircraft

Manned aircraft, ranging larger multi-engine research planes, to small single-engine general aviation aircraft can fly at different altitudes and have a long range. High altitude flights can target large areas while low altitude flights can detect and measure methane from a point source.

TABLE 4 highlights the overall strengths and limitations of aircraft.

**TABLE 4**
Aircraft: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Aircraft can cover wide areas, often in a single day | • Most data collected by aircraft is proprietary and not accessible to the public<br>• Accuracy can be significantly affected by weather conditions, including clouds and wind speed<br>• Aircraft surveys are typically done bi-annually or quarterly<br>• Aircraft have limited capabilities for localizing the source of emissions |

## Ball Aerospace

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| Field | Description |
|---|---|
| **NAME** | Ball Aerospace Methane Monitor |
| **HQ/LOCATION** | Boulder, CO |
| **PARTNERS/INVESTORS** | * Carina RST<br>* Environmental Defense Fund (MethaneSAT) |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | The Ball Aerospace Methane Monitor uses lidar attached to a fixed-wing aircraft to gather atmospheric column measurements of methane. According to the company, the technology works regardless of cloud conditions and can survey up at least 100 square miles of production sites or approximately 375 miles of transmission pipelines each day.<br><br>The flight data is geolocated and provided in near real time; some data is processed on board to allow for real-time alerts regarding large emission sources and full results are delivered within 24 hours. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 9-12 kg/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | Ball Aerospace is also developing the spectrometer-based sensing system for MethaneSAT (see profile in the *Satellites* section). |
| **RECENT PROJECT(S)** | In 2018, Ball Aerospace announced it would provide its methane monitoring technology and data analytics tools exclusively to Denver-based Carina RST, a company offering methane monitoring as a service to oil and gas producers. |

BRIDGER PHOTONICS

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| Field | Description |
|---|---|
| **NAME** | Bridger Photonics Gas Mapping Lidar |
| **HQ/LOCATION** | Bozeman, MT |
| **PARTNERS/INVESTORS** | • ARPA-E<br>• Collaboratory to Advance Methane Science (CAMS), an industry-led research collaboration administered by the Gas Technology Institute<br>• ExxonMobil<br>• Massachusetts Institute of Technology (MIT)<br>• SoCalGas |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Bridger Photonics offers a "Gas Mapping Lidar" technology for aerial surveys of oil and gas infrastructure, including production facilities and other infrastructure. Data and images are captured during the aerial surveys and then processed using proprietary algorithms to quantify emissions and identify the source, down to the equipment level.<br><br>Bridger Photonics operates across North America in the Permian Basin, Alberta, Eagle Ford Basin, Denver-Julesburg area, and with distribution utilities across the U.S. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Some technical results from the August 2021 CAMS study of Bridger Photonics' Gas Mapping Lidar technology can be found here.<br><br>The company claims to have achieved an MDL of <3 kg/h in the CAMS study. |
| **NOTEWORTHY DISTINCTIONS** | In April 2021, following field trials, ExxonMobil subsidiary XTO Energy selected Bridger Photonics Gas Mapping Lidar for the first application to the EPA Alternate Means of Emissions Limitation (AMEL) under Subpart OOOOa. The AMEL provision allows an entity to petition the EPA to allow an alternative compliance approach to a federal air standard provided that the proposed alternative achieves equivalent or greater emissions reduction relative to the existing standard.<br><br>Bridger Photonics and MIT were winners of the 2019 R&D100 award for the Gas Mapping Lidar technology.<br><br>The Gas Mapping Lidar technology was developed with $2.5 million in support from ARPA-E's MONITOR program from 2015 to 2018. The technology was also awarded $4.6 million under ARPA-E's SCALEUP program in 2020. |
| **RECENT PROJECT(S)** | In August 2021, SoCalGas signed a $12 million agreement with Bridger Photonics to "detect, localize, and quantify" methane emissions across its distribution area. |

KAIROS AEROSPACE

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| Field | Description |
|---|---|
| **NAME** | Kairos Aerospace LeakSurveyor |
| **HQ/LOCATION** | Mountain View, CA |
| **PARTNERS/INVESTORS** | * Data Collective Venture Capital (DCVC)<br>* DCP Midstream<br>* Energy Innovation Capital<br>* ExxonMobil<br>* John Crane, an engineering technology firm<br>* Oil and Gas Climate Initiative (OGCI)<br>* Pioneer Natural Resources |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Kairos Aerospace offers a hyperspectral imaging system mounted on a small aircraft called LeakSurveyor. The system uses sensors and an optical camera to map a region. Kairos can survey up to 100 square miles per plane, per day (Kairos uses nine planes, as of February 2021). The technology provides georeferenced methane emissions data, including a digital map or aerial photo of the ground basin or facility tied to geographic coordinates. This digital imagery is combined with real-time optical imagery to identify the source of the emissions and assist in quantification.<br><br>The technology can be used for upstream, midstream, and downstream oil and gas surveying. Kairos has worked in North America, including in the Permian Basin, Rockies Basins, Midcontinent Basins, and Western Canadian Basins. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 46-52 kg/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | In August 2021, Kairos announced that it had raised an additional $26 million in funding from DCVC, OGCI, and other investors.<br><br>In 2020, ExxonMobil announced it is conducting field trials of eight emerging methane detection technologies, including Kairos, at nearly 1,000 sites in Texas and New Mexico.<br><br>In 2020, the Society of Petroleum Engineers published a case study of Kairos Aerospace's work with Pioneer Natural Resources.<br><br>In 2018, Kairos was selected to participate in EDF's methane detector challenge but was unable to conduct testing due to flooding at its test site that would have severely impacted the capability of its sensor system. |
| **RECENT PROJECT(S)** | The company provides data in their technical white paper showing how during 2019 and 2020, they inspected more than 136,000 wells and over 42,000 miles of pipeline in North America, resulting in the elimination of more than 8 billion cubic feet of methane emissions. |

SCIENTIFIC AVIATION

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| Field | Description |
|---|---|
| **NAME** | Scientific Aviation |
| **HQ/LOCATION** | Boulder, CO |
| **PARTNERS/INVESTORS** | * California Air Resources Board (CARB)<br>* Environmental Defense Fund (EDF)<br>* ExxonMobil<br>* National Oceanic and Atmospheric Administration (NOAA)<br>* United Nations Environment Programme (UNEP) and Climate and Clean Air Coalition (CCAC)<br>* University of Michigan<br><br>Scientific Aviation is participating in the PermianMap project (see *Technologies in Action* section of this report).<br><br>ChampionX acquired Scientific Aviation in July 2021. |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Scientific Aviation operates four fixed-wing aircraft that have been specifically configured for atmospheric measurements and emissions quantifications of methane and other greenhouse gases. The company offers measurements to trace methane, and other complementary measurements including wind speed and direction, temperature, humidity, 3-dimensional location, and time.<br><br>Data are transmitted to an onboard computer system where Scientific Aviation's custom software compiles, stores, and displays the data in real time. All data is also continuously uploaded and stored to the company's cloud-based data repository. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 2-5 kg/h (as provided by the company, according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | Scientific Aviation is partnering with the UNEP/CCAC and EDF to undertake "a first-of-its-kind group of studies that will provide top-down quantification of methane emissions from the energy sector in Europe and North Africa." The initial three projects will be in the Norwegian North Sea, Romania, and Algeria. The public can track the flights for this program here. |
| **RECENT PROJECT(S)** | California Air Resources Board (CARB) contracted with Scientific Aviation to conduct airborne methane emissions quantifications at a variety of target sites, including industrial, agricultural, and waste sources. The company made 199 measurements at 114 different target sites between November 2019 and February 2021. Results of the surveys can be found here.<br><br>In 2020, ExxonMobil announced it is conducting field trials of eight emerging methane detection technologies, including Scientific Aviation aircraft, at nearly 1,000 sites in Texas and New Mexico.<br><br>In 2016, Scientific Aviation was contracted to collect point source measurements of the Aliso Canyon Gas Leak in Southern California. |

### Drones

Unmanned aerial vehicles (UAVs) or drones can typically measure methane in three dimensions, including methane concentrations in the vertical atmospheric column within a methane plume. In addition, some can calculate wind speed and direction enabling more data for calculations.

TABLE 5 highlights the overall strengths and limitations of drones.

**TABLE 5**
Drones: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Drones can identify large and small emissions sources<br>• Drones can safely get physically closer to evaluate a potential emissions source compared to larger vehicles<br>• Drones can cover a moderately large area in a short amount of time<br>• Data collected is typically available in real time or near real time | • Most data collected by drones is proprietary and not accessible to the public<br>• Drone surveys are typically done bi-annually or quarterly<br>• Drones are not typically operated autonomously and require personnel to operate, potentially creating safety issues<br>• Drones may be prohibited in certain sensitive or restricted facilities or areas of a site |

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| Field | Description |
|---|---|
| **NAME** | ABB HoverGuard |
| **HQ/LOCATION** | Zurich, Switzerland |
| **PARTNERS/INVESTORS** | * Anemoment, Colorado-based air monitoring equipment manufacturer<br>* ZICOM Group, Singapore-based engineering and equipment specialist firm |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | ABB, a global technology solutions company, offers four technologies for methane leak detection, including handheld, stationary, and mobile (car-mounted and drone-mounted) technologies[3]. The company's HoverGuard solution is a drone-based solution for detection, monitoring, and quantification of methane and carbon dioxide emissions from natural gas distribution and transmission pipelines, storage facilities, and other sources along the natural gas value chain.<br><br>The sensor that detects emissions activity uses a patented laser-based technique called cavity-enhanced laser absorption spectroscopy. The UAV from which the technology operates is also retrofitted with a Global Navigation Satellite System (GNSS) that provides data on location, navigation, and timing of emissions, a sonic anemometer provided by Anemoment used to profile wind speed and frequency, and a gas analyzer to measure gas concentrations. The data collected by the drone is connected to a cloud system to relays information on the source location and size of the leak in real time. The patented algorithms in ABB's proprietary software provide estimates of leak origin and emissions volumetric flow rate calculated and other relevant emissions measurements. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | HoverGuard can detect leaks 100 m from the source |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | HoverGuard was launched in April 2021, and ZICOM, ABB's partner in the South Asia region for testing its Mobile Gas Leak Detection solutions, noted in a July 2021 article that they are "keen to explore the speed of inspection" of the technology in Bangladesh. |

[3] Based on our analysis of publicly available information regarding the various ABB technologies, it is not clear that all are able to measure and quantify emissions. The scale and maturity of ABB's stationary technology (EverGuard) is also unclear. The capabilities of HoverGuard are more clearly delineated, and therefore we have chosen to include a profile for HoverGuard and exclude profiles for the other technologies. Additional ABB technology profiles may be reconsidered in a future phase of this project.

Baker Hughes

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| Field | Description |
|---|---|
| **NAME** | LUMEN Sky |
| **HQ/LOCATION** | Houston, TX |
| **PARTNERS/INVESTORS** | * Oklahoma State University<br>* Shell |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | LUMEN Sky is an aerial, drone-based system for methane monitoring. It is part of an integrated LUMEN system that also includes LUMEN Terrain, a ground-based, stationary, continuous monitoring device. These technologies are operated by Avitas, a Baker Hughes venture.<br><br>LUMEN Sky gathers data and images that are then processed to identify, localize, and quantify methane emissions. According to the company, surveys may be conducted quarterly or every other month to optimize data collection and actionable results. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 61 g/h (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | Since 2018, Shell has used LUMEN Sky in the Permian Basin, conducting over 500 test flights. |

SCIENTIFIC AVIATION

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| Field | Description |
|---|---|
| **NAME** | Scientific Aviation |
| **HQ/LOCATION** | Boulder, CO |
| **PARTNERS/INVESTORS** | * ConocoPhillips<br>* Environmental Defense Fund (EDF)<br>* Neptune Energy<br>* Texo DSI, UK-based drone platform provider<br>Scientific Aviation was acquired by ChampionX in July 2021 |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Scientific Aviation offers quadcopter and hexacopter platforms for drone-based aerial surveys. The drones are equipped with sensors to analyze methane/ethane from point sources as well as wind, temperature, relative humidity, and pressure. The drones are controlled remotely using an app, and data and images are available in real-time. Scientific Aviation also uses a proprietary software platform to process data. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | * MDL: 10 g/h (according to the *Carbon Limits* report)<br>* Accuracy: 20-50% (according to "field experience from an independent party" as reported in the *Carbon Limits* report)<br>* Detection distance: 1-20 m (according to the *Carbon Limits* report) |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | In 2021, Scientific Aviation's drone technology was deployed in the North Sea with Texo DSI for a methane quantification study on an offshore gas production facility operated by Neptune Energy, a UK-based oil and gas production company.<br>In 2019, Scientific Aviation partnered with ConocoPhillips on drone field-testing at the Eagle Ford site in Texas. |

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| Field | Description |
|---|---|
| **NAME** | SeekOps |
| **HQ/LOCATION** | Austin, TX |
| **PARTNERS/INVESTORS** | * BP<br>* Caterpillar Venture Capital<br>* Environmental Defense Fund (EDF)<br>* Equinor and Equinor Technology Ventures<br>* ExxonMobil<br>* FlyLogix<br>* Harbour Energy, a UK-based oil and gas company<br>* Neptune Energy<br>* OGCI Climate Investments<br>* Schlumberger<br>* Shell<br>* Sky-Futures, a global drone inspection and survey provider<br>* Total |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | SeekOps offers the drone-agnostic SeekIR sensor, which uses laser absorption spectrometry to measure in-plume concentrations. The technology is capable of detecting, localizing and quantitating methane emissions using SeekOps' proprietary machine learning algorithms and data analytics. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: 22 g/h |
| **NOTEWORTHY DISTINCTIONS** | In July 2021, SeekOps closed $14 million in new funding from Schlumberger, Equinor Ventures, OGCI Climate Investments, and Caterpillar Venture Capital.<br><br>According to the *Carbon Limits* report, SeekOps' results from the EDF methane detector challenge show that SeekOps detected 100% of leaks in all leak classes and did not have any false positive detection. However, the uncertainty of the quantification was higher than the technical specifications and may have a bias towards overestimation. |
| **RECENT PROJECT(S)** | In 2020, ExxonMobil announced it is conducting field trials of eight emerging methane detection technologies, including SeekOps, at nearly 1,000 sites in Texas and New Mexico.<br><br>In 2020, SeekOps and FlyLogix achieved a significant milestone in field testing of offshore production in the North Sea; the technologies demonstrated measurement of an emissions rate of <2.5 kg/h, lower than the stretch goal of 3 kg/h for the project. The project is supported by bp, Total, Equinor, Harbour Energy, and Shell. |

### Mobile Technologies (Other/Cross-Cutting)

Many sensors can be used in a variety of mobile applications, including specific aerial applications described above, as well as with ground-based vehicles (cars, trucks, vans). Ground-based mobile surveys are typically limited by available roads downwind from the site or source of methane. Operators also highlight potential safety issues from driving vehicles around sites.

TABLE 6 highlights the overall strengths and limitations of sensors attached to ground vehicles. However, note that the sensors described in this section may also be attached to other types of vehicles.

TABLE 6
Ground Vehicles: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Ground vehicles can identify smaller emissions sources<br>• Ground vehicles can cover a moderately large area in a short amount of time<br>• Data collected is typically available in real time or near real time | • Most data collected by ground vehicles is proprietary and not accessible to the public<br>• Ground vehicles may require multiple passes over an area to achieve the same coverage as an aircraft or satellite, or even a drone<br>• Ground vehicles require a driver, potentially creating safety issues<br>• Ground vehicles may be prohibited in certain sensitive or restricted facilities or areas of a site |

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| Field | Description |
|---|---|
| **NAME** | Aeris Technologies MIRA |
| **HQ/LOCATION** | Hayward, CA |
| **PARTNERS/INVESTORS** | * ARPA-E Methane Observation Networks with Innovative Technology to Obtain Reductions (MONITOR) program<br>* Los Alamos National Laboratory<br>* Rice University<br>* Southern Cross, a provider of field services to utilities |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Aeris Technologies offers a series of middle infrared (MIRA) gas analyzers with tunable diode laser spectrometers combined with miniaturized electronics for detection of methane and other gases. The company offers four versions of its technology: Pico (for mobile applications in the field); Ultra (for temperature-controlled mobile or stationary applications); Strato (designed for UAV applications); and Responder (designed for any vehicle).<br><br>Data is GPS enabled and available in real time through a data file continuously updated for mapping in Google Earth. According to a 2020 analysis by the group Carbon Limits, Aeris sensors only deliver concentration data, and their ability to quantify emissions "depends on method of use." |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | The company notes that it achieves a level of sensitivity (<1ppb/s sensitivity for methane and ethane) that discriminates between methane/ethane and biogenic sources such as landfill gas, cattle operations, swamp gas, sewer gas, and permafrost. The company claims this capability "eliminates" false positives. |
| **NOTEWORTHY DISTINCTIONS** | In 2018, Aeris was one of eleven companies invited to participate in the controlled testing phase of the Mobile Monitoring Challenge, sponsored by Stanford University's Natural Gas Initiative (NGI) and the Environmental Defense Fund (EDF). |
| **RECENT PROJECT(S)** | In 2021, the company announced a partnership with Southern Cross to provide advanced detection and emissions reduction solutions to utilities in North America.<br><br>Between 2015 and 2018, Aeris received $2.5 million in funding from the ARPA-E MONITOR program to develop a complete methane leak detection system that allows for highly sensitive, accurate methane detection at natural gas systems. |

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| Field | Description |
|---|---|
| **NAME** | LaSen |
| **HQ/LOCATION** | Las Cruces, NM |
| **PARTNERS/INVESTORS** | * British Columbia Oil and Gas Commission<br>* Colorado State University (CSU) Methane Emissions Technology Evaluation Center (METEC)<br>* U.S. Department of Energy (DOE)<br><br>LaSen also notes that they "partner with" (which may mean they are a member of) the following associations: American Gas Association, Global Methane Initiative, Interstate Natural Gas Association of America, and several regional and state gas trade associations. |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | LaSen offers two technologies for methane detection and quantification: a laser-based Differential Absorption Lidar (DIAL) chemical sensor technology called Airborne LiDAR Pipeline Inspection System (ALPIS) deployed using a helicopter; and a drone-based Tunable Diode Laser Absorption Spectrometer (TDLAS) tuned to specifically absorb methane with an optical gas imaging (OGI) camera and GPS receiver. LaSen operates its own fleet of helicopters and drones to conduct surveys. Data is accessed through LaSen's proprietary dashboard in near real time. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | The company claims "98% accuracy is not limited by clouds, wind, or time of day."<br><br>LaSen's helicopters can cover survey up to 300 miles per day. |
| **NOTEWORTHY DISTINCTIONS** | LaSen received support from DOE's advanced manufacturing program to support development of the ALPIS system.<br><br>LaSen's website notes that its drone-mounted solution complies with EPA's OOOOa inspection requirements for upstream assets. |
| **RECENT PROJECT(S)** | Between 2017 and 2019, LaSen's helicopter-mounted LIDAR system was deployed by the British Columbia Oil and Gas Commission to conduct aerial surveys of 98 gas wells near Alberta, Canada. The survey aided in leak identification over large sections of pipeline assets and the Commission "intends to continue the aerial inspection program annually, focusing on different areas throughout northeastern British Columbia."<br><br>In 2018, LaSen's Differential Absorption LIDAR (DIAL) airborne sensor unit mounted under their helicopter was one of the twelve technologies tested at the CSU METEC facility. |

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| Field | Description |
|---|---|
| **NAME** | mAIRsure |
| **HQ/LOCATION** | Jackson, WY |
| **PARTNERS/INVESTORS** | * Colorado State University (CSU) Methane Emissions Technology Evaluation Center (METEC)<br>* Colorado Office of Economic Development and International Trade<br>* ExxonMobil<br>* U.S. Department of Agriculture |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | mAIRsure is an early-stage company that offers a system of mobile sensors that can be mounted on various vehicles, including trucks and UAVs, and cloud-based analytics for methane monitoring at oil and gas operations. Its solutions can geolocate point sources of methane including wells and tanks, as well as tailing ponds and open face mines. The company refers to its solution as "sensors as a service."<br><br>The company evolved from research by Colorado State University and Cornell University in the areas of laser sensing, turbulent plume dispersion, and integrated cloud-based analytics. The company has published several academic papers regarding its technology and collaborations with EPA and a Google Street View car, among others, which can be accessed here. mAIRsure's system has also been independently validated by CSU METEC.<br><br>See mAIRsure's 2021 presentation to EPA here. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | * Detection threshold as low as 3 scfh<br>* Accuracy +/- 20% |
| **NOTEWORTHY DISTINCTIONS** | In 2016, mAIRsure was one of twelve companies invited to participate in the annual Oil & Gas Cleantech Challenge, sponsored by The Colorado Cleantech Industries Association (CCIA).<br><br>According to mAIRsure, their sensors have been deployed on over 300,000 pickup trucks. |
| **RECENT PROJECT(S)** | In 2020, ExxonMobil announced it is conducting field trials of eight emerging methane detection technologies, including truck-mounted sensors from mAIRsure, at nearly 1,000 sites in Texas and New Mexico. |

# PICARRO

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| Field | Description |
|---|---|
| **NAME** | Picarro |
| **HQ/LOCATION** | Santa Clara, CA |
| **PARTNERS/INVESTORS** | • CleanAir Engineering, a provider of technical products and services for sustainability and resource management<br>• Italgas, the largest gas distributor in Italy<br>• National Aeronautics and Space Administration (NASA)<br>• National Oceanic and Atmospheric Administration's (NOAA)<br>• Pacific Gas & Electric (PG&E)<br>• Southern Cross, a provider of field services to utilities<br>• University of Wyoming |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Picarro provides solutions to measure greenhouse gas (GHG) concentrations, trace gases, and stable isotopes across several industries. Picarro's gas analyzers use a patented Cavity Ring-Down Spectroscopy (CRDS) that can determine the presence and concentration of methane in the atmosphere.<br><br>The Picarro CRDS can be mounted to any vehicle to collect methane plume data. That data is sent to Picarro's cloud-based platform, where analytics software transforms the data into actionable results that clients can access in real time. Picarro also measures atmospheric and meteorological conditions and integrates this data to improve accuracy. The company says that its technology can "virtually eliminate" false positives caused by non-natural gas sources of methane. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | In 2012, PG&E became the first utility to use Picarro's methane detection technology. In 2016, the utility announced it had completed its 1 millionth inspection using the technology.<br><br>Picarro's instruments have been used by NASA to calibrate the Japanese GOSAT satellite. |
| **RECENT PROJECT(S)** | In September 2021, Picarro partnered with CleanAir Engineering to quantify upstream and midstream natural gas operator emissions in the Marcellus Shale region. The companies claim that the results will help clients "meet environmental, social, and governance (ESG) targets."<br><br>Picarro's Cavity Ring Down Laser Spectroscope (CRDS) instrument has been used as part of Scientific Aviation's aerial surveys and the University of Wyoming's ground vehicle surveys in the PermianMAP project. The University of Wyoming has also used Picarro's CRDS is their study quantifying emissions from orphaned coalbed methane wells in the Powder River Basin. The results of the study, published in 2021, can be found here.<br><br>Since 2017, Picarro has worked with Italgas to improve leak surveillance and enhance analysis of emissions. In 2021, Italgas became the largest user of Picarro's natural gas management solutions, with 20 Picarro-equipped vehicles and an additional 80 other mobile units. |

UNIVERSITY OF CALGARY

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| Field | Description |
|---|---|
| **NAME** | Portable Methane Leak Observatory (PoMELO) |
| **HQ/LOCATION** | Calgary, Canada |
| **PARTNERS/INVESTORS** | * Colorado State University (CSU) Methane Emissions Technology Evaluation Center (METEC)<br>* Emissions Reduction Alberta<br>* Stanford University/Environmental Defense Fund (EDF) Mobile Monitoring Challenge |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | The Portable Methane Leak Observatory (PoMELO) is a University of Calgary project to build a methane sensing system for the upstream oil and gas industry and serve as a research platform to advance mobile pollution monitoring. The system consists of a methane sensor, a Global Navigation Satellite System (GNSS) that provides data on location, and an anemometer to measure wind speed and direction. The system is vehicle-based and includes a roof-mounted, open-path laser absorption sensor connected to a data analytics platform. The project also includes a variant called "Padmapper" which is focused on increasing the efficiency and efficacy of surveys on upstream oil and gas pads. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | In 2019, developers of the PoMELO mobile methane detection system presented their technology at the Stanford/EDF Mobile Monitoring Challenge and published their results here. |
| **RECENT PROJECT(S)** | In 2020, the University of Calgary published an summary and detailed paper from a single-blind detection experiment at the CSU METEC facility, highlighting the ability of the Padmapper system to detect small emissions sources in a mock facility.<br><br>In June 2020, the PoMELO technology won a $1.6 million grant from the Emissions Reduction Alberta Natural Gas Challenge for a full-scale field pilot. |

### Handheld Technologies

Handheld technologies, primarily optical gas imaging cameras, can survey individual equipment and components for methane emissions and allow identification of very small emissions sources. However, handheld technologies require close access to equipment and components and can be very time consuming. A single component may require measurement from multiple angles to classify with high accuracy. OGI cameras are approved for surveys required under the EPA OOOOa regulation and are the standard way that oil and gas operators have conducted annual methane LDAR programs. Handheld technologies here typically process images and data collected using proprietary algorithms and models to more precisely quantify emissions.

TABLE 7 highlights the overall strengths and limitations of handheld technologies.

TABLE 7
Handheld Technologies: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Handheld technology is highly portable and can be deployed in many locations<br>• Handheld technology allows closer proximity to identify the source of small leaks<br>• Data collected is typically available in real time or near real time | • Most data collected by handheld technologies is proprietary and not accessible to the public<br>• Handheld technology is very limited in its ability to cover larger areas at a fast pace<br>• Safety hazards may increase in close proximity to a methane emissions source<br>• Handheld technologies may have limited ability to quantify large emissions sources |

DISTRAN

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| Field | Description |
|---|---|
| **NAME** | Distran Ultra Pro |
| **HQ/LOCATION** | Zurich, Switzerland |
| **PARTNERS/INVESTORS** | The company notes that the technology has been used by major industrials including Total and Shell<br><br>SpaceX has deployed the technology at the International Space Station, but not for methane detection |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Distran's Ultra Pro is a handheld ultrasound imaging camera that uses 124 ultrasound microphones to detect the specific sounds that pressurized gas leaks emit and identify the position of the sound source. The technology can quantify the leak rate (in liters per hour or in cubic feet per minute) in real time. An operator can use Distran's Audalytics software or other software to create a report from the data that is collected. Watch a brief (20-second) demonstration of the technology here. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Minimum detection threshold of 2 L/h at 30 cm (in a quiet environment) and 10 L/h at 30 cm (in an industrial environment)<br><br>Working distance from 0.3 m to 100 m. |
| **NOTEWORTHY DISTINCTIONS** | In 2021, the Distran Ultra Pro became the first ATEX certified ultrasound camera. (The ATEX Directive is a safety certification in the EU.) Renamed the Ultra Pro X, the new version has been specifically designed for use within potentially explosive atmospheres for the oil and gas, chemistry, and power plant industries.<br><br>In 2020, the Distran Ultra Pro was included in SpaceX's 21st Commercial Resupply Services mission (CRS-21) to the International Space Station f(ISS) for use in detecting air leaks at the ISS. Over time, air leaks require re-pressurization of the ISS atmosphere. |
| **RECENT PROJECT(S)** | |

PROVIDENCE PHOTONICS

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| Field | Description |
|---|---|
| **NAME** | Providence Photonics |
| **HQ/LOCATION** | Baton Rouge, LA |
| **PARTNERS/INVESTORS** | • Teledyne FLIR |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Providence Photonics has developed two Quantitative Optical Gas Imaging (qOGI) technologies: Q100 and QL320 that are intended to be add-ons to existing Teledyne FLIR infrared cameras (specifically the GF320 and GFx320 models). The Q100 was released in 2016 and requires a synchronization procedure for calibration with the device and a specific camera. The QL320 does not require this synchronization procedure.<br><br>The devices work by measuring the 2D size of an emitted gas plume, estimates the volume of the plume in space, and models how fast the plume is dispersing into the atmosphere. Data from the devices can be accessed in real time. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | According to a recent study by the European Oil Company Organization for Environment, Health and Safety (CONCAWE), Providence Photonics' qOGI technologies have a 6% error rate on average, compared to the 31% error rate of a traditional detection technology. |
| **NOTEWORTHY DISTINCTIONS** | This technology could represent a simple add-on for measuring emissions; the use of FLIR OGI cameras for leak detection and repair is quite common across the oil and gas industry and the Providence technology may represent one simple and cost-effective approach for transitioning from LDAR to measurement. |
| **RECENT PROJECT(S)** | |

SENSIA

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| Field | Description |
|---|---|
| **NAME** | Sensia Solutions |
| **HQ/LOCATION** | Madrid, Spain |
| **PARTNERS/INVESTORS** | • European Commission (see Sensia Solutions profile under Stationary Technologies) |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Sensia Solutions provides infrared imaging technologies for a variety of gases, including methane detection and quantification. The company offers two models of handheld optical gas imaging (OGI) cameras for methane detection: Caroline Y and Mileva 33. According to an analysis by Colorado State University, these cameras (specifically the Mileva) only offer methane detection, not quantification. However, the company notes that many of its cameras (including the Caroline and Mileva) can be paired with its "Redlook" advanced image processing software to quantify the mass flow rate and gas concentration. The Redlook platform also offers a variety of advanced, real-time monitoring features. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Minimum Detectable Leak Rate (MLDR) of 0.35 g/h (Mileva 33) and 1.4 g/h (Caroline Y) |
| **NOTEWORTHY DISTINCTIONS** | In October 2021, Sensia Solutions received Spain's CincoDias prize for innovation in the category of business-university collaboration, related to its work with the Carlos III University in Madrid. |
| **RECENT PROJECT(S)** | |

## Stationary Technologies

Fixed sensors that continuously monitor methane emissions are fundamental to measurement and quantification of methane, including calculating an emissions baseline, reducing emissions compared to that baseline, and differentiating and certifying Responsibly Sourced Gas (RSG). The number and placement of sensors necessary to optimize detection and quantification at a site is typically developed according to a proprietary model and varies by site.

TABLE 8 highlights the overall strengths and limitations of stationary technologies.

TABLE 8
Stationary Technologies: Strengths and Limitations

| Strengths | Limitations |
|---|---|
| • Stationary technologies offer continuous 24/7 measurement and monitoring<br>• Data collected is typically available in real time or near real time<br>• Stationary technologies can detect large and small emissions, depending on the position and maximum distance they are able to cover<br>• Stationary technologies are generally autonomous and do not require human intervention | • Most data collected by stationary technologies is proprietary and not accessible to the public<br>• Stationary technologies may have limited functionality based on where they are located or positioned; the optimal number of stationary sensors may vary by site and facility |

Baker Hughes

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| Field | Description |
|---|---|
| **NAME** | LUMEN Terrain |
| **HQ/LOCATION** | Houston, TX |
| **PARTNERS/INVESTORS** | * Northeast Natural Energy<br>* Oklahoma State University<br>* Roeslein Alternative Energy |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | LUMEN Terrain is a ground-based, stationary, continuous monitoring device for methane emissions. It is part of an integrated LUMEN system that also includes LUMEN Sky, an aerial, drone-based methane monitoring sensor. These technologies are operated by Avitas, a Baker Hughes venture.<br><br>LUMEN Terrain is solar-powered and capable of streaming data from sensors to a cloud-based software dashboard in real time. The information collected from the sensors is wirelessly streamed to a cloud platform. LUMEN Terrain provides methane concentration data, as well as the location and rate of the leak. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | In June 2021, Roeslein Alternative Energy announced that it would deploy LUMEN Terrain at 22 biogas lagoons in Missouri. Results from the project can be found here.<br><br>In April 2021, Northeast Natural Energy, a West Virginia-based oil and gas company, announced it would deploy LUMEN Terrain as part of an effort to seek independent certifications of natural gas production under the MiQ methane standard and under the Equitable Origin EO100TM Standard for Responsible Energy Development. |

CleanConnect.ai™
AI Solutions for Energy

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| Field | Description |
|---|---|
| **NAME** | CleanConnect.ai |
| **HQ/LOCATION** | Berthoud, CO |
| **PARTNERS/INVESTORS** | • Sixgill, an artificial intelligence solutions provider based in Israel |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | CleanConnect.ai offers a system of EPA-certified OGI cameras and AI software to autonomously and continuously detect and quantify methane leaks, called the Autonomous 365 Suite. Cameras are mounted in a fixed location to provide a view of a facility and provide images, leak rate, equipment causing the leak, and GPS location, among other data. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | CleanConnect.ai offers monitoring as a service, thereby reducing the capital expenditure required by an operator. |
| **RECENT PROJECT(S)** | At the August 2021 EPA workshop, the company highlighted results from several unnamed, upstream "early adopters" of their technology. The company has also noted that Jonah Energy and Occidental Petroleum mentioned their technology at the workshop. The presentation can be found here. |

# Honeywell

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| Field | Description |
|---|---|
| **NAME** | Honeywell Rebellion Gas Cloud Imaging (GCI) and Mini GCI |
| **HQ/LOCATION** | Houston, TX |
| **PARTNERS/INVESTORS** | |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | In 2019, Honeywell acquired Rebellion Photonics, a Houston-based provider of visual gas monitoring solutions. The company's Gas Cloud Imaging (GCI) and Mini GCI technologies use hyperspectral imaging to capture infrared spectrum and video to continuously monitor, quantify, and display gas leaks in real time.<br><br>The standard GCI is designed for large sites and has a range up to. 1,700 m; the Mini GCI designed for congested areas and small sites and has a range up to 100 m. Both provide methane concentration and leak size and location data. Honeywell also offers a propriety AI-driven software platform, Spectra, to manage data analytics and display real-time video footage. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | False alarm rate <1% |
| **NOTEWORTHY DISTINCTIONS** | According to the company, Honeywell's gas cloud imaging system has been deployed by more than 25 energy and chemicals customers globally. |
| **RECENT PROJECT(S)** | |

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| Field | Description |
|---|---|
| **NAME** | Kuva Systems (formerly known as MultiSensor Scientific) |
| **HQ/LOCATION** | Cambridge, MA |
| **PARTNERS/INVESTORS** | • Carbon Management Canada Research Institutes<br>• Cenovus Energy<br>• Clean Energy Venture Group<br>• Dräger Safety AG & Company, a global medical and safety technology provider<br>• Emissions Reduction Alberta<br>• Launchpad Venture Group<br>• Microsoft<br>• NAL Resources, a private oil and gas company in Canada<br>• Texas Tech University (TTU) |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Kuva Systems is an industrial IoT platform providing an automated, image-based, continuous methane monitoring and quantification solution. Kuva's infrared imaging system automatically detects and measures emissions in real time and provides operators with an annotated video clip of the leak. Kuva's cameras provide an adjustable 360-degree field of view and captured images are first qualified by the Kuva Cloud to eliminate false-positives and then quantified for display in a data dashboard. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: <0.02 kg/h in a lab test and 1-10 kg/h in the TTU field test (with no false positives), as noted by the company in their EPA workshop presentation<br><br>Range: 50 m |
| **NOTEWORTHY DISTINCTIONS** | Kuva Systems is part of the Microsoft for Startups program; Microsoft Azure IoT platform "provides scalability, configurability, digital twin as well as industrial grade security and encryption" for Kuva imaging cameras and the Kuva Cloud. |
| **RECENT PROJECT(S)** | In September 2020, Kuva Systems announced it would begin field installations at up to 100 sites in Alberta, Canada and additional field testing in Texas.<br><br>In June 2020, Kuva's monitoring technology won a $1.6 million grant from the Emissions Reduction Alberta Natural Gas Challenge to demonstrate an automated fixed camera system and relocatable camera system along with partners Cenovus Energy, NAL Resources, and CMC Research Institutes.<br><br>Kuva has field tested its technology at the Texas Tech University (TTU) Oilfield Technology Center using over 100 blinded tank releases over a 6-week period. |

LONGPATH TECHNOLOGIES

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| Field | Description |
|---|---|
| **NAME** | LongPath Technologies |
| **HQ/LOCATION** | Boulder, CO |
| **PARTNERS/INVESTORS** | * Advanced Research Projects Agency-Energy (ARPA-E)<br>* Colorado State University Methane Emissions Technology Evaluation Center (METEC)<br>* National Institute of Standards and Technology (NIST)<br>* National Oceanic and Atmospheric Administration (NOAA)<br>* University of Colorado, Boulder |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | LongPath Technologies has developed a stationary laser sensor technology and software to monitor oil and gas leaks over long distances (>2.5 miles). The company describes the technology as a "radar for methane;" it deploys a single, centralized laser sensor that sends invisible, eye-safe beams across a region to detect, locate, and size methane leaks among dense oil and gas infrastructure. In addition, the company offers a cloud-based data collection and reporting system within 30 minutes after detection (near real-time).<br><br>LongPath received approximately $2 million from ARPA-E in 2015 under the MONITOR program and $5 million in 2021 under the agency's SCALE-UP program to support commercialization. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | In a test conducted by the Methane Emissions Technology Evaluation Center (METEC) at Colorado State University, LongPath quantified >90% of leaks (out of more than 30 leak scenarios) down to less than 10 scfh (approximately 0.2 Mcfd or 0.2 kg/h) from a distance of nearly 1 mile. |
| **NOTEWORTHY DISTINCTIONS** | The inventors of LongPath's core technology—laser-based precision spectroscopy including the optical frequency comb technique—won the Nobel Prize in Physics in 2005; LongPath has been working with the technology for almost a decade. |
| **RECENT PROJECT(S)** | According to the company, the technology has been piloted with four companies in Colorado, California, and Canada and is currently deployed commercially in New Mexico, Texas, and Oklahoma, covering 180 wells over a 30 square mile area. |

# MIRICO

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| Field | Description |
|---|---|
| **NAME** | MIRICO |
| **HQ/LOCATION** | Oxford, UK |
| **PARTNERS/INVESTORS** | * Foresight Williams Technology EIS Fund, a UK-based investment fund supporting disruptive technology<br>* Longwall Ventures<br>* Shell<br>* Rutherford Appleton Laboratory, a government research agency in the UK<br>* Science and Technology Facilities Council, a government agency in the UK |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | MIRICO offers laser dispersion spectroscopy technologies that delivers continuous monitoring of methane and other gases in real-time. The MIRICO ORION CH4 can be deployed for continuous or intermittent monitoring of oil and gas facilities, landfills, and agricultural operations. The MIRICO CLOUD, released in 2021, enables real-time visualization of data collected from the ORION, enabling quantification and comparisons with historical data. MIRICO acquired Sedolabs, a cloud-based emissions analytics platform in 2020. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Detection limit of 50 ppb methane over 100m in 1s<br>Measurement range of 50m to 400 m |
| **NOTEWORTHY DISTINCTIONS** | In 2020, MIRICO won 3rd prize in the Green Future Enterprise Competition run by GDRF, a major gas utility in France. |
| **RECENT PROJECT(S)** | In 2017, MIRICO collaborated with Shell's atmospheric science and modelling experts to combine MIRICO's monitoring technology with Shell's proprietary plume modelling software. The findings of the collaboration were published here. |

# PROJECT CANARY

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| Field | Description |
|---|---|
| **NAME** | Project Canary, Canary Model S and Canary Model X |
| **HQ/LOCATION** | Denver, CO |
| **PARTNERS/INVESTORS** | * Chisholm Energy Holdings, a New Mexico-based natural gas producer<br>* Colorado State University Methane Emissions Technology Evaluation Center (METEC)<br>* IES/Trustwell (see Technologies in Action section of this report)<br>* Lunar Outpost, a company developing air quality and environmental monitoring systems for the lunar surface and Earth<br>* NextDecade Corp, an LNG developer<br>* PureWest Energy, a Wyoming-based natural gas producer<br>* Tallgrass Energy, a Kansas-based pipeline operator<br>In 2020, Project Canary acquired Troposphere Monitoring, a developer of hydrocarbon emissions sensor technology. |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Project Canary is focused on continuous monitoring technology that address a broad array of environmental data (air, water, land, and community) relevant to ESG reporting and certification of Responsibly Sourced Gas (RSG). The Canary Model S is a continuous solar-powered air quality and meteorological monitoring system. Data is transmitted in real-time to a Canary Cloud data platform. The Canary Model X offers higher precision, sensitivity, accuracy, and measurement frequency; the fidelity of its data collection is consistent with what is typically required to certify RSG. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Results from Project Canary's August 2021 testing at METEC can be found here. The test results show that Project Canary can quantify total site methane emissions with a ~100% leak detection rate and a cumulative calculation error of 6%. |
| **NOTEWORTHY DISTINCTIONS** | Project Canary is actively engaged in building relationships with state and Federal lawmakers, which may increase their influence on future policy and regulation. |
| **RECENT PROJECT(S)** | Project Canary has worked with a number of smaller gas producers to quantify, verify, and certify emissions, including Chisholm Energy Holdings, NextDecade Corp, PureWest Energy, and Tallgrass Energy. |

QLM

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| Field | Description |
|---|---|
| **NAME** | QLM Technology |
| **HQ/LOCATION** | Bristol, UK |
| **PARTNERS/INVESTORS** | * Bristol Equity Club, a technology accelerator<br>* Britbots Seed Fund, a technology accelerator<br>* ChampionX<br>* Development Bank of Wales<br>* Green Angel Syndicate, angel investment firm in the UK<br>* Enterprise 100 Syndicate, a private angel investment group in the UK<br>* Inzpire, a UK-based supplier of advanced defense training, technical services, and military mission systems<br>* Newable Venture Fund, venture capital firm in the UK<br>* SPLICE Project, a consortium effort supporting progress toward commercial readiness of QLM's technology which includes about a dozen research partners, including several universities as well as BP, and National Grid<br>* University of Bristol |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | QLM Technology has developed the Quantum Gas Camera, a Tunable Diode Lidar (TDLidar) gas sensor that combines multiple technologies and can be used in stationary, mobile, drone, and handheld applications.<br><br>The initial version of the Quantum Gas Camera is intended to be mounted on a pole or tripod mount, with optical zoom and versatile tilt/pan features to measure methane emissions from a fixed location over a long range. The company is also developing a second version of its camera for handheld or drone-mounted applications; QLM is testing this version of its technology as part of an unmanned aircraft system with its partner Inzpire. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Range: 200 m; the company claims that it can cover an entire facility with one camera<br><br>Additional technical specifications provided by the company can be found here. |
| **NOTEWORTHY DISTINCTIONS** | In April 2021, QLM announced it had raised 3.1 million GBP from a consortium of UK-based investors and Texas-based oilfield technology provider, ChampionX.<br><br>In April 2021, QLM was named one of twelve Bloomberg New Energy Finance (BNEF) Pioneers, a group of "early-stage companies that are pursuing exciting and important low-carbon opportunities." |
| **RECENT PROJECT(S)** | In December 2021, QLM completed its first successful trial of the Quantum Gas Camera at a National Grid Gas site as part of the SPLICE Project.<br><br>Results from a 2020 trial with the National Physical Library, the UK's national measurements standards laboratory can be found here. |

Quanta3

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| Field | Description |
|---|---|
| **NAME** | Quanta3 |
| **HQ/LOCATION** | Longmont, CO |
| **PARTNERS/INVESTORS** | * Environmental Defense Fund (EDF)<br>* Equinor<br>* Shell<br>* Statoil<br><br>Quanta3 is also participating in Project Astra, whose partners include: AT&T, Chevron, the Collaboratory to Advance Methane Science (CAMS), EDF, ExxonMobil, Microsoft, Pioneer Natural Resources, and Schlumberger |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Quanta3 offers a laser-based stationary sensor that provides continuous monitoring and quantification of methane emissions, including leak location and baseline and history. The sensors are solar powered, operate autonomously, and are not expected to require maintenance for 1-2 years. The sensors transmit data to the cloud and enable access to the data in real time. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | Quanta3 is one of seven continuous monitoring companies participating in Project Astra, which plans to establish a pilot sensor network that will leverage advances in methane-sensing technologies, data sharing, and data analytics to provide near continuous methane monitoring for a region encompassing approximately 50 km2 in the Permian Basin of West Texas. Quanta3's sensors operated in the field from October 2020 to June 2021. The best-performing sensors will then be considered for use in the next phase of the project, scheduled to launch in late 2021.<br><br>In early 2017, Statoil (now Equinor) became the first operator to pilot Quanta3's technology in Texas as a part of EDF's Methane Detectors Challenge. Later that year, Shell also piloted the technology in Alberta, Canada as part of the challenge. The Methane Detectors Challenge, launched in 2014, is a collaboration between EDF oil and gas companies, and US-based technology developers. |

SCIENTIFIC AVIATION

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| Field | Description |
|---|---|
| **NAME** | Systematic Observations of Facility Intermittent Emissions (SOOFIE) |
| **HQ/LOCATION** | Boulder, CO |
| **PARTNERS/INVESTORS** | Scientific Aviation was acquired by ChampionX in July 2021<br><br>Project Falcon partners include Chevron, ConocoPhillips, Devon Energy, ExxonMobil, Pioneer Natural Resources, Shell, and TRP Energy<br><br>Scientific Aviation is also participating in Project Astra, whose partners include AT&T, Chevron, the Collaboratory to Advance Methane Science (CAMS), EDF, ExxonMobil, Microsoft, Pioneer Natural Resources, and Schlumberger |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | SOOFIE is a fixed sensor technology offered by Scientific Aviation to provide continuous monitoring and quantification of methane emissions. The sensors are solar powered and provide enough battery backup to survive one week of overcast weather. Data measurements are transmitted to cloud-based servers for analysis. accessed through the SOOFIE data dashboard. The SOOFIE system is also integrated with Google Earth to localize and visualize the methane leak locations. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | Scientific Aviation's Dashboard User Guide provides more detailed information on the kinds of data offered through the system. |
| **NOTEWORTHY DISTINCTIONS** | |
| **RECENT PROJECT(S)** | In early 2021, Scientific Aviation announced the launch of Project Falcon, a six-month joint industry study that aims to determine the best way to deploy the company's continuous methane monitoring technology. Under the project, Chevron, ConocoPhillips, Devon Energy, ExxonMobil, Pioneer Natural Resources, Shell, and TRP Energy will test SOOFIE in Colorado, New Mexico, and Texas.<br><br>Scientific Aviation is one of seven continuous monitoring companies participating in Project Astra, which plans to establish a pilot sensor network that will leverage advances in methane-sensing technologies, data sharing, and data analytics to provide near continuous methane monitoring for a region encompassing approximately 50 km2 in the Permian Basin of West Texas. Quanta3's sensors operated in the field from October 2020 to June 2021. The best-performing sensors will then be considered for use in the next phase of the project, scheduled to launch in late 2021. |

SENSIA

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| Field | Description |
|---|---|
| **NAME** | Sensia Solutions |
| **HQ/LOCATION** | Madrid, Spain |
| **PARTNERS/INVESTORS** | • European Commission |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | In 2021, Sensia Solutions announced the integration of its optical gas imaging with a new "Methane Laser" (based on Tunable Diode Laser Absorption Spectroscopy), resulting in a stationary, continuous monitoring technology for methane (Caroline FYL) that is integrated with Sensia's software analytics platform, Redlook. Sometimes referred to as Build-in Redlook the two technologies in the system validate or "doublecheck" the results, and the company claims to achieve "virtually zero false alarms." The fixed monitoring devices are solar powered, autonomous, and allow for real-time monitoring. A brochure about Redlook, including the monitoring system and associated software platform can be downloaded here. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | • MDL: 80-100 g/h at 35 m and 200-350 g/h at 50 m<br>• False positives rate: 1 alarm per month |
| **NOTEWORTHY DISTINCTIONS** | In October 2021, Sensia Solutions received Spain's CincoDias prize for innovation in the category of business-university collaboration, related to its work with the Carlos III University in Madrid |
| **RECENT PROJECT(S)** | In 2018, Sensia tested its prototype fixed monitoring system at oil and gas sites across Europe as part of the European Commission-funded Horizon 2020 program GaSeS project. |

SENSIRION
THE SENSOR COMPANY

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| Field | Description |
|---|---|
| **NAME** | Sensirion Nubo Sphere |
| **HQ/LOCATION** | Zurich, Switzerland |
| **PARTNERS/INVESTORS** | • Colorado State University (CSU) Methane Emissions Technology Evaluation Center (METEC) |
| **TECHNOLOGY DESCRIPTION (WHAT IS IT?)** | Sensirion is a Switzerland-based manufacturer of digital sensors and systems for air quality and environmental monitoring solutions. In September 2021, the company announced Nubo Sphere, a stationary methane leak detection system that provides real-time, continuous methane concentration data as well as meteorological data including wind speed and direction, temperature, humidity, and barometric pressure. Data is uploaded to a proprietary "Nubo Cloud," which also monitors the health of connected sensors and the overall system for maintenance or repair issues. The company notes that its system is "future-proofed" because sensor cartridges can be easily changed or updated without upgrades to the overall system. |
| **NOTEWORTHY TECHNICAL SPECIFICATIONS** | MDL: <1 kg/h, according to the company's video at the EPA workshop virtual vendor hall. |
| **NOTEWORTHY DISTINCTIONS** | In May 2021, Sensirion acquired Swiss company IRsweep, a provider of optical sensing solutions relevant to methane detection. |
| **RECENT PROJECT(S)** | Sensirion has tested Nubo Sphere at the CSU METEC test site and has other field tests planned, according to its video at the EPA workshop virtual vendor hall. |

## Technologies in Action

*Carbon Mapper*

Carbon Mapper is a non-profit that aims to advance climate action by integrating advanced methane detection technologies with real-time tracking and data analytics. The NGO has public-private partnerships consisting of a broad-based coalition of industry, government, academic institutions, and philanthropic organizations, which are working to leverage their resources and expertise to fund, design, build, and promote satellite and remote-sensing technologies for methane emissions. The project technology will also look at several other environmental indicators, including CO2.

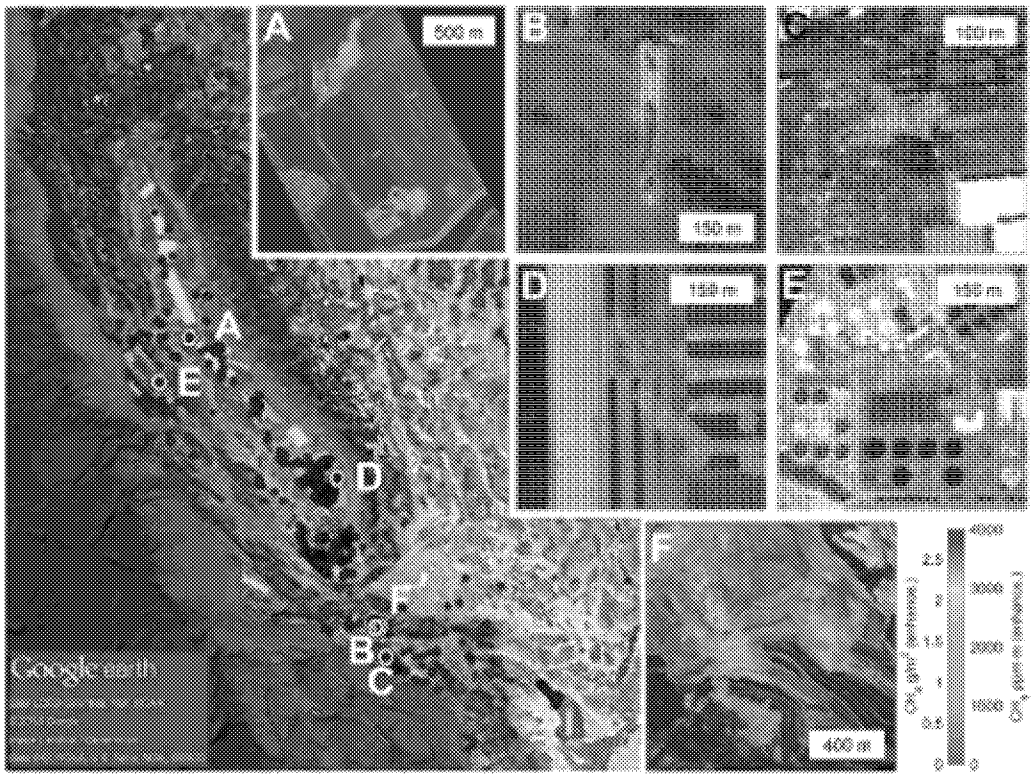


IMAGE 1
Carbon Mapper

Currently, Carbon Mapper is using aircraft equipped with high resolution hyperspectral imaging camera to collect data on super emitters in the Permian basin; the group's longer-term plan is to develop and launch a constellation of satellites for measuring and tracking methane and other greenhouse gases. Carbon Mapper's key partners are NASA's Jet Propulsion Lab (JPL), Planet, California Air Resources Board (CARB), High Tide Foundation, The University of Arizona and Arizona State University, Rocky Mountain Institute (RMI), and Bloomberg Philanthropies. The organization's stated mission is to pinpoint, quantify, and track methane and CO2 emissions at a facility level using satellite data that they will collect from Carbon Mapper satellites built by partners such as NASA JPL and Planet, while offering fast methane leak detection services to operators and regulators, and delivering independent data to help certify methane intensity for oil and gas supply chains. In addition, they will make this data available publicly available through its global open data portal called Methane Source Finder, to increase accessibility, transparency and understanding of the received data. Carbon Mapper will also offer technical support for end-users to enhance the impact of data. This public portal, built in partnership with California's Air Resources Board, will make the data available to industry, private citizens, government, and other sectors.

Carbon Mapper's first two satellite launches are planned for 2023, with additional satellites to be added starting in 2025.

*Climate Action Engine*

Climate Action Engine (CAE) is an emissions data and analytics platform that visualizes methane emissions from oil and gas industry operations in West Texas' Permian Basin and helps users assess climate risk.

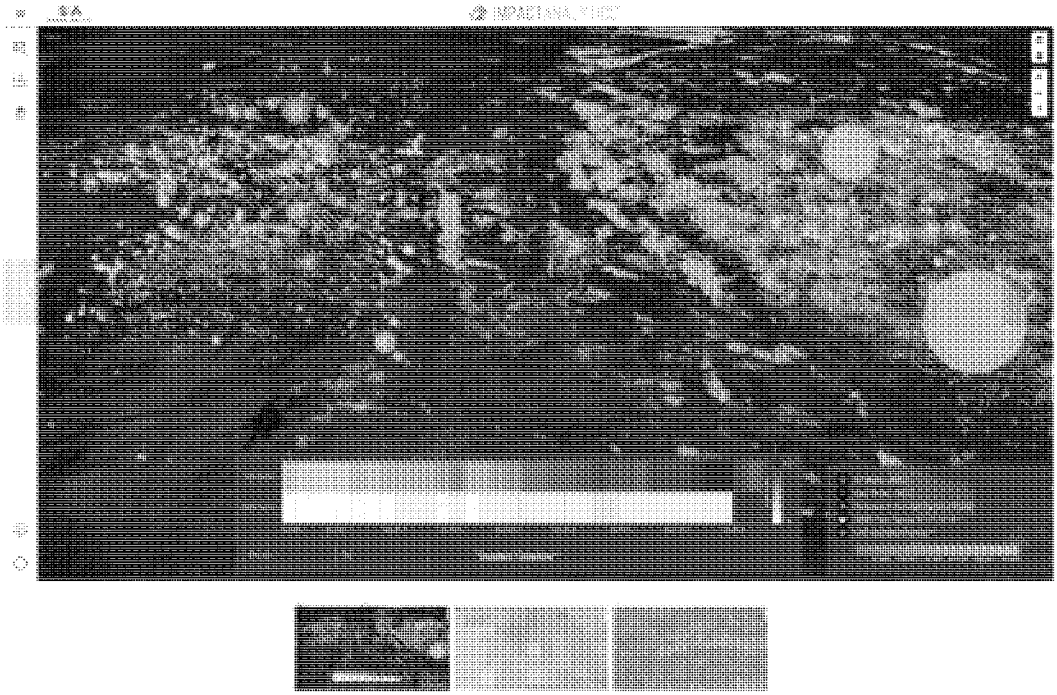

**IMAGE 2**
Climate Action Engine

The platform integrates publicly available data from aerial sensors and satellites (currently NOAA VIIRS and Europe's TROPOMI) with information about oil and gas industry sites and facilities to produce a more comprehensive picture of emissions and their sources. Users may also upload their own data to the platform.

CAE generates "asset-grade" data (AGD), which is data embedded with proof, immutability, and auditability and can help investors quantify and contextualize ESG factors against more tangible commercial/corporate/business priorities.

CAE is a partnership between RMI (formerly the Rocky Mountain Institute) and Spherical Analytics. The platform has been piloted by major energy companies including Shell, Exxon, and Chevron, and Shell has estimated an 80% reduction in flaring at their Permian Basin operations since they adopted the platform in 2017. CAE enables users to report emissions data in accordance with various standard protocols including the Taskforce on Climate-related Financial Disclosures (TCFD), Sustainability Accounting Standards Board (SASB), Global Reporting Initiative (GRI), and the Climate Disclosure Project (CDP).

See a video demonstration of the platform here.

*Flaring Monitor*

Flaring Monitor is a first-of-its kind project that tracks company-level flaring in the largest U.S. oil and gas basins, including North Dakota and the Permian Basin. The project uses images from the company Planet and NASA satellite sensor readings of heat signatures from natural gas flares to estimate CO2 and methane emissions in real-time. Flaring Monitor is open source, meaning that it makes its data, code, algorithms, and the resulting datasets available to the public through the platform GitHub.

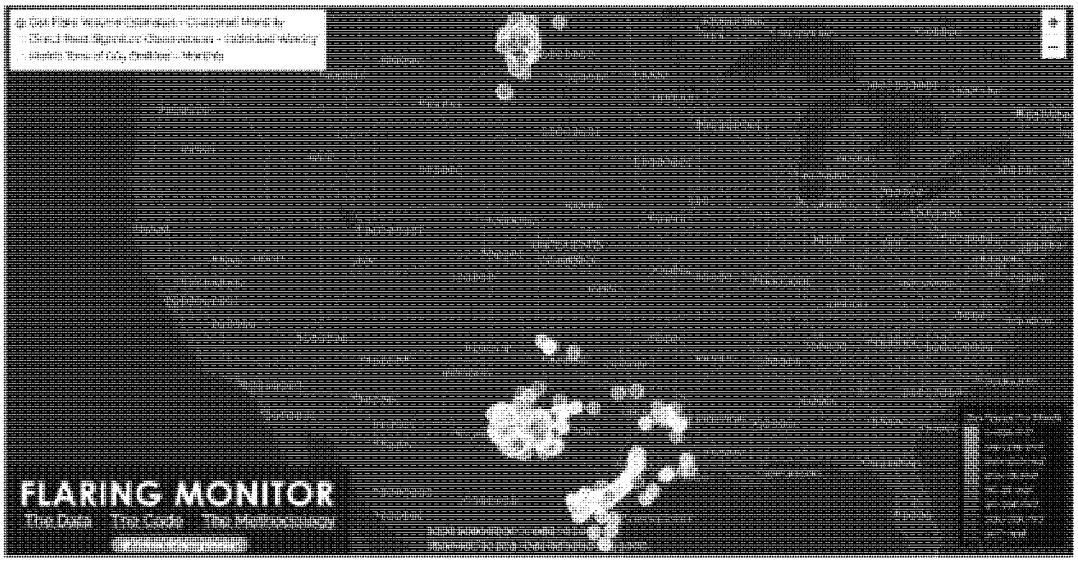


**IMAGE 3**
Flaring Monitor

Flaring Monitor allows users to compare a company's self-reported data (provided to regulatory agencies) against objective satellite measurements. The platform also allows comparison of flaring associated with different companies. In May 2021, Flaring Monitor noted that its data shows that Shell is "doing better on flaring" than other large energy companies.

For additional information, see Flaring Monitor's white paper here.

*IES and Project Canary*

In 2020, Project Canary, a provider of stationary technologies for continuous monitoring of methane emissions merged with Independent Energy Standards (IES), a provider of analytics for the oil and gas industry and developer of the "TrustWell" rating and certification system for Responsibly Sourced Gas (RSG). The combined company provides a comprehensive solution for oil and gas sector companies seeking to measure, monitor, verify, and report accurate, timely information about methane emissions and access the growing market for differentiated gas.

**IMAGE 4**
IES and Project Canary

Project Canary's technology measures environmental data including emissions information in near real-time and stores the data on its cloud-based platform. The data is then integrated with the TrustWell verified attribute programs to create a rating (Rated, Silver, Gold, and Platinum). Each verified attribute program assesses four factors at a facility: 1) the inherent risk of operations; 2) control measures; 3) performance with regard to specific events; and 4) continuous improvement in risk reduction and operations. Each of these factors has multiple components that make up the rating.

Low-Methane is the first of the verified attribute programs to be implemented; the three additional programs are: Freshwater Friendly, Safe Operator, and Chemical Steward. In March 2020, Jonah Energy was the first company to receive a TrustWell Gold rating under the Low-Methane Verified Attribute program.

See the TrustWell report on Jonah Energy's Responsibly Sourced Gas here.

*Jonah Energy and OGMP*

In 2020, Jonah Energy became the first U.S. company to join the Oil and Gas Methane Partnership (OGMP), a program sponsored by the United Nations Environment Programme and the Climate and Clean Air Coalition. Membership in the group requires a commitment to three specific actions:

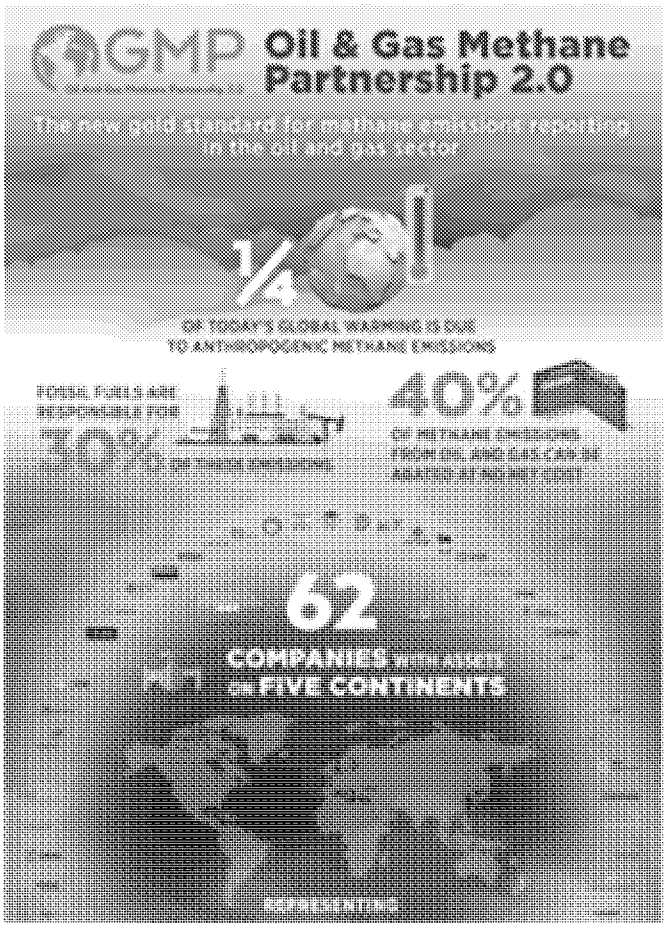


**IMAGE 5**
Jonah Energy and OGMP

- Surveying facilities for nine core sources that make up the majority of methane emissions in typical upstream operations
- Evaluating cost-effective technology options to address uncontrolled sources
- Reporting progress on surveys, project evaluations, and project implementation in a transparent, credible manner that demonstrates results

OGMP is a broad multi-national and multi-stakeholder partnership working on methane emissions measurement and reporting protocols that will enable companies to demonstrate real emission reductions. In 2020, OGMP published its 2.0 Framework, which establishes a "gold standard" for credibility and trust in reporting and reducing methane emissions.

In July 2021 (less than a year after joining), Jonah Energy announced was on track to be the first company to achieve this "gold standard" under the framework. To achieve this, the company is implementing a variety of technologies, including stationary measurement devices, drone-based sensors, aerial laser scanning, and satellite-based asset-wide measurement, that overall enable verified emissions measurement at both the site level and at the source.

See the OGMP 2.0 Framework here. Read the detailed OGMP technical guidance documents here.

*PermianMAP*

The Permian Methane Analysis Project (PermianMAP) is a pilot project that combines established data collection methods with emerging measurement and monitoring technologies to quantify and report on oil and gas methane emissions in the Permian Basin. It is led by the Environmental Defense Fund (EDF) with technical support from several research and technology partners.

The project focuses on a subsection of the Permian Basin, specifically a 10,000 square-kilometer grid in the Delaware Basin that contains 10% (11,000) of the region's active wells and produces 40% of its oil and gas. More than 100 companies including both oil majors and small independents operate there.

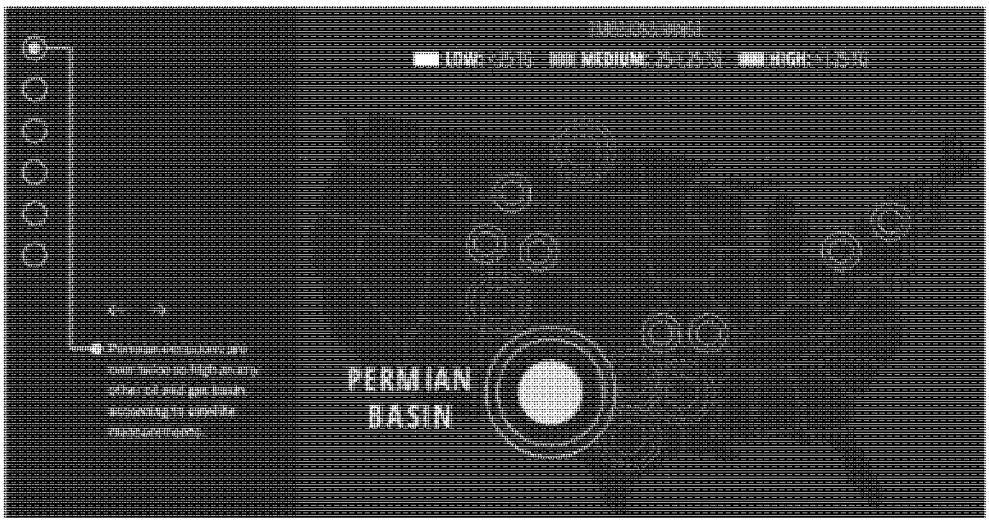


**IMAGE 6**
PermianMAP

Methane emissions measurements are taken in four ways:

- By Scientific Aviation aircraft that conducted three surveys of the area over 100 days
- By Leak Surveys, Inc. helicopters equipped with an infrared camera to detect flares
- By stationary sensors installed at five towers across the study area that measure methane concentrations continuously (24/7) and are analyzed using a Penn State University model to determine the area's total methane emissions on a quarterly basis
- By the University of Wyoming mobile methane detection van equipped with an infrared camera that can identify the sources (specific locations and equipment) of methane emissions

Data measurements are then cross-referenced with data from the TROPOMI satellite to estimate total methane emissions and then reviewed and verified by an independent scientific advisory panel made up of academics from the U.S. and Canada. Once verified, all data will be made available to the public on the PermanMAP website. Data is also shared directly with companies responsible for the emissions.

To date, the project has revealed that the rate of methane leaks in the Permian Basin are three times higher than the national average. The project has found that 11% of flares were either unlit (releasing un-combusted methane) or inefficient (burning only part of the gas and releasing the rest).

See the project's full methodology here. See the data dashboard here.

## Snapshot of Criteria Used in Ratings

COEFFICIENT developed 14 criteria for assessing the 3Ts (Transparency, Trust, and Transactability). These criteria were defined primarily to apply to broad-based initiatives that addressed a combination of methane measurement, monitoring, reporting, and verification activities, including but not primarily technology initiatives.

TABLE 9 describes our current criteria and definitions. The criteria, which were designed to begin an introductory dialogue around the policy and market opportunities of these technologies, were validated with a small group of key stakeholders and may continue to evolve in future phases of this project.

**TABLE 9**
Criteria for Use in Ratings

| 3Ts Category | Criteria | Definition |
|---|---|---|
| Transparency | Access to data or system | Does the technology use an open-source approach or is it only offered as a proprietary product or subscription? Does it make data collected available to the public? |
| Transparency | Accuracy of Inputs | Does the technology provide accurate data? Is it affected by weather or other sensitivities? Does it result in a significant number of false positives? |
| Transparency | Granularity of Inputs | Does the technology provide granular data? What is its Minimum Detection Level (MDL) or resolution for images? Does it identify the specific source of methane? |
| Transparency | Monitoring Frequency | What is the frequency of data collection? |
| Transparency | Timeliness | How soon after data collection is the data available to access? |
| Transparency | Area | How much area can the technology cover over a specific survey or timeframe? |
| Transparency | Support for Advanced Technologies, Digital MRV | Does the technology enable quantification and interoperability, not just LDAR? Does it include data analytics software or platform for understanding the data collected? |
| Trust | Verification Practices/ Mechanisms | Does the technology provider allow for independent validation of the data collected? Does it verify the data through an integrated third-party verification tool/ process/mechanism? |
| Trust | Quantity of Participants | How many partner organizations are funding, supporting, piloting, or adopting the technology? |
| Trust | Quality of Participants | Are the partner organizations well-known, credible, and diverse? |
| Trust | Policy Engagement | Does the technology intersect with policy or regulation? Have policymakers or regulators integrated features of the technology into law? |
| Trust | Maturity and Scale | Is the technology still under development, already demonstrated, or commercial? Is the technology easy and cost effective to scale? |
| Transactability | Certification of natural gas products | Does the technology enable certification of low-emission natural gas that can be bought/sold/traded in a market? |
| Transactability | Enables Meaningful Investor Analysis/ Assessment | Does the technology enable contextualization of methane emissions data in a way that can be understood and shared across the corporate ESG and financial communities? Does it have the capability to align with standard or emerging reporting methodologies used by investors and financial markets? |

## Key Takeaways from Preliminary Ratings (Version 1.0)

COEFFICIENT developed a set of preliminary ratings of the technologies profiled in this report. These ratings are based on the information we have been able to collect and our evaluations of how well each technology addresses the 3Ts criteria; they are intended to help inform stakeholders about the general strengths and limitations of various technologies in a policy context and indicate how different technologies can complement each other. We believe any of the technologies profiled and rated have the potential to be valuable solutions for different contexts; the intention of the ratings is not to provide a full technical evaluation of the specifics of each technology or to exclude any technology from consideration as a methane measurement solution, but to start a dialogue about the potential of these technologies to work collectively to provide a more transparent, trustworthy and transactable energy future.

Ratings were assessed on a 1-5 scale, with 1 being the lowest and 5 being the highest. Ratings were assigned based on known information; where not enough publicly available information was found on specific criteria, no rating was made. All but three of the profiles were rated on at least ten criteria, and most were rated on between 11 and 13 criteria. New or additional information about any technology may impact the rating. Ratings are likely to evolve as additional information becomes available in future phases of this project.

The following are key conclusions from these preliminary ratings:

- Almost all companies/technologies have the *capability* to quantify methane emissions and integrate with Digital MRV systems. However, our sense is that the technologies are *not actually implemented* in this way by most oil and gas operators; instead, many operators are focused on regulatory compliance under EPA OOOOa rather than taking the next steps toward measurement and quantification.
- Most companies/technologies are offered as a product or service to customers, and except for some satellite technologies, the data collected is housed in proprietary systems and not made public. Without new standards, this may create interoperability barriers to wider deployment and integration with new regulation.
- Timeliness (how quickly data is available) is a strength of most companies/technologies; most offer access to data in real time or near real time.
- Very few companies/technologies are focused on key criteria for trust and transactability, specifically: verification activities; integration with emerging policy and regulation; certification activities; or investor activities. As such, most profiles receive ratings of 1 on these criteria.
- Many companies/technologies received a rating of 3 on maturity/scale, indicating that they are currently or have been piloted in the field with oil and gas operators, but testing and improvements are ongoing, and the technologies may not yet be ready for wide-scale commercial deployment.
- The overall top-rated profiles are: MethaneSAT (satellite); TROPOMI (satellite); Picarro (mobile- other/cross-cutting); Baker Hughes LUMEN Terrain (stationary); and Project Canary (stationary). These generally received higher ratings not necessarily because of better technical specifications but rather because they were some of the very few companies/technologies that are addressing verification and certification activities. Each of these received an overall rating between 3 and 4. All other profiles received overall ratings between 2 and 3. The average rating across all profiles was 2.43.
- For additional details regarding how ratings were defined and calculated in this report, and for recommendations on how to evolve these criteria in future phases of this project, please contact COEFFICIENT.

## Emerging Issues for Consideration

### Interoperability and the Future of Digital MRV

An emerging issue that oil and gas companies should build awareness around is interoperability. Interoperability is essentially an issue of integration. Data that meets high standards of transparency, trust, and transactability will also need to be used across different platforms and programs.

However, currently standards are lacking to enable interoperability. Different formats and processing techniques, varying definitions for metadata, and varying granularity all create barriers to sharing data across platforms. In addition, costs associated with creating interoperable systems and legitimate concerns about privacy and confidentiality often block progress.

Although seemingly arcane, interoperability must be addressed to fully realize the potential of the 3Ts (Transparency, Trust, and Transactability). Industry and policymakers may consider a role for the National Institute of Standards and Technology (NIST), which has a long and respected history of working with diverse stakeholders to establish technical standards.

In the early 2000s, concepts for a "smart grid" began to emerge, but there were no standards for power plants, meters, buildings, vehicles, and other devices and systems to communicate with the grid. Without standards, smart grid technologies were at risk of becoming prematurely obsolete or being implemented without necessary security features.

In 2007, Congress directed NIST to coordinate development of a framework and standards to achieve interoperability of smart grid devices and systems. In 2010, NIST published a "Framework and Roadmap for Smart Grid Interoperability," including a "reference model"—a tool for defining and developing architectures for systems and subsystems within the smart grid and ensuring interoperability and cybersecurity.

Today, the NIST Smart Grid Interoperability Panel (SGIP) maintains a catalog of standards and provides an open process for stakeholders to interact and accelerate standards harmonization and advance the interoperability of smart grid devices and systems. As of December 2020, 88 million smart meters have been deployed in the U.S., representing 57% of all electric meters. NIST may be well-positioned to play a similar role in data interoperability for methane emissions.

### Transactability and the Role of Environmental Attributes in Certification of RSG

A durable framework to achieve methane emission reduction requires transparency, trust, and transactability. Fast-advancing technologies (as discussed in this assessment) are increasingly enabling the transparency of emissions data. In addition, efforts are ongoing to increase trust by reconciling the differences between top-down and bottom-up emissions calculations and developing standardized reporting methodologies.

However, achieving transactability of responsibly sourced gas (RSG) products will require additional tools to 1) independently verify the environmental attributes of the product and 2) enable secure transactions between producers and customers.

Similar challenges existed two decades ago as renewable electricity production began to rise and power producers sought to attract (or respond to demand from) customers for clean or "green" energy. In response, Renewable Energy Credits (RECs) were created to track renewable electricity from the point of generation to the consumer. Today, a REC represents one megawatt-hour (MWh) of electricity generated from a renewable energy resource that can be bought and sold in the open market.

In the U.S., RECs grew as states passed renewable portfolio standards (RPSs) and have also been also used in the voluntary market, where customers buy renewables to meet sustainability goals. RECs are tracked by regional digital tracking systems that facilitate the creation, management, and retirement of RECs and ensure that each REC is assigned a unique serial number and counted only once. Auditing of RECs is done by independent third-party organizations or certified internal auditors.

How might the REC model apply to RSG? Environmental attributes for RSG are more complex than for renewable power, and challenges remain around establishing 1) consistent definitions for attributes, 2) standardized measurement protocols, and 3) interoperability among trading platforms and registries. However, several initiatives are emerging to apply the lessons of RECs to these challenges.

One company exploring this opportunity is Xpansiv. Xpansiv operates multiple registries that allow producers and customers to track, measure, and transact commodity products based on environmental or other derived attributes. In October 2021, Xpansiv and S&P Global Platts launched a new benchmark for methane performance in natural gas production based on methane intensity and other measurable, differentiating attributes, including well location and production type. Producers that meet the benchmark receive a digital Methane Performance Certificate (MPC) representing one (1) MMBtu of gas; MPCs are embedded with a blockchain-based system of record-tracking. Buyers and sellers can also access Xpansiv's digital inventory of third-party verified asset information to understand and track attributes including other certifications such as those offered by Equitable Origin (EO) and Independent Energy Standards (IES). In these ways, Xpansiv is offering a digital view inside each MMBtu of a gas, creating as they call it, "Digital Natural Gas."

In encouraging the growth of the marketability of differentiated gas products beyond paper contracts and bilateral transactions, the market requires a suite of technologies to build the digital infrastructure to support diverse types of transactions. Digital solutions can be employed to create verified systems to validate the environmental attributes of differentiated gas and facilitate transparent transactions. Like the renewable power sector, the oil and gas industry has an opportunity to adapt digital frameworks to achieve the sector's objectives and mandates for emissions reduction.

## Conclusions and Recommendations

The following are key conclusions from this assessment and recommendations for industry and policymakers.

- Many oil and gas operators today have not yet moved from a mindset of leak detection to a **mindset of measurement and quantification**. In large part, this is because regulation has not required them to do so. However, as measurement technologies continue to improve and mature, both investors and regulators are likely to demand more on measurement and quantification. There is an opportunity for industry to get ahead of this trend by moving toward measurement and quantification now.
- Very few companies/technologies profiled in this assessment are focused on key criteria for **trust and transactability**, specifically: verification activities; integration with emerging policy and regulation; certification activities; or investor activities. These criteria are absolutely critical to addressing growing pressure from investors and to building markets for Responsibly Sourced Gas (RSG).
- Measurement and monitoring **technologies have advanced significantly** in recent years and will likely continue to evolve as industry and other stakeholders learn more about their performance in the field under various scenarios and conditions. Industry and its partners should **engage directly with policymakers to share data and outcomes** that can help inform and ensure effective policy and regulation.
- Policymakers and regulators have an opportunity to enable more **transparent methane emissions reporting** and ensure **real emissions reductions** in the near term and long term by using this assessment and other resources to understand the strengths and limitations of advanced measurement and monitoring technologies and how these technologies are being demonstrated and assessed in the field. Policymakers should consider **establishing protocols for assessing the performance** of emerging measurement and monitoring technologies to better ensure their effective deployment.
- Policymakers and regulators will also need to better understand how data collected using these technologies can be used to **calculate a company's total emissions**. Efforts are underway by the Gas Technology Institute and others to **develop methodologies** for integrating and reconciling top-down and bottom-up measurements of methane emissions, and policymakers should also consider a government role in establishing or verifying such methodologies.
- Companies should consider the formation of a **buyer's consortium** for customers interested in RSG procurement. Such a consortium could help support policymaker outreach and education and accelerate the deployment of measurement and verification technologies necessary to certify RSG and enable new markets.

## Additional Resources

Alvarez, Ramón A. Daniel Zavala-Araiza, David R. Lyon, David T. Allen,Zachary R. Barkley, Adam R. Brandt, Kenneth J. Davis, et al. "Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain." Science 361 (6398): 186-188. Accessed December 13, 2021, doi: 10.1126/science.aar7204.

Blanton, Erin M. and Samer Mosis. "The Carbon-Neutral LNG Market: Creating a Framework for Real Emissions Reductions." Commentary, Columbia University Center on Global Energy Policy, July 8, 2021, https://www.energypolicy.columbia.edu/research/commentary/carbon-neutral-lng-market-creating-framework-real-emissions-reductions.

Carbon Limits, *Overview of Methane Detection and Measurement Technologies for Offshore Applications*, Oslo, Norway: Carbon Limits, June 23, 2020, https://www.carbonlimits.no/wp-content/uploads/2020/08/Methane-measurement-technologies-offshore_for-website.pdf.

Environmental Defense Fund (EDF) in collaboration with Accenture Strategy, *Fueling a Digital Methane Future*. n.p.: EDF and Accenture, 2019, https://www.edf.org/sites/default/files/documents/Fueling%20a%20Digital%20Methane%20Future_FINAL.pdf.

EPA Methane Detection Technology Workshop. Day 1 Recording, August 23, 2021, https://youtu.be/KfY50npQ0sM.

EPA Methane Detection Technology Workshop. Day 2 Recording, August 24, 2021, https://youtu.be/lQcUhMG24X0.

EPA Methane Detection Technology Workshop. Virtual Vendor Hall, https://www.youtube.com/playlist?list=PL1P8ajXEpoMdN6wSUsT4bgqvNSn6OLfTC.

International Energy Agency (IEA). "Methane Emissions from Oil and Gas." IEA website, accessed December 13, 2021, https://www.iea.org/reports/methane-emissions-from-oil-and-gas.

Kleinberg, Robert. "Methane Emission Controls: Redesigning EPA Regulations for Greater Efficacy." Commentary, Columbia University Center on Global Energy Policy, October 4, 2021, https://www.energypolicy.columbia.edu/research/commentary/methane-emission-controls-redesigning-epa-regulations-greater-efficacy.

LaCount, Robert, Tom Curry, Luke Hellgren, and Pye Russell. *Benchmarking Methane and Other GHG Emissions of Oil & Natural Gas Production in the United States*. n.p.: Ceres, Clean Air Task Force, and M.J. Bradley & Associates (MJB&A), June 2021, https://www.mjbradley.com/sites/default/files/OilandGas_BenchmarkingReport_2021.pdf.

# Letter Regarding Use of Forests for Bioenergy

(February 11, 2021)

To President Biden, President von der Leyen, President Michel, Prime Minister Suga, and President Moon,

The undersigned scientists and economists commend each of you for the ambitious goals you have announced for the United States, the European Union, Japan and South Korea to achieve carbon neutrality by 2050. Forest preservation and restoration should be key tools for achieving this goal and simultaneously helping to address our global biodiversity crisis. We urge you not to undermine both climate goals and the world's biodiversity by shifting from burning fossil fuels to burning trees to generate energy.

For decades, producers of paper and timber products have generated electricity and heat as by-products from their process wastes. This use does not lead to the additional harvest of wood. In recent years, however, there has been a misguided move to cut down whole trees or to divert large portions of stem wood for bioenergy, releasing carbon that would otherwise stay locked up in forests.

The result of this additional wood harvest is a large initial increase in carbon emissions, creating a "carbon debt," which increases over time as more trees are harvested for continuing bioenergy use. Regrowing trees and displacement of fossil fuels may eventually pay off this carbon debt, but regrowth takes time the world does not have to solve climate change. As numerous studies have shown, this burning of wood will increase warming for decades to centuries. That is true even when the wood replaces coal, oil or natural gas.

The reasons are fundamental. Forests store carbon - approximately half the weight of dry wood is carbon. When wood is harvested and burned, much and often more than half of the live wood in trees harvested is typically lost in harvesting and processing before it can supply energy, adding carbon to the atmosphere without replacing fossil fuels. Burning wood is also carbon-inefficient, so the wood burned for energy emits more carbon up smokestacks than using fossil fuels. Overall, for each kilowatt hour of heat or electricity produced, using wood initially is likely to add two to three times as much carbon to the air as using fossil fuels.

Increases in global warming for the next few decades are dangerous. This warming means more immediate damages through more forest fires, sea level rise and periods of extreme heat in the next decades. It also means more permanent damages due to more rapid melting of glaciers and thawing of permafrost, and more packing of heat and acidity into the world's oceans. These harms will not be undone even if we remove the carbon decades from now.

Government subsidies for burning wood create a double climate problem because this false solution is replacing real carbon reductions. Companies are shifting fossil energy use to wood, which increases warming, as a substitute for shifting to solar and wind, which would truly decrease warming.

In some places, including Japan and French Guiana, there are proposals not just to burn wood for electricity but to burn palm or soybean oil. Producing these fuels requires expansion of palm or soybean production that leads to clearing of carbon dense tropical forests and reduction of their important carbon sink, both of which add carbon to the atmosphere.

"Sustainability standards" for forest or vegetable oil management cannot alter these results. Sustainable management is what allows wood harvest to eventually pay back carbon debts but cannot alter these decades or even centuries of increased warming. Similarly, any increased demand for vegetable oil adds to the global pressure to clear more forests already created by rising food demands.

Making countries responsible for emissions from land use changes, although desirable, cannot alone fix laws that treat burning wood as carbon neutral because these national responsibilities do not alter the incentives created by those laws for power plants and factories to burn wood. In the same way, the fact that countries are responsible for emissions from diesel fuel use would not fix a law encouraging trucks to burn more diesel on the flawed theory that diesel is carbon neutral. Both treaties that shape national climate responsibilities and each country's energy laws that implement them must accurately recognize the climate effects of the activities they encourage.

Your decisions going forward are of great consequences for the world's forests because if the world supplied just an additional 2% of its energy from wood, it would need to double its commercial wood harvests. There is good evidence that increased bioenergy in Europe has already led to greatly increased forest harvests there. These approaches also create a model that encourages tropical countries to cut more of their forests – as several countries have pledged to do – undermining the goals of globally accepted forest agreements.

To avoid these harms, governments must end subsidies and other incentives that today exist for the burning of wood whether from their forests or others. The European Union needs to stop treating the burning of biomass as carbon neutral in its renewable energy standards and in its emissions trading system. Japan needs to stop subsidizing power plants to burn wood. And the United States needs to avoid treating biomass as carbon neutral or low carbon as the new administration crafts climate rules and creates incentives to reduce global warming.

Trees are more valuable alive than dead both for climate and for biodiversity. To meet future net zero emission goals, your governments should work to preserve and restore forests and not to burn them.

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Message

**From:** Mitchell Hescox [mitch@creationcare.org]
**Sent:** 2/16/2021 7:28:11 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Methane Questions

Joe,

Would you be kind enough to help me understand the direction EPA is planning on addressing methane both existing sources and new sources?

There has been much chatter on a CRA for the Trump version, new legislation such as separate codification bills from Rep. Scott Peters and Rep. DeGette. I know Senator Carper has not supported a CRA while some green jobs have pushed Leader Schumer. And now I hear it's out of favor (CRA).

Is EPA planning a new revised standard as you have written in in your Harvard work?

If you have any thoughts or can make some reason out of the possibilities and give us any clarity - it would be greatly appreciated.

Blessings

Mitch
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Message

**From**: Rakosnik, Delaney [rakosnik.delaney@epa.gov]
**Sent**: 2/23/2021 8:55:40 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: Random question

Hi Joe,

Totally random, but do you know Stuart Davies (forest ecologist) from Harvard?

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# Kicking Ash: Who (or What) is Winning the "War on Coal"?

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US coal-fired generating capacity has shed nearly 25% of its footprint between 2011 and 2018. Multiple factors—regulation, natural gas prices, renewable energy adoption, and environmental activism—have each been lauded by various stakeholders for this trend. To improve our understanding of this environmental technology transition, it is important to determine the extent to which each of these factors has accelerated coal unit retirements. We do so in this study through an accelerated failure time model that utilizes data on US coal-fired generating units from 2008 through 2016. Our findings indicate that environmental regulation, reduced natural gas price volatility, increased utilization of renewable capacity, and the Sierra Club's Beyond Coal campaign have all accelerated coal unit retirements. We do not, however, find evidence that natural gas price levels or the penetration of renewable capacity have accelerated coal unit retirements. Among the significant drivers, we estimate that the Beyond Coal campaign has had the greatest effect per unit, reducing expected operating life by an average of 24.4 months. However, among these factors, federal regulation affected the greatest number of coal units, and thus had the greatest aggregate impact on coal retirements. In *post hoc* analysis, we estimate that 40% of the generation that had been provided by retired coal-fired units spilled over to surviving coal-fired units. However, we estimate the 60% that was displaced from the coal fleet resulted in a 103.6 to 178.2 million metric ton net reduction in $CO_2$ emissions each year.

*Key words:* carbon emissions; climate change; environmental operations; environmental regulation; environmental activism
*History*: Received: September 2019; Accepted: December 2020 by Atalay Atasu after 2 revisions.

## 1. Introduction

Transitioning to cleaner production technologies is a critical step in reducing the environmental impact of the world's industrial systems (Drake and Spinler 2013). Such technology transitions require both the adoption of clean technologies and the retirement of environmentally intensive technologies (Newell and Raimi 2018). The former is required to sustain (or grow) production levels to keep pace with demand, while the latter is required to reduce emissions.

For example, the rapid transition toward renewable energy and away from $CO_2$-intensive energy sources such as coal is touted as an essential step to averting the worst outcomes of human-induced climate change (Intergovernmental Panel on Climate Change 2018). From 2008 through 2016, renewables—including hydropower and marine, solar, wind and bio energy—grew from 22.8% to 30.9% of the world's installed power generating capacity (Energy Information Administration 2018a). However, over this same period, and despite its decreased share, total installed fossil fuel capacity also grew (Energy Information Administration 2018a). As a consequence, even with the increased penetration of renewables, emissions from global power generation grew by 12% from 11.83 to 13.25 Gigatons of $CO_2$ (International Energy Agency 2018).

Emissions reduction results only to the extent that clean technologies displace incumbent, emissions-intensive capacity. It is the operational decision to retire emissions-intensive capacity that results in emissions reduction. However, while substantial academic attention has focused on the adoption of clean technologies (e.g., Aflaki and Netessine 2017, Drake 2018, Drake et al. 2016, Georgallis et al. 2019, Kök et al. 2020, Pacheco et al. 2014, etc.), less attention has been given to factors that drive the decision to retire emissions-intensive technologies. In this study, we explore those factors in the context of US coal-fired power generation.

## 2. US Coal-fired Power Generation

Coal-fired power formed the bedrock of the US generating footprint from the 1940s through the early 2010s, fueling tremendous economic growth. However, coal is also the most environmentally harmful technology in the generation fleet (Muller et al. 2011). Due to the particulates and toxins that it emits, coal is associated with a host of environmental and health effects ranging from climate change to acid rain to hundreds of thousands of preventable heart attacks,

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asthma attacks, and other medical maladies (Clean Air Task Force 2010, and Finkelman and Tian 2018). These impacts have led to the "war on coal," a concentrated effort by politicians, entrepreneurs, and activists to supplant coal with alternative cleaner sources of power such as natural gas, wind, and solar energy.

Since the mid-1990s, coal-fired power generation has been the target of a bevy of environmental regulation including: the Acid Rain Program (ARP) implemented in 1995 to limit $NO_x$ and $SO_2$ emissions; air quality standards in 1997, 2006, and 2012 to limit the size and concentration of particulate emissions; and the Clean Air Interstate Rule (CAIR) in 2008 to further limit $NO_x$ and $SO_2$ emissions. US coal capacity proved inelastic to such efforts, with total coal-fired capacity hovering between 296 Gigawatts (GW) in 1988 and 317GW in 2011 (Energy Information Administration 2018b). However, recently the United States has shed coal capacity at an unprecedented rate.

From 2011 through 2018, coal-fired generating capacity in the United States has contracted by 23% (Institute for Energy Economics 2019). This is a stunning decline and, depending upon one's perspective, either a rousing success of environmental stewardship or a devastating blow to an important economic resource. Regardless, multiple stakeholders have been given or have taken credit for coal's decline. For example, EPA regulation is credited by some as the primary driver of the surge in coal-fired generating unit retirements (e.g., American Coalition for Clean Coal Electricity 2017. On the other hand, natural gas proponents argue that increased natural gas extraction due to hydraulic fracturing has led to lower natural gas prices that have enabled it to supplant coal (e.g., Anadarko 2013). Renewable energy advocates make similar claims, pointing to the plummeting price of wind and solar energy production over this same time period (Cheon and Urpelainen 2018). Finally, the Sierra Club and others claim that the vast majority of these coal retirements have resulted directly from the concerted activism of their "Beyond Coal" campaign (e.g., Sierra Club 2019).

How much credit each stakeholder deserves is an important empirical question, and one that can inform future efforts to transition away from environmentally intensive technologies. With recent analysis demonstrating that the early retirement of coal capacity is necessary to limit climate change (Tong et al. 2019), understanding the drivers of coal unit retirement is critical. This paper reports, to our knowledge, the first large-scale empirical examination of operational, market, and non-market drivers underlying the decision to retire coal-fired generating capacity.

We utilize data from 979 coal-fired generating units operating in the United States from 2008 through 2016. This sample represents roughly 96% of the coal-fired generating capacity that operated in the continental United States over that horizon. We estimate coal unit survival time through an accelerated failure time (AFT) model to identify the impact regulation, natural gas prices, renewable adoption and signaling, and the Beyond Coal campaign have had on the retirement rate. Through *post hoc* analysis, we estimate the share of generation from retired units that was absorbed by surviving coal units and the share displaced from the coal fleet, projecting that retirements accounted for an annual 103.6 to 178.2 million metric ton reduction in $CO_2$ emissions.

## 3. Review of Related Literature

Our work relates to the growing literature focused on environmental technology choice. Technology choices are operational decisions regarding the technology a firm will use to meet its strategic goals (Cohen and Halperin 1986, Goyal and Netessine 2007). When, why, and how firms choose between available technologies has long interested operations scholars (Li and Tirupati 1994). However, more recent work has also looked at the broader implications of technology choice for both firms and society (Kalkanci et al. 2019). Within environmental technology choice, our work relates most closely to the operations management (OM) technology replacement literature, which considers the retirement of legacy capacity or processes.

*Technology replacement*. The retirements explored in the OM technology replacement stream differ from our work because replacement studies assume retirement and adoption are one-to-one—that is, the adoption of new technology (capacity) is assumed to be contemporaneous to and co-located with the retirement of legacy technology (capacity). For example, Kraft et al. (2013) examine firms' decisions whether or not to replace a potentially hazardous substance given research and implementation costs and potential regulatory, consumer, and NGO pressure. Similarly, Dhanorkar et al. (2017) empirically investigate how external organizations and agencies can motivate firms to replace an environmentally intensive process with a less intensive process. This literature examines important questions aimed at improving environmental and social performance in settings where the one-to-one assumption core to technology replacement holds. Yet, in many critical industrial settings, such assumptions may not apply. This is the case with coal-fired generating capacity. For example, among the 348 coal-fired generating unit retirements in our data, only 62 were due to replacement. The remaining 286 retirement events were simply closures without a direct replacement. Given the uncoupled adoption

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and retirement decisions in our setting, we focus on the latter to examine the under-studied factors that accelerate coal unit closures.

*Energy technology retirement*. In the realm of energy technology retirement, researchers have long purported that an operational choice perspective could be useful for improving firm level decisions (Masse and Gibrat 1957), creating long-term policy (Manne et al. 1979), and moving away from unsustainable energy sources (Powell and Oren 1989). However, the promise of such research has not been achieved. In a recent review of OM research on the electric supply industry, Parker et al. (2019) show that there is a strong and growing literature examining environmental technology/capacity adoption. Yet, their review found no papers addressing technology/capacity retirement. While OM research on energy technologies has examined critical questions regarding the adoption of clean technology, there is still need to develop our understanding of the divestment of emissions-intensive capacity. The drivers of the operational decision to retire coal-fired production capacity is, in particular, an important setting for such research (Oberschelp et al. 2019).

Research on coal-fired generating unit retirement has been published in energy and environmental journals more so than the OM literature. Yet, even in those literatures, the "war on coal" has received little empirical attention. We found one study directly examining coal-fired unit retirements (Schiavo and Mendelsohn 2019). This study found support for the theory that tighter regulation of coal-fired pollution and increased natural gas fracturing have accelerated retirements in the US; however, multiple factors were excluded from this analysis (e.g., plant and time effects, renewables adoption, gas price volatility, activism against coal, demand measures, etc.). Fleischman et al. (2013) compare coal unit costs to local gas and renewable costs to identify units that should be considered for retirement. Similar economic predictors have been examined elsewhere, with the broad findings that coal units are more likely to be retired when: (a) coal is more expensive; (b) coal retirement is less costly (e.g., older units forego less future value); and (c) natural gas and renewables are less expensive (e.g., Jewell et al. 2019, Maamoun et al. 2020). Contrasting this work, Linn and McCormack (2019) employ a computational model to simulate long-run generating portfolios. They caution that the posited effect of natural gas prices on coal retirements may be overstated, finding that demand reduction plays an equally important role.

But, what of the "war on coal"? Did activism and policy have little or no effect? Do gas and renewables play their purported role in coal retirement after accounting for other geographic and temporal trends? Based on a review of the literature, it seems we know very little about the operational choice to retire coal-fired generating capacity. What empirical evidence we do have fails to rigorously consider potential simultaneous economic, policy, technological, and activism impacts. This paper contributes to our understanding of the "war on coal" sections a comprehensive analysis of factors potentially driving the operational decision to retire coal-fired generating capacity.

## 4. Research Context and Hypotheses

In our data, an average of 9.3 coal-fired generating units retired per year from 2005 through 2010, while an average of 55.8 units retired per year from 2011 through September 2016 (the end of our data horizon). Regulators, the natural gas boom, renewable adoption, and the Sierra Club's Beyond Coal campaign have each taken credit for, or been lauded as, the primary factor in driving this trend in coal unit retirements. The hypotheses we develop in sections 4.1 through 4.4 are based on these claims. However, the null hypothesis—that none of these stakeholders have significantly impacted coal unit retirement rates—should not be discounted out of hand. Table 1 presents the number of retirements per year from 2005 through September 2016, and provides descriptive statistics related to the age of those units at the time of their retirement.

Despite the increased volume of retirements, it is not clear from Table 1 that coal units are retiring any sooner. It is possible that this trend in retirements simply reflects the surge in coal unit construction during the 50s and 60s, with those units now reaching their natural end of life. In light of this, rather than

**Table 1 Age (in Years) of Coal Units at Retirement**

| | | Age (years) at retirement... | | | |
|---|---|---|---|---|---|
| Year | Units retired | Mean | Std. Dev. | Min | Max |
| 2005 | 7 | 40.6 | 16.7 | 5.6 | 57.0 |
| 2006 | 9 | 45.4 | 6.8 | 34.4 | 51.5 |
| 2007 | 13 | 51.3 | 11.5 | 20.7 | 64.9 |
| 2008 | 4 | 51.1 | 8.7 | 39.0 | 59.3 |
| 2009 | 5 | 47.3 | 6.1 | 42.5 | 57.5 |
| 2010 | 18 | 58.3 | 7.9 | 44.3 | 69.7 |
| 2011 | 39 | 56.6 | 5.3 | 45.3 | 73.6 |
| 2012 | 66 | 56.0 | 5.5 | 40.0 | 64.9 |
| 2013 | 32 | 51.1 | 9.9 | 20.4 | 62.9 |
| 2014 | 27 | 54.7 | 6.8 | 38.3 | 63.8 |
| 2015 | 98 | 54.8 | 8.0 | 27.7 | 71.0 |
| 2016 (Sept.) | 59 | 53.7 | 9.4 | 20.6 | 64.3 |
| | 377 | 54.1 | 8.5 | 5.6 | 73.6 |

Model free retirement statistics reveal no clear trends in the age of coal units at their retirement, suggesting that they may not be retiring any earlier in their economic lives despite the pressures they face.

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simply assessing the impact of each potential retirement driver on the *likelihood* of a coal unit's retirement, it is more informative to examine the extent to which each driver *accelerated* those retirements. We frame our hypotheses accordingly.

### 4.1. Emissions Regulation

Prior research demonstrates how a firm's operational practices can, in general, be shaped by policies that stringently regulate environmental quality (Drake and Just 2016, Shimshack and Ward 2005), while also demonstrating how such regulation can fail (Drake and Just 2016). In the case of coal-fired power generation, emissions regulation has likely been impactful. From an economic standpoint, the costs to comply with such regulation inherently increase the likelihood that utilities will retire a unit. Both sides of the political aisle agree. Political conservatives claim that coal unit closures are driven by the Obama administration's creation of unfair and job destroying regulations (Orr and Palmer 2018). More liberal voices laud the impact of regulation on coal unit retirements while arguing that such policies are required of "any national leader that takes environmental protection and the fate of the planet seriously" (Grunwald 2014). Despite the different spin, both sides claim that environmental regulation accelerates coal retirements.

Hypothesis 1A. *Regulation limiting the emissions from coal-fired generation accelerates the retirement of those units.*

Furthermore, it stands to reason that the more environmentally intensive a unit is, the more economically and operationally challenging it will be to bring it into compliance with regulatory requirements. This would contribute to making regulation more impactful in accelerating the retirement of more environmentally intensive units.

Hypothesis 1B. *Regulation will have a greater effect on accelerating the retirement of more emissions-intensive coal-fired units.*

### 4.2. Natural Gas Prices

From 2005 through 2016 production of natural gas increased by over 50 percent (Energy Information Administration 2019a). As a result, gas prices plummeted from a typical range between $0.017 and $0.034 per kilowatt hour (kWh) to a range that has often been less than $0.010/kWh since 2015 (Energy Information Administration 2019b). A transition from coal to gas as the primary fossil fuel in US power generation has coincided with this trend. In 2003, 51% of US electricity was generated using coal and only 17% was generated from natural gas (Knittel et al. 2015). By 2017, 30% of US electricity was generated using coal, while 32% percent was generated using natural gas (https://www.eia.gov/tools/faqs/faq.php?id=427&t=3).

Researchers have found that reduced natural gas prices have contributed to its greater adoption relative to coal in new plant construction (Wolak 2016). Furthermore, gas proponents claim that decreasing natural gas prices have accelerated coal unit closures (Energy Information Administration 2018c, Kemp 2016, Knittel et al. 2015). While it is established that decreased natural gas prices have increased the adoption of gas-fired generating units, whether these prices have accelerated the closure of coal-fired units or whether gas units have simply displaced coal units at the latter's "natural" end-of-life, has not been rigorously tested. We examine that question here.

Hypothesis 2A. *Lower gas prices accelerate the retirement of coal-fired generating units; conversely, greater natural gas prices decelerate coal-fired generating units' retirement.*

Because the cost required to replace a coal unit with a gas unit prior to the former's natural end-of-life is substantial, it is reasonable to assume that generators are more likely to make this largely irreversible decision when natural gas prices are on a clear downward trajectory (Kotchen and Mansur 2016). As one energy executive we interviewed put it, it is important to "shield [our] customers from longer-term price uncertainties of fuel." Less uncertainty regarding the price of natural gas will reduce the risk operators and their customers are exposed to, thereby accelerating the retirement of coal capacity.

Hypothesis 2B. *Lower natural gas price volatility accelerates the retirement of coal-fired generating units; conversely, greater natural gas price volatility decelerates coal unit retirements.*

### 4.3. Wind and Solar Penetration

From 2008 through 2017, renewable capacity has grown from 11.1% to 19.7% of the US power generating portfolio (US Department of Energy 2017). Many factors are credited for the rise of renewables including a clarification of the most viable renewable energy technology paths (York and Venkataraman 2010), and policies that have directly regulated incumbent technologies such as coal (Georgallis et al. 2019, Pacheco et al. 2014). What is less understood, however, is how the increased adoption of renewable energy sources has impacted the retirement of coal units. Renewable energy advocates argue that rapidly falling costs for wind and solar energy have increasingly led utilities to close coal units in favor of renewable energy sources (Gimon et al. 2019).

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Between 2010 and 2016, the global levelized cost of electricity—which includes amortized capital costs—fell 69%, from \$0.36/kWh to \$0.11/kWh for utility-scale solar photovoltaic plants and 18% from \$0.085/kWh to \$0.070/kWh for wind energy, with projects regularly delivering \$0.04/kWh (International Renewable Energy Association 2017). For comparison, in 2015, US coal-fired levelized costs of electricity were also an estimated \$0.04/kWh (Institute for Energy Research 2016). This trend in renewable costs led to projections as early as 2012 for renewable energy levelized costs below that for coal (Energy Information Administration 2012).

While adoption of renewables is often measured in capacity, actual generation may vary widely due to seasonality, geographic variance, and the intermittency of sun and wind resources. Due to its ability to ramp more efficiently, gas-fired generation is better positioned than coal to accommodate the intermittency of renewables (Kök et al. 2020, and Verdolini et al. 2018). With US demand for energy flat (Energy Information Administration 2018d), and given the greater ability of gas to complement renewables, coal is the more likely conventional technology to be phased out of the capacity footprint due to renewables growth.

Hypothesis 3A. *Greater adoption of solar and wind capacity into a region accelerates the retirement of coal-fired generating units.*

Falling prices for solar and wind energy have also encouraged state-level policies promoting renewable adoption. The most widespread state-level policies are renewable portfolio standards (RPSs) which require retail electricity suppliers to produce a minimum percentage of their load with renewable energy. By 2017, 29 US states had announced an RPS, covering 56% of the national retail load (Barbose 2016). RPS policies have been demonstrated to increase renewables adoption in the states in which they are implemented (Pacheco et al. 2014). Furthermore, multiple states increased RPS targets over time as the challenges of grid integration and intermittency were resolved.

Utilities can progress toward achieving their RPS requirements through increased generation from renewables and/or through decreased generation from conventional fossil fuel sources. Thus, our expectation is that more demanding RPS targets incentivize not only increased renewable adoption, as has been previously demonstrated, but also an accelerated retirement of coal capacity.

Hypothesis 3B. *Greater RPS targets for renewable energy production accelerate the retirement of coal-fired generating units.*

### 4.4. Sierra Club Beyond Coal Campaign

Prior work has established that social movement organizations can effectively frame current practices as problematic to effect operational change (Hiatt et al. 2009, Sine and Lee 2009, Weber et al. 2008). In the case of the Beyond Coal campaign (https://content.sierraclub.org/coal/), the Sierra Club has altered the framing of coal from being the most economical current energy solution to being a major driver of human-induced climate change and other damaging health outcomes. For example, Beyond Coal rhetoric described coal units as "...our country's dirtiest energy source, from mining to burning to disposing of coal waste" (https://content.sierraclub.org/coal/).

The Beyond Coal campaign has shifted environmental activism from picket lines to courtrooms. With their deep war chest—Michael Bloomberg alone has committed \$600 million to the campaign (Friedman 2019)—Beyond Coal employs litigators who battle coal operators in court. In this effort, the Sierra Club typically raises economic (as opposed to environmental) arguments to block rate increases earmarked for coal compliance investments. When successful in eliminating a rate increase, these efforts force coal units to close as operators are adverse to absorbing the cost of control technologies themselves. As stated by the lawyer representing a group of hospitals that had partnered with Beyond Coal to retire a plant in Oklahoma, the Sierra Club's lawyers have "become masters at bringing financial arguments to environmental questions" (Grunwald 2015).

Through these efforts, the Sierra Club claims that their Beyond Coal campaign has retired one third of the nation's coal-fired power generating fleet (Brune 2019). Analysis by one of Beyond Coal's largest donors, Bloomberg Philanthropies, has claimed that at least 40% of US coal retirements since 2010 can be attributed to the movement's advocacy (Grunwald 2015). However, even if these claims are true, it is not clear whether the Beyond Coal campaign nudges nearly retired units into closure, or substantively accelerates the retirement of the coal units it targets. We test the extent to which the Beyond Coal campaign has accelerated closures.

Hypothesis 4. *The Sierra Club's Beyond Coal campaign has accelerated the retirement of the coal-fired generating units that it has targeted.*

## 5. Data Sources and Variables

We employ a variety of data sources to investigate the potential drivers of US coal unit survival time. The backbone of our data was purchased from the "fuels" and "power" modules of the Ability Velocity Suite

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from ASEA Brown and Boveri (ABB). The ABB Ability Velocity Suite includes data for all units required to report through the Energy Information Administration's Form 860 (Energy Information Administration 2018b): that is, all commercial generating units operating within plants with a total rated capacity of 1 MW or greater. This sample includes all significant fossil fuel generating units operating within the US. We augment the ABB data with data from many additional sources: the US Department of Energy; the National Renewable Energy Laboratory; the US Energy Information Administration; the Database of State Incentives for Renewables and Efficiency; dozens of legal documents, news articles, and press releases; the US Environmental Protection Agency; Thomson Reuters; the Sierra Club; and the League of Conservation Voters. The specific covariates drawn from each are discussed throughout this section. The choice of covariates described here is informed by interviews with more than 20 energy executives, energy NGO directors and analysts, energy policy experts, and environmental law experts.

From the ABB data, we include all coal-fired generating units in the contiguous United States that operated at some point over the horizon from January 2008 through September 2016 for which production and demand data were available. This reduced the sample from 1108 coal units in the full ABB data for the contiguous United States to 979 coal units (roughly 88% of the units and 96% of the capacity of the full sample). "Coal units" were determined as any unit with coal indicated as the primary fuel category as well as 41 units that had produced primarily with coal at some point over the data horizon but that were indicated to have natural gas as their primary fuel source by the end of the data horizon (the inclusion of these 41 units will be described in more detail in section 5.1). The robustness of results to the inclusion/exclusion of these 41 units is assessed in section 6.2.

In our sample, 948 units entered the sample as legacy units, having commercial online dates predating January 2008, while 31 units began operation within our horizon. Robustness of results to the decision to include these 31 delayed entries is tested in section 6.2. Of the units in the sample, 348 exited during the data horizon due to their retirement, while 631 of the units survived through the end of the horizon. Each coal unit in the sample operated within one of 408 plants. The number of coal units per plant ranged from a minimum of a single unit (127 instances) to a maximum of 10 units (2 instances), with an average of 2.40 coal units per plant.

Where appropriate (and as indicated below), lagging 12-month moving averages are used.

### 5.1. Dependent Variable

*Coal unit survival time.* The dependent variable for our analysis is coal-fired power generating unit survival time, which is demarked by a unit's retirement or is right censored by the end of the horizon. Right censoring is common in duration analysis and does not prohibit accurate estimates for survival times (Rodriguez 2010). As noted previously, our data include 348 retirement events, or slightly more than 35.5% of the sample. It is worth noting that a coal unit retirement can take three forms, which we refer to as "classic retirements," "conversions," and "switches." A classic retirement occurs when a unit produced with coal prior to the retirement event and permanently ceased all production following the retirement event. Conversion occurs when a coal-fired power generating unit is retrofitted to produce with another fuel source (typically, but not always, natural gas). Such conversions occur when a unit produces strictly with coal prior to the retirement event, but then (after capital investment and downtime) can produce strictly with a different fuel source following the retirement event. Finally, a permanent switch occurs when a unit capable of producing with both coal and another fuel source (known as dual-fire, or fuel switching units) have their capability to produce with coal dismantled. Such units produce with a combination of fuels prior to the retirement event, but are no longer capable of producing with coal following that event—that is, they are committed to producing with their non-coal fuel source. Of the 348 retirement events in our sample, 286 were classic retirements, 34 were conversions, and 28 were switches.

Included among the coal unit retirements are 41 units indicated in our data as gas-fired generating capacity. Each of these units had produced with coal, but had been converted to gas (24 units) or were a dual-fire unit that had been permanently switched to produce only with gas (17 units). The fuel category classification for these units, which is time-invariant in the ABB data, had been updated to "gas." However, for our purposes, these units are treated as coal retirements at the point of their conversion or permanent switch and were manually flagged within our data as such. Robustness of results to the decision to include these units is assessed in section 6.2.

### 5.2. Independent Variables

*Regulation of coal-fired generation.* The Clean Air Interstate Rule (CAIR) established emissions trading markets for $NO_x$ and $SO_2$ for generating units in 26 US states. CAIR's $NO_x$ market was implemented on January 1, 2008. However, CAIR was challenged in US Courts and the rule was vacated on July 11, 2008 by the US Court of Appeals in Washington DC (US Court

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of Appeals 2008a). The US Court of Appeals then remanded this vacatur on December 23, 2008, which enabled CAIR's full implementation on January 1, 2009. In so doing, the US Court of Appeals also required that the US Environmental Protection Agency (EPA) issue a new rule to replace CAIR after further dialogue with all relevant stakeholders (US Court of Appeals 2008b).

The Cross State Air Pollution Rule (CSAPR) was developed by the EPA as CAIR's replacement. CSAPR required reductions in annual emissions of $NO_x$ and $SO_2$ from generating units in 28 US states. CSAPR was also vacated by the US Court of Appeals in Washington DC (US Court of Appeals 2012). However, this ruling was overturned by the US Supreme Court on April 29, 2014 (US Supreme Court 2014), paving the way for the implementation of CSAPR on January 1, 2015.

For coal units affected by CAIR and/or CSAPR, an indicator at the unit-year level for each rule is turned "on" at its respective implementation month (January 2008 for CAIR and January 2015 for CSAPR). The CAIR flag is then turned off following December 2014, its final month of implementation before CSAPR replaced it. The date of CAIR's initial implementation is used in our primary analyses. However, robustness is assessed with respect to the vacatur ordered over the second half of 2008. To assess whether CAIR and/or CSAPR had a greater impact on more environmentally damaging units, we interact each policy's indicator with the $SO_2$ emissions-intensity control detailed in section 5.3.

*Gas price level and volatility.* To develop counterfactual gas prices for the units in our data, we used the monthly weighted average gas price ($/mmbtu) for the transmission area in which each focal coal unit operated. Over our sample, there are 53 such transmission areas. Weighted average gas prices were available at this level for all but 1777 of the total 38,265 plant-months. In the 4.6% of instances in which the transmission area weighted average price was not available, we used the monthly weighted average gas price for the North American Electric Reliability Corporation (NERC) sub-region in which the coal unit operated (of the 17 NERC sub-regions in our data). These gas prices were included as lagging, 12-month moving averages at the plant-month level.

Gas price volatility is captured as the standard deviation of gas price over the preceding 12 months. Raw gas prices from the counterfactual mosaic, rather than moving average gas prices, were used to derive these rolling, 12-month standard deviations at the plant-month level.

*Wind and solar adoption.* To assess renewable adoption we develop two measures: penetration of renewable capacity, and utilization of that capacity. We obtained wind capacity data from the WINDExchange platform (US Department of Energy 2016), which aggregates wind power installation information from the American Wind Energy Association. Through 2016, a total of 82,171 MW of wind capacity was included in the WINDExchange data. For solar capacity data, we used the Open PV Project (US National Renewable Energy Laboratory 2017), which includes data related to 1,019,912 solar installations through September 2016, totaling 16,474 MW of installed solar capacity nationwide. This combined 98,645 MW of 2016 installed wind and solar capacity equates to roughly 97.2% of the utility-grade wind and solar capacity installed at the time (Energy Information Administration 2017). To derive utilization, we divided state-year level renewable generation (MWh) obtained from the Energy Information Administration (2020c) by installed capacity multiplied by 8760 annual hours. The renewable capacity and utilization measures were both included as lagging 12-month moving averages at the state-month level.

Data for state-year level RPS policies were obtained from the Database of State Incentives for Renewables and Efficiency (2018), which draws from a website hosted by the National Conference of State Legislatures (2018). To create our RPS measure, we took several steps. First, we looked up the year of passage, target percentage of electricity generated from renewable sources, and required compliance year for each state. For example, Arizona passed a RPS in 2008 requiring 2% generation by the year 2009. Second, because RPS standards vary over our data horizon as many targets were increased annually (e.g., Arizona's target increased by 0.5% annually 2008–2014), we updated the percentage for each state when a change took place. For example, in Colorado the original RPS target of 20% by 2020 was passed in 2008 and subsequently increased to 30% by 2020 in 2010. Third, we recorded any instances where a RPS was repealed (e.g., West Virginia in 2015) or changed to a voluntary "goal" (e.g., Kansas in 2015). In these instances, the RPS target prior to the repeal is the target set by law, while the target following the repeal is reset to zero. Finally, if the target year is met then we continue to measure RPS as the last recorded target, as we could find no instances of states reducing renewables generation in the wake of a successful RPS.

For our main analysis, we utilized the RPS target for each state-year. In robustness checks, we utilized a stringency measure calculated by dividing the target percentage by the number of months until compliance was required. Following the example from Colorado above, in 2008 our stringency measure was 20%/145 months (0.1379), while it was 30%/121 (0.2479) in 2010.

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*Sierra Club Beyond Coal activism*. Through an exhaustive web search for articles, press releases, and legal documentation relating the Sierra Club to any of the 979 units in our data, we identified documents to corroborate Sierra Club involvement in facilitating the closure of 115 units. Furthermore, we identified an additional 20 retirements for which the Sierra Club explicitly claimed credit, but for which no associated legal documentation was discovered. We coded these units as Sierra Club verified and claimed victories, respectively. This data gathering process identified Sierra Club successes, but it is incomplete in that it does not include instances in which the Sierra Club targeted a unit but did *not* succeed in retiring that unit within our data's horizon.

Experts at the Harvard Environmental & Energy Law Program assisted in identifying instances where the Sierra Club targeted a unit that did not retire within our data horizon. If legal challenges at the local level fail to result in a unit's retirement, the plaintiff (in this case the Sierra Club) can appeal the challenge to the federal level by filing a Title V petition with the EPA. It is the opinion of the legal experts that we consulted with that filing such a petition would be standard process in the event of failure at the local level as the work required to file a Title V petition with the EPA would have been completed during the failed local challenge. Through the EPA's Title V Petition Database (Environmental Protection Agency 2020) and the Westlaw EPA Title V Final Orders Database (Thomson Reuters 2020), a total of 100 units from our sample were identified and coded as the target of a Title V petition filed with the EPA by the Sierra Club.

In total, we verified 207 units as having been targeted by the Sierra Club. Of these, 107 units were required to retire due to local action, 8 were required to retire following an EPA Title V petition, and 92 survived through the end of our data horizon. Sierra Club targeting is indicated at the generating unit-year level. It takes a value of 0 for all units until 2010 (the launch year of the Beyond Coal campaign), where it becomes 1 for the 207 targeted units and remains 0 for all other units. We assess robustness by including the additional 20 claimed victories as targets.

### 5.3. Unit-level Control Variables

A unit's characteristics such as age, generating capacity, operational capabilities, and by-products may all contribute to its retirement. The following variables are intended to control for such factors.

*Age*. Older units are likely more prone to retirement than newer units. To control for the effect of age, the difference in months between each period over the data horizon and the unit's commercial online month was coded at the unit-month level.

*Capacity*. Firm's may be more reluctant to retire larger units. To control for this possibility, each unit's nameplate capacity is included at the unit level. (Nameplate capacity for 13 of the sample's 979 units changed over the data horizon. These 13 units were coded at the unit-month level).

*Coal prices*. Coal units may be more likely to retire when and where coal prices increase. Lagging 12-month moving average coal prices ($/mmbtu) are included at the unit-month level.

*Sulfur dioxide emissions intensity*. Due to greater perceived exposure to future regulation, more emissions-intensive units may be retired sooner. To control for this, lagging 12-month moving average sulfur dioxide intensity ($SO_2$ tons/MWh) was added at the unit-month level.

*Fuel switching capability*. Coal units capable of generating electricity through alternative fuel sources may be less exposed to retirement pressures. Units capable of using fuels other than just coal were therefore coded at the unit level as a control.

### 5.4. Regional Control Variables

Regional demand and capacity trends, and the general environmental sentiments of a region's populace may also influence retirement decisions. The following variables control for these factors.

*Transmission area load factor*. The level of demand relative to the level of available capacity within a region is likely to influence retirement rates. The lagged 12-month moving average for transmission area load factor—the area's demand normalized by the area's capacity—is therefore included as a control at the transmission area-month level.

*State-level coal mining revenues*. States that generate substantial revenue from coal mining may have a vested interest in preserving coal-fired generating capacity. To control for this possibility, we include the lagged 12-month moving average for coal mining revenues at the state-month level.

*Sierra Club memberships*. A coal unit's retirement may be influenced by the prevalence of environmental activism and the overall environmental conscientiousness of the population within the region where it operates. We include the lagged 12-month moving average (in thousands) of Sierra Club memberships to control for this potential factor. These data were received from the Sierra Club following an emailed request from the authors and are at the state-month level.

*League of Conservation Voters score*. To control for the influence each state's general political environment, we include scores from the League of Conservation Voters (LCV). These data were obtained from the 2008 through 2016 LCV "National Environmental Scorecard" which represent the "consensus of experts

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**Table 2 Descriptive Statistics**

| | | Percentile | | | | |
|---|---|---|---|---|---|---|
| | Mean | 5th | 50th | 95th | Std Dev. | Level |
| CAIR (y/n) | 0.650 | 0 | 1 | 1 | 0.477 | State-year |
| CSAPR (y/n) | 0.134 | 0 | 0 | 1 | 0.340 | State-year |
| Gas price/mmbtu | 5.559 | 3.182 | 5.140 | 9.128 | 1.801 | Plant-month |
| Std dev of gas price/mmbtu | 1.038 | 0.281 | 0.737 | 2.586 | 0.861 | Plant-month |
| State wind & Solar capacity (GW) | 1.311 | 0.0001 | 0.453 | 5.478 | 2.652 | State-month |
| Renewable utilization (%/100) | 0.2173 | 0.00 | 0.2313 | 0.3829 | 0.1709 | State-month |
| RPS target (%) | 10.56 | 0 | 11 | 25 | 9.566 | State-year |
| Beyond Coal activism (legal, y/n) | 0.150 | 0 | 0 | 1 | 0.357 | Unit-year |
| Age (months) | 502.9 | 225 | 514 | 718 | 160.4 | Unit-month |
| Capacity (MW) | 368.6 | 54.40 | 280.0 | 735.9 | 274.0 | Unit |
| Coal price/mmbtu | 2.466 | 1.251 | 2.300 | 4.048 | 0.962 | Unit-month |
| Fuel switching capability (y/n) | 0.126 | 0 | 0 | 1 | 0.332 | Unit |
| $SO_2$ emissions ($SO_2$ tons/MWh) | 8.977 | 0.433 | 5.492 | 28.22 | 27.67 | Unit-month |
| Transmission area load factor (%) | 73.17 | 67.95 | 73.33 | 79.18 | 4.000 | Trans. area-month |
| Coal revenues ($100 MMs/year) | 13.24 | 0 | 3.638 | 62.02 | 23.68 | State-month |
| Sierra Club memberships (000's) | 10.91 | 1.716 | 9.199 | 22.92 | 7.478 | State-month |
| League of Conservation Voters score | 83.98 | 20.33 | 79.83 | 166.0 | 46.45 | State-month |

Mean, illustrative percentiles, standard deviation, and level for all independent and control variables, where "level" indicates the granularity of potential variation for each covariate.

from about 20 respected environmental and conservation organizations" (League of Conservation Voters 2008–2016). Two scores on a zero to 100 scale reflect each state's US congressional House and Senate voting record on environmental issues. In our analysis, we include the lagged 12-month moving average of the sum of these scores at the state-month level.

Table 2 provides descriptive statistics and levels for all of our independent and control variables, while Table A1 in the Appendix presents correlations between each of these covariates.

## 6. Empirical Approach, Results, and Robustness

Our hypotheses explore the effect of various factors on the expected operating life of coal-fired power generating units. We therefore focus on duration-class empirical models. Within this class, our empirical strategy is shaped by the hierarchical structure of our data and the potential non-proportionality of our data's hazard ratios.

*Hierarchical structure*. We conduct our analysis at the generating unit-month level. We must therefore account for the reality that multiple coal units are often co-located within a given power plant. Unless this structure between units is accounted for, factors that drive the closure of a plant as a whole would result in the errors for units co-located within the plant to be correlated, violating their assumed independence. Similarly, multiple plants operate within a given state. State-level factors may therefore concurrently affect multiple coal-fired generating units in our data, which would again violate the assumed independence between errors associated with each unit.

We can address this issue by clustering standard errors at the highest level of the hierarchy (i.e., the state level), or through nested random effects (which also requires clustering at the highest level of the nesting). In addition to relaxing the assumed independence of errors within the nesting, nested random effects also control for unobserved plant- or state-level characteristics that may otherwise bias results. That is, while clustering standard errors relaxes the assumed independence of errors, nested random effects relaxes the independence of errors *and* accounts for shared level effects in coefficient estimations. Therefore, along with the error term, $\varepsilon_{k,j,i}$, we include nested random effects $u_k$ and $u_{k,j}$ in our model, where unit $i$ operates at plant $j$ in state $k$.

We assess the need for this hierarchical specification in section 6.2. To preview those results here, we find intra-class correlations between units co-located within the same plant, and between plants co-located within the same state, to be significant and meaningful. Incorporating the nested structure of the data, as we do through nested random effects, is necessary to avoid bias.

*Potential non-proportionality*. Proportional hazards are not supported in our data. Through an inspection of Kaplan–Meier curves relative to predicted survival curves, we could not conclude that they were close and parallel (Cleves et al. 2016). Furthermore, a quantitative analysis of Schoenfield residuals also failed to support a proportional hazards assumption.

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We take two steps to address this potential non-proportionality. First, we examine accelerated failure time (AFT) models for our analysis. This does not allay concerns related to non-proportional hazards in and of itself—AFT models make their own proportionality assumptions, as will be discussed. However, employing AFT models will allow a comparison of models to assess the fit and robustness of coefficient estimates across different proportionality assumptions. Second, we shift our data horizon to examine whether and how coefficient estimates evolve. Specifically, in section 6.2, we replicate our base estimation (a 2008 to 2016 horizon) with model horizons beginning in 2010 and 2012. In doing so we find that coefficient magnitudes do change, supporting the presence of non-proportional hazards. However, and critically, we find that conclusions related to our hypotheses are consistent across each horizon, and that our base model yields the most conservative coefficient estimates.

*Model specification.* AFT models provide flexibility (as a class) with their proportionality assumptions. For example, Weibull and exponential AFT models require proportional hazard ratio assumptions. However, log-logistic AFT models employ a proportional odds assumption (Rodriguez 2010). While proportional hazards assume that the hazard ratio remains constant over time, proportional odds assume that it converges to 1 as $t \to \infty$, making it a valuable alternative (Kirmani and Gupta 2001). Given that we are unable to support proportional hazards, in section 6.2 we compare proportional hazard and proportional odds models to assess fit.

We use the Weibull AFT model for our baseline analysis. Based on its estimated shape and scale parameters, Weibull AFT models have been used across a broad range of applications from the estimation of Zika virus survival in body fluids (Paz-Bailey et al. 2018), to an analysis of pricing policy on customers' repeated purchase of theater tickets (Tereyağoğlu et al. 2017). A Weibull AFT model, on log scale, takes the form of a model with extreme value (i.e., Gumbel) distributed residuals. In our case, with plant and state nested random effects, it is parameterized as

$$\ln(t_i) = \beta_0 + \mathbf{x}_i(t)'\boldsymbol{\beta}_x + u_k + u_{k,j} + \varepsilon_{k,j,i},$$

where $t_i$ is the (possibly right censored) survival time of the $i$th unit, $u_k$ and $u_{k,j}$ are the nested state- and plant-level random effects, the unit-specific error $\varepsilon_{k,j,i}$ is Gumbel distributed, $\beta_0$ is an estimated constant, and $\mathbf{x}_i(t)'\boldsymbol{\beta}_x$ are (potentially time variant) covariates and their estimated coefficients.

Covariates in AFT models expedite failure events (i.e., coal unit retirement) by a factor of $\exp(-\boldsymbol{\beta}_x \mathbf{x}_i(t)')$.

Importantly, coefficients are therefore interpreted as the negative of the acceleration factor—that is, negative coefficient estimates imply that increases in the covariate accelerate retirement, while positive coefficients imply that increases in the covariate decelerate retirement.

### 6.1. Results

Excluding interactions, variance inflation factors (VIF) for all variables were below 2.46, with a mean VIF of 1.68, supporting a very low multicollinearity risk (Kutner et al. 2005). With the inclusion of interaction terms, the mean VIF increases to 2.17, with a high of 6.02 for the interaction between the indicator for CAIR regulation and $SO_2$ emissions. As will be discussed below, our results are robust to the inclusion of this interaction. Table 3 presents our main results.

*Model fit and control variables* Each of the models in Table 3 yields reasonable estimates for coal-fired units' age at retirement, aligning with the retirement age averages presented in Table 1. Model 3 includes all variables aside from the potentially problematic interaction between the flag for CAIR regulation and $SO_2$ emissions. With a max VIF of 2.46 and mean VIF of 1.66, it raises no multicollinearity concerns. By comparing model 3 to model 4, it is evident that all estimates are robust—in terms of direction, magnitude, and significance—to the inclusion of the interaction between CAIR and $SO_2$ emissions.

Several of our control variables are significant. As expected, an older unit is nearer to its end of life than a newer unit, with expected time to retirement decreasing with each month in operation ($\beta = -0.0005$, $p < 0.05$). Larger units have longer operating lives, with each additional MW of capacity decelerating a unit's closure ($\beta = 0.0007$, $p < 0.01$). More emissions-intensive units (in terms of $SO_2$ emissions) retire sooner ($\beta = -0.0005$, $p < 0.01$). In terms of our significant regional control variables, units operating in more heavily utilized transmission areas remain in service longer. Each incremental percentage point of transmission area load factor decelerates closure ($\beta = 0.0165$, $p < 0.05$). Finally, units in states with more Sierra Club memberships retire sooner than those operating in states with less membership ($\beta = -0.0097$, $p < 0.05$).

*Main results* Claims that regulation has accelerated coal-unit retirements (Hypothesis 1A) are supported. Implementation of both CAIR ($\beta = -0.1720$, $p < 0.05$) and CSAPR ($\beta = -0.2070$, $p < 0.05$) accelerated retirement rates. We find partial support that this regulation has had a greater effect on more emissions-intensive units (Hypothesis 1B) as greater $SO_2$ intensity strengthened the impact of CSAPR ($\beta = -0.0014$, $p < 0.01$), but had no statistically significant effect on the retirement rate due to CAIR.

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**Table 3 Main Results**

| | | (1) | (2) | (3) | (4) Base |
|---|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | −0.1431** | −0.1762** | −0.1570** | [illegible] |
| | | (0.0663) | (0.0712) | (0.0675) | [illegible] |
| | CSAPR, 2015 onward (y/n) | −0.2164** | −0.2185** | −0.2043** | [illegible] |
| | | (0.0892) | (0.0896) | (0.0871) | [illegible] |
| | CAIR×SO2 intensity (tons/MWh) | | 0.0017** | | [illegible] |
| | | | (0.0008) | | [illegible] |
| | CSAPR×SO2 intensity (tons/MWh) | | | −0.0016*** | [illegible] |
| | | | | (0.0005) | [illegible] |
| H2 | Gas price/mmbtu | 0.0129 | 0.0136 | 0.0134 | [illegible] |
| | | (0.0316) | (0.0320) | (0.0316) | [illegible] |
| | Std Dev of gas price/mmbtu | 0.0231 | 0.0240* | 0.0238* | [illegible] |
| | | (0.0143) | (0.0142) | (0.0143) | [illegible] |
| H3 | State wind & solar capacity (GW) | 0.0125* | 0.0127* | 0.0135* | [illegible] |
| | | (0.0069) | (0.0068) | (0.0072) | [illegible] |
| | Renewable utilization | −0.1270** | −0.1245** | −0.1235** | [illegible] |
| | | (0.0539) | (0.0528) | (0.0524) | [illegible] |
| | RPS target (% of state capacity) | −0.0002 | −0.0006 | −0.0006 | [illegible] |
| | | (0.0021) | (0.0021) | (0.0021) | [illegible] |
| H4 | Beyond Coal activism (y/n) | −0.2435*** | −0.2442*** | −0.2459*** | [illegible] |
| | | (0.0706) | (0.0705) | (0.0715) | [illegible] |
| Unit controls | Age (months) | −0.0006** | −0.0006** | −0.0006** | [illegible] |
| | Capacity (MW) | 0.0008*** | 0.0008*** | 0.0008*** | [illegible] |
| | Coal price/mmbtu | 0.0073 | 0.0067 | 0.0072 | [illegible] |
| | Fuel switching capability (y/n) | −0.0053 | −0.0056 | −0.0062 | [illegible] |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | −0.0006*** | −0.0008** | −0.0003** | [illegible] |
| Regional controls | Transmission area load factor (%) | 0.0153** | 0.0150** | 0.0148** | [illegible] |
| | State coal revenues ($100 MM/yr) | 0.0003 | 0.0002 | 0.0004 | [illegible] |
| | State Sierra Club memberships (000's) | −0.0104** | −0.0103** | −0.0097** | [illegible] |
| | League of conservation voters score | 0.0004 | 0.0005 | 0.0005 | [illegible] |
| | Constant | 2.7679*** | 2.7793*** | 2.7568*** | [illegible] |
| Mixed effects | Plant and state random effects | Yes | Yes | Yes | [illegible] |
| | Year fixed effects | Yes | Yes | Yes | [illegible] |
| Model fit | Model $\chi^2$ | 2978 | 3126 | 3357 | [illegible] |
| | Model $p$-value | 0.0000 | 0.0000 | 0.0000 | [illegible] |
| | Akaike information criterion | 3396.5 | 3394.8 | 3391.1 | [illegible] |
| | Bayesian information criterion | 3669.1 | 3676.8 | 3673.1 | [illegible] |
| VIF | Mean VIF | 1.68 | 2.11 | 1.66 | [illegible] |
| | Max VIF | 2.46 | 5.28 | 2.46 | [illegible] |
| | Max VIF variable | LCV Score | CAIR × $SO_2$ | LCV Score | [illegible] |
| Sample | Units | 979 | 979 | 979 | [illegible] |
| | Retirements | 348 | 348 | 348 | [illegible] |
| | Unit-months | 89,378 | 89,378 | 89,378 | [illegible] |
| | Estimated age at retirement (years) | 52.37 | 52.28 | 52.26 | [illegible] |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Independent variable standard errors are reported in parentheses.

Claims that lower natural gas prices accelerate coal unit retirement (Hypothesis 2A) are not supported. Gas price level had no significant impact on retirement rates. However, Hypothesis 2b, that lower gas price volatility accelerates coal unit retirement, is supported ($\beta = 0.0241, p < 0.10$).

We find mixed support for Hypothesis 3A. Claims that increased penetration of wind and solar capacity accelerates coal retirement are not supported. In fact, we find weak statistical support for the opposite effect; that increased penetration of renewables *decreases* coal unit retirement rate ($\beta = 0.0134$, $p < 0.10$). However, results do support that greater utilization of renewable capacity significantly accelerates retirements ($\beta = -0.1227$, $p < 0.05$). We reserve conjecture related to these contradictory results for the discussion. Greater RPS targets do not significantly accelerate coal unit retirement, indicating no support for Hypothesis 3B.

Sierra Club targeting a unit significantly accelerates the unit's retirement rate ($\beta = -0.2457$, $p = 0.01$). This provides support that Sierra Club's Beyond Coal campaign materially reduces the operating lives of coal units (Hypothesis 4), rather than simply attacking nearly retired units.

Table 4 summarizes results related to our hypotheses.

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**Table 4 Summary of Hypotheses and their Support**

| | Hypotheses | Support |
|---|---|---|
| H1a | Regulation has accelerated coal retirements | ++ |
| H1b | Regulation has a greater effect on more intensive units | + |
| H2a | Lower gas prices accelerate coal retirements | × |
| H2b | Less volatile gas prices accelerate coal retirements | + |
| H3a | Solar and wind adoption accelerate coal retirements | +/− |
| H3b | More aggressive RPS targets accelerate coal retirements | × |
| H4 | Sierra Club's Beyond Coal campaign accelerates retirements | ++ |

++ indicates strong support.+ indicates weak support. × indicates no support. − indicates support counter to the hypothesized effect.

### 6.2. Model Robustness

*Hierarchical specification.* To evaluate the multi-level hierarchy of our principal empirical model (units belong to plants, which belong to states), we compare it to three possible alternatives: no random effects (but with standard errors clustered at the plant level), plant random effects only (units belong to plants), and plant and owner random effects (units belong to plants, which belong to owners). Results are presented in Appendix Table A2, with standard errors clustered at the plant and owner level, respectively, for the latter two models.

In model 2, the plant-level intra-class correlation coefficient (ICC) is 0.8907 ($p<0.01$). Furthermore, comparing model 2 to model 1, the difference in some coefficient magnitudes (e.g., more than a 500% change in the renewable capacity coefficient, and 100% change in the Sierra Club coefficient) indicate that, in order to avoid bias in estimated levels, this ICC should be addressed through nested random effects rather than clustering alone. Adding the state level to the hierarchy as in our principal analysis (model 3) has a lesser effect. The state-level ICC is 0.0345 ($p<0.05$), indicating that errors between units belonging to the same state are significantly, but marginally, correlated.

The unit/plant/owner hierarchy in model 4 provides an alternative structure to the unit/plant/state hierarchy in the main model. ICC for the owner level in this model is 0.0004 ($p < 0.01$). While significant, it is nearly two orders of magnitude less than the already marginal magnitude for the state-level ICC in model 3.

In addition to these tests, we also tested a specification where state random effects were replaced by state fixed effects. Results were consistent in terms of direction and relative magnitude, but with a decrease in significance for CSAPR and renewable utilization, and lost significance for gas price volatility, and renewable penetration. These results are available from the authors upon request.

*Distribution of errors.* It is clear from Table A3 that the exponential model (model 3 in the table) is misspecified. It yields a wholly unreasonable average age at retirement of more than 1.7 million years. The Weibull and log-logistic models, on the other hand, produce reasonable expected life estimates and perform similarly. The principal differences between the two models' results are that the interaction of the CSAPR policy indicator with $SO_2$ intensity is significant under the Weibull specification while the interaction of the CAIR policy indicator with $SO_2$ intensity is significant under the log-logistic specification. The Weibull model yields better performance based on the Akaike and Bayesian criteria, supporting its use in the principal analysis.

*Data and lag horizon.* Table A4 presents results when we shift the data horizon. The base horizon (2008–2016) is presented alongside results when the horizon begins in 2010, and 2012 in models 2 and 3, respectively. The magnitude of estimated coefficients change with this shift in horizon, which provides evidence of non-proportional hazards. However, despite non-proportional hazards, the base model provides the more conservative magnitude estimates and conclusions regarding support (and lack of support) for our hypotheses are generally consistent across each data horizon. The exceptions were the effect of renewable capacity in decelerating coal unit retirement rates, which loses its significance over shorter data horizons, and the interaction of $SO_2$ intensity with regulation for which significance shifts from CSAPR to CAIR.

Robustness to the lag horizon used in the base model was tested by replacing 12-month moving averages with 24-month moving averages. In doing so, gas price volatility lost significance, and the controls for transmission area load factor and Sierra Club memberships became less significant.

*Data inclusion decisions.* Recall from section 5.1 that our sample includes 41 generating units that had once operated as coal units but had been converted to gas (24 units), or permanently switched to use only gas (17 units). While these units are active gas units from an energy analyst's perspective (and therefore flagged as gas units in the ABB data), their coal-burning capability has been retired. For our purposes, they are therefore counted as retired coal units in base estimations. As seen in Table A5, when these 41 units are excluded from the sample, while still directionally supported, the effect of gas price volatility on coal unit retirement rates loses its significance. All other results are consistent in terms of their support.

We also tested the robustness of results to delayed entries—the 31 units with commercial online dates after January 2008. Results are robust to the exclusion of these delayed entries.

*Alternative measures.* Table A6 presents results when testing the base model's robustness to the use of

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alternative measures for state-level RPS, Sierra Club targeting, and CAIR. In model 2, base RPS targets were adjusted for "urgency" by dividing that target by the number of month's remaining to the specified compliance deadline. In model 3, legal documentation for Sierra Club targeting along with Title V petitions was replaced by Sierra Club claims along with Title V petitions. In model 4, the CAIR indicator was adjusted by turning the CAIR indicator "off" over the 6 months in 2008 that the regulation's vacatur was in effect. Results are robust in terms of direction and significance across each of these alternative measure models.

Additionally, we tested $age^2$ and $\sqrt{age}$ as alternative measures for age. As Table A7 indicates, this resulted in no changes in direction or reduction in significance levels aside from the alternative age term.

## 7. Discussion, Limitations, and Conclusions

Figure 1 presents the marginal effects for each of the hypothesized drivers of coal-unit retirement that were supported with significance. As evident from the figure, non-market factors—federal regulation and Sierra Club activism—had the greatest effect in accelerating coal unit retirement rates. Market and operational factors such natural gas prices and renewable penetration, have had a lesser or no significant effect on retirements.

*Environmental regulation.* Our results indicate that regulation has had a strong impact in accelerating coal unit retirements, validating claims by both sides of the political spectrum (e.g., Grunwald 2014, Orr and Palmer 2018). As evident in Figure 1, when holding all other covariates at their mean, regulation by CAIR and by CSAPR decreased the life of a coal unit by an average of 16.0, and 21.6 months, respectively. As a main effect, this is a greater per unit impact than all factors studied except for the Sierra Club's Beyond Coal campaign.

Given that both CAIR and CSAPR were intended to limit emissions from power generation, one might expect that they would accelerate the retirement of more emissions-intensive units to a greater extent. We observe this effect with CSAPR. As indicated in Figure 1, CSAPR has significantly reduced the operating life of units with below-median emissions intensity by an average of 18.9 months as compared to 22.7 months for units with above-median emissions intensity. However, in our base model, CAIR did not significantly affect coal units' retirement based on their emissions intensity. It is possible that this is driven by the finite horizon of CAIR as a condition of its vacatur's removal. Mandating an end to CAIR as its implementation was allowed may have encouraged some operators to delay decisions related to their coal units in order to learn whether those units would be covered by CAIR's replacement policy.

Overall, both CAIR and CSAPR played a substantial role in reducing the expected life of the coal units that they covered. However, the full impact of these policies on the retirement rate of coal units only comes into focus when considering their aggregate effect. In our sample, CAIR affected 766 units and CASPR affected 652 units. Combining this breadth of impact with each policy's per unit effect on coal-fired units' operating life, CAIR and CASPR have reduced the coal fleets operating life across the country by an aggregate of roughly 1021 and 1174 unit-years, respectively—far more than any other factor tested.

*Gas prices.* There is evidence that lower natural gas prices have driven the *adoption* of gas as an alternative to coal (e.g., Wolak 2016). However, gas proponents and others have further argued that lower natural gas prices have also been pivotal in driving the early retirement of coal capacity (Anadarko 2013, Energy Information Administration 2018c, Kemp 2016, Parker et al. 2019), but we do not find support for this claim over our data range (i.e., a 5th to 95th percentile range of 3.182 to 9.128 $/mmbtu). This non-result is surprising, and counter to the popular narrative.

There are potential behavioral and practical reasons underlying this non-result. When an operator evaluates a coal unit's profitability, gas prices do not meaningfully affect the outcome. Gas prices only affect coal unit retirement rates if operators go beyond evaluating whether or not the coal unit is profitable, to evaluate whether it would be *more* profitable if it were replaced with a gas unit. The literature examining opportunity costs has found that they are typically undervalued relative to real costs (e.g., Rudi and Drake 2014), providing a potential behavioral explanation for why gas price levels are not found to effect coal unit retirement rates. Furthermore, gas price levels would only contribute to accelerating coal retirement rates if the profit difference between a coal unit and its hypothetical gas replacement was sufficiently great to offset capital deployment and permitting/bureaucratic effort and risk.

If simultaneity was present in the data—that is, if gas prices *increased* in anticipation of a coal unit closure—it could suppress the hypothesized effect. However, this seems unlikely as gas consumption added in anticipation of a coal unit closure would be atomistic with respect to overall gas demand. For example, if a large (90th percentile) gas unit of 600 MW replaced a coal unit, it would represent a small fraction of the roughly 477,000 MW of US gas generating capacity in 2016, which in turn accounted for only

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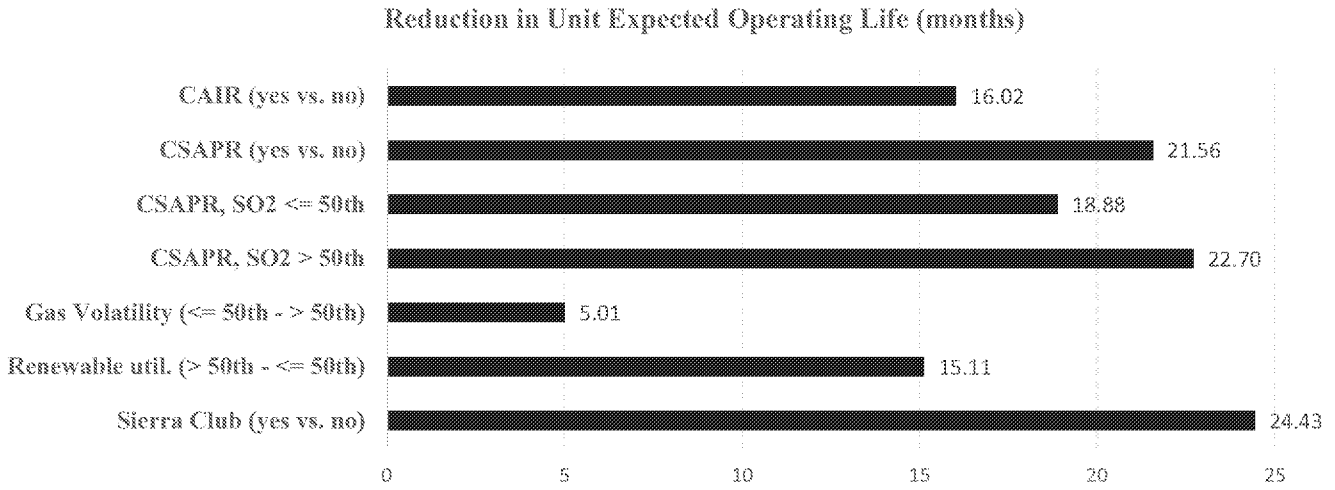
**Figure 1 Marginal Effects from the Factors Supported with Significance. <=50th (and >50th) Indicate Below (Above) Median Levels of the Related Covariate. <=50th–>50th Indicate the Difference Between the Marginal Effect on Below Median Units Relative to the Marginal Effect on Above Median Units**




36.4% of natural gas demand (Energy Information Administration 2020b).

While gas price levels do not significantly affect coal unit retirement rates, lower gas price volatility does (which is weakly supported in the base model and most, but not all, robustness tests). While holding values constant at their mean for all other covariates, coal units in regions with gas price volatility below the median can be expected to retire 5.0 months sooner than coal units in regions with gas price volatility above the median. This is less than one-third the main effect of other significant coal-retirement drivers.

*Wind and solar adoption.* Despite claims by renewables advocates (Gimon et al. 2019), we find no support that the adoption of wind and solar capacity accelerates coal unit retirement. In our base model and most (but not all) robustness tests, we find weakly significant support for the opposite—that the adoption of renewable capacity *delays* coal unit retirement. This is contrary to our hypothesis and contrary to potential simultaneity effects, which would exist if renewable capacity were added in response to future coal retirements. We conjecture that this deceleration may be because renewable capacity penetration forces gas generating units to be available as an intermittency backstop. In other words, as renewable capacity in a region increases, the portion of gas-fired generation that could be pre-committed to a base-load role would decrease. This is because an increasing portion of that gas capacity would need to provide recourse if renewable capacity is unavailable due to its well-documented intermittency. This need to remain flexible with the deployment of a greater portion of gas capacity in the region could encourage prolonged life for coal units in the area.

Unlike renewable capacity itself, we do find the utilization rate of that capacity accelerates coal unit retirement. Wind and solar utilization rate is driven by natural sources of intermittency—wind velocity and the intensity of sunlight—rather than active decision-making. As such, the intermittency-driven utilization of renewable capacity can be thought of as a form of availability: how often, based on natural factors, will the renewable capacity be able to operate. More reliably available renewable capacity would diminish (but not eliminate) the portion of gas capacity reserved for a recourse role which, in turn, would allow for the earlier retirement of coal capacity. To wit, in regions with above median utilization rates for renewable capacity, coal units retire an estimated 15.1 months sooner than they would have had they operated in regions with below median utilization rates for renewable capacity.

*Beyond Coal activism.* The Beyond Coal campaign has been lauded as being a pivotal force in driving coal capacity from the US generating footprint (e.g., Grunwald 2015, Sierra Club 2019). Our results support these claims, identifying Sierra Club activism through the Beyond Coal campaign as the single most effective driver in terms of accelerating per unit coal retirements. As indicated in Figure 1, while controlling for all other covariates at their mean levels, targeting by the Sierra Club Beyond Coal campaign reduces a coal unit's expected life by 24.4 months. Over the 207 units in our sample identified as targeted by the Sierra Club, this amounts to an aggregate total of roughly 421 unit-years of operation prevented by the campaign through September 2016. This may represent a slightly conservative estimate. Using the organization's claims (model 3 of Table A6), Sierra Club's effect in accelerating coal unit retirement

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increases to 27.0 months per unit and an aggregate total of 511 unit-years. In short, Beyond Coal has had a pronounced impact on accelerating the retirement of scores of coal-fired generating units throughout the US.

### 7.1. *Post Hoc* Analysis—Impact of Retirements on Coal Generation and Emissions

While our principle analysis investigates which factors have driven the retirement of coal-fired generating units, it does not assess whether those retirements have reduced carbon emissions. A Welch's t-test indicates that the 348 units that retired over our data horizon were significantly smaller and less utilized than the 631 units that survived. Units in the sample that retired were 37.0% the size of surviving units (167.0 MW vs. 451.5 MW, $p < 0.0001$) and 19.8 points less utilized (58.0% load factor over retired units' operating lives within the data horizon vs. 77.8% for surviving units, $p < 0.0001$). This begs the question (e.g., Storrow 2019): did the observed retirements significantly move the needle with respect to reducing carbon emissions, or was the generation from these smaller, retired units simply absorbed by the larger coal units still in operation?

To address that question we estimated 2009 through 2016 annual, state-level coal generation. We did so through a panel regression with each state's cumulative number of coal unit retirements as the independent variable of interest. We controlled for each of the independent and control variables from the main analysis and included state and year fixed effects. Specifically, we controlled for the number of coal units in operation that were targeted by CAIR, the number targeted by CASPR, the number targeted by the Sierra Club, the number of fuel switching units, and the number of Sierra Club memberships, each at the state-year level. We also controlled, at the state-year level, for lagged, average: gas price, standard deviation in gas price, renewable capacity, renewable utilization, coal price, coal mining revenues, and transmission area load factor. Finally, we controlled, at the state-year level, for RPS target, LCV score, average unit age, and average unit capacity.

Based on this estimation, each retirement over our horizon reduced coal-fired power generation by 511.1 GWh per year ($p < 0.001$). Given the 167 MW average capacity and 58% average load factor for units retired over the data horizon, and the 8760 available generating hours per year, a retired unit in our sample generated an average of 848.5 GWh of power each year that it operated. This implies that roughly 40% ([848.5−511.1]/848.5=0.398) of the power that had been generated by a retired coal unit was absorbed by surviving coal units. The concern that power generated by a retired coal unit may simply spill-over to other coal-fired generators is valid. That said, an estimated 60% of the power that had been generated by retired coal units in our sample was removed from the coal fleet, a shift that results in sizeable environmental improvement.

Given the estimated 511.1 GWh reduction in a state's annual coal-fired power generation for each retired unit over our horizon, coal-fired generation was reduced nationally by 177,862 GWh per year due to the 348 retirements in our sample. Coal emits 1002 metric tons of $CO_2$ per GWh while natural gas emits 419.5 metric tons of $CO_2$ per GWh (Energy Information Administration 2020a). The reduction in coal-fired generation due to retirements in our data therefore equates to an annual reduction in emissions between 103.6 million metric tons of $CO_2$ (if 100% of the reduction in coal-fired generation is replaced by natural gas) and 178.2 million metric tons of $CO_2$ (if 100% of the reduction in coal-fired generation is replaced with renewables or not replaced). This emissions reduction is equivalent to between 7.7% and 13.2% of the coal-fired emissions generated in 2016 (Energy Information Administration 2020d). To cast this emissions reduction in a different light, the annual decrease in $CO_2$ emissions due to coal unit retirements in our sample equates to between slightly more than 260% and 450% of the $CO_2$ emissions generated by the entire US cement industry in 2016 (Statista 2020)—another notoriously emissions-intensive sector.

### 7.2. Limitations

As with any empirical analysis, ours suffers from limitations. First, despite our best efforts to econometrically address any sources of endogeneity, there exists a potential for simultaneity that cannot be resolved through lagged explanatory variables (Bellemare et al. 2017). However, as discussed above, simultaneity is unlikely to drive the results related to renewable energy penetration and gas price levels, which intuitively seem to be the factors that would be most vulnerable to such endogeneity.

Second, as our data horizon ends in September 2016, there is a possibility that the effects of the factors studied here on coal unit retirements have evolved. It is important to consider that our analysis may be more applicable to how environmental technology transitions begin, rather than end. For example, within the scope of our data covering the initial phases of the transition away from coal, we found Sierra Club activism and federal regulation to be highly effective, while market factors such as substitute input costs were less so. Perhaps, although, if gas price continued to decrease beyond the range in our data, it may become a significant factor in driving coal unit retirement, while activism and federal regulation

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could potentially become less effective levers in the waning phases of an environmental technology transition. We look forward to future research that builds on the findings here to increase our understanding of such technology transition dynamics.

### 7.3. Conclusions

Results indicate that federal regulation, renewable utilization, and Sierra Club activism have had the most substantial effect in accelerating coal unit retirement rates. Both CAIR and CSAPR have accelerated coal retirements by an average of more than 16 and 20 months, respectively. In aggregate, these policies have reduced coal unit expected life by an estimated 1021 and 1174 years. Sierra Club activism through their Beyond Coal campaign contributed the largest per unit marginal effect, accelerating coal unit retirements by 24.4 months for each of the 207 units identified as being targeted by the campaign's lawyers. As a consequence, the Sierra Club's efforts have contributed an estimated aggregate of 421 years in reduced coal capacity life.

Natural gas prices have been demonstrated to contribute to the adoption of gas capacity as an alternative to the adoption of coal capacity. However, we find no significant support that natural gas price levels contributed significantly to increased coal unit retirement rates. We do find weak support that reduced gas price volatility accelerates retirement rate, but the magnitude of this effect is minimal relative to other significant contributors. Similarly, we do not find that the penetration of renewable capacity or states' RPS targets significantly increased retirement rates. However, greater utilization of renewable capacity does contribute to increased coal unit retirement rates. We find that, in regions with above-median utilization for renewable capacity, coal-fired units retire 15.1 months sooner than in regions with below-median utilization.

A *post hoc* analysis indicates that 40% of retired coal units' former production is absorbed by surviving coal units. However, the 60% of retired units' former production displaced from the coal fleet improves the energy sector's environmental impact, reducing annual $CO_2$ emissions by an estimated 103.6 to 178.2 million metric tons each year. As a consequence, the factors identified as accelerating coal retirement also contribute to significant environmental improvement.

These results have important implications for policy makers, managers, and social movement organizations. Our findings indicate that non-market factors have been major drivers of coal unit retirement. Along with federal policies that directly regulate coal-fired units, our findings indicate that the Sierra Club has been quite effective in their "War on Coal," suggesting tactics that may benefit other environmental activists. While the literature predominantly focuses on adoption, adoption alone is not sufficient to drive environmental technology transitions. Equally important in such transitions is the retirement of environmentally intensive technologies. This study contributes to our understanding of the drivers of that retirement, and thus our ability to transition away from environmentally harmful technology.

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# Appendix A. Correlation Table and Robustness Tests

**Table A1 Correlation Table**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) CAIR, 2008 to 2015 (y/n) | 1.00 | | | | | | | | | | | | | | | | |
| (2) CSAPR, 2015 onward (y/n) | –0.54 | 1.00 | | | | | | | | | | | | | | | |
| (3) Gas price/mmtbu | 0.24 | –0.35 | 1.00 | | | | | | | | | | | | | | |
| (4) Std dev of gas price/mmbtu | 0.07 | –0.17 | 0.65 | 1.00 | | | | | | | | | | | | | |
| (5) State wind & solar capacity (GW) | –0.09 | 0.15 | –0.19 | –0.07 | 1.00 | | | | | | | | | | | | |
| (6) Renewable utilization | –0.33 | 0.21 | –0.09 | –0.03 | 0.20 | 1.00 | | | | | | | | | | | |
| (7) RPS target (% state capacity) | –0.15 | –0.06 | –0.06 | –0.13 | 0.13 | 0.19 | 1.00 | | | | | | | | | | |
| (8) Beyond Coal activism (legal, y/n) | 0.03 | 0.04 | –0.19 | –0.10 | 0.03 | 0.02 | –0.04 | 1.00 | | | | | | | | | |
| (9) Age (months) | 0.10 | 0.07 | –0.04 | –0.03 | –0.19 | –0.04 | 0.05 | 0.14 | 1.00 | | | | | | | | |
| (10) Capacity (MW) | –0.02 | 0.08 | –0.10 | –0.07 | 0.17 | 0.05 | –0.04 | 0.01 | –0.52 | 1.00 | | | | | | | |
| (11) Coal price/mmbtu | 0.26 | 0.02 | –0.16 | –0.19 | –0.21 | –0.19 | –0.10 | 0.04 | 0.21 | –0.13 | 1.00 | | | | | | |
| (12) Fuel switching capability (y/n) | 0.01 | –0.01 | 0.01 | 0.00 | 0.12 | 0.01 | 0.11 | –0.02 | 0.02 | –0.14 | 0.05 | 1.00 | | | | | |
| (13) $SO_2$ emissions ($SO_2$ tons/MWh) | 0.08 | –0.05 | 0.06 | 0.00 | –0.04 | –0.02 | –0.04 | 0.03 | 0.12 | –0.09 | 0.05 | –0.01 | 1.00 | | | | |
| (14) Transmission area load factor (%) | –0.33 | –0.02 | 0.00 | 0.11 | –0.01 | 0.19 | 0.19 | 0.03 | –0.01 | –0.10 | –0.41 | 0.00 | –0.01 | 1.00 | | | |
| (15) State coal revenues ($100 MMs) | 0.00 | –0.09 | 0.06 | 0.16 | –0.03 | –0.06 | –0.10 | –0.06 | –0.06 | 0.02 | –0.19 | –0.08 | –0.01 | 0.32 | 1.00 | | |
| (16) State SC memberships (000's) | 0.17 | 0.05 | 0.04 | –0.16 | 0.28 | 0.08 | 0.42 | –0.02 | 0.03 | 0.00 | 0.10 | 0.09 | 0.02 | –0.14 | –0.24 | 1.00 | |
| (17) LCV score | 0.12 | –0.17 | 0.20 | –0.01 | –0.15 | –0.02 | 0.59 | –0.05 | 0.14 | –0.15 | 0.04 | 0.08 | 0.03 | 0.16 | –0.22 | 0.47 | 1.00 |

Covariate correlations. Numbers within the parentheses of the left column provide a legend for column labels.

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**Table A2 Robustness: Hierarchical Specification**

| | | (1) No RE | (2) Plant only | (3) Plant/State | (4) Plant/Owner |
|---|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | −0.0911 | −0.1757*** | −0.1720*** | −0.1756*** |
| | | (0.0879) | (0.0645) | (0.0630) | (0.0619) |
| | CSAPR, 2015 onward (y/n) | −0.2236 | −0.2089*** | −0.2070*** | −0.2089*** |
| | | (0.1560) | (0.0795) | (0.0674) | (0.0696) |
| | CAIR×SO2 intensity (tons/MWh) | 0.0003 | 0.0001 | 0.0010 | 0.0010 |
| | | (0.0005) | (0.0011) | (0.0007) | (0.0009) |
| | CSAPR×SO2 intensity (tons/MWh) | −0.0013 | −0.0013*** | −0.0013*** | −0.0013*** |
| | | (0.0008) | (0.0005) | (0.0005) | (0.0005) |
| H2 | Gas price/mmbtu | −0.0113 | 0.0144 | 0.0137 | 0.0144 |
| | | (0.0418) | (0.0269) | (0.0316) | (0.0261) |
| | Std Dev of gas price/mmbtu | 0.0755* | 0.0235 | 0.0241* | 0.0235 |
| | | (0.0406) | (0.0213) | (0.0142) | (0.0243) |
| H3 | State wind & solar capacity (GW) | −0.0024 | 0.0124** | 0.0134* | 0.0124** |
| | | (0.0069) | (0.0057) | (0.0071) | (0.0062) |
| | Renewable utilization | −0.1117 | −0.1258** | −0.1222*** | −0.1258*** |
| | | (0.1352) | (0.0621) | (0.0522) | (0.0422) |
| | RPS Target (% of state capacity) | −0.0027 | −0.0012 | −0.0007 | −0.0011 |
| | | (0.0030) | (0.0017) | (0.0021) | (0.0025) |
| H4 | Beyond Coal activism (y/n) | −0.1012 | −0.2480*** | −0.2457*** | −0.2480*** |
| | | (0.0652) | (0.0785) | (0.0713) | (0.0589) |
| Unit controls | Age (months) | −0.0009* | −0.0006*** | −0.0006*** | −0.0006*** |
| | Capacity (MW) | 0.0008* | 0.0008*** | 0.0008*** | 0.0008*** |
| | Coal price/mmbtu | −0.0246* | 0.0071 | 0.0069 | 0.0071 |
| | Fuel switching capability (y/n) | −0.0083 | −0.0088 | −0.0091 | −0.0088 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | −0.0011* | −0.0005*** | −0.0005*** | −0.0005*** |
| Regional controls | Transmission area load factor (%) | 0.0127 | 0.0137*** | 0.0147*** | 0.0137** |
| | State coal revenues ($100 MM/yr) | −0.0007 | 0.0001 | 0.0003 | 0.0001 |
| | State Sierra Club memberships (000's) | −0.0001 | −0.0100*** | −0.0092*** | −0.0100*** |
| | League of conservation voters score | 0.0002 | 0.0005 | 0.0005 | 0.0005 |
| | Constant | 3.0938*** | 2.8812*** | 2.7455*** | 2.8807*** |
| Mixed effects | Random effects | None | Plant | Plant/State | Plant/Owner |
| | Year fixed effects | Yes | Yes | Yes | Yes |
| Model fit | Model $\chi^2$ | 1048 | 647 | 2993 | 1899 |
| | Model $p$-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | Akaike information criterion | 3747 | 3393 | 3392 | 3394 |
| | Bayesian information criterion | 4019 | 3675 | 3694 | 3686 |
| Sample | Units | 979 | 979 | 979 | 979 |
| | Retirements | 348 | 348 | 348 | 348 |
| | Unit-months | 89,378 | 89,378 | 89,378 | 89,378 |
| | Estimated age at retirement (years) | 51.40 | 52.27 | 52.23 | 52.27 |
| ICC | Plant ICC | – | 0.8907*** | 0.8896*** | 0.8906*** |
| | State ICC | – | – | 0.0545** | – |
| | Owner ICC | – | – | | 0.0004*** |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Independent variable standard errors are reported in parentheses. Model 3 (in gray) replicates base model results to facilitate comparison.

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**Table A3 Robustness: Distributional Assumption**

| | | (1) Weibull AFT | (2) Log-log AFT | (3) Exponential AFT |
|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | −0.1128*** | −0.2518*** | −1.4113*** |
| | | (0.0609) | (0.0937) | (0.4742) |
| | CSAPR, 2015 onward (y/n) | −0.2070** | −0.1959** | −1.8297*** |
| | | (0.0874) | (0.0922) | (0.6551) |
| | CAIR×SO2 intensity (tons/MWh) | 0.0010 | 0.0044*** | 0.0078 |
| | | (0.0007) | (0.0012) | (0.0062) |
| | CSAPR×SO2*Z* intensity (tons/MWh) | −0.0014*** | −0.0079 | −0.0113*** |
| | | (0.0005) | (0.0068) | (0.0026) |
| H2 | Gas price/mmbtu | 0.0137 | −0.0039 | 0.5241** |
| | | (0.0318) | (0.0250) | (0.2334) |
| | Std Dev of gas price/mmbtu | 0.0241* | 0.0366*** | 0.1768 |
| | | (0.0142) | (0.0134) | (0.1587) |
| H3 | State wind & solar capacity (GW) | 0.0134* | 0.0123 | 0.0895 |
| | | (0.0071) | (0.0076) | (0.0596) |
| | Renewable utilization | −0.1227** | −0.1381* | −1.4116*** |
| | | (0.0522) | (0.0768) | (0.3314) |
| | RPS target (% of state capacity) | −0.0007 | −0.0035 | −0.0157 |
| | | (0.0021) | (0.0032) | (0.0203) |
| H4 | Beyond coal activism (y/n) | −0.2457*** | −0.2285*** | −1.8488*** |
| | | (0.0713) | (0.0716) | (0.4479) |
| Unit controls | Age (months) | −0.0006*** | −0.0005** | −0.0065*** |
| | Capacity (MW) | 0.0008*** | 0.0007*** | 0.0068*** |
| | Coal price/mmbtu | 0.0009 | 0.0009 | 0.0199 |
| | Fuel switching capability (y/n) | −0.0061 | −0.0190 | −0.2089 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | −0.0005*** | −0.0045*** | −0.0058*** |
| Regional controls | Transmission area load factor (%) | 0.0141*** | 0.0112* | 0.1344*** |
| | State coal revenues ($100 MM/yr) | 0.0003 | 0.0001 | −0.0001 |
| | State Sierra Club memberships (000's) | −0.0091*** | −0.0091 | −0.0707** |
| | League of conservation voters score | 0.0005 | 0.0007 | 0.0068 |
| | Constant | 2.7875*** | 3.1240*** | 2.4454 |
| Mixed effects | Plant and state random effects | Yes | Yes | Yes |
| | Year fixed effects | Yes | Yes | Yes |
| Model fit | Model $\chi^2$ | 2363 | 2348 | 4309 |
| | Model *p*-value | 0.0000 | 0.0000 | 0.0000 |
| | Akaike information criterion | 3392 | 3402 | 3472 |
| | Bayesian information criterion | 3684 | 3694 | 3754 |
| Sample | Units | 979 | 979 | 979 |
| | Retirements | 348 | 348 | 348 |
| | Unit-months | 89,378 | 89,378 | 89,378 |
| | Estimated age at retirement (years) | 52.23 | 51.78 | 1,725,042 |

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Independent variable standard errors are reported in parentheses. Model 1 (in gray) replicates base model results to facilitate comparison.

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**Table A4 Robustness: Data and Lag Horizon**

| | | (1) 2008–2016 | (2) 2010–2016 | (3) 2012–2016 | (4) 24-month avg. |
|---|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | −0.1720*** | −0.3077** | −0.3752*** | −0.1543** |
| | | (0.0650) | (0.1552) | (0.1174) | (0.0611) |
| | CSAPR, 2015 onward (y/n) | −0.2701** | −0.3724** | −0.4905*** | −0.1887** |
| | | (0.0874) | (0.1671) | (0.1721) | (0.0800) |
| | CAIR×SO2 intensity (tons/MWh) | 0.0010 | 0.0029* | 0.0053** | 0.0010 |
| | | (0.0007) | (0.0016) | (0.0025) | (0.0006) |
| | CSAPR×SO2 intensity (tons/MWh) | −0.0014*** | −0.0026* | −0.0009 | −0.0010*** |
| | | (0.0003) | (0.0015) | (0.0008) | (0.0004) |
| H2 | Gas price/mmbtu | 0.0131 | 0.0629 | 0.0037 | −0.0016 |
| | | (0.0316) | (0.0804) | (0.0592) | (0.0336) |
| | Std Dev of gas price/mmbtu | 0.0241** | 0.0548* | 0.1104 | 0.0212 |
| | | (0.0142) | (0.0318) | (0.0721) | (0.0217) |
| H3 | State wind & solar capacity (GW) | 0.0134* | 0.0096 | 0.0144 | 0.0121* |
| | | (0.0071) | (0.0110) | (0.0123) | (0.0070) |
| | Renewable utilization | −0.1237** | −0.2240** | −0.2727** | −0.0964** |
| | | (0.0502) | (0.0997) | (0.1096) | (0.0451) |
| | RPS target (% of state capacity) | −0.0007 | −0.0003 | 0.0017 | −0.0007 |
| | | (0.0021) | (0.0036) | (0.0035) | (0.0019) |
| H4 | Beyond coal activism (y/n) | −0.2453*** | −0.4408** | −0.4745*** | −0.2338*** |
| | | (0.1120) | (0.1782) | (0.1345) | (0.0722) |
| Unit controls | Age (months) | −0.0008** | −0.0013 | −0.0015*** | −0.0005** |
| | Capacity (MW) | 0.0016*** | 0.0016** | 0.0013*** | 0.0007*** |
| | Coal price/mmbtu | 0.0065 | 0.0053 | 0.0047 | 0.0016 |
| | Fuel switching capability (y/n) | −0.0361 | −0.0285 | −0.0595 | −0.0065 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | −0.0005*** | −0.0010*** | −0.0022*** | −0.0011*** |
| Regional controls | Transmission area load factor (%) | 0.0147** | 0.0293* | 0.0260** | 0.0134* |
| | State coal revenues ($100 MM/yr) | 0.0003 | −0.0011 | −0.0029 | 0.0005 |
| | State Sierra Club memberships (000's) | −0.0387** | −0.0057 | −0.0046 | −0.0089* |
| | League of conservation voters score | 0.0003 | −0.0001 | 0.0002 | 0.0003 |
| | Constant | 2.7424*** | 2.3036*** | 2.9031*** | 2.9798*** |
| Mixed effects | Plant and state random effects | Yes | Yes | Yes | Yes |
| | Year fixed effects | Yes | Yes | Yes | Yes |
| Model fit | Model $\chi^2$ | 2353 | 1502 | 660 | 2667 |
| | Model $p$-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | Akaike information criterion | 3332 | 3265 | 2617 | 3397 |
| | Bayesian information criterion | 3634 | 3530 | 2852 | 3688 |
| Sample | Units | 979 | 969 | 911 | 979 |
| | Retirements | 348 | 339 | 282 | 348 |
| | Unit-months | 89,378 | 66,672 | 44,341 | 89,378 |
| | Estimated age at retirement (years) | 51.23 | 57.88 | 55.76 | 51.71 |

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Independent variable standard errors are reported in parentheses. Model 1 (in gray) replicates base model results to facilitate comparison.

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**Table A5 Robustness: Data Inclusion**

| | | (1) All data included | (2) No units coded "gas" | (3) No delayed entries |
|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | [illegible] | −0.1503** | −0.1712** |
| | | [illegible] | (0.0672) | (0.0687) |
| | CSAPR, 2015 onward (y/n) | [illegible] | −0.1884** | −0.2056** |
| | | [illegible] | (0.0934) | (0.0869) |
| | CAIR×SO2 intensity (tons/MWh) | [illegible] | 0.0007 | 0.0010 |
| | | [illegible] | (0.0007) | (0.0007) |
| | CSAPR×SO2 intensity (tons/MWh) | [illegible] | −0.0014*** | −0.0014*** |
| | | [illegible] | (0.0005) | (0.0005) |
| H2 | Gas price/mmbtu | [illegible] | 0.0127 | 0.0137 |
| | | [illegible] | (0.0339) | (0.0317) |
| | Std Dev of gas price/mmbtu | [illegible] | 0.0472 | 0.0240* |
| | | [illegible] | (0.0310) | (0.0142) |
| H3 | State wind & solar capacity (GW) | [illegible] | 0.0116 | 0.0132* |
| | | [illegible] | (0.0075) | (0.0070) |
| | Renewable utilization | [illegible] | −0.1166** | −0.1217** |
| | | [illegible] | (0.0592) | (0.0519) |
| | RPS target (% of state capacity) | [illegible] | −0.0003 | −0.0007 |
| | | [illegible] | (0.0019) | (0.0021) |
| H4 | Beyond coal activism (y/n) | [illegible] | −0.2279** | −0.2478*** |
| | | [illegible] | (0.0705) | (0.0720) |
| Unit controls | Age (months) | [illegible] | −0.0010*** | −0.0006** |
| | Capacity (MW) | [illegible] | 0.0008*** | 0.0008*** |
| | Coal price/mmbtu | [illegible] | 0.0062 | 0.0070 |
| | Fuel switching capability (y/n) | [illegible] | −0.0066 | −0.0057 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | [illegible] | −0.0004*** | −0.0005*** |
| Regional controls | Transmission area load factor (%) | [illegible] | 0.0116* | 0.0146** |
| | State coal revenues ($100 MM/yr) | [illegible] | −0.0009 | 0.0003 |
| | State Sierra Club memberships (000's) | [illegible] | −0.0152** | −0.0097** |
| | League of conservation voters score | [illegible] | 0.0013* | 0.0005 |
| | Constant | [illegible] | 3.2690*** | 2.7831*** |
| Mixed effects | Plant and state random effects | [illegible] | Yes | Yes |
| | Year fixed effects | [illegible] | Yes | Yes |
| Model fit | Model $\chi^2$ | [illegible] | 3005 | 2979 |
| | Model $p$-value | [illegible] | 0.0000 | 0.0000 |
| | Akaike information criterion | [illegible] | 3019 | 3392 |
| | Bayesian information criterion | [illegible] | 3309 | 3682 |
| Sample | Units | [illegible] | 938 | 948 |
| | Retirements | [illegible] | 307 | 348 |
| | Unit-months | [illegible] | 85,979 | 87,227 |
| | Estimated age at retirement (years) | [illegible] | 53.17 | 52.22 |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Independent variable standard errors are reported in parentheses. Model 1 (in gray) replicates base model results to facilitate comparison.

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**Table A6 Robustness: Alternative Measures**

| | | (1) Base model | (2) RPS urgency | (3) Sierra Club claims | (4) CAIR vacatur |
|---|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | [illegible] | −0.1685*** | −0.1922** | −0.2229** |
| | | [illegible] | (0.0643) | (0.0772) | (0.0965) |
| | CSAPR, 2015 onward (y/n) | [illegible] | −0.2042** | −0.1875** | −0.2442** |
| | | [illegible] | (0.0844) | (0.0858) | (0.1026) |
| | CAIR×SO2 intensity (tons/MWh) | [illegible] | 0.0009 | 0.0009 | 0.0002 |
| | | [illegible] | (0.0007) | (0.0008) | (0.0009) |
| | CSAPR×SO2 intensity (tons/MWh) | [illegible] | −0.0013*** | −0.0014*** | −0.0015*** |
| | | [illegible] | (0.0005) | (0.0005) | (0.0005) |
| H2 | Gas price/mmbtu | [illegible] | 0.0138 | 0.0144 | 0.0117 |
| | | [illegible] | (0.0320) | (0.0322) | (0.0291) |
| | Std Dev of gas price/mmbtu | [illegible] | 0.0238* | 0.0239* | 0.0243* |
| | | [illegible] | (0.0143) | (0.0142) | (0.0142) |
| H3 | State wind & solar capacity (GW) | [illegible] | 0.0132* | 0.0136* | 0.0133* |
| | | [illegible] | (0.0068) | (0.0072) | (0.0068) |
| | Renewable utilization | [illegible] | −0.1235** | −0.1242** | −0.1219** |
| | | [illegible] | (0.0520) | (0.0525) | (0.0490) |
| | RPS target (% of state capacity) | [illegible] | −0.0073 | −0.0007 | −0.0009 |
| | | [illegible] | (0.0119) | (0.0021) | (0.0022) |
| H4 | Beyond coal activism (y/n) | [illegible] | −0.2448*** | −0.2719*** | −0.2427*** |
| | | [illegible] | (0.0703) | (0.0756) | (0.0663) |
| Unit controls | Age (months) | [illegible] | −0.0006** | −0.0006** | −0.0006** |
| | Capacity (MW) | [illegible] | 0.0008*** | 0.0008*** | 0.0008*** |
| | Coal price/mmbtu | [illegible] | 0.0068 | 0.0079 | 0.0073 |
| | Fuel switching capability (y/n) | [illegible] | −0.0064 | −0.0096 | −0.0070 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | [illegible] | −0.0005*** | −0.0005*** | −0.0004** |
| Regional controls | Transmission area load factor (%) | [illegible] | 0.0147** | 0.0150** | 0.0142** |
| | State coal revenues ($100 MM/yr) | [illegible] | 0.0002 | 0.0001 | 0.0005 |
| | State Sierra Club memberships (000's) | [illegible] | −0.0099** | −0.0098** | −0.0088** |
| | League of conservation voters score | [illegible] | 0.0004 | 0.0006 | 0.0004 |
| | Constant | [illegible] | 2.7901*** | 2.7757*** | 2.7048*** |
| Mixed effects | Plant and state random effects | Yes | Yes | Yes | Yes |
| | Year fixed effects | Yes | Yes | Yes | Yes |
| Model fit | Model $\chi^2$ | [illegible] | 3037 | 4047 | 4422 |
| | Model $p$-value | [illegible] | 0.0000 | 0.0000 | 0.0000 |
| | Akaike information criterion | [illegible] | 3392 | 3379 | 3386 |
| | Bayesian information criterion | [illegible] | 3684 | 3670 | 3677 |
| | Units | [illegible] | 979 | 979 | 979 |
| Sample | Retirements | [illegible] | 348 | 348 | 348 |
| | Unit-months | [illegible] | 89,378 | 89,378 | 89,378 |
| | Estimated age at retirement (years) | [illegible] | 52.21 | 52.31 | 52.13 |

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Independent variable standard errors are reported in parentheses. Model 1 (in gray) replicates base model results to facilitate comparison.

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**Table A7 Robustness: Alternative Age Measures**

| | | (1) Base model | (2) $Age^2$ | (3) $\sqrt{Age}$ |
|---|---|---|---|---|
| H1 | CAIR, 2008–2015 (y/n) | [illegible] | −0.1732** | −0.1714** |
| | | [illegible] | (0.0681) | (0.0692) |
| | CSAPR, 2015 onward (y/n) | [illegible] | −0.2144** | −0.2027** |
| | | [illegible] | (0.0876) | (0.0868) |
| | CAIR×SO2 intensity (tons/MWh) | [illegible] | 0.0009 | 0.0010 |
| | | [illegible] | (0.0007) | (0.0007) |
| | CSAPR×SO2 intensity (tons/MWh) | [illegible] | −0.0014*** | −0.0014*** |
| | | [illegible] | (0.0005) | (0.0005) |
| H2 | Gas price/mmbtu | [illegible] | 0.0133 | 0.0139 |
| | | [illegible] | (0.0311) | (0.0320) |
| | Std Dev of gas price/mmbtu | [illegible] | 0.0241* | 0.0240* |
| | | [illegible] | (0.0141) | (0.0143) |
| H3 | State wind & solar capacity (GW) | [illegible] | 0.0145** | 0.0129* |
| | | [illegible] | (0.0072) | (0.0071) |
| | Renewable utilization | [illegible] | −0.1188** | −0.1223** |
| | | [illegible] | (0.0516) | (0.0520) |
| | RPS target (% of state capacity) | [illegible] | −0.0008 | −0.0007 |
| | | [illegible] | (0.0021) | (0.0021) |
| H4 | Beyond coal activism (y/n) | [illegible] | −0.2510*** | −0.2444*** |
| | | [illegible] | (0.0713) | (0.0713) |
| Unit controls | Age, $Age^2$, or $\sqrt{Age}$ | [illegible] | −3.98e−07* | −0.0305** |
| | Capacity (MW) | [illegible] | 0.0008*** | 0.0008*** |
| | Coal price/mmbtu | [illegible] | 0.0070 | 0.0070 |
| | Fuel switching capability (y/n) | [illegible] | −0.0034 | −0.0065 |
| | $SO_2$ intensity ($SO_2$ tons/MWh) | [illegible] | −0.0005*** | −0.0005*** |
| Regional controls | Transmission area load factor (%) | [illegible] | 0.0147** | 0.0146** |
| | State coal revenues ($100 MM/yr) | [illegible] | 0.0004 | 0.0003 |
| | State Sierra Club memberships (000's) | [illegible] | −0.0095** | −0.0099** |
| | League of conservation voters score | [illegible] | 0.0005 | 0.0005 |
| | Constant | [illegible] | 2.5800*** | 3.1733*** |
| Mixed effects | Plant and state random effects | Yes | Yes | Yes |
| | Year fixed effects | Yes | Yes | Yes |
| Model fit | Model $\chi^2$ | [illegible] | 2926 | 3007 |
| | Model $p$-value | [illegible] | 0.0000 | 0.0000 |
| | Akaike information criterion | [illegible] | 3399 | 3389 |
| | Bayesian information criterion | [illegible] | 3690 | 3681 |
| Sample | Units | [illegible] | 979 | 979 |
| | Retirements | [illegible] | 348 | 348 |
| | Unit-months | [illegible] | 89,378 | 89,378 |
| | Estimated age at retirement (years) | [illegible] | 52.08 | 52.42 |

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Independent variable standard errors are reported in parentheses. Model 1 (in gray) replicates base model results to facilitate comparison.

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ED_006623A_00000355-00023

EPA-HQ-2022-5321 5322



## References

Aflaki, S., S. Netessine. 2017. Strategic investment in renewable energy sources: The effect of supply intermittency. *Manuf. Serv. Oper. Manag.* **19**(3): 489–507.

American Coalition for Clean Coal Electricity. 2017. Retirement of Coal-fired Electric Generating Units. Available at http://www.americaspower.org/wp-content/uploads/2017/06/Coal-Retirements-Paper-June-2017.pdf (accessed date August 21, 2019).

Anadarko. 2013. Facts on Natural Gas from Shales: Exploring Emissions. Available at https://www.anadarko.com/content/documents/apc/news/APC-ShaleGasEmissionsFAQs.pdf (accessed date august 21, 2019).

Barbose, G. 2016. US renewables portfolio standards: 2016 annual status report. Lawrence Berkeley National Laboratory: Berkeley CA.

Bellemare, M. F., T. Masaki, T. B. Pepinsky. 2017. Lagged explanatory variables and the estimation of causal effect. *J. Polit.* **79** (3): 949–963.

Brune, M. 2019. Landmark Victory in Fight Against Coal Exports. *The Sierra Club*. Available at: https://blogs.sierraclub.org/michaelbrune/2014/08/landmark-victory-in-fight-against-coal-exports.html (accessed date September, 2019).

Cheon, A., J. Urpelainen. 2018. The campaign against coal in the United States. *Activism and the Fossil Fuel Industry*. Routledge, Abingdon, 126–153.

Clean Air Task Force. 2010. The Toll from Coal: An Updated Assessment of Death and Disease from America's Dirtiest Energy Source. Available at https://www.catf.us/wp-content/uploads/2010/09/CATF_Pub_TheTollFromCoal.pdf (accessed date August 21, 2019).

Cleves, M., W. W. Gould, Y. V. Marchenko. 2016. *An Introduction to Survival Analysis Using Stata*. Stata Press, College Station, TX.

Cohen, M. A., R. M. Halperin. 1986. Optimal technology choice in a dynamic-stochastic environment. *J. Oper. Manag.* **6**(3–4): 317–331.

Database of State Incentives for Renewables and Efficiency. 2018. Find Policies & Incentives by State. Available at https://www.dsireusa.org (accessed date May 24, 2018).

Dhanorkar, S. S., E. Siemsen, K. W. Linderman. 2017. Promoting change from the outside: Directing managerial attention in the implementation of environmental improvements. *Management Sci.* **64**(6): 2535–2556.

Drake, D. F. 2018. Carbon tariffs: Effects in settings with technology choice and foreign production cost advantage. *Manuf. Serv. Oper. Manag.* **20**(4): 667–686.

Drake, D. F., R. L. Just. 2016. Ignore, avoid, abandon, and embrace: What drives firm responses to environmental regulation? *Environmentally Responsible Supply Chains*. Springer, Cham, 199–222.

Drake, D. F., S. Spinler. 2013. OM forum—Sustainable operations management: An enduring stream or a passing fancy? *Manuf. Serv. Oper. Manag.* **15**(4): 689–700.

Drake, D. F., P. K. Kleindorfer, L. N. Van Wassenhove. 2016. Technology choice and capacity portfolios under emissions regulation. *Prod. Oper. Manag.* **25**(6): 1006–1025.

Energy Information Administration. 2012. Annual Energy Outlook 2012. Available at https://www.nrc.gov/docs/ML1409/ML14093A265.pdf (accessed date August 26, 2019).

Energy Information Administration. 2017. Electric Power Annual 2016, Table 4.2.B. Available at https://www.eia.gov/electricity/annual/archive/pdf/03482016.pdf (accessed date June 25, 2020).

Energy Information Administration. 2018a. International Energy Statistics: Total Installed Capacity. Available at https://www.eia.gov/beta/international/data/browser (accessed date date August 20, 2019).

Energy Information Administration. 2018b. Form EIA-860. Available at https://www.eia.gov/electricity/data/eia860/ (accessed date December 10, 2018).

Energy Information Administration. 2018c. US Coal Consumption in 2018 Expected to be to be the Lowest in 39 Years. Available at https://www.eia.gov/todayinenergy/detail.php?id=37692 (accessed date August 26, 2019).

Energy Information Administration. 2018d. Annual Energy Outlook 2018: With Projections to 2050. Available at https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf (accessed date September 3, 2019).

Energy Information Administration. 2019a. US Dry Natural Gas Production. Available at https://www.eia.gov/dnav/ng/hist/n9070us2a.htm (accessed date August 27, 2019).

Energy Information Administration. 2019b. Henry Hub Natural Gas Spot Price. Available at https://www.eia.gov/dnav/ng/hist/rngwhhdd.htm (accessed date August 27, 2019).

Energy Information Administration. 2020a. How Much Carbon Dioxide is Produced per kilowatthour of U.S. Electricity Generation?. Available at https://www.eia.gov/tools/faqs/faq.php?id=74&t=11 (accessed date September 30, 2020).

Energy Information Administration. 2020b. Natural Gas Explained: Use of Natural Gas. Available at https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php (accessed date September 30, 2020).

Energy Information Administration. 2020c. Net Generation by State by Type of Producer by Energy Source. Available at https://www.eia.gov/electricity/data/state/ (accessed date March 17, 2020).

Energy Information Administration. 2020d. Table 11.1 Carbon Dioxide Emissions from Energy Consumption by Source. Available at https://www.eia.gov/totalenergy/data/browser?tbl=T11.01#/?f=A&start=1973&end=2019&charted=0 (accessed date September 30, 2020).

Environmental Protection Agency. 2020. Title V Petition Database. Available at https://www.epa.gov/title-v-operating-permits-title-v-petition-database (accessed date April 4, 2020).

Finkelman, R. B., L. Tian. 2018. The health impacts of coal use in China. *Int. Geol. Rev.* **60**(5–6): 579–589.

Fleischman, L., R. Cleetus, J. Deyette, S. Clemmer, S. Frenkel. 2013. Ripe for retirement: An economic analysis of the US coal fleet. *Electric. J.* **26**(10): 51–63.

Friedman, L. 2019. Michael Bloomberg Promises $500 million to Help End Coal. The New York Times (online edition). Available at: https://www.nytimes.com/2019/06/06/climate/bloomberg-climate-pledge-coal.html (accessed date August 27, 2019).

Georgallis, P., G. Dowell, R. Durand. 2019. Shine on me: Industry coherence and policy support for emerging industries. *Adm. Sci. Q.* **64**(3): 503–541.

Gimon, E., M. O'Boyle, C. T. M. Clack, S. McKee. 2019. The coal cost crossover: Economic viablity of existing coal compared to new local wind and solar resources. Energy Innovation. Available at: https://energyinnovation.org/wp-content/uploads/2019/04/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf (accessed date September 3, 2019).

Goyal, M., S. Netessine. 2007. Strategic technology choice and capacity investment under demand uncertainty. *Management Sci.* **53**(2): 192–207.

Grunwald, M. 2014. New Carbon Rules the Next Step in Obama's War on Coal. *time.com*. Available at https://time.com/

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ED_006623A_00000355-00024

EPA-HQ-2022-5321 5322



2806697/obama-epa-coal-carbon/ (accessed date September 6, 2019).

Grunwald, M. 2015. Inside the War on Coal: How Mike Bloomberg, Red-State Businesses, and a Lot of Midwestern Lawyers are Changing American Energy Faster than you Think. Available at https://www.politico.com/agenda/story/2015/05/inside-war-on-coal-000002 (accessed date December 13, 2018).

Hiatt, S. R., W. D. Sine, P. S. Tolbert. 2009. From Pabst to Pepsi: The deinstitutionalization of social practices and the creation of entrepreneurial opportunities. *Adm. Sci. Q.* **54**(4): 635–667.

Institute for Energy Economics. 2019. US Coal Plant Retirements to Top 10 GW in 2019-EIA. Available at http://ieefa.org/u-s-coal-plant-retirements-to-top-10gw-in-2019-eia/ (accessed date August 21, 2019).

Institute for Energy Research. 2016. The levelized cost of electricity from existing generation resources.

Intergovernmental Panel on Climate Change. 2018. Global Warming of 1.5°C: Summary for Policymakers. Available at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf (accessed date August 27, 2019).

International Energy Agency. 2018. Tracking Energy Transitions: Power Sector CO2 Emissions. Available at https://www.iea.org/tracking/ (accessed date August 20, 2019).

International Renewable Energy Association. 2017. Renewable power: Sharply falling generation costs.

Jewell, J., V. Vinichenko, L. Nacke, A. Cherp. 2019. Prospects for powering past coal. *Nat. Clim. Chang.* **9**(8): 592–597.

Kalkanci, B., M. Rahmani, L. B. Toktay. 2019. The role of inclusive innovation in promoting social sustainability. *Prod. Oper. Manag.* **28**(12): 2960–2982.

Kemp, J. 2016. Old and Worn Out, US Coal-Fired Power Plants Easy Prey for Gas. Reuters. Available at https://www.reuters.com/article/usa-coal-kemp/rpt-columnold-and-worn-out-u-s-coal-fired-power-plants-easy-prey-for-gas-kemp-idUSL8N1DF6DY (accessed date August 27, 2019).

Kirmani, S. N. U. A., R. C. Gupta. 2001. On the proportional odds model in survival analysis. *Ann. Inst. Stat. Math.* **53**(2): 203–216.

Knittel, C. R., K. Metaxoglou, A. Trindade. 2015. Natural gas prices and coal displacement: Evidence from electricity markets. Working paper, NBER No. 21627.

Kök, A. G., K. Shang, Ş. Yücel. 2020. Investments in renewable and conventional energy: The role of operational flexibility. *Manuf. Serv. Oper. Manag.* **22**(5): 925–941.

Kotchen, M. J., E. T. Mansur. 2016. Correspondence: Reassessing the contribution of natural gas to US $CO_2$ emission reductions since 2007. *Nat. Commun.* **7**: 10648.

Kraft, T., F. Erhun, R. C. Carlson, D. Rafinejad. 2013. Replacement decisions for potentially hazardous substances. *Prod. Oper. Manag.* **22**(4): 958–975.

Kutner, M. H., C. J. Nachtsheim, J. Neter, W. Li. 2005. *Applied Linear Statistical Models*, vol. 5. McGraw-Hill Irwin, Boston.

League of Conservation Voters. 2008–2016. National Environmental Scorecard Archives. Available at http://scorecard.lcv.org/scorecard/archive (accessed date December 12, 2018).

Li, S., D. Tirupati. 1994. Dynamic capacity expansion problem with multiple products: Technology selection and timing of capacity additions. *Oper. Res.* **42**(5): 958–976.

Linn, J., K. McCormack. 2019. The roles of energy markets and environmental regulation in reducing coal-fired plant profits and electricity sector emissions. *Rand J. Econ.* **50**(4): 733–767.

Maamoun, N., R. Kennedy, X. Jin, J. Urpelainen. 2020. Identifying coal-fired power plants for early retirement. *Renew. Sustain. Energy Rev.* **126**: 109833.

Manne, A. S., R. G. Richels, J. P. Weyant. 1979. Energy policy modeling: A survey. *Oper. Res.* **27**(1): 1–36.

Masse, P., R. Gibrat. 1957. Application of linear programming to investments in the electric power industry. *Management Sci.* **3**(2): 149–166.

Muller, N. Z., R. Mendelsohn, W. Nordhaus. 2011. Environmental accounting for pollution in the United States economy. *Am. Econ. Rev.* **101**(5): 1649–1675.

National Conference of State Legislatures. 2018. State Renewable Portfolio Standards and Goals. Available at http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx. (accessed date May 24, 2018).

Newell, R., D. Raimi. 2018. Despite Renewables Growth, there has Never been an Energy Transition. Available at https://www.axios.com/despite-renewables-growth-there-has-never-been-energy-transition-e11b0cf5-ce1d-493c-b1ae-e7dbce483473.html (accessed date August 17, 2018).

Oberschelp, C., S. Pfister, C. E. Raptis, S. Hellweg. 2019. Global emission hotspots of coal power generation. *Nat. Sustainab.* **2**(2): 113–121.

Orr, I., F. D. Palmer. 2018. *How Obama-era Regulations are Shutting Down Perfectly Good Power Plants*. The Heartland Institute, Illinois.

Pacheco, D., J. G. York, T. J. Hargrave. 2014. The coevolution of industries, social movements, and institutions: Wind power in the United States. *Organ. Sci.* **25**(6): 1609–1632.

Parker, G. G., B. Tan, O. Kazan. 2019. Electric power industry: Operational and public policy challenges and opportunities. *Prod. Oper. Manag.* **28**(11): 2738–2777.

Paz-Bailey, G., E. S. Rosenberg, K. Doyle, J. Munoz-Jordan, G. A. Santiago, L. Klein, J. Perez-Padilla, F. A. Medina, S. H. Waterman, L. E. Adams. 2018. Persistence of Zika virus in body fluids. *N. Engl. J. Med.* **379**(13): 1234–1243.

Powell, S. G., S. S. Oren. 1989. The transition to nondepletable energy: Social planning and market models of capacity expansion. *Oper. Res.* **37**(3): 373–383.

Rodriguez, G. 2010. Parametric survival models. Princeton University working paper.

Rudi, N., D. F. Drake. 2014. Observation bias: The impact of demand censoring on newsvendor level and adjustment behavior. *Management Sci.* **60**(5): 1334–1345.

Schiavo, J. G., R. Mendelsohn. 2019. The effect of domestic air pollution mitigation and fracking on retirements of coal power plants. *Clim. Chang. Econ.* **10**(2): 1.

Shimshack, J. P., M. B. Ward. 2005. Regulator reputation, enforcement, and environmental compliance. *J. Env. Econ. Manag.* **50**(3): 519–540.

Sierra Club. 2019. Sierra Club's Beyond Coal Campaign Reaches Major Milestones. Available at https://www.sierraclub.org/press-releases/2019/05/sierra-club-s-beyond-coal-campaign-reaches-major-milestones (accessed date August 21, 2019).

Sine, W. D., B. H. Lee. 2009. Tilting at windmills? The environmental movement and the emergence of the US wind energy sector. *Adm. Sci. Q.* **54**(1): 123–155.

Statista. 2020. U.S. Greenhouse Gas Emissions from Cement Production between 1990 and 2017. Available at https://www.statista.com/statistics/451804/green-house-gas-emissions-in-united-states-from-cement-production/ (accessed date September 30, 2020).

Storrow, B. 2019. And now the Really big Coal Plants Begin to Close. Available at https://www.scientificamerican.com/article/and-now-the-really-big-coal-plants-begin-to-close/ (accessed date October 2, 2020).

Tereyağoğlu, N., P. S. Fader, S. Veeraraghavan. 2017. Pricing theater seats: The value of price commitment and monotone discounting. *Prod. Oper. Manag.* **26**(6): 1056–1075.

Thomson Reuters. 2020. Westlaw EPA Title V Final Orders Database (accessed date April 7, 2020).

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EPA-HQ-2022-5321 5322



Tong, D., Q. Zhang, Y. Zheng, K. Caldeira, C. Shearer, C. Hong, Y. Qin, S. J. Davis. 2019. Committed emissions from existing energy infrastructure jeopardize 1.5°C climate target. *Nature* **572**: 373–377.

US Court of Appeals. 2008a. State of North Carolina v. Environmental Protection Agency, 05-1244, July 11, 2008. Available at https://law.justia.com/cases/federal/appellate-courts-cadc-05-1244-05-1244-1127017-2011-03-24.html (accessed date December 13, 2018).

US Court of Appeals. 2008b. State of North Carolina v. Environmental Protection Agency, 05-1244, December 23, 2008. Available at https://www.scdhec.gov/sites/default/files/docs/HomeAndEnvironment/Docs/CAIR_Remand_20081223.pdf (accessed date December 13, 2018).

US Court of Appeals. 2012. Environmental Protection Agency v. EME Homer City Generation, 11-1302. Available at https://www.cadc.uscourts.gov/internet/opinions.nsf/19346B280C78405C85257A61004DC0E5/$file/11-1302-1390314.pdf (accessed date December 13, 2018).

US Department of Energy. 2016. Windexchange: US Installed and Potential Wind Power Capacity and Generation. Available at https://windexchange.energy.gov/maps-data/321 (accessed date December 13, 2018).

US Department of Energy. 2017. Renewable Energy Data Book: Including Data and Trends for Energy Storage and Electric Vehicles. Available at https://www.nrel.gov/docs/fy19osti/72170.pdf (accessed date August 27, 2019).

US National Renewable Energy Laboratory. 2017. The Open PV Project. Available at https://openpv.nrel.gov/search (accessed date November 13, 2018).

US Supreme Court. 2014. Environmental Protection Agency v. EME Homer City Generation, 134 S.Ct. 1584 (2014). Available at http://www.scotusblog.com/case-files/cases/environmental-protection-agency-v-eme-homer-city-generation/ (accessed date December 13, 2018).

Verdolini, E., F. Vona, D. Popp. 2018. Bridging the gap: Do fast-reacting fossil technologies facilitate renewable energy diffusion? *Energy Pol.* **116**: 242–256.

Weber, K., K. L. Heinze, M. DeSoucey. 2008. Forage for thought: Mobilizing codes in the movement for grass-fed meat and dairy products. *Adm. Sci. Q.* **53**(3): 529–567.

Wolak, F. A. 2016. Assessing the impact of the diffusion of shale oil and gas technology on the global coal market. *Stanford University Working Paper*.

York, J. G., S. Venkataraman. 2010. The entrepreneur-environment nexus: Uncertainty, innovation, and allocation. *J. Bus. Ventur.* **25**(5): 449–463.

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Message

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**Sent:** 3/3/2021 10:33:03 AM
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**Subject:** FERC ready to take action on Texas power crisis

## FERC ready to take action on Texas power crisis

By Eric Wolff

03/03/2021 05:30 AM EST

Texas' second major power failures in a decade could spur FERC to take the rare step of ordering new reliability standards, experts say.

Despite FERC's limited authority in Texas, federal regulators could direct the North American Electric Reliability Corp. to develop those standards to force the state to mitigate the risks caused by extreme winter weather. And the commissioners could rely on their convening power to draw attention to the shortcomings in Texas to push state regulators to take stronger measures to protect the grid after the February freeze that left 4.4 million Texans without power for days and triggering comparisons to the 2011 cold snap that also caused massive generation failures.

FERC and NERC issued a report on the need for new winterization standards after the 2011 problems, but neither the state nor the federal government imposed new requirements. This time around, FERC Chair Rich Glick vowed the commission will take action even though it can't regulate the power market managed by the Electric Reliability Council of Texas.

But there is plenty of room for the federal government to act, experts agree.

"Chairman Glick is signalling that he's open to ordering NERC to develop a standard on generators' winterization," said Jeff Dennis, general counsel for Advanced Energy Economics, a clean energy advocate and a former adviser to FERC during the 2011 crisis. "That was shown a gap in the reliability standards in the 2011 report. No state has standards. There are no regional standards. He's been signaling early on, he's been looking at that gap."

FERC and NERC promised an investigation last month even before the lights in Texas were back on. Although the Federal Power Act prevents the commission from touching Texas' isolated market for power sales, it does give FERC the authority to order NERC — which is run by the power industry to develop standards — to make new reliability rules mandatory, rather than voluntary as the 2011 report was.

"The 2011 event was a sentinel signal, and we didn't heed it," said Becky Klein, a former ERCOT board member and former chair of the Public Utility Commission of Texas. "I think that one aspect was this was a low probability event to occur again, even though it was high risk. The other reason was that there was some speculation that the market would take care of itself."

Texas does not operate a capacity market like the ones in PJM Interconnection or ISO-New England, which pay generators to make power plants available years into the future. Instead it relies on an energy-only market that allows power prices to skyrocket up to a $9,000 per megawatt-hour cap to motivate generators to be ready for spikes in power demand, which in Texas typically happen in the summer. During the deep freeze, the market hit the cap for days, but no amount of profit motive could restore critical generation that was unprepared for the cold.

In February, Glick discussed potential actions by the commission and the importance of ensuring that "the results of the inquiries don't just sit on the shelf gathering dust."

"I am prepared, if necessary, to support the imposition of new mandatory standards to make sure that electric generators and others are better prepared when weather strikes the next time," he said during an open meeting that month.

FERC cannot investigate what happened to power prices in Texas, but it promised an investigation into market manipulation across the Midwest and South, both of which had their own, more moderate, power problems that same week. And it can probe how shipments of natural gas from Texas were disrupted by winter freeze.

"Under Natural Gas Act authority, to the extent anything was happening in the interstate natural gas markets, FERC would have authority to look into that in Texas," said Ari Peskoe, director of the Harvard University Electricity Law initiative.

Peskoe added that FERC also has a certain amount of soft power to push Texas to do more to protect its grid.

"FERC has its convening power as well. Even though it doesn't have jurisdiction over market rules or planning, it could hold technical conferences to shed more light, once it has more information," he said.

Other federal agencies may also get involved. The Commodity Futures Trading Commission and FERC worked out how to resolve overlapping jurisdiction in a 2014 Memorandum of Understanding that allows the CFTC to dig into any potential problems in futures and swaps trading that happened during the power crisis.

"We are monitoring irregularities in the Texas energy markets following last week's freeze, specifically where there is a federal nexus with CFTC regulated markets and listed products," acting Chair Rostin Behnam said at the commission's meeting last week. "We remain prepared to do whatever is necessary to protect the integrity of our markets."

And Congress plans to get involved. Rep. Ro Khanna (D-Calif.), who chairs the environment subcommittee of the House Oversight Committee, and Sen. Joe Manchin (D-W.Va.), chair of the Energy Committee, both promised hearings into the crisis.

Congress can also provide more long-term solutions. President Joe Biden's much-anticipated infrastructure bill is expected to include funding to promote transmission construction that could help relieve bottlenecks in Texas. And Sen. John Cornyn (R-Texas) plans to introduce a bill this month that would require federal funds be available to help southern states, which are typically ill-prepared for snow and cold weather, to winterize their power infrastructure.

"What we intend to do is to introduce legislation here in Washington that will create a program within the Department of Energy that will provide grant funding to states like Texas for preparing their grid for extreme weather situations through formula grants," he told Texas reporters last month. "This legislation that I'm now talking about introducing will create a separate grant program designed specifically so states like Texas, including Texas, won't be caught flat-footed by another storm like this."

Klein and others from Texas have no objection to a federal infusion of cash but bristle at the idea of new rules from FERC or another federal body, or calls like those from Energy Secretary Jennifer Granholm suggesting Texas should interconnect with the rest of the U.S. grid to improve its reliability.

"There are other parts of the country under FERC jurisdiction that have had problems with reliability," said former FERC commissioner Bernard McNamee, who was raised in Texas.

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**CC:** Vizcarra, Hana V. [hvizcarra@law.harvard.edu]
**Subject:** Week One Executive Orders in depth, new analysis from Harvard

Hello from EELP,

This week we published a new resource analyzing President Biden's first week flurry of executive orders (EOs) focused on environmental issues and climate change. Our new report, Biden's Week One: Mapping Ambitious Climate Action, connects the instructions in the EOs to the current state of play on the relevant topics and explains what this means for the corresponding agencies' work.

The report organizes the directives given in eight executive orders and presidential memoranda issued in the first week of Biden's presidency (and related statements) by topic area, so you can easily see how they will impact energy development (fossil fuels and renewables), science in rulemaking, greenhouse gas regulation, and public lands protections, among other topics.

The concrete impacts of these executive actions on different topic areas aren't always obvious at first glance. Topics like environmental justice and the hidden impacts of revoking Trump EOs on disaster resilience have had less coverage in relation to these executive orders. In our report, we assess not only the explicit instructions given agencies but also how the president's revocation of prior orders will impact environmental regulation. We have built on our extensive knowledge of environmental and energy regulation over the last four years to explain the context in which the agencies will carry out these directives.

To augment the analysis, we've built two charts—one listing the Trump executive orders revoked by President Biden's week one directives, the other showing the deadlines these directives set for agencies, working groups, and task forces.

We hope this report helps you untangle and understand the numerous effects of these first Biden environmental orders and track agency actions in response. Please reach out if you have any questions or if we can help you use this information in your reporting.

Please contact staff attorney Hana Vizcarra, one of our co-authors (and cc'd on this email), for any follow-up at hvizcarra@law.harvard.edu.

Warmly,
Robin

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**Subject:** Daily News Clips: Afternoon Edition 3/25/2021

**Daily News Clips - Afternoon Edition**
**March 25th, 2021**

**Administration**

- Dino Grandoni, Washington Post, **Congressional Democrats aim to reinstate rules on methane gas emissions from oil and gas works**
- InsideEPA, **Biden Administration Shows Early Support For Industry Ship GHG Plan**
- TTNews, **Coalition Asks Biden Administration to Reduce Truck Emissions by Fall 2022**
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**Congressional Democrats aim to reinstate rules on methane gas emissions from oil and gas works**
Democrats want to require companies to monitor their pipelines for leaks of the potent greenhouse gas - and fix them fast
March 25, 2021

BY: DINO GRANDONI

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**https://www.washingtonpost.com/climate-environment/2021/03/25/climate-methane-regulation/?utm_source=rss&utm_medium=referral&utm_campaign=wp_climate-environment**

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Democrats on Capitol Hill are aiming to swiftly reinstate Obama-era rules designed to rein in the emission of methane from the nation's oil and gas industry.

Senate Majority Leader Charles E. Schumer (D-N.Y.) announced Thursday he is backing an effort to restore Environmental Protection Agency requirements meant to fix leaks of the potent greenhouse gas from new wells, pipelines and other equipment that were watered down by the Trump administration, with a floor vote planned for April. On the other side of the Capitol, House Democrats led by Rep. Diana DeGette (D-Colo.) are set to introduce a companion resolution this week.

"Time is of the essence in this fight to combat the climate crisis," DeGette said. "If we're serious about wanting to stave off the worst effects of climate change before it's too late, then we absolutely have to take steps now to reduce the amount of methane that's being released into our atmosphere."

Congressional Democrats want to take advantage of the Congressional Review Act, which allows Congress to overturn what it sees as objectionable rules completed in the waning days of the outgoing administration without having to go through a cumbersome rulemaking process.

This would be the first time Congress has turned to the Congressional Review Act to undo a rule under a Democratic president. The Trump administration used the 1996 law, the brainchild of former GOP House speaker Newt Gingrich, to reverse more than a dozen rules issued by the Obama administration on a wide variety of issues, including water pollution, worker safety and online privacy.

The effort is a part of a broader, government-wide plan forming under President Biden to tackle global warming and meet his goal of eliminating the country's contributions to climate change by the middle of the century.

The United States is planning to unveil next month a new target for cutting climate-warming emissions and prod other nations to do the same under the Paris climate accord, which is designed to keep the Earth from warming by an average of more than 1.5 degrees Celsius. The planet is already 1 degree Celsius warmer than preindustrial levels, and a Washington Post analysis found roughly one-tenth of the globe has already warmed by more than 2 degrees Celsius. "When it comes to steps we can take to address climate change, limiting methane emissions is the low-hanging fruit," said Sen. Sen. Angus King (I-Maine), who is introducing the resolution with Sen. Martin Heinrich (D-N.M.) in the Senate.

But the effort to compel the oil and gas industry to curb methane emissions comes at a time when the industry is already feeling squeezed by the Biden administration's efforts to pause the sale of drilling rights and halt the construction of the Keystone XL pipeline.

Even so, the American Petroleum Institute, the largest oil and gas lobbying group in Washington, says it wants to work with Congress and the Biden administration to shape any regulations going forward, noting that the more methane is captured, the more gas it can sell.

"We have an opportunity to build on the progress the industry has made in driving down methane emissions through technological advancement and cost-effective government policies," said Frank Macchiarola, the group's senior vice president of policy, economics and regulatory affairs.

If passed, the resolution would restore requirements on companies to check for methane leaks from pipelines, storage tanks and other equipment installed after 2015 every six months — and plug them within 30 days once detected.

Environmental advocates say preventing such seepage is crucial for the United States to meet its climate goals. Over a 20-year period, the gas has 84 times the global warming power of carbon dioxide.

The energy sector is the country's largest source of methane emissions. In 2018, U.S. oil and gas companies emitted enough methane into the atmosphere to equal of warming effect of 175 million metric tons of carbon dioxide, according to the EPA.
David Doniger, senior strategic director of the climate and clean energy program at the Natural Resources Defense Council, called the Trump administration's rollback "a free pass for America's oil and gas companies to keep leaking."

"Congress could quickly erase an appalling rollback," he added. "This is big."

The move by congressional Democrats would also open the door to the EPA writing even more expansive rules targeting errant methane emissions from older equipment built before 2015, which tends to be leakier. On his first day in office, Biden ordered the EPA to write comprehensive standards for curbing methane leaks from existing oil and gas infrastructure by September.
When the Trump administration whittled down some of those surveillance responsibilities last August, officials argued the rules it rolled back were redundant, boasting the action would save the industry "millions of dollars in compliance costs each year."

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**Biden Administration Shows Early Support For Industry Ship GHG Plan**
March 25, 2021

**https://insideepa.com/weekly-focus/biden-administration-shows-early-support-industry-ship-ghg-plan**

The Biden administration is offering early support for a revised plan by a U.S.-based shipping sector body for an industry-funded research organization to develop new low-carbon options for fueling ships, a category of mobile sources for which EPA has not yet set greenhouse gas standards compared to other regulated sources such as cars and aircraft.

Under the plan developed by the World Shipping Council (WSC), which represents much of the world container shipping sector, shipping companies would jointly fund the $5 billion venture to develop alternatives to fossil fuel propulsion, as the sector searches for ways to dramatically cut its GHG emissions.

The fund would be overseen by the U.N. International Maritime Organization (IMO), of which the United States is a member, and would require approval by IMO's maritime environmental protection committee (MEPC) and ultimately the IMO's 174 member states for a modification of the International Convention for the Prevention of Pollution from Ships (MARPOL).

An industry source says that in initial talks, the Biden administration has appeared "fully supportive" of the plan. IMO talks are conducted primarily by the State Department, although mobile source emissions reductions also fall within EPA's jurisdiction.

EPA has, for example, introduced domestic regulations to fulfill U.S. commitments to the IMO to use ultra-low sulfur fuels within an emissions control area (ECA) close to the North American coast, and to limit air emissions from U.S-based shipping. The agency has also promoted voluntary programs to cut GHGs in U.S. ports, and funded measures to achieve such reductions.

The agency has listed as a priority a review of Trump-era Clean Air Act rules setting first-time GHG standards for aircraft, after strong criticism from environmentalists that the Trump standards merely preserve the status quo. However, the Biden administration has so far not announced major new climate initiatives for ships.

The United States and other members of the IMO have agreed to halve the global shipping industry's GHG emissions by 2050, relative to 2008 levels, but achieving this will require entirely new fuels, going beyond the energy efficiency and design improvements that IMO countries have so far agreed, sources say.

The WSC proposal would establish an International Maritime Research and Development Board (IMRB) to oversee the new fund that would pay research institutions and technology developers -- but not shipping companies -- to develop innovative new technologies. The new version is proposed at IMO by Georgia, Greece, Japan, Liberia, Malta, Nigeria, Palau, Singapore, Switzerland and a number of shipping organizations.

**Research Proposal**

Unlike the original proposal, the modified research plan would dedicate a portion of the funding expressly for small island developing states (SIDS) and least developed countries (LDCs) to assist their efforts to curb global warming. It further specifies that the new fund should be governed within IMO, not a separate non-government organization.

The leading fuel options to reduce GHGs from ocean-going ships are ammonia and hydrogen, which present a series of challenges, but other options include biofuels and liquefied natural gas (LNG) as a "bridge" to zero-carbon fuels. Batteries, and electric power supplied from shore while ships are in port, might also play a much larger role in the future. Smaller vessels such as ferries traveling shorter distances may also widely adopt electric propulsion.

The IMO Feb. 9 and 10 hosted **an international symposium** on fuel options, at which international shipping companies and trade groups debated different technologies. While ammonia and hydrogen featured as possible fuels for the long-term future, several speakers saw LNG as a medium-term option to reduce emissions, or as part of a mix with other technologies such as batteries to produce hybrid solutions.
Hydrogen, which is explosive, and ammonia, which is poisonous, currently lack the required fuel distribution infrastructure, safety equipment and industry safety protocols for widespread use, the shipping sector source says. Hydrogen may be more promising in the long run than ammonia, if safety concerns can be mitigated, the source says.

Hydrogen and ammonia offer better low- or zero-carbon fuel options for the future than LNG, which continues to have a significant GHG footprint, the source adds.

Also, several presenters at the IMO symposium offered presentations on the benefits of biofuels, although the shipping industry source says these are also not credible as a long-term option. "There are few biofuels that even come close to carbon neutrality," says the source, adding that the biofuels with the greatest GHG reduction potential also "have inherently limited supply." -- *Stuart Parker* (**sparker@ipwnews.com**)

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## Coalition Asks Biden Administration to Reduce Truck Emissions by Fall 2022

March 25, 2021

https://www.ttnews.com/articles/coalition-asks-biden-administration-reduce-truck-emissions-fall-2022

A wide-ranging coalition of business, science and environmental groups is calling on the Biden administration to within the next 18 months set "multi-pollutant climate and clean air standards" that will eliminate particulate matter, oxides of nitrogen and greenhouse gas emissions from new freight trucks and buses.

"We urge your administration to adopt pollution standards by fall of 2022, eliminate the smog-forming nitrogen oxides, deadly particles and climate pollution from freight trucks and buses that are based upon, and fully mobilize, the availability of zero-emitting solutions," said a letter to President Joe Biden, dated March 23.

The Natural Resources Defense Council, Environmental Defense Fund, Union of Concerned Scientists, Interfaith Power & Light, League of Conservation Voters, American Council for an Energy Efficient Economy and the California Business Alliance for a Clean Economy were among the 17 groups signing onto the letter.

Coalition Clean Air Letter by Transport Topics
Copies of the letter also were sent to a range of top Environmental Protection Agency officials, including recently confirmed EPA Administrator Michael Regan.

Truck pollution standards should eliminate pollution from all new freight trucks and buses no later than 2040, and from freight trucks and buses used in urban and community areas no later than 2035, the letter said.

A recent analysis by the Environmental Defense Fund showed that pollution standards that achieve the groups' goals would prevent 57,000 premature deaths and eliminate more than 4.7 billion metric tons of climate pollution by 2050, according to the letter.

"Pollution from freight trucks and buses is concentrated in low-income communities and communities of color," the letter said. It said "protective standards are essential in order to address that disproportionate impact."

"What we're trying to get across is that we want to ensure that the Biden administration gets a multi-pollution standard that will get us on a trajectory of electrifying trucks," Katherine Garcia, deputy director for national policy for the Sierra Club, told Transport Topics. "We're seeing a number of states that are working to adopt an advanced clean trucks rule. I think that is really sending a signal to the Biden administration that it needs to act on cleaning up trucks."

Added Glen Kedzie, energy and environmental affairs counsel for American Trucking Associations: "The trucking industry is extremely proud of the historical progress we have made over the past two decades in reducing our nitrogen oxide and particulate matter emission footprints to near-zero levels on all new trucks entering the marketplace. In addition, we worked closely with both the EPA and The National Highway Traffic Safety Administration in finalizing first-ever fuel consumption and greenhouse gas standards for new trucks, engines and trailers which took effect beginning in 2014 with progressive and stringent implementation milestones through 2027.

"Trucking considers environmental stewardship as one of our top priorities," Kedzie continued. "As such, ATA will continue to work with the federal government and states to ensure that the next generation of clean technology vehicles on the horizon will be commercially available for all diversified trucking applications, economically affordable, thoroughly tested, and not impair the movement of our nation's goods."

Peter Zalzal, senior counsel for the Environmental Defense Fund, told TT, "We see a real opportunity with the increasing availability of zero-emitting solutions in the medium- and heavy-duty space right now. And we see even more on the horizon that are capable of reducing a full suite of pollution from medium- and heavy-duty vehicles. We think standards should fully leverage that."

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**Biden's Environmental Agenda in Bull's-Eye for Red State AGs**
March 25, 2021

BY: ELLEN M. GILMER

https://news.bloomberglaw.com/environment-and-energy/bidens-environmental-agenda-in-bulls-eye-for-red-state-ags

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Environmental policy has emerged as a primary target for conservative attorneys general looking to keep the Biden agenda in check, the latest battleground in a long-running conflict over the scope of federal regulation.

Republican-led states have filed a half-dozen lawsuits against the administration so far, with the three biggest actions focused on the White House's energy and climate policies.

Legal observers say the new administration isn't likely to repeat the types of regulatory missteps that earned early legal rebukes for Trump-era policies. But Biden's ambitious policy goals on climate change and environmental justice could nonetheless provide ample legal fodder for challenges.
The latest of those cases arose Wednesday as Louisiana and 12 other states sued the Biden administration over a federal oil and gas leasing pause, while Wyoming filed its own case. Earlier in the month, Texas led a 21-state coalition in a challenge to President Joe Biden's decision to block the Keystone XL pipeline, and Missouri and 11 others sued over the administration's reworked metric for climate impacts. Those are the first multistate coalition lawsuits filed against Biden.
"This is a strong indicator that we will see aggressive litigation from Republican AGs challenging the Biden administration's climate and air regulations," said Hana Vizcarra, a staff attorney at Harvard Law School's Environmental and Energy Law Program.

Republican attorneys general have promised as much, saying energy and environmental issues are top priorities as they challenge what they see as executive overreach from the Biden team in a number of areas, including immigration and pandemic relief.
Georgia Attorney General Chris Carr, chairman of the Republican Attorneys General Association, told Bloomberg Law he's prepared to push back on the administration "using environmental causes as political symbolism and not recognizing the real-world impacts that they have."

Biden's day-one decision to scrap a key permit for Keystone XL is a prime example, he said. Georgia signed on to last week's pipeline lawsuit saying Biden exceeded his authority.

**'Doesn't Bode Well'**

The early focus from Republican attorneys general on environmental policy tracks with state officials' longtime involvement in those issues, said Marquette University professor Paul Nolette, who studies state AGs.

The Clean Air Act and other anti-pollution statutes have interstate "conflict that was built into the system," he said, fueling multistate lawsuits going back to the Reagan administration.

Democratic attorneys general were especially active on pollution and energy issues during the Trump administration. Out of a record 157 multistate lawsuits challenging federal policies, about half focused on environmental issues and resulted in repeated victories for states, according to Nolette's data.
States fighting the Biden administration might not see the same level of success, as many of the early wins against Trump were attributed to rushed agency efforts to sideline Obama-era policies.

"It's not clear right now that the Biden administration is going to cut corners in the same way," said Bethany Davis Noll, executive director of New York University's State Energy & Environmental Impact Center. The center has received funding from Bloomberg Philanthropies, the charitable organization founded by Michael Bloomberg. Bloomberg Law is operated by entities controlled by Michael Bloomberg.

Republican state officials aren't necessarily looking to match their Democratic counterparts on the volume of cases filed, Carr said, but "we're not going to hesitate when something is legally or constitutionally wrong."

Montana Attorney General Austin Knudsen, a Republican who took office in January, said Biden's early flurry of executive actions on Keystone XL and climate change suggest Montana will have a busy few years litigating federal natural resources policies—a critical issue for a state rich in coal, oil, and gas.

"When he does stuff like this on day one, it doesn't bode well," Knudsen said in an interview.

**Future Battles**

But state AGs' most significant legal work against the new administration likely will come later in Biden's presidency, as the Environmental Protection Agency, Interior Department, and other agencies revamp Trump-era regulations or issue new ones.

Top targets include the EPA's future efforts to reduce greenhouse gas emissions from the power and transportation sectors, as well as the agency's approach to Clean Water Act jurisdiction.

"I expect we'll see heated battles by the red-state AGs to most of the environmental initiatives that the Biden administration intends to undertake," said Crowell & Moring LLP attorney Thomas A. Lorenzen, a former Justice Department lawyer.

Republican attorneys general have a history of collaboration to guide their work, said Hunton Andrews Kurth lawyer Matthew Z. Leopold, a former Florida Department of Environmental Protection lawyer who often partnered with the state AG's office in that role.

During the Obama years, Republican AGs launched coordinated attacks that blocked the Bureau of Land Management's hydraulic fracturing rule, stalled the EPA's water jurisdiction interpretation in some states, and forced the EPA to study the costs of its mercury and air toxics standards for power plants. Their biggest victory came in 2016, when the U.S. Supreme Court froze the EPA's Clean Power Plan after more than two dozen states challenged it.

"It was really important to make sure that everyone spoke with one voice," said Troutman Pepper lawyer Misha Tseytlin, who was Wisconsin's solicitor general from 2015 to 2018 and helped challenge the EPA climate rule.

An array of factors, including legal strategy and judges, will affect Republican AGs' success against the Biden agenda. But what may matter most is the substance of the new administration's actions, Case Western Reserve University law professor Jonathan H. Adler said.

Federal officials will have to balance their desire for bold environmental action against the reality that many courts are skeptical of any novel use of an agency's authority, he said.

"A lot really depends," Adler said, "on how much the Biden administration thinks about and accounts for the legal vulnerabilities of different sorts of strategies."

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## District court finalizes contested EPA air deal with Indiana utility

March 25, 2021

**https://insideepa.com/daily-feed/district-court-finalizes-contested-epa-air-deal-indiana-utility**

A federal district court in Indiana has given final approval to a Trump-era consent decree between EPA and an Indiana electric utility that provoked opposition from environmentalists because it allows the company to avoid installing near-term emissions controls by closing electric generating units (EGUs) already scheduled to retire.

The U.S. District Court for the Southern District of Indiana entered the decree March 23 in *United States of America, et al., v. Indianapolis Power & Light Company (IPL)*, finalizing **an agreement proposed Aug. 31** to resolve a longstanding enforcement action by EPA and Indiana state regulators over alleged Clean Air Act infractions dating from 2008, 2015 and 2016 at the firm's Petersburg plant in Pike County, IN.
The case involves a variety of alleged violations of Clean Air Act new source performance standards, Title V and new source review air permit terms, as well as the Indiana state implementation plan for complying with the air law.

The consent decree aims to significantly reduce air pollutants including sulfur dioxide, nitrogen oxides, particulate matter and sulfuric acid mist.
It requires IPL to install selective non-catalytic reduction (SNCR) on one of the plant's EGUs, upgrade its sulfuric acid mitigation system and optimize use of existing controls. The decree also requires IPL to pay a civil penalty of $1.525 million, of which $925,000 will go to the United States and $600,000 to Indiana.

But the decree also gives IPL the option to avoid installing the expensive SNCR controls if it closes two generating units at the plant by July 2023.

This provision spurred one environmentalist to label the deal "just for show," because it does not require sufficiently stringent emissions cuts, saying the decree looks like a "sweetheart" deal.

"For example, it doesn't require retirement of any units. It requires SNCR, rather than [selective catalytic reduction, (SCR)], with SNCR being much cheaper but much less effective, for Petersburg Unit 4. But even then, it lets them off the hook for that if Petersburg 1 and 2 are retired," the source says, noting that those units are already slated for retirement and so the decree merely codifies plans the utility already had in place.

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**EPA Publishes Advance Notice of Proposed Rulemaking in Preparation for Crafting PFAS Effluent Limitations Guidelines**
March 25, 2021

**https://www.jdsupra.com/legalnews/epa-publishes-advance-notice-of-4033648/**

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On March 17, the U.S. Environmental Protection Agency (EPA) published an Advance Notice of Proposed Rulemaking (ANPRM) that puts forth 28 questions directed at manufacturers and formulators of per- and polyfluoroalkyl substances (PFAS). The agency intends to use the ANPRM and comments it receives to initiate formal rulemaking to establish effluent limitations guidelines (ELGs) for facilities that manufacture or blend PFAS with other chemicals or products, likely at least initially as an amendment to the existing guidelines governing the "Organic Chemicals, Plastics and Synthetic Fibers" (OCPSF) industrial sector.

ELGs are sector-specific wastewater discharge limits based on the degree of pollutant reduction that can be achieved through demonstrated treatment technologies and controls taking into account feasibility, cost, and other factors. They can only be established through extensive notice-and-comment rulemaking and require significant technical and economic administrative record support. EPA is required to consider updates to existing ELGs or identify new industrial discharge categories potentially in need of control as part of its ongoing review obligations under the Clean Water Act. ELGs are incorporated into National Pollutant Discharge Elimination System (NPDES) permits for the covered sources. The OCPSF sector currently includes, among other industries, manufacturers of PFAS. Note, however, that formulators of PFAS are not necessarily included within the existing OCPSF sector. Formulators are facilities that take raw PFAS feedstock and integrate the chemicals into new commercial products or intermediate products that are subsequently used in other consumer products. As a result, the data EPA gathers under this ANPRM may be used to revise other ELGs or create a new ELG category or subcategory. It is also likely that EPA will continue to evaluate the need for PFAS ELGs for other significant end-user sectors, such as commercial airports, textile and carpet manufactures, pulp and paper facilities, and other manufacturing sectors.
The ANPRM follows EPA's January 11 release of its latest "ELG Plan," where it announced it would be seeking new data to draft a PFAS ELG rule. Addressing PFAS in water has been a priority at EPA over the past several years, but after undertaking a multi-industry study on PFAS use, treatment, and discharges, the agency appears to be acknowledging that it currently lacks the data it needs to immediately move into a formal rulemaking process. The ANPRM should fill some of the information gaps EPA currently has on industrial sources of PFAS discharges, as well as the types and concentrations of the PFAS compounds contained in the discharges. Additionally, EPA may gain additional information regarding the number and locations of industrial sites that use PFAS, including the identities of known PFAS formulators and manufacturers. Thus far, the ANPRM has preliminarily identified six PFAS manufacturing sites and 10 possible PFAS

formulators, but EPA expects these numbers to change. EPA may also seek to use other information gathering authorities to supplement the information it receives through the ANPRM process.
EPA also seeks information related to how PFAS manufacturers and formulators treat, manage, and dispose of PFAS-contaminated wastewater. To that end, EPA is requesting that wastewater monitoring data be accompanied by information on the analytical methods used by the manufacturers and formulators, in addition to information regarding any existing treatment systems currently deployed to limit discharges to surface waters or wastewater treatment plants. This information helps EPA determine whether it needs to move forward with a formal ELG process for particular source categories, and whether existing controls can achieve meaningful pollutant reductions. Industry frequently engages with EPA at this stage to ensure that EPA is acting on accurate information and is not simply regulating based on the perception of need. Importantly, EPA is also requesting data on any PFAS compounds detected in wastewater — not just the PFAS compounds that may already be monitored through individual NPDES permit requirements.

While this advance notice serves as an acknowledgement that EPA may currently lack the data it needs to set sector-specific standards, it does serve as a harbinger of regulations to come under the new administration. And while EPA is only in the advance stages of rulemaking, EPA will continue to work with its regions and states on strategies for monitoring and then regulating individual discharges of PFAS through the NPDES permit program. That this notice was a continuation of a Trump administration initiative under its PFAS Action Plan also speaks volumes about the level of bipartisan support targeted PFAS regulation currently has in the executive branch, on the Hill, and at the state and local community level. That support is expected to grow over the next few years.

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**EPA Report Identifies Hot Spots for Hazardous Spills Into Drinking Water Sources**
Agency finds "significant risk" nationally for toxic emergencies.
March 25, 2021

BY: BRETT WALTON

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**https://www.circleofblue.org/2021/world/epa-report-identifies-hot-spots-for-hazardous-spills-into-drinking-water-sources/**

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The morning of January 9, 2014, regulators at the West Virginia Department of Environmental Quality received complaints of strange odors akin to licorice coming from the Freedom Industries chemical storage facility, in Charleston.

When inspectors arrived on site, they found two holes at the bottom of tank 396. The holes, no wider than a nickel, allowed about 11,000 gallons of crude MCHM, a coal washing chemical, to flow into the adjacent Elk River.

Less than two miles downstream of the spill was the intake for West Virginia American Water, the operator of Charleston's drinking water system. Owing to confusion about the nature of the chemical, crude MCHM slipped into the utility's distribution network, resulting in 300,000 residents in nine counties being told not to use their tap water. The do-not-use order, for some residents, lasted nine days.

The Freedom Industries spill is one of many incidents detailed in a new U.S. Environmental Protection Agency report that is the most comprehensive assessment to date of the number, location, and characteristics of chemical and toxic spills into U.S. drinking water sources.
Using a combination of federal data sets covering the years between 2010 and 2019, the assessment found 3,931 incidents of toxic spills into groundwater, rivers, or lakes used for drinking water. The spills occurred in the vicinity of 15 percent of the country's drinking water intakes that draw from surface water but in less than 1 percent of groundwater wells.

"The findings from this study demonstrate there is a significant risk of releases into sources of drinking water at a national scale," according to the report. "However, the risk to a community water system will depend on their unique circumstances."

The EPA did not make the report author available for an interview but the agency noted in a statement that the risk of contamination varies across individual water systems.

Outside experts said that the report is an important contribution to understanding contamination risks to drinking water.

"I don't think there's ever been an aggregation of the data in this manner before," Kevin Morley of the American Water Works Association, an industry group, told Circle of Blue.

Spills occurred in every state, but certain regions exhibited more failures. The largest number of incidents were concentrated around transportation routes, mining and drilling sites, and industrial hubs. Those areas include the Ohio River Valley, Mississippi Delta, Los Angeles area, oil and gas belts of Oklahoma and Texas, and Interstate 95 corridor in the Northeast.

States with the most incidents were Texas (303), California (244), Oklahoma (236), Louisiana (205), and Pennsylvania (169). Osage County, Oklahoma, an oil and gas hub, alone accounted for 117 incidents.

More than half the incidents were small, meaning spills of less than 1,000 gallons. Large spills like the release of millions gallons of coal waste into the Dan River in North Carolina in 2014 were infrequent.

Equipment failures (27 percent) were the leading cause of spills, and private industry was most often the responsible party.

Out of the 840 hazardous substances that were documented in the decade of spills, more than half the incidents were related to discharges of refined oil.

These details add up to a clearer picture of risks to drinking water, said Alan Roberson, the executive director of the Association of State Drinking Water Administrators.

"The idea is that utilities will be better informed about what's upstream," Roberson told Circle of Blue.

**Assessing Risks**

Congress, in 2018, passed the America's Water Infrastructure Act. Several provisions in the act were in response to the Freedom Industries spill and were intended to provide community water systems with more information about threats to drinking water, like the tanks of crude MCHM sitting upstream from Charleston.
West Virginia American Water knew that the chemical storage tanks were a risk. But the utility did not know what chemicals they stored, according to the U.S. Chemical Safety and Hazard Investigation Board.

The America's Water Infrastructure Act was designed to lift that ignorance. The act allows community water systems to access hazardous chemical data collected under federal law that previously had been available mostly to fire departments and emergency responders. The act also requires that water systems receive prompt notice of a spill.

The report recommends that utilities use the powers granted by the 2018 act to catalog facilities that could prompt an emergency and identify the chemicals they use. Then utilities should make contact with facility owners to establish lines of communication for direct contact during an emergency. Utilities should identify labs that can test for the chemicals in question. They should plan how to protect an intake and whether their treatment process can remove hazardous materials that might be spilled.

"It's all about the time," Morley explained. "The more time, the more options I have." Instead of scrambling to learn the characteristics of a spilled substance and reacting on the spot, utilities can write those details into emergency response plans that the 2018 act also requires.

The EPA said it briefed national water associations on the report and shared its findings to utilities via webinars and conferences.

The report examined spills that were reported to the National Response Center, a clearinghouse, between 2010 and 2019. The report includes spills that occurred in waters used as a drinking water source for community water systems serving more than 1,000 customers. For systems using surface water, the "zone of concern" extended 50 miles upstream and a quarter mile downstream of a drinking water intake. For groundwater systems, the zone was a half-mile radius around a well. Spills of less than 100 gallons were excluded from the analysis, except in the case of arsenic, cyanide, pesticides, and other highly toxic materials.

The report is useful in other ways, Morley said. It demonstrates that this sort of risk analysis — combining the locations of chemical facilities and drinking water intakes and wells — is possible for other laws like the Toxic Substances Control Act and Clean Water Act that require similar spatial assessments.

"This shows that EPA does have the capability," Morley said.

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**Environmentalists Eye 'Damning' Records To Support TSCA Reversals**
March 25, 2021

**https://insideepa.com/daily-news/environmentalists-eye-damning-records-support-tsca-reversals**

Environmentalists say newly released emails between Trump EPA toxics officials and industry figures show a "damning" level of coordination between the agency and regulated entities, which they hope will in turn help convince the Biden administration to undo its predecessor's policies.

In a recent interview with *Inside TSCA*, environmental attorney and former EPA official Bob Sussman said the correspondence, which deals with several aspects of the Toxic Substances Control Act (TSCA) new chemicals program including model language for consent orders, individual compliance actions and possible rulemaking that was a subject of internal debate at the time, is "pretty revealing, and unfortunately pretty damning."

And Anita Desikan, a research analyst for the Union of Concerned Scientists (UCS), said her group was "so shocked" by the details revealed in the unearthed emails.

"Sadly, it just seems to correspond to the many things that we've been seeing with other issues involving TSCA" during the Trump administration, she said.

The emails, which were first publicized by Environmental Defense Fund (EDF) senior scientist Richard Denison in **a March 11 blog post**, show EPA officials in ongoing contact with industry attorneys and trade associations, as they crafted individual consent orders for new chemical uses, developed model language for such orders, and considered whether to overhaul the program's framework regulations.
In general, Sussman said, the documents show a lack of transparency under the Trump EPA that further calls into question several Trump-era decisions environmentalists have already urged the Biden administration to rescind or re-evaluate.

Sussman said one set of documents in particular caught his eye -- emails between EPA and industry players that showed the agency had solicited comments about changes to model language for TSCA Section 5(e) pre-manufacture notice (PMN) consent orders prior to any public announcement that changes were even possible.

"The public never knew that EPA was redrafting the order until it was done and posted on the website," Sussman said. He continued that at the time he and other environmentalists had written a letter to EPA asking why the agency did not solicit their input, to which he says officials replied that the changes were very minor and not substantive.

"But then it turns out that industry lawyers and trade associations were submitting pages and pages of comments and suggestions," Sussman said. "So how minor were they, and was EPA really being honest when they said 'don't worry, these changes are minor'? Because at that point in time, they knew they had very extensive comments from industry, which indicated that the changes were pretty substantive and important to industry."

He concluded, "I think the changes that were made to the standard EPA consent order for new chemicals should be reconsidered, both because of the lack of transparency and because they weaken the PMN program. I believe we called for these steps when it came to light that EPA weakened the consent order without any public notice and comment."

"Hopefully this will be done as part of the Biden EPA's reexamination of how the agency is implementing the new chemical review reforms in the 2016 TSCA amendments."

Environmental groups are pushing the agency to revisit several major TSCA actions it took during the Trump administration, including **evaluations of existing chemicals** and its approaches to handling PMNs and other elements of the new-chemicals program.

**'Far Beyond The Normal Processes Of Government'**

Desikan said that the "details indicate" a "pattern of continuous solicitation of feedback," followed by "incorporation of everything industry seems to be saying," which she compared to tactics used by the tobacco industry when it sought to counter the once-controversial studies of whether smoking causes lung cancer.

The Trump EPA "adhered to industry's playbook almost to the point of corporate capture," she added, "to the point where it goes far beyond the normal processes of government and takes away the ability of government to protect our health and safety."

Desikan said, "The way rulemaking is supposed to work at the EPA is there is a point where you do solicit public opinion. You have public comment periods, you have public hearings, and industry and academics and community members and all other members of the public can provide that needed input at that stage. So it's fine if industry does it at that stage -- it's actually a very good step there."

However, Desikan said that the Trump EPA seemed to cherry-pick which stakeholders it sought out for early input, which "takes away from the normal processes of how public health regulations are supposed to work."

"This is a point of giving special interest to groups that we have seen for years and years and years try to undermine public health regulations, health and safety measures, for things that basically come down to profit," she said.

Sussman agreed that what he saw in Denison's post was "pretty extreme," and told *Inside TSCA* that though the agency was "never perfect" in the years he spent there, the newly published emails were a significant departure from the transparency policies he expected.

"All they needed to do here was issue a *Federal Register* notice saying 'we're thinking of changing our 5(e) consent order, and we would appreciate getting comments from interested stakeholders,'" Sussman said. "That's all they had to do." -- *Diana DiGangi* (ddigangi@iwpnews.com)

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**Tank full of anhydrous ammonia pulled from Missouri River**
March 25, 2021

https://apnews.com/article/environment-missouri-tigers-mens-basketball-jefferson-city-missouri-river-721526bf5c1c06406af681c06d5c8c19

CLAYSVILLE, Mo. (AP) — A 1,500-gallon tank full of anhydrous ammonia was pulled from the Missouri River as it floated downstream near Jefferson City, the Environmental Protection Agency said.

Observers reported the tank and its wheeled chassis floating on the river near Claysville last Friday, when the river was at flood stage, the EPA said in a news release Thursday.

Because anhydrous ammonia is a toxic and potentially deadly chemical, the Missouri Department of Natural Resources called in the EPA. The Missouri State Highway Patrol and Jefferson City fire department secured the tank Friday and determined it wasn't leaking.

Federal, state, Jefferson City agencies and businesses, along with the Missouri Farmers Association, worked together to corral the tank and remove it from the river on Saturday, when the water level was safer, the EPA said.

The MFA is storing the tank while authorities search for its owner.

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**EPA Extends Coronavirus Enforcement Against On-Line Sales Of Unregistered Disinfectants**
March 25, 2021

BY: JOSEPH J. GREEN

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**https://www.mondaq.com/unitedstates/environmental-law/1050900/epa-extends-coronavirus-enforcement-against-on-line-sales-of-unregistered-disinfectants**

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Earlier this week, EPA issued another "stop sale" order to Amazon directing the company to take steps to prevent the continued sale "of potentially dangerous or ineffective unregistered pesticides and pesticide devices making illegal and misleading claims, including multiple products that claimed to protect against viruses." The February 9th order adds 70 products to the 30 products identified in a prior June 2020 order issued to Amazon (a similar order also was issued to eBay last spring).

"*Unregistered pesticides in the e-commerce marketplace pose a significant and immediate health risk to consumers, children, pets, and others exposed to the products,"* – Ed Kowalski, Director of the EPA Region 10 Enforcement Compliance Assurance Division

The new order extends the agency's aggressive enforcement actions taken in response to the pandemic, and builds on EPA's ongoing efforts, in conjunction with U.S. Customs and Border Protection, to prevent the import and sale of illegal disinfectant products. Over the last year, EPA also has engaged with Amazon and other e-commerce companies in discussions about policing the third-party sale of illegal disinfectants and other pesticide products on their platforms. In fact, EPA's focus on on-line sales of pesticide products extends well before the pandemic, and the recent order to Amazon is the third pesticide-related "stop sale" order issued to the company in the last three years. Those efforts are among the agency's highest enforcement priorities in light of the continued spread of the SARS-CoV-2 strain of the *coronavirus*.
Further information, including an agency press release and copies of the Amazon "stop sale" orders, are available on EPA's website.

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**EPA decision will determine DOD's PFAS disposal costs**
March 25, 2021

**https://insideepa.com/daily-feed/epa-decision-will-determine-dod-s-pfas-disposal-costs**

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The Defense Department (DOD) says it is awaiting EPA's final decision on which disposal and treatment methods are acceptable for per- and polyfluoroalkyl substances (PFAS) before it will know its funding needs for cleanups across its bases, although DOD is estimating the cost range will be $2 billion to $3 billion.

Rep. Tony Gonzales (R-TX), during a March 24 House appropriations military construction subcommittee hearing on PFAS remediation and impacts, noted that DOD official Paul Cramer had called for a nationwide solution for PFAS disposal and treatment and asked how the subcommittee might aid that effort through the appropriations process.

Cramer, DOD acting assistant secretary for sustainment, said, "I believe the next action is on EPA." He added that EPA is currently reviewing **numerous comments** it received on its interim guidance on PFAS disposal and plans to issue a final document. Potential acceptable disposal methods "range from no incineration to some incineration," he said, referring to a method that has been heavily used by DOD to dispose of its stockpiles of aqueous film forming foam (AFFF) containing PFAS, but has drawn significant opposition from environmentalists.
Until "we understand what the approved disposal methods are, we really can't put a ballpark number on or advise the committee on our next steps," he said. Earlier, he said as to the long-term costs of PFAS cleanup, DOD is estimating the figure to be in the ballpark of $2 billion to $3 billion.

DOD faces likely significant cleanup costs as hundreds of its facilities may be contaminated with PFAS after the military for decades used AFFF containing PFAS to both train and fight fuel-based fires.

During the hearing, the subcommittee probed DOD's progress in addressing PFAS, with Subcommittee Chairwoman Debbie Wasserman Schultz (D-FL) questioning why DOD and the Department of Veterans Affairs are not doing more on PFAS, particularly in researching its effects. The military construction subcommittee last year appropriated an additional $100 million for PFAS identification, mitigation and cleanup at closed bases, Wasserman Schultz noted.

DOD officials appeared to maintain the same position taken during the Trump administration on state cleanup levels, saying that it would commit to following a limited set of state PFAS levels. Cramer pledged DOD to following "properly promulgated state drinking water standards" for situations where the military is producing the water by permit. He said if there is a conflict between EPA's non-enforceable lifetime health advisory of 70 parts per trillion for the two most studied PFAS and enforceable state drinking water standards and DOD is the permit holder, it will meet the state standard, known as a maximum contaminant level (MCL). Absent that, DOD will meet EPA's advisory level, he added.

But, during a second panel, Jamie DeWitt, an associate professor in the toxicology department at East Carolina University, testified that EPA's advisory level, set in 2016, is outdated. States have promulgated more stringent levels in recent years. She said while she is "heartened to hear" DOD will clean up to state drinking water standards, "it really should be across all sites regardless of who the purveyor of that water is."

In addition, pressed by Rep. Ed Case (D-HI) about roadblocks by the Army and Navy over state requests for sampling PFAS at bases in Hawaii, Cramer said DOD, if necessary, will issue guidance to ensure military bases are "transparent" with regulators.

DOD officials at the hearing also revealed that the Air Force expects by mid-April to have sent out approximately 2,500 notifications to landowners of farms telling them they are within one-mile of a location where DOD has detected PFAS in groundwater or linked it to a local water source, per instructions laid out by Congress in the fiscal year 2021 National Defense Authorization Act.

Cramer also pledged to Wasserman Schultz that DOD's PFAS Task Force, established under the Trump DOD in order to take a "proactive stance" on PFAS contamination, would produce an update within 30 days.

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**Understanding EPA's PBT Rules and Actions Is Vital for Compliance**
March 25, 2021

BY: WILEY REIN LLP

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**https://www.jdsupra.com/legalnews/understanding-epa-s-pbt-rules-and-2219030/**

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Under the authority of the Toxic Substances Control Act (TSCA), the U.S. Environmental Protection Agency (EPA) issued its final rules for five persistent, bioaccumulative, and toxic (PBT) chemicals on January 6, 2021. These rules impact the following chemicals: decabromodiphenyl ethers (DecaBDE); phenol, isopropylated, phosphate (3:1) (PIP (3:1)); 2,4,6-Tris(tert-butyl)phenol (2,4,6-TTBP); pentachlorothiophenol (PCTP); and hexachlorobutadiene (HCBD). Each of these rules has certain prohibitions, restrictions, and exclusions.*
We have been reading about what others are saying these final rules permit and prohibit. In light of those interpretations, we strongly recommend that you contact your trusted TSCA counsel to ensure that your understanding of these five rules is consistent with the regulatory text, the preambles establishing those regulations, and EPA's response to public comments. Possessing an incorrect understanding of these rules could result in an EPA enforcement action that carries with it a penalty of $41,056/day per violation. Taking a little additional time now to understand these actions could save you significant time and resources in the future.

*Earlier this month, EPA also announced a No Action Assurance for PIP (3:1) and a 60-day comment period for all five rules.

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**Researchers find harmful 'forever chemicals' in pesticide used against mosquitoes in Maryland**
March 25, 2021

BY: CHRISTINE CONDON

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**https://www.baltimoresun.com/news/environment/bs-md-pfas-pesticide-maryland-mosquito-control-20210325-db76zvkaxrc5ripawakzjpefly-story.html**

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Lab tests ordered by environmental groups found harmful chemicals, called PFAS, in a pesticide that Maryland uses for its mosquito control program, the groups said Thursday.

PFAS — per- and poly-fluoroalkyl substances — are known as "forever chemicals" because they don't break down in nature, and they're found in all kinds of products, from nonstick cookware to firefighting foams.

"The results for us are extremely disturbing, given the health impacts linked to these forever chemicals," Ruth Berlin, executive director of the Maryland Pesticide Education Network, said.

Last year, Maryland regulators announced they intended to **begin testing drinking water and Chesapeake Bay oysters** for PFAS, as a growing number of studies linked the chemicals to liver, kidney and reproductive dysfunction, as well as high cholesterol levels and tumor growth.
I discovered recently that hearing aids could be purchased online. I decided to take the plunge with a hearing aid company and test the idea of hearing aids online for myself.

The recent testing, ordered by the Maryland Pesticide Education Network and Public Employees for Environmental Responsibility, found 3,500 parts per trillion of one type of PFAS and 630 parts per trillion of another in Permanone 30-30, a pesticide sprayed by Maryland's Department of Agriculture.

The Environmental Protection Agency has set a lifetime health advisory for two types of PFAS in drinking water at 70 parts per trillion, meaning consistent daily exposure at that level isn't likely to cause adverse effects.

The Maryland Department of Agriculture's mosquito control program serves 2,100 communities in 16 counties, and spraying typically begins in mid-May in Southern Maryland and the Lower Eastern Shore. In other parts of the state, it begins in late May and early June.

"MDA and private vendors are going to begin their applications in numerous communities in the state," said Berlin. "The impact of that exposure could affect hundreds of thousands of Marylanders."

A spokesman for Maryland's Department of Agriculture said the agency is reviewing the study and will wait for further guidance from the EPA.

"Early findings from the U.S. EPA suggest that PFAS levels found in pesticides are related to plastic containers. All of the Permanone 30[-]30 used by MDA's Mosquito Control Program is packaged in metal containers," wrote spokesman Jason Schellhardt in a statement.

A spokesperson for the EPA said the agency received PEER's research, and "will review it as part of the agency's ongoing **efforts to investigate PFAS contamination** in pesticide products."
"EPA understands the need to provide guidance to states, tribes, and other users as they prepare to purchase mosquito control products for 2021 and will provide more information as it continues its investigation," read a statement from the agency.

After Public Employees for Environmental Responsibility found PFAS in a different pesticide, called Anvil 10+10, last year, EPA officials said that fluorinated containers used for storage may be to blame. The agency asked states with pesticides stored in the containers to pause their use while it investigates whether they contain or leach PFAS.

But concerned environmental and public health groups worry the chemicals may be discovered in a number of different pesticides, even those that don't use the same container.

"Our suspicion was that: Maybe it was the barrels in the case of Anvil, but that wasn't the end of the story," said Kyla Bennett, PEER's director of science policy.

Meanwhile, the Maryland Pesticide Education Network became concerned that Permanone could contain PFAS, since it's the same sort of pesticide as Anvil, Berlin said.

Last year, PEER released the results of testing conducted on seafood in St. Mary's County and drinking water in Montgomery County, which found high levels of PFAS. The group tested oysters, crabs and rockfish caught near the Patuxent River Naval Air Station, where the chemicals are believed to have been used in firefighting exercises over many years. That practice will be prohibited in Maryland starting in October. The group also tested drinking water in three homes in Poolesville and Bethesda.

As researchers discover PFAS in a variety of products, consumers ought to educate themselves whenever possible, and purchase products known to be PFAS-free, Bennett said. They should also consider water filtration systems for their homes.

"It's absolutely a game of Whac-A-Mole," she said.

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**PFAS Paper Mill Lawsuit In Maine Exposes Corporate Susceptibility**
March 25, 2021

BY: JOHN GARDELLA

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**https://www.natlawreview.com/article/pfas-paper-mill-lawsuit-maine-exposes-corporate-susceptibility**

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On March 5, 2021, a class action lawsuit was filed in Maine by residents of Fairfield, Maine, in which they allege that a paper mill company polluted residential land with PFAS, thereby devaluing the properties, exposing residents to risks of harm to their health, and necessitating costly remediation of the contaminated land. The PFAS paper mill lawsuit will surely be closely followed anyone involved in PFAS litigation; however, companies of all types (not just paper companies) must understand that this is but one representative example of the type of lawsuits that we have predicted will have significant impacts on company financials as awareness of PFAS issues continues to grow. These impacts will be felt well beyond industries that use PFAS directly in their manufacturing processes, and companies of any type would must take a closer look at current or legacy PFAS issues that may plague them in the near future.

**What Are PFAS and Why Are They a Concern?**

Per- and poly-fluoroalkyl substances ("PFAS") are a class of over 7,000 manmade compounds. Chemists at 3M and Dupont developed the initial PFAS chemicals by accident in the 1930s when researching carbon-based chemical reactions. During one such experiment, an unusual coating remained in the testing chamber, which upon further testing was completely resistant to any methods designed to break apart the atoms within the chemical. The material also had the incredible ability to repel oil and water. Dupont later called this substance PFOA (perfluorooctanoic acid), the first PFAS ever invented. After World War II, Dupont commercialized PFOA into the revolutionary product that the company branded "Teflon."

Only a short while later, 3M invented its own PFAS chemical – perfluorooctane sulfonate (PFOS), which they also commercialized and branded "Scotchgard." Within a short period of time, various PFAS chemicals were used in hundreds of products – today, it numbers in the thousands.

The same physical characteristics that make PFAS useful in a plethora of commercial applications, though, also make them highly persistent and mobile in the environment and the human body – hence the nickname, "forever chemicals." While the science is still developing regarding the extent of possible effects on human health, initial research has shown that PFOA and PFOS are capable of causing certain types of cancer, liver and kidney issues, immunological problems, and reproductive and developmental harm.

**The PFAS Paper Mill Lawsuit**

The Skowhegan paper mill, owned by Sappi and referred to as the Somerset Mill, is a pulping and papermaking facility that manufactures various paper products, including coated paper, grease=proof packaging paper, and bleached

chemical pulp. The paper mill has an annual production of 970,000 metrics tons of coated paper and 525,000 metric tons of bleached chemical pulp. The paper mill also consists of a wood mill, where incoming lumber is prepared for the manufacturing process.
The Somerset Mill, like many other paper mills across the globe, produce biosolid waste as a result of cleaning and chemically preparing materials for use in the mill's finished product. The biosolid waste is a sludge material that must be disposed of in some fashion by the mill. Studies have shown that on average, 35% of the material entering pulp and paper mills becomes waste residue. The waste includes a variety of materials, including wastewater sludge, woodyard waste, trash, demolition debris, and ash from boilers. While some of the waste residue can be reused for energy production, the rest must be discarded. Paper mills typically dispose of residue waste by discharging it into the air, water in the form of treated effluent, or into the soil in the form of solid waste or sludge.

In the PFAS paper mill lawsuit, the allegations are that the paper mill obtained licenses from the state of Maine to spread the sludge material on nearby farms, as it also has fertilizing properties that are beneficial to farmers. However, the paper mill is alleged to have known that the PFAS-containing waste that they spread on farms was hazardous, or based on the existing knowledge about PFAS, they should have known of those hazards.

Since 2020, the Maine Department of Environmental Protection has been investigating PFAS contamination in Fairfield, where at least 29 wells have levels exceeding the U.S. Environmental Protection Agency's maximum limit of 70 parts per trillion. According to pleadings in the case, in January 2021, one well measurement for one of the named plaintiffs was 12,910 parts per trillion..

**Why This Lawsuit Should Concern Many Businesses**

The PFAS paper mill lawsuit is but one example of the type of lawsuit that we predict will overwhelm businesses in the near future, especially when (as we predict) the EPA for the first time sets an enforceable PFAS limit with respect to drinking water. The EPA regulatory action will trigger a requirement that all states follow suit, although each state is still permitted to enact more aggressive standards than the EPA, if they wish.
As states accelerate testing requirements for drinking water sources of all types to determine compliance with the EPA or state-level PFAS limits, enormous amount of data will be collected regarding the scope of PFAS proliferation in the nation's water. This data will allow not only regulatory agencies, but also citizens, such as the ones in Fairfield, Maine, to determine likely sources of PFAS contamination due to businesses in proximity to those water sources. Those companies may become targets of not only regulatory agency action for remediation costs, but also lawsuits from citizens seeking damages for additional remediation costs, property devaluation, and personal injury. Depending on the scope of the PFAS contamination and a company's ultimate contribution to PFAS problems, this could cost some companies millions of dollars.

As the PFAS paper mill lawsuit shows, the lawsuits will not be confined only to chemical manufacturers producing PFAS. Rather, they will extend to companies that utilize the PFAS for their manufacturing process, that purchase raw materials that may be contaminated with PFAS, that utilize water that may be contaminated with PFAS (which would then be discharged by the company), and waste discarded that may contain PFAS. Even companies that merely purchase land that may have legacy PFAS contamination issues may find themselves the target of lawsuits or regulatory action if the PFAS have slowly leached from the soil into water sources over time.

**Conclusion**

Our prediction remains that in 2021, PFAS drinking water rules will be finalized at the federal level. This will require states to act, as well (and some states may still enact stronger regulations than the EPA). Both the federal and the state level regulations will impact businesses and industries of many kinds, even if their contribution to drinking water contamination issues may seem on the surface to be de minimus. In states that already have PFAS drinking water standards enacted, businesses and property owners have already seen local environmental agencies scrutinize possible sources of PFAS pollution much more closely than ever before, which has resulted in unexpected costs. All companies of all types would be well advised to conduct a complete compliance audit to best understand areas of concern for PFAS liability issues, and ways to mitigate PFAS concerns.

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## Farm Workers Sue to Block EPA's Antibiotic Pesticide Approval

March 25, 2021

BY: SYLVIA CARIGNAN

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**https://news.bloomberglaw.com/environment-and-energy/farm-workers-sue-to-block-epas-antibiotic-pesticide-approval?utm_source=rss&utm_medium=NEVE&utm_campaign=00000178-6ad9-dd1e-a1f9-6effa0f20002**

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The EPA approved the use of streptomycin sulfate on citrus crops without first ensuring the pesticide wouldn't cause unreasonable harm to public health or the environment, farm worker advocacy groups said in a petition filed in federal appeals court Thursday.

The Migrant Clinicians Network, Farmworker Association of Florida and others want the U.S. Court of Appeals for the Ninth Circuit to review the Environmental Protection Agency's January registration of streptomycin sulfate. The agency failed to consult with federal agencies responsible for protecting endangered or threatened species and their habitats, the groups said in their petition.

The pesticide is an antibiotic used to control diseases in crops ranging from beans to greenhouse tomatoes to ornamental plants in residential areas, according to the final registration decision.

The EPA found streptomycin to be "practically nontoxic" to honeybees acutely exposed to the substance, but additional data on its effects on pollinators wasn't available when the registration was finalized.

The agency's registration authorized the pesticide's use on a group of citrus crops including grapefruits, limes, and oranges. The change came in response to 2015 applications from Geo Logic Corp. and AgroSource Inc. to allow new uses of streptomycin on the crop group, according to the final registration decision.

**Cause of Action**: Federal Insecticide, Fungicide, and Rodenticide Act; Endangered Species Act.

**Relief:** Judicial review; declaration that the EPA's approval of the pesticide violated FIFRA and ESA.

**Response:** "Because this is pending litigation, EPA has no additional information to share," an agency spokesperson said.

**Attorneys:** The Center for Biological Diversity, Earthjustice, Center for Public Interest Research, and Natural Resources Defense Council are representing the plaintiffs.

The case is Migrant Clinicians Network v. EPA, 9th Cir., No. 21-70719, 3/25/21.

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**EPA awards 2020 ENERGY STAR certification to bakeries**

March 25, 2021

BY: TARYN PARKER

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**https://www.bakingbusiness.com/articles/53318-epa-awards-2020-energy-star-certification-to-bakeries**

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WASHINGTON — Bimbo Bakeries USA, Horsham, Pa., Flowers Foods, Thomasville, Ga., and other baking companies were among the 95 manufacturing plants awarded ENERGY STAR certification in 2020 by the United States Environmental Protection Agency (EPA). ENERGY STAR certification designates manufacturing facilities as the most energy efficient in their industries.

"These forward-looking businesses have demonstrated that economic development and job creation go hand-in-hand with environmental progress," said Michael S. Regan, EPA administrator. "The transition to a clean energy economy is happening now, as partnerships like ENERGY STAR encourage companies to go the extra mile, bringing innovation, cost-savings and pollution reductions in return."

Overall, these ENERGY STAR plants saved nearly $400 million on energy bills which is equivalent to the payroll of more than 8,000 US manufacturing jobs. They also avoided the consumption of 80 trillion Btus of energy compared to average plants and prevented more than 5 million metric tons of greenhouse gas emissions which is equal to the energy use of nearly 600,000 homes.

Among the 95 manufacturing plants were several wholesale baking facilities, including Chicago-based Alpha Baking Co.'s facility in Manitowoc, Wis.

"This is an area that we will continue to focus on going forward," said Lawrence Marcucci, chief executive officer at Alpha Baking Co. "Having said that, 2020 was a tough year. Since we are largely foodservice focused our volume was impacted by the pandemic in 2020. With the reduced volume it was a challenge to stay on track. Many energy uses in the plant are fairly static so maintaining our ENERGY STAR position will be hard."

The industrial sector emits nearly a third of US total greenhouse gas emissions. Efforts to increase the energy efficiency is crucial for reducing the industrial greenhouse gas emissions necessary.

The ENERGY STAR certification has been around for 15 years. Throughout those years over $6 billion have been saved on energy bills and prevented more than 65 million metric tons in greenhouse gas emissions compared to average-performing facilities.

Bimbo Bakeries USA had 16 plants awarded, Flowers had 10, TreeHouse Foods Inc. had four, Weston Foods had two, and Mile Hi Companies and Holsum Bakery also achieved the certification.

"Bimbo Bakeries USA is committed to building a sustainable, highly productive and deeply humane company, especially during such trying times as these," said Chris Wolfe, corporate director, environmental & sustainability at Bimbo Bakeries USA. "We were able to make our operations more efficient by running limited SKUs to ensure shelves were stocked and available to consumers, all while following strict COVID-19 safety protocols to keep our workers and community safe. We are so grateful for frontline associates who make it possible to feed America while staying safe. The ENERGY STAR certifications are honors given to organizations who have consistently made contributions to protecting the environment for several years in a row. We understand that, as the largest commercial bakery in the US, it's important for us to be a leader in sustainability and we are honored to have multiple facilities receive ENERGY STAR certifications in 2020."

Plants with a verified energy performance score of 75 (or higher) out of 100 are eligible for the ENERGY STAR certification. This means their plant perform better than 75% of plants within their industry. Energy Star certification can be earned by 20 different manufacturing sectors.

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**EPA recognizes Chester County among nation's leading Green Power users**
March 25, 2021

**https://www.dailylocal.com/news/local/epa-recognizes-chester-county-among-nations-leading-green-power-users/article_3576275c-8d9c-11eb-80ae-2b093cde9cab.html**

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WEST CHESTER—The Chester County Commissioners announced today the County's acceptance by the U.S. Environmental Protection Agency (EPA) as a Green Power Partner.

In its confirmation of the County of Chester as a Green Power Partner, the EPA noted the County's purchase of 20,460,000 kilowatt-hours (kWh) of green power annually, which is enough green power to meet 100 percent of the County's own electricity use.

"By choosing green power, Chester County is helping advance the voluntary market for green power and development of those sources," noted the EPA in its confirmation.

"Being recognized as a Green Power Partner by the U.S. Environmental Protection Agency is a great honor," said Chester County Commissioners' Chair Marian Moskowitz. "Using green power helps us to reduce air pollution and lower our emissions footprint, and this acknowledgment will, we hope, encourage other local governments, businesses and organizations in the regionto do the same."

By moving the needle in the voluntary green power market, Chester County governmentand other Green Power Partners are helping to reduce the negative health impacts of air emissions, including those related to ozone, fine particles, acid rain, and regional haze.

Chester County Commissioner Josh Maxwell said, "One of the first actions we took as a new Board of Commissioners last year was to appoint members to the County's Environmental and Energy Advisory Board. Soon after that we signed a renewable electric supply purchase agreement to offset 100% of our electricity supply.

"Actions such as this have helped us to achieve the Green Power Partnership with the EPA."

Earlier this month,Chester County presented the first draft of its Climate Action Plan which provides a current greenhouse gas emissions inventory, and sets out actions for reducing emissions and improving energy efficiency throughout the county. The Climate Action Plan establishes a blueprint for how the county, municipalities, businesses and other stakeholders can reduce their carbon footprint, and it expands on the County's original 2010 Greenhouse Gas Reduction Report.

"Our Climate Action Plan will help guide us and all of our communities in Chester County as we work together to reduce our carbon footprint," said Chester County Commissioner Michelle Kichline. "But we know that we must lead by example, which is why the environmental and energy actions that we have takenand will continue to take, and the confirmation that we have received by the EPA as a Green Power Partner, are so important."

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**U.S. EPA blocks Virgin Islands refinery expansion pending environmental justice review**
March 25, 2021

BY: VALERIE VOLCOVICI

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**https://leaderpost.com/pmn/business-pmn/u-s-epa-blocks-virgin-islands-refinery-expansion-pending-environmental-justice-review**

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WASHINGTON — The U.S. Environmental Protection Agency on Thursday said it has revoked an expansion permit for the Limetree Bay oil refinery in the U.S. Virgin Islands, citing concerns that the area around the facility is overburdened with pollution.

The decision allows the plant to keep operating but will block ongoing expansion work pending an EPA review to assess measures the facility needs to take to protect nearby residents.

"Withdrawing this permit will allow EPA to reassess what measures are required at the Limetree facility to safeguard the health of local communities in the Virgin Islands, while providing regulatory certainty to the company," said EPA acting Regional Administrator Walter Mugdan.

Limetree was not immediately available for comment.

The move marks the first big decision by President Joe Biden's EPA to withdraw a permit for a large industrial facility over considerations of environmental justice, which Biden has said would be a big priority for his administration.

The 200,000 barrel per day facility on St. Croix had restarted this year after a decade idle after securing a Clean Air Act "plantwide applicability limit" permit from the Trump administration on Dec. 2, 2020. The permit had allowed it to build additional units without being deemed a new source of pollution, which triggers more stringent pollution controls.

The owner of the refinery, Limetree Bay Ventures, backed by private equity firms EIG and Arclight Capital, challenged requests by the EPA to increase air quality monitoring. The company argued the monitors are not necessary and that it should not have to pay the costs to operate them.

Some local residents told Reuters recently https://www.reuters.com/article/us-usa-caribbean-refinery-environment-in-idUSKBN2B00DA that since the refinery restarted earlier this year, they have had difficulty breathing along with headaches and watery eyes. (Reporting by Valerie Volcovici; additional reporting by Laura Sanicola; Editing by David Gregorio)

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**Regan's broad science integrity review targets Pebble Mine**
March 25, 2021

**https://insideepa.com/daily-feed/ewire-regan-s-broad-science-integrity-review-targets-pebble-mine**

EPA Administrator Michael Regan's project to identify past agency actions that broke its science integrity policy will cover a wide range of programs and research with a new report noting it has already identified the Clean Water Act (CWA) assessment of impacts from the controversial Pebble Mine project as one such potential violation.

**A March 24 *New York Times* article** cites one person involved in the process saying the Pebble Mine study is already on a "list of decisions where staff say scientific integrity was violated," and that the source expects the review to identify "about 90" actions by the Trump administration by the time it concludes.
Stakeholders and Democratic lawmakers **have already urged Regan** to issue a CWA "veto" of the Alaska mining project, which opponents say poses an existential threat to salmon fisheries in the nearby Bristol Bay.
The Army Corps of Engineers rejected a permit application for Pebble last year, saying it was contrary to public interest, but some critics maintain EPA's CWA veto is needed to ensure that decision stands.

A finding that political appointees interfered in the scientific assessment of possible harms from the mine -- research that happened largely under the Obama administration but whose use was contested throughout the Trump era -- could aid those calls.

Regan announced the project **through an email to staff** earlier this week, writing that he has directed EPA Science Advisor Jennifer Orme-Zavaleta -- who also serves as the acting assistant administrator for the Office of Research and Development -- and Scientific Integrity Official Francesca Grifo to lead a three-pronged review of agency science policies, practices and advisory panels.
He also urged staff to "bring any items of concern to the attention" of either Grifo or a deputy scientific integrity official.
The memo also does not specify what steps EPA will take after identifying violations, but the agency has already set a precedent for withdrawing actions it deems the result of "political interference" by **scrapping a controversial toxicity assessment** for the chemical perfluorobutanesulfonic acid (PFBS).
And acting chemicals chief Michal Freedhoff has identified two other chemical decisions as the product of integrity violations, namely the 2018 registration of the herbicide dicamba and a Toxic Substance Control Act (TSCA) evaluation of the solvent trichloroethylene (TCE), though she has not publicly stated how her office will proceed on either.

But Trump-era officials and other Republicans are likely to defend their work, setting off new political and policy battles over whatever steps Regan and his team take next. The *Times* quotes former EPA Chief of Staff Mandy Gunasekara as

saying, "Every decision we made in the Trump administration was rooted in science and was based on both advice and concurrence with the career scientific team. . . . Not all of them agreed, but that's with any team."

The *Times* notes that the Pebble assessment is unlikely to be the only high-profile action caught in Regan's integrity review, noting that the list of violations "currently includes well-known controversies" other than the mine, "as well as rulings around relatively obscure toxic chemicals."

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**Cohasset awarded $182,500 grant to protect water**
March 25, 2021

BY: QUINN KELLY

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**https://www.wickedlocal.com/story/cohasset-mariner/2021/03/25/cohasset-awarded-182-500-grant-protect-drinking-water-contaminants/6997960002/**

-
On the heels of the announcement that the town would be proposing a water rate increase at May's Town Meeting, Cohasset has learned it will be receiving a state grant to combat water contamination.

The grant comes in the amount of $182,500 and will be earmarked to support efforts to address elevated levels of PFAS in drinking water.

PFAS compounds are a family of chemicals widely used since the 1950s to manufacture common consumer products. The compounds are also contained in some legacy fire-fighting foams.

Drinking water may become contaminated if PFAS deposited onto the soil seeps into groundwater or surface water. PFAS has been linked to a variety of health risks, particularly in women who are pregnant or nursing, and in infants.

Cohasset was only recently informed of their need to contend with the pollutant, an expense that Water Commission Chair Leonara Jenkins said was "unplanned."

"We sat at a round table with DEP (Department of Environmental Protection) and were told about this new pollutant that has arrived on the scene," Jenkins explained. "This is something that was kind of dropped on us. This is not something that would be normal maintenance."

Ridding the town's water supply of PFAS will require a new granular activated carbon (GAC) filtration system.

Town Finance Director Don Piatt explained that this will be no small cost for the town.

"The GAC filtration system project [has a] $3.6 million price tag," said Piatt. "That alone is almost $280,000 per year over 20 years. In addition to that, the ongoing maintenance of that system is about $300,000 a year."

Before worrying about what the state may add in terms of requirements in dealing with PFAS, Cohasset will already have added nearly $600,000 per year to its bottom line expenses.

"We don't know what regulations are really coming down yet because DEP and EPA are still haggling over whatever, and we are kind of at their mercy," Jenkins added. "So we have to make sure that we have enough income to meet whatever requirements they tell us."

The grant should help offset some of the costs of those regulations, which have recently begun coming down from the state.

The new drinking water standard for PFAS is 20 ppt (parts per thousand)for the sum of six PFAS compounds, called "PFAS6." The rule requires public water suppliers to test for PFAS6 and act when there is a detection above the limit. In using the sum of six PFAS compounds, these standards provide a higher degree of protection, particularly for sensitive subgroups including pregnant women, nursing mothers and infants. There are currently no federal PFAS standards for drinking water.

All community public water systems are required to test for PFAS6. Large public water supplies, those serving a population of 50,000 or more, were required to begin their initial PFAS6 tests as of January 1, 2021. Public water supplies serving populations between 10,000 and 50,000 will begin initial tests April 1, 2021, and those serving a population of less than 10,000 will begin testing October 1, 2021.

Local officials including Senator Patrick O'Connor (R-Weymouth) and Representative Joan Meschino (D-Hull) expressed enthusiasm for the potential help the funding will bring for Cohasset.

"Municipalities across the Commonwealth need this funding to adequately protect their drinking water from harmful contaminants and ensure the health of their residents," said Senator Patrick O'Connor (R-Weymouth). "I'm looking forward to seeing Cohasset's project progress and I appreciate the support the Administration has given to this effort."

"Contamination of public drinking water is of utmost importance to both environmental and public health," said Representative Meschino (D-Hull). "This funding is a crucial first step to cleaning, and ultimately maintaining, healthy, drinkable water for all present and future Cohasset residents."

"Maintaining a high-quality drinking water supply is one of the most important things we can do for our residents," said Cohasset Town Manager Christopher Senior. "This grant will help Cohasset proactively ensure the Town's water system meets all state requirements."

The award was a part of a funding round that saw $3 million in grants given to 17 public water supply systems for expenses related to the design and planning of treatment systems that protect drinking water against PFAS.

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**EPA urged to reconsider listing Missouri lakes as 'impaired'**
March 25, 2021

BY: JIM SALTER

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**https://apnews.com/article/blaine-luetkemeyer-lakes-environment-missouri-tigers-mens-basketball-vicky-hartzler-d758ab564ea3fe6324f6a899183ddf0a**

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O'FALLON, Mo. (AP) — The eight Republican members of Missouri's congressional delegation are urging the Environmental Protection Agency to reconsider listing 40 of the state's waterways as "impaired," a list that includes the Lake of the Ozarks and Truman Reservoir.

A letter from Reps. Blaine Luetkemeyer and Vicky Hartzler and signed by the other GOP delegation members was sent this week to Edward H. Chu, acting administrator for the EPA's Region 7, Luetkemeyer's office said Thursday. The letter said the impaired designations "would have significant impacts on families, landowners, small businesses," and on the state's economy.

"Not only was this listing misinformed, but it could potentially cost our communities $1.7 billion in local revenue at a time when our economy is still recovering and small businesses are working to get back on their feet," Luetkemeyer said in a news release.

The EPA announced the listing of the 40 lakes and reservoirs in November, while under the administration of President Donald Trump. The change in administrations has not impacted the list.

The EPA cited high levels of chlorophyll-a in each waterway. Chlorophyll-a is a measure of the amount of algae growing in the water, according to the EPA's website. Though a natural part of freshwater, too much algae can cause green water, odor and can result in decreased levels of dissolved oxygen.

Those decreased oxygen levels can impact the health of aquatic life. The EPA cited fish kills at Lake of the Ozarks, Truman Reservoir and Jackrabbit Lake in Jackson County. But the congressional letter said some of the fish kills were not verified by the Missouri Department of Natural Resources or the Missouri Department of Conservation.

Missouri DNR Director Carol Comer also wrote to EPA, on March 16, and asked for more time to gather new data and evaluate existing data. Comer wrote that it would be "premature" to list the lakes as impaired.

"The consequences of listing are serious, and therefore impairment determinations require a level of confidence we have not yet reached for these lakes," Comer wrote.

Some lakes were placed on the list based on older data "that have a low probability of being representative of current conditions," Luetkemeyer and Hartzler wrote. The letter also notes that while EPA criteria indicate that points of compliance examined should be near the dam or outflow of each lake or reservoir, many were not.

EPA spokesman Curtis Carey said in an email that the agency received more than 80 comments concerning its plan to add the lakes and reservoirs to the impaired list. "After considering the comments received, EPA may make revisions, as appropriate, and will transmit the EPA's final decision to Missouri," he said.

Carey did not offer a timetable on when the final decision will be made.

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**U.S. Environmental Protection Agency and Beverly, Ohio, Ferroalloy Production Plant Enter into Consent Agreement**
March 25, 2021

**https://www.jdsupra.com/legalnews/wastewater-enforcement-u-s-7382904/**

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The United States Environmental Protection Agency ("EPA") and Globe Metallurgical, Inc. ("GMI"), entered into a December 20th Consent Agreement and Final Order ("CAFO") addressing alleged violations of a Clean Water Act National Pollution Discharge Elimination System ("NPDES") permit. See Docket No. CAA-05-2021-0004.

The CAFO provides that GMI operates a Beverly, Ohio, ferroalloy production plant ("Plant").

GMI is also stated to own and/or operate a landfill located adjacent to the Plant.

The Plant is stated to have received from the Ohio Environmental Protection Agency an NPDES permit. Such permit is stated to have only authorized the discharge of pollutants from certain designated outfalls. Those outfalls are designated Outfalls 001, 002 and 601.

The CAFO alleges the following violations:

- Unlawful Discharge of Pollutants through Outfall 001
- Unlawful Discharge of Pollutants through Outfall 002
- Unlawful Discharge of Pollutants through Outfall 601

A civil penalty of $55,300 is assessed.

A copy of the CAFO can be downloaded here.

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**DEP reaches consent agreement with Chesapeake Energy**
March 25, 2021

BY: PAUL J. GOUGH

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**https://www.bizjournals.com/pittsburgh/news/2021/03/25/chesapeake-energy-consent-agreement.html**

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The Pennsylvania Department of Environmental Protection and the U.S. Environmental Protection Agency have reached a proposed consent agreement and a potential $1.9 million fine for Chesapeake Appalachia over alleged violations of the Clean Water Act and the Pennsylvania's Clean Streams Law.

In a lawsuit filed Wednesday in the U.S. District Court for Middle Pennsylvania, EPA and DEP charged that Chesapeake Appalachia was responsible for unauthorized dredge and fill into 76 separate sites in Pennsylvania. The alleged incidents "resulted in the unauthorized discharge of dredged and/or filled material into waters of the United States and/or caused and created unauthorized water obstructions, encroachments and pollution in, along, across or projecting into the waters of the Commonwealth."

The sites were in Beaver County as well as Bradford, Sullivan, Susquehanna and Wyoming counties. The complaint said the discharges in question affected 2,326 linear feet of streams and 25.7 acres of wetlands, with nine of the sites representing about half of the acreage.

A consent decree with Chesapeake Energy filed this week included a $1.9 million fine with half going to federal authorities and the other half going to the Pennsylvania DEP. Pennsylvania's funding will go half to the Dams and Encroachments Fund and the other half to the Oil and Gas Fund.

Chesapeake will also repair damage to wetlands, according to the consent decree.

Chesapeake released a brief statement: "Having voluntarily disclosed these issues with the DEP and EPA seven years ago, we are pleased to resolve this legacy matter." Chesapeake (NYSE: CHK) told the EPA and DEP in 2014 that it had identified sites with unauthorized discharges.

The two sites are the CTG BEA and Kerry BEA pads in Beaver County.

Message

**From**: Goffman, Joseph [jgoffman@law.harvard.edu]
**Sent**: 1/20/2021 4:46:21 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: FW: DC Cir strikes down ACE RULE
**Attachments**: American Lung Assn v. EPA (DC Cir.), No. 19-1140 Per Curiam Decision.pdf

Joseph Goffman | **Executive Director**
**Harvard Law School** | Environmental and Energy Law Program
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202.746 4693 | jgoffman@law.harvard.edu
Twitter: **@JosephGoffman**

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**From:** Freeman, Jody
**Sent:** Tuesday, January 19, 2021 10:28 AM
**To:** Just, Robin L <rjust@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Goffman, Joseph <jgoffman@law.harvard.edu>
**Subject:** DC Cir strikes down ACE RULE

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Message

**From**: Aldy, Joseph Edgar [joseph_aldy@hks.harvard.edu]
**Sent**: 4/1/2021 10:35:00 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: McGartland, Al [McGartland.Al@epa.gov]; Marten, Alex [Marten.Alex@epa.gov]; Nagarajan, Shruti [shruti_nagarajan@hks.harvard.edu]
**Subject**: Re: AI and public comment on regulatory proposals

Thanks Joe!

Shruti, let me suggest that you follow up with Al and Alex on this. Al and Alex, thanks in advance for any assistance you can offer. And I'd be happy to discuss further if you'd like.

Best,

Joe

Sent from my iPhone

On Mar 30, 2021, at 8:32 PM, Goffman, Joseph <goffman.joseph@epa.gov> wrote:

Al and Alex, copied here, are the people to connect with on this.

Best,
Joe

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Aldy, Joseph Edgar <joseph_aldy@hks.harvard.edu>
**Sent:** Monday, March 29, 2021 10:43 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Nagarajan, Shruti <shruti_nagarajan@hks.harvard.edu>
**Subject:** AI and public comment on regulatory proposals

Hi Joe,

I hope you are doing well. I suspect that you are very busy trying to save the planet, so let me cut to the chase. I have a favor to ask.

Shruti Nagarajan, cc'd, is one of my HKS MPP students working on a policy analysis of natural language processing and broadly artificial intelligence in rulemaking. Through Ignite, an internal innovation program run out of the HHS IDEA Lab, teams at the Department of Health and Human Services and the Environmental Protection Agency tackled the comment review process by beta testing NLP software to review comments received. Has the EPA conducted an evaluation of this (and potentially other) application(s) of AI in the processing of public comments on major regulatory proposals? For example, has the agency assessed the cost-savings and efficiencies that stem from the utilization of NLP in comment review and analysis? Given your role on the Clean Power Plan -- and the

many many comments received on that proposal, I thought you might have a sense of this or would know who to direct Shruti to who would be familiar with this.

Thanks in advance for any assistance you can offer.

Best,

Joe

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University Fellow
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Faculty Research Fellow
National Bureau of Economic Research
I: www.nber.org/people/joseph_aldy

Senior Adviser
Center for Strategic and International Studies
I: csis.org/expert/joseph-aldy

Message

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 4/8/2021 4:58:36 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]; Peskoe, Ari [apeskoe@law.harvard.edu]; Perls, Hannah [hperls@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]; Davies, Kyra [kdavies@law.harvard.edu]
**Subject**: Re: Jody and Richard first 100 days presentation

Clearly we need a follow up talk with Ari.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, April 8, 2021 12:58 PM
**To:** Peskoe, Ari <apeskoe@law.harvard.edu>; Just, Robin L <rjust@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

Oooh. Can't wait! But no FERC? Boo!

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Peskoe, Ari <apeskoe@law.harvard.edu>
**Sent:** Thursday, April 8, 2021 12:54 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

It's a travesty. No mention of FERC.
Oh wow! Surprise appearance by an EELP colleague at the end. No spoilers for Joe as to who it is.

Ari Peskoe
Director, Electricity Law Initiative

617.495.4425 | @aripeskoe
eelp.law.harvard.edu/electricity-law-initiative/

Harvard Law School Environmental and Energy Law Program
6 Everett Street, Suite 4119 Cambridge, MA 02138

HARVARD LAW SCHOOL | ENVIRONMENTAL & ENERGY LAW PROGRAM

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**From:** Just, Robin L
**Sent:** Thursday, April 08, 2021 12:53 PM

**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Re: Jody and Richard first 100 days presentation

Yes! I'll send you the link when it's up. It's good.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, April 8, 2021 12:52 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

Any chance that a video of this will be posted? Not in the cards today for me to catch it live. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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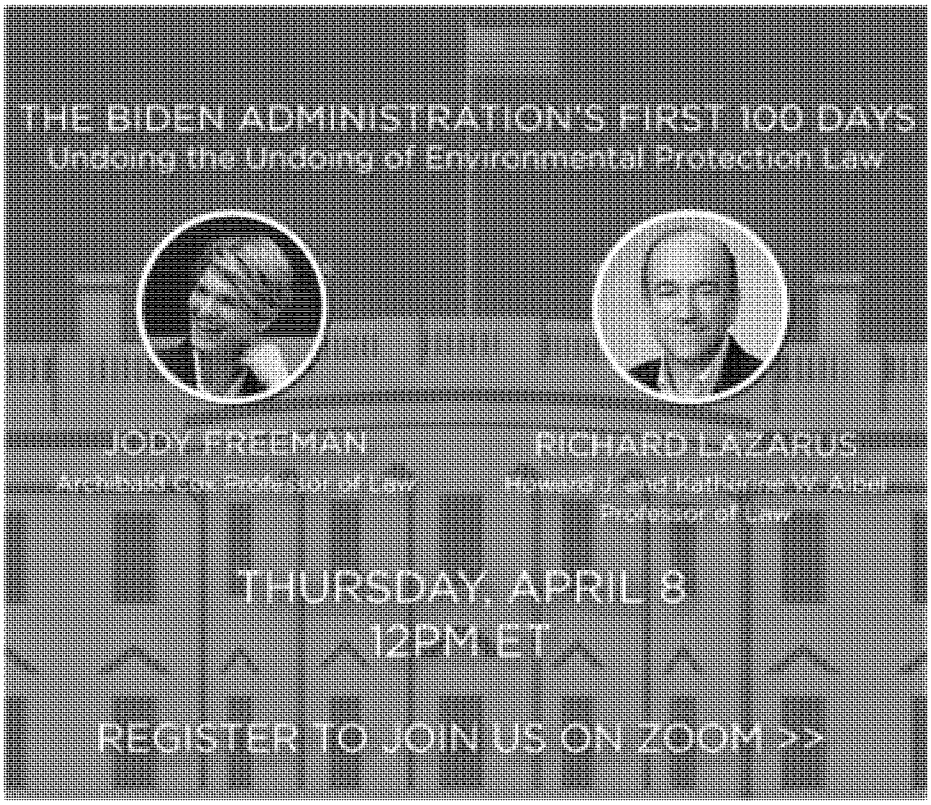
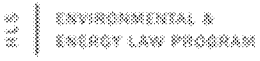
**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Tuesday, March 30, 2021 2:51 PM
**To:** Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Jody and Richard first 100 days presentation

ICYMI, hosted by HUCE, April 8th. Open to all. Sign up here if you're interested https://t.co/J7pd08rV7J?amp=1





**Robin Just | Director of Outreach and Communications**
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617.495.5391 | **rjust@law.harvard.edu**
Pronouns: she/her

Message

**From**: Nishida, Jane [Nishida.Jane@epa.gov]
**Sent**: 1/20/2021 10:42:28 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]; Utech, Dan [Utech.Dan@epa.gov]
**Subject**: RE: Federal Register
**Attachments**: Administrator Weekly 011421.pdf

Thanks Joe.

I am attaching the most recent Weekly Reports that the NPMs and Regions send to the Administrator's Office (AO), included is Office of Policy (OP)'s list of actions sent to OMB (see page 33).

Dan – as I mentioned in our earlier call, think it would be helpful to continue these Weekly Reports. Don't think there will not be one this week, because of the transition.

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**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, January 20, 2021 5:28 PM
**To:** Utech, Dan <Utech.Dan@epa.gov>; Nishida, Jane <Nishida.Jane@epa.gov>
**Subject:** FW: Federal Register

EPA Guidance on the list

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**From:** Goffman, Joseph <jgoffman@law.harvard.edu>
**Sent:** Wednesday, January 20, 2021 5:17 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Fwd: Federal Register

Sent from my iPhone

Begin forwarded message:

**From:** "Goffman, Joseph" <jgoffman@law.harvard.edu>
**Date:** January 20, 2021 at 9:36:42 AM EST
**To:** GOFFMAN.JOSEPH@epa.gov
**Subject: Fwd: Federal Register**

Sent from my iPhone

Begin forwarded message:

**From:** "Lazarus, Richard" <lazarus@law.harvard.edu>
**Date:** January 20, 2021 at 9:34:10 AM EST
**To:** "Goffman, Joseph" <jgoffman@law.harvard.edu>, jgoffman@jbrpt.org, cgiles@jbrpt.org
**Subject: FW: Federal Register**

Here is the full listing of relevant environmental items to be published tomorrow in the Federal Register, but in effect is in final format today. Today is a holiday, which is why nothing formally today. Odd but seems to be true that they therefore do tomorrow today. I don't get it.

In all events, nothing of obvious concern. I expect that is because the outgoing Trump folks were worried that the new Administration might be able to do something with them, so held back on publishing anything in the FR "today," which is "tomorrow."

**Published Fed. Reg. for the 1/21 issue**

**DOJ**

Notice of Lodging of Proposed Consent Decree Under the Clean Air Act, 86 Fed. Reg. 6,366 (Jan. 21, 2021).
Notice: https://www.govinfo.gov/content/pkg/FR-2021-01-21/pdf/2021-01233.pdf
Consent decree: https://www.justice.gov/enrd/consent-decree/file/1354131/download

**EPA**

**Guidance**
Applying the Supreme Court's County of Maui v. Hawaii Wildlife Fund Decision in the Clean Water Action Section 402 National Pollutant Discharge Elimination System Permit Program, 86 Fed. Reg. 6,321 (Jan. 21, 2021).
Notice: https://www.govinfo.gov/content/pkg/FR-2021-01-21/pdf/2021-01254.pdf
Guidance Memorandum: https://www.epa.gov/sites/production/files/2021-01/documents/final_ow_maui_guidance_document_-_signed_1.14.21.pdf

**Risk Evaluation**
C.I. Pigment Violet 29; Final Toxic Substances Control Act (TSCA) Risk Evaluation, 86 Fed. Reg. 6,322 (Jan. 21, 2021).
Notice: https://www.govinfo.gov/content/pkg/FR-2021-01-21/pdf/2021-01229.pdf
The actual risk evaluation doesn't appear to have been posted yet

**Two updates mentioned yesterday re: particular oil and gas lease sales - probably not major but wanted to flag just in case**

**Interior / BLM**
Proposed Reinstatement of Terminated Oil and Gas Lease NMNM 119276, New Mexico, 86 Fed. Reg. 6,362 (Jan. 21, 2021).
https://www.govinfo.gov/content/pkg/FR-2021-01-21/pdf/2021-01256.pdf

**Interior / BOEM**
Gulf of Mexico, Outer Continental Shelf (OCS), Oil and Gas Lease Sale 257, 86 Fed. Reg. 6,365 (Jan. 21, 2021).
https://www.govinfo.gov/content/pkg/FR-2021-01-21/pdf/2021-01251.pdf
Record of Decision: https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/regional-leasing/gulf-mexico-region/Lease-257-ROD.pdf

**Pre-Publication (same items as yesterday)**

**Commerce / NOAA / NMFS - Temporary Rule**
Fisheries of the Exclusive Economic Zone Off Alaska; Pacific Cod by Catcher Vessels Using Trawl Gear in the Western Regulatory Area of the Gulf of Alaska - to be published in Fed Reg. 1/25/2021; to be codified at 50 C.F.R. pt. 679
https://public-inspection.federalregister.gov/2021-01434.pdf

**Commerce / NOAA / NMFS - Temporary Rule**
Fisheries of the Exclusive Economic Zone Off Alaska; Pacific Cod by Pot Catcher/ Processors in the Bering Sea and Aleutian Islands Management Area - to be published in Fed. Reg. 1/22/2021; to be codified at 50 C.F.R. pt. 679
https://public-inspection.federalregister.gov/2021-01354.pdf

**Interior / BOEM - Withdrawal of proposed rule**
Risk Management, Financial Assurance and Loss Prevention - to be published in Fed. Reg. 1/22/2021; to be codified at 30 C.F.R. pts. 250 and 290
https://public-inspection.federalregister.gov/2021-01293.pdf

**Interior / NPS**
**Final Rule**
Commercial Visitor Services; Concession Contracts - to be published in Fed. Reg. 1/22/2021; to be codified at 36 C.F.R. pt. 51
https://public-inspection.federalregister.gov/2021-00789.pdf

**Proposed Rule**
Visitor Experience Improvements Authority Contracts - to be published in Fed. Reg. 1/22/2021; to be codified at 36 C.F.R. pt. 52
https://public-inspection.federalregister.gov/2021-01147.pdf

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**From:** Revesz, Richard [mailto:Revesz@exchange.law.nyu.edu]
**Sent:** Wednesday, January 20, 2021 8:10 AM
**To:** David Hayes <dhayes@jbrpt.org>; Lazarus, Richard <lazarus@law.harvard.edu>
**Cc:** alesnak@jonesday.com
**Subject:** Re: Time sensitive

It's so interesting that the vast powers of the Presidency don't extend to stopping the publication of the Federal Register.

Ricky

---

**From:** David Hayes <dhayes@jbrpt.org>
**Date:** Wednesday, January 20, 2021 at 8:04 AM
**To:** "Lazarus, Richard" <lazarus@law.harvard.edu>
**Cc:** "alesnak@jonesday.com" <alesnak@jonesday.com>, "Revesz, Richard" <Revesz@exchange.law.nyu.edu>
**Subject:** Re: Time sensitive

The bad news is being conveyed by the top incoming politicals at OMB. Really unfortunate.

On Wed, Jan 20, 2021 at 7:42 AM Lazarus, Richard <lazarus@law.harvard.edu> wrote:

> Thanks David for the notice. Will do. No doubt you are as unhappy about this as I am confounded. I would not have thought this as I in doable but routine. My only suggestion is to have someone make sure this is not some isolated bozo somewhere. It happens.
>
> Sent from my iPad
> Please excuse typos and misdirected auto correct
>
> On Jan 20, 2021, at 7:39 AM, David Hayes <dhayes@jbrpt.org> wrote:

As an FYI, bad news from OMB about the Fed Reg. We can't pull back tomorrow's Fed Reg, so I'd appreciate your sending me relevant notices that appear in tomorrow's edition, as well as today's.

My jbrpt account should remain open as I switch over to a .gov account.

Here's what OMB said on the issue: *Because tomorrow is a holiday, we can't get the Federal Register to stop anything slated to be published on 1/21. We're working with Comms to be be prepared to explain why this is happening on the first day of the Administration. I'm happy to work with you on how to withdraw the guidance as quickly as possible.*

Thanks.

---------- Forwarded message ---------
From: **Richard Lazarus** <rlazarus@jbrpt.org>
Date: Tue, Jan 19, 2021 at 4:38 PM
Subject: Re: Time sensitive
To: Angela Lesnak <alesnak@volunteer.jbrpt.org>
Cc: David Hayes <dhayes@jbrpt.org>, Ricky Revesz <rrevesz@volunteer.jbrpt.org>

Will do. Thanks. Hope you had Dan Farber as a prof there at Berkeley. From my hometown, Urbana, IL.

On Tue, Jan 19, 2021 at 4:34 PM Angela Lesnak <alesnak@volunteer.jbrpt.org> wrote:

Please use my personal email: alesnak@berkeley.edu. Keep fighting the good fight!

AEL

Angela E. Lesnak | she/her
(218) 969-3613

On Tue, Jan 19, 2021 at 4:32 PM David Hayes <dhayes@jbrpt.org> wrote:

Thanks, Richard, Ricky and Angela!

And don't forget to send me the Fed Reg entries that appear tomorrow morning.

On Tue, Jan 19, 2021 at 4:30 PM Richard Lazarus <rlazarus@jbrpt.org> wrote:

Thanks!

On Tue, Jan 19, 2021 at 4:28 PM Ricky Revesz <rrevesz@volunteer.jbrpt.org> wrote:

Richard:

There's a typo in mine. In any event please use this alias instead:

richard.revesz@nyu.edu

It was great to communicate to you on jbrpt.org during these months and I look forward to continuing to do that on our academic e-mails.

Ricky

On Tue, Jan 19, 2021 at 4:25 PM Richard Lazarus <rlazarus@jbrpt.org> wrote:

Because all of our jbrpt emails, or at least mine, will reportedly go defunct at of around 5 today, I will send my last Fed Reg report for January 20 to your other addresses.

here are the addresses I will use. Please let me know if I should use a different address:

david.hayes@nyu.edu
Revesz@exhange.law.nyu.edu
alesnak@jonesday.com

Thanks

Richard

On Tue, Jan 19, 2021 at 12:01 PM David Hayes <dhayes@jbrpt.org> wrote:

excellent.

On Tue, Jan 19, 2021 at 11:57 AM Richard Lazarus <rlazarus@jbrpt.org> wrote:

I have now an answer for #35. The D.C. Circuit this morning granted the plaintiffs' motion for abeyance.

On Tue, Jan 19, 2021 at 11:22 AM David Hayes <dhayes@jbrpt.org> wrote:

I agree that many of the general rules also will engender localized sensitivities, but we're keeping all of them on the list.

Only looking at the ones Ricky listed to potentially drop, unless there's a near-term litigation need to keep them on the list.

Many thanks.

On Tue, Jan 19, 2021 at 11:16 AM Richard Lazarus <rlazarus@jbrpt.org> wrote:

David

I have sent an inquiry to the career DAAG who will be the Acting AAG as of tomorrow.

I will let you know as soon as I hear back. Your concerns about confirmation and site specific agency decisions strike me as apt on their face, because of their obvious geographic focus, though certain ESA rules while written generally have similar potential. A balancing act to be sure, but I hope not ultimately paralyzing.

Hopefully I will hear back soon from ENRD.

Richard

On Tue, Jan 19, 2021 at 11:12 AM Angela Lesnak <alesnak@volunteer.jbrpt.org> wrote:

Here is information as to (what I think are) the specific cases for numbers 13 and 31.

| | | |
|---|---|---|
| 13 | "Notice of Availability of the Record of Decision for the Proposed Willow Master Development Plan Project, Alaska," 85 Fed. Reg. 69351 (November 2, 2020). | Information here |
| 31 | Bureau of Land Management, Normally Pressured Lance Natural Gas Development Project Record of Decision (August 27, 2018). | W. Watersheds Project v. Salazar, No. 1:08-cv-516-BLW (D. Idaho) |

On Tue, Jan 19, 2021 at 11:07 AM David Hayes <dhayes@jbrpt.org> wrote:

That would be great, Richard. Many thanks.

On Tue, Jan 19, 2021 at 11:05 AM Richard Lazarus <rlazarus@jbrpt.org> wrote:

I can ask folks at ENRD. I would expect there are not, but that is the only way to know for sure. Would you like for me to do that?

On Tue, Jan 19, 2021 at 11:04 AM David Hayes <dhayes@jbrpt.org> wrote:

There is angst at high levels about including place-based RODs in this "non-exclusive" list, given nomination sensitivities. If there aren't filing deadlines within the next 30 days in these matters, we are inclined to remove them (except for #13 and #35, perhaps). Is there a way to check?

On Tue, Jan 19, 2021 at 10:53 AM Richard Lazarus <rlazarus@jbrpt.org> wrote:

Hi Ricky

Taking a quick look, here is the challenge with getting this information immediately. As you may recall, I began this project in early November, focused on identifying pending litigation in which ENRD was defending Trump Administration environmental policies. But consistent with the idea of having an EO that listed the underlying agency Trump rollbacks, by early December we abandoned the pending litigation as the denominator for our inquiry and replaced it with Trump environmental rollbacks, whether or not there was litigation. The related litigation was deleted from the new spreadsheet.

This denominator shift in focus was especially relevant to new agency actions that occurred after November 1. Several of the items you listed for inquiry occurred after November 1 and therefore our litigation tracker does not consider whether litigation was in fact brought, because that became no longer relevant to the EO focus. We anticipated litigation but, especially because we were barred by the Transition rules from contacting opposing counsel, we never learned about new filings after November 1. The most we could write was "anticipated litigation." That will be true for items, 4, 11, and 13, all of which occurred after November 1. We did not track new filings (had no resources available to do so) and do not know.

For No. 35, it was easy to quickly identify the litigation, listed below. For the others, would require more digging because the original litigation listing of all 261 cases did not identify with precise formal links all the underlying agency actions. Those were added later, when we created a new spreadsheet with the agency action denominator, which was after we were asked to eliminate the precise litigation reference. I expect there is litigation for all three -- 15, 31, and 35 -- because it was the presence of litigation that brought the agency actions to our attention in the first instance, but I cannot establish that immediately for all three.

Richard

For #35

| | | | |
|---|---|---|---|
| Interior | *The Wilderness Society v. Bernhardt* | 1:20-cv-01176 | D. D.C. |

On Tue, Jan 19, 2021 at 10:34 AM Angela Lesnak <alesnak@volunteer.jbrpt.org> wrote:

I'll take a look now. Thanks!

On Jan 19, 2021, at 10:29 AM, Richard Lazarus <rlazarus@jbrpt.org> wrote:

I will also take a look. I still have access to my original underlying spreadsheet for a few hours longer.

RIchard

On Tue, Jan 19, 2021 at 10:27 AM Ricky Revesz <rrevesz@volunteer.jbrpt.org> wrote:

Angela:

I would be grateful if could let me know, right away if possible, from Richard's spreadsheet or otherwise, whether any of items 4, 11, 13, 15, 31, 35 on the Interior list are currently in litigation.

Ricky

Message

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 4/8/2021 4:57:56 PM
**To**: Peskoe, Ari [apeskoe@law.harvard.edu]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Perls, Hannah [hperls@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]; Davies, Kyra [kdavies@law.harvard.edu]
**Subject**: Re: Jody and Richard first 100 days presentation

I think you should use your access and cut the question line and ask why no FERC.

---

**From:** Peskoe, Ari <apeskoe@law.harvard.edu>
**Sent:** Thursday, April 8, 2021 12:54 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

It's a travesty. No mention of FERC.
Oh wow! Surprise appearance by an EELP colleague at the end. No spoilers for Joe as to who it is.

Ari Peskoe
Director, Electricity Law Initiative

617.495.4425 | @aripeskoe
eelp.law.harvard.edu/electricity-law-initiative/

Harvard Law School Environmental and Energy Law Program
6 Everett Street, Suite 4119 Cambridge, MA 02138

HARVARD LAW SCHOOL | ENVIRONMENTAL & ENERGY LAW PROGRAM

---

**From:** Just, Robin L
**Sent:** Thursday, April 08, 2021 12:53 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Re: Jody and Richard first 100 days presentation

Yes! I'll send you the link when it's up. It's good.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, April 8, 2021 12:52 PM
**To:** Just, Robin L <rjust@law.harvard.edu>; Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** RE: Jody and Richard first 100 days presentation

Any chance that a video of this will be posted? Not in the cards today for me to catch it live. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Tuesday, March 30, 2021 2:51 PM
**To:** Peskoe, Ari <apeskoe@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Davies, Kyra <kdavies@law.harvard.edu>
**Subject:** Jody and Richard first 100 days presentation

ICYMI, hosted by HUCE, April 8th. Open to all. Sign up here if you're interested https://t.co/J7pd08rV7J?amp=1

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | **rjust@law.harvard.edu**
Pronouns: she/her

[ SEQ CHAPTER \h \r 1]**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Washington, D.C. 20460

OFFICE OF
AIR AND RADIATION

**MEMORANDUM**

SUBJECT: Recusal Statement

FROM: Joseph Goffman
Acting Assistant Administrator

TO: Michael S. Regan
Administrator

I have consulted with the Office of General Counsel/Ethics (OGC/Ethics) and been advised about my ethics obligations. This memorandum formally notifies you of my continuing obligation to recuse myself from participating personally and substantially in certain matters in which I have a financial interest, or a personal or business relationship. I also understand that I have obligations pursuant to Executive Order 13989 and President Biden's Ethics Pledge that I signed.

*OBLIGATIONS UNDER EXECUTIVE ORDER 13989*

Pursuant to Section 1, Paragraph 2 of the Executive Order, I understand that I am prohibited from participating in any particular matter involving specific parties in which my former employer, **Harvard University,** is a party or represents a party. I understand that my recusal will last for two years from the date that I joined federal service. This recusal will end after January 20, 2023.

I have been advised by OGC/Ethics that, for the purposes of this pledge obligation, the term "particular matters involving specific parties" is broadened to include any meetings or other communication relating to the performance of my official duties, unless the communication applies to a particular matter of general applicability and participation in the meeting or other event is open to all interested parties. I am further advised that the term "open to all interested parties" means that the meeting should include a multiplicity of parties. If, for example, there is "a meeting with five or more stakeholders regarding a given policy or piece of legislation, [then I] could attend such a meeting even if one of the stakeholders is a former employer or former client."[1] Such a meeting must also include a diversity of interests. Should a question arise as to whether a specific forum qualifies as "open to all interested parties," then I will consult with

[1] *See* Office of Government Ethics (OGE) Advisory DO-09-011 (3/26/09), which applies to Exec. Order 13989 pursuant to OGE Legal Advisories LA-21-03 (1/22/21) and LA-21-05 (2/23/21).

OGC/Ethics.

*FINANCIAL CONFLICTS OF INTEREST*

As required by 18 U.S.C. § 208(a), I will not participate personally and substantially in any particular matter in which I know that I have a financial interest directly and predictably affected by the matter, or in which I know that a person whose interests are imputed to me has a financial interest directly and predictably affected by the matter, unless I first obtain a written waiver, pursuant to 18 U.S.C. § 208(b)(1), or qualify for a regulatory exemption, pursuant to 18 U.S.C. § 208(b)(2). I understand that the interests of the following persons are imputed to me: any spouse or minor child of mine; any general partner of a partnership in which I am a limited or general partner; any organization in which I serve as officer, director, trustee, general partner or employee; and any person or organization with which I am negotiating or have an arrangement concerning prospective employment.

*Particular Matters Involving Specific Parties*

Because of the current level of financial ownership, I am disqualified from participating personally and substantially in any particular matter that affects any of following entities as a specific party:

| RECUSAL LIST – SPECIFIC PARTY MATTERS | | | |
|---|---|---|---|
| Abbot Laboratories | Abbvie | Accenture PLC | Agilent Technologies |
| Alphabet Inc | Altria Group | Amazon | American Express |
| Ameriprise Financial | Apple, Inc. | Arthur J Gallagher | AT&T |
| Becton Dickinson | Broadcom Inc | Canadian National RY | Centene Corp |
| Champion X Corp | Charter Communications | Cisco Systems | Colgate Palmolive |
| Comcast | Costco | Danaher Corp | Deere & Co. |
| Discover Financial | Disney | Dollar Tree Inc | Dover Corp |
| Eaton Corp | Ecolab Inc. | Facebook | Fidelity |
| First Rep Bank | Fortive Corp. | Glaxo Smith Kline | Home Depot |
| IBM | Intel Corp | Johnson & Johnson | JP Morgan Chase |
| Lab Co of America Holding | Markel Corp | Martin Marietta Materials Inc | Meditronic PLC |
| Merck & Co. | Mettler Toledo Intl | Microsoft | Mondelez International |
| Monster Beverage | Nestle S.A. | Nike | Novartis AG |
| NVIDIA Corp | Omnicom Group | PayPal | PepsiCo |
| Pfizer Inc. | Philip Morris | Proctor & Gamble Co. | PNC Financial |
| Qualcomm INC | Roche Holding AG | Roper Technologies | SalesForce |
| Sherwin Williams | Skyworks Solutions | Spotify | Starbucks Corp |
| State Street | Texas Instruments | TJX | Truist Financial Corp |
| United Health Group | US Bancorp | Verizon Comm | Visa |
| Wells Fargo | Zoetis, Inc. | | |

*Particular Matters of General Applicability*

I am also disqualified from participating personally and substantially in any particular matter of general applicability that is focused on the interests of any individual discrete and identifiable class of "persons" (identified as "sectors" below). This prohibition extends to each class (or sector) individually. If a matter affects all sectors or if a particular matter affects a combination of sectors, including the ones listed below, then I understand that I do not have a financial conflict of interest.

| RECUSAL LIST – INDIVIDUAL SECTORS | | |
|---|---|---|
| Advertising | Apparel | Banking |
| Communications Equipment | Credit Services | Discount Stores |
| Entertainment | Farm & Heavy Construction Machinery | Footwear |
| Healthcare Plans | Home Improvement Retail | Household & Personal Products |
| Information Technology Services | Insurance | Internet Content |
| Internet Retail | Non-Alcoholic Beverages | Packaged Foods |
| Paint | Pharmaceuticals & Drug Manufacturing | Restaurants |
| Scientific & Technical Instruments | Semiconductors | Snack Food |
| Snack Food | Software | Specialty Chemicals |
| Specialty Industrial Machinery | Specialty Industrial Machinery | Telecom Services |
| Tobacco | | |

*Corporate Bonds*

I am recused from participating in any particular matter that will have a direct and predictable financial effect upon the ability and willingness of the following bond issuers to honor their obligations or that will affect their bond ratings:

| RECUSAL LIST – BONDS | | | |
|---|---|---|---|
| Amgen, Inc. | Anthem, Inc. | Apple, Inc. | Comcast Corporation |
| General Dynamics Corporation | Morgan Stanley | Starbucks Corporation | State Street Corporation |

*Certificate of Divestiture*

I intend to seek a certificate of divestiture and will update this recusal statement when my financial situation changes.

*SCREENING ARRANGEMENT*

In order to ensure that I do not participate in matters relating to any of the entities listed above, I will instruct Ann Ferrio, Chief of Staff, to assist in screening EPA matters directed to my attention that involve my former employer or my former clients. All inquiries and comments involving the entities or issue areas on my recusal list should be directed to the Chief of Staff without my knowledge or involvement.

If the Chief of Staff determines that a particular matter will directly involve any of the entities or issue areas on my recusal list, then she will refer it for action or assignment to another, without my knowledge or involvement. In the event that she is unsure whether an issue is a particular matter from which I am recused, then she will consult with OGC/Ethics for a determination. I will provide a copy of this memorandum to my principal subordinates and a copy to Justina Fugh, Director, Ethics Office.

*UPDATE AS NECESSARY*

In consultation with OGC/Ethics, I will revise and update my recusal statement whenever warranted by changed circumstances, including changes in my financial interests, changes in my personal or business relationships, or any changes to my EPA duties. In the event of any changes, I will provide a copy of the revised recusal statement to you and OGC/Ethics.

cc: Elizabeth Shaw, Deputy Assistant Administrator
Tomás Carbonell, Deputy Assistant Administrator for Stationary Sources
Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources
Ann (Campbell) Ferrio. Chief of Staff
Eunjung Kim, Special Assistant
Justina Fugh, Director, Ethics Office

Message

**From**: Fugh, Justina [Fugh.Justina@epa.gov]
**Sent**: 4/9/2021 3:16:07 AM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Campbell, Ann [Campbell.Ann@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Shaw, Betsy [Shaw.Betsy@epa.gov]; Clarke, Victoria [clarke.victoria@epa.gov]; Kim, Eun [Kim.Eun@epa.gov]
**Subject**: RE: Goffman Recusal Statement -- Signed
**Attachments**: Signed recusal 4-8-21.docx

Thanks, Joe! I noticed that the document you sent was signed but not dated. I took the liberty of inserting today's date, so here you go. (Believe me, we're going to want to have a dated recusal).
Justina

Justina Fugh | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Thursday, April 08, 2021 8:05 PM
**To:** Fugh, Justina <Fugh.Justina@epa.gov>
**Cc:** Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>; Shaw, Betsy <Shaw.Betsy@epa.gov>; Clarke, Victoria <clarke.victoria@epa.gov>; Kim, Eun <Kim.Eun@epa.gov>
**Subject:** Goffman Recusal Statement -- Signed

Justina -- Please find attached my recusal statement. Thank you – thank you, Victoria – for your invaluable support and diligence in working with me to formulate this statement.

Ann and OAR colleagues – thank you in advance for assisting me in implementing the commitments made in this statement.

At the moment, I plan to move expeditiously to divest several holdings that create potential conflicts, which likely will result in this document being modified.

Again, thank you.

Best,
Joe

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

[ SEQ CHAPTER \h \r 1]**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Washington, D.C. 20460

April 8, 2021

OFFICE OF
AIR AND RADIATION

**MEMORANDUM**

SUBJECT: Recusal Statement

FROM: Joseph Goffman
Acting Assistant Administrator

TO: Michael S. Regan
Administrator

I have consulted with the Office of General Counsel/Ethics (OGC/Ethics) and been advised about my ethics obligations. This memorandum formally notifies you of my continuing obligation to recuse myself from participating personally and substantially in certain matters in which I have a financial interest, or a personal or business relationship. I also understand that I have obligations pursuant to Executive Order 13989 and President Biden's Ethics Pledge that I signed.

*OBLIGATIONS UNDER EXECUTIVE ORDER 13989*

Pursuant to Section 1, Paragraph 2 of the Executive Order, I understand that I am prohibited from participating in any particular matter involving specific parties in which my former employer, **Harvard University,** is a party or represents a party. I understand that my recusal will last for two years from the date that I joined federal service. This recusal will end after January 20, 2023.

I have been advised by OGC/Ethics that, for the purposes of this pledge obligation, the term "particular matters involving specific parties" is broadened to include any meetings or other communication relating to the performance of my official duties, unless the communication applies to a particular matter of general applicability and participation in the meeting or other event is open to all interested parties. I am further advised that the term "open to all interested parties" means that the meeting should include a multiplicity of parties. If, for example, there is "a meeting with five or more stakeholders regarding a given policy or piece of legislation, [then I] could attend such a meeting even if one of the stakeholders is a former employer or former client."[1] Such a meeting must also include a diversity of interests. Should a question arise as to whether a specific forum qualifies as "open to all interested parties," then I will consult with

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|---|---|---|---|
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| Alphabet Inc | Altria Group | Amazon | American Express |
| Ameriprise Financial | Apple, Inc. | Arthur J Gallagher | AT&T |
| Becton Dickinson | Broadcom Inc | Canadian National RY | Centene Corp |
| Champion X Corp | Charter Communications | Cisco Systems | Colgate Palmolive |
| Comcast | Costco | Danaher Corp | Deere & Co. |
| Discover Financial | Disney | Dollar Tree Inc | Dover Corp |
| Eaton Corp | Ecolab Inc. | Facebook | Fidelity |
| First Rep Bank | Fortive Corp. | Glaxo Smith Kline | Home Depot |
| IBM | Intel Corp | Johnson & Johnson | JP Morgan Chase |
| Lab Co of America Holding | Markel Corp | Martin Marietta Materials Inc | Meditronic PLC |
| Merck & Co. | Mettler Toledo Intl | Microsoft | Mondelez International |
| Monster Beverage | Nestle S.A. | Nike | Novartis AG |
| NVIDIA Corp | Omnicom Group | PayPal | PepsiCo |
| Pfizer Inc. | Philip Morris | Proctor & Gamble Co. | PNC Financial |
| Qualcomm INC | Roche Holding AG | Roper Technologies | SalesForce |
| Sherwin Williams | Skyworks Solutions | Spotify | Starbucks Corp |
| State Street | Texas Instruments | TJX | Truist Financial Corp |
| United Health Group | US Bancorp | Verizon Comm | Visa |
| Wells Fargo | Zoetis, Inc. | | |

*Particular Matters of General Applicability*

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| RECUSAL LIST – INDIVIDUAL SECTORS | | |
|---|---|---|
| Advertising | Apparel | Banking |
| Communications Equipment | Credit Services | Discount Stores |
| Entertainment | Farm & Heavy Construction Machinery | Footwear |
| Healthcare Plans | Home Improvement Retail | Household & Personal Products |
| Information Technology Services | Insurance | Internet Content |
| Internet Retail | Non-Alcoholic Beverages | Packaged Foods |
| Paint | Pharmaceuticals & Drug Manufacturing | Restaurants |
| Scientific & Technical Instruments | Semiconductors | Snack Food |
| Snack Food | Software | Specialty Chemicals |
| Specialty Industrial Machinery | Specialty Industrial Machinery | Telecom Services |
| Tobacco | | |

*Corporate Bonds*

I am recused from participating in any particular matter that will have a direct and predictable financial effect upon the ability and willingness of the following bond issuers to honor their obligations or that will affect their bond ratings:

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|---|---|---|---|
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| General Dynamics Corporation | Morgan Stanley | Starbucks Corporation | State Street Corporation |

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*SCREENING ARRANGEMENT*

In order to ensure that I do not participate in matters relating to any of the entities listed above, I will instruct Ann Ferrio, Chief of Staff, to assist in screening EPA matters directed to my attention that involve my former employer or my former clients. All inquiries and comments involving the entities or issue areas on my recusal list should be directed to the Chief of Staff without my knowledge or involvement.

If the Chief of Staff determines that a particular matter will directly involve any of the entities or issue areas on my recusal list, then she will refer it for action or assignment to another, without my knowledge or involvement. In the event that she is unsure whether an issue is a particular matter from which I am recused, then she will consult with OGC/Ethics for a determination. I will provide a copy of this memorandum to my principal subordinates and a copy to Justina Fugh, Director, Ethics Office.

*UPDATE AS NECESSARY*

In consultation with OGC/Ethics, I will revise and update my recusal statement whenever warranted by changed circumstances, including changes in my financial interests, changes in my personal or business relationships, or any changes to my EPA duties. In the event of any changes, I will provide a copy of the revised recusal statement to you and OGC/Ethics.

cc: Elizabeth Shaw, Deputy Assistant Administrator
Tomás Carbonell, Deputy Assistant Administrator for Stationary Sources
Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources
Ann (Campbell) Ferrio. Chief of Staff
Eunjung Kim, Special Assistant
Justina Fugh, Director, Ethics Office

Message

**From**: Murphy, Tina [Murphy.Tina@epa.gov]
**Sent**: 4/5/2021 7:25:13 PM
**To**: OAR Briefings [OAR_Briefings@epa.gov]
**CC**: Desai, Mausami [Desai.Mausami@epa.gov]; Gunning, Paul [Gunning.Paul@epa.gov]; Irving, Bill [Irving.Bill@epa.gov]; Schmeltz, Rachel [Schmeltz.Rachel@epa.gov]; Millett, John [Millett.John@epa.gov]; DeLuca, Isabel [DeLuca.Isabel@epa.gov]
**Subject**: Overview of Inventory of U.S. GHG Emissions and Sinks: 1990-2019 - Tuesday, April 6th: 3:30-4 p.m.
**Attachments**: GHGInventory_1990-2019_Final_Report_Release_Comms Plan_v6.docx; FinalReport_Review_GHGI_OAR.pptx

Dear OAR Leadership:

Please find attached slides and the draft comms plan for "Overview of Inventory of U.S. GHG Emissions and Sinks: 1990-2019" on Tuesday, April 6th: 3:30-4 p.m.

Thank you.

**NOT YET SCHEDULED FOR ORAL ARGUMENT**

# United States Court of Appeals for the District of Columbia Circuit

**No. 21-1028**
**Consolidated with 21-1060**

STATE OF NEW YORK; STATE OF CALIFORNIA; STATE OF CONNECTICUT; DISTRICT OF COLUMBIA; STATE OF ILLINOIS; STATE OF MARYLAND; COMMONWEALTH OF MASSACHUSETTS; STATE OF MINNESOTA; STATE OF NEW JERSEY; STATE OF OREGON; COMMONWEALTH OF PENNSYLVANIA; STATE OF RHODE ISLAND; STATE OF VERMONT; COMMONWEALTH OF VIRGINIA; STATE OF WASHINGTON; STATE OF WISCONSIN; CITY OF NEW YORK,

*Petitioners,*

v.

ENVIRONMENTAL PROTECTION AGENCY; JANE NISHIDA, IN HER OFFICIAL CAPACITY AS ACTING ADMINISTRATOR OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

*Respondents.*

---

*Petition for Review of a Decision by a Federal Agency*

## BRIEF OF ENERGY POLICY ADVOCATES AS AMICUS CURIAE IN SUPPORT OF RESPONDENT

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## CERTIFICATE AS TO PARTIES, RULINGS, RELATED CASES, AND FILING OF SEPARATE BRIEF

As required by Circuit Rules 28(a)(1) and 29(d), counsel for Proposed Amicus hereby certifies as follows:

### A) Parties

The parties to this matter are:

State of New York,
State of California,
State of Connecticut,
District of Columbia,
State of Illinois,
State of Maryland,
Commonwealth of Massachusetts,
State of Minnesota,
State of New Jersey,
State of Oregon,
Commonwealth of Pennsylvania,
State of Rhode Island,
State of Vermont,
Commonwealth of Virginia,
State of Washington,
State of Wisconsin,
City of New York,
Petitioners,

and

Environmental Protection Agency,
Jane Nishida, in her official capacity as Acting Administrator of the United States Environmental Protection Agency,

Respondents.

**B) Rulings Under Review**

The agency action under review is identified in Petitioners' Joint Opening Brief for Petitioners.

**C) Related Cases**

There is one related case:

*American Academy of Pediatrics v. EPA*, 21-1060. That case was consolidated with the instant matter on February 16, 2021.

**D) Separate Brief**

Following discussions with various parties that are concerned generally with the issues in this matter, undersigned counsel certifies that he is not aware at this time if any of those entities have decided to file a brief or what the contents of any proposed brief might be. As such, it is not practicable at this time to file a joint amicus brief.

## CORPORATE DISCLOSURE STATEMENT

Pursuant to Circuit Rule 26.1, Energy Policy Advocates hereby certifies that it is a nonprofit, nonstock corporation incorporated under the laws of Washington State. As such, Energy Policy Advocates has no parent company or subsidiaries and no entity owns any part of its stock. Nor does Energy Policy Advocates own any shares of the stock of any other entity.

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# GLOSSARY

| | |
|---|---|
| CO2 | Carbon Dioxide |
| CAA | Clean Air Act |
| CPP | Clean Power Plan |
| EPA | United States Environmental Protection Agency |
| EPAA | Energy Policy Advocates |
| FOIL | New York Freedom of Information Law |
| GHG | Greenhouse Gas |
| GHGs | Greenhouse Gases |
| NAAQS | National Ambient Air Quality Standards |
| OAR | Office of Air and Radiation |
| OAG | Office of Attorney General |
| USEPA | United States Environmental Protection Agency |

## STATEMENT OF IDENTITY, INTEREST IN THE CASE, AND STATEMENT OF AUTHORITY TO FILE

Pursuant to Federal Rule of Appellate Procedure 29(a) Energy Policy Advocates (Proposed Amicus, or "EPAA") submits this proposed *amicus curiae* brief in support of the Respondent U.S. Environmental Protection Agency ("USEPA") in the above-captioned case.

Proposed Amicus EPAA is a nonprofit based in Washington State which conducts research into government policy by seeking access to public records under the federal Freedom of Information Act and similar state transparency laws, and educating the public on same by broadly disseminating such information. EPAA has no direct interest, financial or otherwise, in the outcome of the case, aside from its interest in good governance and advocating for the proper role of the federal judiciary.

Because of its lack of a direct interest, combined with its intimate and firsthand knowledge of records illustrating the Parties' desire to use friendly litigation to vacate and thereby necessitate replacement of a properly enacted Rule to end-run the Clean Air Act and other legal and political constraints, EPAA can provide the Court with a perspective that is distinct and independent from that of the parties. Further, the courts have acknowledged that collusive litigation is

improper. This appears to be collusive litigation, and Proposed Amicus also seeks to provide this Court with records strongly suggesting that this is the case.

EPAA seeks to file this brief pursuant to a contemporaneously filed Motion for Leave to File as an *Amicus Curiae*. Circuit Rule 19(b).

## STATEMENT OF AUTHORSHIP AND FINANCIAL CONTRIBUTIONS

No counsel for a party authored this brief in whole or in part, and no counsel or party made a monetary contribution intended to fund the preparation or submission of this brief. No person other than *Amicus Curiae*, its members, or its counsel made a monetary contribution to its preparation or submission.

## I. INTRODUCTION

Fifteen States, the District of Columbia, and the City of New York have sued in this Court to challenge a final regulation of the Environmental Protection Agency ("USEPA"). The regulation in question is the *Review of the Ozone National Ambient Air Quality Standards*, 85 Fed. Reg. 87,256 (Dec. 31, 2020)("the Rule"). The Rule maintains the existing air quality criteria and the national ambient air quality standards ("NAAQS") for photochemical oxidants including ozone ("O3") under the Clean Air Act ("CAA"), without revision. Petitioners seek a determination that the final action is unlawful and arbitrary and capricious. They therefore argue that the Rule must be vacated.

The current state of the law is to the Parties' express frustration, however the Rule is not unlawful, nor is it arbitrary and capricious.

Sections 108 and 109 of the Clean Air Act ("CAA") govern criteria pollutants.[1] Neither carbon dioxide ("CO2") nor a greenhouse gas ("GHG") proxy for CO2 is listed by Respondent USEPA as a criteria pollutant subject to NAAQS. Public records obtained by Proposed Amicus Energy Policy Advocates affirm that the Parties seek the regulatory effect of restricting CO2/GHGs as criteria pollutants governed by NAAQS. Unfortunately and contrary to duly-enacted law, however, they seek to do so without proposing a CO2 or GHG NAAQS, in recognition of the substantial legal and political obstacles to doing so.

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[1] Section 108 (42 U.S.C. 7408) directs the Administrator to identify and list certain air pollutants and then to issue air quality criteria for those pollutants, *inter alia*, for which he plans to issue air quality criteria. Section 109 (42 U.S.C. 7409) directs the Administrator to propose and promulgate ''primary'' and ''secondary'' NAAQS for pollutants for which air quality criteria are issued (42 U.S.C. 7409(a)). Section 109(b)(1) defines primary standards as ones ''the attainment and maintenance of which in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health." A secondary standard, under section 109(b)(2), must ''specify a level of air quality the attainment and maintenance of which, in the judgment of the Administrator, based on such criteria, is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of [the] pollutant in the ambient air.''

When Petitioner Attorneys General and the Respondent's official presently responsible for the NAAQS programs, including the Rule at issue, Joe Goffman,[2] consulted about how to force greenhouse gas regulations through the CAA's NAAQS program in late 2019, the AGs were exploring regulating CO2 as a criteria pollutant,[3] thereby triggering a CO2 or GHG-equivalent NAAQS. That proposition has long been understood to carry considerable risk.[4] President Obama's first EPA Administrator, Lisa Jackson, rejected a climate NAAQS as not "advisable."[5] One prominent environmentalist group attorney, also seeking to quell controversy over the prospect early in the Obama administration, said "hell will freeze over before there's a NAAQS for CO2."[6]

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[2] Joe Goffman is both the Acting Assistant Administrator for EPA's the Office of Air and Radiation and Principal Deputy Assistant Administrator, https://www.epa.gov/aboutepa/about-office-air-and-radiation-oar. "OAR is responsible for administering the Clean Air Act." *Id.* Goffman also was working in the Agency as a member of the Biden Administration transition team prior to and when suit was filed on January 19, 2021.

[3] This would prompt a CO2 equivalent or GHG equivalent NAAQS, herein "CO2 eq", "GHG eq".

[4] A climate NAAQS, whether or not obscured within a "secondary ozone NAAQS," would require massive central regulation of nearly all aspects of economic life, essentially a perpetual "Lockdown Economy," requiring truly massive reductions in energy use emissions.

[5] Robin Bravender, "EPA chief signals opposition to Clean Air Act curbs on GHGs," E&E News, December 8, 2009, https://www.eenews.net/stories/85407.

[6] *Id.*

Records show the Petitioners' plan evolved out of perceived necessity because of the legal and political obstacles inherent in attempting to declare carbon dioxide a criteria pollutant, and in order to circumvent the federal judiciary's foreclosure of direct frontal attempts to impose GHG standards in *Util. Air Regulatory Grp. v. Envtl. Prot. Agency* 573 U.S. 302 (2014)[7] and *West Virginia et al. v. EPA*, 15-1363, 2019 U.S. App. LEXIS 29593 (D.C. Cir. Sep. 17, 2019). That plan became to try and use a secondary ozone NAAQS to regulate GHGs.

The records EPAA has obtained illuminate in detail how the challenge now before this Court itself seeks an arbitrary and capricious outcome, an outcome that sets in motion a coordinated effort among the Parties to vacate (requiring replacement of) the properly enacted Rule. Petitioners and Respondent, as currently staffed, planned the replacement to include a secondary NAAQS for ozone which transmogrifies the NAAQS program to regulate non-criteria pollutant CO2/GHGs, after activists were frustrated in their pursuits through proper channels. These records reflect a shared objective of Petitioners and Respondent to

[7] The Supreme Court held in this 9-0 opinion that while *Massachusetts v. EPA*, 549 U.S. 497 (2007) found that the Clean Air Act's general definition of "air pollutant" included greenhouse gas emissions, it does not require the Environmental Protection Agency (EPA) to include greenhouse gas emissions every time the Act uses the term "air pollutant."

thereby fundamentally transform the Clean Air Act's NAAQS provision into an unrecognizable and never intended framework for economy wide decarbonization.[8]

This approach of using a secondary ozone NAAQS as a "back door" to a desired but unattainable regulatory outcome is improper on its face. Further, however, records detailing the 2019-2020 planning efforts also revealed an alternate desired outcome or "motive" for this challenge, in the event the judiciary rejects a secondary ozone NAAQS as a GHG regulatory scheme. That motive is equally improper: to assist private plaintiffs against private parties in climate "public nuisance" litigation by obtaining a declaration, effectively, that the predominant "nuisance" claims are not in fact displaced by EPA regulatory authority under *American Electric Power v. Connecticut*, 131 S. Ct. 2527, 2539, 564 U.S. 410, 426 (2011). Given that using the federal government to assist such private plaintiffs is also something the new administration promised to direct its

[8] See, e.g., "As justification for the abeyance, respondents cited an executive order by President Biden that directed review of certain agency actions related to the environment taken during the Trump administration. Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (Jan. 20, 2021). That order identified a non-exclusive list of agency actions for agency heads to review, including the EPA's ozone determination. Respondents' implication, of course, is that the federal government is likely to change its position regarding the 2020 rule." Motion of The States of Texas, Arkansas, Louisiana, Mississippi, Missouri, and Montana for Leave to Intervene as Respondents, at 3.

Attorney General to do -- highly improperly -- during the 2020 presidential campaign (see *infra*), Proposed Amicus also seeks to provide this information to the Court.

This suit to vacate the properly enacted Rule thereby triggering the need for a replacement rule is the pretextual culmination of a coordinated effort to revamp CAA's NAAQS program into a GHG regulatory regime, achieving a policy outcome that has been denied Petitioners and Respondent through the proper statutory and regulatory means.

## II. ARGUMENT

The petition in this matter is pretextual and seeks to create an arbitrary regulatory outcome, not to vacate one. Worse, it seeks to do so for what records express to be improper purposes. This Court must uphold the current Rule to prevent such an end-run around current law and sound policy.

### A. The Challenge is Improperly Founded.

Among the relevant public records obtained by Proposed Amicus are documents showing that as of October 2019 Petitioner Attorneys General were consulting with Joe Goffman, who is now Respondent U.S. Environmental Protection Agency's Principal Deputy Assistant Administrator for the Office of Air and Radiation ("OAR", responsible for greenhouse gas regulation), and also the

Acting Assistant Administrator for OAR.[9] These consultations specifically involved strategies for regulating GHGs through the NAAQS, replacing and expanding the Obama Administration's "Clean Power Plan" which was stayed by the United States Supreme Court in *West Virginia v. EPA*. Mr. Goffman was at the time employed at Harvard Law School which boasted that he was "'EPA's Law Whisperer' because 'his specialty is teaching old laws to do new tricks'" and that "he was one of the chief architects of the ground-breaking Clean Power Plan."[10]

Public records obtained by Proposed Amicus from Petitioner New York Office of Attorney General under New York's Freedom of Information Law show that, following initial discussions among themselves about approaching this problem by seeking to declare CO2 a criteria pollutant, Petitioner Offices of Attorney General ("OAGs") led by New York consulted with Mr. Goffman specifically because the former sought "people who have made the case for using

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[9] Proposed Amicus also possesses public records from Mr. Goffman's tenure at Respondent EPA during the Obama administration showing a long history of coordinating with Petitioner New York Attorney General and environmentalist groups, together, to advance the cause of GHG regulation and often used Gmail and AOL email accounts to conduct official business. As such, Proposed Amicus also notes that Goffman was working in the Agency as a member of the Biden Administration transition team prior to and when New York filed suit.

[10] "Joseph Goffman joins Environmental Law Program as new executive director," October 2, 2017, https://today.law.harvard.edu/joseph-goffman-joins-environmental-law-program-new-executive-director/ (last viewed February 11, 2021).

NAAQS" to regulate GHGs. These documents suggest that Petitioners' deliberations with a network of former EPA officials now turned activists, with whom Mr. Goffman put Petitioners in contact, led to Petitioner OAGs settling on the use of secondary NAAQS as their vehicle to obtain preferred policy goals but in hopes of skirting certain, substantial political and legal headwinds. This decision was made after taking "a hard look at the steps needed to actually develop a GHG NAAQS, as well as to implement it," and "issues in setting the NAAQS" for "CO2 and other GHG". Email Subject fields reveal that OAG consultations with Mr. Goffman and his network, and among Petitioner OAGs included, e.g., "GHG NAAQS — Structure of the discussion tomorrow at 3," "NAAQS call," and "GHG calls debrief."

Other emails specifically show that Mr. Goffman arranged for former senior career EPA officials to counsel these OAGs, led as in this suit by New York, telling EPA's former Associate Director for Science Policy and New Programs John Bachmann, *inter alia*, "You may be able to talk [New York OAG's Michael Myers] through the some [sic] NAAQS issues and/or identify others who would be good to talk to." Records show that after Goffman arranged for consultation, Mr. Bachmann then explained at length the reasons for and means of using a secondary

ozone NAAQS as the "backdoor" method to obtain the desired regulation of greenhouse gases.

Mr. Bachmann provided the unambiguously titled document "ClimateNAAQS.ppt", which Petitioner New York then circulated to other Petitioner OAGs as part of their extensive follow-up on Bachmann's recommended course of using an ozone NAAQS (and also possibly a secondary particulate matter NAAQS) to regulate GHGs. Bachmann noted that "new legislation requiring specific actions would be much better than NAAQS, and yet I'm mindful of the obvious problem of how to get such legislation even with a new administration". His "ClimateNAAQS.ppt" slide show, obtained by Proposed Amicus from another Petitioner OAG (Minnesota), stated, *inter alia*:

> Policy Assessment decisions
>
> • Primary standards: GHG do not cause health effects, but subsequent changes in climate can do indirectly
>
> • But Primary NAAQS attainment date is 10 years after designation
>
> • Secondary Standards: Climate is listed in the Act as a welfare effect
>
> • Secondary Standards attainment "as expeditiously as practicable"

Petitioners' consultation with Bachmann, which addressed the impracticality of seeking to impose NAAQS by declaring CO2 or GHGs as criteria pollutants -- which has the added political burden of requiring standards be attained in ten years

while a secondary NAAQS (for e.g., ozone, particulate matter) has no such deadline -- led to Bachmann's suggestion that "We can test run a GHG NAAQS now" using secondary NAAQS.[11]

Supporting the secondary NAAQS approach were suggestions passed through Bachmann to Petitioner OAGs from retired EPA Office of General Counsel lawyer Nancy Ketcham-Colwill, after Bachmann spoke with Petitioner New York OAG and explained the OAGs' wishes to both Ms. and Mr. Ketcham-Colwill.[12] The Ketcham-Colwills provided counsel on "using the NAAQS for GHGs," in an email conveyed by Bachmann, that:

> First, the most promising avenue for using the NAAQS may be to set just a secondary NAAQS (no margin-of-safety conundrum, no

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[11] "[R]ecommending that climate be considered in setting a secondary PM NAAQS as a basis for recommending the same thing for ozone during public comments I'll deliver in person at CASAC's December 5th meeting down here. Ozone is short lived climate forcer, and it would force more attention on methane as a precursor. We can test run a GHG NAAQS right now……" (ellipses in original) Also, "recommendations to consider the effects of climate in the review of the secondary standard for ozone." Obtained by Proposed Amicus under New York's FOIL.

[12] "Nancy and Jim Ketcham-Colwill who worked on parts of the [2008 GHG ANPR] at EPA [who] had thoughts on some retired EPA lawyers and I've left a message with probably the best one for your purpose." December 11, 2019 email from Bachmann to New York OAG's Myers, Subject: Fwd: Draft note on NAAQS lawyers and EPA GHG ANPR 2008 info. Produced to Proposed Amicus by Petitioner Vermont Office of the Attorney General under that state's open records law. Available at https://climatelitigationwatch.org/wp-content/uploads/2021/02/20201123-VT-OAG-Records-Produced-Redacted-Final.pdf, "Record 1," pp. 7-8.

statutory attainment deadline). The [2008 "Greenhouse Gas (GHG) Advanced Notice of Proposed Rulemaking" (ANPR) July 30, 2008, Federal Register Vol. 73, No. 147, p. 44354-44520[13]] discusses that option and there's a decent legal argument for it since GHGs don't directly (e.g., through inhalation) harm human health and the first listing criterion is whether the pollutant is reasonably expected to endanger public health OR welfare. The CAA definition of welfare include effects on climate, and Congress added that effect to the welfare definition in 1970 out of concern for anthropogenic climate change…

As we discussed, a NAAQS, even a secondary NAAQS, would take lots of time to implement, so is both a long shot and a longer-term strategy, when what we need is something more sure-fire and quick. But that would take legislation. Personally, we strongly believe that the next Administration should have a double-barrel strategy of pushing for legislation AND moving forward with CAA regulation (and other measures) in case Congress stalls out, as usual…

In our note yesterday we had said that even a 2dary NAAQS would surely be set below current levels given the CAA standard-setting criteria, but perhaps an argument might be made that current levels haven't bought us dangerous warming — yet (the effects of CO2 concentrations take years to fully assert themselves). The standard-setting criteria for 2dary [sic] standards call for protecting

[13] See, https://www.epa.gov/sites/production/files/2015-01/documents/2008_09_ghgfull.pdf.

> public welfare from "any known or anticipated adverse effects," so just avoiding "dangerous" warming might not cut it, particularly since climate change is already fueling more fire, floods, extreme weather, etc. But setting a NAAQS at current levels would avoid nonattainment NAAQS requirements for a while. Actually, the NAAQS would probably need to be set at the CO2 level expected for the time period relevant for designations.
>
> The science and statute would make a maintenance level NAAQS a hard sell and short-lived, but it's another interesting angle and possibly a useful gamble.[14]

This "long shot," "useful gamble" does appear, from the available record, to be where Petitioners ended up after consulting with Goffman, and the parties to whom Goffman referred Petitioners. Proposed Amicus respectfully states that Petitioners and Respondent have no interest in maintaining the standard that went into effect in December after the most recent notice and comment rulemaking.

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[14] December 3, 2019 email from Nancy Ketcham-Colwill to John Bachmann, forwarded on December 11, 2019 by Bachmann to New York OAG's Myers, Subject: Fwd: Draft note on NAAQS lawyers and EPA GHG ANPR 2008 info. Produced to Proposed Amicus by Petitioner Vermont Office of the Attorney General under that state's December 3, 2019 email from Nancy Ketcham-Colwill to John Bachmann, forwarded on December 11, 2019 by Bachmann to New York OAG's Michael Myers, Subject: Fwd: Draft note on NAAQS lawyers and EPA GHG ANPR 2008 info. Produced to Proposed Amicus by Petitioner Vermont Office of the Attorney General under that state's open records law. Available at https://climatelitigationwatch.org/wp-content/uploads/2021/02/20201123-VT-OAG-Records-Produced-Redacted-Final.pdf, "Record 1," pp. 7-10.

Some of these public records obtained by Proposed Amicus also articulate other purposes for the instant matter. In addition to using the replacement ozone NAAQS, which this suit seeks to necessitate, as a Trojan Horse to import the politically elusive regulatory regime for greenhouse gases, public records demonstrate an improper and illegitimate intended use of the regulatory process here. Records suggest that the Petitioners expect that if their "long shot" "useful gamble" fails to pay off, by losing in litigation triggered by the replacement rule, i.e., originally by this suit, they possibly might provide private tort litigants a better chance of succeeding in "public nuisance" litigation[15] by obtaining a clear declaration that the spate of climate "nuisance" claims are not in fact displaced by

[15] Petitioner OAGs have entered confidentiality agreements, obtained by Proposed Amicus EPAA, "Regarding Participation in Climate Change Public Nuisance Litigation," purporting a common legal interest in these matters, which "Climate Change Litigation includes, but may not be limited to: *City of Oakland, et al. v. BP P.L. C., et al.* (N.D. Cal. 17-cv-06011), *City and County of San Francisco, et al. v. BP P.L.C., et al.* (N.D. Cal. 17-cv-06012), *San Mateo v. Chevron Corp.* (N.D. Cal. 17-cv-04929), *Rhode Island v. Chevron Corp.* (R.I. Super. Ct. PC-2018-4716, and D. R.I. 18-00395), *Mayor & City Council of Baltimore v. BP p.l.c.* (Md. Cir. Ct. 24-C-18-004219 and D. Md. 18-02357), *City of New York v. BP p.l.c.* (S.D.N.Y 18- 00182), *King County v. BP p.l.c.* (Wash. Super. Ct. 18-2-11859-0 and W.D. Wash. 18-00758), and *Board of County Commissioners of Boulder County, et al., v. Suncor Energy, et al.,* No. 19-1330 (10th Cir.), and any appeals arising from those matters."

EPA regulatory authority and *American Electric Power v. Connecticut*, 131 S. Ct. 2527, 2539, 564 U.S. 410, 426 (2011).[16]

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[16] Further troubling and adding to concerns that this, too, is or will be pursued as a shared objective of the regulatory actions set in motion by the instant case is that the new administration ran for office vowing to deploy its Department of Justice to assist the same plaintiffs in private litigation. See, specifically, "Biden will instruct the Attorney General to…(iii) strategically support ongoing plaintiff-driven climate litigation against polluters." https://joebiden.com/environmental-justice-plan/ (last viewed February 11, 2021). Similarly, Proposed Amicus also notes correspondence it obtained of Bachmann pointing Petitioner New York OAG to a then-recent law review article convincing him that "there are reasons to push a GHG NAAQS approach other than an intent to actually do one." Howard M. Crystal et al., *Returning to Clean Air Act Fundamentals: A Renewed Call to Regulate Greenhouse Gases Under the National Ambient Air Quality Standards (NAAQS) Program*, 31 Geo. Env't L. Rev. 233, 235 (2019). The article argues, *inter alia*, that even losing an effort to obtain GHG through NAAQS, in court, might nonetheless erode the defense of private parties sued in an ongoing epidemic of "public nuisance" climate litigation, coordinated in part by the same Petitioners according to other public records. *American Electric Power v. Connecticut*, 131 S. Ct. 2527, 2539, 564 U.S. 410, 426 (2011)). "To be sure, in 2011 the Supreme Court ruled that federal nuisance claims against power plants over greenhouse gas emissions are displaced by Clean Air Act Section 111, because that provision expressly provides for the EPA to regulate those plants' greenhouse gas emissions (which it did with the CPP). However, in more recent cases defendants and their allies are arguing that even entities that are *not* regulated under Section 111 remain immune from tort liability, on the grounds that any and all such regulation of greenhouse gases must be done by the EPA in light of its comprehensive power under the Clean Air Act. If it turns out the EPA cannot enact a greenhouse gas NAAQS, these defenses to climate change tort suits will have less force. Accordingly, resolving the scope of the EPA's power to regulate under a NAAQS—even if it meant Congress expressly removing that power—may be an improvement over the current *status quo*, under which the *possibility* of a greenhouse gas NAAQS theoretically exists, but the EPA refuses to act." Crystal, et al. at 283 (citations omitted)).

For these reasons, Proposed Amicus wishes to provide this Court with the extensive documentary trail supporting the argument that the instant matter is designed to obtain what could not otherwise be obtained through the ordinary political and regulatory processes, with the alternate goal of strengthening the arguments of private tort litigants in event this challenge fails.

**B. This Challenge Seeks to Cause, Rather than Prevent, Arbitrary and Capricious Agency Action.**

Although the Petitioners claim that they seek to overturn an arbitrary and capricious final agency action, they in fact seek *to cause* such an outcome. This Court cannot allow the properly adopted Rule to be vacated as part of a plan by aligned Parties to substitute a regulation they prefer, which they began designing before the Rule was even proposed, in hopes of this moment.

Litigation among friendly or aligned litigants has been employed to establish Agency obligations "with little to no public input or transparency" or meaningful participation.[17] As Respondent USEPA itself put it in announcing a directive which USEPA has apparently and recently removed from its website, "Over the years,

[17] See, e.g., News Release, "Administrator Pruitt Issues Directive to End EPA 'Sue & Settle,'" Environmental Protection Agency, October 16, 2017, https://archive.epa.gov/epa/newsreleases/administrator-pruitt-issues-directive-end-epa-sue-settle.html. The directive was previously located at https://www.epa.gov/newsroom/directive-promoting-transparency-and-public-participation-consent-decrees-and-settlement (last viewed February 12, 2021).

outside the regulatory process, special interest groups have used lawsuits that seek to force federal agencies – especially EPA – to issue regulations that advance their interests and priorities, on their specified timeframe." *Id.*

The U.S. Chamber of Commerce notes, "'Sue and Settle' refers to when a federal agency agrees to a settlement agreement, in a lawsuit from special interest groups, to create priorities and rules outside of the normal rulemaking process. The agency intentionally relinquishes statutory discretion by committing to timelines and priorities that often realign agency duties."[18] The Heritage Foundation wrote of the practice, "Rules that affect the way an agency does business, especially ones that could saddle Americans with significant costs, are intended to be proposed and debated openly. The public is supposed to have ample opportunity to comment before being subjected to new rules that can affect their livelihoods. But under 'sue and settle,' that's not the case. Agencies simply caved, unable or unwilling to fight the lawsuits. Worse, they would agree to make changes that went beyond what the law required…"[19]

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[18] "Sue and Settle: Regulating Behind Closed Doors," March 6, 2018, https://www.uschamber.com/report/sue-and-settle-regulating-behind-closed-doors

[19] Edwin J. Fuelner, PhD, "Burying "Sue And Settle'," October 31, 2017, https://www.heritage.org/government-regulation/commentary/burying-sue-and-settle.

These organizations describe what Proposed Amicus has found is now underway with the filing of this suit to vacate the Rule at issue, supported both by Petitioners and the current Respondent official responsible for responding to their challenge, when in the private sector. A half-hearted (or non-existent) Agency defense of its Rule, or consent decree among friendly litigants, necessitates replacement of the Rule.[20] Such a replacement Rule has been the subject of the above-described planning as revealed in these public records, and therefore this challenge is almost certainly intended by the Parties to set in motion the "backdoor" effort to impose restrictions on non-criteria pollutants via NAAQS.

This Court has held that "Agency action is arbitrary or capricious if 'the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.'" *Guedes v. BATFE*, 440 U.S. App. D.C. 141, 172, 920 F.3d

[20] See FN 8, *supra*; see also, "The intervenor States cannot trust that the federal government will serve as adequate representatives of their interests—or that it will provide an adequate defense of the 2020 rule—going forward. Motion of The States of Texas, Arkansas, Louisiana, Mississippi, Missouri, and Montana for Leave to Intervene as Respondents, at 9.

1, 32 (2019), quoting *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43, 103 S. Ct. 2856, 77 L. Ed. 2d 443 (1983).

Here, the Petitioners allege that the existing Rule is arbitrary and capricious, but the records Energy Policy Advocates has obtained suggest that this describes the very suit seeking a replacement rule the Petitioners have developed, in consultation with Respondent, for the reasons articulated, *supra*. The replacement regulation the Parties consulted on together was for the purpose of thwarting, rather than implementing, Congressional intent in the Clean Air Act by using a program never intended to serve as an end-run framework for economy-wide decarbonization, to impose a regulatory regime denied the Parties to date through the proper processes.

The January 19, 2021 filing before this Court, preceding by a day the change in staffing atop both the Environmental Protection Agency and the Department of Justice, is a befitting coda to the events preceding the suit. This timing and history, and the apparent alignment of interests between the nominal adversaries in this litigation which has been revealed by the records discussed herein, suggest that both particular caution and the inclusion of more voices are in order.

The coordination of supposedly adversarial parties is corrosive to both litigation and the norms of agency rule-making. As the D.C District Court held in

an unpublished opinion, "To the extent the law disallows claims against one's self, it does so to preclude collusive litigation by which third parties may incur vicarious liability." *Leavell v. Shaw*, 946 F. Supp. 46, 47, 1996 U.S. Dist. LEXIS 18022, *5 (D.D.C. October 31, 1996). Similarly, the First Circuit expressed its concern that the Executive Branch may turn to friendly litigation to escape legislative enactments with which it disagrees. *Common Cause R.I. v. Gorbea*, 970 F.3d 11, 17 (1st Cir. 2020) ("We have paid attention, too, to the possibility that this litigation is collusive, with defendants having agreed to judgment just days after the suit was filed. A state official unhappy with the lawful decisions of the state legislature should not be able to round up an agreeable plaintiff who then uses collusive litigation to 'force' the state to do what the official wants.").

Here, Energy Policy Advocates respectfully submits that the Petitioners and the Respondent have interests so aligned and positions so pre-ordained as a result of prior consultation on precisely the outcome this litigation seeks to compel that the Respondent agency is similarly situated to an individual who attempts to claim against himself. Just as the First Circuit recognized in *Gorbea*, here the Executive Branch has teamed up with the Petitioners and entangled the judiciary in what would otherwise and rightly be the subject of a legislative battle over what Congress does – and does not – intend for the Agency to regulate under the Clean

Air Act. This Court has long recognized that such an approach runs contrary to the notion that an agency should only exercise its considerable rule-making authority with "a degree of public awareness, understanding, and participation commensurate with the complexity and intrusiveness of the resulting regulations." *Weyerhaeuser Co. v. Costle*, 590 F.2d 1011, 1028 (D.C. Cir. 1978).

This Court should decline the Petitioners' invitation to become entangled in political gamesmanship, or oversee Respondent's acquiescing in a pretextual suit to vacate a properly adopted Rule for these preordained purposes. It should instead uphold a Rule that was lawfully enacted using the ordinary regulatory process, and leave it to subsequent regulatory processes or legislative enactments to change such a Rule, rather than sanction the described, pretextual *pas de deux*.

## III. CONCLUSION

Energy Policy Advocates files this brief because it appears that without amicus participation the matter will lack informed balance among interests represented in what is designed to be the first, necessary step on the path to imposing the Parties' shared desire for a replacement rule on which the Parties also coordinated before this Rule at issue was even conceived. The Petitioners and Respondent are in express alignment and spent months of working together in

planning for this moment.[21] The federal government has an interest in its proposed final rule, if an interest that this Court will very soon see has been reversed with the employment of the new Acting Assistant Administrator who consulted with Petitioners on replacing the Rule prior to assuming his position with USEPA. Proposed Amicus, however, can oppose Petitioners' action, having in its possession an extensive collection of public records setting forth what is transpiring among the various parties.

The Proposed Amicus supports the Rule as properly enacted. Proposed Amicus can demonstrate that the Parties have collaborated to use this Court to impose an elusive greenhouse gas agenda through a "backdoor" that recasts the Clean Air Act from its current form, if without legislation because that does not have the necessary political support. The Proposed Amicus seeks to protect the

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[21] EPAA notes that this case was consolidated with *American Academy of Pediatrics v. EPA*, 21-1060, on February 16, 2021. The Petitioners in that case include, *inter alia*, Appalachian Mountain Club and Sierra Club, represented by EarthJustice. Public records obtained by Energy Policy Advocates show that both parties, again represented by EarthJustice, have since April 2019 been sharing information about ozone NAAQS litigation under a "Common Interest Agreement" with Petitioner Offices of the Attorney General for New Jersey and New York, which Offices also entered a common interest agreement, verbatim but for the Parties, on April 4, 2019 with Petitioner Offices of the Attorney General for Connecticut, Massachusetts, and also Petitioner New York City. Proposed Amicus obtained both pacts from Petitioner New Jersey Office of the Attorney General under that state's Open Public Records Act.

integrity of the regulatory process, the legislative process, and the judicial processes which the collaborating Parties hope to circumvent with friendly litigation.

Accordingly, the Proposed Amicus files this proposed *Amicus Curiae* brief under Fed. R. App. P. 29(a) in support of the Rule. This Court should uphold the Rule and reject an attempt by friendly litigants to overturn it.

Respectfully submitted this the 22nd day of February, 2021,

/s/ Christopher C. Horner
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## CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS AND TYPE STYLE REQUIREMENTS

1. This Brief complies with the type-volume limitation.

__X__ The Brief contains 5,406 words, excluding the parts of the Brief exempted by rule.

2. This brief complies with the typeface requirements and the type style requirements.

__X__ The brief has been prepared in a proportionally spaced typeface using MS Word in a 14 point Times New Roman font or

February 22, 2021

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## CERTIFICATE OF FILING AND SERVICE

I, Christopher C. Horner, hereby certify pursuant to Fed. R. App. P. 25(d) that, on February 22, 2021 the foregoing Brief of Energy Policy Advocates as Amicus Curiae in Support of Respondent was filed through the CM/ECF system and served electronically on registered parties.

/s/ Christopher C. Horner
Christopher C. Horner

Message

**From:** Millett, John [Millett.John@epa.gov]
**Sent:** 5/10/2021 6:02:37 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Fwd: EPA: Meet the man tasked with carrying out Biden's air agenda -- Monday, May 10, 2021 -- www.eenews.net

Begin forwarded message:

**From:** "Jones, Enesta" <Jones.Enesta@epa.gov>
**Date:** May 10, 2021 at 2:01:33 PM EDT
**To:** "Millett, John" <Millett.John@epa.gov>
**Subject: EPA: Meet the man tasked with carrying out Biden's air agenda -- Monday, May 10, 2021 -- www.eenews.net**

https://www.eenews.net/greenwire/2021/05/10/stories/1063732131

# Meet the man tasked with carrying out Biden's air agenda

Sean Reilly, E&E News reporterPublished: Monday, May 10, 2021

## EPA

Joe Goffman is EPA's acting air chief. School of Transnational Governance EUI/YouTube

Ask professional acquaintances about acting EPA air chief Joe Goffman, and adjectives like "smart" are accompanied by qualifiers like "careful," "cautious" and "strategic."

Those characteristics now face new tests as the veteran Clean Air Act lawyer occupies the center of a regulatory vortex with no recent parallel, tasked with both making good on the Biden administration's ambitious pledges and undoing a host of regulatory rollbacks undertaken under former President Trump.

"The pile of wreckage is huge," said Bruce Buckheit, a former EPA air enforcement chief who is now a consultant. "The work going forward is huge."

Among the forces in play: environmental groups insistent on the need for aggressive action to slash carbon emissions, existing policies in the way of the administration's objectives, and congressional Republicans and industry-allied organizations mobilizing in opposition. Already, one conservative group has accused Goffman in court papers of working with

Democratic officeholders before rejoining the agency on a scheme to decarbonize the economy.

Goffman will be juggling these tasks while overseeing one of EPA's main operations. With some 1,700 employees, the Office of Air and Radiation is the largest and most influential of the agency's program bailiwicks.

In a sign of the stakes, President Biden used one of his first executive orders to lay out explicit timetables for replacement of Trump-era methane and vehicle fuel efficiency rules. More than a half-dozen other Trump-era air regulations are also up for scrutiny, including live-wire decisions to leave soot and ozone standards unchanged.

Buckheit is among those placing Goffman in the "smart" and "cautious" category. While Goffman won't be making the final decisions, the people above him "will get good analysis and good options," Buckheit said.

Goffman, whose formal title is acting assistant administrator, declined to be interviewed for this article but answered several written questions through a spokeswoman.

Meanwhile, he has already gotten some assists from federal judges.

Just before Biden took office in January, for example, the U.S. Court of Appeals for the District of Columbia Circuit threw out the Trump administration's replacement for the Clean Power Plan, which Goffman helped write when previously serving with the Obama administration in a landmark bid to cut carbon emissions from coal-fired electricity plants (*Climatewire*, Jan. 20).

"YESSSSSS!!!!!!!!!" Goffman exulted on his once-chatty Twitter account, now largely mute except as a venue for highlighting musical tastes that range from New Orleans-flavored jazz to contemporary Estonian.

But if air office employees no longer have to grapple with the time-consuming mechanics of repealing the Trump-era replacement, known as the Affordable Clean Energy (ACE) rule, they still have to figure out what to put in its place.

"Sometimes the agency acts in a very risk-averse kind of way," said Ann Weeks, legal director for the Boston-based Clean Air Task Force, who was involved in the ACE rule litigation. "Certainly, the issue is too important for them not to act with courage."

Against a drumbeat of grim forecasts of climate change's impact, the same high-wire act lies ahead on the ultimate shape of long-term fuel efficiency standards for cars and light-duty trucks. Last month, EPA moved ahead with the first steps to reverse the Trump administration's weakening of those long-term targets. Its replacement strategy has yet to be unveiled.

At an online February panel discussion that marked one of Goffman's handful of public appearances thus far, Weeks hailed the Biden administration's start but added, "We need an all-of-the-above response on climate and clean air, and we need it yesterday."

To date, however, EPA's pace toward tomorrow has been measured, with its exact agenda still unclear.

Like other executive branch agencies, it has given the White House budget office a list of other Trump-era actions it plans to revisit by year's end but declined to make the roster public.

To Shannon Broome, an industry lawyer with the firm Hunton Andrews Kurth LLP, Goffman's "thoughtful" approach is encouraging. At the Natural Resources Defense Council, Clean Air Director John Walke pointed to newly proposed limits on the "superpollutants" known as hydrofluorocarbons that have crosscutting support (*Greenwire*, May 3). "I think they are wisely rationing and prioritizing to ensure there will be progress beyond the status quo ... with each action they take," Walke said.

But signs of heightened expectations that may be hard to satisfy are percolating elsewhere.

In two recent separate petitions to EPA, environmental groups have sought notable expansions of the agency's regulatory authority, both to limit farm-related methane emissions and pollution from oil and gas production that helps spawn lung-searing ozone (*Greenwire*, April 8).

In each instance, petitioners were motivated at least in part by the administration's self-proclaimed determination to confront climate change and upend a status quo that has long saddled low-income and minority communities with disproportionate exposure to pollution.

"Although previous administrations have failed to reduce [greenhouse gas] emissions from industrial animal agriculture, we expect the Biden EPA to step up and grant the petition to prevent irreversible climate impacts and achieve environmental justice," Kristina Sinclair, food project fellow at Public Justice, a Washington nonprofit that's leading the push for tighter methane curbs on hog and dairy operations, said in an email.

EPA has traditionally been loath to clamp down on politically influential farmers and agribusiness; agency representatives have said only that the agency will review and respond to the petitions. Last month, Sens. John Thune (R-S.D.) and Kyrsten Sinema (D-Ariz.) introduced legislation to block EPA regulation of methane and other emissions from livestock operations (*E&E Daily*, May 4).

## Clean Air Act's 'law whisperer'

Goffman, 66, has been a fixture in Clean Air Act circles since the 1980s, whether on behalf of the Environmental Defense Fund, as a staffer on the Senate Environment and Public Works Committee, or at EPA.

A previous tour at the agency, running from late 2009 to early 2017, spanned almost all of the Obama administration. Then, he was associate assistant administrator for climate and senior counsel, with a portfolio that ranged from the Clean Power Plan to air toxics regulations, according to his LinkedIn profile.

A 2014 profile in E&E News dubbed Goffman the "law whisperer" for his work in teasing new regulatory authority out of the act (*Greenwire*, Jan. 22, 2014).

Before returning to EPA in January after serving on Biden's transition team for the agency, he was executive director of the Harvard Environmental & Energy Law Program. Now he is among a throng of Obama-era vets serving in the new administration. Former EPA chief Gina McCarthy is at the White House; former acting air head Janet McCabe, also deeply involved in the crafting of the Clean Power Plan, is EPA deputy administrator.

It's unclear whether Biden plans to nominate Goffman to hold his current job on a Senate-confirmed basis, despite having taken that step last month for his counterparts at EPA's water and chemicals offices (*Greenwire*, April 14). Another EPA representative, saying Goffman is "pleased to serve in his current role," punted the question to the White House. There, a spokesperson did not respond to an email.

A conservative research group has meanwhile alleged that Goffman consulted with Democratic state attorneys general while still at Harvard on how to regulate greenhouse gases under EPA's National Ambient Air Quality Standards (NAAQS) umbrella.

"That proposition has long been understood to carry considerable risk," an attorney for the organization, known as Energy Policy Advocates, wrote in a February friend-of-the-court brief in litigation brought by states and environmental groups to scrap the Trump administration's decision to leave ozone standards unchanged. That collaboration, the organization alleged, was part of a strategy to transform the NAAQS system "into an unrecognizable and never intended framework for economy-wide decarbonization."

The group, based in Washington state, cited documents received through open records act requests. Under the NAAQS framework, EPA currently sets standards for only a half-dozen pollutants like ozone and soot.

Not long after the brief's filing, EPA retracted the Trump administration's denial of an environmental group's petition to broaden the framework to include greenhouse gases (*Climatewire*, March 17). Agency officials have so far given no indication of whether they now intend to grant the petition.

In an email forwarded through an EPA spokesperson, Goffman declined to comment on Energy Policy Advocates' allegations because they are entangled in pending litigation. "I can say that EPA will follow science and the law to ensure that the environment and public health are protected," he said.

A staunch believer in outreach, he accompanied air quality regulators, according to copies of his work calendar obtained under the Freedom of Information Act and less detailed versions posted on an agency website.

Also on the list, in what one calendar entry describes as an "informational discussion," was a virtual meeting in February with Bill Wehrum, who ran the air office during part of Trump's term and oversaw development of many of the rollbacks that Goffman may have to unwind. Goffman, saying it was routine for incoming air office leaders to touch base with their predecessors, called the meeting "collegial and cordial."

Wehrum, who has since returned to private law practice, said in an email that they did not discuss substantive issues.

"I was pleased to have the chance to congratulate Joe on his return to EPA," he wrote. "I'm glad that OAR is in good hands."

Message

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 1/21/2021 4:30:31 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: Re: Where's Waldo?

Was this your swearing in??

Sent from my iPhone

On Jan 21, 2021, at 11:28 AM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

https://static.politico.com/dims4/default/4446dca/2147483647/resize/1160x/quality/90/?url=https%3A%2F%2Fstatic.politico.com%2Fe5%2Fcc%2F8e36ec074a3da3ee208e18b4e660%2F210120-biden-3-getty-773.jpg

Message

**From**: Griffo, Shannon [Griffo.Shannon@epa.gov]
**Sent**: 5/18/2021 8:35:12 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Fugh, Justina [Fugh.Justina@epa.gov]
**Subject**: For Your Awareness - FOIA Release of your Recusal Statement
**Attachments**: Signed recusal 4-8-21 Joe Goffman.pdf

Hi Joe,

OGC/Ethics receives a monthly FOIA request asking for certain ethics-related documents for all political appointees. OGC/Ethics has reviewed your responsive records and plans to release your recusal statement dated 4/8/21 (no redactions) to the following requestor on **Monday, May 24th**:

- Kevin Bogardus (E&E News), EPA-2021-004065 – requesting copies of recusal statements, impartiality determinations, ethics waivers, and outside activity approvals for all political and AD appointees from April 1 to May 1, 2021

Please see the attached document and let us know if you have any questions.

Thanks,
Shannon

Shannon Griffo
Office of General Counsel, Ethics
U.S. Environmental Protection Agency
(202) 564-7061
Griffo.Shannon@epa.gov

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Washington, D.C. 20460

April 8, 2021

OFFICE OF
AIR AND RADIATION

**MEMORANDUM**

SUBJECT: Recusal Statement

FROM: Joseph Goffman
Acting Assistant Administrator

TO: Michael S. Regan
Administrator

I have consulted with the Office of General Counsel/Ethics (OGC/Ethics) and been advised about my ethics obligations. This memorandum formally notifies you of my continuing obligation to recuse myself from participating personally and substantially in certain matters in which I have a financial interest, or a personal or business relationship. I also understand that I have obligations pursuant to Executive Order 13989 and President Biden's Ethics Pledge that I signed.

*OBLIGATIONS UNDER EXECUTIVE ORDER 13989*

Pursuant to Section 1, Paragraph 2 of the Executive Order, I understand that I am prohibited from participating in any particular matter involving specific parties in which my former employer, **Harvard University,** is a party or represents a party. I understand that my recusal will last for two years from the date that I joined federal service. This recusal will end after January 20, 2023.

I have been advised by OGC/Ethics that, for the purposes of this pledge obligation, the term "particular matters involving specific parties" is broadened to include any meetings or other communication relating to the performance of my official duties, unless the communication applies to a particular matter of general applicability and participation in the meeting or other event is open to all interested parties. I am further advised that the term "open to all interested parties" means that the meeting should include a multiplicity of parties. If, for example, there is "a meeting with five or more stakeholders regarding a given policy or piece of legislation, [then I] could attend such a meeting even if one of the stakeholders is a former employer or former client."[1] Such a meeting must also include a diversity of interests. Should a question arise as to whether a specific forum qualifies as "open to all interested parties," then I will consult with OGC/Ethics.

[1] *See* Office of Government Ethics (OGE) Advisory DO-09-011 (3/26/09), which applies to Exec. Order 13989 pursuant to OGE Legal Advisories LA-21-03 (1/22/21) and LA-21-05 (2/23/21).

*FINANCIAL CONFLICTS OF INTEREST*

As required by 18 U.S.C. § 208(a), I will not participate personally and substantially in any particular matter in which I know that I have a financial interest directly and predictably affected by the matter, or in which I know that a person whose interests are imputed to me has a financial interest directly and predictably affected by the matter, unless I first obtain a written waiver, pursuant to 18 U.S.C. § 208(b)(1), or qualify for a regulatory exemption, pursuant to 18 U.S.C. § 208(b)(2). I understand that the interests of the following persons are imputed to me: any spouse or minor child of mine; any general partner of a partnership in which I am a limited or general partner; any organization in which I serve as officer, director, trustee, general partner or employee; and any person or organization with which I am negotiating or have an arrangement concerning prospective employment.

*Particular Matters Involving Specific Parties*

Because of the current level of financial ownership, I am disqualified from participating personally and substantially in any particular matter that affects any of following entities as a specific party:

| RECUSAL LIST – SPECIFIC PARTY MATTERS | | | |
|---|---|---|---|
| Abbot Laboratories | Abbvie | Accenture PLC | Agilent Technologies |
| Alphabet Inc | Altria Group | Amazon | American Express |
| Ameriprise Financial | Apple, Inc. | Arthur J Gallagher | AT&T |
| Becton Dickinson | Broadcom Inc | Canadian National RY | Centene Corp |
| Champion X Corp | Charter Communications | Cisco Systems | Colgate Palmolive |
| Comcast | Costco | Danaher Corp | Deere & Co. |
| Discover Financial | Disney | Dollar Tree Inc | Dover Corp |
| Eaton Corp | Ecolab Inc. | Facebook | Fidelity |
| First Rep Bank | Fortive Corp. | Glaxo Smith Kline | Home Depot |
| IBM | Intel Corp | Johnson & Johnson | JP Morgan Chase |
| Lab Co of America Holding | Markel Corp | Martin Marietta Materials Inc | Meditronic PLC |
| Merck & Co. | Mettler Toledo Intl | Microsoft | Mondelez International |
| Monster Beverage | Nestle S.A. | Nike | Novartis AG |
| NVIDIA Corp | Omnicom Group | PayPal | PepsiCo |
| Pfizer Inc. | Philip Morris | Proctor & Gamble Co. | PNC Financial |
| Qualcomm INC | Roche Holding AG | Roper Technologies | SalesForce |
| Sherwin Williams | Skyworks Solutions | Spotify | Starbucks Corp |
| State Street | Texas Instruments | TJX | Truist Financial Corp |
| United Health Group | US Bancorp | Verizon Comm | Visa |
| Wells Fargo | Zoetis, Inc. | | |

*Particular Matters of General Applicability*

I am also disqualified from participating personally and substantially in any particular matter of general applicability that is focused on the interests of any individual discrete and identifiable class of "persons" (identified as "sectors" below). This prohibition extends to each class (or sector) individually. If a matter affects all sectors or if a particular matter affects a combination of sectors, including the ones listed below, then I understand that I do not have a financial conflict of interest.

| RECUSAL LIST – INDIVIDUAL SECTORS | | |
|---|---|---|
| Advertising | Apparel | Banking |
| Communications Equipment | Credit Services | Discount Stores |
| Entertainment | Farm & Heavy Construction Machinery | Footwear |
| Healthcare Plans | Home Improvement Retail | Household & Personal Products |
| Information Technology Services | Insurance | Internet Content |
| Internet Retail | Non-Alcoholic Beverages | Packaged Foods |
| Paint | Pharmaceuticals & Drug Manufacturing | Restaurants |
| Scientific & Technical Instruments | Semiconductors | Snack Food |
| Snack Food | Software | Specialty Chemicals |
| Specialty Industrial Machinery | Specialty Industrial Machinery | Telecom Services |
| Tobacco | | |

*Corporate Bonds*

I am recused from participating in any particular matter that will have a direct and predictable financial effect upon the ability and willingness of the following bond issuers to honor their obligations or that will affect their bond ratings:

| RECUSAL LIST – BONDS | | | |
|---|---|---|---|
| Amgen, Inc. | Anthem, Inc. | Apple, Inc. | Comcast Corporation |
| General Dynamics Corporation | Morgan Stanley | Starbucks Corporation | State Street Corporation |

*Certificate of Divestiture*

I intend to seek a certificate of divestiture and will update this recusal statement when my financial situation changes.

*SCREENING ARRANGEMENT*

In order to ensure that I do not participate in matters relating to any of the entities listed above, I will instruct Ann Ferrio, Chief of Staff, to assist in screening EPA matters directed to my attention that involve my former employer or my former clients. All inquiries and comments involving the entities or issue areas on my recusal list should be directed to the Chief of Staff without my knowledge or involvement.

If the Chief of Staff determines that a particular matter will directly involve any of the entities or issue areas on my recusal list, then she will refer it for action or assignment to another, without my knowledge or involvement. In the event that she is unsure whether an issue is a particular matter from which I am recused, then she will consult with OGC/Ethics for a determination. I will provide a copy of this memorandum to my principal subordinates and a copy to Justina Fugh, Director, Ethics Office.

*UPDATE AS NECESSARY*

In consultation with OGC/Ethics, I will revise and update my recusal statement whenever warranted by changed circumstances, including changes in my financial interests, changes in my personal or business relationships, or any changes to my EPA duties. In the event of any changes, I will provide a copy of the revised recusal statement to you and OGC/Ethics.

cc: Elizabeth Shaw, Deputy Assistant Administrator
Tomás Carbonell, Deputy Assistant Administrator for Stationary Sources
Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources
Ann (Campbell) Ferrio. Chief of Staff
Eunjung Kim, Special Assistant
Justina Fugh, Director, Ethics Office

Message

**From**: Hoffer, Melissa [Hoffer.Melissa@epa.gov]
**Sent**: 5/20/2021 2:01:38 AM
**To**: McCabe, Janet [McCabe.Janet@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Arroyo, Victoria [Arroyo.Victoria@epa.gov]
**Subject**: New Harvard Study--Gas, Wood, Biomass Combustion Health Impacts Outpace Coal

https://www.hsph.harvard.edu/c-change/news/stationarysources/

"The increasing role of gas and biomass and wood emissions in the health burden of $PM_{2.5}$ exposure indicates that swapping one air pollution-emitting fuel source for another is not a pathway to a healthy energy system. Our work demonstrates that health can be considered in energy decisions, health and energy policy are inextricably linked, and that inclusion of health in energy policy may be necessary for true primary prevention of a large portion of disease burden in the U.S. New energy infrastructure that is installed now will likely be operational for decades—likely 'locking in' their health impacts along with their GHG emissions for decades [40–42]. This means that deployment of zero-emission renewable energy sources now may be necessary to continue on a path toward a healthy energy system, and to avoid changes to the energy system that will become 'regrettable assets' in the future."

Melissa A. Hoffer
Acting General Counsel
Principal Deputy General Counsel
U.S. Environmental Protection Agency
Office of General Counsel
1200 Pennsylvania Avenue, NW
Washington, DC 20460
T: 202.440.1671
E: hoffer.melissa@@epa.gov

Message

**From**: Campbell, Ann [Campbell.Ann@epa.gov]
**Sent**: 5/20/2021 12:49:52 PM
**To**: Tsirigotis, Peter [Tsirigotis.Peter@epa.gov]; Koerber, Mike [Koerber.Mike@epa.gov]; Grundler, Christopher [grundler.christopher@epa.gov]; Kocchi, Suzanne [Kocchi.Suzanne@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Edwards, Jonathan [Edwards.Jonathan@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]
**CC**: Shaw, Betsy [Shaw.Betsy@epa.gov]; Monroe, Scott [Monroe.Scott@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]
**Subject**: J Goffman Recusal Statement
**Attachments**: Signed recusal 4-8-21.docx

Good morning. Please find attached Joe's current recusal statement. Please note that Joe's statement will be updated soon as he continues to divest of some of his holdings creating the financial conflicts of interest. When that happens, I will circulate his updated recusal statement.

Thank you for your continued assistance in aiding the leadership team in meeting their ethical obligations. If you have any questions, please feel free to contact me.

Ann (Campbell) Ferrio
Chief of Staff
EPA/Office of Air and Radiation
Office: 202 566 1370

Message

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 1/21/2021 4:43:52 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: Re: Where's Waldo?
**Attachments**: ATT00001.txt

That is so very lovely! Yesterday was amazing. So much joy. I'm really happy you got to be part of it. You deserve it and I'm thrilled some of the old team is getting back together to get some carbon regs launched!

Sent from my iPhone

On Jan 21, 2021, at 11:35 AM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

Yep. It was classy for him to do this. Administered the oath himself and gave a lovely, and gracious speech.

https://www.youtube.com/watch?v=5IsSpAOD6K8

Ceremony is probably on YouTube as well.

**From:** Just, Robin L <rjust@law.harvard.edu>
**Sent:** Thursday, January 21, 2021 11:31 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: Where's Waldo?

Was this your swearing in??
<image001.jpg>
Sent from my iPhone

On Jan 21, 2021, at 11:28 AM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

https://static.politico.com/dims4/default/4446dca/2147483647/resize/1160x/quality/90/?url=https%3A%2F%2Fstatic.politico.com%2Fe5%2Fcc%2F8e36ec074a3da3ee208e18b4e660%2F210120-biden-3-getty-773.jpg

Message

**From**: Hamilton, Lindsay [Hamilton.Lindsay@epa.gov]
**Sent**: 1/21/2021 4:52:15 PM
**To**: Arroyo, Victoria [Arroyo.Victoria@epa.gov]; Adhar, Radha [Adhar.Radha@epa.gov]; Fox, Radhika [Fox.Radhika@epa.gov]; Blythers, Dorien [Blythers.Dorien@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Cassady, Alison [Cassady.Alison@epa.gov]; Chaudhary, Dimple [Chaudhary.Dimple@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Enobakhare, Rosemary [Enobakhare.Rosemary@epa.gov]; Fine, Philip [Fine.Philip@epa.gov]; Fox, Radhika [Fox.Radhika@epa.gov]; Harris, Sincere [Harris.Sincere@epa.gov]; Hoffer, Melissa [Hoffer.Melissa@epa.gov]; Katims, Casey [Katims.Casey@epa.gov]; Lucey, John [Lucey.John.D@epa.gov]; Utech, Dan [Utech.Dan@epa.gov]
**Subject**: PLEASE REVIEW: Draft Personnel Announcement
**Attachments**: Day One Political Appointees Draft Announcement.docx

All,

Attached is the draft personnel announcement we will issue today. **Please review your bio and respond to me with any changes as soon as possible**.

In some cases, this might be the short bio you provided to us and in others it is distilled from a longer version or other sources.

If you have changes to your bio, please send me your updated version in the body of an email. No need to track changes in the document, we will copy and paste it back into the central version. Please be mindful of length.

This will also be copy edited after the updates are made.

Thank you,
Lindsay

Message

**From:** Kakade, Seema [skakade@law.umaryland.edu]
**Sent:** 6/24/2021 10:02:05 AM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]; Rakosnik, Delaney [rakosnik.delaney@epa.gov]
**Subject:** Invitation: ABA SEER Fall Conference

Dear Joe,

It feels like a long time since we were chatting in person at Harvard ELR's Symposium in March 2020 just before the pandemic hit! I hope things are well as you have transitioned to EPA. I am writing as a member of this year's ABA SEER's 2021 Fall Conference Planning Committee. The Committee is in the process of planning our 29th Fall Conference, which will take place from October 13-15, 2021 at the Grand Hyatt in Washington, DC. The Committee is developing a session on the Clean Air Act that is currently titled, ***"The Role of and Challenges with the Clean Air Act in Realizing the Biden Administration's effort to improve air quality, reduce greenhouse gases, and advance environmental justice."*** Given your expertise in the Clean Air Act, the Committee would be delighted if you would be interested and available to speak on this panel, which currently is scheduled from 1:30 to 2:30 pm on Friday, October 15th.

To meet Continuing Legal Education requirements, each speaker must submit a publication-quality paper that is four to 10 pages, single-spaced, although a collaborative paper prepared by all panelists may also meet CLE requirements. Moderators and speakers are offered a reduced registration fee for the entire Conference and complimentary registration on the day of their presentations.

The Committee is operating under tight deadlines now that we have received authorization to hold the Conference in-person, so it would be great if you can let me know by Tuesday, June 29, whether you can participate. I hope you can attend.

I am also cc'ing here Delaney Rakosnik, who I understand from Roger Martella, is your assistant.

Warm regards,
Seema

Ms. Seema Kakade
Associate Professor
Director, Environmental Law Clinic
University of Maryland Carey School of Law
500 W. Baltimore Street
Baltimore, MD 21201
(410) 706-0590

Message

**From**: Shaw, Betsy [Shaw.Betsy@epa.gov]
**Sent**: 7/25/2021 7:52:59 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: RE: Talking Points for Lead Region College

I think that's likely since he did a stint at NESCAUM. Hopefully he'll be onscreen on Monday and you can get visual confirmation. BTW, I just google him and it looks like he does improv on the side.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Sunday, July 25, 2021 3:48 PM
**To:** Shaw, Betsy <Shaw.Betsy@epa.gov>
**Subject:** RE: Talking Points for Lead Region College

Got it. Thanks. For some reason, I think Leiran was Janet and my point of contact for an article we co-wrote with William Niebling on NSR for the AWMA journal back in 2019?

http://eelp.law.harvard.edu/wp-content/uploads/mccabe.pdf

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Shaw, Betsy <Shaw.Betsy@epa.gov>
**Sent:** Sunday, July 25, 2021 3:17 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; OAR Briefings <OAR_Briefings@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>; Kim, Eunjung <Kim.Eun@epa.gov>; Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>; Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Hyde, Courtney <Hyde.Courtney@epa.gov>; Wolfe, Michael <Wolfe.Michael@epa.gov>
**Subject:** Talking Points for Lead Region College

Hi Joe,

Attached please find talking points for Monday's "Lead Region College" at which you are slated to speak around 11:20 a.m. Per OCIR's request, the talking points highlight the value of the lead region system to OAR in addition to paying tribute to Region 10 and Justin Spenillo for their service as lead region to OAR for the last two years. You'll end with a welcome to Region 1 and Leiran Biton who will officially assume the lead region role in October.

Thanks for covering this event!

Betsy

Message

**From**: Biton, Leiran [biton.leiran@epa.gov]
**Sent**: 7/26/2021 3:43:09 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: RE: Look Familiar?

Ha. I was wondering if you would make that connection. In all the tornado of things you are involved in, I am impressed that you could pull my name out from a couple years ago.

I'm very much looking forward to working with you over the next couple years. We have big work to do, and I'm happy to be a small part of it. And don't worry, I've got Justin's number on speed-dial ☺

--
**Leiran Biton** *(he/him)*
US EPA Region 1, New England
Office (617) 918-1267
biton.leiran@epa.gov
The environment will be just a little bit sadder if you choose to print this message.

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Monday, July 26, 2021 11:41 AM
**To:** Biton, Leiran <biton.leiran@epa.gov>
**Subject:** Look Familiar?

http://eelp.law.harvard.edu/wp-content/uploads/mccabe.pdf

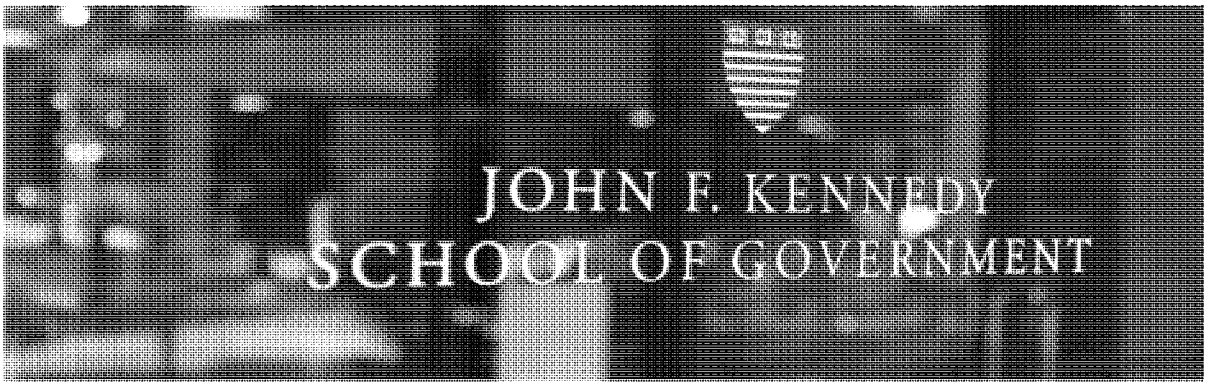
Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Take your professional development to the next level with an online program from Harvard Kennedy School Executive Education.

Message

**From:** Harvard Kennedy School [exed@hks.harvard.edu]
**Sent:** 7/21/2021 2:46:37 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Build Leadership Skills with Harvard Exec Ed Programs (Online)

HARVARD Kennedy School




Take your professional development to the next level with an online program from Harvard Kennedy School Executive Education. Each program offers live sessions led by Harvard faculty, and the interactive learning environment will help you build a lasting network of peers and expand your global perspective.

VIEW ONLINE PROGRAMS

---

Upcoming Online Programs:

Nonprofit Management and Leadership: Strategies for Organizational Success

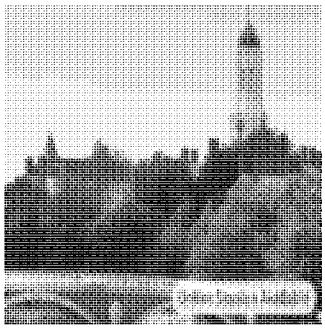
September 1 - October 26, 2021

This seven-week online program provides you with a deeper understanding of the nonprofit sector at large and help you develop core leadership skills to advance your career.

## Promoting Racial Equity in the Workplace

September 13-17, 2021

This one-week online program is designed for leaders from the public, private, and nonprofit sectors who want to learn effective strategies for increasing diversity, inclusion, and racial equity within their organization.



## Creating Collaborative Solutions

September 14 - November 19, 2021

This nine-week online program will improve your ability to spot and seize opportunities for value-creating solutions to problems using collaborative approaches. You'll learn tools to mobilize diverse resources beyond their direct control and deploy them in new, concrete initiatives.

## Climate Change Policy: Economics and Politics

September 20-24, 2021

This five-day online program addresses the significant challenge of climate change and its impacts on the environment, as well as society and the global economy. The engaging virtual curriculum explores potential policies to address climate change.

## Leadership Decision Making

September 20 - October 1, 2021

This two-week online program improves your decision analysis and leadership effectiveness. You'll discover how to recognize biases in judgment that affect even the most intelligent individuals and to incorporate structured decision-making techniques empirically shown to enhance decision making.

## Leading Smart Policy Design

September 21 - October 12, 2021

This three-week online program is for leaders and their teams charged with designing and delivering policies or programs that address social and economic problems around the world. It provides practical frameworks for analysis and hands-on experience using a smart, systematic, and collaborative approach to theory- and data- driven innovation.

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**Unsubscribe**

This message sent to **goffman.joseph@epa.gov** from

exed@hks.harvard.edu | +1 617.496.9000
Harvard Kennedy School | Harvard Kennedy School
79 JFK Street , Cambridge, MA 02138

Message

**From**: Griffo, Shannon [Griffo.Shannon@epa.gov]
**Sent**: 7/19/2021 7:12:59 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Fugh, Justina [Fugh.Justina@epa.gov]
**Subject**: For Your Awareness - FOIA Release of your Updated Recusal Statement
**Attachments**: Joe Goffman Updated Recusal 6_30_21.pdf

Hi Joe,

As you may recall, OGC/Ethics receives a monthly FOIA request asking for certain ethics-related documents for all political appointees. OGC/Ethics has reviewed your responsive records and plans to release your recusal statement dated 6/30/21 (no redactions) to the following requestor on **Thursday, July 22nd**:

- Kevin Bogardus (E&E News), EPA-2021-005307 – requesting copies of recusal statements, impartiality determinations, ethics waivers, and outside activity approvals for all political and AD appointees from June 1 to July 1, 2021

Please see the attached document and let us know if you have any questions.

Thanks!
Shannon

Shannon Griffo
Office of General Counsel, Ethics
U.S. Environmental Protection Agency
(202) 564-7061
Griffo.Shannon@epa.gov

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Washington, D.C. 20460

OFFICE OF
AIR AND RADIATION

**MEMORANDUM**

SUBJECT: Updated Recusal Statement

FROM: Joseph Goffman
Acting Assistant Administrator

JOSEPH GOFFMAN Digitally signed by JOSEPH GOFFMAN Date: 2021.06.30 12:48:36 -04'00'

TO: Michael S. Regan
Administrator

I have consulted with the Office of General Counsel/Ethics (OGC/Ethics) and been advised about my ethics obligations. This memorandum formally notifies you of my continuing obligation to recuse myself from participating personally and substantially in certain matters in which I have a financial interest, or a personal or business relationship. I also understand that I have obligations pursuant to Executive Order 13989 and President Biden's Ethics Pledge that I signed. This recusal statement replaces and supersedes the recusal statement I signed on April 8, 2021.

*OBLIGATIONS UNDER EXECUTIVE ORDER 13989*

Pursuant to Section 1, Paragraph 2 of the Executive Order, I understand that I am prohibited from participating in any particular matter involving specific parties in which my former employer, **Harvard University,** is a party or represents a party. I understand that my recusal will last for two years from the date that I joined federal service. This recusal will end after January 20, 2023.

I have been advised by OGC/Ethics that, for the purposes of this pledge obligation, the term "particular matters involving specific parties" is broadened to include any meetings or other communication relating to the performance of my official duties, unless the communication applies to a particular matter of general applicability and participation in the meeting or other event is open to all interested parties. I am further advised that the term "open to all interested parties" means that the meeting should include a multiplicity of parties. If, for example, there is "a meeting with five or more stakeholders regarding a given policy or piece of legislation, [then I] could attend such a meeting even if one of the stakeholders is a former employer or former client."[1] Should a question arise as to whether a specific forum qualifies as "open to all interested parties," then I will consult with OGC/Ethics.

[1] *See* Office of Government Ethics (OGE) Advisory DO-09-011 (3/26/09), which applies to Exec. Order 13989 pursuant to OGE Legal Advisories LA-21-03 (1/22/21) and LA-21-05 (2/23/21).

*FINANCIAL CONFLICTS OF INTEREST*

As required by 18 U.S.C. § 208(a), I will not participate personally and substantially in any particular matter in which I know that I have a financial interest directly and predictably affected by the matter, or in which I know that a person whose interests are imputed to me has a financial interest directly and predictably affected by the matter, unless I first obtain a written waiver, pursuant to 18 U.S.C. § 208(b)(1), or qualify for a regulatory exemption, pursuant to 18 U.S.C. § 208(b)(2). I understand that the interests of the following persons are imputed to me: any spouse or minor child of mine; any general partner of a partnership in which I am a limited or general partner; any organization in which I serve as officer, director, trustee, general partner or employee; and any person or organization with which I am negotiating or have an arrangement concerning prospective employment.

*Particular Matters Involving Specific Parties*

Because of the current level of financial ownership, I am disqualified from participating personally and substantially in any particular matter that affects any of following entities as a specific party:

| RECUSAL LIST – SPECIFIC PARTY MATTERS | | | |
|---|---|---|---|
| Abbot Laboratories | Abbvie | Accenture PLC | Agilent Technologies |
| Alphabet Inc | Altria Group | Amazon | American Express |
| Ameriprise Financial | Apple, Inc. | Arthur J Gallagher | AT&T |
| Becton Dickinson | Centene Corp | Charter Communications | Cisco Systems |
| Colgate Palmolive | Comcast | Costco | Danaher Corp |
| Deere & Co. | Discover Financial | Disney | Dollar Tree Inc |
| Facebook | Fidelity | First Rep Bank | Glaxo Smith Kline |
| IBM | Johnson & Johnson | JP Morgan Chase | Lab Co of America Holding |
| Markel Corp | Martin Marietta Materials Inc | Meditronic PLC | Merck & Co. |
| Mettler Toledo Intl | Microsoft | Mondelez International | Monster Beverage |
| Nestle S.A. | Nike | Novartis AG | Omnicom Group |
| PayPal | PepsiCo | Pfizer Inc. | Philip Morris |
| Proctor & Gamble Co. | PNC Financial | Roche Holding AG | SalesForce |
| Sherwin Williams | Spotify | Starbucks Corp | State Street |
| TJX | Truist Financial Corp | United Health Group | US Bancorp |
| Verizon Comm | Visa | Wells Fargo | Zoetis, Inc. |

*Particular Matters of General Applicability*

I am also disqualified from participating personally and substantially in any particular matter of general applicability that is focused on the interests of any individual discrete and identifiable class of "persons" (identified as "sectors" below). This prohibition extends to each class (or sector) individually. If a matter affects all sectors or if a particular matter affects a combination of sectors, including the ones listed below, then I understand that I do not have a financial conflict of interest.

| RECUSAL LIST – INDIVIDUAL SECTORS | | |
|---|---|---|
| Agricultural & Farm Machinery | Apparel, Accessories, & Footwear | Banks |
| Commodity Chemicals (Paint) | Construction Machinery & Heavy Trucks | Construction Materials |
| Cruise lines | Diversified Financials | Food & Staples Retailing |
| Healthcare Equipment & Services | Household & Personal Products | Household Appliances (lawn & garden tools) |
| Insurance | Internet & Direct Marketing Retail | Logistics |
| Media & Entertainment (including interactive media and services, and advertising) | Non-Alcoholic Beverages | Packaged Foods & Meats (snack food) |
| Pharmaceuticals, Biotechnology, & Life Sciences | Professional Services | Software & Services |
| Technology Hardware & Equipment | Telecommunication Services | Tobacco |

*Corporate Bonds*

I am recused from participating in any particular matter that will have a direct and predictable financial effect upon the ability and willingness of the following bond issuers to honor their obligations or that will affect their bond ratings:

| RECUSAL LIST – BONDS | | | |
|---|---|---|---|
| Amgen, Inc. | Anthem, Inc. | Apple, Inc. | Comcast Corporation |
| General Dynamics Corporation | Morgan Stanley | Starbucks Corporation | State Street Corporation |

*SCREENING ARRANGEMENT*

In order to ensure that I do not participate in matters relating to any of the entities listed above, I will instruct Ann Ferrio, Chief of Staff, to assist in screening EPA matters directed to my attention that involve my former employer or my former clients. All inquiries and comments involving the entities or issue areas on my recusal list should be directed to the Chief of Staff without my knowledge or involvement.

If the Chief of Staff determines that a particular matter will directly involve any of the entities or issue areas on my recusal list, then she will refer it for action or assignment to another, without my knowledge or involvement. In the event that she is unsure whether an issue is a particular matter from which I am recused, then she will consult with OGC/Ethics for a determination. I will provide a copy of this memorandum to my principal subordinates and a copy to Justina Fugh, Director, Ethics Office.

*UPDATE AS NECESSARY*

In consultation with OGC/Ethics, I will revise and update my recusal statement whenever warranted by changed circumstances, including changes in my financial interests, changes in my personal or business relationships, or any changes to my EPA duties. In the event of any changes, I will provide a copy of the revised recusal statement to you and OGC/Ethics.

cc: Elizabeth Shaw, Deputy Assistant Administrator
Tomás Carbonell, Deputy Assistant Administrator for Stationary Sources
Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources
Ann (Campbell) Ferrio. Chief of Staff
Eunjung Kim, Special Assistant
Justina Fugh, Director, Ethics Office

THE COMMONWEALTH OF MASSACHUSETTS
OFFICE OF THE ATTORNEY GENERAL
ONE ASHBURTON PLACE
BOSTON, MASSACHUSETTS 02108

MAURA HEALEY
ATTORNEY GENERAL

(617) 727-2200
(617) 727-4765 TTY
www.mass.gov/ago

July 26, 2021

*Via Electronic Mail*

Erika Sasser, Director
Health and Environmental Impacts Division
sasser.erika@epa.gov

Nick Hutson, Group Leader
Energy Strategies
hutson.nick@epa.gov

Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
109 T.W. Alexander Drive
Mail Code D243-01
Research Triangle Park, North Carolina 27711

**Re: Supplemental Comments on "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review," RIN: 2060-AV12, Doc. ID No. EPA–HQ–OAR–2018–0794**

Dear Director Sasser and Mr. Hutson:

Thank you to you and your Environmental Protection Agency ("EPA") colleagues for meeting on June 9, 2021 with representatives of the Attorney General's Offices of Massachusetts, California, and New York, along with our public health and environmental organization partners, to discuss EPA's review of the final action entitled "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review," 85 Fed. Reg. 31,286 (May 22, 2020) ("Revised Finding"). We appreciated the opportunity to discuss the significant and continuing public health, environmental, and economic benefits of the national hazardous air pollutant emissions limitations for power plants, commonly known as the Mercury and Air Toxics Standards or "MATS Rule," 77 Fed. Reg. 9304 (Feb. 16, 2012), and the

urgent need for EPA to reverse its unlawful Revised Finding.[1]

As we mentioned at our meeting, compliance with the MATS Rule has generated enormous reductions in hazardous air pollutant emissions that are vital to protecting public health and the environment and leveling the regulatory playing field across the country. Power-plant mercury emissions, for instance, declined eighty-six percent between 2006 and 2017, mainly as a result of the MATS Rule and other emissions-control policies. 84 Fed. Reg. 2670, 2689 tbl.4 (Feb. 7, 2019).

As we discussed, a wide array of studies and data published since the MATS Rule was promulgated demonstrate that the Rule's environmental, health, and economic benefits are substantially greater than initially anticipated, and that the costs of the MATS Rule are lower than originally estimated. These data confirm that the MATS Rule's benefits far exceed its costs. For your reference and consideration, below please find a compilation of notable post-2011 sources that are relevant to assessing the benefits and costs of the MATS Rule, including sources regarding: fisheries and aquatic systems, human health and welfare, and compliance costs.

## POST-2011 SOURCES RELEVANT TO THE BENEFITS AND COSTS OF THE MATS RULE FOR EPA'S CONSIDERATION

### *Fisheries and Aquatic Systems*

**Robert E. Unsworth et al., Industrial Economics, Inc., *The Economic Benefits of the Mercury and Air Toxics Standards (MATS) Rule to the Commercial and Recreational Fishery Sectors of Northeast and Midwest States* (2019), Doc. ID No. EPA–HQ–OAR–2018–0794–1175 Att. 2.**

> Concluding that the MATS Rule has reduced mercury loadings to aquatic ecosystems and reduced mercury levels in recreationally caught and commercially harvested fish. "Given the importance of recreational fishing and the commercial fishing and processing sectors to the economies of the Northeast and Midwest, even modest changes in recreator and consumer behavior in response to reductions in mercury concentrations from the MATS Rule are likely to result in substantial benefits to the economies and residents of these states and the Nation as a whole. . . . [I]t is reasonable to conclude that the Rule may generate recreational and commercial fishing benefits in excess of $1 billion *annually*." Finding also that "[t]here are

[1] *See* Comments of the Attorneys General of Massachusetts, et al. on EPA's Proposed "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review," 84 Fed. Reg. 2670 (Feb. 7, 2019) (Apr. 17, 2019), Doc. ID No. EPA–HQ–OAR–2018–0794–1175 (arguing that EPA's action to revise its prior finding that regulation of power-plant hazardous air pollutants is "appropriate and necessary" is unlawful and *ultra vires*).

widely accepted methods that EPA could have used to monetize the benefits of reduced mercury concentrations in recreationally caught and commercially harvested fish. These benefits would include both regional economic performance (including jobs and expenditures) as well as social welfare benefits."

**Elsie M. Sunderland, Miling Li, & Kurt Bullard, *Decadal Changes in the Edible Supply of Seafood and Methylmercury Exposure in the United States*, 126(1) Envtl. Health Perspectives 017006-1 (2018), https://ehp.niehs.nih.gov/doi/pdf/10.1289/EHP2644.**

Estimating the geographic origins of seafood consumed in the United States and how shifts in edible supply impacted methylmercury exposures. Finding that "[c]oastal ecosystems account for 37% of U.S. population-wide MeHg intake and can be expected to respond to domestic efforts to curb mercury pollution."

**Christopher R. DeSorbo et al. *Mercury Concentrations in Bald Eagles Across an Impacted Watershed in Maine, USA*, 627 Sci. of the Total Env't 1515 (2018), https://www.ncbi.nlm.nih.gov/pubmed/30857113.**

Finding that bald eagles in interior Maine and in the Catskill Park region of southeastern New York State are commonly exposed to mercury, primarily from atmospheric deposition, at concentrations associated with neurological and reproductive impacts in birds.

**Cheng-Shiuan Lee et al., *Declining Mercury Concentrations in Bluefin Tuna Reflect Reduced Emissions to the North Atlantic Ocean*, 50(23) Sci. & Tech. 12,825 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5161346/.**

Finding that mercury concentrations in bluefin tuna from the Northwest Atlantic "declined significantly" at a rate of 19% from 2004 to 2012. The decrease paralleled declining mercury emissions in North America and reductions in North Atlantic atmospheric mercury concentrations, demonstrating connection between efforts to reduce mercury emissions and meaningfully lower mercury concentrations in commercially important fish.

**Ford A. Cross et al., *Decadal Declines of Mercury in Adult Bluefish (1972-2011) from the Mid-Atlantic Coast of the U.S.A.*, 49 Envtl. Sci. Tech. 9064 (2015), https://pubmed.ncbi.nlm.nih.gov/26148053/.**

Measuring concentrations of total mercury in adult bluefish collected in 2011 off North Carolina and comparing those measurements with similar measurements made in 1972. Finding that mercury levels decreased by 43% between 1972 and 2011, similar to the estimated reductions of mercury observed in atmospheric deposition and aquatic ecosystems over that time. Also citing additional studies conducted between 1973 and 2007 that confirm a correlation between lower mercury levels in bluefish and decreasing U.S. mercury air emissions, and concluding that reduced mercury emissions have likely resulted in reduced human mercury exposures.

**Ryan F. Lepak et al., *Use of Stable Isotope Signatures to Determine Mercury Sources in the Great Lakes*, 2(12) Envtl. Sci. & Tech. Letters 335 (2015), https://pubs.acs.org/doi/abs/10.1021/acs.estlett.5b00277.**

Identifying three primary sources of mercury in Great Lakes sediment: atmospheric, industrial, and watershed-derived. Findings suggest "that atmospheric sources, rather than contaminated historical sediments, may be an important source of bioaccumulative Hg in Great Lakes fish."

**Michael S. Hutcheson et al., *Temporal and Spatial Trends in Freshwater Fish Tissue Mercury Concentrations Associated with Mercury Emissions Reductions*, 48 Envtl. Sci. Tech. 2193 (2014), https://www.ncbi.nlm.nih.gov/pubmed/24494622.**[2]

Analyzing mercury concentrations monitored from 1999 to 2011 in largemouth bass and yellow perch in 23 lakes in Massachusetts during a significant period of reductions in local and regional mercury emissions. Finding that average tissue mercury concentration in largemouth bass decreased 44% in most lakes in a regional mercury "hotspot" area, and average tissue mercury concentration in yellow perch in all sampled lakes in the same area decreased 43%. During a similar time period, mercury emissions from major point sources decreased 98% in the hotspot area, and 93% in the rest of the state, demonstrating a correlation between emissions reductions and decreased mercury concentrations in aquatic species.

**Paul E. Drevnick et al., *Spatial and Temporal Patterns of Mercury Accumulation in Lacustrine Sediments across the Laurentian Great Lakes Region*, 161 Envtl. Pollution 252 (2012), https://surface.syr.edu/cie/6/.**[3]

Analyzing core sediment samples from the Great Lakes and nearby lakes to assess historical and recent changes in mercury deposition. Finding that sedimentary mercury is declining in the region and that "atmospheric Hg deposition appears uniform across the Great Lakes airshed," which "suggests that local and regional sources of atmospheric Hg emissions are important sources of Hg deposition compared to global sources" and "that regional and local controls on atmospheric emissions have been effective in decreasing the delivery of Hg to lakes."

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[2] Exhibit 7, Appendix to Comments of Environmental, Public Health, and Civil Rights Organizations on the Proposed National Emissions Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review, 84 Fed. Reg. 2670 (Feb. 7, 2019) (Apr. 17, 2019) (hereinafter "Comments of Environmental, Public Health, and Civil Rights Organizations"), Doc. ID No. EPA–HQ–OAR–2018–0794–1267.

[3] Exhibit 8, Appendix to Comments of Environmental, Public Health, and Civil Rights Organizations, Doc. ID No. EPA–HQ–OAR–2018–0794–1267.

**David C. Depew et al., *Toxicity of Dietary Methylmercury to Fish: Derivation of Ecologically Meaningful Threshold Concentrations*, 31(7) Envtl. Toxicology & Chemistry 1536 (2012), https://deepblue.lib.umich.edu/bitstream/handle/2027.42/92130/1859_ftp.pdf?sequence=2&isAllowed=y.**

Finding adverse effects on the reproductive and behavioral health of wild fish populations at low levels of environmental methylmercury exposure.

**David C. Depew et al., *Derivation of Screening Benchmarks for Dietary Methylmercury Exposure for the Common Loon (*Gavia Immer*): Rationale for Use in Ecological Risk Assessment*, 31(10) Envtl. Toxicology & Chemistry 2399 (2012), https://deepblue.lib.umich.edu/bitstream/handle/2027.42/93756/1971_ftp.pdf?sequence=1&isAllowed=y.**

Surveying literature and summarizing effects of dietary methylmercury on the common loon.

***Human Health and Welfare Benefits***

**David G. Streets et al., *Global and Regional Trends in Mercury Emissions and Concentrations, 2010-2015,* 201 Atmospheric Env't 417 (2019), http://bgc.seas.harvard.edu/assets/ae-paper.pdf.**

Analyzing global and regional trends in mercury concentrations in the period 2010 to 2015. Finding that U.S. emissions declined during this period.

**Vivian E. Thomson, Kelsey Huelsman, & Dominique Ong, *Coal-fired power plant regulatory rollback in the United States: Implications for local and regional public health*, 123 Energy Pol'y 558 (2018), https://www.sciencedirect.com/science/article/pii/S030142151830627X.**

Analyzing which U.S. regions benefited from air quality improvements due to the MATS Rule and transport rule by modeling estimated differences between the impacts of pre-regulatory emissions and current emissions on fine particulate matter ($PM_{2.5}$) concentrations and on public health. Finding that annual average $PM_{2.5}$ concentrations are lower by 1–5 μg/m3, and 17,176–39,291 premature mortalities are avoided for each year of lower emissions.

**Xue Feng Hu, Kavita Singh, & Hing Man Chan, *Mercury Exposure, Blood Pressure, and Hypertension: A Systematic Review and Dose-Response Meta-analysis*, 126(7) Envtl. Health Perspectives 076002 (2018), https://ehp.niehs.nih.gov/doi/10.1289/EHP2863.**

Reviewing 29 studies, covering more than 55,000 participants from 17 countries, and finding a significant positive association between mercury and hypertension and between mercury and blood pressure. Noting that "MeHg is generally considered to be the most toxic form [of

mercury] and a dose-response relationship has been proposed between MeHg and cardiovascular outcomes."

**Noah Kittner et al.,** ***Trace Metal Content of Coal Exacerbates Air-Pollution-Related Health Risks: The Case of Lignite Coal in Kosovo*****, 52(4) Environ. Sci. & Technol. 2359 (2018), https://pubmed.ncbi.nlm.nih.gov/29301089/.**

Finding significant trace metal content in lignite coal from Obilic, Kosovo.

**Giuseppe Genchi et al.,** ***Mercury Exposure and Heart Diseases*****, 14(1) Int'l J. Envtl. Research & Pub. Health 1 (2017), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5295325/pdf/ijerph-14-00074.pdf.**[4]

Finding that high levels of methylmercury exposure in adults have been associated with adverse cardiovascular effects, including increased risk of fatal heart attacks.

**Philippe Grandjean & Martine Bellanger,** ***Calculation of the disease burden associated with environmental chemical exposures: application of toxicological information in health economic estimation*****, 16(123) Envtl. Health 1 (2017), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5715994/pdf/12940_2017_Article_340.pdf.**[5]

Estimating the societal costs of the cognitive deficits associated with methylmercury exposure in the United States amount to approximately $4.8 billion annually.

**Ki-Hyun Kim et al.,** ***A Review on the Distribution of Hg in the Environment and Its Human Health Impacts*****, J. Hazardous Materials 306 (2016), https://www.ncbi.nlm.nih.gov/pubmed/26826963.**

Reviewing the route of mercury exposure to humans, its health impacts, and the associated risk assessment based on recent studies.

**Vincent Nedellec & Ari Rabl,** ***Costs of Health Damage from Atmospheric Emissions of Toxic Metals: Part 2—Analysis for Mercury and Lead*****, Risk Analysis 1 (2016), https://pubmed.ncbi.nlm.nih.gov/26992113/.**

Estimating the damage cost associated with one kilogram of emitted mercury pollution, with 91% of the cost due to mortality from heart disease and the rest from IQ loss.

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[4] Exhibit 16, Appendix to Comments of Environmental, Public Health, and Civil Rights Organizations, Doc. ID No. EPA–HQ–OAR–2018–0794–1267.

[5] Exhibit 3, Appendix to Comments of Environmental, Public Health, and Civil Rights Organizations, Doc. ID No. EPA–HQ–OAR–2018–0794–1267.

**Elsie M. Sunderland et al., *Benefits of Regulating Hazardous Air Pollutants from Coal and Oil-Fired Utilities in the United States*, 50 Envtl. Sci. & Tech. 2117 (2016), https://pubs.acs.org/doi/pdf/10.1021/acs.est.6b00239.**

Concluding that the monetized benefits in EPA's 2011 Regulatory Impact Analysis for the MATS Rule underestimated power plants' contribution to local mercury deposition as well as the benefits associated with reductions of power-plant emissions. Concluding also that "as-yet-unquantified benefits to human health and wildlife from reductions in EGU mercury emissions are substantial."

**Amanda Giang & Noelle E. Selin, *Benefits of mercury controls for the United States*, 113(2) Proceedings of the Nat'l Acad. of Sci. 286 (2016), https://www.pnas.org/content/pnas/113/2/286.full.pdf.**[6]

Projecting that the total economy-wide benefits associated with the continued implementation of the MATS Rule through 2050 would amount to at least $43 billion based on reductions in mercury emissions alone. Providing a dose-response function quantifying the effect of methylmercury exposure on heart attacks.

**Yanxu Zhang et al., *Observed Decrease in Atmospheric Mercury Explained by Global Decline in Anthropogenic Emissions*, 113(3) Proceedings of the Nat'l Acad. of Sci. 526 (2016), https://www.pnas.org/content/113/3/526.**

Showing that spatial and temporal trends in atmospheric mercury concentrations and deposition are influenced by local and regional actions. "This implies that prior policy assessments underestimated the regional benefits of declines in mercury emissions from coal-fired utilities."

**Aisha S. Dickerson et al., *Autism Spectrum Disorder Prevalence and Associations with Air Concentrations of Lead, Mercury, and Arsenic*, 188(7) Envtl. Monitoring & Assessment 407 (2016), https://www.ncbi.nlm.nih.gov/pubmed/27301968.**

Examining associations between autism spectrum disorder prevalence and ambient concentrations of arsenic, lead, and mercury, and finding that tracts in the highest quartile of lead and mercury air concentrations had significantly higher autism prevalence than tracts in the lowest quartile for each of these pollutants, once the researchers adjusted for confounding factors.

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[6] Exhibit 2, Appendix to Comments of Environmental, Public Health, and Civil Rights Organizations, Doc. ID No. EPA–HQ–OAR–2018–0794–1267.

**T.I. Fortoul et al., "Health Effects of Metals in Particulate Matter," in *Current Air Quality Issues* (Farhad Nejadkoorki ed. 2015), https://www.intechopen.com/chapters/48145.**

Describing the health impacts, and mechanisms underlying the health impacts, of toxic metals in particulate matter.

**Ahmed Zaky et al., *Chlorine Inhalation-induced Myocardial Depression and Failure*, 3(6) Physiol. Rep. 1 (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4510636/.**

Observing cardiac pathology in rats exposed to chlorine gas.

**Sara T.C. Orenstein et al., *Prenatal Organochlorine and Methylmercury Exposure and Memory and Learning in School-Age Children in Communities Near the New Bedford Harbor Superfund Site, Massachusetts*, 122(11) Envtl. Health Perspectives 1253 (2014), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4216164/.**

Finding that increases in maternal hair concentrations of mercury were associated with decreases in childhood memory and learning, particularly visual memory.

**Lisa M. Sweeney et al., Naval Medical Research Unit Dayton, *Acute Lethality of Inhaled Hydrogen Cyanide in the Laboratory Rat: Impact of Concentration x Time Profile and Evaluation of the Predictivity of "Toxic Load" Models*, Rep. No. NAMRU-D-13-35 (2013), https://apps.dtic.mil/sti/pdfs/ADA579551.pdf.**

Reporting acute effects of exposure to hydrogen cyanide in animals.

**K. He et al., *Mercury Exposure in Young Adulthood and Incidence of Diabetes Later in Life: The CARDIA Trace Element Study*, 36(6) Diabetes Care 1584 (2013), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3661833/pdf/1584.pdf.**

Finding that toenail mercury levels are associated with incidence of diabetes in a dose-response manner among American young adults.

**Martine Bellanger et al., *Economic Benefits of Methylmercury Exposure Control in Europe: Monetary Value of Neurotoxicity Prevention*, 12(3) Envtl. Health 1 (2013), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3599906/.**

Documenting neurodevelopmental impacts of methylmercury at exposure levels below EPA's reference dose.

**Sofia Jonasson, Bo Koch, & Anders Bucht, *Inhalation of Chlorine Causes Long-standing Lung Inflammation and Airway Hyperresponsiveness in a Murine Model of Chemical-Induced Lung Injury*, 303 Toxicology 34 (2013), https://pubmed.ncbi.nlm.nih.gov/23146759/.**

Exposing mice to chlorine one time and finding an acute response that subsided after 48 hours and a sustained airway hyperresponsiveness for at least 28 days.

**Philippe Grandjean et al., *Calculation of Mercury's Effects on Neurodevelopment*, 120(12) Envtl. Health Persp. A452 (2012), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3548290/pdf/ehp.1206033.pdf.**

Suggesting an updated dose-response relationship for prenatal methylmercury, with a lower threshold Hg level corresponding to 50% of the previous reference dose.

***Compliance Costs***

**James E. Staudt, *Andover Technology Partners, Update of the Cost of Compliance with MATS – Ongoing Cost of Controls* 7, 8 tbl.8 (2019), Doc. ID No. EPA–HQ–OAR–2018–0794–1175 Att. 3.**

Finding that annual incremental operating costs associated with the MATS Rule are approximately $203 million.

**Declaration of James E. Staudt, attached to Comments of Calpine Corp. et al. on EPA's Proposed Supplemental Finding (Dec. 1, 2015), Doc. ID No. EPA–HQ–OAR–2009–0234–20549.**

Finding that EPA's projection of compliance costs in 2015, $9.6 billion, was nearly five times higher than the actual estimated cost of approximately $2 billion incurred through 2016.

* * * *

Please do not hesitate to reach out to us should you have any questions about this information or like to discuss further. Our contact information is below. Thank you again for your time and consideration.

Respectfully Submitted,

FOR THE COMMONWEALTH OF MASSACHUSETTS

MAURA HEALEY
ATTORNEY GENERAL

MEGAN M. HERZOG
DAVID FRANKEL
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TRACY TRIPLETT
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Cc: Joseph Goffman, Acting Assistant Administrator, EPA
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Tomás Elias Carbonell, Deputy Assistant Administrator for Stationary Sources, EPA
carbonell.tomas@epa.gov

EPA Docket Clerk
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Message

**From**: Shaw, Betsy [Shaw.Betsy@epa.gov]
**Sent**: 7/20/2021 1:26:31 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]
**Subject**: FW: Meeting Materials for 7/20 Business Review
**Attachments**: July 2021 OAR Business Review Agenda.docx; June 2021 Bowling Chart.xlsx; June Ideas Improvements Celebrations (1).xlsx; CM OAR 6-2021.docx; Draft LTPGs.xlsx; 2022-26 EPA MYP Strategic Plan-Goal 2 EJ and Civil Rights.pdf; Results of Strategic Foresight Horizon Scanning 07.07.21.pdf

Hi Joe, Tomas and Ale,

The key document to focus on for this afternoon's discussion at the Monthly Business Review is the spreadsheet entitled Draft LTPGs, third from the top on the left.

Thanks,

Betsy

**From:** Peacock, Grant <Peacock.Grant@epa.gov>
**Sent:** Monday, July 19, 2021 4:06 PM
**To:** Cherepy, Andrea <Cherepy.Andrea@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Bunker, Byron <bunker.byron@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>; Harvey, Reid <Harvey.Reid@epa.gov>; Lubetsky, Jonathan <Lubetsky.Jonathan@epa.gov>; Gunning, Paul <Gunning.Paul@epa.gov>; Newberg, Cindy <Newberg.Cindy@epa.gov>; Snyder, Carolyn <Snyder.Carolyn@epa.gov>; Hopkins, Daniel <Hopkins.Daniel@epa.gov>; Koerber, Mike <Koerber.Mike@epa.gov>; Kornylak, Vera S. <Kornylak.Vera@epa.gov>; Brachtl, Megan <Brachtl.Megan@epa.gov>; Costa, Shelley <Costa.Shelley@epa.gov>; Whitlow, Jeff <Whitlow.Jeff@epa.gov>; Saltman, Tamara <Saltman.Tamara@epa.gov>; Monroe, Scott <Monroe.Scott@epa.gov>; LaRue, Steven <LaRue.Steven@epa.gov>; Mathias, Scott <Mathias.Scott@epa.gov>; Bullard, Pamela <Bullard.Pamela@epa.gov>; Alpert, Adina <Alpert.Adina@epa.gov>; Santiago, Juan <Santiago.Juan@epa.gov>; White, Sharon <White.Sharon@epa.gov>; Diaz, Charlene <diaz.charlene@epa.gov>; Wilds, Edward <Wilds.Edward@epa.gov>; White, Rick <White.Rick@epa.gov>; Stafford, Andrea <Stafford.Andrea@epa.gov>; Fine, Steven <fine.steven@epa.gov>; Siegel, Kelly C. <Siegel.KellyC@epa.gov>; Shoaff, John <Shoaff.John@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Watkins, Erica <Watkins.Erica@epa.gov>; Clark, Mike S. <Clark.Michael@epa.gov>; OAR Briefings <OAR_Briefings@epa.gov>; Suzuki, Debra <Suzuki.Debra@epa.gov>; Senter, Stephen <Senter.Stephen@epa.gov>; Millar, Emily <Millar.Emily@epa.gov>; Holden, Patricia <Holden.Patricia@epa.gov>; Marusiak, Eleanor <Marusiak.Eleanor@epa.gov>; Kabanda, Thierry <Kabanda.Thierry@epa.gov>; Rakosnik, Delaney <rakosnik.delaney@epa.gov>; Henning, Julie <henning.julie@epa.gov>; Ward, Hillary <Ward.Hillary@epa.gov>; Ashley, Jackie <Ashley.Jackie@epa.gov>
**Cc:** DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Millett, John <Millett.John@epa.gov>
**Subject:** Meeting Materials for 7/20 Business Review

Good Afternoon All,

Attached are the materials for the July 20, 4:00-5:00 PM, OAR Business Review, which include the:

- Agenda;
- Bowling Chart;
- Countermeasures;
- MBR Supplemental (processes improved, employee ideas, celebrations); and
- Draft LTPGs.

Additional materials to consider while working on the Strategic Plan include:

- OA presentation on EPA Strategic Plan Goal 2; and
- Results of Strategic Foresight Horizon Scanning for Strategic Plan.

Please remember that all Business Review materials are internal to the EPA.

Let us know if you have any questions.

Thank you,
Grant Peacock
Office of Program Management Operations
Office of Air and Radiation
(202) 564-6732

Message

**From**: DeLuca, Isabel [DeLuca.Isabel@epa.gov]
**Sent**: 8/18/2021 4:05:46 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]; Fugh, Justina [Fugh.Justina@epa.gov]; Millett, John [Millett.John@epa.gov]; Campbell, Ann [Campbell.Ann@epa.gov]
**CC**: Clarke, Victoria [clarke.victoria@epa.gov]
**Subject**: RE: Media Inquiry: Joseph Goffman Ethics Complaint

Yes – we're on it.

https://www.protectpublicstrust.org/category/press-releases/
https://justthenews.com/accountability/political-ethics/watchdog-group-files-complaint-epa-inspector-general-over-apparent
https://www.breitbart.com/politics/2021/08/17/ethics-watchdog-acting-head-of-epa-office-admits-to-ethics-violation/

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, August 18, 2021 12:02 PM
**To:** Fugh, Justina <Fugh.Justina@epa.gov>; Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
**Cc:** Clarke, Victoria <clarke.victoria@epa.gov>
**Subject:** RE: Media Inquiry: Joseph Goffman Ethics Complaint

Thanks, Justina. John/Isabel – Please confirm that we will be responding to the inquiry appropriately. Thanks, again.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Fugh, Justina <Fugh.Justina@epa.gov>
**Sent:** Wednesday, August 18, 2021 10:25 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
**Cc:** Clarke, Victoria <clarke.victoria@epa.gov>
**Subject:** RE: Media Inquiry: Joseph Goffman Ethics Complaint

Hi Joe,
I got the same question and told the reporter to contact OPA.
Justina

Justina Fugh (she/her) | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, August 18, 2021 10:23 AM
**To:** Millett, John <Millett.John@epa.gov>; DeLuca, Isabel <DeLuca.Isabel@epa.gov>; Campbell, Ann

<Campbell.Ann@epa.gov>
**Cc:** Fugh, Justina <Fugh.Justina@epa.gov>; Clarke, Victoria <clarke.victoria@epa.gov>
**Subject:** FW: Media Inquiry: Joseph Goffman Ethics Complaint

Please advise. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Andrew Kerr <akerr@dailycallernewsfoundation.org>
**Sent:** Wednesday, August 18, 2021 10:18 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: Media Inquiry: Joseph Goffman Ethics Complaint

Joseph,

Just wanted to make sure you got this.
--
Andrew Kerr
Investigative Reporter
Daily Caller News Foundation
(704)770-5938
@AndrewKerrNC

On Tue, Aug 17, 2021 at 12:09 PM Andrew Kerr <akerr@dailycallernewsfoundation.org> wrote:

> Hi Joseph,
>
> I'm a reporter with the Daily Caller News Foundation.
>
> Protect the Public's Trust, a watchdog group, filed a complaint today to the Environmental Protection Agency inspector general about a meeting you agreed to schedule with representatives from Harvard University in late April/early May. Emails obtained by the group show that shortly after you agreed to the meeting, you informed an ethics officer that your recusal bars you from agreeing to them meeting. The ethics officer informed you: "Now we have to unring the bell, which we will do without your knowledge or involvement."
>
> Can you confirm whether or not this meeting between you and Kathleen Fallon Lambert, Elise Sunderland and Charles Driscoll as described in this complaint every took place? And can you clarify what was meant by "unring the bell"?
>
> Best,
> --
> Andrew Kerr
> Investigative Reporter
> Daily Caller News Foundation
> (704)770-5938
> @AndrewKerrNC

--

--

Andrew Kerr

Investigative Reporter

Daily Caller News Foundation

(704)770-5938

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Message

**From**: Hicks, Destine [Hicks.Destine@epa.gov]
**Sent**: 9/17/2021 9:04:18 PM
**To**: Harris, Sincere [Harris.Sincere@epa.gov]
**Subject**: NEXT TUESDAY: Harvard Law Lecture "Navigating Difficult Conversations"
**Attachments**: Managing Difficult Conversations Program Description.pdf

Happy Friday Appointees!

We are pleased to share with you all the following invitation from the Office of Presidential Personnel:

On next **Tuesday, 9/21, at 8am**, in collaboration with Triad Consulting, we will be hosting "Navigating Difficult Conversations" led by Harvard Law School Lecturer Sheila Heen. This class is based on Sheila's NYT bestselling book: "Difficult Conversations: How to Discuss What Matters Most."

This renowned session will unpack the underlying structure of difficult conversations, where you will learn how to increase your understanding when parties see things differently and problem solve together. Attached below is a session description for you all.

Warm regards,

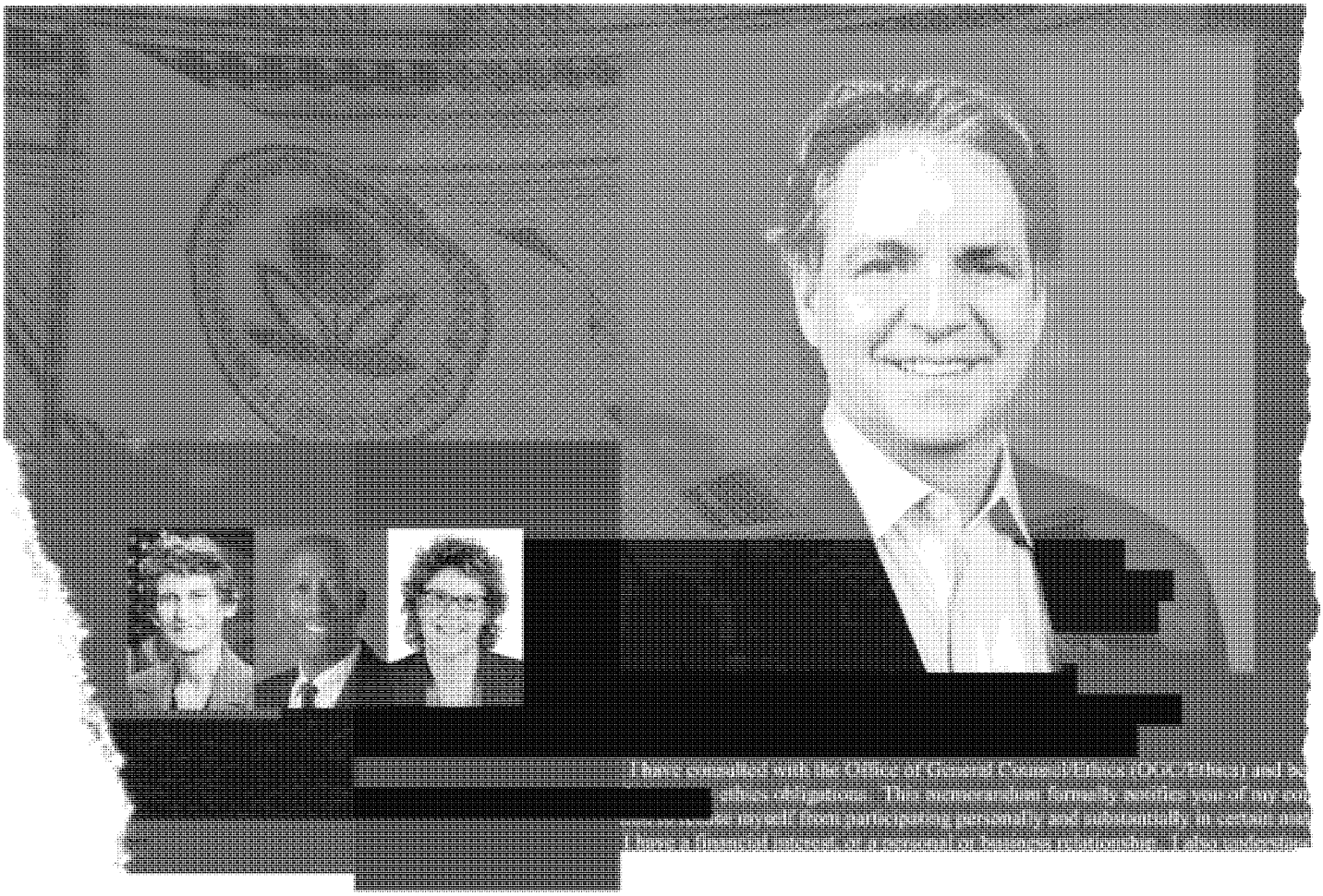
U.S. Environmental Protection Agency
*Office of the White House Liaison*

Message

**From:** Drinkard, Andrea [Drinkard.Andrea@epa.gov]
**Sent:** 10/1/2021 12:30:14 AM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** E&E

# Top EPA air appointee offloaded oil stocks

By Kevin Bogardus, Sean Reilly | 09/30/2021 12:35 PM EST



Ethics documents show several of President Biden's political appointees at EPA have former clients and financial interests with business before the agency. Left to right: Janet McCabe, Carlton Waterhouse, Melissa Hoffer and Joe Goffman. Claudine Hellmuth/E&E News (illustration); Francis Chung/E&E News (EPA building); EPA (text and McCabe); Environmental Law Institute (Waterhouse); Hampshire College (Hoffer); Harvard Law School (Goffman)

Minutes after taking the oath of office on Jan. 20, President Biden delivered strong and impassioned comments in his inaugural address to describe the perils posed by "a climate in crisis."

Earth, he said, is voicing "a cry for survival" that could not be "any more desperate or any more clear."

Not long after, one of Biden's top EPA appointees in the fight against climate change was unloading stock in some of the biggest producers of the fossil fuels that are driving up global temperatures.

On Jan. 22, Joe Goffman, acting head of the agency's Office of Air and Radiation, sold shares in Exxon Mobil Corp., Marathon Petroleum Corp., Occidental Petroleum Corp. and Chevron Corp., according to financial disclosure records.

The precise value of his holdings was not revealed since sales and purchases must be reported only within dollar ranges. They totaled between $46,000 to $165,000.

Furthermore, the day before, Goffman sold between $181,000 and $465,000 in Berkshire Hathaway Inc., the conglomerate headed by famed investor Warren Buffett. Its varied holdings include power producer PacifiCorp, which runs a half-dozen coal-fired power plants in Utah and Wyoming and has clashed with EPA over air pollution reduction requirements.

Goffman is not the only Biden EPA appointee to have held stock in fossil fuel producers and consumers, records show. Others include Radhika Fox, head of the agency's water office, and JoAnn Chase, director of the American Indian Environmental Office. Goffman's holdings stand out, however, because of the air office's role in reducing greenhouse gas emissions as well as in ensuring those companies' compliance with the Clean Air Act.

Goffman also signed a recusal statement, which he later updated, pledging to stay away from matters affecting vast swaths of industry. Yet that prohibition only focuses on individual sectors.

"If a matter affects all sectors or if a particular matter affects a combination of sectors, including the ones listed below, then I understand that I do not have a financial conflict of interest," Goffman said in his recusal statement.

Goffman, who has not been nominated to the air office post but has been leading the office in an acting capacity since January, is now in his third tour at EPA. Before rejoining the agency, he was executive director of Harvard University's Environmental & Energy Law Program and is covered by a two-year bar on taking part in matters involving the school.

And while Goffman no longer reports ownership of oil company stocks, his or his spouse's financial stakes in 64 other companies were substantial enough to disqualify him from "participating personally and substantially in any particular matter" affecting them "as a specific party." That sprawling roster includes tech companies Facebook Inc. and PayPal Holdings Inc.; drug maker Pfizer Inc.; and cigarette producers Altria Group Inc. and Philip Morris International Inc., according to his statement.

EPA did not grant a request for an interview with Goffman for this story.

"Any notion that Joe Goffman is conflicted is completely refuted by his decades of work to protect people from pollution, and his recent leadership of the Office of Air and Radiation, where he has delivered clear results on the Biden-Harris agenda to tackle the climate crisis and to ensure clean, breathable air for those that need it most," EPA spokesperson Tim Carroll told E&E News.

He added that Goffman committed to uphold "the ethical obligations as acting assistant administrator" and is following through with "the necessary steps to comply with that commitment, in coordination with the agency's ethics officials."

E&E News obtained more than a hundred ethics documents and financial disclosure reports filed by Goffman and Biden's other EPA appointees, either under the Freedom of Information Act or through requests to agency ethics officials. The records show those top EPA officials often had ties to those with business before the agency through past employment, former clients and financial holdings.

EPA is a powerful agency with regulations that slash pollution and move markets, requiring its officials to often dump stocks and keep their distance from prior work to stay within ethical boundaries.

Further, Biden's appointees often tangled with the agency during the Trump administration, necessitating them to step away from litigation they once led against EPA's rollbacks of environmental rules. And as appointees, they signed the president's ethics pledge, which has tough standards such as limiting contact with former clients and employers.

Carroll with EPA told E&E News that along with abiding by "the high ethical standards required of all employees," the agency's political appointees are required to sign the ethics pledge and have ethics training as part of the onboarding process.

"Career ethics officials consider the full range of potential financial conflicts, pledge concerns, impartiality concerns, attorney bar obligations and any additional potential conflicts real or perceived. They counsel appointees on these issues and work with them to resolve conflicts appropriately," Carroll said.

He added that EPA appointees are committed to following ethics rules and have taken the necessary steps to comply with them.

"Upholding these ethical obligations is crucial as these appointees work to advance this administration's agenda to tackle the climate crisis, advance environmental justice and deliver environmental benefits for all Americans," Carroll said.

# Ties to green groups

Those ethics restrictions could come into play between EPA and environmental organizations during the Biden administration.

Before joining the air office in January as deputy assistant administrator for mobile sources, Alejandra Nunez was a senior attorney with the Sierra Club. There, she worked on litigation challenging the Trump administration's decision to revoke California's long-standing waiver to set vehicle tailpipe emissions standards stronger than EPA's. Under Biden, the agency is revisiting that decision.

Nunez is barred from involvement in the courtroom challenges to that decision, according to her most recent recusal statement, signed last month. Similarly, Nunez is recused from direct involvement in a separate bloc of lawsuits contesting another Trump-era decision to weaken vehicle fuel efficiency requirements in which the Sierra Club is a plaintiff.

Because of her "current level of financial ownership," Nunez is also disqualified from participation in specific matters that could affect 10 businesses, ranging from online retail colossus Amazon.com Inc. to Peloton Interactive Inc., the exercise equipment maker.

Tomás Elías Carbonell, now the air office's deputy assistant administrator for stationary sources, was previously senior counsel and director of regulatory policy at the Environmental Defense Fund. Like the Sierra Club, EDF has been in the thick of legal fights against Trump-era rollbacks.

Carbonell represented the group over the scrapping of the legal basis for EPA's limits on power plant mercury emissions, court records indicate. A Colorado-based coal company is now suing to end those limits altogether. In his EPA post, Carbonell can't have anything to do with that suit, along with related litigation that seeks to strengthen the standards, besides restoring their legal underpinning, according to his recusal statement.

Among other cases on his recusal list, Carbonell has to steer clear of litigation over a high-profile rollback that allows industrial plants to ease hazardous pollutant controls if their emissions fall below specified levels.

Carbonell is also subject to a two-year cooling-off period regarding "any particular matter" in which the Environmental Defense Fund is involved. He also has a one-year ban on dealings with

the Institute for Policy Integrity, a liberal-leaning group based at New York University, where he served as an unpaid adviser.

# Time to divest

It's not just appointees in EPA's air office facing a number of ethics restrictions. Across the agency, top officials have vowed to stay away from ex-clients and financial interests.

Chief of staff Dan Utech signed a recusal statement in April. It noted he is disqualified in taking part in issues involving Donaldson Company Inc., Intel Corp. and Paychex Inc. because of his level of ownership in those companies. He later filed a transaction report reporting the sale of several assets, including interests in those firms worth between $80,000 and $200,000 overall.

Utech's updated recusal, signed in August, no longer listed those companies as financial conflicts of interest. He would continue to recuse himself from "any particular matter" involving his past employer Yale University and former consulting clients like the Energy Foundation, the Center for Applied Environmental Law and Policy, and Clean Wisconsin.

Several Biden appointees received certificates of divestiture. The documents lets officials offload financial holdings that conflict with their public duties. It also allows them to defer capital gains taxes on the sale of those assets as long as their proceeds are reinvested in property that is ethically palatable, such as Treasury notes and mutual funds.

Fox received such a certificate to sell stocks like Berkshire Hathaway, Chevron Corp. and Exxon Mobil Corp. (*Greenwire*, Aug. 18). She has since sold interests in those companies, according to a transaction report she filed.

In April, the spouse of Victoria Arroyo, associate administrator of EPA's policy office, was issued a certificate to sell shares of DuPont, Dow Inc. and Chemours Co., among others. The following day, those interests were sold, Arroyo indicated in a financial disclosure form.

Nunez's spouse received a certificate to sell holdings in BorgWarner Inc. Susannah Weaver, senior counselor at EPA, and her spouse also received one to divest their shares in Sunrun Inc. and SolarEdge Technologies Inc.

Goffman was also issued a certificate to sell his shares in Ecolab Inc. and Roper Technologies Inc.

If EPA appointees own stock over certain thresholds, agency ethics officials may judge they have a financial conflict of interest with their government duties. Those appointees could then face

additional ethics restrictions. But if their stock ownership is below those levels or if they sell off the asset, they no longer have that conflict.

# Lists of lawsuits

Appointees' past legal work also means they have to avoid certain cases they once litigated against EPA — or be cleared by ethics officials to weigh in on them again at the agency.

Melissa Hoffer, EPA's acting general counsel, has several ethics documents, stemming from her litigation history. As chief of the Massachusetts Office of the Attorney General's Energy and Environment Bureau, she often challenged the Trump EPA in court.

Hoffer was given an "impartiality determination" the day before Biden was inaugurated so she could take part in "policy decisions" about lawsuits involving the Bay State, including cases she had worked on before. She, however, had to avoid working on the merits of those cases.

Hoffer also has another determination allowing her to do "new or future" work with Massachusetts and received consent to work on a matter tied to the Merrimack Generation Station in New Hampshire. Also included among the documents is a list of environmental cases involving Massachusetts, which she will be personally recused from.

Several other EPA senior attorneys, such as Dimple Chaudhary, Marianne Engelman-Lado and Weaver, had similar lists of lawsuits among their ethics documents. All three are recused from the cases they name for the entirety of their time at the agency.

Engelman-Lado was given a waiver from Biden's ethics pledge so she could take part in pesticides and toxic chemicals matters involving her former client, the Natural Resources Defense Council (*Greenwire*, April 29).

Carroll with EPA said appointees who are attorneys are subject to the federal ethics laws, Biden's ethics pledge and to their own bar rules."Generally speaking, those restrictions relate to specific party matters, such as litigation, enforcement actions, permits or contracts in which they previously participated or in which a former employer or former client is a party," Carroll said. "Broad policy matters, including rulemaking, are not specific party matters at all. These restrictions do not attach to matters of general applicability."

Other Biden appointees at EPA will stay away from their old clients, as required by Biden's ethics pledge.

Jennifer Macedonia, deputy associate administrator in EPA's policy office, will avoid Duke University, the Environmental Defense Fund and Meier Engineering Research, all former clients of hers, she said in her recusal statement.

EPA Deputy Administrator Janet McCabe will do the same for her former employers, the Environmental Law & Policy Center and Indiana University, according to her recusal.

Ya-Wei (Jake) Li, deputy assistant administrator for pesticide programs, is recused from matters involving nearly a half-dozen ex-clients like CropLife America, the Electric Power Research Institute and Perkins Coie LLP, as well as former employers, the Environmental Policy Innovation Center and the Sand County Foundation, his statement says.

Appointees' recusal periods typically last a year after they resigned from their prior jobs or two years after they joined the federal government, as required by the president's ethics pledge. They should avoid "particular matters" with past business ties, such as meetings with them, unless "general applicability" applies.

Several at EPA who held positions in local and state governments can interact with those prior employers while at the agency.

Philip Fine, EPA's principal deputy associate administrator for policy, has an impartiality determination to participate in "new or future specific party matters" involving the South Coast Air Quality Management District, his past employer, but not on the same issues he worked on "personally and substantially."

Casey Katims, EPA's deputy associate administrator for intergovernmental affairs and former aide to Washington Gov. Jay Inslee (D), also has a determination so he could work on issues involving the state of Washington.

Administrator Michael Regan received a determination regarding the North Carolina Department of Environmental Quality, which he led before taking charge of EPA. He will stay away from a number of cases as well, his recusal statement said (*Greenwire*, May 17).

# 'Change that designation'

Others have connections outside the agency, albeit with EPA ethics officials' approval.

Arroyo received an approval of outside activity to teach a Georgetown University Law Center course on climate change law this past spring semester. And so did Carlton Waterhouse, deputy

assistant administrator in EPA's Office of Land and Emergency Management and the nominee to lead that office, to teach a property law course at Howard University School of Law.

Carroll with EPA said Waterhouse's leave from Howard started on Feb. 1, "with the exception of completing the property law course which began before Carlton's appointment."

"Other than teaching that single course, no other Howard duties have been performed since Feb. 1, 2021," Carroll said.

Both Arroyo and Waterhouse faced various ethics restrictions though, the documents say, including not to misuse their EPA positions for "the private gain" of their respective schools.

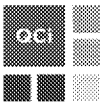
Weaver was approved for serving on the Georgetown law school's board of visitors. It was an unpaid role advising the law school's dean but because of her EPA position, there are limits on who she could fundraise from, interview for agency jobs and how she identifies herself.

Georgetown University Law Center's website had listed her solely with her agency affiliation, Weaver's approval warned. An archived webpage from Aug. 2 shows that EPA identification.

"Please take steps immediately to notify GULC to change that designation. You are not serving in your official EPA capacity," the document said.

The website now says she is a "Federal Employee."

Andrea Drinkard
Senior Advisor to the Deputy Administrator
U.S. Environmental Protection Agency
Desk: 202.564.1601
Cell: 202.236.7765



Mr. Joe Goffman
Acting Assistant Administrator
for Air and Radiation
Environmental Protection Agency
Washington, DC 20460

January 13, 2022

Dear Mr. Goffman,

Today, hundreds of communities around the country are struggling, without Federal support, to confront the public health problem of noise. Our small organization is trying to provide scientific support to these efforts, but we can barely scratch the surface of the kind of help these communities need that was previously provided by EPA's Noise Program.

- **We are asking for your help to correct this situation.**

We are writing to you specifically because, until it was de-funded, EPA's Noise Program was a key component of the Office of Air, Noise, and Radiation. Last fall we met with some of your staff about this situation and our 2017 petition,[1] and have now developed a specific proposal that we discuss in this letter.

Noise is not simply a "nuisance" or "annoyance" as some believe but a serious public health risk – not only to hearing but to cardiovascular, metabolic, neurological and psychiatric health, and well as children's learning.[2] In addition, several national studies show that environmental justice (EJ) communities bear the brunt of the noise burden – pre-disposing them to poorer health and learning outcomes.[3] Addressing noise now is especially important given that major infrastructure projects -- funded by the **Infrastructure and Jobs Act** -- are likely to impact EJ communities the hardest.

The Noise Program was not de-funded in 1981 because it was failing to deliver results. Quite the contrary. It was shut down for political reasons because it was delivering results. A businessman in Michigan became angry when the equipment he manufactured was regulated by the Noise Program. Unfortunately for the Program, he was a constituent of Congressman David Stockman. When Ronald Reagan appointed David Stockman as Director of the Office of Management and Budget, it took Mr. Stockman only a few days before he told EPA to shut the Noise Program down in a directive that he said could not be appealed by the Agency.

The Agency has complied with Mr. Stockman's directive for the past 40+ years, but the current public health and environmental justice needs in our communities present a strong reason for the Biden Administration to correct this situation by re-funding the Program under the authorization that remains in the Act.

The Noise Control Act of 1972, which was not rescinded and therefore is still the law of the land, is similar in strength and scope to the other core EPA environmental laws which Congress enacted in the 1970's. The Act contains a number of non-discretionary mandatory requirements for EPA action which,

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[1] Petition to the US EPA, Quiet Communities, 2017
[2] *Noise as a Public Health Hazard*, American Public Health Association, 2021.
[3] Casey JA et al. *Environ Health Perspect* 2016;125. Collins TW et al. *Environ Res.* 2019;175:257-265. Collins TW et al. *Journal of Transport Geography* 2020; 82:102604.

if addressed again as they were when the Program was shut down, would lead to major improvements in public health. Key EPA noise regulations are still on the books. Major companies that are currently subject to these 1980-era noise regulations are now forced to compete with other companies that cheat because they know that EPA has stopped enforcing them. This is not fair for companies that are trying to do the right thing.

We are lucky to be working with a former Director of the Noise Program, Chuck Elkins. He brought to our attention that in 1980, on the 10th anniversary of the Noise Program's creation (originally under Title IV of the Clean Air Act of 1970), the Agency published *The Noise Control Program to Date—1980.*[4] This report summarizes all the regulations, publications, and program achievements during the Program's existence. It provides a very useful primer for re-establishing the Noise Program which, at its peak employed 107 full-time staff and had a budget of $11.9 million ($37 million in 2022 dollars).

Using that 1980 Report as a guide, we have worked with Mr. Elkins to develop the attached proposed budget for the first-year of a re-funded program. The proposal advances several goals of EPA's current strategic plan and calls for:

1. Financial and technical support to community noise efforts,
2. Enforcing the current regulations, and
3. Updating the key technical documents on health effects, monitoring and control information and model ordinances—documents designed to undergird the national effort on noise.

**We ask you to consider funding this proposal in the Agency's FY2024 budget.**

We would like to arrange a Zoom meeting with you and your staff to go over this proposed budget and discuss how it could enable the Agency to begin to tackle the Agency's long-neglected Congressional noise control mandates that would begin to address the environmental justice problems and assistance needs of communities all across this country. We will be in touch with your office soon to arrange a mutually convenient time for this discussion.

Sincerely,

Jamie Banks, PhD, MSc, Founder and President, Quiet Communities Inc

Arline Bronzaft, PhD, Board of Directors, GrowNYC; Professor Emerita, City University of New York

Chuck Elkins, JD, Former Director, Noise Control Program, US EPA

Joel Mintz, JD, Professor Emeritus of Law and C. William Trout Senior Fellow in Public Interest Law

Rick Reibstein, JD, Lecturer, Boston University, Harvard Continuing Education; Board of Directors, National Pollution Prevention Roundtable

Sidney Shapiro, JD, Frank U. Fletcher Chair in Administrative Law, Wake Forest Law School

David M Sykes, MA, Boston University and Rensselaer Polytechnic Institute, Professor (retired)

[4] US EPA. *The Noise Control Program to Date—1980.*

## Proposed Initiative and Budget to Re-fund the Noise Control Act of 1972

Introduction: This is a proposal to the Office of Air and Radiation and to EPA to re-fund the Noise Control of Act of 1972 (including the Quiet Communities Act of 1978). This Act was de-funded for non-programmatic reasons at the beginning of the Reagan Administration and has never been re-funded in the 40 years since. Yet the Act is still in force, contains non-discretionary mandates for the Agency, and regulations promulgated before the Act's de-funding are going un-enforced. Noise damages public health with the preponderance of this damage occurring in disadvantaged communities raising environmental justice issues that the Agency should no longer ignore.

Advancing of EPA's 2022-2026 Strategic Plan: This proposal advances the following goals of EPA's Strategic Plan:

- Take Decisive Action to Advance Environmental Justice and Civil Rights
- Enforce Environmental Laws and Ensure Compliance
- Ensure Clean and Healthy Air for All Communities[5]

The Noise Control Act: The Act contains a comprehensive set of responsibilities including the regulation and enforcement of noise-emitting products in interstate commerce, providing grants to communities for noise control, carrying out technical studies and providing technical assistance in monitoring and local control ordinances. At the time of its de-funding, the Agency's noise budget was at $12 million ($37 million in today's dollars) and 100 FTE, of which 10 were in the regions.

Public Health Benefits: Abating and controlling noise will reduce risks of hearing damage, cardiovascular disease, metabolic disease, psychological disorders, and will improve children's learning, work productivity, and quality of life. For example, lowering environmental noise just five decibels is estimated to reduce the prevalence of hypertension by 1.4% and of coronary heart disease by 1.8%, resulting in medical cost savings of $3.9 billion annually (Swinburn, 2015).

Environmental Justice Benefits: Abating and controlling noise in low income and minority communities – whose residents bear a disproportionate burden of environmental noise exposure (Casey, 2016) – will result in improved health and learning outcomes.

Proposed Re-funding of the Act: We propose that the Agency's noise program be ramped up in a phased manner, emphasizing 4 major components:

- Inventorying and supporting the existing local noise control programs in communities around the country by:
  - Updating previous surveys/studies of local community noise control programs and ordinances;
  - Providing EJ grants to communities to institute controls that immediately reduce the impact of noise on disadvantaged communities from transportation (aviation, vehicles, trains) and other sources such as construction and industrial activity; and
  - Re-staff the Regional Offices with noise specialists to provide award grants and provide technical assistance to states and localities.

[5] The Agency's initial Congressional mandate related to noise was an amendment to the Clean Air Act and during its existence, the Agency's Noise Control Program was part of the Office of Air, Noise, and Radiation. In addition, there is a close nexus with air pollution from combustion sources, the typical source of most harmful noise impacts.

- Enforcing the current regulations' established noise emission limits on new motorcycles and after-market exhaust systems, medium and heavy trucks, and air compressors, and performance rating requirements for hearing protectors, starting with requiring manufacturers to submit their required testing results.
- Updating approximately 15 existing key technical documents that provide health effects, monitoring, control information and model ordinances that were developed to undergird the national efforts.
- Foster development of quieter technology by linking to the Agency's partnership infrastructure (e.g. Energy Star) and coordinate research/ technical assistance with relevant federal programs such as NIOSH.

Why a Federal Program is Necessary: Noise control, like air pollution control, is a highly technical field requiring guidance on monitoring, control technology, and health effects at various degrees of exposure. Local communities currently must each individually address these issues, a task that is both difficult and expensive. Where products sold in interstate commerce are involved, communities are not able to limit their emissions. Yet, with a relatively small amount of national technical assistance, regulation, and enforcement, immediate reductions in noise impacts on populations can be achieved at the local level.

**Estimated Resources Needed for the First Year Re-starting of the Noise Control Office**

| Area | Staff | Funds: staffing payroll | Funds: Contracts, grants, and other |
|---|---|---|---|
| 1. Survey/study of local programs/ordinances | 4 | $0.4 million | $0.5 million |
| 2. Grants for EJ (administered through Regional offices) | 5 | $0.5 million | $ 6 million |
| 3. Update Technical documents/guides | 7 | $0.7 million | $5 million |
| 4. Enforcement | 5 | $ 0.5 million | $1.5 million |
| 5. Regional offices | 10 | $ 1 million | $2 million |
| TOTALS | 31 | $3.1 million | $15.0 million |
| GRAND TOTALS | 31 | $18.1 million | |

Message

**From**: Kim, Eunjung [Kim.Eun@epa.gov]
**Sent**: 1/14/2022 6:50:50 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Nunez, Alejandra [Nunez.Alejandra@epa.gov]
**Subject**: FW: Letter, budget proposal, request for meeting
**Attachments**: QCi_Letter to Joe Goffman re refunding Noise Program_2022.01.13.pdf

Hey Joe – here's the letter from Quiet Communities.

Eunjung Kim
Special Assistant
Office of Air and Radiation
Environmental Protection Agency
(202) 815-7252

---

**From:** Jamie Banks <jamie@quietcommunities.org>
**Sent:** Thursday, January 13, 2022 12:56 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Kim, Eunjung <Kim.Eun@epa.gov>; Rakosnik, Delaney <rakosnik.delaney@epa.gov>; Arline L Bronzaft PhD <Albtor@aol.com>
**Subject:** Letter, budget proposal, request for meeting

Dear Mr. Goffman,

Please find attached our letter as a follow up to our meetings in Fall 2021. Once you have had the chance to review the letter and budget proposal, we would like to schedule a Zoom meeting to discuss them with you.

Thank you for your consideration.

Sincerely,

--

Jamie L. Banks PhD, MS, President
Quiet Communities Inc.
quietcommunities.org
Chair, Noise & Health Committee
American Public Health Association
Web Facebook Twitter LinkedIn APHA Connect (members only)
Email: jamie@quietcommunities.org
Tel: 781.259.1717

*Quiet Communities, Inc. (QCi) is a national 501(c)(3) non-profit organization dedicated to protecting the public health, the environment, and quality of life for everyone -- children, families, seniors, minorities and disadvantaged -- by reducing noise and related pollution. QCi hosts 5 programs: Quiet Coalition, Quiet Outdoors, Quiet Conversation, Quiet Healthcare, and Quiet American Skies.*

Mr. Joe Goffman
Acting Assistant Administrator
for Air and Radiation
Environmental Protection Agency
Washington, DC 20460

February 8, 2022

Dear Joe,

Thank you for taking the time to meet with us last Wednesday (2/1). We are grateful for the attention you gave us, given the many demands on the Air Office.

We believe that EPA can benefit greatly by ending the long period of neglect of noise as a major environmental and public health issue. The legal mandates for EPA remain. Preemption remains in place, restricting what states and municipalities can do. States and localities have been unable to fill the gap, and communities – particularly environmental justice neighborhoods – are especially harmed by noise. The unconstrained growth of noise is also causing extensive harm to wildlife.

Our aim is to help you restore EPA to its previous position as the national leader in addressing this harm, even if we need to start small. As you and your team consider what EPA might do in terms of a "high leverage strategy," we want to be clear about how we might help.

Quiet Communities has a substantial and growing community network. We are able to involve these groups with any initiatives that we can bring forward. Our aim is to get this network to a point where it can do much of what Chuck Elkins referred to when he mentioned ONAC's "Each Community Helps Others" (ECHO) program. Even though our funding is limited, we believe that interest is so strong that, working with EPA, we can quickly form this national community network as a first priority for a national effort.

In 2022, we will organize a conference series to bring communities together around noise, related pollution, and alternative solutions. (A good example is our national conference – The Quiet Transition: Leading by Example in Clean, Quiet Land Care held in Dec 2021 -- that featured communities that have successfully taken action.[1] Nearly 200 people participated and it received a very positive response). Future conferences will address transportation and industrial operations, including solutions such as soundproofing; equipment powered with quieter, less polluting energy alternatives; legal mechanisms, and cultural and educational approaches. We want to emphasize the importance of addressing noise now – as new infrastructure projects are considered – so that we avoid the mistakes of the past that placed a disparate burden on poorer communities. We hope EPA will be interested in participating in these events in some way.

We also have a network of scientific, legal, and health professionals who have worked on noise for many years, and would be able assist EPA in developing internal education, interagency education, or any similar initiative.

We also stand ready to respond to your staff's suggestions of ways that noise can be incorporated into ongoing EPA programs that address multiple pollutants. For instance, leaf blowers and lawn mowers might be good candidates for the Energy Star program.

Lastly, we heard loud and clear that your financial resources are limited and your ability to request funds (a move we think is necessary to comply with the law) may be limited by the extent of other concerns. Therefore, we have attached

[1] https://www.bu.edu/rccp/2021/12/17/739/

a scaled-down sample budget, which we think could get things started and something we hope you feel comfortable proposing. Although this version is not adequate to fully meet the challenge, it will be something, which will be a vast improvement over what is essentially an absence at the table.

- **One last question: Would you be able to help us arrange a meeting with the Assistant Administrator for Enforcement and Compliance Assurance so we can make a pitch for including money in his budget for enforcement of current regulations?**

The opportunity to begin a new era of action may not seem to be a priority issue to some, but we believe this misperception can be countered with accurate information. To those now suffering from excessive noise, the benefit of seeing EPA take up the issue again will be enormous.

We look forward to working with you and your team.

Sincerely,

Jamie Banks, PhD, MSc, Founder and President, Quiet Communities Inc

Arline Bronzaft, PhD, Board of Directors, GrowNYC; Professor Emerita, City University of New York

Chuck Elkins, JD, Former Director, Noise Control Program, US EPA

Joel Mintz, JD, Professor Emeritus of Law and C. William Trout Senior Fellow in Public Interest Law

Rick Reibstein, JD, Lecturer, Boston University, Harvard Continuing Education; Board of Directors, National Pollution Prevention Roundtable

Sidney Shapiro, JD, Frank U. Fletcher Chair in Administrative Law, Wake Forest Law School

David M Sykes, MA, Boston University and Rensselaer Polytechnic Institute, Professor (retired)

**SAMPLE BUDGET**

| Resources Needed for a Re-start of the Noise Control Office | | | |
|---|---|---|---|
| **Area** | **Staff** | **Funds: staffing payroll** | **Funds: Contracts, grants, and other** |
| 1. Outreach and Support to state and local noise programs | 2 | $0.2 million | $0.1 million |
| 2. Grants for Communities with emphasis on Environmental Justice | 2 | $0.2 million | $ 1.5 million |
| 3. Enforcement of current regulations (OECA) | 2 | $ 0.2 million | $0.3 million |
| TOTALS | 6 | $0.6 | $1.9 million |
| GRAND TOTALS | 6 | $2.5 million | |

Message

**From**: Jennifer Schafer [jasca@cascadeassociates.net]
**Sent**: 1/26/2021 2:13:27 PM
**To**: 'Cliff Majersik' [cliff@imt.org]; jgoffman@law.harvard.edu; 'joe.goffman@jbrpt.org' [joe.goffman@jbrpt.org]; Goffman, Joseph [Goffman.Joseph@epa.gov]; 'joseph.goffman@jbrpt.org' [joseph.goffman@jbrpt.org]
**Subject**: RE: Meeting with EPA transition team re energy efficiency and existing admin authority?
**Attachments**: EESG Contacts .pdf

Congrats on your new position, Joe. We're all looking forward to working with you on energy efficiency as emissions reduction as we did back in 2014!

Attached is a list of the groups that will be in the meeting. Trying a couple other emails for you.

Thanks
Jennifer

Jennifer Schafer
Cascade Associates
202-297-6037

---

**From:** Cliff Majersik <cliff@imt.org>
**Sent:** Tuesday, January 26, 2021 8:00 AM
**To:** jgoffman@law.harvard.edu
**Cc:** Jennifer Schafer <jasca@cascadeassociates.net>
**Subject:** Re: Meeting with EPA transition team re energy efficiency and existing admin authority?

Joe,
I'm following up in case you didn't receive my note below. Jean Lupinacci suggested that we reach out to you in your EPA transition team capacity. Are you available to meet with us?

Warm regards,
Cliff

On Wed, Jan 13, 2021 at 8:00 AM Cliff Majersik <cliff@imt.org> wrote:

> Joe,
> Thank you for your role in the Biden EPA transition team!
>
> I write on behalf of the Energy Efficiency Strategy Group. The EESG coordinates Federal policy requests from the various energy efficiency community. Participants are: ACEEE, ASE, AEE, ASHRAE, BCSE, Building Performance Coalition, E2, E4theFuture, EESI, FPCC, ICC, IMT, NASEO, NAESCO, NRDC, NASCSP, Sierra Club, USGBC and WRI -- see attached contact list.
>
> We've met with the Biden DOE transition team and would like to schedule a meeting with the EPA team to discuss opportunities for EPA to utilize existing administrative authority to spur energy efficiency, fight climate change, create jobs, and protect public health -- see EESG's attached recommendations.
>
> Would you and the team like to suggest a few times in the next two weeks when you would be able to meet with us?
>
> Feel free to share plans or analyses that you'd like for us to review in advance of a meeting.
>
> Warm regards,

Cliff

--
Cliff Majersik
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www.imt.org
@IMTCliff

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Message

**From:** Gibson, Neshawne [Gibson.Neshawne@epa.gov]
**Sent:** 1/25/2021 5:22:22 PM
**To:** AO OPA OMR CLIPS [AO_OPA_OMR_CLIPS@epa.gov]
**Subject:** Daily News Clips January 25, 2021 (morning edition)

Daily News Clips January 25, 2021 (**morning edition)**

**Administrative**
The Hill: Biden leans on Obama-era appointees on climate

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**Biden leans on Obama-era appointees on climate**
https://thehill.com/policy/energy-environment/535498-biden-leans-on-obama-era-appointees-on-climate

BY RACHEL FRAZIN AND REBECCA BEITSCH
01/23/21

President Biden has begun to draft officials to lead his primary environmental agencies, turning to former Obama-era appointees, nonprofit leaders and longtime congressional aides to enact his climate vision.

The administration this week announced the first round of political appointees who will begin working at the Environmental Protection Agency (EPA), Interior Department and the Energy Department (DOE).

The latest hires will be key players in carrying out the energy and environment agenda that Biden set forth on the campaign trail, including goals of reaching carbon neutrality by the year 2050 and having a carbon free power sector by 2035.

Biden last month tapped Rep. Deb Haaland (D-N.M.) to lead Interior, North Carolina regulator and former EPA official Michael Regan as that agency's administrator, and former Michigan Gov. Jennifer Granholm (D) to be his Energy secretary. All are awaiting confirmation.

The latest appointees have already gotten to work at their respective agencies and in just a few days have begun carrying out Biden's agenda.

Melissa Hoffer, who was named as the Biden EPA's principal deputy general counsel, has asked lawyers at the Department of Justice to pause cases where Trump administration rollbacks are being challenged by environmental groups.

And a recent Interior Department order that temporarily halted new drilling permits on federal lands, a step toward the Biden campaign promise of ending new public lands leasing, is stirring up mixed reactions.

"It is a team that is exceptionally knowledgeable in the subject areas they are getting hired for. These folks are not going to need a lot of ramp up time," said Aaron Weiss, deputy director of the Center for Western Priorities.

The moves were praised by environmentalists, but the Biden administration's early action on climate change has received pushback from Republicans.

"The Biden admin's message to America's blue-collar workers: If you are a blue-collar worker in the energy industry, find a new job," tweeted Sen. Ted Cruz (R-Texas) in response to the news of the Keystone XL cancellation and pause on drilling permits.

Some trade associations in Washington, including the U.S. Chamber of Commerce, applauded the decision to rejoin the Paris accord, while criticizing the Keystone decision.

Several of the new hires, announced over the past several days, are Obama administration officials returning to their respective departments.

At Interior, Elizabeth Klein will serve as deputy secretary. She was formerly the department's associate deputy secretary. Kate Kelly, who held high-ranking positions at Interior under Secretaries Sally Jewell and Ken Salazar, will serve as the deputy chief of staff for policy.

Vicki Arroyo, who now leads the Georgetown Climate Center, and Joseph Goffman, who ran the Environmental and Energy Law Program at Harvard Law School, are returning to the EPA after both previously worked at its Air and Radiation Office.

EPA's new chief of staff Dan Utech formerly served in the Obama White House as deputy assistant to the president for energy and climate change. He will be joined by officials coming from environmental advocacy organizations such as the Environmental Defense Fund and the Natural Resources Defense Council.

The Energy Department's new chief of staff, Tarak Shah, is also a former Obama official, having worked as a chief of staff to the agency's undersecretary for science and energy.

Andrew Light, who served as an adviser to the U.S. special envoy on climate change and also worked on Washington Gov. Jay Inslee's climate-focused presidential campaign, is also joining DOE as its principal deputy assistant secretary for international affairs.

The Biden administration is also creating some new roles to further advance campaign pledges Biden made on issues like ensuring an equitable transition away from fossil fuels.

At DOE, the Biden team created new positions leading the department's efforts on energy jobs and energy justice, which will be held by Jennifer Jean Kropke, formerly of an electrical workers union, and Shalanda Baker, who was a professor at Northeastern University, respectively.

These positions are expected to advance Biden's campaign pledges to ensure that 40 percent of the benefits of clean energy investments go toward disadvantaged communities and that the agency's actions on energy create jobs.

Baker in particular will look at the agency's existing programs to ensure they are consistent with Biden's energy justice campaign promises.

Some argued the experienced picks could help lighten tension between career officials and political appointees.

"It's a very knowledgeable and experienced crew, and I think this will be a great reassurance to the career staff at the agency as well," said Stan Meiberg, a former acting deputy administrator for the EPA during the Obama years who now teaches at Wake Forest University.

"That's both because of the people but also the tenor and tone of the relationship the president has set between politicals and career staff, and that's a contrast to what happened under the previous administration," he said.

But even if agency relationships are less tense, the dynamics with Congress may largely stay the same.

"On the Biden administration's very first day, it took several big steps in the wrong direction," said Sen. Mitch McConnell (Ky.), the top Republican in the Senate, citing the Paris agreement and Keystone pipeline decisions.

## Aperia secures EPA honor

Aperia Technologies' Halo Tire Inflator earned the technology supplier 2020 Clean Air Excellence Award for Transportation Efficiency Innovations.

HTTPS://WWW.FLEETOWNER.COM/RUNNING-GREEN/PRESS-RELEASE/21152985/APERIA-SECURES-EPA-HONOR

JAN 25, 2021

The U.S. Environmental Protection Agency (EPA) recently honored Aperia Technologies with a 2020 Clean Air Excellence Award in the Transportation Efficiency Innovations category for its Halo Tire Inflator.

The award is the EPA's highest national recognition for a project based on its impact, innovation and replicability in improving the nation's air quality. Aperia is a supplier of efficiency and safety-enhancing tire management technologies.

"For 17 years, the Clean Air Excellence awards have honored those who go above and beyond to improve air quality both at the local and national level," said Anne Austin, principal deputy assistant administrator for EPA's Office of Air and Radiation. "Our winners' inspirational dedication to environmental protection is a model for all of us, and we look forward to many more years of clean air innovation and collaboration."

With the Clean Air Excellence Award, the EPA recognizes and highlights the Halo Tire Inflator for its outstanding innovative contribution to achieving cleaner air in the category of transportation efficiency innovations, Aperia said.

Even a slightly underinflated tire increases the rolling resistance of a vehicle, thereby directly increasing fuel consumption and emissions.

Used extensively by leading commercial trucking fleets since 2015, the Halo is an automatic tire inflation system for trucks and trailers that installs in minutes and eliminates tire underinflation.

The Halo Tire Inflator delivers one of the greatest impacts on sustainability per dollar invested for trucking fleets than any other retrofittable efficiency technology, the company maintained. By actively combating tire underinflation, Halo helps commercial vehicle fleets tackle sustainability objectives while also delivering a rapid ROI by mitigating the impact of tire underinflation.

Since its introduction, Halo has covered more than 22 billion miles, Aperia said.

"We are able to reduce carbon emissions by 9 million tons and keep 5 million tires out of landfills every year by equipping all heavy-duty commercial trucks in the United States with the Halo tire management platform," said Josh Carter, CEO of Aperia Technologies. "We founded our company on the promise that we can 'change the world, one revolution at a time,' and today our team celebrates that we are delivering on that promise and that we are serving the environment with our highest effort and dedication.

"We are deeply honored by this award."

**Biden's Clean-Air, Climate Actions Seen as Benefit for PA**

https://www.publicnewsservice.org/2021-01-25/climate-change-air-quality/bidens-clean-air-climate-actions-seen-as-benefit-for-pa/a72919-1x

January 25, 2021

HARRISBURG, Pa. -- Environmental advocates say President Joe Biden's actions on clean air and climate will make a big difference for air quality in the Keystone State.

The executive orders signed by the president on his first day in office will start reversing some of the most aggressive moves by the Trump administration to weaken or eliminate clean-air and climate-protection regulations.

Joe Minott, executive director and chief counsel for the Clean Air Council, said that's welcome news for areas such as Pittsburgh, which are consistently on the American Lung Association's list of cities with the worst, year-round air pollution.

"We're going to see a tightening of some of the pollution standards that will be allowed," Minott observed. "And I think we may see better enforcement of environmental laws in general."

While some Republicans are calling for Senate review of Biden's order rejoining the Paris Climate Agreement, Minott noted both major parties generally are in agreement on environmental issues.

"The new normal is coming back, where the Environmental Protection Agency is in fact going to protect the environment, which means protecting public health, and I think that's a great thing," Minott commented.

He pointed out many of the environmental regulations weakened by the Trump administration also are being restored by the courts.

Last week, a federal court overturned the Trump EPA's replacement for the Obama administration's Clean Power Plan. Minott believes the trend will continue.

"I think that we will see a resurgence of regulations at the federal level to deal with mercury from power plants, greenhouse-gas emissions from power plants, and that is absolutely needed," Minott contended.

He added because regulations such as auto-emission standards had been rolled back, new regulations will have to be even tighter to meet clean air goals, but the technology to do it is there.

**Uranium Ore Site Must Meet Drinking Water Requisites, Tribe Says**

https://news.bloomberglaw.com/environment-and-energy/uranium-ore-site-must-meet-drinking-water-requisites-tribe-says?context=search&index=1

BY SYLVIA CARIGNAN

Jan. 25, 2021

A South Dakota uranium recovery project shouldn't be exempt from drinking water protections, the Oglala Sioux Tribe said in its request for a federal appeals court to review the EPA decision.

The tribe filed its petition in the U.S. Court of Appeals for the Eighth Circuit over the Environmental Protection Agency's exemption for the Dewey-Burdock In-Situ Recovery Project in Custer and Fall River Counties, S.D.

The EPA issued the Nov. 24 exemption to allow a substance to be injected into aquifers in the project area to recover uranium ore from deposits. The substance, a lixiviant, allows the uranium to be removed and pumped to the surface.

The company that requested the exemption, Powertech Inc., anticipates building 1,461 injection wells and 869 production wells in the area over the life of the project, according to the agency's record of decision.

As part of its underground injection permit, Powertech is required to monitor injection fluids to prevent them from moving outside the wellfield. The company's license under the Nuclear Regulatory Commission requires Powertech to conduct groundwater restoration after uranium recovery is finished, in order to meet commission-approved drinking water standards, according to the EPA decision.

The agency evaluated the groundwater quality of the aquifers within the 1,970 acre exemption area. The groundwater would need reverse osmosis treatment to reduce the amount of iron, manganese, and dissolved substances before it is drinkable, the EPA said in its record of decision.

The land in the Dewey-Burdock Project Area is mainly used for cattle grazing, and it is unlikely the population would grow enough to need a public water system, the EPA said.

The tribe's petition was filed Jan. 22.

**Cause of Action**: Administrative Procedure Act; National Environmental Policy Act; National Historic Preservation Act; Safe Drinking Water Act.

**Relief:** Judicial review.

**Response:** The agency didn't immediately respond to a request for comment.

**Attorneys:** Western Mining Action Project and Energy & Conservation Law are representing the tribe.

The case is Oglala Sioux Tribe v. EPA, 8th Cir., No. 21-1167, 1/22/21.

**AMERICAS: EPA ANNOUNCES $46 MILLION IN FUNDING TO REDUCE DIESEL ENGINES EMISSIONS**

https://www.bunkerspot.com/americas/52314-americas-epa-announces-46-million-in-funding-to-reduce-diesel-engines-emissions

By Rhys Berry
January 25, 2021

The US Environmental Protection Agency (EPA) has announced the availability of grant funding for projects which reduce emissions from the nation's existing fleet of older diesel engines.

The EPA anticipates awarding approximately $46 million in Diesel Emissions Reduction Act (DERA) grant funding to eligible applicants, subject to the availability of funds, and expects to award between 40 and 70 assistance agreements.

'The DERA program continues to provide much needed assistance to agencies and ports to improve poor air quality in communities across America,' said EPA Administrator Andrew Wheeler. 'Over the last three years, EPA has provided nearly $300 million in grants and rebates to modernise diesel fleets with cleaner heavy-duty trucks and equipment.'

EPA is soliciting applications nationwide for projects that 'significantly reduce diesel emissions and exposure', especially from fleets – including commercial marine vessels – operating at goods movements facilities in areas designated as having poor air quality. Applicants may request funding to upgrade or replace diesel-powered marine engines, as well as buses, trucks, locomotives and non-road equipment with newer, cleaner technologies.

Priority for funding will also be given to projects that engage and benefit local communities and applicants that demonstrate their ability to promote and continue efforts to reduce emissions after the project has ended.

**Biden administration to review contentious EPA landfill emissions regulation**

https://www.wastedive.com/news/biden-epa-landfill-methane-climate/593869/

By Megan Quinn
Jan. 25, 2021

*The image by Alan Levine is licensed under CC BY 2.0*

Dive Brief:

- The Biden administration will review the U.S. EPA's contentious Emission Guidelines for Municipal Solid Waste Landfills (EG) regulation that has been stalled in legal battle for several years, a hint that the new administration may aim to speed the implementation process.
- The 2016 regulation set forth emission guidelines for certain MSW landfills to limit greenhouse gas emissions, directing states to submit plans for complying with the emissions rules, and the EPA to create a federal plan to cover states that do not create their own.
- President Biden announced the review through an executive order on his first day in office, signaling his administration wants the EPA to put states "back on the clock for getting their rules done" and prompt the EPA to move forward with issuing its federal plan, said Pat Sullivan, senior vice president at SCS Engineers.

Dive Insight:

The executive order is the latest development in a long legal battle over the EG rule. Though it's not clear when the states and the EPA would be required to finalize their compliance plans, the Biden administration's inclusion of this landfill emissions rule in its executive order signals the EPA's window for further delaying implementation could be closing, Sullivan said.

Addressing climate change is a major part of President Biden's agenda, and landfills are a significant source of methane emissions and a major contributor to global warming, according to the Intergovernmental Panel on Climate Change. Gina McCarthy, who was EPA administrator when the original rule came out in 2016, is back under Biden as a national climate advisor.

The EG rule applies to more than 1,900 MSW landfill sites in the United States and encompasses any MSW landfills that have accepted waste since Nov. 8, 1987. A separate New Source Performance Standards rule applies to any MSW landfills constructed since July 17, 2014.

The EG rule requires states to develop their own implementation plans for compliance, but initial plans were only submitted by regulators in Arizona, California, Delaware, New Mexico and West Virginia. Other state agencies have said they are unsure about whether to submit their own plans or wait for a future federal plan.

Under the Trump administration, the EPA sought to delay finalizing its federal landfill emissions plan and put off approval of any state plans. Industry associations and companies have supported the EPA's request for a delay, in part because of confusion over what the rules could mean for landfill costs and operations. The National Waste & Recycling Association, one of the industry players that initially sought to challenge the regulations, declined to comment.

Attorneys general from eight states, along with the Environmental Defense Fund, have challenged the delay in court, but the latest ruling from the Ninth Circuit Court of Appeals sided with the EPA's appeal in October. The plaintiffs challenged that decision by asking for a stay in December, but a federal judge denied the request on Jan. 19.

The landfill emissions regulation is one of about 100 included in Biden's executive order. The list encompasses regulations and other executive actions issued by the Trump administration, and about half of the agency actions listed for review fall under the scope of the EPA. The list also includes two rules related to the disposal of coal ash from electric utilities.

Kevin Minoli, a former senior official in EPA's Office of General Counsel, said in a statement that the list "should not be viewed as the death knell" for the EPA actions listed. He anticipates the Biden administration will take "appropriate action" on each item, allowing those regulated to weigh in on what that action could look like.

**EPA Pulls Biogenic GHG Emissions Rule, Air Modeling Guide From OMB**

https://insideepa.com/daily-news/epa-pulls-biogenic-ghg-emissions-rule-air-modeling-guide-omb

By *Stuart Parker*
January 22, 2021

The Biden EPA has withdrawn from White House pre-publication review a long-pending Trump administration proposal to exempt some biogenic greenhouse gas emissions from Clean Air Act permitting mandates, and it has also pulled a separate proposed guidance on modeling ozone and fine particulate matter (PM2.5) emissions.

The two withdrawals took place Jan. 21 one day after President Joe Biden's Chief of Staff Ronald Klain issued a memo to EPA and all other agencies announcing a "freeze" of all pending regulations, so that the new administration can review a host of Trump administration policies for potential revision or reversal.

The Trump EPA sent its proposed biomass emissions rule for mandatory White House Office of Management & Budget (OMB) pre-publication review Feb. 24, where it remained. The administration first announced its plan for the rule in the Spring 2018 Unified Agenda of pending policies, and in the most recently updated Fall 2020 Unified Agenda EPA said that it still planned to issue the rule but the date of the action was "to be determined."

The plan labeled biomass energy as carbon-neutral, but the Trump administration delayed its issuance pending legal arguments in litigation over its Affordable Clean Energy (ACE) power plant GHG rule. The Department of Justice was said to have concerns that issuance of the biomass policy would undercut the agency's defense of the ACE rule, which relied on the use of source-specific controls.

The biomass proposal was expected to say biomass is carbon neutral because forest regrowth offsets emissions at the stack of biomass power plants.

However, the U.S. Court of Appeals for the District of Columbia Circuit vacated ACE in a Jan. 19 ruling. Judges during October oral argument on rule repeatedly pressed EPA on why it had excluded biomass as a way for states to comply with ACE.
Many environmentalists and others question whether biomass should be labeled carbon-neutral, given its potential to increase GHGs in the near term, although industry groups using forest products strongly support such a finding.
The Biden administration on Jan. 21 also withdrew from OMB review a proposed guidance document outlining how state and federal air quality modelers should approach modeling emissions of ozone and PM2.5. EPA had sent the guidance for OMB review on Jan. 12, but the plan had not yet appeared in the Unified Agenda.
The withdrawn notice appears to refer to a Feb. 10 draft that outlined a "a two-tiered demonstration approach for addressing single-source impacts" of industrial projects on ozone and PM2.5 first promoted by EPA in 2017. The technical guidance applied to air permitting under the new source review (NSR) program, in order to determine the likely pollution impacts and therefore the air permitting obligations of an industrial project.
The first tier of analysis "involves use of technically credible relationships between precursor emissions and a source's impacts," according to the February draft. The second, more in-depth tier "involves application of more sophisticated case-specific chemical transport models (CTMs), e.g., photochemical grid models, to be determined in consultation with the EPA Regional Offices," the draft guidance said.

**EPA Asks DOJ To Seek Stays Of Litigation Challenging Agency Rules**

https://insideepa.com/daily-news/epa-asks-doj-seek-stays-litigation-challenging-agency-rules

By *Lara Beaven*
January 22, 2021

EPA Acting General Counsel Melissa Hoffer is officially asking the Justice Department (DOJ) to seek judicial pauses in pending litigation challenging agency rules or seeking to establish a deadline for EPA regulation, in order to provide the Biden administration time to review a slew of lawsuits before deciding how to proceed.
In a Jan. 21 letter to Jean Williams and Bruce Gelber, deputy assistant attorneys general within DOJ's Environment and Natural Resources Division, Hoffer says her request conforms with President Joe Biden's "Executive Order [EO] on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis."
The Jan. 20 order, which Hoffer references as the "Health and Environment" EO, directs the heads of all agencies to "immediately review all existing regulations, orders, guidance documents, policies and any other similar agency actions" taken during the entire Trump administration, starting on Jan. 20, 2017, "that are or may be inconsistent with or present obstacles to the policy" goals of the new order.
Hoffer says her letter "will confirm my request on behalf of the U.S. Environmental Protection Agency (EPA) that the U.S. Department of Justice (DOJ) seek and obtain abeyances or stays of proceedings in pending litigation seeking judicial review of any EPA regulation promulgated between January 20, 2017, and January 20, 2021, or seeking to establish a deadline for EPA to promulgate a regulation in connection with the subject of any such regulation, in order to provide an opportunity for new Agency leadership to review the underlying rule or matter."
She also references a Jan. 20 memorandum from Biden Chief of Staff Ronald Klain that announced a regulatory "freeze" for EPA and all other federal agencies blocking them from pursuing any rulemaking efforts until the new administration can review the policies.

"For a case where an abeyance or stay of proceedings is not feasible, we request that DOJ seek extensions of time that are of sufficient duration to allow this review," Hoffer writes. "While these rule cases are a particularly high priority, we also anticipate that a similar request may apply for additional cases in a defensive posture. For any case that you believe merits separate consideration, or for which you believe an abeyance, stay of proceedings, or sufficient extension is not feasible, please promptly notify us and the involved EPA Office of General Counsel's Associate General Counsel for a discussion."
Hoffer says the EPA Office of General Counsel will work with DOJ to help implement the request.

**Citizen Coalition Urges Biden To Tap PFAS 'Czar' To Oversee Federal Actions**

https://insideepa.com/daily-news/citizen-coalition-urges-biden-tap-pfas-czar-oversee-federal-actions

By *Suzanne Yohannan*
January 22, 2021

A coalition of local citizen and environmental groups is urging the Biden administration to embrace aggressive measures to address per- and polyfluoroalkyl substances (PFAS), stressing the need for a White House PFAS "czar" to oversee policy and ensure accountability from the Defense Department (DOD) in addressing the chemicals.
The National PFAS Contamination Coalition, comprised of 18 groups in 16 states across the country fighting PFAS contamination, is pushing administration officials to embrace a 22-point action plan that lays out a series of aggressive steps for Biden to take on PFAS policy, including creating a high-level official to oversee federal agencies on the matter.
Anthony Spaniola and Andrea Amico, members of the coalition and with citizen groups in Michigan and New Hampshire, respectively, say the most significant action the coalition is seeking is for President Joe Biden to appoint someone at the White House level to oversee PFAS as part of an action item aimed at ordering DOD to more aggressively respond to PFAS contamination.
They say they are seeking to create a position similar to the one Biden created when he tapped former EPA Administrator Gina McCarthy to serve as a climate "czar," saying there have been systemic breakdowns among federal agencies on PFAS.
"This requires a massive coordinated effort," Spaniola tells *Inside EPA*.
The coalition -- which since its inception in 2017 has prompted attention from lawmakers -- also has backing from national environmental group leaders, who signed on as "allies" to the 22-point action plan and a corresponding letter to the Biden administration following the election.
Others who signed the letter include Environmental Working Group legislative attorney Melanie Benesh; the Natural Resources Defense Council's Senior Strategic Director Erik Olson; and Earthjustice attorney Eve Gartner.
The coalition reiterated its drive for implementing its action plan in a Jan. 11 release of several videos calling on Biden to act on PFAS contamination.
It is unclear whether, or how much, of the coalition's 22-point action plan the Biden administration may take up, but environmentalists are expected to press the new administration to implement its campaign pledges to regulate and study the risks of PFAS, among these the listing of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) as Superfund hazardous substances, which would trigger cleanup actions.
The group's push for the Superfund listings could be bolstered as many observers expect the new Democratically controlled Congress or the Biden administration to take such a step.
But Spaniola and Amico say the coalition's call for appointing a special PFAS advisor is the most important measure among the 22 items.

**'Complete Overhaul And Transformation'**

In a statement supplementing the plan, the two say meaningful action on PFAS has to involve "a complete overhaul and transformation of [DOD's] PFAS effort." If the federal government is "serious about PFAS, it must clean up its own act within the Department of Defense." DOD holds significant cleanup liability for PFAS, as it used the chemicals in firefighting foam used for training and extinguishing fuel fires across its bases. Spaniola says that PFAS cannot be addressed by simply changing a few policies.

"Given the long history of systemic mismanagement and deceit spanning several administrations, [DOD] cannot be left to reform itself," the two say in the statement.

"That's why our Coalition is calling for direct leadership, action and involvement from the White House by means of executive order, budgeting and personnel review, overseen and directed by a PFAS Czar in the Executive Office, with input from a Presidential Council including leaders from heavily impacted communities and exposed groups (such as veterans and firefighters). The Department of Defense must be transformed from a laggard on PFAS to a dynamic, proactive leader," they say in the statement.

At various times over the past several years, DOD has opposed efforts by both EPA and the federal Agency for Toxic Substances & Disease Registry (ATSDR) on PFAS issues, for instance challenging EPA on its cleanup goal for a groundwater cleanup guidance for PFOA and PFOS.

And in 2018, DOD sought to interfere with ATSDR's release of a draft toxicological profile on four PFAS that included more conservative risk estimates than EPA had used.

Amico says one of the biggest breakdowns has been that no one has held DOD accountable when it puts pressure on EPA behind the scenes not to regulate the chemicals.

In addition, Amico and Spaniola say strong leadership and inter-agency coordination from the White House is needed for such a large public health challenge. The czar should "also be charged with overseeing and managing a streamlined and coherent PFAS effort across all agencies of the federal government."

They also note that Rep. Dan Kildee (D-MI), who co-chairs the bipartisan PFAS congressional task force and has pushed legislation to require EPA regulation of PFAS, in a Nov. 23 article in *MLive* voiced support for a White House coordinated, inter-agency PFAS initiative.

A spokesman for Kildee's office could not comment on the matter at press time.

Spaniola and Amico cite the Michigan PFAS Action Response Team (MPART) as a potential model for the federal government. MPART was created in 2017 by executive order to work across agencies on investigating sources and locations of PFAS and protecting drinking water.

**22 Items**

The 22 items in the PFAS contamination coalition agenda were developed by coalition members impacted by PFAS contamination across the country with months of discussion and strategizing, a spokeswoman for the coalition says.

The list includes calls for regulatory measures, testing protocols and boosted budgets, with Spaniola noting that DOD's budget for addressing the matter is "anemic." Among the budgetary measures is one calling on White House involvement in ensuring DOD's PFAS cleanup budget requests "are dramatically increased," as well as federal government assistance to states "with resources to address PFAS and hold polluters responsible financially, so the additional costs do not fall onto impacted communities."

On the regulatory front, the group calls for regulating the chemicals -- which number in the thousands -- as a class, setting a stringent federal drinking water limit of 1 part per trillion for all PFAS or mandating a health-protective treatment technique for the class, placing a moratorium on all new PFAS approvals, listing and regulating PFAS under the Clean Water Act and the Clean Air Act and designating the chemicals as hazardous substances under Superfund law, and updating EPA's Significant New Use Rule to reflect all uses of all PFAS.

And on testing, it calls for setting an Unregulated Contaminant Monitoring Rule 5 (UCMR 5) that requires public drinking water suppliers to test for at least 29 PFAS -- an action the Trump EPA Jan. 19 proposed to do.

It also asks the new administration to bar the use of biosolids on agricultural property "and update the sludge rule to require testing for PFAS until the use can be shown to be safe."

Further, the coalition calls for banning PFAS incineration and disposal and requiring safe storage of PFAS until safe disposal methods are discovered, prioritizing funding for research into disposal methods, setting a national protocol to remove, replace and store firefighting foam containing PFAS. It also notes that many communities must now pay for alternative water supplies and water treatment, but that polluters, including producers of PFAS, should be held accountable for contamination, including paying for blood testing, health studies, alternative water supplies and treatment.

**Biden EO Might Signal Two-Track Plan For Vehicle GHG Rulemaking**

https://insideepa.com/daily-news/biden-eo-might-signal-two-track-plan-vehicle-ghg-rulemaking

By *Doug Obey*
January 22, 2021

President Joe Biden's recent climate executive order (EO) might signal EPA will pursue a two-track plan for regulating vehicle greenhouse gases, with one track a swift reversal of the Trump administration's rollback of GHG rules through model year (MY) 2026 but a longer track pursuing stricter GHG rules for later years, sources say.

The EO that Biden signed Jan. 20 includes an array of preliminary deadlines for revisiting numerous Trump administration policies, including a July timeframe for initial action on federal vehicle standards while remaining vague on the specifics. Among the uncertain issues is the stringency of GHG limits and whether to "decouple" EPA and National Highway Traffic Safety Administration (NHTSA) vehicle programs.

But observers are also suggesting that a possible Jan. 27 climate announcement by Biden on both domestic and international climate policies -- beyond the recent EO and related early actions -- could also give the administration another opening to further elaborate on its vehicle GHG policy plans.

EPA "clearly has the authority to go beyond model year 2026," says an environmentalist, suggesting the viability of the second longer track for pursuing more-stringent auto GHG limits after MY26.

"But to propose it by July . . . would be very ambitious," the environmentalist says of such a rulemaking.

A source tracking the issue largely agrees with that view, saying, "it is not possible" for the Biden administration to propose a post-MY26 regulatory approach by July.

But that does not mean that Biden must delay the start of efforts to craft such longer-term standards, the source says, suggesting the administration could pursue two concurrent tracks -- the first being the quick undoing of Trump-era vehicle GHG deregulatory actions and the second being the longer process of new regulations.

EPA staff "can begin cranking up now," on a longer-term effort even if putting out an actual regulation happens later, adds the source tracking the issue.

The section of the climate change EO focused on Trump administration rules says, "The head of the relevant agency, as appropriate and consistent with applicable law, shall consider publishing for notice and comment a proposed rule suspending, revising, or rescinding the agency action within the timeframe specified."

The EO specifies a July 2021 timeframe for initial action on the Trump administration's rollback of federal greenhouse gas and fuel economy standards through MY26, which was issued by NHTSA and EPA. That timeline is a few months later than the EO's suggested deadline of April 2021 for revisiting a separate Trump administration rule attacking state vehicle emissions programs.

"The literal reading of it is you've got to do something about the rollback [of federal standards out to MY26]," says a former agency staffer, with the recent EO "silent on what is going to come" for later years.

But the former staffer notes it is already clear that "you are not going to confront the climate crisis" without establishing ambitious GHG standards for autos well beyond MY26.

Biden has pledged to push toward decarbonizing the transportation sector in coming decades, and to pursue new vehicle standards that boost vehicle electrification.
One path forward could be focusing EPA's technical experts on the longer term rulemaking efforts, "because that is where the tough decisions are going to be," the former staffer says, while letting legal staff focus more heavily on "what you are going to do about the rollback."

**Regulatory Path Forward**
The EO document's July timeframe is silent on both the specifics of vehicle standards and the precise division of labor between EPA and NHTSA on the issue, at a time when the Biden administration has been considering a potential decoupling of the two agencies' vehicle regulatory activities.
The environmentalist says there is a significant existing record available to the Biden administration on standards out to MY26, including the ability to meet them without significant reliance on electrification.
The source contrasts that with what is necessary to issue longer term standards, adding, "[Getting to] model year 2030, that is going to involve building a technical record that hasn't been done before."
The EO's July 2021 timeframe appears to reflect a desire to "get the [Trump] rule cleaned up quickly," adds the source tracking the issue. "I think the auto industry wants that too."
Sources in this vein have previously cited an agreement between California and five automakers during the Trump administration as a potential model for near-term vehicle standards.
But Center for Biological Diversity Safe Climate Transport Campaign Director Daniel Becker in comments to *Inside EPA* says he has some concern at the EO's July timeframe, if any efforts to meet that deadline distract the Biden administration from efforts to achieve more-ambitious GHG cuts from the fleet. "The challenge is to do it well, not just to do it fast,' he says.
EPA can "both claw back" the Trump rollback and "set tough standards" aimed at decarbonizing the transportation sector by 2050, Becker adds.

EPA delivers results on PFAS Action Plan

The PFAS Action Plan is the most comprehensive cross-agency plan ever to address an emerging chemical of concern.

https://www.waterworld.com/drinking-water/potable-water-quality/press-release/14196103/epa-delivers-results-on-pfas-action-plan

Jan 25th, 2021

Photo by Sohaib Al Kharsa on Unsplash

**WASHINGTON --** The U.S. Environmental Protection Agency (EPA) announced a suite of actions from across the agency that will continue the significant progress the agency has made to implement the PFAS Action Plan — the most comprehensive cross-agency plan ever to address an emerging chemical of concern. EPA has made progress in all of its program areas under the Action Plan, and the agency is helping states, tribes, and local communities across the country target PFAS reductions and protect public health.

EPA is issuing the following actions:

**Moving Forward on Regulating PFOA and PFOS in Drinking Water by Issuing Final Regulatory Determinations**

After evaluating more than 11,000 public comments, the agency is taking the next step to regulate these two PFAS under the processes laid out in the Safe Drinking Water Act by issuing final regulatory determinations for PFOA and PFOS. EPA will now initiate the process to develop a national primary drinking water regulation for these two PFAS, which will include further analyses, scientific review, and opportunity for public comment. Additionally, EPA intends to fast track evaluation of additional PFAS for future drinking water regulatory determinations if necessary information and data become available. For additional information: www.epa.gov/safewater

**Advance Notice of Proposed Rulemaking Addressing PFOA and PFOS in the Environment**

EPA is issuing an Advance Notice of Proposed Rulemaking (ANPRM) to get public comment and data to inform the agency's ongoing evaluation of PFOA and PFOS. This information will also help the agency consider whether additional regulatory steps to address PFAS contamination in the environment are necessary. The agency is seeking comment about whether it should take any additional regulatory steps to address PFAS contamination in the environment, including, but not limited to, designating PFOA and PFOS and other PFAS chemicals as CERCLA hazardous substances and seeking comment on whether PFOA and PFOS and other PFAS chemicals should be subject to regulation as hazardous waste under RCRA. EPA will accept comments on the ANPRM for 60 days following publication in the Federal Register. For more information: https://www.epa.gov/pfas/epa-actions-address-pfas

**New Data on PFAS in Drinking Water**

EPA also proposed to collect new PFAS data under the fifth Unregulated Contaminant Monitoring Rule (UCMR 5). The new data will be used to better understand occurrence and prevalence of 29 PFAS in the nation's drinking water. The UCMR 5 proposal includes monitoring for six PFAS that were part of UCMR 3, now using new analytical methods that support lower reporting levels. EPA also proposes that an additional 23 PFAS be monitored using methods developed by EPA. In addition to PFAS, UCMR 5 proposes monitoring for lithium in drinking water. The proposal would require pre-sampling preparations in 2022, sample collection from 2023-2025, and reporting of final results through 2026. EPA is accepting public comment on the proposed UCMR 5 for 60 days following publication in the Federal Register. EPA will hold a virtual stakeholder meeting twice during the public comment period. For additional information: www.epa.gov/safewater

**Releases Toxicity Assessment for PFBS**

EPA is releasing a toxicity assessment for perfluorobutane sulfonic acid (PFBS). Today's PFBS assessment is part of EPA's efforts to increase the amount of research and information that is publicly available on chemicals in the PFAS family. This assessment is not a regulation, rather it provides a critical part of the scientific foundation for human health risk assessment decision-making. The information in the PFBS toxicity assessment may be used by federal partners, states, tribes, and local communities, along with specific exposure and other relevant information to determine, under the appropriate regulations and statutes, if and when it is necessary to take action to address potential risks associated with human exposures to PFBS. The PFBS assessment provides toxicity values and information about the adverse effects of the chemical and the evidence on which the value is based, including the strengths and limitations of the data. All users, including risk assessors and risk managers, are advised to review the information, including potential uncertainties, provided in this document to ensure that the assessment is appropriate for the circumstances (e.g., exposure pathways, concentrations, presence of sensitive subpopulations) in question and the risk management decisions that would be supported by the risk assessment. For additional information: https://www.epa.gov/pfas/epa-actions-address-pfas

**Next Steps to Address PFAS in Wastewater**

Additionally, EPA announced next steps to address PFAS in wastewater, where appropriate. The agency announced an Advance Notice of Proposed Rulemaking to collect data and information regarding manufacturers of PFAS and the presence and treatment of PFAS in discharges from these facilities. EPA is also requesting information regarding PFAS formulators—facilities that produce a variety of PFAS products and materials from PFAS feedstocks. This action is based on information the Agency has collected as described in the recently finalized Effluent Guidelines Program Plan 14. The information collected through this action will help inform whether these industrial sources warrant regulation through national Effluent Limitation Guidelines (ELGs) to address PFAS discharges.

**Coordinating PFAS Research Across the Federal Government**

EPA, in partnership with USDA, DOD and HHS, asked the National Academies of Sciences, Engineering, and Medicine (NASEM)'s to assess the federal government's research efforts into the human health effects of PFAS. A virtual public workshop was convened on October 26-27, 2020 where an independent panel of experts heard from government scientists and reviewed federal agency research to identify potential research and data gaps. A draft report is expected to be published later this week.

Neshawne Gibson
Office of the Administrator
US Environmental Protection Agency
Phone: (202) 566-1957
Mobile: (202) 603-7617

Message

**From:** Joel schwartz [joel@hsph.harvard.edu]
**Sent:** 2/1/2021 9:35:41 PM
**To:** Nishida, Jane [Nishida.Jane@epa.gov]; Utech, Dan [Utech.Dan@epa.gov]; jgmccabe@iu.edu; Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Implementation of the Evidence Act
**Attachments:** LetterToEPAadministrator-evidenc_mak.docx

**Flag:** Follow up

I am attaching a brief statement about ongoing work on implementation of the Evidence act from the North American Chapter of the International Society for Environmental Epidemiology, calling attention to the need to ensure it does not represent a backdoor reinstatement of the censored science rule that was just, thankfully, terminated.
Thank you for your consideration.

Joel Schwartz, for the Society

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The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable causes, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

Virginia Declaration of Rights; " That general warrants, whereby any officer or messenger may be commanded to search suspected places without evidence of a fact committed, or to seize any person or persons not named, or whose offense is not particularly described and supported by evidence, are grievous and oppressive and ought not to be granted."

*Secretariat:*
Infinity Conference Group
(Contact: Doreen Albertson)
1035 Sterling Road,
Herndon, VA 20170

703-925-0178 (Voice) 703-925-9453 (Fax)
secretariat@iseepi.org (E-Mail)
[ HYPERLINK "http://www.iseepi.org" ] (website)

Jane Nishida, Acting Administrator
Office of the Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
*Submitted via email*

*Re*: Implementation of the Evidence Act
Dear Acting Administrator Nishida:

We, the North American Chapter of the International Society for Environmental Epidemiology write to request that you carefully examine the draft protocols for implementing the Evidence act that have been developed by EPA to prevent them from being used as a back door to preventing the EPA from considering epidemiology in rulemaking. With the censored science rule now withdrawn, we want to ensure it does not return. The image below from a recent EPA presentation on dealing with the act indicates the problem. It notes that the Evidence Act requires that the Agency provide open access to underlying datasets "where feasible". Since epidemiological studies are governed by privacy laws, including HIPAA and, for European studies the GDPR, this is rarely if ever feasible, or legal, for epidemiology studies. We have previously commented on how easy it is to re-identify subjects in such studies. Hence the way EPA implements and interprets "where feasible" is critical for EPA's ability to consider the best available science in setting standards, regulations, and reference doses. From the slide deck, it is not clear that EPA is currently taking this issue as seriously as it deserves. We urge you to ensure this is clearly addressed in any protocols and rules for implementing the act.

← Back to message

st changed: Wednesday, January 27, 2021

Evidence Act Overview for EHHP January 2021.pdf
221 KB

# Evidence Act and ROE Indicators

| ROE Workshop Goals | |
|---|---|
| Cross-Media Issues | • Brainstorm how cross-media issues might be addressed<br>• Develop a prioritized list of cross-media issues<br>• Produce potential ways to display cross-media issues |
| ROE Questions and New Indicators | • indicators and new questions for the ROE of the future<br>• confirm existing, or develop new, ROE questions<br>• develop prioritized list of new and revised indicators |
| Trends Analysis | • brainstorm potential methods or approaches for analyzing and interpreting trends in the ROE<br>• develop a prioritized list of potential trends to explore |
| User Experience and Communications | • increase our understanding of all the current and potential users of the ROE |

**Evidence Act asks agencies to:**

- Engage experts in gathering, synthesizing and evaluating evidence
- Identify priority questions for a learning agenda that spans the period of the Strategic Plan
- Produce data (measures, indicators) of enough quality and rigor for use in analyses, research and evaluation
- Provide open access to underlying datasets and metadata, share data with other researchers where feasible

Sincerely,

Joel Schwartz
On behalf of the International Society for Environmental Epidemiology, North American Chapter

Message

**From**: Davis, Emily [edavis@nrdc.org]
**Sent**: 2/2/2021 5:02:14 AM
**To**: Nishida, Jane [Nishida.Jane@epa.gov]; ali.zaidi@whitehouse.gov; regan.michael@epa.gov; mccabe.janet@epa.gov; Utech, Dan [Utech.Dan@epa.gov]; Garbow, Avi [Garbow.Avi@epa.gov]; lucey.john@epa.gov; Harris, Sincere [Harris.Sincere@epa.gov]; Mercado Violand, Fernando [MercadoVioland.Fernando@epa.gov]; O'Donnell, Sean [ODonnell.Sean@epa.gov]; Wong, Helina [wong.helina@epa.gov]; Bartlett, Rashmi [bartlett.rekha@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Tsirigotis, Peter [Tsirigotis.Peter@epa.gov]; Lassiter, Penny [Lassiter.Penny@epa.gov]; Mathias, Scott [Mathias.Scott@epa.gov]; Sasser, Erika [Sasser.Erika@epa.gov]; Wayland, Richard [Wayland.Richard@epa.gov]; Whitehurst, Shanika [whitehurst.shanika@epa.gov]; Kelley, Rosemarie [Kelley.Rosemarie@epa.gov]; Carroll, Thomas [Carroll.Thomas@epa.gov]; Nguyen, Loan [Nguyen.Loan@epa.gov]; Minter, Marsha [Minter.Marsha@epa.gov]; Arroyo, Victoria [Arroyo.Victoria@epa.gov]; Cassady, Alison [Cassady.Alison@epa.gov]; Hamilton, Lindsay [Hamilton.Lindsay@epa.gov]; Enobakhare, Rosemary [Enobakhare.Rosemary@epa.gov]; Mugdan, Walter [Mugdan.Walter@epa.gov]; Ruvo, Richard [Ruvo.Richard@epa.gov]; Guerrero, Carmen [guerrero.carmen@epa.gov]; LaPosta, Dore [LaPosta.Dore@epa.gov]; Chan, Suilin [Chan.Suilin@epa.gov]; Colecchia, Annamaria [Colecchia.Annamaria@epa.gov]; Jon, Frank [Jon.Frank@epa.gov]; Joseph, Towana [Joseph.Towana@epa.gov]; Petriman, Viorica [Petriman.Viorica@epa.gov]; Siegel.Josesph@epa.gov; Jean.Williams@usdoj.gov
**CC**: John Walker [jwalke@nrdc.org]; Elizabeth Neville [elizabeth@neville.com]; Rachel Stevens [RSTEVENS@vermontlaw.edu]; Cooper, Ashley [ACooper@nrdc.org]; Heather Croshaw [heather.croshaw@gmail.com]; Lauren Hudson [lauren.hdsn@gmail.com]; Miyoko Sakashita [miyoko@biologicaldiversity.org]; Dina Roumiantseva [droumiantseva@cooley.com]; jteelsimmonds@biologicaldiversity.org; Michelle Endo [michelle.endo@sierraclub.org]
**Subject**: Petition for Reconsideration of Plantwide Applicability Limit Permit, No. VI-001/2019, issued to Limetree Bay Terminals, LLC and Limetree Bay Refining
**Attachments**: Index of Exhibits.docx; ATT00001.txt; Petition for Reconsideration Limetree PAL.pdf

Dear Acting Administrator Nishida:

Attached please find a petition for reconsideration of a Clean Air Act Plantwide Applicability Limit Permit, No. VI-001/2019, issued to Limetree Bay Terminals, LLC and Limetree Bay Refining, on St. Croix in the U.S. Virgin Islands. Attached, please also find a number of exhibits which we make reference to in the petition for reconsideration.

The petition for reconsideration is filed on behalf of St. Croix Environmental Association, Natural Resources Defense Council, Center for Biological Diversity, Sierra Club, and Elizabeth Neville.

Please feel free to contact me by email or phone if you have any difficulty opening these attachments, or if you have questions about this submittal.

Sincerely,

Emily K. Davis

EMILY DAVIS
*Senior Attorney*
*Climate and Clean Air Program*

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**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

EPA – PAL – VI-001/2019

**PETITION FOR RECONSIDERATION, REOPENING OR REVOCATION OF EPA PLANTWIDE APPLICABILITY LIMIT PERMIT NO. VI-001/2019 FOR LIMETREE BAY TERMINALS, LLC AND LIMETREE BAY REFINING**

**PETITION FOR RECONSIDERATION AND REVERSAL OF RESCISSION OF EPA REACTIVATION POLICY**

February 1, 2021

Respectfully Submitted by the St. Croix Environmental Association, Natural Resources Defense Council, Center for Biological Diversity, Sierra Club, and Elizabeth Neville.

On December 1, 2020, acting on behalf of the Trump Administration Environmental Protection Agency ("EPA"), former Administrator Andrew Wheeler issued[1] a Clean Air Act Plantwide Applicability Limit ("PAL") Permit, No. VI-001/2019 ("Permit")[2], to Limetree Bay Terminals, LLC and Limetree Bay Refining (collectively, "Limetree"), on St. Croix in the U.S. Virgin Islands. The Trump Administration PAL Permit authorizes Limetree to reactivate oil refining activity at one of the ten largest refineries in the world (the "Refinery"), after it shut down in 2012 in the face of significant financial and environmental problems.

The former Administrator's decision also abruptly rescinded the Agency's 42-year-old Reactivation Policy, which effectively served to speed up permitting of a long-shutdown oil refinery, without any obligation to install Best Available Control Technology nor conduct air quality impact analyses. This permitting decision violates the Clean Air Act, the Administrative Procedure Act, and the Endangered Species Act. It contravenes sound environmental policy, protection of the health of the people of the Virgin Islands, its air quality, water quality and endangered species, and a nearby national wildlife refuge. The Permit's issuance further runs afoul of Executive Order 12898: Environmental Justice;[3] Executive Order 13166: Improving Access to Services for Persons with Limited English Proficiency;[4] Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis;[5] Executive Order on Tackling the Climate Crisis at Home and Abroad;[6] and Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking (Jan. 27, 2021). EPA's issuance of the Permit is based on clearly erroneous findings of fact and conclusions of law. The former Administrator's actions warrant reconsideration.

The St. Croix Environmental Association ("SEA"), Natural Resources Defense Council ("NRDC"), Center for Biological Diversity ("CBD"), Sierra Club, and Elizabeth Neville (collectively, "Petitioners") respectfully petition EPA and the Acting Administrator to reconsider, remand, reopen or (preferably) revoke the Permit pursuant to 40 C.F.R. 124.19(j),Sections 165 and 307(b) of the Clean Air Act, 42 U.S.C. §§ 7475 and 7607(b); the Administrative Procedure Act (APA), 5 U.S.C. §§ 555(b) and 558(c); and the First Amendment to the U.S. Constitution, in order to correct significant deficiencies with the permit and the process to issue it. An Executive Summary of this Petition follows, then a Summary of Requested Actions and Relief, followed by the Petition content identifying the facts, legal arguments and policy grounds supporting Petitioners' request that EPA reconsider this Trump Administration permitting decision and policy rescission.

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[1] Former EPA Administrator Andrew Wheeler issued the Permit on Dec. 2, 2020. This is unusual because typically the relevant EPA Region – Region 2 here – would issue the permit.

[2] Final PAL Permit for Limetree Bay Terminals, EPA – PAL -VI-001/2019 (Dec. 1, 2020), Doc. ID. No. EPA-R02-OAR-2019-0551-0162 ("Final PAL Permit").

[3] Exec. Order 12,898, *Federal Actions to Address Environmental in Minority Populations and Low-Income Populations*, 59 Fed. Reg. 7,629 (Feb. 16, 1994) ("Exec. Order 12,898").

[4] Exec. Order 13,166, *Improving Access to Services for Persons with Limited English Proficiency,* 65 Fed. Reg. 50,121 (Aug. 16, 2000) ("Exec. Order 13,166").

[5] Exec. Order 13,990, 86 Fed. Reg. 7,037 (Jan. 20, 2021) ("Exec. Order 13,990).

[6] Exec. Order 14,008, 86 Fed. Reg. 7,619 (Jan. 20, 2021) ("Exec. Order 14,008").

## EXECUTIVE SUMMARY OF FACTS

This case represents an unconscionable abuse by the Trump Administration to favor fossil fuel companies, political donors, investors, and expediency in fulfilling their priorities, at the expense of a community with acute environmental justice needs; public health and concern for cancer risks; clean air and clean water; concern for climate change; endangered species; protection of a cherished national wildlife refuge; and the rule of law.

The permit authorizes the long-shuttered Limetree oil refinery to reactivate refining operations at one of the ten largest oil refineries in the world, under excessively high emissions caps for dangerous air pollutants based on inflated caps keyed to the Refinery's emission levels between 2009 and late 2010, when the facility operated at extremely high levels — processing around 525,000 barrels of oil per day in 2010.

EPA's own environmental justice analysis found the community surrounding the Refinery to be "burdened by several complex environmental challenges nearby," including the St. Croix Renaissance Industrial park that was recently reported to cause health issues due to irritants from Red Mud and odor complaints from sources in the area that resulted in the closing of nearby schools, fires from the Anguilla landfill, proximity to a wastewater treatment plant, noise and traffic issues associated with the nearby Henry E. Rohlsen Airport , and emissions from large ships docked at its coast.[7] The industrialized nature of South Central St. Croix in the vicinity of the Limetree facility stands in contrast to the rest of the Island of St. Croix and even more broadly, the rest of the U.S. Virgin Islands, which is not as industrialized.

EPA is aware that the area around the Refinery has "high risk vulnerability."[8] Census data estimates that the population is 75% minority,[9] with an estimated 26.9% of the population surrounding the refinery living below the poverty line.[10] A 2015 report by EPA's air office found that during this time, the Refinery had the single highest cancer Maximum Individual Risk of *all.* [11]

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[7] U. S. EPA Region 2, Final Environmental Justice Analysis for Limetree Bay Terminal and Refining (Limetree) PAL Permit St. Croix, U.S. Virgin Islands, pg. 2, September 19, 2019, *available at* https://www.eenews.net/assets/2019/11/15/document_gw_01.pdf ("Final EJ Analysis").
[8] *Id.*, at 3.
[9] *Id.*
[10] *Id.*
[11] *See* U.S. EPA Office of Air Quality Planning and Standards, Final Residual Risk Assessment for the Petroleum Refining Source Sector (Sept. 2015), at 6, at 51, Appendix 5, Doc. ID. No. EPA-HQ-OAR-2010-0682-0800; see also https://www.epa.gov/stationary-sources-air-pollution/comprehensive-data-collected-petroleum-refining-sector (Comprehensive Data Collected from the Petroleum Refining Sector) ("FRRA for the Petroleum Refining Source Sector").

In 2011, the Refinery, then owned by Hovensa, violated the Clean Air Act ("CAA") by making emissions-increasing modifications without first obtaining required Clean Air Act pre-construction permits and installing required pollution control devices. EPA required the Refinery owners to pay a $5.3 million civil penalty and spend $700 million on new pollution controls. The Refinery remains subject to that federal Consent Decree. The following year, Hovensa shuttered the refinery after accumulating losses of $1.3 billion dollars over three years and announced they would operate as an oil storage facility only.[12]

Four years later, in December 2015, the Refinery was sold to Limetree, whose parent company, ArcLight Capital, said it planned to operate the facility as an oil terminal, rather than a refinery. ArcLight's founder and managing partner is a major campaign donor to Republican candidates and like-minded political groups, and accompanied President Trump on a trade mission to China in November, 2017,[13] where the president sought to broker billions of dollars in deals with a Chinese oil and gas giant, Sinopec, which owns and operates a portion of the Refinery's oil storage terminal on St. Croix.[14]

Internal EPA emails, obtained through the Freedom of Information Act ("FOIA"), reveal that in August, 2018, then-Administrator Andrew Wheeler directed the Agency's Office of Policy and Office of Federal Activities to "lead in the coordination of the Limetree matter," to help them "resume operations."[15] The EPA project manager appointed by Wheeler reported that he told Limetree representatives, their attorneys, and "primary financiers (ARCLIGHT)" that he would "serve as their front door and switchboard operator for anything they need from EPA."[16] The FOIA documents reveal that EPA "[e]stablished a routine of bi-weekly meetings with [Limetree] and their lead counsel."[17] Topics discussed included Limetree's "27 requests for modification" to its Consent Decree with EPA and the Department of Justice.[18]

Limetree submitted its application for a PAL permit on November 27, 2018. An internal EPA email noted that declaring the permit application complete "before the end of the calendar year was critical to [Limetree] as it allowed for inclusion of 2009 emission data in the ten-year baseline."[19] This referred to Limetree's application requesting highly inflated emissions caps in a PAL permit, for the PAL's crucial "baseline emissions," which would produce the highest possible emissions caps.

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[12] Limetree Reactivation Fact Documents Post-Wehrum Letter, Doc. ID. No. EPA-R02-OAR-2019-0551-0238 (Dec. 2, 2020) ("Reactivation Facts Document").
[13] Corbin Hiar, "Trump admin provides 'customer' service to troubled refinery," E&E News (Nov. 21, 2019), *available at* https://www.eenews.net/stories/1061609813 ("EE News Article").
[14] *See* Jennifer Jacobs & Justin Sink, *Trump's China Trip to Broker Billions of Dollars in Energy Deals*, Bloomberg (Oct. 2017) https://www.bloomberg.com/news/articles/2017-10-27/trump-china-trip-to-broker-multibillion-dollar-u-s-energy-deals ("Bloomberg Article").
[15] FOIA Documents provided to Petitioners, attached as Exhibit 2, at 15.
[16] *Id.*, at 14.
[17] *Id.*, at 12.
[18] *Id.*, at 12.
[19] *Id.*, at 5.

On November 30, 2018, Limetree announced it had "closed a $1.25 billion financing to (sic) restart its refinery" on St. Croix.[20] In record time for a permit of this complexity, on December 28, 2018, EPA Region II rushed out a "completeness determination" letter for the Limetree PAL permit application, while simultaneously indicating that the determination did " *not constitute a finding that EPA has all of the information necessary for completing its review….*," and explicitly noting that an environmental justice analysis had yet to be done.

EPA Region II ordinarily handles this type of permitting in the U.S. Virgin Islands. In a highly unusual intervention, however, former EPA Administrator, Andrew Wheeler, signed and issued the Final PAL Permit to Limetree on December 1, 2020. Shedding light on then-Administrator Wheeler's intervention and the Trump Administration's motivation to rush out the Limetree PAL Permit, a January 26, 2021 news article observed that "[a]chieving full operation is required for Limetree Bay owners' EIG Global Energy Partners and Arclight Capital Partners to retain a crude supply and product offtake contract with BP Plc. Full startup has been delayed a year and the project has run more than $1 billion over budget." BP "warned delays past mid-January would allow it to exercise a clause in its contract and exit the agreement to supply crude oil and market the resulting fuels."[21]

Although Limetree is planning to produce up to 200,000 barrels of oil per day,[22] the Trump Administration's PAL Permit includes seven massively inflated emissions caps based upon the refinery's historic production of over 500,000 barrels of oil per day. The permit acknowledges that the company could "relax[] previously enforceable [emissions] limitations," and was "seek[ing] to eliminate restrictions currently contained in two of [the Refinery's]" Clean Air Act PSD permits.[23] Similarly, the Agency acknowledged that Limetree's emissions could result in violations of both the SO2 and PM2.5 NAAQS [National Ambient Air Quality Standards, and the Trump Administration's Environmental Justice modeling failed to mention public health impacts or propose sufficient mitigation measures.[24]

Lastly, the EPA Response to Comments Document ("RTC") for the Final Permit announced abruptly that the Trump Administration was withdrawing EPA's 42 year-old

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[20] *Limetree Bay Ventures Closes $1.25 Billion Financing to Restart Its Refinery in St. Croix*, https://www.limetreebayenergy.com/limetree-bay-ventures-closes-1-25-billion-financing-to-restart-its-refinery-in-st-croix/ ("Limetree Financing Article").

[21] *Limetree Bay oil refinery begins producing transportation fuel, Hydrocarbon Processing*, https://www.hydrocarbonprocessing.com/news/2021/01/limetree-bay-oil-refinery-begins-producing-transportation-fuel.

[22] *Limetree Bay: About Us*, *available at* https://www.limetreebayenergy.com/about-us/#:~:text=The%20refinery%20will%20be%20capable,Petroleum%20(BP)%20since%202016 ("Limetree Bay: About Us").

[23] U. S. EPA, Region 2, Response to Comments on the Clean Air Act Plantwide Applicability Limit Permit for the Limetree Bay Terminal and Limetree Bay Refining St. Croix, U.S. Virgin Islands, at 63, Nov. 2020, *available at* https://www.epa.gov/sites/production/files/2020-12/documents/response_to_comments-limetree_pal_permit.pdf ("RTC").

[24] *Id.*, at 60.

Reactivation Policy for ensuring PSD permits for reactivation of permanently shutdown sources and units.[25] The RTC declared EPA had not applied the Reactivation Policy to Limetree. Petitioners and the public were denied any fair notice of this decision or opportunity to comment on it, prior to this sudden rescission of the longstanding policy and EPA's decision to do so during issuance of the Limetree PAL Permit.

Since receiving its Final Permit less than two months ago, the Refinery has experienced an upset incident for which it evacuated employees,[26] and a fire.[27] Despite the open period for appeals to the Environmental Appeals Board, Limetree has resumed operations to begin producing transportation fuels,[28] prior to the Final PAL Permit becoming effective.

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[25] *Id.,* RTC at 106-113.

[26] *Gas and Steam Engulf Sky Over Limetree Bay, Company Says it was 'Minor Refinery Upset'*, The Virgin Islands Consortium (Dec. 8, 2020), https://viconsortium.com/vi-community_center/virgin-islands-gas-engulfs-skies-over-limetree-bay-company-says-it-was-minor-refinery-upset ("Minor Refinery Upset").

[27] *Limetree Bay Remains Mum on Thursday Fire at Facility*, The Virgin Islands Consortium (Dec. 28, 2020), https://viconsortium.com/vi-business/virgin-islands-limetree-bay-remains-mum-on-thursday-fire-at-facility- ("Fire at Facility").

[28] Laura Sanicola, *Limetree Bay oil refinery begins producing transportation fuel –sources*, Reuters (Jan. 25, 2021), https://www.reuters.com/article/refinery-restart-limetree-idUSL1N2K0175 ("Reuters Article").

## SUMMARY OF REQUESTED RELIEF AND ACTIONS

- The EPA should reconsider, then remand, reopen or revoke the Limetree PAL Permit.
- The EPA should submit an *amicus* brief or other filing to the EPA Environmental Appeals Board, asking the Board to remand the PAL Permit to the Agency for reconsideration, reopening and/or revocation. The EPA should agree there are clear errors of law and facts underlying the PAL Permit issued by the Trump Administration.
- The EPA should treat the reactivation of the Limetree Refinery as a new source or major modifications to an existing source, for purposes of PSD preconstruction permitting.
- The EPA should not approve any PAL Permit for the Limetree Refinery, due to its history of substantial Clean Air Act violations, excessive cancer risks, and the grossly inflated, harmful emissions limits that would correspond with operation prior to the Refinery's 2012 shutdown.
- The EPA should conduct environmental justice modeling of all adverse health and environmental impacts related to reactivation of the Limetree Refinery and issuance of the PAL Permit, after the Trump Administration failed to conduct adequate modeling.
- The EPA should conduct an environmental justice audit of the Agency programs and offices involved in issuance of the Limetree PAL Permit, and prepare a report for the public addressing whether those activities are consistent with all environmental justice executive orders and presidential memoranda.
- The EPA should release to the public all internal EPA communications and external communications concerning the Limetree PAL Permit application and Final Permit, all activities leading up to Agency action on those documents, and any other issues within EPA's jurisdiction related to reactivation of the Limetree Refinery.
- The EPA should work with the Federal Land Manager for the National Park Service to assess and address any adverse impacts related to visibility and Air Quality Related Values at the nearby Virgin Islands National Park and Hassel Island.
- The EPA Office of Inspector General should investigate the circumstances surrounding issuance of the PAL Permit and any abuse and misconduct that had an adverse effect on EPA programs and operations, including but not limited to those involving protection of public health and air quality, environmental justice, enforcement, endangered species, protection of Air Quality Related Values in Class I areas, insofar as the Limetree PAL permit and related issues are concerned. The OIG also should evaluate the EPA programs and activities implicated in the Limetree PAL Permit to determine whether those activities supported clean air, clear water, cleaner communities, environmental justice, and concern for dangerous climate change.
- The EPA should investigate any and all compliance issues related to the Limetree Refinery's restart prior to final Agency action on the PAL Permit, as reported in recent news accounts. Final Agency action does not occur until after administrative review procedures are exhausted; until EPA Region II issues a final permit decision; and until notice of the Agency's final action with respect to this permit is published in the Federal Register. None of these three things has happened.
- The EPA should investigate any other potential compliance issues related to the Limetree Refinery, such as the "compliance issues" with the hazardous air pollution standards for marine tank vessel loading operations identified in internal EPA emails.

- The EPA should investigate any improprieties and harm to public health, air quality, water quality and environmental justice communities in St. Croix arising out of any modifications to the Refinery's Consent Decree by the Trump Administration.
- If the EPA does propose to approve a future PAL Permit for the Limetree Refinery, the Agency should (1) only do so after subjecting all reactivated emissions units to Best Available Control technology, and the source to adequate analyses of impacts to air quality and Air Quality Related Values in Class I areas; (2) not allow baseline emissions to be based upon operational and emissions levels that are unrepresentative of the Refinery's current planned production; (3) subtract from all PAL levels the emissions from any emissions units that were permanently shutdown after the baseline emissions period, consistent with the EPA Reactivation Policy and this Petition; (4) require additional ambient air quality monitors and require the Refinery to report NAAQS exceedances within 24 hours (compared to the current 15 day reporting period); (5) prepare a health risk assessment analyzing the impacts of the Refinery's emissions in the context of the community's specific health needs; (6) engage in early and ongoing public participation for any revisions to the PAL; and (7) provide translation of vital documents for the limited English proficiency population affected by the Refinery.

# I. BACKGROUND AND HISTORY OF LIMETREE REFINERY

## A. Pre-2018 Limetree Refinery Operating History

The Limetree Refinery ("Refinery") was constructed pursuant to a 1965 agreement between former owners HOVIC and HOVENSA and has presented environmental problems for decades.[29] Between 1982 and 2008, nearly 42 million gallons of petroleum were reclaimed from groundwater at the site of the Refinery, which is nearly four times the amount of oil released in the Exxon Valdez spill.[30] At the height of its production in 2010, the Refinery was processing 525,000 barrels of oil per day.[31] It was also around this time that the Refinery faced significant environmental and financial problems. The Refinery was emitting its highest levels of air pollutants between 2009 and late 2010, and in January 2011, EPA found that HOVENSA had violated the Clean Air Act due to non-conforming emissions, fined the Refinery $5.3 million, and ordered it to pay $700 million to upgrade its pollution controls.[32] In January 2012, HOVENSA shutdown the Refinery for financial reasons; in the preceding three years, it had incurred losses in excess of $1.3 billion.[33] Shortly after the shutdown, HOVENSA expressed intentions to operate the Refinery as a long-term oil storage terminal.[34]

In September 2015, EPA published a cancer risk assessment for the petroleum refining source sector, based on 2011 emissions inventories, distillation feed sampling and analysis, and emissions testing, EPA published detailed cancer risk modelling results for 144 oil refineries in the United States and U.S. territories, with 115 having "a facility-wide cancer [Maximum Individual Risk] greater than or equal to one in a million."[35] The then-HOVENSA refinery had the single highest cancer Maximum Individual Risk of *all* refineries that EPA evaluated, based

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[29] *See, e.g.,* Statement of Basis/Proposed Final Remedy Decision, Area of Concern (AOC) #3 REGION, https://www3.epa.gov/region02/waste/fshovens_statementof_basis_aoc3.pdf.
[30] Eunice Bedminister, *Hovensa Cleanup Comes to 42 Million Gallons So Far*, TheDominican.net, Mar. 10, 2008, https://www.thedominican.net/articlesone/hovensa.htm. .
[31] HOVENSA LLC, Clean Air Act Settlement, Jan. 26, 2011, *available at* https://www.epa.gov/enforcement/hovensa-llc-clean-air-act-settlement.
[32] Press Release, *Nation's Second Largest Refinery to Pay $700 Million to Upgrade Pollution Controls at U.S. Virgin Islands Facility*, Jan. 26, 2011, *available at* https://www.justice.gov/opa/pr/nation-s-second-largest-refinery-pay-700-million-upgrade-pollution-controls-us-virgin-islands.
[33] Jason Bronis, *Hovensa LLC to shut Virgin Islands oil refinery*, Associated Press (Jan. 18, 2012), https://www.toledoblade.com/Energy/2012/01/18/Hovensa-LLC-to-shut-Virgin-Islands-oil-refinery.html.
[34] *See* Reactivation Facts Document, *supra,* n. 12, at 1 (Press Release, Hess Corporation, Hess Announces Charge Related to Closure of Hovensa Joint Venture Refinery (Jan. 28, 2012) (on file with Hess) ("Following the shutdown, the complex will operate as an oil storage terminal.")); (Source staff, *Governor Slams Hovensa Proposal, Threatens Lawsuit*, ST. JOHN SOURCE, Aug. 7, 2012 ("Since the closure, [Hovensa] has championed the idea of converting the refinery into an oil storage facility.")), ST. JOHN SOURCE, Aug. 7, 2012.
[35] *See supra*, n.11, FRRA for the Petroleum Refining Source Sector, at 6, 51.

on its allowable emissions. [36] Notably, the EPA Report indicated that the HOVENSA refinery had "shutdown" after submission of the information collection responses to EPA.[37] The HOVENSA refinery had the ninth highest cancer Maximum Individual Risk of all refineries that EPA evaluated, based on its actual emissions.[38]

The 138 oil refineries currently operating in the United States and U.S. territories emit 178 million metric tons of CO2 equivalent greenhouse gasses ("GHG"), based on 2019 EPA data.[39] This makes the sector the nation's 4th largest emitter of GHGs, behind power plants, petroleum and natural gas systems, and chemical plants. In 2011, the first year for which GHG emissions data is available for the then- HOVENSA refinery on St. Croix, the Refinery's GHG emissions were an astonishing 4,445,885 metric tons of CO2 equivalent greenhouse gasses.[40] Those 2011 emissions earned the St. Croix Refinery the status of the 5th worst GHG polluter among all oil refineries in the United States and U.S. territories:[41]

2011 - U.S. - Total Reported Emissions by Facility in Metric Tons of $CO_2e$

| Facility | City | State | Total Reported Emissions | Sector |
|---|---|---|---|---|
| EXXONMOBIL BAYTOWN | BAYTOWN | TX | 10,117,835 | Refineries |
| EXXONMOBIL BATON ROUGE REFINERY AND CHEMICAL PLANT | BATON ROUGE | LA | 8,332,085 | Refineries |
| Galveston Bay Refinery | TEXAS CITY | TX | 4,545,375 | Refineries |
| CITGO PETROLEUM CORP - LAKE CHARLES MANUFACTURING COMPLEX | Westlake | LA | 4,511,855 | Refineries |
| Limetree Bay Terminals, LLC | CHRISTIANSTED | VI | 4,450,885 | Refineries |

The Refinery's GHG emissions would have been even higher in calendar years 2009 and 2010, based on the facility's production levels. These are the two years on which the Trump Administration based the Limetree PAL Permit's grossly inflated emissions caps for permissible criteria air pollutants and, by extension, GHG pollutants.

In December 2015, HOVENSA sold the Refinery to Limetree.[42] Like its predecessor, Limetree did not express a continuous intent to restart the shutdown Refinery. Instead, Limetree's parent company had plans to operate the facility as an oil terminal, rather than an oil refinery, and to potentially dismantle part of the refinery and sell off the scrap metal.[43] Economic factors may have discouraged Limetree from restarting operations. As of July

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[36] *Id.*, at Appendix 5, Table 1, at 4 (identifying the HOVENSA refinery by Facility ID, NEI46556) & Appendix 5, Table 2c, at 2 (facility NEI46556 has a cancer MRI of 9.40E-05, or 94 in a million, higher than any other refinery listed).
[37] *Id.*, at Appendix 5, Table 1, at 4 (row for NEI46556).
[38] *Id.*, at Appendix 5, Table 2a, at 2 (facility NEI46556 has a cancer MRI of 3.02E-05, or 30.2 in a million).
[39] *See* U.S. EPA, 2019 Greenhouse Gas Emissions from Large Facilities, https://ghgdata.epa.gov/ghgp/main.do#.
[40] *Id.*, (search for 2011 St. Croix refinery GHG emissions conducted on January 31, 2021).
[41] *Id.*, (search conducted on January 31, 2021, for 2011 St. Croix refinery GHG emissions compared to all oil refineries in U.S. & U.S. territories).
[42] Press Release, *USVI Signs $800M Deal to Sell Shuttered Oil Refinery*, Dec. 3, 2015 *available at* https://www.voanews.com/americas/usvi-signs-800m-deal-sell-shuttered-oil-refinery.
[43] *See* Justin Jacobs, HOVENSA Files for Bankruptcy, Ending a Long-Running Dispute, Petroleum Economist, Sept. 22, 2015 ("Limetree's parent company ArcLight Capital owns pipelines and storage facilities across the US and will seek to operate the terminal, rather than the

2018, the investment required to "refurbish and restart a portion of the [Refinery] was reported to be $1.4 billion."[44]

In 2017, the managing partner and founder of ArcLight Capitol, one of Limetree's Investor parent companies, and a major campaign donor to Republican campaigns, traveled to China on the same plane as then-President Trump on a trade mission to China in November, 2017,[45] where the president sought to broker billions of dollars in deals with a Chinese oil and gas giant.[46]

B. 2018 Initiation of "Limetree Matter"

Internal EPA emails, obtained through the Freedom of Information Act ("FOIA"), reveal that in August, 2018, then-Administrator Andrew Wheeler directed the Office of Policy and Office of Federal Activities at EPA to "lead in the coordination of the Limetree matter," to help them "resume operations."[47] Another internal email shows the EPA project manager appointed by Wheeler told Limetree representatives, their attorneys, and "primary financiers (ARCLIGHT)" that he would "serve as their front door and switchboard operator for anything they need from EPA." *Id.*

More Agency emails and calendars obtained through FOIA show EPA "[e]stablished a routine of bi-weekly meetings with [Limetree] and their lead counsel," which involved political appointees from EPA's Office of Air & Radiation, Office of Enforcement & Compliance Assurance, and Region II. Topics discussed included Limetree's "requests for modification" to its Consent Decree with EPA and the Department of Justice. Limetree and its attorneys expressed "appreciation for [EPA's] attention, coordination and responsiveness." An October 5, 2018 EPA email reveals the EPA project team was "discussing [Limetree's] perceived need/desire for a Plantwide Applicability Limit (PAL)." EPA staff notes the Agency was "unclear on the purpose it would serve for [Limetree], but continuing discussions with

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refinery as a whole.") (emphasis added)); Source Staff, Sinopec, Freepoint Lease HOVENSA Storage: Update, ARGUS, Dec. 1, 2015 (reporting a deal whereby Sinopec planned to "lease more than three quarters of the operational storage at the HOVENSA oil terminal," allowing Limetree's parent company "two years to assess what provisions [of the refinery] would be utilized and what would be dismantled and removed," and detailing a payment structure within the agreement for "the sale of scrap metal.")).

[44] Collin Eaton, St. Croix Oil Refinery gets $1.4 Billion Investment, Plans to Restart, July 2, 2018 (noting an 18-month timeline for refurbishment); *see also* Kelsey Nowakowski, Monarch Energy Still Interested in HOVENSA, Despite Obstacles, Oct. 2, 2015 (reporting oil and gas analyst comments that "HOVENSA's improvement needs are too large for it to be worth restarting. . . the refinery just isn't competitive anymore.")).

[45] *See supra*, n. 13, EE News Article.

[46] *See supra*, n. 14, Bloomberg Article.

[47] Ex. 2, at pg. 15.

[Limetree] on their contemplated scope of expansion projects such that we may provide accurate advice and assistance if/when an application is received." *Id.*[48]

C. Application for PAL Permit

On November 26, 2018, nearly seven years after the Refinery ceased refining operations, Limetree applied for a Clean Air Act PAL permit to EPA Region II for the purpose of reactivating refining operations.[49] On November 30, 2018, Limetree announced it had "closed a $1.25 billion financing (sic) to restart its refinery" on St. Croix.[50]

Limetree sought a PAL permit in order to establish source-wide "caps" on its regulated emissions. Limetree based its PAL application on an April 5, 2018 letter from former EPA Assistant Administrator William Wehrum ("Wehrum Letter"), that concluded the Refinery should be treated as the reactivation of a facility that was not shutdown, rather than a "new source," under longstanding EPA Reactivation Policy and the Act's Prevention of Significant Deterioration ("PSD") preconstruction permitting program.[51] By avoiding PSD permitting, the Refinery would be allowed to avoid Best Available Control Technology ("BACT") for all emissions units shutdown since 2012, including units that were the subject of the 2011 EPA enforcement action, and also avoid the PSD requirements to conduct an air quality impact analysis.

In its PAL Permit application, Limetree requested emissions caps for seven distinct regulated air pollutants, set at levels corresponding to the HOVENSA refinery's full operations in calendar years 2009 and 2010, *plus* an additional significant increase level for each regulated air pollutant.[52] This 300-page document was submitted to the Agency on November 27, 2018,

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[48] Ex. 2, pg. 14 (The internal emails released pursuant to FOIA reveal a raft of other environmental compliance issues raised in these meetings. Among other things, A November 2 Agency email indicates "[Limetree] likely to elevate complaints specific to perceived delays by [National Marine Fisheries Service]" related to the timing of its "biologic opinion under the Endangered Species Act (ESA) for impacts to coral habitat," pg. 14, and a November 16 EPA email shows "critical and time sensitive" "compliance issues" with the hazardous air pollution standards for "marine tank vessel loading operations." pg. 7).

[49] Limetree PAL Application (Nov. 2017), Doc. ID. No. EPA-R02-OAR-2019-0551-0236.

[50] *See supra*, n. 20, Limetree Financing Article.

[51] Letter from William Wehrum, Assistant Administrator, EPA, to LeAnn Johnson Koch, Perkins Coie (Apr. 5, 2018), https://www.epa.gov/sites/ production/files/2018-04/documents/limetree_2018.pdf ("Wehrum Letter").

[52] *See supra*, n. 2, Final PAL Permit Enclosure 1, at 3. The final PAL permit establishes plantwide emissions limits for the following pollutants at the following amounts, in tons per year (tpy): Volatile Organic Compounds (VOC)( 6,094 tpy), Nitrogen Oxides (NOx)( 5,594 tpy), Carbon Monoxide (CO)( 3,248 tpy), Particulate Matter less than or equal to 2.5 micron (PM2.5)( 399 tpy), Particulate Matter less than or equal to 10 micron (PM10)(412 tpy), Particulate Matter (PM)(466 tpy), and Sulfur Dioxide (SO2)(1,482 tpy).

and Limetree scheduled a meeting to "walk the region through" the application on December 11th.[53]

On December 28, 2018, Region II wrote Limetree's CEO to declare the application complete, as of December 27th.[54] Paradoxically, the letter also noted that "a determination of completeness does *not* constitute a finding that EPA has all of the information necessary for *completing* its review and, therefore, EPA reserves the right to ask [Limetree] for any additional clarification or substantiation, should they become necessary while processing this PAL application." *Id.* (emphasis added) Indeed, the letter noted that "EPA received on December 21, 2018, via email LBT's commitment to work collaboratively on a modeling protocol and modeling to support the Agency's performance of an environmental justice analysis," making clear EPA had not received that information as of the 'completeness' determination. Internal correspondence noted that providing the letter "before the end of the calendar year was critical to [Limetree] as it allowed for inclusion of 2009 emission data in the ten-year baseline."[55] This referred to Limetree's application requesting highly inflated emissions caps for seven air pollutants in its PAL permit, reflecting its highest production levels (525,000 barrels of oil per day in 2010) and the resulting highest emissions levels, in the past 10 years, for the PAL's crucial "baseline emissions" that would produce the highest possible emissions caps.

D. Draft Permit & Public Comment

On September 20, 2019, EPA Region II issued a draft PAL permit ("Draft Permit") to Limetree, proposing plant-wide emissions limits for seven types of pollutants: Sulfur Dioxide, Nitrogen Oxides, Volatile Organic Compounds, Carbon Monoxide, Particulate Matter, Particulate Matter 10, and Particulate Matter 2.5. The Region also announced a 45-day public comment period. Petitioners commented during this period and attach and incorporate by reference our comments herein.[56]

On February 19, 2020, EPA requested concurrence from the Fish and Wildlife Service ("FWS") with its determination that the air pollution impacts of the Permit were not likely to adversely affect four federally-protected species, omitting the roseate tern, loggerhead sea turtle, and green sea turtles from consideration.[57] EPA requested concurrence from the National Marine Fisheries Service ("NMFS") limited to the impacts of air emissions on an additional 19 protected species on August 11, 2020.[58] EPA received concurrence from FWS and NMFS that the permitted activity was not likely to adversely affect certain listed species on February 28, 2020 and September 3,2020, respectively.

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[53] Exhibit 2, pg. 6 (Tomiak Email 12/6).
[54] *See* Letter from Suilin W. Chan, Chief, Permitting Section, Air Programs Branch, U.S. EPA Region II, to Darius Sweet, CEO, Limetree at 1, (Dec. 28, 2018), Doc. ID. No. EPA-R02-OAR-2019-0551-0047.
[55] Exhibit 2, pg. 5 (Tomiak Email 1/31).
[56] *See* Comments by St. Croix Environmental Association, et al. (Nov. 25, 2019), Doc. ID. No. EPA-R02-OAR-2019-0551-0001 ("Petitioners' Comments").
[57] *Id.*
[58] *Id.*

EPA did find, however, that permitted activity would have a disproportionate impact on the EJ community.[59]

E. Issuance of Final Permit

On December 1, 2020, EPA issued the Final PAL Permit. It was not signed by the Regional Administrator for Region II, however, who has jurisdiction to issue PSD permits in the U.S. Virgin Islands.[60] Instead, then-EPA Administrator Andrew Wheeler signed the permit, personally, despite his absence from any (public) involvement with the Permit proceedings.[61]

Limetree states it is planning to produce up to 200,000 barrels of oil per day,[62] but the Trump Administration's PAL Permit includes seven massively inflated emissions caps based upon the refinery's historic production of over 500,000 barrels of oil per day. In the accompanying Response to Comment document, EPA acknowledged that under its new PAL, Limetree could "relax[] previously enforceable [emissions] limitations," and that the company was "seek[ing] to eliminate restrictions currently contained in two of HOVENSA's PSD" permits. RTC, at 63. The Agency acknowledged further that "[l]ifting the $PM_{10}$ restrictions only serves to increase the level of uncertainty about whether the $PM_{2.5}$ [National Ambient Air Quality Standards] will be violated as a result of impacts from Limetree." *Id.* EPA also admitted that "[g]iven the stricter 2010 short-term $SO_2$ standard and the results of the modeling analysis, there is too much uncertainty about whether emissions from the facility will exceed the [$SO_2$] NAAQS and thereby endanger the environmental justice community." *Id.*

The Trump Administration's Environmental Justice modeling proposed insufficient mitigation measures and did not mention public health impacts; moreover, EPA failed to provide materials or make public meeting accommodations for individuals with Limited English Proficiency. RTC, at 89. Similarly, The Final Permit makes no accommodations for air pollution and haze over the nearby Virgin Islands National Park. An internal EPA email noted "The [National Parks Services Federal Land Manager] will not assess the Class I area [Air Quality Related Values] through the PAL permit issuance process; EPA has discretion to reopen the PAL and consult with the FLM in the event that a Class I area AQRV problem is identified after permit issuance." [63]

Finally, the EPA response to comments for the Final Permit announced abruptly that the Trump Administration was withdrawing EPA's 42-year-old Reactivation Policy for ensuring PSD permits for reactivation of permanently shutdown sources and units. The response to comments declared EPA had not applied the Reactivation Policy to Limetree. Petitioners and the

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[59] *Id.*
[60] U.S. EPA, *Clean Air Permitting in the U.S. Virgin Islands, available at* https://www.epa.gov/caa-permitting/clean-air-permitting-us-virgin-islands.
[61] *See supra*, n. 52, Final PAL Permit, Enclosure 1, at 3.
[62] *See supra*, n. 22, Limetree Bay: About Us.
[63] FOIA Documents provided to Petitioners, attached as Exhibit 4, pg. 5 (Email from Annamaria Colecchia, EPA Region II, to EPA and National Park Service recipients (May 27, 2020)).

public were denied any fair notice of this decision or opportunity to comment on it. Nonetheless, Administrator Wheeler issued the permit.

Per the requirements of 40 C.F.R. 124.19, Petitioners appealed the permit to the Environmental Appeals Board (EAB) and received a 30-day extension for its Petition for Review. That case is currently pending in front of the EAB. Permitee Limetree has also petitioned the EAB for review of the permit, and has similarly received an extension of time to file its petition for review.[64] Since receiving its Final Permit less than two months ago, the Refinery has experienced an upset incident for which it evacuated employees,[65] and a fire.[66] Despite a pending permit appeal in the Environmental Appeals Board, Limetree has resumed operations to begin producing transportation fuels,[67] prior to the Final PAL Permit becoming effective.

EPA Region 2 has sole permitting authority to issue Prevention of Significant Deterioration permits in the U.S. Virgin Islands. A PAL permit is a PSD Permit. *Id.* EPA has not delegated this authority to the U.S. Virgin Islands. *Id.*[68]

## II. STATUTORY FRAMEWORK

### A. Clean Air Act Permitting Scheme

Disappointed with lackluster progress in improving the nation's air quality, Congress amended the Clean Air Act in 1977 to expand and strengthen provisions governing pre-construction review of impacts on air quality. This process, known as New Source Review ("NSR"), requires new major stationary sources of air pollution, as well as existing major sources undertaking major modifications, to obtain preconstruction permits that impose strict requirements and limitations on facilities' operation. 42 U.S.C. §§ 7475, 7503; 40 C.F.R §§ 51.165, 51.166, 52.21, 52.24.

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[64] U.S. EPA, Air Permit Delegations in Region 2, *available at* https://www.epa.gov/caa-permitting/air-permit-delegations-region-2.

[65] *See supra*, n. 26, Minor Refinery Upset.

[66] *See supra*, n. 27, Fire at Facility.

[67] *See supra*, n. 28, Reuters Article.

[68] *See supra*, n.23, RTC, at 64-65. ("Since EPA is not the minor source permitting authority in the USVI, the USVI implementation plan is disapproved with respect to PSD, and 40 CFR § 52.21 is incorporated into the applicable implementation plan, by the process of elimination, Limetree's PAL is a "major NSR permit" under 40 CFR § 52.21. It therefore falls under the "Prevention of Significant Deterioration program", which is defined in 40 CFR § 52.21(b)(43) as "the EPA implemented major source preconstruction permit program[.]" The definition also provides that "[a]ny permit issued under such a program is a major NSR permit." As a permit issued under 40 CFR § 52.21, the PAL is a permit under Part C of the Clean Air Act and must not interfere with attainment or maintenance of the NAAQS.')

The Act establishes separate requirements for major sources located in "clean air" attainment areas and those major sources located in more polluted areas that have failed to attain the national air quality standards. In "clean air" areas—where the objective is the prevention of significant deterioration (PSD) of air quality—Part C of Title I of the Act, 42 U.S.C. §§ 7470–7492, specifies that no "major emitting facility" may begin construction or undertake major modifications without first demonstrating that emissions from construction or operation of the facility will not exceed applicable limitations. 42 U.S.C. § 7475(a)(3). "Modification" is defined to include, "any physical change in, or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source or which results in the emission of any air pollutant not previously emitted." 42 U.S.C. § 7411(a)(4); 40 C.F.R. § 52.21(b)(2)(1).

Additionally, the PSD program requires installation of the best available control technology ("BACT") at such major emitting facilities prior to construction or modification. *Id.* § 7475(a)(4). PSD permittees must also conduct a detailed "analysis of ambient air quality in the area." 40 C.F.R. § 52.21(m)(3).

The PSD program applies to "major emitting facilities" 42 U.S.C. § 7479(1), and has two emission thresholds — 100 tons per year and 250 tons per year — for designating a plant a major source of pollutants. If a facility falls within any one of 28 listed industrial categories, then it is a major source if it emits at least 100 tons per year of any regulated pollutant (including particulate matter, 42 U.S.C. § 7473. 42 U.S.C. § 7479(l); 40 C.F.R. § 52.21(b)(1)(i)(a). All other facilities not among those 28 listed industrial categories are allowed to emit up to 250 tons per year of any regulated pollutant before being designated a major source. 42 U.S.C. § 7479(l); 40 C.F.R. § 52.21(b)(1)(i)(a). Petroleum refineries are among the 28 identified categories subject to a 100 ton per year major source threshold. 42 U.S.C. § 7479(1).

Alternatively, certain *existing* major stationary sources may apply for a Plantwide Applicability Limitation ("PAL") permit, which has a 10-year duration. 67 FR 80186 (Dec. 31, 2002). A PAL permit sets plantwide emissions limits, in tons per year, for regulated pollutants. Under a PAL permit, sources are able to make physical and operational changes "without triggering major NSR or the need to conduct project-by-project major NSR applicability analyses," as may be required under PSD permitting. *See* EPA Memorandum Re: Guidance on PAL Provisions at 1 (Aug. 4, 2020). A source can avoid much regulatory and public oversight under a PAL permit. However, PAL permits are only available "for any *existing* major stationary source," 40 C.F.R. 51.166(w)(1)(i), and for non-major modifications. *Id.* at (w)(1)(ii).

B. Reactivation Policy

Since 1978, EPA has applied its "reactivation" guidance to "govern[] when an idled source is considered a new source for NSR permitting. The policy applies a rebuttable

presumption that a source idled for more than two years should be treated as a new source" subject to the New Source Review permitting provisions of the Clean Air Act.[69]

Under the agency's Reactivation Policy:

> [r]eactivation of facilities that have been in an extended condition of inoperation may trigger PSD requirements as "construction" of either a new major stationary source or a major modification of an existing stationary source. Where facilities are reactivated after having been permanently shutdown, operation of the facility will be treated as operation of a new source. Alternatively, shutdown and subsequent reactivation of a long-dormant facility may trigger PSD review by qualifying as a major modification.[70]

In assessing whether or not a facility is required to obtain a permit as a new source or a source undertaking a major modification under the reactivation policy, the Agency, and courts reviewing the Agency's application of the policy, have weighed six factors. Specifically,

> EPA has examined factors such as the amount of time the facility has been out of operation, the reason for the shutdown, statements by the owner or operator regarding intent, cost and time required to reactivate the facility, status of permits, and ongoing maintenance and inspections that have been conducted during shutdown ...

*In the matter of Monroe Electric Generating Plant Entergy Louisiana, Inc., Proposed Operating Permit,* Petition No. 6–99–2, p. 9–11, dated June 11, 1999 ("*Monroe* Order").

C. 2018 Wehrum Letter

Under the Reactivation Policy factors, the Refinery should have been treated as a new source subject to PSD permitting. The Refinery ceased refining operations in January 2012, over six years before it applied for a PAL permit. Throughout that time-period, and certainly for the first two years of its shutdown, the Refinery's former and current owners never expressed a continuous desire to restart the Refinery.

Although the facts demonstrate the Refinery had been permanently shut down, on February 1, 2018, an attorney for Limetree wrote EPA Region II officials in an attempt to establish that the Refinery is not subject to PSD review and to request the Region's views on the

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[69] Joseph Goffman, Janet McCabe & William Niebling, EPA's Attack on New Source Review and Other Air Quality Protection Tools, at 16 n.24 (Nov. 1, 2019) http://eelp.law.harvard.edu/wp-content/uploads/NSR-paper-EELP.pdf ("New Source Review Attack").

[70] Carol Browner, U.S. EPA, Order *In re* Monroe Electric Generating Plant, at 7, Pet. 6-99-2, https://www.epa.gov/sites/production/files/2015-08/documents/entergy_decision1999.pdf ("Monroe Order").

issue.[71] In a highly unusual move, rather than EPA Region II responding, then-Assistant Administrator for the Office of Air & Radiation, William Wehrum[72], answered the letter.

Mr. Wehrum's April 5, 2018 letter concurred that the Refinery should not be considered a new source under the Reactivation Policy.[73] Although the Wehrum letter agreed that the Refinery had shut down in 2012 and remained shut down for well over two years, and was thus presumptively permanently shut down, the letter went on to conclude that based on what the Limetree attorney "explain[ed]," the facility operations were "idling" in 2012.[74] Neither the Limetree attorney's letter to Region II nor the Wehrum letter even addressed or acknowledged the repeated contemporaneous statements by Hess & HOVENSA that the Refinery had been "shutdown" in 2012 and remained shutdown thereafter. The Limetree attorney's letter used the term "idling" to describe the shutdown period from 2012-2014, with no documented citation for that characterization.[75] The only actual documentation of the "idling" characterization in the 29-page attorney letter relate to three stray instances in 2015.[76]

In two cursory paragraphs of analysis, the Wehrum letter did not cite or quote any record evidence that the facility had been idling from 2012 to 2014. The letter did not address or even acknowledge the clear evidence of the Refinery's constant shutdown status, in its owners' own words; indeed, the letter failed to cite any actual record evidence. Mr. Wehrum ignored all contradictory evidence and misapplied the Reactivation Policy factors, including a facility owner's "original intent not to permanently shut down"; the "continuous intent" to reopen in the "reasonably foreseeable future"; and whether "for at least some period of the shutdown, the shutdown was intended to be permanent."[77] Instead, the Wehrum letter made a conclusory declaration that Limetree and HOVENSA had "displayed a continuous intent to restart the refinery operations,"[78] despite all aforementioned factors under the Reactivation Policy negating that conclusion.

D. Rescinding Reactivation Policy

On December 2, 2020, EPA issued Limetree the PAL permit and simultaneously announced that it would no longer follow the Reactivation Policy in its Response to Comments

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[71] Letter from LeAnn Johnson Koch, Perkins Coie, to John Filippelli, EPA Region II (Feb. 1, 2018), Doc. ID. No. EPA-R02-OAR-2019-0551-0237 ("Filippelli Letter").
[72] Prior to joining EPA, Mr. Wehrum had been an attorney representing oil companies, through the American Fuel and Petrochemical Manufacturers. Jamie Corie, FOIA Documents Show EPA Air and Radiation Head Continued Meeting with Industry He Once Represented, Documented (Feb. 5, 2019), https://documented.net/2019/02/foia-documents-show-epa-air-and-radiation-head-continues-meeting-with-industry-he-once-represented/. Upon exiting EPA in June 2019, Mr. Wehrum resumed his representation of the American Fuel & Petrochemical Manufacturers.
[73] *See supra*, n. 51, Wehrum Letter.
[74] *Id.* at 2-3.
[75] *See generally, supra*, n. 71, Filippelli Letter,
[76] *See supra*, n. 71, Filippelli Letter, at 10, 13.
[77] *See supra*, n.70, Monroe Order, at 9-10; *see generally supra*, n. 51, Wehrum Letter, at 2-3.
[78] *See supra*, n. 51, Wehrum Letter, at 2.

("RTC") on the Permit, signed by Mr. Wehrum.[79] This was surprising given that EPA had until that point been applying the Reactivation Policy to the permit application, and based the draft permit on it. It was the first notice that Petitioners or any member of the public received that EPA would jettison its 42-year-old Reactivation Policy. Specifically, EPA stated:

> The Agency has determined it is not appropriate to continue applying the Reactivation Policy because the policy was not well-grounded in the NSR regulations, and it is not supported by the current NSR regulations.
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> …
>
> Since EPA has concluded that the Reactivation Policy is no longer an appropriate policy in the context of the existing NSR regulations, the Agency is not applying it in this permitting action.

EPA Region II, RTC on Limetree PAL Permit at 109.

## III. STATUTORY BASES FOR RECONSIDERATION

### A. EPA'S Permit is Flawed and Reconsideration is Appropriate Here

As noted above, we respectfully petition the EPA to convene a proceeding to reconsider, remand, reopen or revoke the Permit pursuant to 40 C.F.R. 124.19(j),Section 165 the Clean Air Act, 42 U.S.C. § 7475;the Administrative Procedure Act (APA), 5 U.S.C. §§ 555(b) and 558(c); and the First Amendment to the U.S. Constitution, and in line with Executive Orders on public health, environmental justice, and climate, in order to correct significant deficiencies in the permit.

On January 20, 2021, President Biden issued Executive Order 13990, entitled *Protecting Public Health and the Environment by Restoring Science to Tackle the Climate Crisis*, requiring all federal agencies to immediately review actions taken between January 20, 2017 to January 20, 2021 "that are inconsistent with, or present obstacles to" policies that prioritize environmental justice and climate change.[80] The Order states: "For any such actions identified by the agencies, the heads of agencies shall, as appropriate and consistent with applicable law, consider suspending, revising, or rescinding the agency actions." Further, the Order directs all agencies to within 30 days of the date of the Order submit to the Director of the Office of Management and Budget (OMB) a preliminary list of actions to be reconsidered. For the reasons listed below, this permit is presents grave obstacles to the Agency centering environmental justice in its work, and is permitted at such a level that it is similarly inconsistent with the Administration's goals on fighting climate change. The Permit's issuance further runs afoul of

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[79] The Response to Comments lists EPA Region II as its author. But, in a highly unusual step, EPA Administrator Andrew Wheeler intervened personally to issue the Permit, a permit that should have been issued by EPA Region II officials, with jurisdiction over federal permitting in the Virgin Islands. *See supra,* n. 23, RTC.

[80] Exec. Order No. 13990, 86 Fed. Reg. 7037 (Jan. 20, 2021).

Executive Order 12898: Environmental Justice;[81] Executive Order 13166: Improving Access to Services for Persons with Limited English Proficiency;[82] Executive Order on Tackling the Climate Crisis at Home and Abroad;[83] and Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking (Jan. 27, 2021). The mandates of these orders just as urgently require EPA to revoke the permit.

Similarly, EPA's authority to reconsider permits compels a similar result. Specifically, the Regional Administrator has the authority to reconsider permits it issues, "at any time prior to 30 days after the Regional Administrator files its response" to a petition for review with the EAB, and

> may, upon notification to the Environmental Appeals Board and any interested parties, withdraw the permit and prepare a new draft permit under § 124.6 addressing the portions so withdrawn. The new draft permit must proceed through the same process of public comment and opportunity for a public hearing as would apply to any other draft permit subject to this part.

40 C.F.R. § 124.19(j).

For the reasons elaborated upon below, the Regional Administrator should immediately act to reconsider, then remand, reopen or revoke the Limetree PAL Permit issued by the Trump Administration. EPA should submit an *amicus* brief or other filing to the EPA Environmental Appeals Board, asking the Board to remand the PAL Permit to the Region for reconsideration, reopening and/or revocation. The EPA should agree there are clear errors of law and facts underlying the PAL Permit issued by the Trump Administration.

Similarly, we ask the Agency to convene a proceeding for reconsideration under the authorities granted by the Administrative Procedures Act. 5 U.S.C.A. § 555 (b) provides that

> So far as the orderly conduct of public business permits, an interested person may appear before an agency or its responsible employees for the presentation, adjustment, or determination of an issue, request, or controversy in a proceeding, whether interlocutory, summary, or otherwise, or in connection with an agency function. With due regard for the convenience and necessity of the parties or their representatives and within a reasonable time, each agency shall proceed to conclude a matter presented to it. This subsection does not grant or deny a person who is not a lawyer the right to appear for or represent others before an agency or in an agency proceeding.

5 U.S.C.A. § 555 (b).

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[81] *See supra*, n. 3, Exec. Order 12,898.
[82] *See supra*, n. 4, Exec. Order 13,166.
[83] *See supra*, n. 6, Exec. Order 14,008.

Similarly, section 558 provides that

> When application is made for a license required by law, the agency, with due regard for the rights and privileges of all the interested parties or adversely affected persons and within a reasonable time, shall set and complete proceedings required to be conducted in accordance with sections 556 and 557 of this title or other proceedings required by law and shall make its decision.

5 U.S.C.A. § 558(c).

Lastly, we request this proceeding pursuant to Petitioners' right to petition under the Petition Clause. Courts have consistently recognized that "[t]he First Amendment provides, in relevant part, that 'Congress shall make no law ... abridging ... the right of the people ... to petition the Government for a redress of grievances.' We have recognized this right to petition as 'one of the most precious of the liberties safeguarded by the Bill of Rights,' and have explained that the right is implied '[t]he very idea of a government, republican in form,'" *BE & K Const. Co. v. N.L.R.B.*, 536 U.S. 516, 524–25 (2002) (citations omitted); *see also Eastern Railroad Presidents Conference v. Noerr Motor Freight, Inc.,* 365 U.S. 127, 136 (1961) (holding that federal antitrust law "does not prohibit ... persons from associating ... in an attempt to persuade the legislature or the executive to take particular action with respect to a law that would produce a restraint or a monopoly.").

B. <u>EPA Should Reconsider the Permit Because the Trump Administration Should Have Treated the Refinery as a New Source or a Major Modification Subject to PSD Preconstruction Permitting</u>

The Clean Air Act requires Prevention of Significant Deterioration ("PSD") preconstruction permits prior to construction and/or operation of a new major stationary source and for major modifications to an existing stationary source, in attainment and unclassifiable areas, for air pollutants that the source will emit. *See* 42 U.S.C. §§ 7475(a) & 7479(2)(C); *see* generally 40 C.F.R. 52.21. "Modification" is defined to include, "any physical change in, or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source or which results in the emission of any air pollutant not previously emitted." 42 U.S.C. § 7411(a)(4); 40 C.F.R. § 52.21(b)(2)(1).

Under EPA's longstanding Reactivation policy interpreting the Act and implementing regulations:

> [r]eactivation of facilities that have been in an extended condition of inoperation may trigger PSD requirements as "construction" of either a new major stationary source or a major modification of an existing stationary source. Where facilities are reactivated after having been permanently shutdown, operation of the facility will be treated as operation of a new source. Alternatively, shutdown and subsequent reactivation of a long-dormant facility may trigger PSD review by qualifying as a major modification.

*Monroe* Order, at 7.

PSD permits shall require a new stationary source to apply "best available control technology for each regulated NSR pollutant that it would have the potential to emit in significant amounts." 40 C.F.R. § 52.21(j)(2). Major modifications shall apply "best available control technology for each regulated NSR pollutant for which it would result in a significant net emissions increase," *id.,* § 52.21(j)(3), and undertake an analysis of ambient air quality in the area." *Id.* § 52.21(m)(3).

As discussed below, that EPA Reactivation policy was active when the Limetree Permit was proposed; it was active when the permit was finalized; and the policy remains active today, never having been lawfully withdrawn or supplanted. The final Limetree Permit, however, failed to follow that policy, in violation of EPA's own rules. Further, the unusual processes and political interference that surrounded the issuance of the permit underscore the necessity of a new process. As such, it was arbitrary, capricious, and an abuse of the Administrator's discretion to issue the permit as written, and the permit must be remanded.

### 1. The Limetree Refinery Should Be Subject to New Source PSD Permitting Requirements

Pursuant to the CAA, the Reactivation Policy, and the facts of the operation, the Refinery should be treated as a "new source" subject to new source PSD permitting requirements. The Refinery is a new source because it has been completely shut down and inoperable as an oil refinery for over eight years. The record establishes that "at the time of the shutdown" in 2012 (*Monroe* Order, at 8), and for "more than two years" afterwards, the refinery shutdown was "presumed to be permanent" under the Reactivation Policy, and then-owner Hovensa had no intent to restart operations. *Id.* The below bullets are a non-exhaustive list of circumstances in which Hovensa communicated its decision to permanently shutter the facility starting in 2012 and throughout the remainder of its years of ownership.

- A January 18, 2012 Hess Corporation press release announced a "shutdown of the HOVENSA L.L.C. Refinery in St. Croix, U.S. Virgin Islands."[84]

- The Hess 2012 Annual Report noted repeatedly that the Refinery had been "shutdown" in early 2012, in order to "operate the complex as an oil storage terminal."[85]

- An October 2013 PowerPoint presentation for HOVENSA's executive committee, entitled "Shut Down Cash Cost Summary ($MM)," details "Shutdown and Mothball" costs, "Personnel Exit Cash Costs," "Future Oblig (Pension, etc)" costs, and other "Shutdown Cash Costs."[86] Importantly, the presentation shows estimated shutdown costs in December 2011, actual costs in 2012, and forecast ("Fcst") and planned ("Plan") shutdown costs from 2013 to "2016++."[87]

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[84] *See supra,* n.12, Reactivation Facts Document, at 1 (Hess. Corp., "HOVENSA Announces Closure of St. Croix Refinery" (Jan. 18, 2012)).
[85] *Id.*, at 1(Hess 2012 Annual Report, at 2, 10, 13, 81 & 107).
[86] *See supra*, n.71, Attachment A to Filippelli Letter.
[87] *Id.*

- The record shows further that during the period from 2013 to 2017, HOVENSA made a point of telling the Virgin Islands Division of Environmental Protection each year that "it [was] not subject to payment of fees" under the Division's operating permit program regulations.[88]

It should also be noted that EPA staff appear to have agreed that the plant had permanently shut down for purposes of the Reactivation Policy, and that it should undergo new source PSD preconstruction permitting. Officials in EPA Region II prepared a document for the record entitled, "Limetree Reactivation Fact Documents Post-Wehrum Letter."[89] This document lists 13 documents concerning the HOVENSA refinery, ranging from 2012 to 2015, which confirm that the refinery was shut down in 2012 and remained shut down throughout that period, contradicting the unsubstantiated opposite conclusion in the Wehrum letter.[90] Almost all of the above bulleted points are pulled directly from that EPA-drafted record document. Moreover, *Monroe* requires that for facilities:

> to preserve their ability to reopen without a new source permit, EPA believes owners and operators of shutdown facilities must continuously demonstrate concrete plans to restart the facility sometime in the reasonably foreseeable future . . . such owner or operator cannot overcome this suggestion that the shutdown was intended to be permanent by later pointing to the most recent efforts to reopen the facility.

*Monroe,* 9-10.

There is no evidence in the record of Hovensa's expression of a "continuous intent to reopen" in 2012, nor in the years that followed; to the contrary, the consistent expression of intent was the opposite - to "shutdown" the refinery and operate it as an oil storage terminal. *See* RTC, at 111.[91] Second, the record is devoid of any evidence of "an original intent not to permanently shutdown," much less the "continuing validity of the original intent not to permanently shut down." *Monroe* Order, at 9. Third, the record is clear for "at least some period of the shutdown, the shutdown was intended to be permanent," *id.*; again, EPA identified no contrary evidence to overcome this conclusion. Fourth, the later attempts by Limetree attorneys, starting in 2018, to

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[88] *See, e.g.,* HOVENSA, 2015 Title V/Part 70 Permit Emissions Inventory, Feb. 19, 2016, Doc. Id. No. EPA-R02-OAR-2019-0551-0233 (noting that Hovensa takes position that it is not subject to fees).

[89] *See supra*, n. 12, Reactivation Facts Document. This one-page document lists no author, but metadata for the Adobe Acrobat file reveals that the author was Joseph Siegel, a senior attorney in EPA Region II. This document was posted to the permitting docket on December 2. 2020.

[90] *Id. See, e.g.*, Duff & Phelps, LLC, *Highest and Best Use of the HOVENSA Refinery*, at 4 (Aug. 3, 2012) ("shut-down of the Refinery was completed on February 21, 2012"; "HOVENSA plans to transition the facility into an oil storage terminal"; Letter from John P. de Jongh, Jr., Governor, to Shawn-Michael Malone, President, Virgin Islands (July 12, 2013) (discussing "actual shutdown" of refinery three weeks after January 18, 2012).

[91] In fact, the Agency concedes this point: *see supra*, n. 23, RTC, at 112 ("some of the evidence the commenter proffers tends to show that HOVENSA pursued the option of permanently converting the facility to an oil storage and transfer facility.").

"overcome [the] suggestion that the shutdown was intended to be permanent" necessarily fail; evidence of more "recent efforts to reopen the facility" are irrelevant to the inquiry under the Reactivation Policy.

By failing to treat the Refinery as a "new source" under the PSD permitting regulations, EPA acted unlawfully, and the Agency must reconsider the Permit.

### 2. Reactivating the Refinery Is a Major Modification

Reactivation of the refinery would certainly represent a major modification of an existing stationary source under the PSD Regulations, as a "physical change in, or change in the method of operation of, a stationary source," and would warrant permitting as such, should the Agency for some reason decline to require new source permitting at the shutdown refinery.[92]

The reactivation of the long-dormant refinery emissions units constitutes a "physical change" under the PSD modification trigger,[93] and their reactivation does not qualify for any of the regulatory exemptions from this term.[94] The reactivation of these units also qualifies as a "change in the method of operation" of the source.[95] No regulatory exemption from that trigger applies here, either, and EPA and Limetree do not claim they do.[96]

The record clearly establishes the permanent shutdown status, since 2012, of the HOVENSA emissions units used to process and refine crude oil. The same contemporaneous documentation and analysis applied to the entire facility under the EPA Reactivation Policy, applies with just as great force to "modifications" involving these process units. There is no characterization of the process units for refinery operations being "idled" anywhere in the record, only "shutdown." The Wehrum letter tried arguing, unsuccessfully, that the Refinery was not shutdown because the "terminal operations, wastewater treatment plant, and power generation have continued to operate."[97] The Limetree attorney represented the same.[98]

Neither represents or identifies record evidence to support any claim, however, of continuing operation or continuing intent to operate the *Refinery's* significant number of process units and other emissions units used for the refinery operations.[99] The reactivation of all these

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[92] 42 U.S.C. § 7411(a)(4); 40 C.F.R. § 52.21(b)(2)(1).
[93] *See supra*, n. 70, Monroe Order, at 10 (citing *Wisconsin Elec. Power Co. v. Reilly*, 893 F.2d 901, 908 (7th Cir. 1990) (noting that "courts considering the modification provisions of NSPS and PSD have assumed that 'any physical change' means precisely that").
[94] *Id.*, at 10-11 (discussing the most common exemptions). Neither EPA nor Limetree attorney argue that any of the PSD regulatory exemptions apply, here.
[95] *Id.*, at 11-13.
[96] *See, e.g.*, *id.*, at 11-12 (discussing non-application of the "increase in hours exemption at a shutdown source").
[97] See *supra*, n. 5, Wehrum letter, at 3.
[98] *See supra*, n. 71, Filippelli Letter, at 1.
[99] See Final Limetree PAL Permit, Appendix (Dec. 1, 2020) (listing over 400 "PAL Permit Units" used for the Limetree refining operations).

process units and emissions units represents a "change in the method of operation" of the whole source.[100] Any construction work conducted at these units, in order to return them to operation, constitutes "any physical change" under the PSD regulations' "major modification" provision.[101] Both cause the reactivated emissions units to trigger PSD as "major modifications" that required PSD permits.[102]

As with the reactivation of the shutdown power plant units at issue in the Monroe Order, for Limetree, "[t]he primary issue in calculating the net emissions increase associated with the restart of a shutdown facility is usually calculation of the actual emissions increase."[103] And just like the situation analyzed in the Monroe Order, "EPA has made clear that in calculating the net emissions increase for reactivation of long dormant sources potentially subject to PSD, the source is considered to have zero emissions as its baseline."[104]

As discussed above, the Administrator did not assign any of these emissions units zero emissions as their baseline; instead, he assigned the units an average annual emissions rate associated with their highest level of operation (and emissions) during 2009-2011. These decisions ran afoul of both the PSD regulations and the longstanding Reactivation Policy applying those regulations, enabling Limetree to avoid PSD permitting, BACT, air quality impact analysis and analysis of impacts on air quality related values ("AQRVs") in Class I areas, for these hundreds of emissions units. What's more, documents FOIA'ed from the Agency show that the permitting process was rushed *specifically* with an eye to locking in inflated baseline emissions from calendar year 2009. This was done so the permit could establish grossly inflated, harmful emissions caps (for the seven regulated air pollutants) that included the 500,000+ barrel per day production and associated emissions from the HOVENSA refinery in calendar year 2009.

### 3. EPA Should Reconsider the Permit Because the Trump Administration Approved Limetree's Unlawful "Disaggregation" of Simultaneous Construction Activities, Allowing the Refinery Owners to Evade PSD Preconstruction Review Permitting for Major Modifications at the Source

In addition to misapplying EPA's Reactivation Policy to aid Limetree's attempts to evade PSD preconstruction permitting, the April 2018 Wehrum Letter also misapplied longstanding PSD-NSR policies on "aggregation," to facilitate Limetree's evasion of PSD permitting for the simultaneous MARPOL and Renewable Diesel construction activities.[105] This improper course by the Trump Administration provides an independent justification for reconsidering the Permit and its circumvention of PSD preconstruction permitting.

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[100] 40 C.F.R. §§ 52.21(a)(2)(ii) & 52.21(b)(2)(i).
[101] *Id.*
[102] *Id.*
[103] *See supra*, n.70, Monroe Order, at 13.
[104] *Id.*, at 14.
[105] *See supra,* n. 51, Wehrum Letter, at 3-5.

"From the earliest days of the NSR program, [EPA] recognized that a party seeking to avoid major source NSR might attempt to break up a single physical or operational change into nominally-separate changes in order to make the emission increase associated with each change appear to be less than significant."[106] The Agency "recognized that an owner or operator might apply for multiple minor permits for nominally-separate, small changes that by themselves result in *de minimis* emission increases, instead of obtaining a permit for the collection of changes that, when examined as a single project, resulted (or would result) in a significant emission increase." *Id.*

The PSD-NSR regulations "make[] it necessary to accurately define what constitutes the 'project' under review to ensure that the proper emissions increase resulting from the project is used when comparing it with the applicable NSR significance threshold at Step 1 of the NSR applicability analysis. Otherwise, a source could conceivably carve up a higher-emitting project into two or more lower-emitting "projects" and avoid triggering major NSR requirements."[107] "Project aggregation," therefore, ensures that nominally-separate projects occurring at a source are treated as a single project for NSR applicability purposes where it is unreasonable not to consider them a single project."[108]

The Trump Administration, through Mr. Wehrum, improperly signed off on this unlawful 'carving up' of the properly aggregated MAPOL and Renewable Diesel construction and emissions-increasing activities at the Limetree Refinery. This allowed the Refinery's total, contemporaneous, significant emissions increases to be 'disaggregated' into lower-emitting 'projects' and avoid PSD permitting requirements. This is what the April 2018 Wehrum Letter purported to do. At the time, however, the PSD-NSR regulations and governing EPA policies did not permit the evasive approach taken in the Wehrum Letter. Indeed, the Wehrum Letter purported to apply a far laxer approach taken in a January 15, 2009 midnight rollback rulemaking that Mr. Wehrum himself had a hand in crafting, during the George W. Bush Administration. The Obama-Biden Administration EPA had subsequently stayed the effectiveness of that Bush rollback rulemaking indefinitely,[109] however, and the rulemaking remained stayed at the time of Wehrum's 2018 Limetree letter.[110]

The unlawful 'disaggregation' approach that Wehrum applied in his April, 2018 letter to Limetree's attorneys was the subject of a November 15, 2018 Trump EPA "[f]inal action" — not a final rule, importantly — that purported to lift the Obama-Biden EPA administrative stay and announce an effective date of November 15, 2008, for the lax, harmful Bush EPA "2009 NSR

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[106] 75 Fed. Reg. 19,570/2 (April 15, 2010) (internal citations omitted).
[107] 83 Fed. Reg. 57,324, 57,325-326 (Nov. 15, 2018).
[108] *Id.*, at 57,326/1.
[109] *See* 83 Fed. Reg. 57,324, 57,327 (Nov. 15, 2018) (discussing the history of EPA aggregation policies, the June 15, 2019 rulemaking, the February 13, 2009 EPA grant of reconsideration of the Bush EPA rollback, and the May 18, 2010 indefinite stay of the Bush aggregation rollback).
[110] *See* 74 Fed. Reg. 2,376 (Jan. 15, 2009); *see also* 74 Fed. Reg. 7193 (Feb. 13, 2009) & 74 Fed. Reg. 7,284 (Feb. 13, 2009) (granting reconsideration of the Jan. 15, 2009 Bush EPA rule & delaying its effective date for 90 days).

Aggregation Action."[111] The November 27, 2018 Limetree PAL Permit application and the Region II December 28, 2018 "completeness determination" (albeit wrongly, determined) *both* were based upon the Wehrum letter's erroneous conclusions about the lawful EPA approach to aggregation for PSD permitting. Wehrum's April, 2018 letter had applied the far narrower approach that the Trump Administration did not pretend to make effective until November, 2018 notice that "require[d] projects to have a substantial technical or economic relationship, where EPA had previously presumed that activities that occurred at the same time and that supported a source's overall purpose were related[112] for major NSR permitting purposes. "Coupled with EPA's expressed intention to defer to the company's determinations of applicability," as the Wehrum letter expressly did, the approach taken in the April 2018 Trump EPA letter "is yet another guide to industry about how to avoid permitting requirements." *Id.*

The Harvard Law School, Environmental & Energy Law Program published a November, 2019 article co-authored by two former officials from the Obama-Biden Administration EPA, Office of Air & Radiation, which had granted reconsideration of the January, 2009 Bush EPA aggregation rollback rulemaking, and stayed its effectiveness, indefinitely. *Id.* The article addressed the Wehrum letter and the Limetree refinery's arguments as examples of ""carv[ing] up a higher-emitting project into two or more lower-emitting 'projects' [to] avoid triggering major NSR requirements." *Id.* The article continued:

> One example of this in practice comes in a letter regarding a refinery in the US Virgin Islands. As part of restarting an idled refinery, the source solicited EPA's views on several NSR issues, including whether two contemporaneous projects should be combined for permitting purposes. In this instance, the source is intending to do two things: first, to restart certain refinery equipment to produce marine fuel that meets sulfur requirements due to take effect in 2020; and, second, to repurpose other parts of the refinery to produce renewable diesel fuel to satisfy federal and state renewable fuel requirements.
>
> While these projects are happening at the same time at a single facility, the source asserts that they are intended to produce different products with different business cases and are not interdependent. Under the old test, looking at whether the projects are occurring at the same time and supporting the source's overall purpose, they likely would have been considered one project; they are unquestionably at the same time, and the overall purpose of a refinery is to produce fuel, even if it produces multiple varieties. But under the new test, EPA found that these actions lack the technical or economic relationship necessary to qualify as one project, because they are using different equipment and serving different markets. While the letter does not specify the emissions levels, this could allow the projects to avoid major source permitting they would otherwise have triggered. This facility is adjacent to residential neighborhoods and about a mile from an elementary school, a reminder about the real effects these policy changes can have.

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[111] *See* 83 Fed. Reg. 57,324 (Nov. 15, 2018).
[112] *See supra*, n. 69, New Source Review Attack, at 15.

*Id.* (internal citations omitted). The Trump Administration acted improperly and unlawfully to allow disaggregation of Limetree activities that should have been aggregated and considered together for PSD permitting purposes. This provides an independent justification for reconsidering the PAL Permit and the circumvention of PSD preconstruction permitting by Limetree and the Trump Administration.

Petitioners also hereby petition the EPA to reconsider, stay and withdraw the harmful and unlawful interpretations of the NSR-PSD regulations reflected in the November 15, 2018 Trump EPA notice, 83 Fed. Reg. 57,324, and the Bush Administration's January 9, 2009 NSR Aggregation Action, 74 Fed. Reg. 2,376.[113] The Agency should replace these damaging and deregulatory approaches to PSD-NSR permitting with the more responsible, protective approach followed by EPA prior to the January 2009 Bush EPA Action, and between the May, 2009 EPA stay of that harmful approach and the Trump Administration's temporary policy starting November 15, 2018. EPA should apply the longstanding, historic approach to aggregation to require PSD permitting for the physical changes and changes in the method of operation at the Limetree Refinery that the Trump Administration allowed to evade PSD permitting as two, disaggregated projects.

#### 4. EPA Should Reconsider the Permit, Because by Evading PSD Preconstruction Permitting, EPA Failed to Perform Adequate Analyses of Impacts to Air Quality Related Values in Nearby Class I Areas, and Acid Deposition to Water Bodies

Internal EPA emails obtained through FOIA reveal Agency officials and their counterparts from the National Park Service discussing potential adverse impacts from the Limetree Refinery restart to the nearby Class I areas of the Virgin Islands National Park and Hassel Island near St. Thomas, and adverse impacts from acid rain deposition to waterbodies.[114] None of those discussions resulted in changes or improvements to the Permit; in fact, the decision was reached to defer any analysis of impacts to AQRVs to the two Class I areas until *after* permit issuance.[115] In the case of harmful deposition, there is no evidence of that analysis having been done, despite the response to comments saying it would be addressed.

A May 21, 2020 email from an EPA Region II official to counterparts in the Region and the National Park Service discussed a series of decisions to do nothing about any harmful impacts to visibility or AQRVs at the Virgin Islands National Park and Hassel Island near St. Thomas, until *after* the Limetree Refinery restart:

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[113] This petition hereby incorporates the NRDC petition for reconsideration of the 2009 NSR Aggregation Action. *See* 83 Fed. Reg., at 57,327/3 ("On January 30, 2009, the Natural Resources Defense Council (NRDC) submitted a petition for reconsideration of the 2009 NSR Aggregation Action (the "NRDC Petition")).")

[114] Exhibit 4, attached.

[115] *Id.*, at 4 (May 27, 2020 email from Annamaria Colecchia, Region II, to EP & NPS addressees, summarizing decision "regarding the Limetree Bay restart and the Class I area AQRV analysis for the Virgin Islands National Park in St. John including Hassel Island near St. Thomas").

> 1. EPA Region 2's PSD permitting team will connect you with the EPA team working on the Regional Haze FIP and Reasonable Progress analysis so that you can discuss with them incorporating AQRVs into the Regional Haze process;
>
> 2. The FLM will not assess the Class I area AQRVs through the PAL permit issuance process;
>
> 3. EPA has discretion to reopen the PAL and consult with the FLM in the event that a Class I area AQRV problem is identified after permit issuance.[116]

These decisions to defer and delay any potential obstacles to restart of the Refinery (and any potential safeguards to protect these Class I areas) are consistent with the rushed, politicized, and result-oriented process by the Trump Administration that one sees throughout the Permit's administrative record.

A National Park Service document obtained through FOIA, and entitled "NPS Summary Review of the St. Croix Limetree (formerly Hovensa Oil Refinery) Restart/PAL

05/28/2020," prepared *after* the May 21st email quoted above, indicates pointedly that:

> Based on existing modeling for the 2012 [Regional Haze Federal Implementation Plan], this facility is a concern from a visibility standpoint. We don't have an assessment of deposition impacts. The 2012 [Federal Implementation Plan] modeling demonstrated that the facility "caused" visibility impacts based on modeling of the entire facility (not just [Best Available Retrofit Technology] eligible units). We do not have updated visibility modeling results from EPA.[117]

The NPS Summary document went on to note, pointedly (again, after the May 21 email, above):

- "In the 2012 FIP, EPA determined that [a Reasonable Progress] analysis for Hovensa (now known as Limetree) was not necessary because the facility was currently idled. EPA committed to "assess if additional control measures are warranted to meet the regional haze requirement" upon notification that the facility intends to restart."
- "Under the 2012 [Federal Implementation Plan], [Reasonable Progress] decisions for this facility are triggered by the restart - will EPA formally address this with the NPS and the public?"
- "How does EPA intend to handle [NPS Federal Land Manager] consultation requirements regarding the [Reasonable Progress] decisions for this facility? (<u>Again, we note that per the 2012 [Federal Implementation Plan] decisions, [Reasonable Progress] analysis requirements are triggered by the restart, not the second round of RH planning</u>.) *Id.*, at 1 (emphasis in original)

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[116] *Id.*

[117] FOIA Documents provided to Petitioners, attached as Exhibit 1, at 1.

- "2012 Regional Haze FIP: The Hovensa facility "caused" visibility impairment in VIIS based on modeled visibility impact (CALPUFF 2007-2010)."

- "EPA acknowledges in their 2012 FIP response to comments that:

    - "[M]odeling predicts that HOVENSA has a significant impact on visibility in the Virgin Islands National Park on St. John, so if reasonable controls on emissions are available from Hovensa, they will reduce this this (sic) significant impact on the view in the Park."

    - "[T]he HOVENSA Consent Decree is not an analysis of reasonable control measures as required for regional haze. The Consent Decree was developed for entirely different reasons. (Note, the same is true for the PAL permit.)"

    - Increased FLM involvement on "technical issues related to regional haze in the Virgin Islands" is important, "especially via informal sharing of new information." (Note: We agree and would like to consult with EPA on the RP determinations for this facility, as triggered by the restart.)"

- "PALS Permit:

    a. WE DO NOT KNOW THE REVISED IMPACT OF THE LIMETREE FACILITY UNDER THE NEW PALS. PALS emissions are significantly lower, but still very high. (See emissions tables below).

    b. Limetree concludes that "As a result of these dramatically lower emissions, we do not expect there to be a need to revisit the "reasonable progress" analysis of 40 C.F.R. 51.308(d)(1) and revise the FIP."

    c. EPA did not respond to this assertion in their PALS Fact Sheet released with the permit. Class I impacts and RH requirements were not addressed in the fact sheet.

    d. 40CFR52.21 (aa)(8)(ii)(b)(3) allows EPA to "Reduce the PAL if the reviewing authority determines that a reduction is necessary to avoid causing or contributing to a NAAQS or PSD increment violation, **or to an adverse impact on an air quality related value that has been identified for a Federal Class I area by a Federal Land Manager** and for which information is available to the general public." However, we would need to first identify the adverse impact. Reopening the PAL to address the adverse impact is at the "**Administrator's discretion**" per paragraph (b)." *Id.*, at 2-3 (all emphases in original NPS document)

The damning NPS Summary concluded by reminding Trump Administration EPA officials of a series of comments and rejoinders that EPA had made in 2012, responding to HOVENSA's objections to the regional haze Federal Implementation Plan. *Id,*, at 4-6. These included EPA's 2012 comments that:

- "**EPA proposed the requirement for HOVENSA to submit an analysis of reasonable control measures in the event that HOVENSA resumes operation of any refinery process units as an alternative to requiring such an analysis at this time**. While refinery operations are currently idled, HOVENSA has retained its air permits and has not surrendered them to EPA. **Therefore, EPA cannot rely on the idling of HOVENSA's refinery operations as an enforceable emission reduction for meeting the regional haze requirements**." (emphases in original NPS document)

- **HOVENSA stated that EPA's FIP should reflect the determination that HOVENSA's compliance with the terms of the Consent Decree satisfies its regional haze obligations during the first planning period of the program** and that any changes to the refinery's compliance obligations would be evaluated as part of the five year review.

- Response: HOVENSA's comment specifically says that HOVENSA's compliance with the terms of the Consent Decree satisfies its regional haze obligations. **In fact, the HOVENSA Consent Decree is not an analysis of reasonable control measures as required for regional haze. The Consent Decree was developed for entirely different reasons. A consent decree is a negotiated agreement, and was not evaluated for meeting the requirements for a reasonable control measure analysis required for regional haze**. (emphases in original NPS document)

- EPA Response: "**If the refining process restarts, reasonable controls may add to this improvement because HOVENSA has a total impact of 3.34 deciviews on the highest 98th percentile day**." (emphasis in original NPS document)

- "In addition, **modeling predicts that HOVENSA has a significant impact on visibility in the Virgin Islands National Park on St. John, so if reasonable controls on emissions are available from Hovensa, they will reduce this this significant impact on the view in the Park**."[118] (emphasis in original NPS document)

It is highly revealing that the NPS, in late May, 2020, needed to remind Trump Administration officials what EPA was on record having told HOVENSA, already, about its adverse impacts to visibility on the Virgin Island National Park and Hassel Island, near St. Thomas.

The Trump Administration's Final Permit for Limetree did not resolve any of these concerns, and the Permit did not include any additional air pollution controls designed to mitigate the identified adverse impacts.

[118] *Id.*, 1-9.

Regarding harmful acid rain deposition to waterbodies, the NPS summary notes that, "**[u]nlike visibility, the PAL is the only way deposition impacts could be addressed for this restart**" (emphasis in original NPS document).[119] Internal EPA emails dating to October, 2020, obtained through FOIA, indicate that Region II claimed to have performed a deposition analysis.[120] Public commenters representing St. Croix residents objected to the proposed Limetree permit's harmful deposition impacts.[121] The Trump Administration's response to comments purported to respond to these concerns, pointing to another response that "" discusses EPA's acid deposition analysis."[122] Reading that identified response, however, there is *no* mention of acid rain deposition impacts, and certainly nothing that anyone would call a 'deposition analysis.'[123] A May, 2020, NPS email had reminded EPA officials that "if there are pollutant deposition concerns, [Regional Haze] will not address those, but" EPA could address them, *if* the Agency reopened the PAL Permit *after* permit issuance.

It remains unclear in the administrative record whether or how the Trump Administration addressed these deposition concerns. But, any decision to defer those decisions until *after* Permit issuance, *if* the PAL Permit is reopened, represents arbitrary and capricious decision-making and an abuse of agency discretion. The EPA should reconsider the PAL Permit, and reopen or revoke it, in order to address concerns over adverse impacts to AQRVs and visibility in nearby Class I areas, and harmful impacts from pollution deposition to nearby waterbodies.

### 5. EPA Should Reconsider Its Withdrawal of the Reactivation Policy Because the Trump Administration Action Deviates from Sound Public Health & Environmental Policy. Moreover, According to the Agency's Own Rules, Withdrawal at that Times Required Prior Notice and Comment Rulemaking

The Trump Administration's sudden withdrawal of its longstanding Reactivation Policy is indefensible and should be reconsidered and reversed.

First, the timing and circumstances of this withdrawal show that EPA has acted arbitrarily and capriciously and has abused its discretion. For the entire duration of the permitting process, including in the draft permit and throughout the public comment period, EPA applied the Reactivation Policy in its analysis of whether to grant the Permit (albeit, wrongly). Only on the very day that EPA approved the Final Permit, well after Petitioners and others had a chance to comment on and consider the issue, EPA stated, buried on page 108 in its RTC, that it would no longer apply the Reactivation Policy. If EPA had considered this issue in a non-arbitrary and capricious manner, it would have announced this decision earlier on in the permitting process and allowed public comment on it.

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[119] *Id.* at 1.
[120] Exhibit 1, attached, at pg. 1.
[121] *See supra*, n.23, RTC, at 93 (Comment 120).
[122] *Id.,* at 94 (EPA Response 120).
[123] *Id.*, at 96 (EPA Response 122).

Second, and specifically, under EPA guidance rules signed by then-Administrator Wheeler and made effective on November 18, 2020 by the Trump EPA, EPA's withdrawal of the Reactivation Policy and apparent establishment of a new policy – that long-shuttered "idling" sources can obtain PAL permits – could only have been withdrawn by formal notice and comment procedures required in that rulemaking.[124] EPA violated the agency guidance rule by withdrawing the Reactivation Policy — disavowing the longstanding agency guidance in *Monroe* and other Agency reactivation guidance — without first seeking "public comment on the Agency's intent to withdraw a significant active guidance document" and publishing a notice in the Federal Register announcing that intent.[125] There is no record evidence that EPA sought public comment on its intent to withdraw EPA's reactivation guidance, nor published the required notice in the Federal Register. The Trump Administration EPA further violated its own guidance rule then in place, by failing to provide a 30-day public notice and comment period on the draft withdrawal of the reactivation guidance, prior to final withdrawal of the reactivation guidance.[126]

There is no record evidence of EPA meeting those obligations. The Trump EPA Administrator's action did not invoke either of the guidance rule's exceptions to this public comment process and, at any rate, his actions did not meet any of the conditions for those exceptions.[127] Additionally, the Trump EPA violated its own guidance rule by adopting new guidance to replace the reactivation guidance, without first making "publicly available a draft significant guidance document … for public comment before finalizing any significant guidance document," and without "publish[ing] a notice in the Federal Register announcing the availability of a draft significant guidance document.[128] The Agency interpretations and approach in the Limetree RTC that eliminated and supplanted the 42-year-old Reactivation Policy mark a radical shift from longstanding EPA interpretations and practices. EPA's radical reversal, and the manner in which it was executed, denied Petitioners and the public any opportunity to comment on it. The agency also necessarily violated its own guidance document rule requirement that "EPA shall respond to concerns and comments" about its new guidance, that was then active.[129]

Third, EPA's eradication of its longstanding policy goes against the spirit of the Act and the PSD permitting program. For all of the reasons listed in the prior sections, the Clean Air Act explicitly requires new or major modifying sources to undergo PSD permitting to avoid exactly what has happened in the Limetree permitting process. Old, dirty facilities that have been mothballed for years should not be allowed to operate without installing new pollution controls that keep up with the state of the art, so as to protect the people around them and the places where the facilities operate.

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[124] *EPA Guidance; Administrative Procedures for Issuance and Public Petitions*, 85 Fed. Reg. 66,230 *et seq.* (Oct. 20, 2020) ("Guidance Document Rulemaking").
[125] *Id.* at 66,239/1 (40 C.F.R. § 2.506(b)(1) & (2)).
[126] *Id.* (40 C.F.R. § 2.506(c)(1)).
[127] *Id.* (40 C.F.R. § 2.506(d)(1) & (2)).
[128] *Id.* (40 C.F.R. § 2.506(a)(1) & (2)).
[129] *Id.* (40 C.F.R. § 2.506(c)(2)).

Fourth, the reasons EPA set forth in its Response to Comments highlight the clear error in its decision to abandon the Reactivation Policy. A permit is considered appropriate only when, as a whole, the record indicates that the permit issuer "duly considered the issues raised in the comments" and ultimately adopted an approach that "is rational in light of all information in the record."[130]

Then-Administrator Wheeler's evasion of PSD permitting and the Response to Comments' terse explanation for abandoning the Reactivation Policy were clearly erroneous, because they "entirely failed to consider an important aspect of the problem": how to permit long-dormant, permanently shutdown sources under the NSR-PSD preconstruction permitting program that applies to new sources and major modifications at existing sources.

The EPA Reactivation Policy recognizes that reactivation of permanently shutdown facilities can produce significant emissions increases of regulated air pollution into an airshed, just like a "new source" does.[131] The Trump Administration's explanation entirely ignores this reality.[132]

Moreover, the Trump EPA's explanations for abandoning the Reactivation Policy are internally contradictory and made in clear error. The explanations consist of arguing that the Reactivation Policy is inconsistent with a 2002 New Source Review ("NSR") rule in various ways.[133] However, the RTC conveniently ignores that the 2002 rule cited and relied upon the EPA Reactivation Policy — indeed then-Administrator Browner's *Monroe* Order carrying out the Reactivation Policy — as a central element necessary to implement the 2002 rule.

Importantly, the 2002 NSR rule depends on application of the longstanding agency Reactivation Policy to "permanently shutdown" facilities.[134] The 2002 rule favorably references the *Monroe* Order as the Agency's definitive interpretation for when stationary sources and emissions units are "permanently shutdown" for purposes of PSD permitting. There is no hint that EPA's longstanding Reactivation Policy is inconsistent with the 2002 rule in any respect. Rather, it is the Limetree RTC's *post hoc* gloss on the 2002 NSR rule alleging inconsistencies with the Reactivation Policy that were never hinted at in the contemporaneous preamble to the

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[130] *In re: City And County Of San Francisco*, 2020 WL 7135345, at *4 (citing *In re Gov't of D.C. Mun. Sep. Storm Sewer Sys.*, 10 E.A.D. 323, 342 (EAB 2002)).

[131] The Clean Air Act defines a "major stationary source" as one that emits or has the potential to emit either 100 or 250 tons per year. See 42 U.S.C. § 7479(1) (definition of major emitting facility) 40 C.F.R. § 52.21(b)(1)(i)(a) (PSD definition of major stationary source).

[132] *See supra*, n. 23, RTC at 108-111.

[133] *See id.*, at 109-111.

[134] Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NSR); Final Rule and Proposed Rule, 67 Fed. Reg. 80,186 *et seq.* (Dec. 31, 2002) ("PAL Regulations"), at 80,208-80,209 & n. 30 ("[F]or any emissions unit that is permanently shut down or dismantled since the 24-month period, its emissions must be subtracted from the PAL level." (citing Monroe Order for propositions that whether shutdown should be treated as permanent depends on the intention of the owner or operator *at the time of shutdown*, and that shutdowns of more than 2 years are presumed to be permanent)).

2002 rule, or the rule itself. EPA must resort to re-interpreting and misrepresenting the 2002 rule to facilitate disavowal of the Reactivation Policy and issuance of a PAL permit to Limetree. This represents arbitrary and capricious agency action.[135]

EPA acted even more arbitrarily by attempting to twist and shoehorn its *ad hoc* abandonment of the Reactivation Policy into the alleged framework of the 2002 rule. Addressing the Limetree facts, the EPA argues "the idling of the refinery portions of the facility may be viewed to have occurred in the normal course of the 10-year business cycle upon which EPA based the baseline provision in the 2002 rule."[136] This rationale is arbitrary and capricious on its face: there is no industry sector for which 9 or 10 years of non-operation by a facility represents the 'normal course of a 10-year business cycle.' The notion is equally absurd applied to the Refinery, whose nearly decade-long shutdown to date did not represent the normal course of a 10-year business cycle.

The RTC reads like an attempt to explain away a longstanding agency policy, by inventing inconsistencies with a nearly 19-year-old EPA rule, alleged inconsistencies that EPA never has mentioned before December 2020. As shown, the 2002 rule cites and depends on the agency Reactivation Policy to ensure protection of air quality, by assigning shutdown emissions units zero emissions.[137] The 2002 rule does so by relying on the Reactivation Policy for the identical approach to PSD permitting for permanently shutdown sources and emissions units that have been reactivated.[138] This is what EPA should have done, but did not, for the Refinery emissions units that were shut down in 2012. The Agency's failure to do so, and its explanations for this failure, is arbitrary and capricious, and an abuse of discretion.

#### 6. EPA Should Reconsider the Permit Because it is Based on Inappropriate Emissions Data

EPA regulations authorize a concept called a "Plantwide Applicability Limit," which is a "source-wide cap on emissions [that] is one way of making sure that emissions increases from your major stationary source do not occur."[139] In its original PAL Regulations, EPA said that:

> we expect that PALs will encourage you to undertake such projects as: replacing outdated, dirty emissions units with new, more efficient models; installing voluntary emissions controls; and researching and implementing improvements in process efficiency and use of pollution prevention technologies, so that you can maintain maximum operational flexibility.

*Id.*, at 80,207/3. The Limetree PAL does the opposite: it creates a "cap" on emissions astronomically higher than source-wide emissions since 2011. The PAL locks in "outdated, dirty

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[135] *See State Farm*, 463 U.S. at 43 (agency action is arbitrary and capricious is based on "an explanation for its decision that runs counter to the evidence before the agency").
[136] *See supra*, n. 23, RTC, at 110.
[137] *Id.*, at 80,285/3 (40 C.F.R. § 52.21); 67 Fed. Reg., at 80,209 & n.3.
[138] 67 Fed. Reg., at 80,208-80,209 & n.3.
[139] 67 Fed. Reg. 80,207/1 (Dec. 31, 2002) ("PAL Regulations").

emissions units" operating without air pollution controls or poor controls in 2011, and specifically relieves refinery operators from installing "new, more efficient models."[140] The grossly inflated emissions cap eliminates the incentive to install "voluntary emissions controls" prior to reactivation, and removes any incentive to "improve process efficiency," because there is already so much headroom under the inflated emissions cap.[141]

EPA facilitated this more polluting, harmful outcome by violating its own PAL Regulations. Those regulations require that "[e]missions associated with units that were permanently shutdown after [the PAL's initial 24-month baseline period] must be subtracted from the PAL level."[142] A "10-year actuals PAL" is created by adding "baseline actual emissions" for each regulated pollutant, from all emissions units, to an additional significant emissions increase level for each emissions unit. "Baseline actual emissions," relevant to the Limetree PAL, are defined as:

> the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding … the date a complete permit application is received by the Administrator for a permit required under this section.[143]

Baseline emissions for a PAL may be inflated even more by including "emissions associated with startup, shutdown, and malfunction."[144] A source operator's incentive is to inflate "baseline actual emissions" as much as possible, so the PAL emissions cap will be set at the highest possible level at which the facility is allowed to operate.

The Limetree PAL is based on baseline emissions from the HOVENSA refinery reflecting the average emissions rate (in tons per year, "tpy") over the years 2009-2011, when the full refinery was operating—far and away the most polluting years in the past twelve years—plus significant emissions increases for each PAL pollutant.[145] Accordingly, the Permit's Plantwide Applicability Limit for volatile organic compounds[146] is an astonishing 6,094 tpy; for nitrogen

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[140] *Id.*
[141] *Id.*
[142] *Id.,* at 80,285/3 (40 C.F.R. § 52.21(aa)(6)(iii))
[143] *Id.,* at 80,278/3 (40 C.F.R. § 52.21).
[144] *Id.,* at 80,285/2 (40 C.F.R. § 52.21).
[145] "Limetree's PAL levels in the permit are based on HOVENSA's actual emissions in 2009 to 2011 plus the significant emission level under 40 CFR § 52.21(b)(23) for each PAL pollutant. The 2009-2011 timeframe is the period when some of the SO2 NAAQS exceedances and violations were measured, so there is significant risk of an exceedance and violation because Limetree's PAL level is similar to the actual emissions when the exceedances and violations took place." *See supra*, n. 23, RTC, at 84.
[146] Volatile organic compounds emitted by oil refineries include volatile hazardous air pollutants, which consist of known carcinogens. What's more "Studies have shown that actual toxic air emissions from many refinery sources, like flares, tanks, and cooling towers, can be 10 or even 100 times higher than what is reported to regulatory agencies. Emissions include a toxic soup of carcinogens, neurotoxins, and hazardous metals, such as benzene, hydrogen cyanide, and lead —

oxides, 5,594 tpy; and for sulfur dioxide, 1,482 tpy.[147] In sharp contrast, these were the facility-wide emissions for these same pollutants during the following years, in tons per year:

| **Year** | **VOCs** | **$NO_x$** | **$SO_2$** |
|---|---|---|---|
| 2012[148] | 944 | 1,101 | 131 |
| 2014[149] | 659 | 493 | 47 |
| 2016[150] | 292 | 556 | 10 |
| *PAL* | *6,094* | *5,594* | *1,482* |

EPA violated its PAL Regulations by approving a PAL for the refinery that did not "subtract[] from the PAL level" "[e]missions associated with units that were permanently shutdown after this 24-month period" in 2009-2011.[151] For all the reasons discussed above, *supra,* III.B.1 & III.B.2, the HOVENSA refinery was shutdown in 2012 and remained shutdown for more than two years. Even if one accepts for the sake of argument that the entire "source" was not permanently shutdown as a refinery, due to the continuing operation of the terminal and wastewater treatment plant,[152] the record is clear that all other emissions units associated with processing crude oil were not operating, and have remained shutdown since 2012.

Critically, the PAL Regulations require that "emissions associated with units that were shutdown" (after 2009-2010, in the case of Limetree) must be "subtracted from the PAL level."[153] This, EPA did not do (or claim to do): the PAL levels in the 2020 permit are based upon the average rate, in tons per year, of emissions units that were operating at the refinery

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to name a few." https://earthjustice.org/sites/default/files/files/Refineries-Fact-Sheet_04-08.pdf; EPA's own analysis indicates "some of the chemicals released are known or suspected cancer-causing agents, responsible for developmental and reproductive problems. They may also aggravate certain respiratory conditions such as childhood asthma." Hazardous Substance Research Centers/South & Southwest Outreach Program, "Environmental Impact of the Petroleum Industry," *available at* https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.files/fileID/14522. As noted above, a 2015 report by EPA's air office found that the Refinery had the single highest cancer Maximum Individual Risk of *all* petroleum refineries. *See supra,* n.35.

[147] *See supra,* n. 52, Final PAL Permit, Enclosure 1, at 3.

[148] Limetree 2012 Title V/Part 70 Permit Emissions Inventory & 2011 Revision (July 12, 2013), Doc. Id. No. EPA-R02-OAR-2019-0551-0230.

[149] Limetree 2014 Title V/Part 70 Permit Emissions Inventory (July 14, 2015), Doc. Id. No. EPA-R02-OAR-2019-0551-0232.

[150] Limetree 2016 Title V/Part 70 Permit Emissions Inventory (July 11, 2017), Doc. Id. No. EPA-R02-OAR-2019-0551-0234.

[151] PAL Regulations, 67 Fed. Reg. at 80,285/3 (40 C.F.R. § 52.21).

[152] *See supra,* n. 51, Wehrum Letter at 3.

[153] PAL Regulations, 67 Fed. Reg. at 80,285/3 (40 C.F.R. § 52.21) (emphasis added).

during 2009-2011, including units that shutdown in 2012 and remained shutdown, thereafter. This sweeping error on the part of the Administrator caused the Limetree emissions caps to be massively, unlawfully inflated, because "EPA has made clear that in calculating the net emissions increase for reactivation of long dormant sources potentially subject to PSD, the source is considered to have zero emissions as its baseline."[154]

It is undisputed that the Administrator did not assign these shutdown units zero emissions for their baseline emissions when establishing the PALs.

As discussed above, the PAL Regulations depend on application of the longstanding agency Reactivation Policy to determine whether emissions units were "permanently shutdown."[155] This is the same Reactivation Policy that Administrator Wheeler disavowed and purported to eliminate when evading PSD permitting requirements for Limetree and when establishing the illegal PAL. The Administrator needed to resort to this drastic step in order to allow Limetree to evade the Reactivation Policy and PSD permitting. In doing so, however, the Administrator violated the EPA regulations that depend on application of that very same Reactivation Policy.

The EPA cannot have it both ways. EPA may not violate PSD regulations by arbitrarily jettisoning the Reactivation Policy, while simultaneously creating PALs under regulations that depend upon the Reactivation Policy to maintain the integrity and environmental protectiveness of permissible PALs.

### C. EPA SHOULD RECONSIDER THE PERMIT BECAUSE IT FAILED TO ADHERE TO ENVIRONMENTAL JUSTICE REQUIREMENTS AND FAILED TO PROTECT THE 2HEALTH OF THE LOCAL COMMUNITY

The Biden Administration has pledged an aggressive, broad-based, "whole-of-government" approach to addressing environmental injustices. On January 20, 2021, President Biden issued Executive Order 13990, entitled *Protecting Public Health and the Environment by Restoring Science to Tackle the Climate Crisis*, requiring all federal agencies to immediately review actions taken between January 20, 2017 to January 20, 2021 "that are inconsistent with, or present obstacles to" policies that prioritize environmental justice.[156] The Order states: "For any such actions identified by the agencies, the heads of agencies shall, as appropriate and consistent with applicable law, consider suspending, revising, or rescinding the agency actions."[157] As EPA renews its commitment to environmental justice and civil rights, EPA must reconsider its decision to issue the PAL permit to the Refinery because it will have

[154] *See supra,* n. 70, Monroe Order, at 14.
[155] PAL Regulations, 67 Fed. Reg. at 80,209-80,209.
[156] *See supra*, n. 5, Exec. Order 13,990.
[157] *Id.*

disproportionately high and adverse effects on the minority and low-income community surrounding the Refinery.[158]

### 1. EPA Must Reconsider the Permit Because Air Pollution from the Refinery Will Have a Disproportionately High and Adverse Impact on the Environmental Justice Community of South Central St. Croix

EPA acknowledged in its EJ Analysis that the South Central area of St. Croix where the Refinery is located is a community of concern because it is an industrialized area surrounded by a number of residents, several schools, a hospital, and other locations that include sensitive populations.[159] EPA found that the community has more low-income and minority populations as compared to the rest of St. Croix and, in part due to the devastating impacts of Hurricanes Irma and Maria, has "high risk vulnerability status" according to the Federal Emergency Management Agency (FEMA).[160]

The community is also burdened by cumulative impacts from several complex environmental challenges nearby, including the St. Croix Renaissance Industrial park that was recently reported to cause health issues due to irritants from Red Mud and odor complaints from sources in the area that resulted in the closing of nearby schools, fires from the Anguilla landfill, proximity to a wastewater treatment plant, noise and traffic issues associated with the nearby Henry E. Rohlsen Airport, and emissions from large ships docked at its coast. [161] The industrialized nature of South Central St. Croix in the vicinity of the Limetree facility stands in contrast to the rest of the Island of St. Croix and even more broadly, the rest of the U.S. Virgin Islands, which is not as industrialized.[162]

EPA made the rare finding that "EPA cannot conclude that the operation of the refinery under the PAL will assure compliance with the NAAQS in the EJ community" and "there is in fact a disproportionate burden in South-Central St. Croix." [163] EPA reached the troubling conclusion that "it is difficult to conclude that the operation of the facility under the flexibility allowed by the PAL, and the uncertainties in the modeling and background concentrations, will not contribute to a disproportionately high and adverse human health or environmental effect on the community." [164] In light of these disproportionate impacts, EPA must uphold the environmental justice mandate and reconsider issuance of the PAL permit.

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[158] *Id.*; *see supra*, n. 3, Exec. Order 12,898; *20th Anniversary of Executive Order 12898 on Environmental Justice*, Proclamation No. 9082 of Feb. 10, 2014, 79 Fed. Reg. 8819 (Feb. 13, 2014), *available at* https://obamawhitehouse.archives.gov/the-press-office/2014/02/10/presidential-proclamation-20th-anniversary-executive-order-12898-environ.
[159] *See supra,* n. 7, U.S. EPA, Final EJ Analysis, at 2.
[160] *Id.* at 2-3.
[161] *Id.* at 2.
[162] *Id.*
[163] See *supra*, n. 23, RTC at 71, 76.
[164] *See supra,* n. 7, Final EJ Analysis, at 14.

### 2. EPA Must Reconsider Its Decision to Issue the PAL Permit Because the Permit Does Not Ensure Compliance with the NAAQS or Protect the Community in Violation of Executive Order 12898

EPA abused its discretion under Executive Order 12898 because EPA made a finding that the Refinery would have a disproportionate impact on an environmental justice community, but did not condition the permit to ensure that such impacts do not occur.[165] EPA must comply with Executive Order 12898 pursuant to its Clean Air Act authority and address environmental justice in the permitting process when there is any "superficially plausible" claim that a minority or low-income population may be disproportionately affected by a particular facility.[166] Executive Order 12898, reinforced by Proclamation No. 9082 and Executive Order 13990, requires EPA to identify and address any disproportionately high and adverse human health and environmental effects from the polluting activity contemplated by the draft permit.[167]

The only permit condition that EPA required to address its finding of disproportionate impact is an ambient air quality monitoring network that includes resuming five $SO_2$ monitors in place when Hovensa operated, adding one new $NO_2$ monitor, and one new $PM_{2.5}$ monitor.[168] Ambient air quality monitoring does not address the real threat of disproportionate harm to the community. The evidence in the record shows that the Refinery has historically—and will continue—to violate the NAAQS. EPA itself acknowledged that there may be adverse impacts on nearby communities because the historic ambient monitors in operation prior to the shutdown of the Refinery showed exceedances and violations of the 1-hour SO2 NAAQS from 2008 to 2011.[169] Further, EPA admits that "the PAL does authorize increases in the short-term emission rate at different units as long as the annual PAL is not exceeded" which "has implications for the 1-hour NO2, 1-hour SO2, and 24-hour PM2.5 NAAQS." *Id.* Given the evidence of historic pollution, the uncertainties in the Refinery's modeling, and EPA's finding that there the community suffers disproportionate adverse impacts, EPA should have taken affirmative action to minimize and mitigate the risk, rather than choosing this "wait and see" approach.

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[165] *See In re Chemical Waste*, 6 E.A.D. 66, 74 (EAB 1995) (holding that "if the operation of a facility would have an adverse impact on the health or environment of the surrounding community, [EPA] would be required to include permit terms or conditions that would ensure that such impacts do not occur.").

[166] *See* 59 Fed. Reg. 7629; *see also In re EcoEléctrica, L.P.*, 7 E.A.D. 56, 69 n.17 (EAB 1997) (PSD permit); *In re Shell Gulf of Mex., Inc. & Shell Offshore, Inc.* ("Shell 2010"), 15 E.A.D. 103, 148 (EAB 2010) (PSD permit); *see also In re Chem. Waste Mgmt.*, 6 E.A.D. 66 (EAB 1995) (articulating Board's authority to review Executive Order concerning environmental justice and encouraging regions to examine any "superficially plausible" claim that a minority or low income population may be disproportionately affected by a particular facility).

[167] *Id.*; *see also* U.S. EPA Region 2, *Interim Environmental Justice Policy*, 22-23, 27 (Dec. 2000) (If EPA finds disproportionately high or adverse impact, "then appropriate action should be pursued to minimize or mitigate such concerns.") *available at* https://www.epa.gov/sites/production/files/2016-03/documents/ejpolicy.pdf.

[168] *Id.* at 59.

[169] *See supra*, n. 23, RTC at 60.

EPA has authority under the Clean Air Act to exercise discretion to require additional PAL permit conditions to ensure compliance with the NAAQS.[170] EPA must act under this authority because of its finding that it "cannot conclude that the operation of the refinery under the PAL will assure compliance with the NAAQS in the EJ community."[171] Without taking action to protect the community from the NAAQS violations, EPA has abrogated its responsibility to protect human health and the environment.

We implore EPA to reconsider its decision to issue the PAL permit and meet its obligations to protect the environmental justice community surrounding the Refinery from suffering disproportionately high and adverse impacts.

### 3. EPA Must Reconsider Its Decision to Issue the PAL Permit Because EPA Failed to Translate Vital Documents for Limited English Proficiency Individuals, Denying Them Meaningful Access to the Public Participation Process and Violating Executive Order 12898 and Executive Order 13166

Even though the U.S. Virgin Islands and the area around the Refinery has many residents with limited English proficiency, EPA denied them meaningful access by failing to release vital documents, such as the public notice and permit fact sheet, in any language besides English.[172] This omission violates EPA's environmental justice obligations under both Executive Order 12898 and Executive Order 13166.[173] EPA, relying only on outdated twenty-year old data (2000 U.S. Census), erroneously concluded it did not need to translate vital documents to LEP individuals, despite being presented with the more recent 2010 U. S. Census data which showed that a higher percentage of the population in the area has limited English proficiency.[174]

In addition, the EPA ignored how other federal and territorial agencies have recognized and accommodated LEP individuals in this area. For example, FEMA has recognized the abundance of LEP individuals in the territory and endeavors to provide vital information and

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[170] *Id.* at 62-64 (explaining EPA's omnibus authority under Clean Air Act § 165(a)(7), PAL provisions of 40 CFR § 52.21, NSR Reform Rule, 67 Fed. Reg. 80196, 80210 (Dec. 31, 2002), and the State Implementation Plan process to "adjust the PAL level at its discretion based on air quality needs.")

[171] *See supra*, n 23., RTC at 71; *see also In re Muskegon Development Company*, 2019 WL 1987188, at *12 (Apr. 29, 2019) (quoting *In re Envotech, L.P.*, 6 E.A.D. 260, 280 (EAB 1996)) (noting that EPA can address its EJ obligations through public participation and its omnibus authority under existing statutes).

[172] *See e.g.,* U.S. EPA, Public Notice, Announcement of Public Comment Period (Oct. 9, 2019), Doc. Id. No. EPA-R02-OAR-2019-0551-0213; U.S. EPA, Press Release, Announcement of Public Comment Period (Sept. 20, 2019), Doc. Id. No. EPA-R02-OAR-2019-0551-0045; U.S. EPA, Fact Sheet, Draft PAL Permit (Sept. 2019), Doc. Id. No. EPA-R02-OAR-2019-0551-0105.

[173] 59 Fed. Reg. 7629; 65 Fed. Reg. 50,121.

[174] PC at 16-17 (citing 2010 U.S. Census, Detailed Crosstabulations, Fig. 1-8). The 2010 U.S. Census demonstrated that close to 1/3 of the U.S. Virgin Islands population over the age of 5 speak a language other than English (28,041 people out of 98,905), and of this group, over 4,000 individuals speak English "not well" or "not at all.

documents in Spanish and French Creole.[175] The Virgin Islands Housing Finance Authority has explicit policies to accommodate LEP individuals.[176] And the Virgin Islands Police Department has recognized a need for bilingual employees, *e.g.,* for 911 calls, to serve the U.S. Virgin Island's LEP population.[177] Historic evidence of the Refinery's history of exploiting workers from non-U.S. Caribbean islands supports the idea that there are LEP individuals surrounding the Refinery.[178]

Under these Executive Orders, EPA is required to translate vital public documents, notices, and hearings relating to human health or the environment for limited English-speaking populations.[179] Specifically, the requirement states: "With respect to documents intended for public outreach or a broad audience, each HQ and regional program office should ensure that the documents it considers 'vital' are translated where a significant percentage of the population is eligible to be served, or likely to be directly affected, by the offices' services, programs, or activities are LEP."[180]

EPA's decision not to assess the LEP population or provide translation of vital documents is irrational in light of all of the information in the record about the LEP population and EPA's finding that the community is overburdened with pollution and would suffer disproportionate adverse impacts from air emissions from the Refinery. EPA's decision to deny meaningful access to the public participation process for LEP individuals is wrong and violates both Executive Order 12898 and Executive Order 13166. EPA must reconsider their error by providing vital documents for LEP individuals and hosting informational sessions and public meetings with accommodations for LEP individuals. This will ensure that the communications between EPA and LEP population near the Refinery are not impaired as a result of this population's limited English proficiency.

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[175] PC at 16 (citing Press Release, FEMA, *U.S. Virgin Islanders, FEMA Speaks Your Language*, Oct. 30, 2017, https://www.fema.gov/news-release/20200220/abitan-zile-vyej-ameriken-fema-pale-menm-lang-avek-ou).
[176] PC at 17 (citing Virgin Islands Housing Finance Authority – CDBG-DR Division, *United States Virgin Island Housing Finance Authority Workforce Development Program Policies*, June 6, 2019, https://www.vihfa.gov/sites/default/files/Workforce_Dev_P%26P_V1_0.pdf.).
[177] PC at 17 (citing Bill Kossler, *911 in USVI Still Lacking Spanish Speakers*, June 24, 2016, https://stjohnsource.com/2016/06/24/911-in-usvi-still-lacking-spanish-speakers/).
[178] PC at 16 (citing David Bond, *Oil in the Caribbean: Refineries, Mangroves, and the Negative Ecologies of Crude Oil,* Comparative Studies in Society & History, at 608 (Cambridge Univ. Press 2017) ("'Bonded aliens,' as imported workers were classified, were housed next to the refinery in camps surrounded by barbed wire fences. These 'bonded aliens' could not vote and were denied access to schools and other public services, and their employer could deport them at will. While these workers were initially brought in to serve the island's seasonal tourism trade, the refinery quickly took advantage of this depoliticized class of worker.")).
[179] 59 Fed. Reg. at 7632; *see* EPA Order No. 1000.32, *Compliance with Executive Order 13166: Improving Access to Services for Persons with Limited English Proficiency,* 10-11 (updated Feb. 10, 2017).
[180] *Id.* at 11.

In order for EPA to comply with President Biden's mandate to immediately review all agency actions "that are inconsistent with, or present obstacles to" policies that prioritize environmental justice, EPA must reconsider its decision to issue the PAL permit without adequate protections for the community being subjected to environmental harm.

D. EPA SHOULD RECONSIDER THE PERMIT BECAUSE IT FAILED TO ADEQUATELY CONSULT ON ALL ENDANGERED AND THREATENED SPECIES THAT WILL BE HARMED BY THE PERMIT, AS REQUIRED UNDER THE ENDANGERED SPECIES ACT.

**1. EPA Should Reconsider the Permit Because it was Issued Without Adequate ESA Consultation**

EPA violated the ESA by failing to appropriately consult with the U.S. Fish and Wildlife Service ("FWS") and the National Marine Fisheries Service ("NMFS") to ensure its issuance of the Permit will not jeopardize the continued existence of threatened or endangered species in the project area. *See* 16 U.S.C. §§ 1536(a)(2).[181]

The Refinery's air, water and other environmental impacts may affect 25 federally listed species: 9 managed by FWS (hawksbill, leatherback, loggerhead, and North and South Atlantic Distinct Population Segments (DPSs) of the green sea turtles when in terrestrial habitat; West Indian manatees; St. Croix ground lizards; and least and roseate terns); and 21 managed by NMFS (the five types of sea turtles while in the marine habitat; blue, fin, sei, and sperm whales; giant manta ray; Nassau grouper; oceanic whitetip shark; Central and Southwest Atlantic DPS of the scalloped hammerhead shark; and boulder star, elkhorn, lobed star, mountainous star, pillar, rough cactus, and staghorn corals).[182] Petitioners' comments described the negative impacts the Refinery's water discharges, noise pollution, light pollution, climate pollution, and air pollution

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[181] EPA does not dispute that issuance of the Permit was a "final permit decision," subject to ESA consultation requirements. 40 C.F.R. § 124.15(a); 50 C.F.R. § 402.02; *see also In re Indeck-Elwood, LLC*, 13 E.A.D. 126, 212 (EAB 2006) (failure to consult is reviewable by the Board); *In re Desert Rock Energy Company, LLC*, 14 E.A.D. 484, 509 (EAB 2009) (remanding to agency in part to address ESA compliance).

[182] Final listing rules for the roseate tern, 52 Fed. Reg. 42064 (Nov. 2, 1987); hawksbill and leatherback sea turtles, 35 Fed. Reg. 8491 (June 2, 1970), Northwest Atlantic Ocean DPS of loggerhead sea turtle, 76 Fed. Reg. 58867 (Oct. 24, 2011), and North and South Atlantic Distinct Population Segments (DPSs) of the green sea turtles, 81 Fed. Reg. 20058 (May 6, 2016); West Indian manatees, 82 Fed. Reg. 16668 (Apr. 5, 2017); St. Croix ground lizards, 42 Fed. Reg. 28543 (June 3, 1977); blue, fin, sei, or sperm whales, 35 Fed. Reg. 18319 (Dec. 2, 1970); giant manta ray, 83 Fed. Reg. 2916 (Jan. 22, 2018); Nassau grouper, 81 Fed. Reg. 42268 (June 29, 2016); oceanic whitetip shark, 83 Fed. Reg. 4153 (Jan. 30, 2018); Central and Southwest Atlantic DPS of the scalloped hammerhead shark, 79 Fed. Reg. 38213 (July 3, 2014); and boulder star, elkhorn, lobed star, mountainous star, pillar, rough cactus, and staghorn corals, 79 Fed. Reg. 53851 (Sept. 10, 2014).

would have on these species, and expressed concern that, at the time of Petitioners' comments, the record demonstrated no evidence that EPA had consulted with FWS or NMFS.[183] Many other comment letters expressed similar concerns.[184] Despite the scale of the Refinery's potential impacts on a significant number of imperiled species, EPA failed to adequately ensure that its action would not jeopardize these listed species. Specifically, EPA failed to conduct any consultation on loggerhead and green sea turtles and the Caribbean roseate tern and violated consultation requirements for the other listed species.

### 2. EPA Failed to Consult with FWS on Loggerhead and Green Sea Turtles and the Caribbean Roseate Tern

EPA failed altogether to consult with FWS on the impacts of permitting the refinery on the loggerhead sea turtle, the North and South Atlantic Distinct Population Segments (DPSs) of the green sea turtles, and the Western Hemisphere DPS of the Caribbean roseate tern.[185] EPA is required to consult where its actions "may affect" a listed species.[186] The threshold for a "may affect" determination triggering EPA's consultation duty is low.[187] ESA provides that in fulfilling the consultation requirements, "each agency shall use the best scientific and commercial data available."[188]

EPA's issuance of the Permit may affect the loggerhead and green sea turtles, as well as the Caribbean roseate tern. The best available science demonstrates that loggerhead and green sea turtles are found in the project area.[189] In fact, green sea turtle nesting "is reported as increasing on Sandy Point."[190] Limetree itself reported that "[g]reen turtles, hawksbills and a

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[183] PC at 17-25.
[184] *See, e.g.,* Comment of Archer H. Christian, (Nov. 26, 2019), EPA-R02-OAR-2019-0551-0142.
[185] *See* Letter from U.S. EPA to U.S. FWS, *Endangered Species Act (ESA) consultation for Limetree Bay Terminals, LLC air permit* (Feb. 19, 2020), ("EPA Consultation Letter"),EPA-R02-OAR-2019-0551-0180; Letter from U.S. FWS to U.S. EPA, *Air Permit Application for Limetree Bay Terminal, St. Croix, USVI* (Feb. 28, 2020), EPA-R02-OAR-2019-0551-0184.
[186] 16 U.S.C. § 1536.
[187] *See* 50 C.F.R. § 402.14(a); 51 Fed. Reg. 19,926, 19,949 (June 3, 1986) ("Any possible effect . . . triggers the formal consultation requirement."); *In re Indeck-Elwood, LLC*, 13 E.A.D. 126 (EAB 2006) at 196 (same).
[188] 16 U.S.C. § 1536(a)(2).
[189] Letter from NOAA to U.S. EPA Region 2, *Concurrence Letter for the U.S. Environmental Protection Agency Region 2 Approval of the Proposed Limetree Bay Terminal Air Permit, St. Croix, U.S. Virgin Islands* at 8, 10 (Sept. 3 2020) (noting that green turtles particularly are "present year-round in the action area where they nest and use nearshore areas such as seagrass beds and coral habitats for refuge and foraging."), Doc. Id. No. EPA-R02-OAR-2019-0551-0186 ("NOAA Letter").
[190] *Id.* at 8.

loggerhead turtle were seen during the site surveys."[191] NOx pollution contributes to the threatened status of the present sea turtles and turtle species are at risk from mercury—a developmental and reproductive toxin.[192] Toxins from air pollution and exposure to hydrocarbons from oil spills may also injure sea turtles.[193]

EPA failure to consult with FWS on the green and loggerhead sea turtles cannot be remedied by NMFS' post-hoc statement that the FWS "did not include green sea turtles in their concurrence letter even though nesting by this species is reported as increasing on Sandy Point, but the effects determination for green sea turtles ***would likely be the same*** as that for the other two sea turtle species [hawksbill and leatherback]."[194] First, this ignores EPA's own failure to consider impacts to the green and loggerhead sea turtles. Second, as courts have made clear, "[t]he failure to respect the process mandated by [the ESA] cannot be corrected with post-hoc assessments of a done deal."[195] Post-hoc rationalization by another agency cannot substitute for EPA's compliance with its ESA duties—particularly where FWS is the expert consulting agency for nesting sea turtles, not NMFS.[196] In its Response to Comments, EPA offered no explanation for why it failed to consult on the loggerhead and green sea turtles, simply stating its "evaluation and determination and the Services' concurrence is included in the record for this permitting action and is incorporated by reference as part of this response."[197]

The roseate tern, whose range encompasses all of the U.S. Virgin Islands, (2010 FWS Sandy Point, Green Cay and Buck Island National Wildlife Refuges Comprehensive Conservation Plan) at 43-44; (1993 FWS Roseate Tern Recovery Plan) at 3, 7, 10-11, 15 (noting vast migration path and largest breeding colonies in the Virgin Islands, its "stronghold"), has also been observed at Krause Lagoon, adjacent to the refinery. (Birds of St. Croix). The Permit may affect these terns by exposing them to pollutants that can cause irreversible lung damage.[198]

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[191]Environmental Assessment Report prepared for Major Coastal Zone Management (CZM) Permit Application No. CZX-10-19(L&W), at 130, *available at* https://www3.epa.gov/region02/waste/fshovens_statementof_basis_aoc3.pdf/ ("2019 Environmental Assessment").

[192] U.S. EPA, *Integrated Science Assessment for Oxides of Nitrogen, Oxides of Sulfur, and Particulate Matter— Ecological Criteria* at 12-100, 14-24, 14-27 (Sept. 2020), ("Integrated Science Assessment"), Doc. Id. No. EPA-R02-OAR-2019-0551-0205.

[193] 81 Fed. Reg., at 20,071 (petroleum contamination "adversely affects turtles by external fouling, ingestion, and interference with olfactory perception and food supply").

[194] *Supra,* n. 189, NOAA Letter at 8.

[195] *Nat. Res. Def. Council v. Houston*, 146 F.3d 1118, 1129 (9th Cir. 1998); *see also In re Desert Rock Energy Co., LLC*, 14 E.A.D. 484, 515-516 (EAB 2009) (quoting same).

[196] *See, e.g., id.* at 1127 (finding agency failed to meet its "independent responsibilities under the ESA" when it failed to "request a formal consultation"); *Resources Ltd. v. Robertson*, 35 F.3d 1300, 1304 (9th Cir. 1994) ("An agency cannot abrogate its responsibility to ensure that its actions will no[t] jeopardize a listed species[.]") (internal quotations omitted).

[197] RTC at 96.

[198] *See e.g.,* Limetree PAL Permit Application, Executive Summary at 20, Doc. Id. No. EPA-R02-OAR-2019-0551-0037; *see supra,* n. 192, Integrated Science Assessment at 8-34, 12-80,

Despite these threats, EPA neither mentioned the roseate tern during its abbreviated consultation process with FWS, nor acknowledged that EPA previously considered the tern to "occur in the vicinity of the facility" in assessing remedies for site contamination by Hovensa.[199]

In the Response to Comments, EPA acknowledged its omission of the roseate tern but explained that while the tern is a threatened species in the U.S. Virgin Islands, "the IPaC tool used for identifying FWS species, does not list this species in the vicinity of the project and impact area."[200] This response is not sufficient to support EPA's failure to consult on the roseate tern and to use best scientific and commercial data available, particularly when other data generated and publicized by the EPA, FWS, and other sources indicates the roseate tern occurs in the project area.[201] EPA's failure to consult on the loggerhead and green sea turtles and roseate tern constitutes a clear error and a violation of the ESA.

### 3. EPA Violated Procedural Obligations for Informal Consultation on Over 20 Other Federally Listed Species

EPA failed to satisfy the ESA's procedural obligations for informal consultation with both FWS and NMFS regarding twenty-three other endangered and threatened species that the Refinery may affect.

To properly engage in informal consultation, an agency "shall include information similar to the types of information described for formal consultation at §402.14(c)(1) sufficient for the Service to determine if it concurs." 50 C.F.R. § 402.13(c)(1). Section 402.14(c)(1) requires "a description of the proposed action, including any measures intended to avoid, minimize, or offset effects of the action." It directs agencies "to provide sufficient detail to assess the effects of the action on listed species and critical habitat, including: (A) The purpose of the action; (B) the duration and timing of the action; (C) the location of the action; (D) The specific components of the action and how they will be carried out; (E) Maps, drawings, blueprints, or similar schematics of the action; and (F) Any other available information related to the nature and scope of the proposed action relevant to its effects on listed species or designated critical habitat." 50 C.F.R. § 402.14(c)(1).

The ESA clarifies that the "action area" encompasses "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." 50 C.F.R. § 402.02. The "effects of the action" include "all consequences to listed species or critical

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15-2, 15-27 (EPA assessment concluding "birds report physiological responses to air pollutants, including PM [particulate matter]").

[199] EPA Statement of Basis/Proposed Final Remedy Decision, Hovensa L.L.C., VID 980536080 (February14, 2008) at 3, *available at* https://www3.epa.gov/region02/waste/fshovens_statementof_basis_aoc2.pdf.

[200] RTC at 96.

[201] *Defs. of Wildlife v. U.S. Dep't of the Interior*, 931 F.3d 339, 346 (4th Cir. 2019) (noting "[t]he best-available-data standard also means [an agency] is not free to disregard other available biological information" and the agency "must seek out and consider all existing scientific data relevant to the decision") (internal quotations omitted).

habitat that are caused by the proposed action." *Id.* Effects are measured against the "environmental baseline" for the species, which should reflect the status quo of no refinery operations. The baseline also includes the "past and present impacts of all Federal, State or private actions and other human activities in the action area."[202]

EPA's February 19, 2020 consultation request to FWS did not comply with these obligations. EPA's request to FWS was a cursory one-page letter that only covered four species in the project area (West Indian manatee, hawksbill sea turtle, leatherback sea turtle, and the St. Croix ground lizard), leaving out other species over which FWS has authority, as discussed above.[203] EPA's request for consultation, and FWS's concurrence, also omitted key information, including that leatherback sea turtles nest at Sandy Point National Wildlife Refuge and it is a critical habitat[204] and that leatherback, hawksbill, and green sea turtles nest at Canegarden Bay and Manchenil Beach, which are directly in the facility's modeled air pollution plume.[205] Limetree itself has reported "as many as 14 turtle nests in this area at one time including nests which were laid by leatherbacks" at the project site.[206] Yet EPA's concurrence request says little more about the Refinery except its location and that it "would like to restart operations at the former HOVENSA refinery" without any specific components of the action.[207] It attaches just three air modeling figures to illustrate the project and concludes there will be no effect on the four species.

Further, EPA inaccurately described the action by stating that the Permit "does not introduce new emissions compared to those emitted by the HOVENSA refinery."[208] EPA made no mention of the baseline conditions on the project site—a total shutdown of refinery operations for the past nine years—nor described the full scope of the facility or its functions. EPA further narrowed its consultation request by only referencing the project's potential for air impacts, saying nothing of its other operational impacts to the project area, including water pollution, vessel strikes, noise and disturbance, trash and debris, light pollution, and risk of oil and chemical spills, particularly in light of increasing frequency and intensity of storms.[209] Based in

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[202] 50 C.F.R. § 402.02.
[203] *See supra*, n. 185, EPA Consultation Letter
[204] NMFS, Biological Opinion on the 2018 Virgin Islands Water Quality Standards, at 34 (Sept. 9, 2019) ("Biological Opinion"), Doc. Id. No. EPA-R02-OAR-2019-0551-0170.
[205] Florida Fish and Wildlife Conservation Commission, Florida Fish and Wildlife Research Institute, Geographic Response Plan Map: VI-2 (May 27, 2011) at 162, *available at* https://homeport.uscg.mil/Lists/Content/Attachments/2349/ACP%20GRS%20Index.pdf; *supra,* EPA Consultation Letter*; compare supra*, FWS Consultation Letter at 26-27 (failing to acknowledge nesting beaches in concluding "Species expected to transit past impacted areas, so any exposures would be short-term").
[206] 2019 Environmental Assessment Report, at 130.
[207] *See supra*, n. 185, EPA Consultation Letter
[208] *Id.*, at 1.
[209] *See, e.g.*, RTC at 97 (responses to comments stating it need not address impacts from "Limetree's vessels on the south shorelines of St. Croix including Cane Garden Beach" and other impacts from the Refinery such as polystyrene accidents, oil spills, and ship strikes because "[t]hese issues related to operations at the facility unrelated to the PAL permit").

part on this improperly narrow view of "action area," "effects of the action," and "environmental baseline" in clear violation of §402.02, EPA concluded that the Permit will have no effect on these four species.[210] In response, FWS sent EPA a cursory 1.5-page concurrence with EPA's determination of "not likely to adversely affect" that largely imported language from EPA's request (including its omission of green and loggerhead sea turtles).[211]

Similar to its consultation with FWS, when it requested concurrence from NMFS on twenty-one species, EPA focused exclusively on air emissions in determining that the Permit "may affect" but was not likely to adversely affect "all listed species in general, including the leatherback turtle, the Nassau Grouper, and the endangered corals."[212] EPA again erred by ignoring the many non-air impacts from restarting the shuttered refinery.[213] In its September 4, 2020 concurrence letter, NMFS acknowledged that the action area "means all areas affected directly or indirectly by the Federal action, and not just the immediate area involved."[214] NMFS also acknowledged that effects of the action mean "all consequences to listed species or critical habitat that are caused by the proposed action."[215] As noted above, effects are measured against the "environmental baseline," which reflects current conditions and threats to listed species in the area and includes the past and present impacts of all Federal, State or private actions in the action area.[216] None of these factors were mentioned, let alone assessed in the request and concurrence letters, rendering the consultation inadequate.[217]

EPA's "no effect" conclusion further improperly relied on vague assertions including that "Limetree will create an Endangered Species Management Plan to address the numerous ESA-listed species that occur in the Action Area, including listed corals, fish, marine mammals, sea turtles and birds. The plan will be provided to NMFS for review prior to the start of operations."[218] The substance of this proposed Endangered Species Management Plan is not clear (nor is it ever mentioned again), though it suggests EPA admits that the Permit action will indeed

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[210] *Id.*, at 2.
[211] *Supra,* n. 185, FWS Letter at 2.
[212] U.S. EPA, Region 2, *Request for NMFS' concurrence on a determination that the approval of the Proposed Limetree Bay Terminal, St. Croix, Air Permit May effect but is Not Likely to Adversely Affect (NLAA) ESA-listed species under NMFS' jurisdiction*, at 16, 23-24 (Aug. 11, 2020) (chart listing species present), Doc. Id. No. EPA-R02-OAR-2019-0551-0181.
[213] *See, e.g.,* RTC at 97.
[214] NMFS, *Concurrence Letter for the U.S. Environmental Protection Agency Region 2 Approval of the Proposed Limetree Bay Terminal Air Permit, St. Croix, U.S. Virgin Islands*, at 5 (Sept. 3, 2020), ("NMFS Concurrence Letter"), Doc. Id. No. EPA-R02-OAR-2019-0551-0186.
[215] *Id.* at 8.
[216] 50 C.F.R. § 402.02.
[217] *See, e.g., Am. Rivers & Ala. Rivers Alliance v. FERC*, 895 F.3d 32, 47 (D.C. Cir. 2018) (analysis arbitrary when failing to account for effects of all relevant conditions on threatened species).
[218] *Id.,* at 16.

impact listed species. EPA may not rely on uncertain, non-binding mitigation plan to arrive at its conclusion of no adverse effect.[219]

The Response to Comments further underscores that EPA clearly erred in issuing the Permit without having adequately considered the aggregate effects of the action in light of the imperiled status of the species at issue and the environmental baseline.[220] EPA's response to comments on this issue was brief and dismissive, incorporating by reference the faulty concurrence requests and concurrences.[221] EPA's cursory responses to comments do not remedy the above-described errors. EPA should vacate the Permit for failing to comply with the ESA. In the alternative, EPA should reinitiate consultation with FWS and NMFS pursuant to 50 C.F.R.§ 402.16(a)(2) to correct the errors that originated in the agency's incomplete consultation requests and failure to consider relevant scientific information.

E. The Climate Change Impacts of the Refinery Contravene Executive Order 13,990 and Provide Reason for Reconsideration

The climate change impacts of the Refinery — both those to be suffered by and those being caused by the Refinery restart — render the PAL and operation of this facility fundamentally incompatible with President Biden's Executive Order 13,990. According to the Fourth National Climate Assessment, the USVI is uniquely vulnerable to the threats that climate change presents vis-à-vis rising temperatures, to freshwater supplies, to marine resources (including fisheries), and as a result of sea level rise.[222] Through its current and proposed activities, the Refinery exacerbates climate change both by emitting greenhouse gases (GHGs) and by contributing to the market for carbon-intensive fossil fuels. Due to these demonstrable and critical risks, we assert that these impacts render the Refinery Restart fundamentally incompatible with the policies and goals delineated in Executive Order 13,990.

**1. Extreme Weather Impacts**

The PAL, its documentation, and the Refinery's activities generally fail to address extreme weather events and their adverse impacts — such as those caused by an event like the devastating Hurricane Maria — and any meaningful measures to prevent or mitigate resultant Refinery pollution. Especially given the US Virgin Islands' devastating experiences with two

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[219] *See, e.g.*, *Ctr. for Biological Diversity v. Bernhardt*, 2020 U.S. App. LEXIS 38033, *36, 54 (9th Cir. 2020) (agency violated the ESA by "relying upon uncertain, nonbinding mitigation measures in reaching its no-adverse-effect conclusion"); *In re Desert Rock Energy Co., LLC* , 14 E.A.D. at 515-16 (agency could not cure consultation deficiencies with a permit condition).
[220] *See* 16 U.S.C. § 1536(a)(2); *Am. Rivers v. U.S. Army Corps of Eng'rs*, 271 F. Supp. 2d 230, 255 (D.D.C. 2003) ("The ESA requires that all impacts of agency action . . . be addressed in the consultation's jeopardy analysis.").
[221] RTC at 96.
[222] U.S. Global Change Research Program, "Fourth National Climate Assessment, Chapter 20: U.S. Caribbean," https://nca2018.globalchange.gov/chapter/20/, last accessed September 3, 2019.

category five hurricanes in 2017, this failure to acknowledge the actual frequency and increasing severity of tropical cyclone[223] activity in the territory is highly problematic.

In a disturbing encapsulation of the attention paid to this issue, an Environmental Assessment Report that Limetree prepared in pursuit of a Coastal Zone Management permit administered by the Virgin Islands Department of Planning and Natural Resources cites a 1974 study to support its assertion that "[t]he annual probability of a [tropical] cyclone is one in sixteen years."[224] This 45-year-old statistic conflicts with modern data that reports an average of 12 named storms per year globally.[225] Utilizing data from 1855 – 2017, NOAA reports that tropical cyclone events occur in the USVI and Puerto Rico approximately once every two years.[226] Of great concern to the Refinery restart is the prevailing scientific consensus that hurricane rainfall rates, storm surge heights due to sea level rise, and the number of the strongest hurricanes (categories 3, 4, and 5) are all projected to rise in a warming global climate.[227]

The actual frequency and increasing severity of hurricanes are crucial factors to consider in evaluating whether the PAL is defensible under Executive Order 13,990 because severe weather events are often tied to ecologically-devastating discharges from industrial facilities such as the Refinery. Famously, Hurricane Katrina caused the release of 1.05 million gallons of mixed crude oil from the Murphy Oil Refinery in Louisiana in 2005.[228] Less famously but more pertinently, in 1989, Hurricane Hugo caused a spill of 10,000 barrels of oil from the Refinery in question.[229]

Extreme weather events can additionally cause discharges outside of the floodplain. For example, Hurricane Harvey caused "34,000 pounds of sodium hydroxide and 300 pounds of benzene . . . [to] escape through a damaged valve" at the Chevron Phillips chemical plant in Baytown, Texas.[230] Despite clean-up efforts by employees, "most of the product 'was lost in the

---

[223] The term "tropical cyclone" is a generic term that can refer to tropical depressions, tropical storms, and hurricanes. See: NASA, "What is a Hurricane, Typhoon, or Tropical Cyclone?" https://pmm.nasa.gov/education/articles/what-hurricane-typhoon-or-tropical-cyclone, last accessed September 3, 2019.
[224] EAR, at 83.
[225] Hurricane Research Division, Atlantic Oceanographic & Meteorological Laboratory, NOAA. https://www.aoml.noaa.gov/hrd/tcfaq/E11.html.
[226] NOAA National Centers for Environmental Information, State Climate Summaries: Puerto Rico and the US Virgin Islands: https://statesummaries.ncics.org/chapter/pr/
[227] *Id.*
[228] US EPA, "Murphy Oil Spill Fact Sheet, February 2006, http://www.columbia.edu/itc/journalism/cases/katrina/Federal%20Government/Environmental%20Protection%20Agency/Murphy%20Oil%20Spill%20Fact%20Sheet%20Feb%202006.pdf, last accessed September 3, 2019.
[229] https://response.restoration.noaa.gov/sites/default/files/Oil_Spill_Case_Histories.pdf - Thankfully, 9,000 barrels' worth were blown onto shore and recovered.
[230] Hiroko Tabuchi, et al., THE NEW YORK TIMES, *Floods are Getting Worse, and 2,500 Chemical Sites Lie in the Water's Path* (Feb. 6, 2018)

floodwater.'"[231] While the government defined the Chevron Phillips site as being only at "moderate risk" of flooding, the incident during Harvey was "at least the third time in three years that the Chevron Phillips facility blamed heavy downpours for chemical leaks."[232] Hurricane Harvey caused additional flood-related pollution when floodwaters reached petrochemical facilities and Superfund sites elsewhere in the state.[233]

### 2. Temperature Rise, Drought, Freshwater Resources

Projected temperature increases caused by climate change pose multifaceted hazards to the island of St. Croix. The temperature increases are estimated to be significant: "Global climate models project about a 1.5°F to 4°F increase in average temperatures for the U.S. Caribbean by 2050 [and] [e]nd-of-century estimates show temperature increases as high as about 9°F under a higher scenario[.]"[234] Warming temperatures are predicted to bring about drier weather overall (factoring in extreme rainfall events, e.g. tropical cyclones), contributing to incidences of drought.[235] This is a major concern in the US Caribbean, where freshwater resources are primarily surface waters, supplemented in part by desalination plants.[236]

### 3. Wildlife Impacts of Climate Change

Climate change threats to listed species protected under the federal Endangered Species Act (ESA) and already-exploited marine food resources including fishery species such as the Caribbean spiny lobster and queen conch, snappers, groupers, and parrotfish, include damage and habitat loss from ocean acidification, coral bleaching, loss of food/habitat resources like mangroves and seagrass, and changes in the frequency and intensity of storm events[237]. Ocean warming "can also harm hard corals that form coral reefs by decreasing successful sexual reproduction, causing abnormal development, impairing coral larvae's attempts to attach to and grow on harm substrate, and affecting hard corals' ability to create their calcium carbonate skeleton."[238] Ocean warming also increases the susceptibility of corals to disease.[239] Given the prevalence of ESA-listed corals near the Refinery, this is a cause for serious concern.[240]

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https://www.nytimes.com/interactive/2018/02/06/climate/flood-toxic-chemicals.html (last visited September 3, 2019).

[231] *Id.*

[232] *Id.*

[233] *Id.*

[234] *Id.*

[235] *Id.*

[236] *Id.*

[237] *Id.*

[238] *Id.*

[239] *Id.*

[240] NOAA Fisheries, SER-2018-19292, Re: Limetree Bay Terminal Single Point Mooring, St. Croix, USVI (SAJ-2017-00416 (SP-JCM)) Draft Biological Opinion, February 12, 2019.

### 4. Sea Level Rise, Coastal Flooding, and Storm Surge

Sea level rise, storm surge, and coastal flooding are climate change impacts that will have massive effects on the Refinery and St. Croix generally. It is projected that the USVI may lose 4.6% of its coastal land area due these impacts by 2100.[241] Since the mid-20th century, relative sea levels have risen by about 2mm per year along the coasts of the USVI; however, rates have noticeably accelerated (by a factor of 3) since 2010 – 2011.[242] Sea levels are projected to increase substantially, with studies estimating a rise of between 0.8 – 2.8 feet by 2050, and up to 6.5 feet by 2100, largely dependent on the amount of future greenhouse gases emitted.[243] In addition to marine ecosystem impacts, this is a matter of concern to the Refinery, given the connection between flooding events and oil spills (referenced above) and the fact that the Refinery sits at sea level. As sea level rises, so too storm surge and high-energy wave action.[244] These impacts present a critical risk to the Refinery and to the island, generally, through inundation and coastal erosion.

Additionally, the location of the Refinery makes it extremely vulnerable to coastal flooding and storm surge. The facility was built directly on the coast, there is no natural buffer between the facility and the sea, and it only sits a few feet above sea level. Scientific studies have indicated that storm surge and coastal flooding will worsen for St. Croix due to rising sea levels, higher energy wave action, warmer sea temperatures, stronger storms, and the degradation of "soft" infrastructure due to changing conditions (i.e. sand, shoreline, mangrove forests, coral reefs, and sea grasses) that would protect the facility.[245]

The failure to address sea level rise, coastal flooding, and storm surge is a major oversight by EPA and must be addressed by reconsideration of the PAL.

### 5. Emissions Increase from Refinery Restart

Finally, by its fundamental nature as a fossil fuel processor, the Refinery Restart will contribute to global GHG emissions by releasing GHGs in its refining activities and by virtue of its products produced. Based on information available from EPA, Limetree is already releasing GHGs via its current activities: carbon dioxide (99,235.50 pounds in 2017), methane (264.75 pounds in 2017), and nitrous oxide (273.27 pounds in 2017); as noted above, it can be reasonably ascertained that the Refinery Restart will increase these releases.[246]

In sum, the reality of climate change and its foreseeable impacts on the territory render this PAL fundamentally incompatible with Executive Order 13990. We accordingly implore EPA to reconsider the PAL.

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[241] *Id.*
[242] Fourth National Climate Assessment, https://nca2018.globalchange.gov/chapter/20/
[243] *Id.*
[244] *Id.*
[245] *Id.*
[246] *See https://echo.epa.gov/air-pollutant-report?fid=110000307864.*

## IV. CONCLUSION

For the above reasons, Petitioners respectfully request that EPA reconsider the Trump Administration's decision to issue the Limetree Permit, and act to reinstate the Agency's longstanding Reactivation Policy.

Dated: February 1, 2021

Respectfully submitted,

Elizabeth Neville, *in her individual capacity and of counsel,*
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Deputy Assistant Attorney General
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Message

**From:** Rachel Miller [rmiller@forbes-tate.com]
**Sent:** 2/5/2021 8:42:45 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Story

# Acting air chief touts quick work on Biden priorities

Sean Reilly, E&E News reporterPublished: Friday, February 5, 2021

Joe Goffman is EPA's acting air chief. School of Transnational Governance EUI/YouTube

In his first public appearance since rejoining EPA, acting air chief Joe Goffman told an online audience yesterday that agency employees are already hard at work to deliver on President Biden's priorities.

Biden's executive orders on climate, environmental justice and related matters "have activated the strength of the EPA, and that is its expert staff," Goffman said at the outset of the virtual panel discussion on the theme of "healthy air and equitable climate action" in the new administration.

Other participants later made clear they're watching with a mixture of anticipation and impatience.

While the administration is off to a great start, "we need an all-of-the-above response on climate and clean air and we need it yesterday," Ann Weeks, legal director of the Boston-based Clean Air Task Force, said during the webinar, suggesting later she would have few qualms about resorting to the courts if needed.

Panelists' recommendations ranged from better air quality monitoring to more money for state and local air regulators. A repeated refrain was the need for ramped-up enforcement, particularly for minority and low-income communities. Coupled with more stringent health protections, "I think that is going to be a game-changer," said Adrienne Hollis, senior climate justice and health scientist at the Union of Concerned Scientists.

*Advertisement*

"The challenges that we are faced with cannot be solved by minor tweaks and adjustments," said Ali Mirzakhalili, air director for the Oregon Department of Environmental Quality.

The 90-minute afternoon event was hosted by the American Lung Association and American University's centers for environmental policy and environmental filmmaking. The moderator was Kelsey Brugger, an E&E News reporter.

Goffman, whose official title is principal deputy assistant administrator of the Office of Air and Radiation, has been on the job since Biden's inauguration last month; some in the environmental community expect him to be eventually nominated to hold the chief's job on a Senate-confirmed basis. He spent the bulk of the Obama administration at the air office focused on climate issues and most recently ran Harvard University's environmental law and energy program.

Before exiting, Goffman also used his few minutes at the discussion's opening yesterday to couple a pledge of public engagement with a pitch for support.

Biden's priorities "have the best possible chance of being realized," he said, if the "blended voices" of experts, key members of the public and representatives of "critical communities" give their backing.

Goffman's return to EPA comes after big changes to the political and regulatory landscape over the last four years.

The Trump administration's embrace of coal notwithstanding, the use of renewable energy sources has continued to soar. The COVID-19 pandemic and the death of George Floyd in the custody of Minneapolis police last May have cast a brighter light on the chronic inequities faced by Black Americans, including disproportionately high exposure to pollution. Public acknowledgment of humans' role in climate change has grown, even as experts warn that time is running short to make critical changes.

For electric utilities, "it's truly different from even just a few years ago," Marcy Reed, Massachusetts president and executive vice president of energy policy and social impact at National Grid, which boasts more than 20 million customers in the Northeast. "We're thinking forward about how to get to net-zero [greenhouse gas emissions] and is it even enough."

But the discussion also served as an oblique reminder that some challenges long predate the Trump administration. According to EPA numbers released two years ago, for example, a steady decline in enforcement inspections began in 2010 (***Energywire***, Feb. 11, 2019). While the Obama administration sought to bolster environmental justice programs, a 2018 EPA report found that people of color are much more likely to breathe dirty air, Hollis said.

Asked by Brugger how the Biden administration can be held accountable, Mirzakhalili suggested a focus on "how things look different in the future," whether it be a more inclusive approach to rulemaking or EPA's handling of challenges to permitting actions.

"Joe Goffman mentioned partnerships," he said. "Let's see how we're all going to be given seats at the table."

Twitter: @SeanatGreenwireEmail: sreilly@eenews.net

# CLEAN AIR ACT CONFLICTS

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Rachel Miller
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Message

**From:** Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent:** 3/13/2021 4:52:04 AM
**To:** laura.a.bloomer@ Ex. 6 Personal Privacy (PP)
**Subject:** FW: InsideEPA Article

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
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**From:** Campbell, Ann <Campbell.Ann@epa.gov>
**Sent:** Friday, March 12, 2021 9:35 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** InsideEPA Article

## EPA Could Revive 'Capacious' Interpretation Of Clean Air Act Authorities

March 11, 2021

Tweet

As the Biden EPA grapples with reversing Trump-era deregulatory actions while tackling major issues such as climate change, the agency could return to a "capacious" interpretation of existing Clean Air Act (CAA) powers as Joe Goffman, currently the Biden administration's top political appointee in EPA's air office, suggested last year.

The expansive and "progressive" view of the agency's powers under the air law echoes the Obama administration, most notably its use of what it saw as existing authority to pursue the Clean Power Plan (CPP) greenhouse gas rule for power plants. The Trump EPA said the rule exceeded the agency's statutory powers and replaced it with the much narrower Affordable Clean Energy (ACE) rule, but a federal appeals court in January vacated ACE.

Goffman was the associate administrator for climate and senior counsel in EPA's Office of Air & Radiation (OAR) during the Obama administration, and is now principal deputy assistant administrator in the Biden EPA's OAR. Sources say his past statements on EPA's powers could help to inform his approach to agency air policies.

Observers note that rules the Biden EPA might create under an expansive view of its air law powers are all but certain to face legal challenges, but that the urgency of tackling major emissions problems requires the approach.

One state air official says, "We're at a stage that we've got to try to move with the tools on hand. We lost four years of progress, climate legislation is still a pipe dream, and climate change isn't going away. If it isn't risky, it isn't big enough to matter."

An environmentalist adds, "EPA has consistently done far less than it could -- and less than the Act requires -- to protect public health and the environment. The Biden Administration can go much further than its predecessors without coming anywhere near the limits on its statutory authority."

In summer 2020, Goffman co-authored an article for the *Case Western Reserve Law Review* making the case for an air law imperative to progressively reduce pollution in accordance with scientific advances, and also for inherent flexibility in the air law that allows for creative problem solving. Goffman wrote the piece, "Disempowering the EPA: How Statutory Interpretation of the Clean Air Act Serves the Trump Administration's Deregulatory Agenda," in his capacity as then-executive director of Harvard Law School's Environmental & Energy Law Program, with Harvard legal fellow Laura Bloomer.

In their article, Goffman and Bloomer criticize a series of Trump EPA regulatory rollbacks for having a narrow reading of air law authorities, seemingly intended to "hamstring" the agency's future ability to regulate. This limited view of the law is at odds not only with decades of EPA practice, but also with judicial precedent that has accepted a much broader reading of the statute and frequently deferred to EPA's legal interpretations, they said.

"For most of its existence, the EPA's path has been 'progressive' in that the statutes the EPA implements, including the CAA, obligate the Agency to advance its regulations as science and technology progress. The EPA's rule-making under the CAA must integrate advances in our understanding of the effects of air pollution on the environment and on public health, as well as new methods to curb pollution," Goffman and Bloomer wrote.

"Where the Act is vague in whether and how it applies to emerging understandings of air-quality challenges, the EPA has read the language to be capacious enough to require or authorize the Agency to take the actions needed to solve these new problems. To do so, the EPA evaluates new science to find CAA-based solutions to meet the Act's emission-reduction goals," according to the authors -- an approach that Goffman could now reinstate at OAR.

Further, EPA has traditionally understood its legal authority to allow it to grant regulated entities compliance flexibility, they wrote. "The courts have mostly ratified the EPA's interpretive approach. This bolsters the Agency's understanding that the CAA contains the necessary tools for it to achieve continually improve air quality."

**Pollution Reductions**

In addition to regulatory flexibility, the CAA inherently presses EPA toward pollution reductions, making the Trump EPA's "static" interpretations of the law inappropriate, Goffman and Bloomer argued. "Woven into the CAA's fabric is a congressional mandate for progress, not through the sweeping aspirational language found in other environmental statutes, but by requiring recurrent standard-setting and upgrades to pollution-control techniques."

For example, the law requires reviews of national ambient air quality standards (NAAQS) every five years and reviews of air toxics standards and new source performance standards every eight years. The CAA's various air regulatory programs contain a number of technology-based standards, all of which reinforce the law's progressive character, the authors say, giving EPA power to purse more-stringent air pollution reduction mandates.

"In addition to the mechanisms designed to result in continually declining pollution, Congress suffused the Act's language with calls for the continuous reduction of air pollution. Maximalist adjectives are the foundation of the various technological standards: *best* available control technology, *maximum* achievable control technology, *best* system of emission reduction, and *lowest* achievable emission rate, for example."

The authors refer to several programs, including the CPP and interstate air trading rules, as embodying the CAA's capacity to identify and mitigate novel problems, such as GHG emissions, using existing authorities.

They claim courts have in general sided with EPA's broad interpretation of its authorities, only limiting its actions but not fully reversing them, citing as one example the Supreme Court's limitation of GHG air permitting to only those "major" air pollution sources already regulated under the CAA by virtue of their non-GHG emissions.

Goffman and Bloomer maintain that CAA section 111 confers considerable flexibility for states to fulfill CAA mandates, as for example under section 111(d) that was the basis for existing source performance standards under the CPP. The Biden administration is working on a plan to regulate power plant GHGs after the U.S. Court of Appeals for the District of Columbia Circuit in January vacated ACE and also scrapped a Trump EPA rule repealing the CPP.

The Biden EPA successfully asked the court to halt implementation of its decision reversing the CPP repeal, signaling that the administration is likely to pursue a new approach to regulating utility GHGs instead.

But any attempt to craft a GHG rule using a "capacious" view of the law might face legal challenges, and potential hurdles with the now more-conservative Supreme Court, because what may permissibly be included in the "best system of emission reduction" (BSER) required by section 111(d) is still an open question.

Sources tell *Inside EPA* that despite the litigation risks inherent in using novel approaches under the CAA to target air quality problems, the agency may have no alternative other than to again try major new programs. Indeed, sources say the agency is already eying a new interstate air rule to address ozone. The Supreme Court has already upheld one such existing interstate air program, the Cross-State Air Pollution Rule (CSAPR).

One possible novel approach would be to set a NAAQS for GHGs -- likely carbon dioxide (CO2) -- if regulation under section 111 or another mechanism does not work out. EPA has previously denied requests from environmentalists to establish CO2 as a "criteria" pollutant subject to a NAAQS, because of the legal, political and practical challenges this would involve, such as what target to set, how to measure that and perhaps most problematically, how to achieve that limit using state implementation plans (SIPs) that apply to states' own emissions. But the agency is now looking at the issue again, reevaluating environmentalists' petition on the question.

**Potential Risks**

A second state source says EPA has already conducted an "endangerment finding" that GHGs endanger human health and welfare, and it therefore must regulate regardless of what Congress does. "There's an endangerment finding that EPA is obligated to develop programs for, and there's clear, low-risk, lawful pathways for mobile sources and stationary sources to be regulated and those emission sources will be first up."

Further, "I think GHGs from the power sector could be regulated under a NAAQS approach, [or] under Section 111, or something else in a way that would survive skeptical judicial review," the source says.

The first state source says, "with the current Supreme Court, any GHG rule having a meaningful impact under the Clean Air Act will be risky," and the White House seems to acknowledge this by spreading its GHG strategy across multiple agencies, in addition to potential support for new legislation in Congress designed to tackle climate change. "I'm not clear that they have plans for a big CPP replacement."

The environmentalist backs Goffman's views, and urges EPA to go beyond even what the Obama administration attempted. Commenting on the law review article, the source "didn't see anything to suggest that Goffman's outlook would lead to reversals in court. The Clean Air Act is a powerful statute, and Congress did not intend its protections to be frozen in 1970 or even 1990 [when Congress passed major revisions to the law]. The text of the statute makes clear Congress intended Clean Air Act protections to keep up with developments in science and technology." -- *Stuart Parker* (sparker@iwpnews.com)

Ann (Campbell) Ferrio
Chief of Staff
EPA/Office of Air and Radiation
Office: 202 566 1370

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 4/6/2021 2:06:03 AM
**To**: Fugh, Justina [Fugh.Justina@epa.gov]; Hamilton, Lindsay [Hamilton.Lindsay@epa.gov]
**Subject**: RE: Publish Date: Acid Rain

Excellent advice, as usual, Justina. Thank you. Lindsay – what do you think?

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Fugh, Justina <Fugh.Justina@epa.gov>
**Sent:** Monday, April 5, 2021 9:43 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Hamilton, Lindsay <Hamilton.Lindsay@epa.gov>
**Subject:** RE: Publish Date: Acid Rain

Hi Joe,
I viewed the educational video (it's fun and informative!). There is no connection in the video to your EPA title or affiliation, so I have no ethics issues to raise. That said, please don't tout the video as part of your EPA duties, despite the exhortation of the developers to share it with your networks. If EPA wishes to link to it officially, then we should consider the possible endorsement ramifications.
Justina

Justina Fugh | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

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**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Monday, April 05, 2021 7:07 PM
**To:** Hamilton, Lindsay <Hamilton.Lindsay@epa.gov>; Fugh, Justina <Fugh.Justina@epa.gov>
**Subject:** FW: Publish Date: Acid Rain

Hi, Lindsay. In my previous job, I worked with Ted-ED on an educational video about acid rain and cap and trade. They're finally ready to post the video (see below) and in the credits I am identified as "Educator" and my name also appears in the YouTube title. As you'll see, no affiliation is given. Is this a problem, and should I ask them to eliminate my name? Justina – Adding you just in case there is an ethics problem I might be overlooking. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Joseph Goffman < Ex. 6 Personal Privacy (PP)
**Sent:** Monday, April 5, 2021 6:58 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Fwd: Publish Date: Acid Rain

---------- Forwarded message ---------
From: **TED-Ed Animation** <TEDEdAnimation@ted.com>
Date: Mon, Apr 5, 2021 at 4:46 PM
Subject: Publish Date: Acid Rain
To: Nick Hilditch < Ex. 6 Personal Privacy (PP) Just, Robin L <rjust@law.harvard.edu>, Joe Goffman
Ex. 6 Personal Privacy (PP) Daniel Kwartler <dan.kwartler@ted.com>

Hi everyone,

Thanks for your hard work on this lovely video! We are very excited to tell you that we will be publishing Acid Rain on **Tuesday, April 13 at 11AM EST**. Once it is published, feel free to share it with your networks and let us know what you think.

It will be published on our website [ed.ted.com] and our YouTube channel [youtube.com/tededucation].

Here is a private sneak peek: Acid Rain

Please do not share this until we have published it on our website. We ask that you take one final look at the video to confirm that your in-video credits are correct and that there aren't any lingering mistakes with the visuals or the sound.

Thank you!
Sazia

Message

**From:** Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent:** 4/9/2021 1:44:38 AM
**To:** Clarke, Victoria [clarke.victoria@epa.gov]
**Subject:** FW: Recusal Statement
**Attachments:** Joe Goffman Draft Recusal - Final.docx

No rest for the weary, Victoria, and sorry to bug you so soon after concluding the Recusal Statement, but where are we in terms of completing the application for a certificate of divesture for the stocks listed below? Do you have everything you need to complete the request documents? As I mentioned in my earlier note, I would like to accomplish the divestment as quickly as possible once the certificate of divesture is issued. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Clarke, Victoria <clarke.victoria@epa.gov>
**Sent:** Thursday, April 8, 2021 1:53 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Fugh, Justina <Fugh.Justina@epa.gov>
**Subject:** Recusal Statement

Hi Joe,

I've certified your 278 and the next step now is to get a formalized recusal statement in place for you. I've drafted a recusal statement which Justina has reviewed – the final product of which is attached. If it is factually accurate and you're in agreement, you can digitally sign the recusal and distribute it.

One overall comment: in both your 278 and the recusal statement, there is a reference to the possibility of you seeking a certificate of divestiture to address any conflicts issues. When you eventually do divest of the assets below (whether through CD or otherwise), we will update and reissue your recusal statement so that it reflects your new situation.

- Ecolab Inc. (ECL)
- The Home Depot, Inc. (HD)
- ChampionX Corporation (CHX)

**Ex. 6 Personal Privacy (PP)**

- Canadian National Railway Company (CNI)
- Eaton Corporation plc (ETN)
- Fortive Corporation (FTV)
- Roper Technologies, Inc. (ROP)
- Dover Corporation (DOV)
- Broadcom, Inc (AVGO)
- Intel Corporation (INTC)
- NVIDIA Corporation (NVDA)
- QUALCOMM Incorporated (QCOM)
- Skywork Solutions, Inc. (SWKS)

- Texas Instruments Incorporated (TXN)

Hopefully, this is some nice chalk for any lingering heartburn.

Victoria

Victoria Clarke
Attorney-Advisor
U.S. Environmental Protection Agency
Office of General Counsel
Washington, D.C. |7348 WJCN
EPA Office: 202-564-1149
EPA Cell: 202-336-9101

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 2/16/2021 12:44:22 PM
**To**: Campbell, Ann [Campbell.Ann@epa.gov]; Rakosnik, Delaney [rakosnik.delaney@epa.gov]
**Subject**: Scientist letter & request for meeting
**Attachments**: Scientist Letter to Biden, von der Leyen, Michel, Suga & Moon Re. Forest Biomass (February 11, 2021).pdf

Let's get this on the calendar pretty soon. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** timothy searchinger <tsearchi@princeton.edu>
**Sent:** Sunday, February 14, 2021 10:10 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Peter Raven Ex. 6 Personal Privacy (PP)
**Subject:** Scientist letter & request for meeting

Greetings Joe,

Strong congratulations on your new position.

Wanted to get to you this letter sent from 500+scentists to President Biden and other world leaders last Thursday.

On behalf Peter Raven and other initiating scientists, we ask for the opportunity to discuss some of these issues with you. I know you understand the main issues well. We think it might be useful for you to get a briefing on the status of expansion of wood for energy in Europe and Asia, where it is accelerating fast.

There has also been some temptation at EPA to use economic models to evaluate the greenhouse gas consequences of woody biomass. Among the signatories are many distinguished economists. We would present to you reasons not to do so, including some that go to the merits of the models and others that go to the broader significance of what any economic model is actually trying to do. We would also present evidence to you that increasing wood demand is not likely to lead to expansion of forest area, which is precisely why recycling is a good and not a bad idea.

Very best,

Tim

--
Timothy D. Searchinger
Senior Research Scholar
Woodrow Wilson School of Public and International Affairs, Princeton University
Senior Fellow, World Resources Institute
Ex. 6 Personal Privacy (PP)

tsearchi@princeton.edu
(202) 465-2074 (mobile - best choice)
website: www.princeton.edu/~tsearchi

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 6/2/2021 1:55:30 PM
**To**: Shaw, Betsy [Shaw.Betsy@epa.gov]
**Subject**: FW: Urgent Whistle Blowing Complaint concerning greenhouse gas regulations against 8 EPA administrators and 3 climate scientists alleging treason and violation of PL 104-113 sec 12(d)
**Attachments**: Complaint to IG EPA etc 6.1.21.pdf

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Brian Kelleher <bkellehr@ix.netcom.com>
**Sent:** Tuesday, June 1, 2021 8:03 PM
**To:** OIG Hotline <OIG_Hotline@epa.gov>; Grundler, Christopher <grundler.christopher@epa.gov>; Gunning, Paul <Gunning.Paul@epa.gov>; Birnbaum, Rona <Birnbaum.Rona@epa.gov>; Regan, Michael <Regan.Michael@epa.gov>; McCabe, Janet <McCabe.Janet@epa.gov>; Utech, Dan <Utech.Dan@epa.gov>; Cassady, Alison <Cassady.Alison@epa.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Shaw.elizabeth@EPA.gov; Nunez.alejandro@EPA.gov
**Subject:** Urgent Whistle Blowing Complaint concerning greenhouse gas regulations against 8 EPA administrators and 3 climate scientists alleging treason and violation of PL 104-113 sec 12(d)

Dear named ladies and gentlemen of EPA

I am not requesting confidentiality. I am not an EPA or federal employee or EPA or federal contractor. I have no ties to anyone. I am a private sector environmental engineer and do lots of work for the courts and litigating parties.

This is really, really bad for EPA and those named. Please review everything very carefully.

Bottom line:

There are **gargantuan** plumes of solar-heated seawater emanating from areas of open ocean that lie within the Antarctic Ozone Hole and areas of Amplified Arctic warming.

Its not from rising atmospheric CO2.

When you make runs with the virtual sensor set at 15 km above sea level at 66.5 deg S, 90 deg E off the NW coast of Antarctica with the Department of Energy NREL ASTM-certified SMARTS2.9.5 radiative transfer model linked to ASTM-certified spectral irradiance standard G-173-03 (last updated 2020) which includes ASTM-certified Chappuis band absorption coefficients comparing baseline 1979/80 to any year after 1993/94 there is not the least doubt that the plumes are due to stratospheric ozone depletion. There are massive increases in visible radiation entering the South Ocean's Antarctic Circumpolar Current (ACC) and way beyond every second of sunlight especially with the sun low in the sky in the spring (about half the sunlit hours). 20-50% stratospheric ozone depletion creates 20-50 percent increases in the amount of visible and UVA radiation entering the MBL relative to the amount absorbed at baseline.

You have been told by NASA, NOAA, LLNL, IPCC that the Chappuis band absorption is very weak and insignificant. Its not weak; its highly significant. It is moderately strong with a quantum yield of 1 during it passage through the stratosphere. They have been lying to everyone.

Engineers never never ever mess with relevant ASTM standards! Climate scientist?

Commencing with mastermind radical environmentalist James Hansen heading the NASA GISS GCM modeling group from 1982-2012, climate scientist working for NASA, NOAA, LLNL and IPCC have not only cast aside the relevant ASTM standards, they have purged the Chappuis band absorption coefficients from their government unique general circulation climate models (GCMs) and fraudulently assigned the stratospheric warming associated with Chappuis band absorption of visible radiation in the 0.5-0.8 micron continuum to postulated CO2 absorption at 13-14 microns somehow coming up from the Earth via the 100% opaque marine boundary layer excepting the 8-12 micron window which is essentially closed in the tropics. EPA bought in hook line and sinker to an utter and complete progressive-left academia hoax.

The Harvard/Smithsonian Center for Astrophysics is even worse. Their scientists with extensive input from NASA and Paris climate scientists, have continuous purged Chappuis band absorption coefficients from HITRAN and fraudulently assigned the stratospheric warming associated with Chappuis band absorption to postulated CO2 absorption at 13-14 microns somehow coming up from the Earth via the opaque marine boundary layer excepting the 8-12 micron window which is essentially closed in the tropics. EPA bought in hook line and sinker to an utter and complete progressive-left academia hoax

The US Air Force research lab MODTRAN radiative transfer model relies on HITRAN and has purged Chappuis band absorption coefficients commencing with version 2 in 1991.

Nevertheless, EPA is very clearly 100 percent responsible for determining whether CO2 is an air pollutant. The progressive-left greenhouse gas charade is entirely the fault of EPA and American citizens and businesses are paying a heavy price with damages already out of the roof and rising fast.

Picture yourself in Court tying to defend the GHGT with civil and environmental engineers easily explaining that all the bona fide empirical evidence is showing that the plumes coming from the ozone hole and associated sea-ice loss in the Arctic are from stratospheric ozone depletion and that the GHGT is a progressive-left hoax manufactured with corrupted numeric models.

You better do something fast or it will be too late.

I am here to help.

Sincerely

Brian Kelleher, Environmental Environmental Engineer (MS U-Mass Lowell civil engineering department 1983) with 30-years experience as neutral fact finder/court consultant assisting superior court special master and mediators, litigating parties, and insurance companies settle lawsuits stemming from the pollution of air, land and water without the need for trial.

Formerly of San Jose,CA now in Stockton, CA

Cell Ex. 6 Personal Privacy (PP)

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 6/30/2021 4:50:37 PM
**To**: Clarke, Victoria [clarke.victoria@epa.gov]
**CC**: Fugh, Justina [Fugh.Justina@epa.gov]; Griffo, Shannon [Griffo.Shannon@epa.gov]; Alejandra Nunez (Nunez.Alejandra@epa.gov) [Nunez.Alejandra@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]; Shaw, Betsy [Shaw.Betsy@epa.gov]; Ann Campbell (Campbell.Ann@epa.gov) [Campbell.Ann@epa.gov]
**Subject**: RE: Your Updated Recusal Statement
**Attachments**: Joe Goffman Updated Recusal - For Digital Signature.pdf

Thank you, Victoria and Everyone.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Clarke, Victoria <clarke.victoria@epa.gov>
**Sent:** Tuesday, June 29, 2021 6:15 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Fugh, Justina <Fugh.Justina@epa.gov>; Griffo, Shannon <Griffo.Shannon@epa.gov>
**Subject:** Your Updated Recusal Statement

Hi Joe,

As promised, I've attached your updated recusal statement.

The companies we sought a CD for have been removed and the corresponding sectors have been removed. You may notice that the sector names may look a little different than the first recusal statement – that's because we've been standardizing how we classify companies and sectors in OGC Ethics. Before you sign, make sure to double check with [redacted] that any of the companies that were held in [redacted] have likewise been sold. Based on my phone call with her last week I believe that to be the case, but best to be sure.

Ex. 6 Personal Privacy (PP)

As always, if you have any questions, please don't hesitate to reach out.

Victoria

Victoria Clarke
Attorney-Advisor
U.S. Environmental Protection Agency
Office of General Counsel | Ethics Office
Washington, D.C. |7348 WJCN
EPA Office: 202-564-1149
EPA Cell: 202-336-9101

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 7/22/2021 7:18:52 PM
**To**: Joseph Goffman [Ex. 6 Personal Privacy (PP)]; James W Bales [bales@mit.edu]
**CC**: J. Kim Vandiver [kimv@mit.edu]; Rakosnik, Delaney [rakosnik.delaney@epa.gov]
**Subject**: RE: Recommendation for Ex. 6 Personal Privacy (PP)

Delaney – Please see if we can find a time for this conversation. And, yes, this would be the second of these chats after the one I had with Ex. 6 Personal Privacy (PP) earlier this week. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Joseph Goffman <Ex. 6 Personal Privacy (PP)>
**Sent:** Thursday, July 22, 2021 3:13 PM
**To:** James W Bales <bales@mit.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** J. Kim Vandiver <kimv@mit.edu>
**Subject:** Re: Recommendation for Ex. 6 Personal Privacy (PP)

Trying again...

On Thu, Jul 22, 2021 at 3:09 PM Joseph Goffman <Ex. 6 Personal Privacy (PP)> wrote:

> Adding my EPA address so that my schedulers can find a time. Back to you soon. Thanks.
>
> On Thu, Jul 22, 2021 at 3:07 PM James W Bales <bales@mit.edu> wrote:
>
> > Dear Mr. Goffman
> >
> > I'm Dr. Jim Bales, and I am the chair of the search committee formed to find a new Communications Office for the MIT Edgerton Center.
> >
> > We recently conducted a delightful interviewed with Ex. 6 Personal Privacy (PP) of your staff. I'm now following up on her references, where she listed you as her former manager when you were the Executive Director of the Harvard Law School Environmental & Energy Law Program.
> >
> > Would it be possible to schedule short phone call to discuss her work with her? We have a tight timeline, I am afraid, so it would be deeply appreciated if we could speak no later than Monday (or, if need be, Tuesday).
> >
> > Best Wishes
> >
> > Jim Bales
> >
> > --
> >
> > Dr. Jim Bales
> >
> > Associate Director, MIT Edgerton Center

Room 4-406
77 Massachusetts Avenue
Cambridge, MA 02139
617.253.6178 (Works during the pandemic)
bales@mit.edu

Message

**From**: Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent**: 1/25/2021 1:22:31 AM
**To**: kenneth kimmell Ex. 6 Personal Privacy (PP)
**Subject**: RE: congratulations!

Hi, Ken. Thanks so much. I am extremely excited. Not sure how you can do better than the cast already weighing in for you, but if it ever turns out to be appropriate for me to add my voice I shall do so. Keep me posted, and good luck.

**From:** kenneth kimmell Ex. 6 Personal Privacy (PP)
**Sent:** Saturday, January 23, 2021 8:47 AM
**To:** Goffman, Joseph <jgoffman@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** congratulations!

Good morning, Joe, I was so pleased to hear that you have been appointed to such a key role at EPA. That is great news, and I am thrilled to see such a strong team forming. Congratulations to you--you must be so excited to have this opportunity.

I am still seeking a position within EPA as well, namely region one (New England) regional administrator, which dovetails well with my experience at UCS and also before that as the commissioner of the Massachusetts DEP. Senators Markey and Warren are backing me, as are many NGO's and others, and Gina McCarthy has also written a letter of recommendation for me. I mentioned this to you briefly a few months back.

I don't know if you will have any input in the RA selection, but if you had the opportunity to put in a good word for me, I would greatly appreciate it. This is a team that I would love to be part of! You are probably super busy right now, but if you wanted to talk, my number is Ex. 6 Personal Privacy (PP)

Best,

Ken Kimmell

Message

**From:** Goffman, Joseph [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=23474D598E8D4EDFA9214A5991F2935B-GOFFMAN, JO]
**Sent:** 1/25/2021 2:22:25 AM
**To:** Levine, Jake C [Ex. 6 Personal Privacy (PP)
**Subject:** RE: Obama climate adviser takes reins as EPA chief of staff

Thanks, Jake.

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**From:** Levine, Jake C Ex. 6 Personal Privacy (PP)
**Sent:** Thursday, January 21, 2021 9:07 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** FW: Obama climate adviser takes reins as EPA chief of staff

What excellent news -- and what a great team! Mazel tov!

---

**From:** POLITICO Pro Energy <alert@email.politicopro.com>
**Sent:** Thursday, January 21, 2021 5:54 PM
**To:** Levine, Jake C Ex. 6 Personal Privacy (PP)
**Subject:** Obama climate adviser takes reins as EPA chief of staff

[EXTERNAL]

## Obama climate adviser takes reins as EPA chief of staff

By Alex Guillén, Annie Snider

01/21/2021 08:52 PM EST

Dan Utech, a former Obama climate adviser, will serve as EPA's chief of staff, one of a slate of political appointments at the agency announced on Thursday evening.

Unlike administrator nominee Michael Regan or his deputy nominee Janet McCabe, none of the newly announced positions require Senate confirmation. But they will allow EPA to begin working on President Joe Biden's agenda, which included a hefty list of regulations to reconsider and rewrite.

The appointments include several Obama administration alumni, and some of the top officials who will serve in key offices, including the air, water and chemicals offices. The list also includes several diverse picks who have highlighted environmental justice issues in their past work.

After serving as an adviser to Hillary Clinton in the Senate, Utech joined the Obama administration at the Energy Department before becoming an energy and climate adviser to Obama in the White House. For the past four years he has run a consultancy called Climate Strategies and lectured at Yale University.

"EPA will be at the heart of President Biden's commitment to protect public health and the environment while building a clean energy future that creates good paying jobs," Utech said in a statement. "We will be guided by science as we work together to achieve these goals on behalf of all Americans."

Here are the other political appointees who have landed at EPA:

**Radha Adhar** will be deputy associate administrator for congressional affairs and comes from advising Sen. Tammy Duckworth (D-Ill.) on energy and environmental issues.

**Vicki Arroyo** will be associate administrator for policy. She has been executive director of the Georgetown Climate Center for 12 years.

**Tomás Carbonell** will be deputy assistant administrator for stationary sources in EPA's air office, which will place him in charge of major regulatory efforts for power plants, the oil and gas sector and other big industries.

He has worked at the Environmental Defense Fund since 2012, most recently as a senior counsel and director of regulatory policy. With expertise in greenhouse gases and the Clean Air Act, Carbonell played a role in multiple legal challenges to Trump EPA rollbacks of climate rules for the power sector and the oil and gas industry.

**Alison Cassady** will be deputy chief of staff for policy. She previously was deputy staff director for the House Select Committee on the Climate Crisis and before that was managing director of the Center for American Progress's energy and environment team.

**Dimple Chaudhary** will serve as deputy general counsel for nationwide resource protection programs. She was previously deputy litigation director for the Natural Resources Defense Council, which sued over many Trump-era EPA actions.

**Rosemary Enobakhare** as associate administrator for public engagement and environmental education. She served as the deputy to that position in the Obama administration, and since has worked at the Clean Water for All Coalition and most recently as campaign director of The Hub Project.

**Philip Fine** will be principal deputy associate administrator for policy after 15 years at the South Coast Air Quality Management District, a regional air regulator in California.

**Radhika Fox** as principal deputy assistant administrator for EPA's water office. She previously was CEO of the U.S. Water Alliance. She is a major voice for water infrastructure investment and elevated environmental justice issues at the nonprofit.

**Michal Freedhoff** will be principal deputy assistant administrator for EPA's chemical and pesticide office. She has been the Democratic oversight director for the Senate Environment and Public Works Committee for the past four years and helped craft the bipartisan 2016 overhaul of the Toxic Substances Control Act, as well as the upper chamber's legislative efforts to address PFAS. She starts on Jan. 25.

**Joe Goffman** will be principal deputy assistant administrator for EPA's air office. He was a top adviser on climate and air issues there during the Obama administration and played a major role in crafting the Clean Power Plan. He spent the past four years running the Environmental and Energy Law Program at Harvard Law School.

**Lindsay Hamilton** will run EPA's public affairs shop. She previously was senior director of national media strategy at the nonprofit communications outfit Climate Nexus.

**Sinceré Harris** will be White House liaison. She has been executive director of the Pennsylvania Democratic Party since 2015.

**Melissa Hoffer** will be principal deputy general counsel. A top energy and environment official in the Massachusetts attorney general's office since 2012, she participated in key lawsuits attacking Trump-era regulations. Hoffer previously spent seven years at WilmerHale and more than five years at the Conservation Law Foundation, a Boston-based environmental group.

**Casey Katims** will be deputy associate administrator for intergovernmental affairs. He comes from Washington Gov. Jay Inslee's office, where he directed federal and interstate affairs. He previously advised Rep. Suzan DelBene (D-Wash.).

**John Lucey** will serve as a special assistant to the administrator and comes from Regan's home agency, the North Carolina Department of Environmental Quality, where he has worked since 2015 and advised on high-level issues including the massive Duke Energy coal ash settlement, among other things.

*To view online*:
https://subscriber.politicopro.com/energy/article/2021/01/obama-climate-adviser-takes-reins-as-epa-chief-of-staff-2029978

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Message

**From**: Shaw, Betsy [Shaw.Betsy@epa.gov]
**Sent**: 2/11/2021 7:15:41 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]
**Subject**: RE: PMF Check in

Hi Joe,

Just looping back on the topic of PMFs. Here are the headlines:

1. Although OAR has had a long and good experience with the PMF program, the key OAR offices of most likely interest to Rachel (OAPPS and OAP) are over ceiling and not likely to have the necessary FTE to host a new PMF position in the near future.
2. Even if we did have an available FTE, the process has changed to a competitive one with Veteran's preference so we can no longer name request a candidate we like.
3. That said, I'm sure John Shoaff and Henry Ferland in OAPPS and Chris Grundler and his folks would be happy to speak with Rachel in the context of exploring whether she would be interested in doing a rotational assignment in OAR from whatever host organization she lands in. I can give them a heads up if you want to suggest to her to be in touch with them.

Please let me know how you'd like to proceed.

Thanks,

Betsy

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, February 10, 2021 10:53 PM
**To:** Shaw, Betsy <Shaw.Betsy@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
**Subject:** RE: PMF Check in

Thanks, Betsy.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Shaw, Betsy <Shaw.Betsy@epa.gov>
**Sent:** Wednesday, February 10, 2021 8:35 AM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
**Subject:** RE: PMF Check in

Hi Joe,

Ann may have experience in OW with this, but it's been awhile since we've hosted a PMF just due to the costs. That said, it's not impossible for us to contemplate. Let me get a refresh from Scott on current PMF-related procedures, and chat with a few folks to see if they'd be interested in interviewing Rachel. How does that sound?

Thanks,

Betsy

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Tuesday, February 9, 2021 10:29 PM
**To:** Campbell, Ann <Campbell.Ann@epa.gov>
**Cc:** Shaw, Betsy <Shaw.Betsy@epa.gov>
**Subject:** FW: PMF Check in

This is an inquiry from one of my proteges in my old job. She's been awarded a Presidential Management Fellowship and is interested in spending the relevant time period of the PMF program working in OAR on international issues. I recall that we had PMF in the IO and/or in OAP when I first arrived under Obama, but I've forgotten the details. Do you have an experience with or thoughts on this? Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Joseph Goffman < Ex. 6 Personal Privacy (PP)
**Sent:** Tuesday, February 9, 2021 10:25 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Fwd: PMF Check in

---------- Forwarded message ---------
From: **Rachel Westrate** Ex. 6 Personal Privacy (PP) .law.harvard.edu>
Date: Tue, Feb 9, 2021 at 10:03 AM
Subject: PMF Check in
To: Ex. 6 Personal Privacy (PP) >

Hi Joe!

I hope you are doing well, and had a great holiday break (if you got a break!). Congratulations on your appointment to EPA!! I speak for myself and the entire HLS (and probably global) environmental community when I say we are ecstatic to have you back there.

I just wanted to check in post-inauguration and post-appointment on the possibility of exploring a PMF appointment at the EPA. When we talked in December, you mentioned that the Office of Air and Radiation has a few people focused on international climate program coordination/domestic climate action in other countries. I would love to chat with anyone involved in that work, if they have started yet and/or have a minute to spare.

Obviously a lot is going on on your end, and with EPA writ large, so just let me know if now is the time to start reaching out, or if I should give it some more time!

Best,
Rachel

Rachel Westrate
Editor-in-Chief | *Harvard Environmental Law Review*
Harvard Law School | Class of 2021
Ex. 6 Personal Privacy (PP) law.harvard.edu | Ex. 6 Personal Privacy (PP)

Message

**From**: Stan Meiburg [Ex. 6 Personal Privacy (PP)]
**Sent**: 2/17/2021 1:51:35 AM
**To**: Michael H. Levin [mhlevin@mhllawgrp.com]
**CC**: Goffman, Joseph [Goffman.Joseph@epa.gov]; lazarus@law.harvard.edu
**Subject**: Re: FYI re DC Circuit ACE decision

Very interesting! Thank you!

Stan

Sent from my iPhone

On Feb 16, 2021, at 6:25 PM, Michael H. Levin <mhlevin@mhllawgrp.com> wrote:

Stan – Following up our chat dialogue during the ZOOM with Vicki Patton et al this PM.

Best.

Mike

Michael H. Levin Law Group, PLLC
3605 Tilden Street NW, Washington DC 20008
Tel: 202-828-3212
Cell: 202-253-4674
W: www.mhllawgrp.com
www.carbonfs.com

Member:
NLGC, LLC
Carbon Finance Strategies LLC
Solar Shield LLC

<ACE 2.FNL.BioCycle.2-16-21.docx>

DRAFT-DELIBERATIVE: INTERNAL DISTRIBUTION ONLY

# INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2019 REPORT COMMUNICATIONS PLAN

**March 30, 2021**

*Purpose*

Each year, EPA prepares the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (*Inventory*), which provides comprehensive information on national-level emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride going back to 1990. This impartial, policy neutral report, compiled annually since 1993, is due by April 15 of each year as part of the U.S. treaty obligations under the United Nations Framework Convention on Climate Change. A draft of the report was released in February for public review, and the final report (covering 1990-2019) is expected to be published by April 15, 2021.

**Ex. 5 Deliberative Process (DP)**

# Ex. 5 Deliberative Process (DP)

Commented [DM1]: Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

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# Ex. 5 Deliberative Process (DP)

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# Ex. 5 Deliberative Process (DP)

with the 2016 U.S. EPA [ HYPERLINK "https://www.epa.gov/ghgemissions/us-greenhouse-gas-inventory-report-1990-2014" ] estimates for the year 2012, which presents national totals for different source types.

**9. During his campaign, Biden laid out some ambitious goals for renewable energy. Do these trends suggest that we could meet those goals?**

The trend of declining emissions reflects a shift in the power sector towards cleaner sources of energy that we expect to continue.

In recent years, the cost of renewable energy has plummeted – becoming the cheapest form of new electricity in many areas of the country. In the last decade, the cost of wind has dropped more than 40 percent and the cost of utility-scale solar installations by more than 80 percent. Renewable energy is on the path to becoming the largest and fastest growing source of new electric capacity in the decades ahead – expanding nearly 50 percent by 2025.

Many of our nation's electric utilities have also embraced the benefits of energy efficiency as a low-cost resource, a way to cut emissions, and perhaps most importantly, to help their customers lower their energy costs and reduce energy burdens.

As a result of these transformations in the energy sector, carbon emissions in the power sector are on track to exceed the goals established in the Clean Power Plan – well in advance of the CPP's timeline, despite the law having never gone into effect.

Given the trends, and with a strengthened commitment to greenhouse gas reductions, energy efficiency, and clean energy technology, United States is well on the path to meet President's ambitious climate goals.

# Inventory of U.S. GHG Emissions and Sinks: 1990-2019

EPA Inventory Team

April 6, 2021

Office of Atmospheric Programs

# Briefing Outline

- Background
- Key Findings
- Improvements
- Changes to Public Review Draft
- Feedback from Public Review
- Trends in Key Sectors
  - Energy: Fossil Fuel Combustion and latest on 2020 emissions
  - Methane overview and focus on Oil and Gas
  - Agriculture, Forestry and Land Use
  - Note on GWPs
- Release Schedule/Relevant Events

# U.S. National Inventory Overview

- **EPA annually compiles a national U.S. GHG Inventory Report**
  - Official U.S. Government data on national GHG emissions and sinks over time by gas, source/sink and economic sector
  - All GHGs: $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$, and $NF_3$
  - Policy-neutral
  - Fulfills U.S. reporting commitment under the UNFCCC
  - (Started reporting in 1993)
- **Interagency effort led by EPA's Office of Atmospheric Programs (OAP)**
  - Involves other USG agencies (e.g., DoE/EIA, USDA/USFS, USGS, etc.) academic and research institutions, industry associations and other EPA offices (e.g., OTAQ)
- **Typical annual schedule**
  - May: Assessing improvements
  - June to September: Compilation of estimates, including improvements
  - October to November: 30-day expert review
  - February: Open for 30-day public review
  - Mid-April: Submittal to UNFCCC (April 15 deadline)
  - September: UNFCCC peer review

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# Understanding the GHG Inventory and GHG Reporting Program (Part 98)

| | U.S. GHG Inventory (UN Requirement) | GHG Reporting Program (Facility Reporting by Clean Air Act Regulation) |
|---|---|---|
| Scale | • National | • Facility |
| Coverage | • All U.S. anthropogenic emissions and sinks<br>  • Energy<br>  • Industrial Processes<br>  • Agriculture<br>  • Forestry and Land Use<br>  • Waste | • ~50% US direct anthropogenic emissions<br>• ~30% US indirect anthropogenic emissions (e.g., fuel & chemical suppliers)<br>• Over 7,600 facilities<br>• Facilities > 25,000 metric tons $CO_2$ equivalent per year<br>• Excludes agriculture, forestry and land use |
| GHGs | • $CO_2$, $CH_4$, $N_2O$, Fluorinated GHGs | • $CO_2$, $CH_4$, $N_2O$, Fluorinated GHGs |
| Methods | • IPCC higher "tiers" (Tier 2 and 3)<br>• Mix of measurement-based emission factors, models, and GHGRP data | • Mix of continuous, periodic measurements, and sampling<br>• Engineering calculations & emission factors |
| Time series | • Annual, 1990 – present | • Annual, since 2010 |
| Key dates | • Annual public review every February<br>• Final report published by April 15 | • Annual reporting deadline March<br>• Data published every Fall |

**GHGRP is an important input to calculating national-level emissions**
**(See Annex 9 of the U.S. GHG Inventory)**

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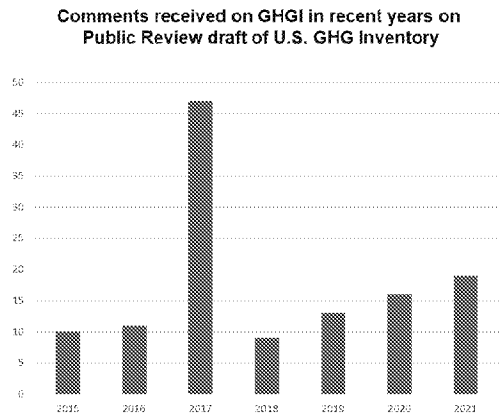
# Public Comment Overview

- Total Comments (19)
- Non-Technical
  - (1 anonymous to improve general readability of report)
- Technical (18)
  - Cross-cutting (1)
  - Energy (4)
  - IPPU (1)
  - Agriculture (9)
  - Waste (3)

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# EPA Oil and Gas Stakeholder Process

- As in previous years, EPA conducted a series of webinars for stakeholder feedback on oil and gas estimates in the 2021 GHG Inventory
- September 2020: Webinar
  - EPA presentations on updates under consideration for meters, mud degassing, and produced water
- November 2020: Webinar
  - Stakeholder presentations on pneumatic controllers, analyses of top-down bottom-up gap, and storage stations
  - EPA presentations on GHGRP, updates under consideration for $CO_2$ uncertainty and storage wells

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# Submission and Release Plan for Final GHG Inventory Report

**April 1-9**

**Communication materials**

- Q and As on report and updates since previous annual report
- Communication plan
- "Blurb" for Administrator Weekly

**April 13**

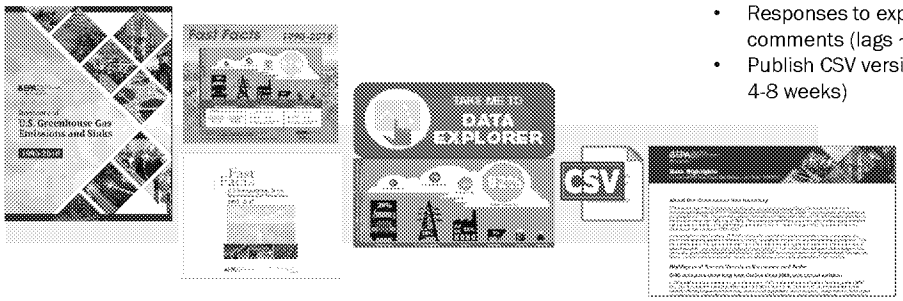
**Submit to UN**

- Report
- Data tables (i.e., "common reporting format")

**April 13**

**Publish to EPA web site**

- Inventory Report
- Fast Facts
- Technical Bulletin (Data Highlights)
- Interactive GHG Inventory Data Explorer
- Updates Gas/Sources of Emissions Web Pages
- Responses to expert and public review comments (lags ~7-10 days)
- Publish CSV versions of report tables (lags 4-8 weeks)

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# 2021 GHG Inventory Schedule and related Data publication

| Compilation step | April 2021 GHGI Report |
|---|---|
| 2020 GHGI Improvement Memo | *August 21, 2020* ✓ |
| *UNFCCC Centralized Review* | *November 2-6, 2020* ✓ |
| **Expert Review (ER)** | **October 20/27-November 19/30, 2020** ✓ |
| *O&G Stakeholder Workshop* | *November 2020* ✓ |
| Federal Register (FR) Notice Routing | *January 6, 2021* ✓ |
| PR - OAP/OAR briefings | *February 1, 2021* ✓ |
| *CAMD 2020 4th Quarter Data* | *End of Jan/early Feb* ✓ |
| **Public Review (PR)** | **February 10-March 12, 2021** |
| Final Report - CCD briefing | *March 31, 2021* ✓ |
| Final Report – OAP/OAR briefings | *April 1/6, 2021* ✓ |
| **Submission** | **April 13, 2020 (Tuesday)** |

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# Upcoming Events

- April Leader's Climate summit
- Updated NDC
- GHGRP proposed revisions
- Clean Air Act rulemaking discussions (e.g., 111d)
- G7/G20 preparatory meetings

# Annex

Additional information on *Inventory* arrangements, trends, etc.

# Inventory Arrangements

- EPA's Office of Atmospheric Program's (OAP) has the lead for preparing the U.S. Government submission (in coordination with other agencies and external partners)
  - EPA source/sink leads coordinate estimate compilation
- Key arrangements
  - Emission estimates:
    - USFS: C stock changes and non-$CO_2$ emissions from U.S. forest lands, harvested wood products
    - DOT/FAA & DOD: international aviation bunker fuels
    - Colorado State University and ARS: land representation, cropland and grassland soils
    - NOAA: C stock changes (i.e., blue carbon) and non-$CO_2$ emissions from coastal wetlands
  - Annual activity data:
    - EIA, USDA, USFS, USGS, DOT/FAA, DOD, BOEM, trade associations, and research studies
  - Other
    - Research: EPA's Office of Research and Development (flooded lands, oil & gas), Harvard (methane gridding)
    - General coordination (EIA, OAQPS/NEI, State Department, CARB)
- Contractors
  - Data collection, updating of time series, aggregation of source/sink estimates, compilation of written report, UNFCCC reporting tables, etc.
  - Design and updating of electronic data management systems



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# Agriculture, Forestry and Land Use Inventory Arrangements
## USG Agencies and Universities

**USDA's Office of the Chief Economist (Office of Energy and Environmental Policy):**
- Accessing new AFOLU data through various USDA surveys to support improvements to manure management, enteric fermentation and agricultural soils data
- Conservation Effects Assessment Project (CEAP)—Detailed land use and mgt. data from subset of NRI points
- Coordinate on periodic basis developing a supplemental and disaggregated USDA AFOLU Inventory Product

**USFS's Forest Inventory & Analysis National Program (FIA)**
- Oversees development of Forest Land and Settlement Trees estimates
- Coordinates on methods and data used to assess carbon stock changes resulting from land-use conversion into and out of Forest Lands

**Colorado State University's Natural Resource Ecology Laboratory (NREL)**
- Key university collaborator with EPA for over 19 years, also works with many USG agencies and is involved in developing multiple sections of the AFOLU Inventory:
  - Develops "Land Representation" product for use across all land use categories
  - Estimates fluxes from Cropland/Grassland/Settlements and Ag sources of $N_2O$ and $CH_4$

**NOAA's Climate Program Office**
- Supporting work on producing Coastal Wetland estimates

**USGS Climate and Land-Use Office**
- Assists with integrating and improving remote sensing products used in the AFOLU Inventory
  - Assess uncertainty in the spatial products such as NLCD and LC-Map
  - Providing pre-1990 land use conversion data from Landsat time series
  - Developing surface-water layer product

**EPA's Office of Research and Development**
- Supporting inclusion of $CH_4$ from flooded lands (e.g., reservoirs)—likely the largest unreported anthropogenic source of $CH_4$



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# Statutory Authority

The **Global Climate Protection Act of 1987**, 15 U.S.C. 2901, Section 1103 states "[t]he Secretary of State shall be responsible to coordinate those aspects of United States policy requiring action through the channels of multilateral diplomacy.... In the formulation of these elements of United States policy, the Secretary of State shall, under the direction of the President, work jointly with the Administrator of the Environmental Protection Agency and other United States agencies concerned with environmental protection, consistent with applicable Federal law." The Global Climate Protection Act of 1987 is codified as 15 U.S.C. Sec. 2901, Note. Section 1103 informs the responsibilities of the State Department and the U.S. Environmental Protection Agency with regard to inventories. Since the passage of the Global Climate Protection Act, the EPA's role has been to coordinate with other Federal Agencies the preparation of greenhouse gas inventories.

**Section 103 of the Clean Air Act**, 42 U.S.C 7403 requires the Administrator to establish a national research and development program for the prevention and control of air pollution. Section 103 (b)(6) authorizes the Administrator to establish a national research program to "…collect and disseminate, in cooperation with other federal departments and agencies, and with other public and private agencies, institutions, and organizations having related responsibilities, basic data on chemical, physical, and biological effects of varying air quality and other information pertaining to air pollution…." Section 103 (c)(2), entitled "Air Pollutant Monitoring, Analysis, Modeling, and Inventory Research," requires the Administrator to "conduct a program of research, testing, and development of methods for sampling, measurement, monitoring, analysis, and modeling of air pollutants." The program is to include the "[e]stablishment of a national network to monitor, collect, and compile data with quantification of certainty in the status and trends of air emissions…."

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Message

**From**: Carbonell, Tomas [Carbonell.Tomas@epa.gov]
**Sent**: 4/13/2021 9:31:19 PM
**To**: Cynthia Giles Ex. 6 Personal Privacy (PP) Goffman, Joseph [Goffman.Joseph@epa.gov]; Shaw, Betsy [Shaw.Betsy@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]
**Subject**: RE: Next Gen and Climate Change

Thank you very much for sharing this, Cynthia. Best wishes,

Tomás

---

**From:** Cynthia Giles Ex. 6 Personal Privacy (PP)
**Sent:** Tuesday, April 13, 2021 4:17 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>; Shaw, Betsy <Shaw.Betsy@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>; Carbonell, Tomas <Carbonell.Tomas@epa.gov>
**Subject:** Re: Next Gen and Climate Change

Actually, it's here.

On Tue, Apr 13, 2021 at 4:04 PM Cynthia Giles Ex. 6 Personal Privacy (PP) wrote:

> Writing to let you know that I just posted a new article on the Harvard website. Next Generation Compliance: Preventing Widespread Violations that Threaten Climate Goals. It looks at three near term climate rules – electric generation (focus on energy efficiency), transportation (focus on the renewable fuel standard), and methane from oil and gas – and how to avoid implementation fails by building strong compliance into the rules. It is far too late in the day to risk compliance collapse with these rules. This article is about what we can do to ensure that doesn't happen.
>
> As Joe, Betsy and Ale know, this is written in my characteristically blunt fashion. Don't beat around the bush is my view!
>
> The article is posted – along with other articles in the series – on the Harvard Environmental and Energy Law page here.
>
> It is wonderful to be writing about this now, when you all are giving me reason for hope!
>
> Best -
>
> Cynthia

Message

**From**: Millett, John [Millett.John@epa.gov]
**Sent**: 4/20/2021 9:27:13 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]; Jones, Enesta [Jones.Enesta@epa.gov]
**Subject**: RE: Questions related to story on your first three months at OAR

# Ex. 5 Deliberative Process (DP)

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Tuesday, April 20, 2021 5:21 PM
**To:** Millett, John <Millett.John@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>; Jones, Enesta <Jones.Enesta@epa.gov>
**Subject:** RE: Questions related to story on your first three months at OAR

# Ex. 5 Deliberative Process (DP)

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Millett, John <Millett.John@epa.gov>
**Sent:** Tuesday, April 20, 2021 4:57 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>; Jones, Enesta <Jones.Enesta@epa.gov>
**Subject:** RE: Questions related to story on your first three months at OAR

# Ex. 5 Deliberative Process (DP)

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Tuesday, April 20, 2021 10:52 AM
**To:** Millett, John <Millett.John@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>; Jones, Enesta <Jones.Enesta@epa.gov>
**Subject:** FW: Questions related to story on your first three months at OAR

Please take a crack at these. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Sean Reilly <sreilly@eenews.net>
**Sent:** Tuesday, April 20, 2021 10:42 AM

**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Jones, Enesta <Jones.Enesta@epa.gov>
**Subject:** Questions related to story on your first three months at OAR

Hi Joe:

While I understand that you don't think the time is right for an interview at this stage, I do need to run a couple of questions by you as a matter of due journalistic diligence. Any assistance you can provide in addressing them would be appreciated. My deadline is 10 a.m. tomorrow.

1) The attached amicus brief, filed in pending litigation over the 2020 ozone NAAQS rule, alleges that in your prior position at Harvard, you coordinated with Democratic state attorneys general on a legal strategy intended (if I understand Mr. Horner correctly) to ultimately regulate greenhouse gases under the NAAQS umbrella. As I far as I can tell, EPA has not yet responded to these allegations in court. Given that the brief names you directly, however, do you have any comment on whether you share that goal with the plaintiffs or on Energy Policy Advocates' allegations more generally?

A. Legal analysis in the private sector or an academic setting is a very different endeavor than when in public service. In public service, the emphasis is on following the counsel and guidance of the agency's legal and technical experts, which is based on case law, statutory imperatives, technical and scientific data, and health and environmental research.

2) According to your February calendar, you had informational discussions on Feb. 11 and Feb. 23 with Bill Wehrum and Anne Austin, respectively. Did those discussions take place, were they initiated at your request and, if so, what was the purpose, given that you're already seeking to undo some of the initiatives undertaken during their respective tenures at OAR?

A. It's routine for incoming OAR leadership to touch base with their predecessors. The meetings were collegial and cordial.

3) Have you been told by the Biden administration whether you will be nominated to be assistant administrator of OAR on a Senate-confirmed basis and, if so, what were you told? If not, what's your understanding of the administration's plans in that regard and do you want the position on a Senate-confirmed basis?

A. Agency policy is to refer questions about future nominations to the White House.

Thanks very much,
Sean

Sean Reilly
Reporter
E&E News/Politico
202-316-4596 (Cell)
Skype: Sreilly_69
sreilly@eenews.net
Twitter: @SeanatGreenwire

**Brian T Kelleher**

Ex. 6 Personal Privacy (PP) Stockton, CA Ex. 6 Personal Privacy (PP)
cell Ex. 6 Personal Privacy (PP)

June 1, 2021

Office of the Inspector General for EPA via upload to the HOTLINE with copies by pdf attachments to all those named for whom I could find email addresses:

Re: Whistle-blowing complaint concerning greenhouse gas regulations against eight United States Environmental Protection Agency (EPA) administrators and three high-level scientists employed by EPA as of May 2021 in decision-making positions alleging treason and rampant civil negligence in connection with wanton violation of Public Law 104-113 Section 12(d) and OMB circular A-119 including the following three counts: **COUNT 1** – I allege that these eleven treasonous and grossly negligent civil servants commencing at least as far back as December 7, 2009, and continuously since then have failed to rely on the use of DOE NREL voluntary consensus standard ASTM G-173-03 "Spectral Irradiance" which includes associated ASTM/ISO-certified **Chappuis band** absorption coefficients coupled to the ASTM-certified SMARTS2.9.5 simple radiative transfer model to identify the well-documented pronounced seasonal climate-warming effects of well-documented levels of stratospheric ozone depletion comparing baseline 1980 and ozone-depleted 1993 and continuing in a depleted state thereafter, particularly in the areas of so-called "Amplified Arctic Warming" and off certain areas of coastal Antarctica. **COUNT 2** – I allege that these same eleven treasonous and grossly negligent civil servants commencing at least as as far back as December 7, 2009, and continuously since then have failed to recognize that federal employees within NASA, NOAA, DOE's LLNL, and the Harvard Smithsonian Center for Astrophysics who have been building extremely complex government-unique general circulation climate models (GCMs) and a government-unique HITRAN international standard database for use by the United Nations/World Meteorological Organization International Panel on Climate Change (IPCC) in an effort to prove out the crackpot greenhouse gas theory of global warming were also legally bound to similarly rely on the use of DOE NREL voluntary consensus standard ASTM G-173-03 "Spectral Irradiance" which includes associated ASTM/ISO-certified **Chappuis band** absorption coefficients, coupled to the ASTM-certified SMARTS2.9.5 simple radiative transfer model. They should have known that the GCMs, HITRAN database and the IPCC reports were potentially severely corrupted with green bias and unacceptable for EPA use in promulgating regulations that declare CO2 an air or water pollutant. **COUNT 3** – I allege that these same eleven treasonous and grossly negligent civil servants commencing at least as far back as December 7, 2009, and continuously since then were obligated under the Clean Air Act and Clean Water Act to act prudently and extremely carefully before declaring CO2 an air and water pollutant given the stakes to our country. In particular, they were obligated to take into consideration the fact there was/is clearly stated unambiguous empirical evidence published in January 1974 by NASA GISS coupled with empirical evidence published on line on the NASA GSFC Ozone Watch web sites commencing in 2006 that massively expanded since then, collectively proving definitively and unambiguously that stratospheric ozone depletion was/is causing the rising atmospheric CO2 levels and warming trends. I allege that rather than so doing, EPA exhibited clear-cut progressive-left Ideology* in acting treasonously, imprudently and with extreme recklessness by putting blind trust in the reports issued by the IPCC given the level of overt green bias that permeates the IPCC reports in completely ignoring overwhelming unambiguous evidence on the warming effects of stratospheric ozone depletion. Under Count 3, I further allege that with all that was at stake, EPA was obligated and remains obligated to do what I have done as one of the country's top private-sector environmental engineers: conduct a proper and professional, dispassionate, completely unbiased independent engineering analysis using the relevant and applicable ASTM/ISO engineering standards as to whether or not rising atmospheric CO2 since 1980 was causing global-warming trends since 1980 in the face of massive empirical evidence published by NASA and others that stratospheric ozone depletion was the source of both the atmospheric CO2 increases and the global-warming trends since 1980.

*By "progressive-left Ideology" I am assuming an inherently treasonous disdain/contempt/loathing for Capitalism coupled with a radical Marxist conviction that leaders of the socialist transition need to be active in encouraging and moving along the inevitable self destruction of the Capitalist system.

Dear Office of the Inspector General for EPA (Sean O'Donnell):

**Chappuis band**! Though EPA, NOAA, NASA, DOE/LLN, Smithsonian, Department of State Office of Global Change (USOGC) and IPCC climate scientists consistently carefully shun any discussion of the effects of the **Chappuis band** absorption of visible radiation in the stratosphere, no climate scientist would dare deny that the stratospheric ozone layer absorbs significant levels of sunlight in its orange and red spectral regions when the sun is very low in the sky due to very high solar-zenith angles/maximum slant path through the Earth's atmosphere. This is because **Chappuis band** absorption is known to affect the color of the twilight sky due to absorption within the visible spectrum. Beyond the twilight sky, however, high solar-zenith angles/slant paths are characteristic of the polar zones (70-90 deg N or S latitude) and to a slightly lesser extent the sub-polar zones (50-70 deg N or S latitude). Climate scientists will also be happy to confirm that between 1980 and 1993, there is definitive empirical evidence via the NASA Goddard Space Flight Center (GSFC) Ozone Watch websites posted beginning in 2006 showing that stratospheric ozone levels declined sharply with the maximum effects in the polar zones and sub-polar zones and that the levels have for the most part remained heavily depleted at the same levels since 1993. What they will not tell you, however, is that every shred of bona fide scientific empirical data from multiple lines of empirical evidence gathered by the world's scientific community since 1980 proves definitively that both the rising atmospheric CO2 and global-warming trends observed since 1980 are very obviously due to the well-documented stratospheric ozone depletion at high solar-zenith angles. To wit, they are down playing the clear-cut forensic significance of gargantuan plumes of solar-heated seawater emanating from the infamous Antarctic ozone hole. To wit, they are also down playing the clear-cut forensic significance of massive plumes of near-surface solar-heated seawater emanating from areas of peak ozone depletion in the sea-ice-loss-prone Arctic which they simply refer to as "Arctic Amplification." Let me set the record straight on the forensic significance: the source of this polar and sub-polar solar-heated seawater and associated sea-ice loss could not be more obvious and it is very clearly not from rising atmospheric CO2 levels; it is definately from stratospheric ozone depletion in the **Chappuis band**.

Almost every word published by EPA on its web pages devoted to climate change or ozone depletion are demonstrably misleading or flat-out wrong. The posts are saturated with progressive-left Ideology. In this complaint, I will explain why there is not a single word about the massive Ocean warming effects of **Chappuis band** absorption in the severely green-biased EPA posts and voluminous scientific reports on climate change periodically issued by the severely green-biased-corrupted IPCC and jointly issued every five years by a coalition of severely green-biased-corrupted federal employees working within federal agencies operating within the Executive Branch including EPA, NASA, NOAA, LLNL, Smithsonian and USOGC. Simply put, it pains me to report that our country has been under attack by cells of severely green-biased civil servants that have gained powerful positions within the Executive Branch and especially including the EPA. Because the green-biased-corrupted IPCC and Executive Branch climate scientists including those working for EPA are mum on the subject, I am raising the red flag high and jumping up and down shouting out **Chappuis band! Chappuis band!! Chappuis band!!!**

Rather than paying due attention to the effects of the critically important **Chappuis band**, on December 7, 2009, EPA's rampantly negligent Administrator recklessly signed two distinct, equally disastrously erroneous findings regarding greenhouse gases under section 202(a) of the Clean Air Act which are clearly based on the published findings of the massively green-biased International Panel on Climate Change and related reports parroting the findings issued via the USOGC every five years by

severely green-biased scientists employed within the Executive Branch rather than any legally proper and competent internal EPA civil or environmental engineering analysis of bona fide empirical evidence. Quoting from a current EPA webpage:

**Endangerment Findings**: *The administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—carbon dioxide (CO2), methane (CH4), nitrous oxide (N2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6)—in the atmosphere threaten the public health and welfare of current and future generations.* **From overwhelming empirical evidence we now know for certain that they don't and that there is no such threat.**

**Cause or Contribute Finding**: *The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicles engines contribute to the greenhouse gas pollution which threatens public health and welfare.* **From overwhelming empirical evidence we now know for certain that they don't and that there is no such contribution.**

First and foremost, in publishing these disastrously reckless and erroneous findings, EPA administration and key staff and the Agency itself were acting in wanton violation of the NTTAA and updated OMB Circular A-119. The NTTAA is the National Technology Transfer and Advancement Act which Congress codified into Public Law 104-113 (1995). The law directs Federal agencies to utilize voluntary consensus standards (for example via American Society of Testing and Materials (ASTM, now ASTM International) or the International Standards Organization [ISO]) wherever possible and strictly prohibits federal agencies and employees from developing government-unique standards in the presence of relevant and applicable voluntary consensus standards. Federal agencies and their employees are specifically required to work through and seek guidance from the Interagency Committee on Standards Policy (ICSP) if questions arise as to whether there is an existing relevant or applicable voluntary consensus standard or a need for a government-unique standard. In issuing the above findings, EPA Administrators and key staff recklessly and illicitly blew off these statutes and regulations and relied exclusively on progressive-left corrupted government-unique standards rather than the following relevant and applicable voluntary consensus standard jointly adopted by the Department of Energy (DOE) and ASTM in 1982: currently ASTM G-173-03 (2020) (formerly E-891) which is a spectral irradiance international standard database that rules out the use of the corrupt HITRAN database for determining the effects of ozone depletion on climate change. This ASTM spectral irradiance standard is currently coupled to the DOE/NREL ASTM certified SMARTS2.9.5 simple radiative transfer model (formerly SPCTRAL2) which rules out the use of all GCMs and the corrupt U.S. Air Force Research Lab (AFRL) MODTRAN radiative-transfer model for determining the effects of ozone depletion on climate change.

The stated purpose for mandating the use of voluntary consensus standards in OMB-Circular A-119 was to protect U.S. commerce from wasteful spending. However, by inference, the use of voluntary consensus standards versus government unique standards eliminates the possibility as well as the potential appearance of bias, malfeasance or incompetence by Executive Branch Agencies and their employees. Moreover, upon entering Executive Branch service all employees are required to swear an oath of allegiance to the United States in upholding its laws and its constitution. They are also subject to a strict code of conduct (5 C.F.R. Part 2635). Putting the interests and progressive-left Ideology of the IPCC above the interests of United States government and its citizens by willfully sabotaging the calibration of a complex GCMs to destroy the U.S. fossil fuel industry is a brazen act of treason as far as I am concerned.

SMART2.9.5 and its antecedent SPECTRAL2 issued circa 1982 are designed for use by anyone interested in evaluating the viability of solar energy at any given location in the United States or within the polar zones represented by the Arctic. When this standard is used to assess the effects of stratospheric ozone depletion on the amount of solar energy at a given location under clear sky conditions, it reveals economically beneficial increases in the amount of shortwave radiation in the **Chappuis band** reaching the earth's surface with the benefits growing with increases in latitudes. However, when this standard is

used to assess the effects of stratospheric ozone depletion on the amount of solar energy entering the Ocean resulting from the Antarctic Ozone Hole including the aftereffects of its seasonal collapse, it shows absolutely massive increases in the orange spectral band of shortwave radiation seasonally entering the Antarctic Circumpolar Current, Southern Ocean, South Atlantic, South Pacific and Southern Indian Ocean comparing baseline 1980 to ozone depleted 1993 and at all times thereafter.

Secondly, EPA is aware that commencing in mid 2020, I have been filing whistle blowing complaints against certain federal employees working within EPA, NASA, NOAA, Smithsonian, and the DOE's Lawrence Livermore National Laboratory (LLNL) that created the government unique general circulation climate models (GCMs) that have been used by the IPCC since it was formed in 1988. I have been alleging wanton violation of the same law as well as sedition and treason for sabotaging the GCMs and associated HITRAN international spectrographic database to suppress evidence of the global-warming effects of stratospheric ozone depletion and concoct evidence of a non-existent greenhouse gas feedback effect that violates the first and second laws of thermodynamics. The complaints point out that those who created the models and database were maliciously purging the GCMs and HITRAN of **Chappuis band** absorption coefficients and fraudulently crediting the warming effects of **Chappuis band** absorption in the stratosphere to greenhouse gases. These complaints cite undisputed NOAA reports of gargantuan plumes of solar-heated seawater emanating from the shores of Antarctica (the ozone hole) and similar areas of "Amplified Arctic Warming" that have experienced severe stratospheric ozone loss since 1980.

Because the bona fide evidence could not be more clear that stratospheric ozone depletion is causing all global warming trends since 1980 including increasing atmospheric CO2 and methane levels, I am naming the following EPA administrators (first eight) and staff (last three) in this complaint and demanding they promptly comply with PL 104-113 section 12(d) and put an end to the progressive-left greenhouse gas charade.

1. Michael Regan, Administrator; EPA Office of the Administrator (AO);
2. Janet McCabe Deputy Administrator, AO;
3. Dan Utech, Chief of Staff, AO;
4. Alison Cassady; Deputy Chief of Staff for Policy, AO,
5. Joseph Goffman, Acting Assistant Administrator and Principal Deputy Assistant Administrator, EPA Office of Air and Radiation (OAR) which is under AO;
6. Elizabeth Shaw, Deputy Assistant Administrator OAR;
7. Tomas Elias Carbonell, Deputy Assistant Administrator for Stationary Sources, OAR;
8. Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources, OAR;
9. Chris Grundler, Director OAR Office of Atmospheric Programs (OAP);
10. Paul Gunning, Director Climate Change Division, (CCD/OAP);
11. Rona Birnbaum, Chief Climate Science and Impacts Branch, CSIB/CCD).

I incorporate by reference all lines of evidence I previously submitted to the EPA's IG in my prior complaints naming Drs. Grundler and Birnbaum of wanton violation of PL 104-113, section 12(d) and OMB Circular A-119 in failing to protect U.S. Commerce.

As Line of Evidence # 1 for this new complaint, I am providing copies of two reformatted manuscripts I submitted in April 2021 for publication in the American Meteorological Society (AMS) *Journal of Climate* both of which have since been unjustifiably declined as unworthy of consideration confirming my opinion that the scientific peer-review process has been weaponized by the progressive-

left elite and, as to be expected, is heavily corrupted with green bias as to climate-change topics. The papers are respectively titled as follows:

- "Overwhelming empirical evidence that global warming since 1937 is from stratospheric ozone depletion (last uploaded to AMS April 1, 2021) ";
- "Overwhelming empirical evidence that increasing atmospheric CO2 since 1937 stems from stratospheric ozone depletion (last uploaded April 14, 2021)."

Given the ongoing efforts of the recently elected Biden administration to impose the progressive-left Green New Deal on hapless Americans as a direct result of the treasonous and negligent behavior of the EPA employees named above including wanton violation of PL 104-113 section 12(d), I request prompt action. The pending economic impacts are out the roof and are mounting.

With respect to my findings and allegations, as a bona fide expert with 30-years environmental-engineering experience in objectively and impartially gathering, synthesizing and analyzing allegedly conflicting empirical evidence on the source and timing of air and water pollution in a judicial setting, let me assure you that there is not a shred of bona fide empirical evidence that would stand up in court supporting the greenhouse gas theory of global warming or associated alleged build up of dissolved carbon dioxide (CO2) in the Ocean, also referred to as Ocean acidification. I also assure you that there is no bona fide empirical evidence that CO2 is an air or water pollutant. The evidence that was presented to the Supreme Court in Massachusetts et al. v EPA (2007) challenging EPA's spot on determination in 2003 that CO2 is not an air pollutant was utterly unconvincing. Unfortunately, when the matter was remanded back to EPA for additional assessment, EPA staff appear to have caved to political pressure by the progressive-left Obama Administration when it declared CO2 a greenhouse gas pollutant in February 2010 by relying completely on green-biased and grossly inaccurate IPCC climate-assessment reports and the like that rely on corrupt numeric models and the corrupt HITRAN database. To repeat, there is zero bona fide empirical evidence that CO2 is an air or water pollutant. There is nothing but conjecture and deceit. CO2 is the antithesis of a pollutant since it is the principal source of life on Earth. This is not a close call.

Based on my extensive environmental-engineering experience in impartially evaluating empirical evidence relating to air and water pollution, I assert with 100% confidence that the actual bona fide empirical evidence collected by climate scientists and meteorologists since 1980 points exclusively, definitively and unambiguously to stratospheric ozone depletion and in particular associated increases of downwelling shortwave radiation in the orange spectral region of visible light. This is called the **Chappuis absorption band** centered at 0.55-0.65 micron with a continuum that spans a slightly broadened visible range of 0.4 to 0.8 micron. There is also a significant contribution from UVA in the 0.215-0.40 micron band particularly in the Antarctic. Given the fact that there is zero bona fide empirical evidence supporting the so-called greenhouse gas theory (GHGT), this also is not a close call.

Shedding light on why stratospheric ozone depletion has such a pronounced effect at the Ocean surface, the orange spectral band of sunlight is absorbed in the top 10 meters of crystal-clear seawater with 15% in the top meter. In turbid seawater characteristic of sea-ice melt fronts the percentage absorbed in the top meter is much higher. UVA absorption/penetration in seawater is about the same. Stratospheric ozone depletion and recovery easily explains all extended periods of warming and cooling in the Holocene Era including the current warming.

Moreover, I continue to point out that Figure 6 of the seminal January 1974 paper by Lacis and Hansen of NASA GISS (see Section 1.1 of my April 1, 2021 paper) and the associated textual explanation all by itself utterly destroys the GHGT and proves definitively that prolonged periods of stratospheric ozone depletion will definitively cause the Earth/Ocean-surfaces to warm particularly in the polar and sub-polar zones in the early morning and late-afternoon hours (six of the twelve average hours of daylight).

I further point out that there is ample empirical evidence that the extremely heavy stratospheric ozone depletion since 1980 is the result of a natural approximately bi-millennial solar cycle that appears to be related to certain planetary alignments with the sun.

I further continue to point out that the same NASA GISS personnel (Lacis and Hansen) who co-authored the seminal 1974 paper, created the first of the corrupt general circulation models (GCMs) constructed by NASA GISS on behalf of the IPCC with the transparent intent of subverting evidence of the global-warming effects of ozone depletion and concocting evidence of a phantom greenhouse gas back-radiation effect that brazenly defies the first and second laws of thermodynamics.

While the GHGT is easily proven to be invalid, multiple lines of overwhelming empirical evidence prove definitively and unequivocally that well-documented top-down stratospheric ozone depletion commencing in 1980 is the direct and sole cause of all associated well-documented global warming trends that commenced concurrently with ozone depletion in 1980 including increasing atmospheric CO2 levels. The same lines of empirical evidence coupled with additional lines of bona-fide empirical evidence reveal the onset of a natural cycle of Grand Solar Maximum atmospheric conditions in 1937 with related warming trends that temporarily subsided in the 1960s and 1970s. The ozone depletion is caused by solar-storm and solar-wind related energetic particle precipitation (EPP) that enters the atmosphere via the polar auroral rims rather than from bottom-up impacts from pollutants such as CFCs.

**Evidence that the above-referenced eleven EPA employees among other federal employees have committed and continue to act treasonously and negligently in failing to comply with PL 104-113 section 12(d)** – Looking at the current political situation as a whole as it relates to academia, it is abundantly clear that the United States free-enterprise system and in particular its fossil-fuel industry has been under a concerted brazen attack by a well organized, well funded, international progressive-left academic community including/encompassing the IPCC that is working in concert with the Chinese Communist Party and America's self-described democratic socialist party currently headed by Biden and Harris (collectively the progressive-left alliance). Whether they realize it or not, the above-referenced eleven EPA employees named in this complaint are not only failing to meet their obligations to serve their country by protecting its economy from this terrible menace as compelled under PL 104-113 section 12(d), they are assuming the role of ringleaders of that component of the progressive-left alliance that is attacking U.S. commerce and in particular the fossil fuel industry from within the Executive Branch. Clearly, at this point in time, the above-referenced eleven EPA employees working in tandem with similar progressive-left cells within NOAA, NASA, Smithsonian, DOE/LLNL, USOGC and elsewhere are directly responsible for the Executive Branch's endorsement of the transparently corrupt GCMs and the corrupt HITRAN database currently in use by the IPCC. The IPCC was created by academia to destroy the fossil fuel industry and needs to be recognized as a very severe progressive-left threat to all capitalist/free-market systems across the world.

Additionally and in particular, in summarizing the key evidence set forth in the two papers or prior complaints against Drs. Grundler or Birnbaum, I allege as follows with respect to the above-referenced eleven EPA employees in supporting my allegations of civil negligence and brazen violation of PL 104-113 Section 12(d):

1. They are fully aware or should be that the GHGT does not stand up to the most basic environmental-engineering standards and principals and is aptly considered by qualified environmental and civil engineers and the EPA Administrators to be: the quintessential crackpot scientific theory; the mother of all scientific wild goose chases; and a disgraceful progressive-left greenhouse-gas charade.
2. They are fully aware or should be that commencing in the late 1970s, the Department of Energy (DOE) newly created Solar Energy Research Institute (SERI) which DOE morphed into the National Renewable Energy Lab [NREL] in 1991) began working closely with the Department of Commerce (DOC) Office of Management and Budget (OMB) and ASTM engineers and

physicists to develop an international voluntary consensus standard for accurately measuring spectral irradiance at the Earth's surface. The resulting ASTM standard E-891 (last updated in 2003 as G-173-03) which was a tabularized database of ASTM-certified absorption and extinction coefficients was published in 1982 along with the NREL SPCTRAL2 radiative-transfer model which was linked to the ASTM standard database.

3. They are fully aware or should be that ASTM Spectral Irradiance Standard E-891 first published in 1982 and recertified in 1987 (last updated in 2003 as G-173-03) included ozone's Hartley, Huggins and **Chappuis band** absorption coefficients initially derived by the U.S. Air Force Geophyical Lab (AFGL) in 1953 and first published by the AFGL for DOE use in 1980. The AFGL took the coefficients from NASA's seminal paper by Lacis and Hansen, 1974 (LH74) titled *A parameterization for the absorption of solar radiation in the Earth's atmosphere*. In this paper the authors specifically claim that the ozone parameterization was intended for use in climate models and was more than sufficiently accurate. In particular, LH74 Figure 6 plots ozone optical density vs the percentage of incident total solar flux absorbed in the stratosphere, then and still assumed to be 1,366 W/m2. Because SPCTRAL2 includes the same **Chappuis band** absorption coefficients plotted in LH74 Figure 6, it predicts that stratospheric ozone depletion at mid to high latitudes significantly benefits the solar energy industry by significantly increasing the levels of the visible spectrum of shortwave radiation reaching Earth primarily in the early morning and late in the day with the benefits increasing with latitude. This beneficial effect associated with stratospheric ozone depletion is referred to vernacularly as "solar brightening."

4. They are either fully aware or should be that proving/confirming the case for stratospheric ozone loss being the source of global warming due to solar brightening, there are gargantuan near-surface and subsurface plumes of solar-heated seawater emanating from certain coastal areas of Antarctica that extend all the way to the southwestern Atlantic and southeastern Pacific tropics reaching great depths along the way. Of utmost significance, these certain coastal areas from which the plumes are emanating lie within the boundaries of the infamous Antarctic ozone hole that began opening up dramatically in the early 1980s and reach seasonal peak levels of depletion exceeding 50% in spring and early summer (Aug-Dec). Of utmost significance, these certain coastal areas which are propagating the plumes are located precisely where open or partially open Ocean fronting and extending away from seasonal Antarctic sea-ice is exposed to downwelling shortwave radiation during Aug-Dec at peak ozone-depletion levels.

5. They are either fully aware or should be that there is definitive empirical evidence that shows that the open or partially open coastal waters surrounding Antarctica that lie within the Antarctic Circumpolar Current (ACC) receive/absorb extraordinarily large amounts of diffuse visible and UVA radiation due to Antarctica's topography, perennial snow and ice cover and meteorology. This strongly amplifies the effects of stratospheric ozone depletion in the greater Antarctic.

6. They are either fully aware or should be that commencing in the early 1970s certain severely green biased NASA GISS and NOAA GFDL personnel, based on the utterly false premise that stratospheric CO2 creates a greenhouse gas feedback effect that brazenly violated the first and second laws of thermodynamics, took it upon themselves to construct extremely complex 3D black-box type numeric models for the sole purpose of attempting to prove that rising stratospheric CO2 levels were capable of causing global warming trends in the complete absence of any supporting bona-fide empirical evidence. They were looking at and severely misinterpreting 800,000 years worth of proxy ice-core data showing a close relationship between atmospheric CO2 levels and near-surface air and Ocean temperature. Of the utmost significance, GCMs are 100% the wrong engineering tool for assessing the impacts of ozone depletion on the amount of shortwave radiation reaching and entering the Oceans during daylight hours at any given time and location. The 100% correct engineering tool since 2003, is the Department of Energy (DOE) National Renewable Energy Lab (NREL) SMARTS2.9.5 radiative transfer model

coupled with the updated ASTM Spectral Irradiance Standard G-173-03 last recertified in 2020. SMARTS2 replaced SPCTRAL2 in 2003 and predicts slightly higher amounts of **Chappuis band** absorption at baseline conditions and higher levels of solar brightening under ozone-depleted conditions. The sad truth is that the NASA GCMs are the corrupt means used by Drs. Lacis and Hansen of NASA GISS and Dr. Ramaswamy of NOAA GFDL among others, to subvert evidence of the warming effects of ozone depletion and to concoct evidence that rising CO2 was the source of the warming. There is no reasonable doubt that the primary objective was to achieve IPCC/progressive-left endorsement of the GCMs as opposed to objectively investigating the source of the warming supporting my accusations of fraud and sabotage.

7. They are either fully aware or should be that the bona fide empirical evidence generated since 1980 is proving definitively that rising atmospheric CO2 that occurs during periods of sustained sea-surface warming with attendant sea-ice melting and permafrost thawing is without the least question the easily predictable result rather than the cause of the warming, melting and thawing. Certain NASA scientists working within the O-CO2 program and in particular Dr. Gunsin have dedicated their careers to suppressing the evidence that the warming Ocean surface and melting sea ice and thawing permafrost are the source of the rising atmospheric CO2 rather than fossil-fuel combustion. In fact, based on my fundamentally sound understanding of how the Ocean's carbonate system works, the notion that fossil-fuel combustion causes atmospheric CO2 to rise is completely outside the realm of possibility given the proven ability for the Ocean to stabilize atmospheric CO2 levels at about 280 ppmv during interglacial periods. Moreover, in situations where there is no continuous CO2 off-gassing due to stratospheric ozone depletion, there will be no shortage of near-surface seawater molecules available to react with incremental atmospheric CO2 molecules and create dissolved inorganic carbon that harmlessly/beneficially enters the Ocean's carbonate buffer system.

8. They are either fully aware or should be that the Henry's Law constant cannot be used to provide meaningful estimates of the amount of CO2 dissolved in the Ocean's near-surface layer because its partial pressure in the atmosphere is much too low to have a significant effect given the comparatively large amounts of CO2 and associated inorganic carbon dissolved in the Ocean from multiple sources besides the atmosphere. They are therefore either fully aware or should be fully aware that under the relevant gas laws, atmospheric CO2 levels are completely controlled by the Ocean surface, not visa versa. CO2 has no choice but to off-gas from the near-surface seawater when it is warmed diurnally by incremental shortwave radiation in the UVA and/or orange spectral bands or when the salinity increases, for example when melted sea-ice reforms at night and sheds brine. They are therefore either fully aware or should be fully aware that during periods of documented global warming with attendant widespread sea-surface temperature increases with attendant sea-ice melting and permafrost thawing such as we have experienced since 1980, atmospheric CO2 levels will most certainly rise continuously until the warming stops and will then start to decline. For the same reasons, it is utterly and completely impossible to have increasing levels of dissolved near-surface CO2 and attendant Ocean acidification during such periods of global warming.

9. They are either fully aware or should be that the GCMs that NASA GISS and NOAA GFDL ended up constructing for use by the IPCC commencing in the late 1980s are transparently corrupt because they ignore the substantial global-warming effects of well-documented stratospheric ozone loss in the polar and sub-polar regions. Specifically they ignore the fact that decreases in stratospheric ozone result in decreases in the levels of **Chappuis band** absorption in the orange spectral region (0.5-0.7 micron) and UVA absorption in the mid to upper Huggins spectral region (0.215-0.40 micron). They ignore the fact that a 20-50% decrease in the ozone in the upper two thirds of the stratosphere will create a 20-50% brightening in the amount of visible

and UVA radiation entering the top of the MBL relative to the amount absorbed at baseline with maximum impacts with the sun low in the sky in the polar and sub-polar zones.

10. They are either fully aware or should be that there is definitive empirical evidence that shows that the vertical interval of the Antarctic stratosphere that is most impacted by ozone depletion lies between 22 and 31 km above sea level which is the exact same vertical interval where well-qualified atmospheric physicists report most of the **Chappuis band** and UVA absorption occurs consistent with the results of SMART2.9.5 runs with its virtual sensor set at 15 km above sea level.

11. They are either fully aware or should be that the GCMs that NASA GISS, NOAA GFDL and DOE LLNL ended up constructing for use by the IPCC commencing in the late 1980s are transparently corrupt because they improperly assign the ignored stratospheric heating effects of ozone absorption in the **Chappuis band** and mid and upper Huggins band to concocted evidence involving CO2's presumed absorption of Earth-emitted longwave radiation at 13-17 microns. This phantom 13-17 micron radiation allegedly emanating from the Ocean surface lies along the outer edge of water-vapor's atmosphere spectral window which spans approximately 7-13 microns over land except where extremely arid where it broadens and approximately 8-12 microns over the Ocean except in the tropics where the window is largely closed. I hold that this skullduggery meets the legal definition of sabotage and/or fraud because it represents attacks on the United States fossil-fuel industry coming from within the U.S. government's Executive Branch by some of the very scientists that have been hired and entrusted to protect the U.S. economy from such attacks and in particular Dr. Taylor of the LLNL, Dr. van den Bosch of DOD and Dr. Farrar of NOAA.

12. They are either aware or should be that the lower third of the stratosphere is fully occupied in absorbing a substantial fraction of Earth/Ocean-emitted water-vapor window radiation in a strong absorption band spanning 9-10 microns while shedding much of the heat in ozone's 13-16 micron absorption band. This is the only 13-17 micron mid to far infrared thermal radiation whose radiant energy is absorbed and then emitted by stratospheric CO2 in this spectral band and it does not originate at the Earth's surface or anywhere within the MBL's wet adiabatic convective zone which expands high into the biosphere during the day and contracts at night. Of the utmost significance, empirical evidence proves that the interface of the Ocean surface and the free troposphere lies within a temperature inversion zone atop the MBL which has a telltale temperature of minus 18 deg C. This temperature has thermodynamic significance in the Earth's energy balance. The fact that it lies at the MBL's capping inversion zone proves that the GHGT of global warming is built on the false premise that the temperature at the Ocean surface would be minus 18 deg C in the absence of a greenhouse gas feedback effect. The minus 18 deg C at the capping inversion zone is proof that the moist dense air within the MBL is heated exclusively by downwelling shortwave energy primarily in the near-infrared bands but also with a significant visible component and must be considered a gaseous fluid extending upward from the Ocean's thermal skin rather than free atmosphere. Bearing this out, as measured from space there is no empirical evidence of significant emittance in CO2's 13-17 micron absorption band at the interface, Ocean surface or any point in between meaning the MBL is an extension of the Ocean's thermal skin except in the 8-12 micron spectral window.

13. They are either fully aware or should be that regardless of the well-documented atmospheric CO2 increases since 1980, the fact that bona fide empirical evidence shows that the stratosphere has significantly cooled since 1980 as a result of ozone depletion makes it impossible for there to have been increasing levels of longwave radiation emitted upward or downward by stratospheric CO2 since 1980. You simply can't have incremental heat-shedding radiant energy leaving/cooling the stratosphere at temperatures that are lower than your reference baseline conditions. Where there is less heating there is less need for heat-shedding/cooling.

14. They are either fully aware or should be that the marine boundary layer (MBL) rising up from the Ocean's thermal skin covering more than 70% of the Earth's surface is 100% opaque to longwave radiation in the 13-17 micron bandwidth due to the combined effects of CO2 and water vapor at rapidly increasing density and humidity as you approach the Ocean surface. The 13-17 micron bandwidth in particular has zero chance of passing through the MBL in either direction and for all intents and purposes is not emitted from the Ocean surface or absorbed or emitted at any point within the MBL's convective zone where heat transfer is strictly by buoyant convection and the water cycle except within the 8-12 micron atmospheric spectral window in accordance with the energy balance of the Ocean.
15. They are fully aware or should be that the change in the spectral signature of out-going reflected shortwave radiation and Earth-emitted longwave radiation exiting the top of the Arctic atmosphere since 1980 provides definitive unequivocal proof that Amplified Arctic Warming is the result of stratospheric ozone depletion rather than increasing stratospheric CO2.
16. Demonstrating severe green bias, they reject out of hand any and all contrary environmental-engineering input because it is not peer reviewed by group-think elitist academia. From the standpoint of a neutral fact finder, they are acting exactly like a plaintiff or defendant in a lawsuit related to the contamination of deep domestic or agricultural water-production wells in which they are trying to prove their case by using black-box numeric models calibrated to slant the evidence in a manner that supports their contentions.

Addressing the eight administrators – Of the outmost importance, Director Regan and/or some or all of the seven other administrators listed in this complaint, for the sake of our country, I am urgently requesting/duly demanding that EPA promptly start making amends by obeying the spirit and intent of PL 104-113 section 12(d) by immediately instructing Mr. Grundler and Mr. Gunning and Ms. Birnbaum to cease whatever they are doing and immediately commence making long-overdue runs with the DOE/NREL SMARTS2.9.5 radiative transfer model to assess the impacts of the Antarctic Ozone hole on the areas of open ocean effected by the ozone hole at 66.5 deg S and 90 deg E (off the northwest coast) comparing baseline ozone levels in 1979/1980 to ozone depleted 2008/2009 over the course of the entire year. This is optimally achieved by making runs for all daylight hours of the 15th day of each month. Instruct them to set the virtual sensor at 15 km above mean sea level which is within the frigid bottom third of the stratosphere and restrict the output to the visible spectral range at 0.4 to 0.75 microns. I am here to help if they need instructions on how to download the model or input the runs and interpret the output sheets. This is vitally important to our country. They will be confirming what is shown in Lacis and Hansen 1974, Figure 6 that 20-40% stratospheric ozone depletion results in a 20-40% increase in the amount of visible radiation downwelling toward the Southern Ocean relative to the amount absorbed at baseline. The results of runs by qualified EPA staff using relevant and applicable ASTM and ISO standards will provide EPA administrators with sufficient engineering proof that the gargantuan plumes of solar-heated seawater emanating from the north and west coasts of Antarctica are due to stratospheric ozone depletion commencing in the early 1980s with the formation of the ozone hole.

Addressing all eleven I am asking all eleven to do a Google search and print out and carefully read every word that NASA GISS—before brazen green bias set in—had to say about ozone absorption in the **Chappuis band** in the following seminal paper commencing their efforts to model climate change: *A parameterization for the adsorption of solar energy in the Earth's Atmosphere* (Lacis and Hansen, 1974).

Of the utmost significance, I request that you admit to yourselves and others that the following citation from the *Encyclopedia of Atmospheric Sciences* (second edition) confirms that what is shown in LH74 Figure 6 is right on the mark. I further request you admit to yourself and others that what is stated below by Moortgat and Ravishankara in conjunction with what is shown in LH74 Figure 6 definitively confirms that documented EPP-related top-down ozone depletion in the upper two thirds of the stratosphere, and particularly the interval between 22-31 km above mean sea level, is without question the

predominant if not the sole source of the gargantuan plumes of solar-heated seawater emanating from the north and west shores of Antarctica, whereas rising stratospheric CO2 levels have absolutely positively nothing to do with it. Your rampant green bias has allowed you to be played by radical Marxists and a Chinese Communist Party that are trying hard to destroy the U.S. economy via the progressive-left's Green New Deal. They are currently gaining traction by exploiting progressive-left politicians and academia and, in particular, each of you and the others I have already named. Please wake up to this grave danger or it will be too late.

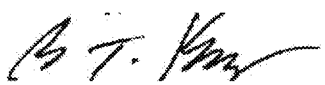
> Photodissociation of ozone in the visible region, the **Chappuis band**, is a major contributor to the stratospheric production of O atoms in their electronic ground state (O(3P)). However, these atoms almost always combine with O2 to form ozone with release of thermal energy (heat). Thus, the absorption of visible radiation by ozone converts light into heat and this conversion is particularly important in maintaining the temperature structure of the stratosphere. . . . From various studies that have been carried out to date, it appears that ozone always dissociates when it absorbs a visible or UV photon, at least at pressures encountered in the Earth's atmosphere. Therefore, we can assume that the quantum yield for ozone dissociation is unity (Moortgat and Ravishankara 2015).

Let me be crystal clear about my allegations and expectations. I am alleging that EPA is utterly and completely responsible for the disaster facing the country with Biden's cockamamie plans to force the progressive left's crackpot Green New Deal down America's throat due to buying into the progressive-left greenhouse gas charade with its brazen violations of the first and second laws of thermodynamics. To begin correcting EPA's disastrous mistake, you don't need the approval of the Supreme Court or the White House or Congress. You don't need the concurrence of crackpot climate scientists employed by NASA, NOAA, LLNL, Smithsonian, U.S. Global Change or IPCC. EPA is in complete charge of deciding whether or not CO2 is a pollutant—which it most certainly is not—EPA has so far severely botched the job.

Because EPA can act faster than the other federal agencies I have name in my complaints, I expect EPA Administrators to require relevant staff on a priority basis to make the suggested legally mandated SMARTS2.9.5 runs to assess the effects of the ozone hole on the Ocean heat content using the appropriate ASTM/ISO standards. Based on the findings of enormous increases in the orange spectral bands of sunlight entering certain ozone-depleted regions of the Antarctic Circumpolar Current, Southern Ocean, South Atlantic, South Pacific and Indian Ocean dating at least as far back as 1980, I expect EPA to promptly issue a press release alerting the world that on the basis of whistle blowing complaints filed against, EPA, NASA, NOAA, Smithsonian, LLNL, USOGC and other federal agencies by a concerned private-sector environmental engineer, EPA has tentatively determined that stratospheric ozone depletion is the most likely source of massive increases in the heat content of the Ocean dating back to at least 1980 and tentatively that CO2 is not an air or water pollutant that causes climate change or ocean acidification. The press-release should announce an upcoming round of proposed rule-making under provisions of the Clean Air Act.

There are forces of evil at work in this country stemming from severe green bias and radical Marxist Ideology. With the progressive-left now in full control, things are at a tipping point with EPA to blame. Do something!

Sincerely



Brian T. Kelleher

Environmental Engineer (MS UMass Lowell, Dept of Civil Engineering, 1973) with 30 years of experience as a neutral court consultant/neutral fact finder helping countless litigating parties, insurance companies and case special masters settle contentious lawsuits stemming from the pollution of air land and water without the need for trial.

*Office of the inspector generals for EPA. Re: Whistle-blowing complaint against six EPA employees with allegations of gross incompetence and wanton violation of PL 104-113, June 1, 2021*

Attachments for Line of Evidence # 1

Copies of the following papers authored by Brian T. Kelleher, Environmental Engineer, Stockton, CA submitted in April 2021 for publication of the AMS Journal of Climate.

- **Exhibit 1** – Paper by Brian T Kelleher last uploaded to AMS on April 1, 2021, titled: "Overwhelming empirical evidence that global warming since 1937 is from stratospheric ozone depletion."
- **Exhibit 2** – Paper by Brian T Kelleher last uploaded to AMS on April 14, 2021, titled: "Overwhelming empirical evidence that increasing atmospheric CO2 since 1937 stems from stratospheric ozone depletion."

Exhibit 1 to Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 1, 2021: *Overwhelming empirical evidence that global warming since 1937 is from stratospheric ozone depletion*

# Overwhelming empirical evidence that global warming since 1937 is from stratospheric ozone depletion

Brian T. Kelleher

Kelleher & Associates Environmental Mgmt LLC, Stockton, CA

ABSTRACT

In the fields of climate science and environmental engineering, optical sensors are used extensively for remote sensing. In particular, sensors housed in satellites are used to monitor the concentrations of so-called greenhouse gas pollutants such as carbon dioxide (CO2), methane, and ozone via the lidar technique (light imaging detection and ranging). They are also used to make direct measurements of the amounts and spectral signatures of shortwave radiation reaching the Earth's surface and short and longwave exiting the top of the atmosphere as a result of scattering or cooling. All scientists endorsing the conclusions of the International Panel on Climate Change (IPCC) established in 1988 by the United Nations Environmental Program (UNEP) are of the firm opinion that the building up of atmospheric pollutants in the Earth's atmosphere is causing the oceans to warm via a greenhouse gas feedback effect primarily involving stratospheric CO2. In this paper, I will apply basic environmental engineering practices and principals to empirical data furnished largely through remote sensing to prove definitively that all warming trends in the Southern Hemisphere since 1937 are the direct result of a natural cycle of top-down ozone depletion in the mid to upper stratosphere.

SIGNIFICANCE STATEMENT

This paper very likely represents the first rigorous top-tier private-sector environmental engineering analysis of the gargantuan pool of empirical data concerning the climatic effects of documented levels of stratospheric ozone loss, in this case by an environmental engineer with 30 years experience as a court-appointed neutral fact finder. Engineers rely heavily on relevant and applicable ASTM/ISO standards when available for good reason; the requirements for ASTM/ISO certification are so lofty they are considered fool proof. Both ASTM and ISO have repeatedly certified Chappuis band absorption coefficients for stratospheric ozone for use in atmospheric transfer models used by the U.S. Department of Energy dating back to 1982. The IPCC and climate scientists who support the GHGT have been blowing off relevant and applicable ASTM/ISO standards in reaching erroneous conclusions on natural cycles of solar forcing.

## 1. Introduction

The empirical evidence is clear that well over 90% of the excess heat attributed to global warming dating back to 1937 when it started is currently stored in the Earth's oceans with the largest fraction of the excess surrounding the frozen continent of Antarctica with its infamous ozone hole (Cheng et al. 2019). This is an important clue as to the source of the warming that raises immediate doubts about the merits of the greenhouse gas theory (GHGT). Why would so-called greenhouse gas pollutants which are discharged primarily in high northern latitudes preferentially cause warming in the coldest most desolate region in the Southern Hemisphere?

According to the GHGT of global warming, the rise in the heat content of the ocean is primarily due to rising atmospheric CO2 levels. In particular, it is alleged that CO2 present in the lower stratosphere absorbs thermal-infrared radiation emitted by the Earth's surface in the mid-infrared 13-14 micron spectral band and sheds heat by emitting in the 13-17 micron band. It is further alleged that due to so called "instantaneous radiative forcing" most of the emitted radiation or its equivalent energy makes its way back to the ocean surface (Ramaswamy et al. 2006). Quoting from page 405 of Ramaswamy et al. 2001 in the IPCC's third climate-change assessment report regarding the definition of radiative forcing as it applies to stratospheric CO2:

> ["Instantaneous radiative forcing"]. . . is the change in net (down minus up) irradiance (solar plus longwave; in Wm2) at the tropopause after allowing for stratospheric temperatures to readjust to radiative equilibrium, but with surface and tropospheric temperatures and state held fixed at the unperturbed values . . . The consideration of forcing, feedback and response as three distinct entities in the modeling framework (see also Charlson, 2000) while originating from the one-dimensional radiative/convective models, has made the transition to GCM studies of climate (Hansen et al., 1981; Wetherald and Manabe, 1988; Chen and Ramaswamy, 1996a).

The fact of the matter, however, is that the GHGT has never been proven via empirical data generated by the use of optical sensors (Kelleher 2021) and never will be. This is because the Marine Boundary Layer (MBL) extending upward from the ocean's thermal skin covering more than 70% of the Earth's surface is 100% opaque to radiation in the 13-17 micron bandwidth (Harries et al. 2008). The MBL has such high density and moisture content it takes on the properties of a gaseous fluid in which heat transfer is largely by buoyant convection and the water cycle rather than radiation.

To defend the GHGT, climate scientists rely heavily on the output of black-box variety numeric models tied to the so-called HITRAN "international standard" database" (Rothman et al. 1998). This database has been owned and continuously upgraded since 1998 by the prestigious Harvard-Smithsonian Center for Astrophysics (HSCFA) (Gordon et al. 2017). The climate models are referred to as general circulation models (GCMs). GHGT supporters have also relied heavily on the repeated unfounded assertion that there is no evidence of a natural cycle of solar forcing at work.

Despite being labeled an "international standard," HITRAN lacks ASTM or ISO certification and Chappuis band absorption coefficients (HITRAN 2021), and therefore is of no use to environmental engineers. The same goes for the GCMs.

To properly model the climatic effects of the well documented levels of stratospheric ozone depletion in this research paper, I applied existing ASTM engineering standard G-173-03 "Spectral Irradiance" which is a table of certified-accurate atmospheric absorption and extinction coefficients. In so doing I also incorporated the use of the existing ASTM certified SMARTS2.9.5 radiative transfer model which is linked to G-173-03 (ASTM 2020). This allowed me to focus attention on the effects of Chappuis band absorption in the orange spectral region of sunlight (0.55-0.65 micron). This spectral region is very well suited to create the observed warming trends since it penetrates and warms just the top 10 meters (33 ft) of clear seawater with a significant percentage (15%) in the top meter (3.3 ft) (Jerlov 1968). It also accelerates the melting of snow and ice once it starts (Light et al. 2008). The Chappuis band absorption coefficients are certified under ASTM G-173-03.

Under public law 104-113, (federalregister.gov 2016) federal employees who have taken it upon themselves or have been charged to assess the climatic effects of stratospheric ozone depletion must use these same ASTM standards. As is the case for engineers, they are not allowed to use the HITRAN database or uncertified GCMs in the presence of existing applicable voluntary consensus standards or methodologies.

In all its assessment reports and for whatever the reasons may be, the UNEP/WMO and UNEP/IPCC have completely ignored Chappuis band absorption and have been falsely asserting that

the main role of the stratospheric ozone layer is removing harmful ultraviolet radiation. In particular, they stress the removal of UVB in the 0.2 to 0.32 micron band which falls partly within the very strong Hartley band (0.2-0.3 micron) and partly within the strong end of the Huggins band 0.30-0.32 micron. Quoting from Fredrick and Leovy 1985 from page 377 of a UNEP/WMO report on ozone-depleting substances: "For many atmospheric applications it is not necessary to include . . . Chappuis band wavelengths."

### *1.1. Relevance of Chappuis band absorption coefficients*

The U.S. Air Force Geophysics Lab (AFGL) conducted the initial formal lab work in this country (Inn and Tanaka 1953) on what has since been referred to as Chappuis band absorption coefficients. The AFGL published them in Chapter 16, part 2 (Gast and King 1960) of the first edition of its Handbook of Geophysics.

Despite the fact that the ozone absorption is very strong in the UVB region, UVB accounts for only about 1.8% of the incoming solar flux, amounting to just 25 W/m2 at the currently accepted solar constant of 1,366 W/m2.

Of utmost significance, in the early 1970s NASA GISS (Lacis and Hansen 1974) (LH74) plotted the AFGL's Hartley, Chappuis and Huggins band absorption coefficients versus ozone optical density (OOD) to create the very telling illustration reproduced here as Fig. 1. It assumes a nominal stratospheric TCO of 0.4 atm-cm, an incoming shortwave flux of 1,366 W/m2 from Labs and Nickel 1968 and air masses/slant paths of 1-10. The OOD is the product of the TCO level in cm and the air mass/slant path. It increases as the sun rises and falls.

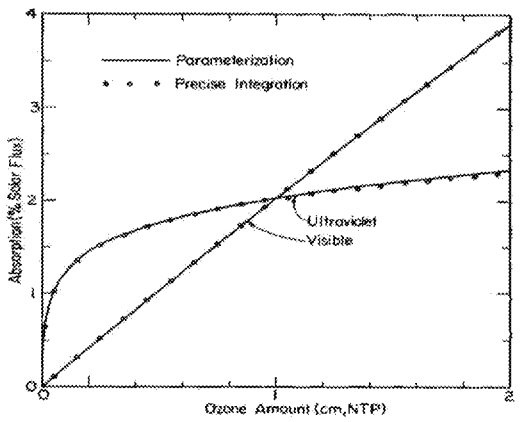



*Fig. 1. NASA plots of UV and visible absorption vs ozone optical density (Ref: Lacis and Hansen, 1974, Fig. 6).*

The LH74 figure is telling us that with a TCO of 0.4 atm-cm, most of the UVB (90%) is absorbed in the upper stratosphere at an OOD of 0.4 (air mass = 1) with the sun directly overhead. It is further telling us that as the sun rises and sinks it continues to absorb a small amount of UVA in the Huggins band and a substantial amount of visible in the Chappuis band.

Fig. 1 further shows that at an OOD of 2 which corresponds to a TCO of 0.4 atm-cm at an air mass/slant path of 10 with the sun low in the sky, the 3.8% absorption of visible amounts to 52 W/m2 and the 2.7% absorption of UV amounts to 37 W/m3 including the 25 W/m2 of UVB and about 12 W/m2 of UVA. The figure is further telling us that a 30 percent decrease in stratospheric TCO at an OOD of 2 will result in a linear 30 percent increase in the amount of visible radiation passing through the stratosphere relative to the amount absorbed at baseline. This comes to 15.6 W/m2 which is huge. It also means that relatively little absorption in the orange spectral band occurs with the sun high in

the sky and relatively large amounts of absorption occur in the three hours preceding/following sunset/sunrise. It also means the highest levels of absorption of visible radiation in the orange spectral band occur in the polar zones where both the average daily slant paths and TCO levels are the highest on Earth in spring and early summer. Quoting from page 9 of an NREL report Gueymard 1995: "Ozone absorbs strongly in the UV, moderately in the visible and weakly in the near infrared." Because there is much more visible light (~600 W/m2) than UVB (~25 W/m2), moderate strength Chappuis band absorption is highly relevant to climate change.

Quoting from the seminal NASA GISS Lacis and Hansen 1974 paper titled "A parameterization of the absorption of solar radiation in the Earth's atmosphere," pages 122, 125 and 132:

> Absorption by ozone can be accurately parameterized because the significant absorption occurs high in the atmosphere where there is little scattering . . . the visual absorption remains nearly proportional to [a linear function of] the ozone amount. . . . the energy absorbed in the visual exceeds that in the ultraviolet for ozone paths greater than about 1 cm . . . the lower atmosphere serves mainly as a reflecting layer . . . . most of the ozone absorption takes place near the maximum ozone concentration where it is primarily due to the Chappuis band . . . [which] is also very sensitive to the ground albedo. . . . the absorbed energy due to the reflected diffuse radiation can exceed that of the direct solar beam. . . . Most of the absorption in the ultraviolet occurs at altitudes 25 to 50 km . . . The heating rate for the polar distribution is much stronger in the region of about 20 km where the absorption is due mainly to the visible Chappuis band and the longer ultraviolet wavelengths of the Huggins band. . . . The parameterization for ozone has a high accuracy, exceeding the accuracy with which the ozone concentration is likely to be known in most applications. There is thus little incentive to seek a more accurate approach.

### *1.2. Recent global warming started in 1937*

Fig. 2 reproduces the second illustration from a NASA GISS website with a feature article titled "Changing Air Temperatures." The trend chart shows that relative to an 1880-1935 baseline, near-surface air and sea temperatures exhibited a sharp increase in the late 1930s with the onset of the very intense and prolonged active phase of solar cycle 17. The temperatures peaked in the early 1940s and fell part-way back in the 50s through late 70s in peaks and valleys corresponding to the active and inactive periods of solar cycles 18 through 20. Temperatures began to soar in the late 1970s with the onset of the prolonged active phase of solar cycle 21 and continued to soar during solar cycles 22 and 23 both of which had extremely intense and prolonged active phases. Temperatures leveled off from 2006-11 during a period of very low sunspot activity and then rebounded during the active phase of solar cycle 24. The close correlation between global warming trends and large solar proton events and sudden stratospheric warming events is shown by Kelleher 2021 using a novel numeric fingerprinting technique and standard statistical calculations.

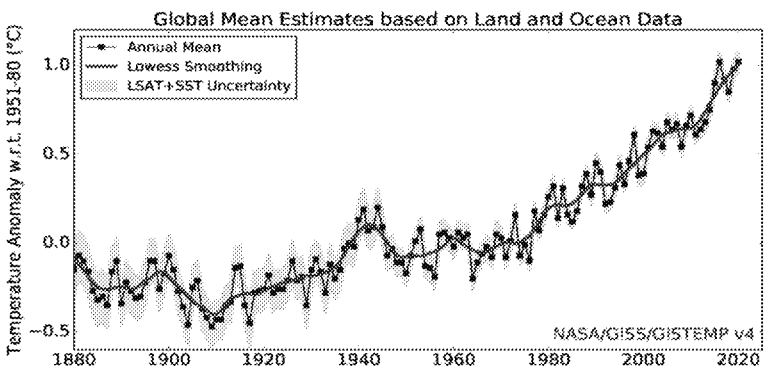



*Fig. 2. NASA GISS plot of surface temperature anomaly from 1880-2019 (Ref: NASA GISS website, 2019).*

### *1.3. Stratospheric ozone depletion started in 1937*

Fig. 3 reproduces an illustration in the NASA Ozone Watch Southern Hemisphere website article "History of the ozone hole." The illustration's caption reads as follows:

> Instruments on the ground (at Halley) and high above Antarctica (Total Ozone Mapping Spectrometer [TOMS], Ozone Monitoring Instrument [OMI], and Ozone Mapping and Profiler Suite [OMPS]) measured an acute drop in total atmospheric ozone during October in the early and middle 1980s. (Halley data supplied by J. D. Shanklin, British Antarctic Survey).

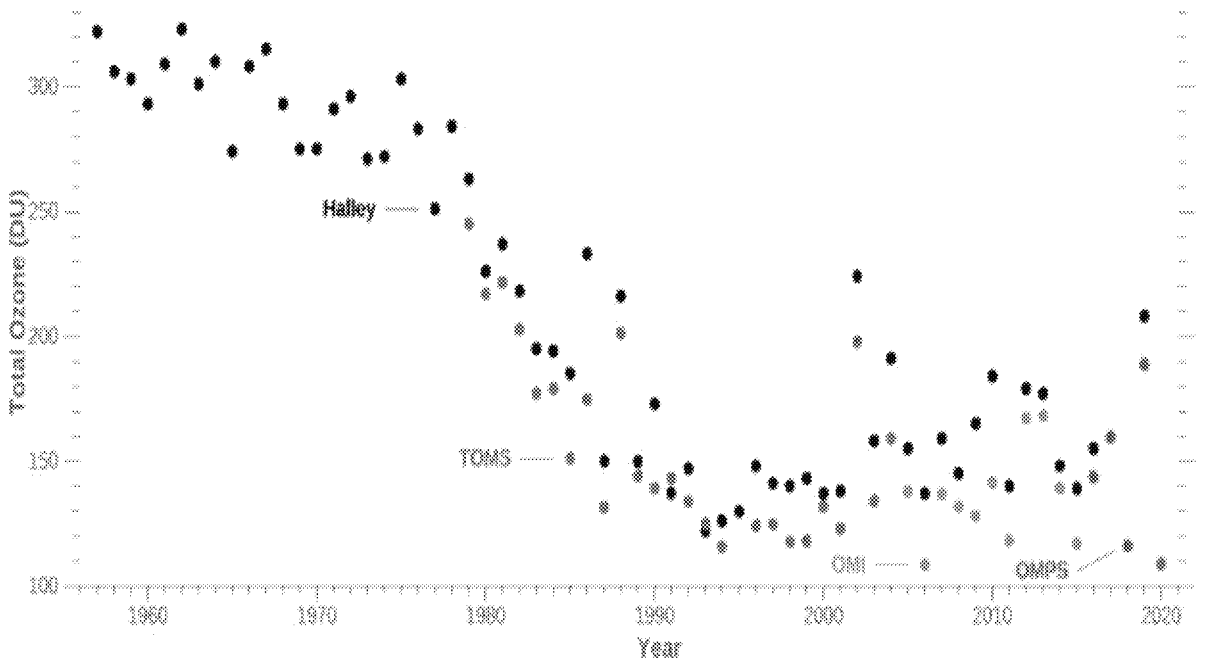



*Fig. 3. NASA plot of total column ozone levels for Antarctic spring (October) from 1956-2020 from four databases (Ref: NASA Ozone Watch facts, 2021, Fig. 1).*

Fig. 3's trend plot shows that stratospheric ozone loss was already in progress when the first measurements were made in 1956 at the British Antarctic Survey's Halley Bay Observatory on the north coast of Antarctica using a Dobson spectrophotometer. The figure also includes lidar measurements made from three different NASA satellites that serve to confirm the land-based readings. The trend chart shows a dramatic decline in ozone from about 260 DU in 1978 to about 125 DU in 1994 (52%). Note that the rapid decline is concurrent with and ostensibly explains the rapid rise in near-surface temperatures that we see in Fig. 2. The ozone depletion appears to hit a floor during the prolonged and intense active phase of solar cycle 22 from 1989-94. Following the prolonged and intense active phase of cycle 23 from 2000-05, the collective data is showing substantial recovery in the late 2000s and early 2010s that was reversed during the short but intense active phase of solar cycle 24 from 2012 to 2015. Though there were no measurements of ozone prior to 1956, Schdeider and Steig 2008 published evidence of significant early 1940s Antarctic warming using ice-core proxy data. This warming further correlates with what is shown in Fig. 2. The decrease over the two decades between 1956 at about 320 DU and 1976 at about 280 DU was about 40 DU. Projecting back two decades to 1936 the mean concentration would have been about 360 DU. Given the warming trends and extent of close correlation with solar activity, it is reasonable to assume that ozone depletion commenced in 1937 with the active phase of solar cycle 17.

### *1.4. Relevance of NASA Ozone Watch maps*

Fig. 4 reproduces NASA Ozone Watch maps for September 1980 and 2008. Using the key, the ozone levels over the areas of open ocean west of the Antarctic Peninsula were about 350 DU in September 1979 (early spring) and declined to about 200 DU in 2008. This is a 40 percent reduction. A more detailed discussion of the remote-sensing methodology and the reasons behind the ozone loss is beyond the scope of this paper. Kelleher 2021 covers the latter in detail.

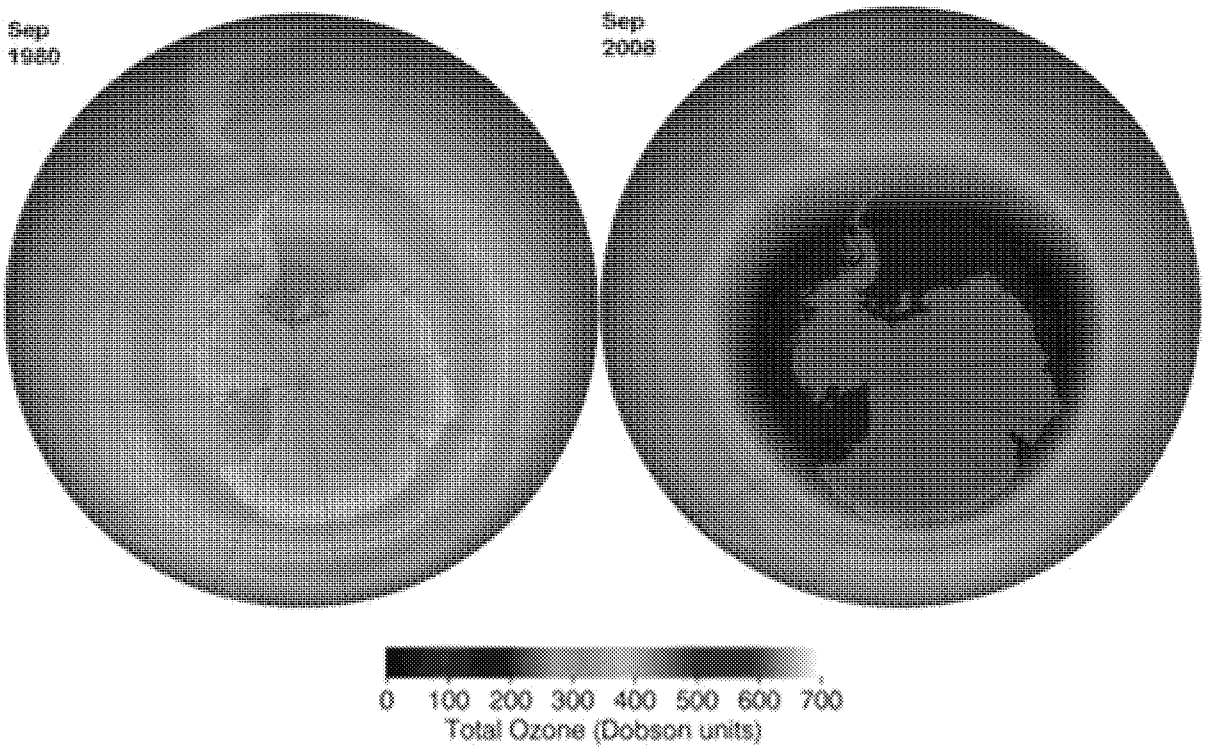



*Fig. 4. NASA Ozone Watch Southern Hemisphere maps for September 1980 and 2008 (Ref: NASA Ozone Watch maps, 2021).*

Note that the rim of the circular ozone hole shown in Fig. 4 for September (spring) lies along the 60 deg S latitude contour. It needs to be recognized, however, that the ozone hole is contained within the Antarctic polar vortex and is rotating clockwise and undulating affecting areas outside the boundaries of what you see here in September. The undulations increase in late November and early December (late spring/early summer) as the vortex weakens and finally collapses. It begins to reform in late fall (April/May).

## 2. Summary of empirical evidence

### *2.1 Extraordinarily large amounts of UVA and visible radiation entering the Southern Ocean*

Fig. 5 reproduces the 4th illustration in a paper by Vihma 2009 of the Finish Institute of Marine Research titled "Radiative and turbulent surface heat fluxes over sea ice in the western Weddell Sea in early summer." The Weddell Sea is within the northern Antarctic hotspot described below. I cropped off row "d" showing albedo. Row "a" is a plot of daily shortwave radiation measured from the 30th of November to the 30th of December 2004 at approximately sea level with either a Kipp & Zonen or an Eppley pyranometer. The work was done by a team of researchers aboard the German icebreaker

*Polarstern* who set up a temporary research station on a large piece of floating sea ice that drifted between 67-69 deg S latitude and 54-56 deg W longitude in the NW Weddell Sea.

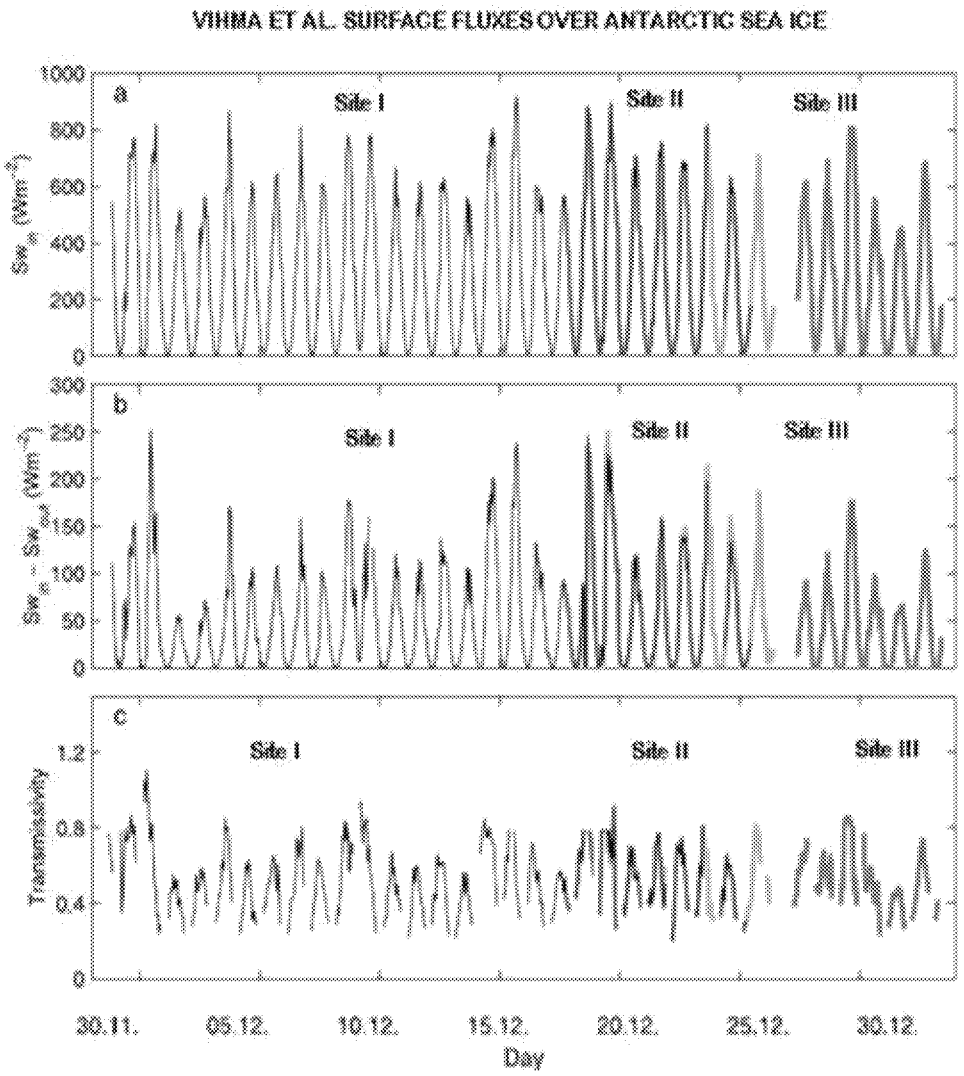



*Fig. 5. Plots of total and net surface solar irradiance in the NW Weddell Sea in December 2004 (Ref: Vihma et al. 2009, Fig. 20).*

Fig. 5 row "b" subtracts the visible radiation reflected off the floating ice sheet some of which is backscattered by the dense cloud layer. Note the very high transmissivity in Fig. 5 row "c" relative to the total flux at the top of the atmosphere despite continuous low-cloud cover. Indeed, the transmissivity equals or exceeds 100% on four occasions and 80% on eighteen occasions despite substantial cloud attenuation of near infrared. Also note that nine of the peaks in row "a" exceed 800 W/m2. This illustration provides hard empirical evidence of extraordinarily large amounts of UVA and visible radiation entering the ocean at 67-69 deg S latitude in the early summer and is equally applicable to the western and southern Antarctic hotspots described below.

The extraordinarily large amount of surface irradiance in the UVA and visible bands is attributable to a combination of factors producing a perfect storm of diffuse irradiance including: (1) the high solar-zenith angles; (2) the very high albedo of ice and snow; (3) a dense humid low cloud layer overlying open ocean; (4) the near absence of cloud cover over the dry frigid surface of the

interior Antarctic continent; and (5) during the entire sun-lit August through May period, much of the UVA and shortwave radiation reflected upward or downward off the face of the melt fronts or coastal and inland down-slopes facing the three hotspots ends up entering the open ocean. In effect, this completely offsets the usual attenuation by Rayleigh and Mai scattering. Thus, incremental orange radiation is actually substantially higher than predicted in Table 1. Plus UVA comes into major play.

### *2.2. Three open-ocean hotspots within the ozone hole*

Fig. 6 reproduces the 7th illustration in the NASA Earth Observatory "World of Change" website. It is based on satellite imagery and shows the annual extent of Antarctic sea-ice advance and retreat during the six-month melt period from the September-2018 maximum to the February-2019 minimum. NASA satellites have been carefully tracking the aerial extent of Antarctic sea ice loss and gain since 1979.

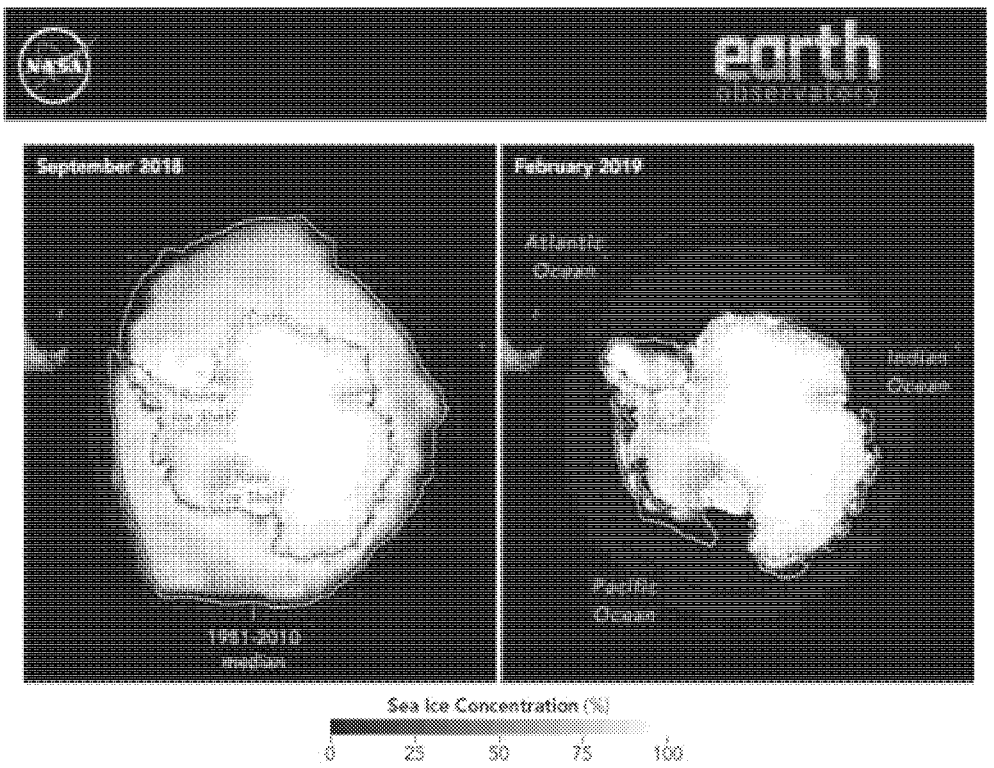



*Fig. 6. NASA imagery showing annual extent of Antarctic sea-ice advance and retreat from the September-2018 maximum to the February-2019 minimum (Ref: NASA Earth Observatory, 2020, Fig. 7).*

North is up on Fig. 6. The yellow line for sea-ice minimum in February 2019 (right side) depicts the aerial extent of the sea-ice loss relative to the 1981-1991 median (yellow line). In so doing it demarks the approximate inner boundaries of three semi-circular West Antarctica open-ocean hotspots. The thin slice of sea-ice loss shown for the September 2018 sea-ice maximum (left side) extending northerly from the tip of the Antarctic Peninsula further demarks the northern hotspot which is within the gulf formed to the NE of the peninsula. The western hotspot lies adjacent to the Antarctic Peninsula and extends through Drake's Passage off the tip of South America. The southern hotspot is off the southern tip of Antarctica at a point which is south of Australia and New Zealand. The western hot spot has attracted a great deal of scientific research with Vaughan et al. 2003 describing it as one of three high-latitude areas of "recent rapid regional climate change."

As to the current state of knowledge about the Antarctic sea-ice thickness, I am quoting here from the abstract of NASA's Rignot et al. 2019 titled "Four decades of Antarctic ice sheet mass balance from 1979-2017":

> We use updated drainage inventory, ice thickness, and ice-velocity data to calculate the grounding line ice discharge of 176 basins draining the Antarctic Ice Sheet from 1979 to 2017. We compare the results with a surface mass balance model to deduce the ice-sheet mass balance. The total mass loss increased from 40 ± 9 Gt/y in 1979–1990 to 50 ± 14 Gt/y in 1989–2000, 166 ± 18 Gt/y in 1999–2009, and 252 ± 26 Gt/y in 2009–2017. In 2009–2017, the mass loss was dominated by the Amundsen/Bellingshausen Sea sectors, in West Antarctica (159 ± 8 Gt/y), Wilkes Land, in East Antarctica (51 ± 13 Gt/y), and West and Northeast Peninsula (42 ± 5 Gt/y).

Wilkes Land adjoins the southern hotspot and is marginally within the ozone hole. The underlined are the western and northern hotspots. According to Rignot the sea-ice loss is primarily due to bottom-up melting.

### *2.3. The Antarctic Circumpolar Current (ACC) disperses solar heated seawater into the southern oceans*

Fig. 7 reproduces the first illustration from a Woods Hole Oceanographic Institute "Polar Discovery" website article titled "Antarctic's ocean circulation." It is provided to show the location of the ACC which encompasses in the winter and early spring the sea-ice-loss prone Amundsen, Bellingshausen and northern Ross Seas (collectively the western hotspot), and outer edge of the Worrell Sea (northern hotspot). It is also intended to show the ACC's relationship with the surrounding continents; the approximate maximum sea-ice extent relative to the 60 degree latitude contour line; and the counterclockwise East Wind Drift which encompasses the ice-free portions of the three hotspots in the summer and early fall.

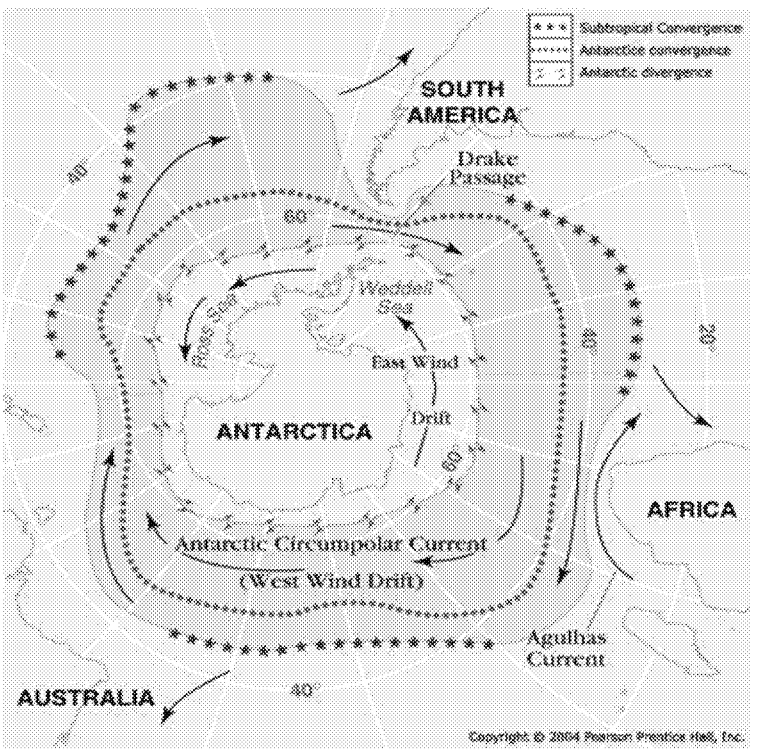



*Fig. 7. Woods Hole Oceanographic Society imagery showing the location and direction of the ACC and it effect on the southern oceans (Ref: Woods Hole Oceanographic Institute, 2021, Fig. 1).*

North is to the right on Fig. 7. Note that the 60 deg N contour constitutes the approximate middle of the portion of the ACC that lies off West Antarctica where it spans about 50-65 deg S. The ACC is wider off East Antarctica where it spans about 40 to 60 deg. The red stars show the ACC pushing heated seawater into the South Pacific and South Atlantic. The black arrows show the ACC pushing heated seawater up the east coasts of Peru and Southern Africa and the west coast of Australia.

*2.4. Correlation of sea-surface temperature (SST) anomalies and regional stratospheric ozone loss*

Fig. 8 reproduces a color-coded map generated online for March 2006 using the image maker for archived data provided at the NOAA Satellite and Information Service website. The output is for global sea-surface-temperature (SST) anomalies measured by satellite sensors at the ocean's thermal skin at night, calibrated to a depth of 0.2 meters (0.7 ft). The baseline is the mean for 1985-90 plus 1993.

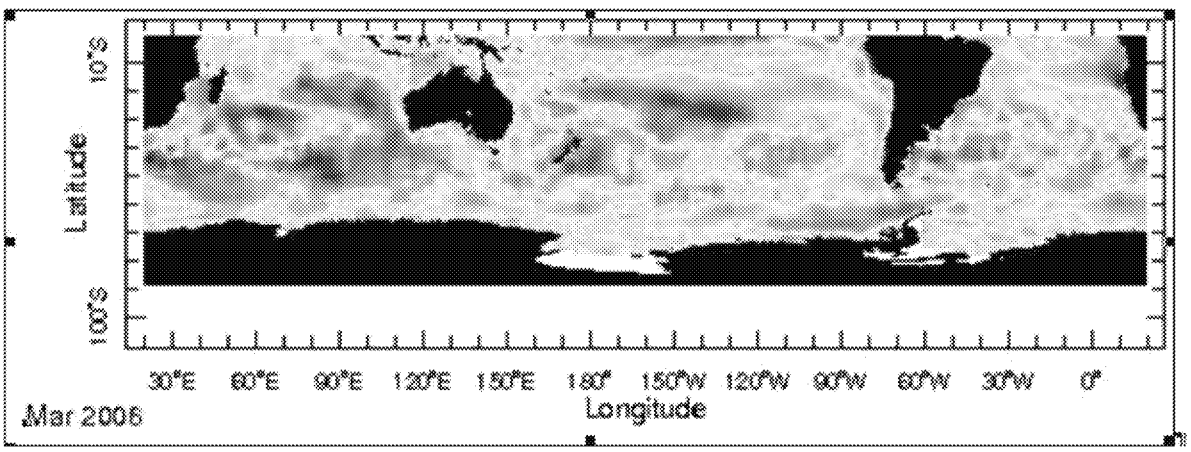



*Fig. 8. NOAA/NCEI image-maker run for the Southern Hemisphere from the Coral Reef Watch website for March 2006 (Ref: NOAA Satellite and Information Service website, 2021).*

In comparing Fig. 8 to Fig. 4 and Fig. 7 we can see the close correlation between the regional distribution of SST anomalies, the regional distribution of ozone depletion, and the effects of the ACC. March 2006 represents the tail end of the very prolonged highly active period of solar cycle 23. There is near-surface warming in the following areas: (1) within and inside the ACC along the coast of West Antarctica in the areas designated above as the northern, southern and western hotspots; (2) areas beyond the ACC comprising the eastern two thirds of the South Atlantic and eastern two thirds of the South Pacific, and western half of the Indian Ocean extending from about 10/20-40/50 deg S; and (3) within the ACC off the coast of East Antarctica due south of the tip Africa. Although the area of rather extensive warming of the surface waters off East Antarctic during the late summer lies marginally within the ozone hole, I interpret it to be largely associated with high levels of diffuse radiation scattered off the steep eastern slope of the bright-white continent at its maximum elevation which ranges from roughly 3,000-4,000 meters (10,000-13,000 ft). This applies to a lesser extent to the three West Antarctica hotspots as well where the elevation is about 2,000 meters (6,600 ft). El Niño and La Niña events play major roles in where the solar-heated surface water ends up.

*2.5. The West Antarctic hotspots are causing the deep warming of the Southern Ocean and beyond*

Fig. 9 reproduces the 7th illustration in an article published on line in March 2019 on the NOAA Climate.gov web site's News and Features. The article is titled "Antarctica is colder than the Arctic but still losing ice." It is a color-coded map of temperature anomalies relative to the average for the mid 1990s to mid 2000s.

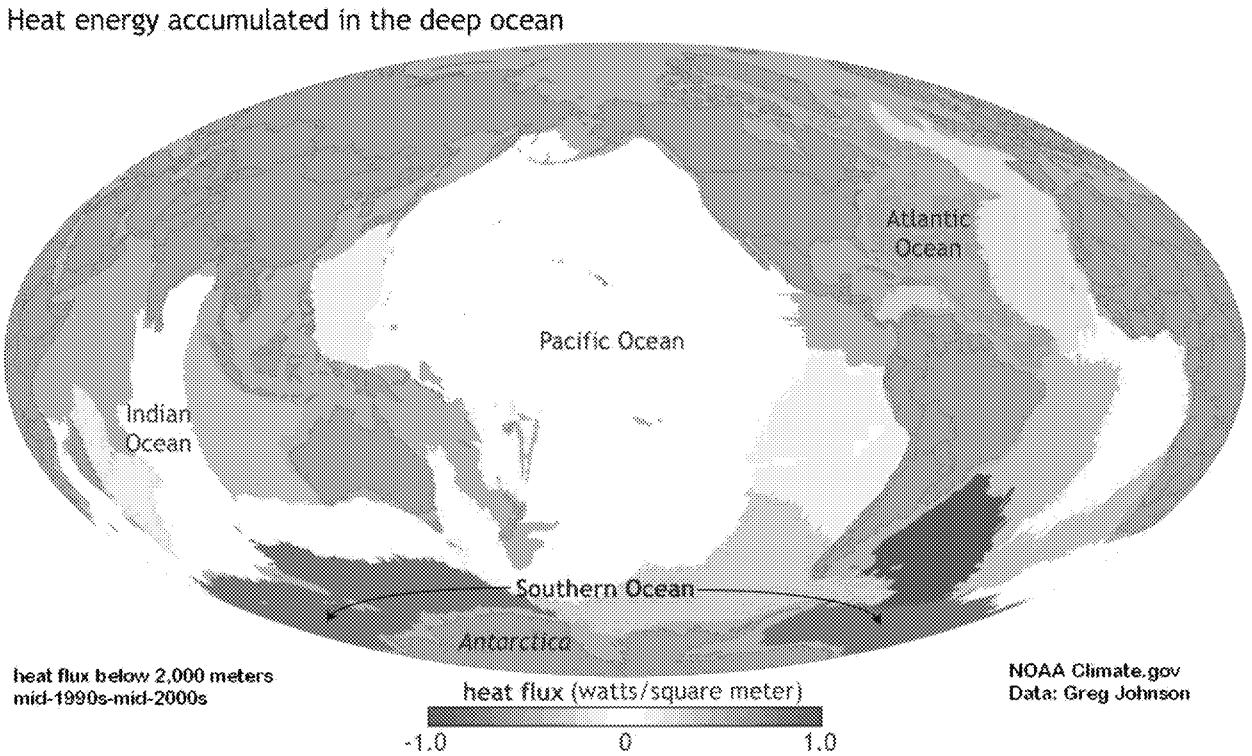



*Fig. 9. NOAA imagery showing heat flux below 2,000 meters emanating from the ozone hole during the mid 1990s to mid 2000s (Ref: NOAA Climate.gov website, 2019, Fig. 7).*

The Fig. 9 contours are clearly showing that most of the deep ocean heating is emanating from the three West Antarctic hotspots with a lesser contribution from the coastal waters of East Antarctica. The dark-red hue on the bottom right side is emanating from the northern hotspot with some contribution from coastal East Antarctica. It represents an expanding plume of heat flux below 2000 meters deep of approximately 1 W/m2 extending far into the South Atlantic in diminishing fashion. The pale-red hue in the middle is emanating from the western hotspot representing an expanding heat flux of approximately 0.5 W/m2 extending far into the depths of the South Pacific in diminishing fashion. The dark red hue at bottom left is emanating from the southern hotspot with an approximately equal contribution from Wilkes Land in coastal East Antarctica.

The increases in the heat content of the oceans are being carefully tracked by NOAA and various academic institutions. A detailed discussion is beyond the scope of this paper. As to the current state of knowledge about the Southern Ocean, I am quoting here from Cheng 2020 page 139.

> The new results indicate a total full-depth ocean warming of 370 ± 81 ZJ (equal to a net heating of 0.38 ± 0.08 W m−2 over the global surface) from 1960 to 2019, with contributions of 41.0%, 21.5%, 28.6% and 8.9% from the 0–300-m, 300–700-m, 700–2000-m, and below-2000-m layers, respectively. . . The heating was distributed throughout the world's oceans, with the vast majority of regions showing an increase in thermal energy (Figs. 1b and 3). The Atlantic Ocean and Southern Ocean (especially near the Antarctic Circumpolar Current, 40 deg–60 deg S) continued to show a larger warming compared to most of the other basins (Cheng et al., 2019c). It is well-established that the Southern Ocean has taken up most of the global warming heat since 1970: multiple observations show that the ocean south of 30 deg S at 0–2000 m was responsible for 35%–43% of the increase in global OHC within 1970–2017 (Meredith et al., 2019). Also, this is associated with a net northward heat transport by the oceans across the equator (Trenberth and Zhang, 2019).

### *2.6. A modern-day Grand Solar Maximum ran from 1937 through at least 2020*

Fig. 10 reproduces illustration 17.9 in Chapter 17 of Evidence-Based Climate Science, 2nd Ed., 2016 written by the Russian Scientist Abdussamatov 2016. Similar illustrations showing a GS Max commencing with the active phase of solar cycle 17 plus or minus a cycle are found in the following papers Solanki et al. 2004, Lockwood et al. 2009, Usoskin et al. 2012, Brunetti and Prodi 2015 and Herrera et al. 2015.

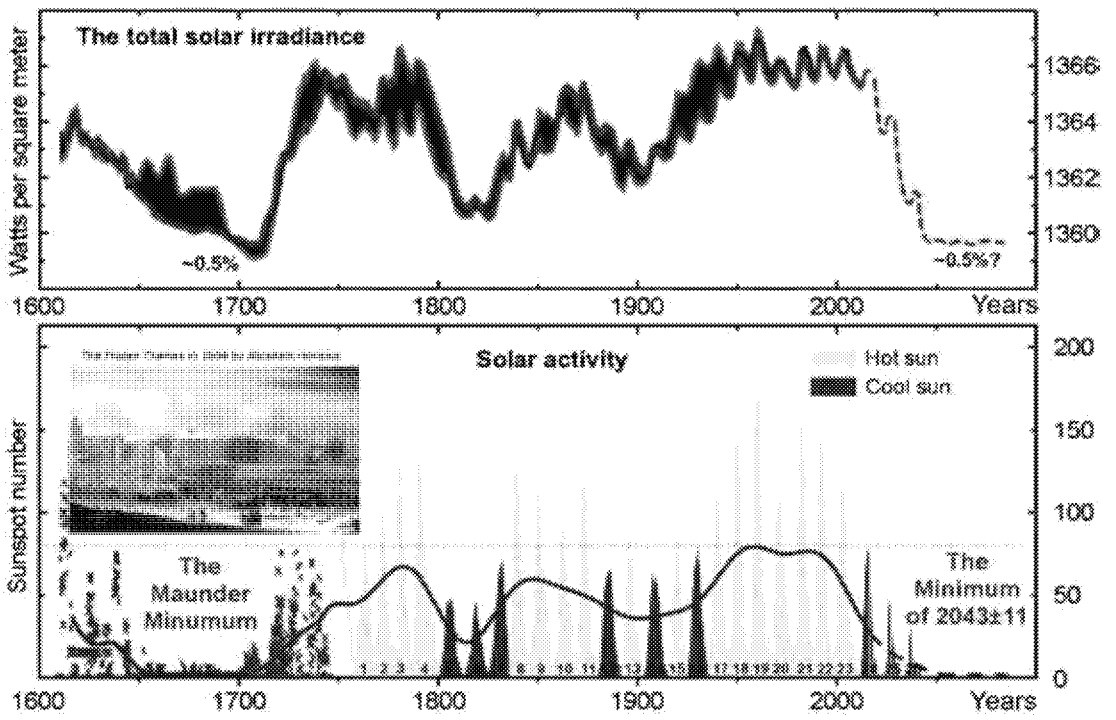



*Fig. 10. Plots of solar activity from1600-2010 projected to 2043 for solar irradiance at top of atmosphere (top) and sun spot number per year (bottom) (Ref: Abdussamatov et al. 2016, Fig. 17.9).*

Fig. 10 is showing a well defined modern day GS Max commencing in 1937 with the active phase of solar cycle 17 as well as smaller maximums in the late 1700s and mid 1800s. This illustration tracks annual sunspot counts and total solar irradiance at the top of the atmosphere. The other cited works are tracking the same data among other types of proxy data including certain geomagnetic indexes (e.g. Ap and aa) and certain isotopes (e.g. carbon-14 and beryllium-10). Aside from observing that stratospheric ozone depletion since 1937 is the result of top-down direct and indirect energetic particle precipitation (EPP) during a period when the active phases of 11-year solar cycles 17 through 23 (except 20) were unusually strong and unusually long, this controversial subject is beyond the scope of this paper.

### *2.7. Correlation between sunspot number and mid stratospheric ozone depletion above the Antarctic*

Quoting from the abstract of Grytsai et al. 2020 from a paper titled "Investigation of the vertical influence of the 11-year solar cycle using SBUV and Antarctic ground-based measurements and CMIP6 forcing data":

> The 11-year solar activity cycle in the vertical ozone distribution over the Antarctic station Faraday/Vernadsky in the Antarctic Peninsula region (65.25 deg S, 64.27 deg W) was analyzed using the

> Solar Backscatter Ultra Violet (SBUV) radiometer data Version 8.6 Merged Ozone Data Sets (MOD) over the 40-year period 1979-2018. . . . A statistically significant signal with a quasi-11-year period consistent with solar activity forcing was found in the lower–middle stratosphere at 22–31 km in ozone over Faraday/Vernadsky.

The Faraday/Vernadsky station is located on a small island along the west coast of the Antarctic Peninsula at about 15 feet above mean sea level (AMSL).

### *2.8. Chappuis band absorption dominates stratospheric heating at 22 to 31 km AMSL*

Fig. 11 reproduces the 5th illustration in Ndengue et al. 2014 from a paper titled "Ozone photolysis: strong isotopologue/isotopomer selectivity in the stratosphere." It is a color-coded line chart showing individual ozone photolysis rates as modeled from empirical data vs altitude for the Hartley, Huggins and Chappuis bands from ground surface to 80 km AMSL.

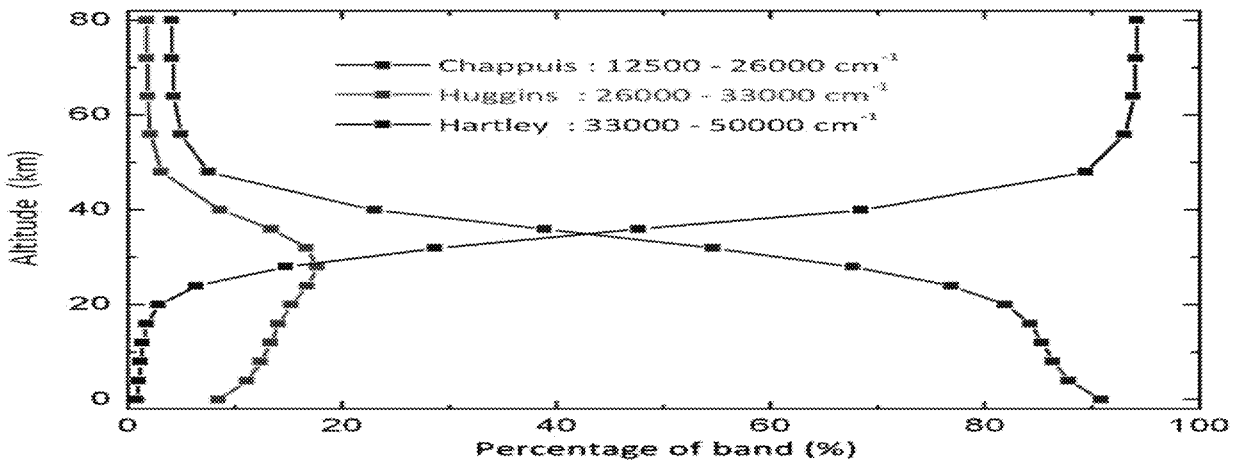



*Fig. 11. Plots showing the relative percentages of ozone absorption of shortwave radiation in the Chappuis, Huggins and Hartley bands vs altitude from 0 to 80 km ABSL (Ref: Ndengue et al. 2014, Fig. 5).*

Fig. 11 is showing that the Chappuis band absorption is responsible for a little over 60% of the mid stratospheric heating at 30 km AMSL and a little over 80% at 20 km AMSL.

Quoting from the Encyclopedia of Atmospheric Sciences (second edition), 2015 from the online synopsis of a subchapter titled "Products of ozone photolysis" (Moortgat and Ravishankara 2015):

> Photodissociation of ozone in the visible region, the Chappuis band, is a major contributor to the stratospheric production of O atoms in their electronic ground state (O(3P)). However, these atoms almost always combine with O2 to form ozone with release of thermal energy (heat). Thus, the absorption of visible radiation by ozone converts light into heat and this conversion is particularly important in maintaining the temperature structure of the stratosphere. . . . From various studies that have been carried out to date, it appears that ozone always dissociates when it absorbs a visible or UV photon, at least at pressures encountered in the Earth's atmosphere. Therefore, we can assume that the quantum yield for ozone dissociation is unity. This is true at all atmospheric pressures and, hence, the quantum yields are independent of pressure. Because the excited ozone produced upon absorption of UV and visible radiation exists for only a very short time, $<10^{-13}$ s, the identity of the molecule that surrounds this ozone does not matter, as the excited state has no time to collide before it dissociates. In other words, the composition of the atmosphere does not change the quantum yield for the dissociation of ozone.

### *2.9. The spectral signature of radiation exiting the top of the atmosphere matches stratospheric ozone depletion*

Fig. 12 reproduces the 7th illustration from a paper titled "The spectral signature of recent climate change" by Brindley and Bantges 2016. The color-coded graph is based on extensive satellite measurements of outgoing radiation at the top of the atmosphere for the high Arctic at 70-90 deg N, 0-100 deg E. The plot shows the output of two different radiative transfer models endorsed by the IPCC. The spectral signatures are identical but the plots differ in the amounts of outgoing radiance in several important spectral regions.

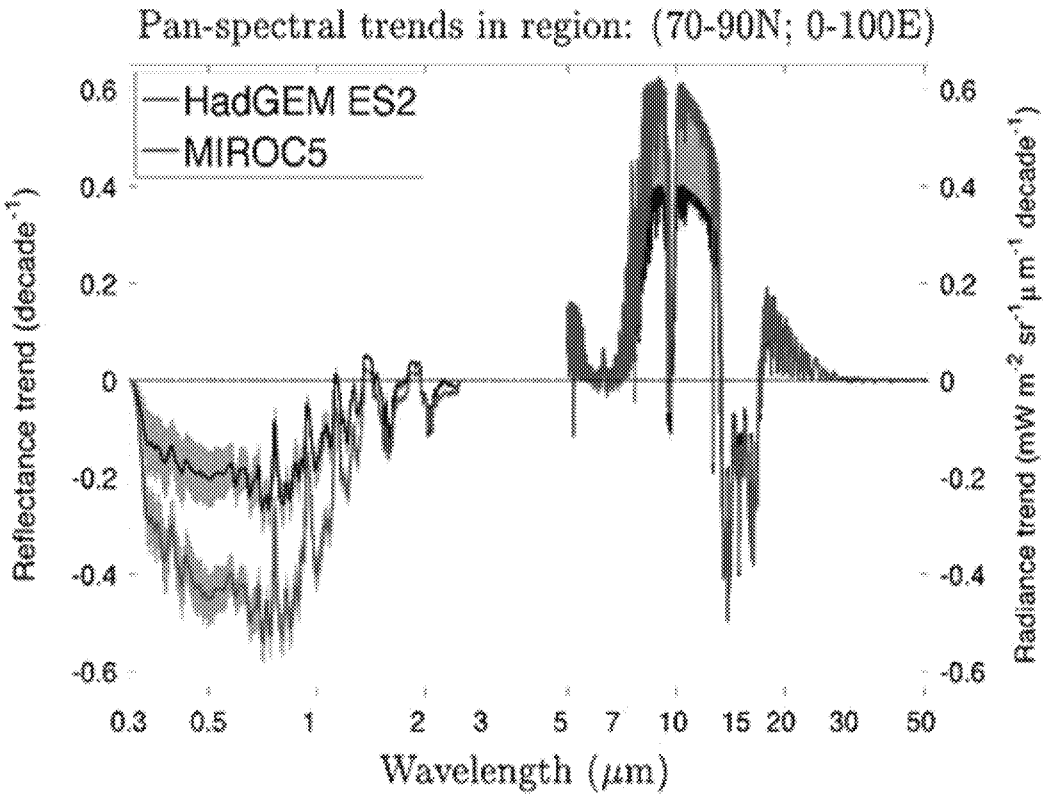



*Fig. 12. Color-coded line chart showing spectral signature of shortwave and longwave radiation exiting the top of the Arctic atmosphere due to the combined effects of scattering and cooling (Ref: Brindley and Bantges 2016, Fig. 7).*

Fig. 12 serves to confirm that Amplified Arctic Warming is due to stratospheric ozone depletion for the following reasons (1) Shortwave spectral signature. The increases in orange spectral irradiance reaching the open ocean along the Arctic and sub Arctic sea-ice melt fronts and the ice sheet itself as a result of stratospheric ozone depletion has reduced sea ice thickness and increased the aerial extent of seasonal sea ice loss. This means increasing amounts of shortwave radiation entering the snow, ice and oceans and less being reflected back to space. (2) Mid infrared spectral signature. Given that ozone absorbs and emits strongly between 9-10 microns within the water-vapor spectral window spanning 8-12 microns, ozone depletion at the base of the stratosphere results in predictable linear increases in the amount of spectral-window radiation in the 8-12 micron bands exiting the top of the atmosphere except for a signature dip centered at about 9.5 microns. The increase at 5-6 microns is from water vapor as explained for far infrared. (3) Mid to far-infrared spectral signature. (a) The radiance in the 5-6 micron band and 17-28 micron band is emitted from water vapor shedding heat at the top of the MBL or cloud tops. The increases are due to incremental shortwave radiation in the orange spectral bands reaching the open Arctic Ocean due to stratospheric ozone depletion and associated increases in SST. The increases in SST result in increases in MBL water-vapor content

including its capping inversion layer and cloud tops. (b) The decline in the CO2 emittance in the 13-17 micron absorption bandwidth is a predictable result of stratospheric ozone depletion and the associated decline in stratospheric temperature. There is less shedding of heat due to ozone depletion. Note that the fall off is significantly deepened on the low side by the concurrent decline in the ozone emittance in its 13-16 micron absorption bandwidth which is centered at about 14.5 microns. Viewed objectively, the pan-spectral trends for 70-90 deg N latitude confirm that well-documented levels of stratospheric ozone depletion caused Amplified Arctic Warming rather than CO2 increases.

## 3. SMART2.9.5 methodology

To conclusively prove that the Antarctic ozone hole is causing the heat content of the Southern Ocean to rise etc., I used the ASTM-certified DOE/NREL SMARTS2.9.5 radiative transfer code to make nine sets of three runs for 66.5 deg S latitude and 90 deg W longitude. This location is at a point near the maximum sea-ice extent and is within the western Antarctic hotspot described by Vaughan et al. 2003. Antarctic winter comprises June/July/August with June and July in near-complete darkness at 66.5 deg S. The early to mid sea-ice melt season is August through early November. The Antarctic late spring and summer which is the heart of the melt season comprises mid November through February. The late melt season with net sea-ice gain is March/April/May (Antarctic fall). I set the SMARTS2.9.5 virtual sensor level at 15 km above mean sea level (AMSL) in the approximate middle of the lower stratosphere (8-22 km AMSL) looking up into the middle and upper stratosphere (22-40 km AMSL). The output was set to a spectral range of 0.4-0.75 micron covering the entire visible bandwidth. The polar winter standard atmosphere was selected for April and August and the polar summer was used for the other months. The precipitable water vapor, turbidity and CO2 were all set to zero. The month, day, hour and total column ozone levels in atm-cm were the variables.

The TCO ozone levels for 1979/80 base conditions and 2008/09 ozone-depleted were ball parked using the color-coded key on NASA Ozone Watch website maps for the Southern Hemisphere for the 15$^{th}$ of each month covering August through April. Because the maps show a great deal of variability in TCO levels within and outside the boundaries of the ozone hole, the estimated nominal baseline and ozone-depleted levels were just for the area of the western Antarctic hotspot during this period.

Knowing from past experience that the afternoon hours are always a mathematical mirror image of the morning hours, to save time and effort in calculating arithmetic means for the total daylight hours of a given day, I ran only the morning hours, doubled the output results, added them to the output for noon and divided by the total sun-lit hours per day The flux units = W/m2 and TCO = Dobson Units (DU).

## 4. Results

Table 1 summarizes the results of the 207 SMARTS2.9.5 runs. Baseline conditions 1979/80. On an hourly basis, the stratospheric absorption of visible radiation (row 7) ranged from 15.9 to 100.6 W/m2. The averages for daylight hours (row 8) ranged from 36.9 to 66.6 W/m2 with the highest levels in August and the lowest in November. Ozone-depleted conditions 2008/09. On an hourly basis the stratospheric absorption for ozone-depleted conditions (row 9) ranged from 11.9 to 80.6 W/m2. The averages for daylight hours (row 10) ranged from 25.8 to 53.4 W/m2 with the highest levels in August and the lowest in October. Shortwave increases. On an hourly basis the increases in visible radiation passing through the stratosphere (row 11) ranged from 3.5 to 31.5 W/m2. The averages for daylight hours (row 12) ranged from 7.6 to 18.1 W/m2 with the highest levels in September and the lowest in February. The weighed-average increase for 133 daylight hours is 10.6 W/m2. The

differences in row 15 would have been negligible if the sensor was set at the bottom of the stratosphere or within the tropopause.

Table 1

SMARTS2.9.5 Data summary for the Antarctic Peninsula's western hotspot

| Row | Month/ Day TCO | 8/15 TCO 350/270 | 9/15 TCO 350/200 | 10/15 TCO 370/250 | 11/15 TCO 370/280 | 12/15 TCO 390/280 | 1/15 TCO 360/280 | 2/15 TCO 350/280 | 3/15 TCO 370/270 | 4/15 TCO 350/280 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sunlit hrs/ day | 7 | 11 | 15 | 19 | 21 | 21 | 17 | 13 | 9 |
| 2 | Extr Terr | 586.7 | 595.1 | 605.3 | 615.1 | 621.1 | 621.8 | 616.6 | 608.0 | 597.3 |
| 3 | SZA range | 80.3 to 87.0 | 69.3 to 86.0 | 57.8 to 86.3 | 47.9 to 87.4 | 43.2 to 87.1 | 45.3 to 89.6 | 53.7 to 89.3 | 64.6 to 88.8 | 76.5 to 87.6 |
| 4 | SZA avg | 83.4 | 76.1 | 69.6 | 65.4 | 64.1 | 67.1 | 70.2 | 75.0 | 81.2 |
| 5 | AM range | 5.4 to 10.8 | 2.8 to 9.6 | 1.9 to 10.0 | 1.5 to 11.2 | 1.4 to 10.8 | 1.4 to 14.1 | 1.7 to 13.8 | 2.3 to 13.2 | 4.1 to 11.5 |
| 6 | AM avg | 7.6 | 4.8 | 3.9 | 3.7 | 3.6 | 4.5 | 4.7 | 5.2 | 6.6 |
| 7 | 79/80 rng abs | 49.6 to 85.0 | 27.8 to 79.8 | 20.6 to 87.9 | 16.9 to 95.8 | 16.5 to 99.1 | 15.9 to 99.2 | 18.0 to 94.1 | 25.3 to 100.6 | 39.6 to 89.6 |
| 8 | 79/80 avg abs. | 66.6 | 44.2 | 38.5 | 36.9 | 38.8 | 41.4 | 41.5 | 48.3 | 57.9 |
| 9 | 08/09 rng abs | 40.4 to 67.9 | 16.2 to 48.3 | 14.0 to 62.3 | 12.9 to 75.5 | 11.9 to 74.7 | 12.4 to 80.6 | 14.4 to 78.2 | 18.6 to 77.3 | 32.1 to 74.0 |
| 10 | 08/09 avg abs. | 53.4 | 26.2 | 25.8 | 28.5 | 28.6 | 32.9 | 33.9 | 36.3 | 47.4 |
| 11 | Range of diff | 9.2 to 17.1 | 11.6 to 31.5 | 6.6 to 25.6 | 4.0 to 20.3 | 4.6 to 24.4 | 3.5 to 18.6 | 3.6 to 15.9 | 6.7 to 23.3 | 7.5 to 15.6 |
| 12 | Avg Diff | 13.2 | 18.1 | 12.7 | 8.4 | 10.2 | 8.5 | 7.6 | 12.0 | 10.5 |
| 13 | Decline % DU | 22.9% | 42.9% | 32.4% | 24.3% | 28.2% | 22.2% | 20.0% | 27.0% | 20.0% |
| 14 | Rise % $Wm^2$ | 19.8% | 40.8% | 31.1% | 23.2% | 27.0% | 21.0% | 18.9% | 25.5% | 18.2% |
| 15 | Diff | -3.1 | -2.1 | -1.3 | -1.1 | -1.2 | -.1.2 | -1.1 | -1.5 | -1.8 |

## 5. Discussion

### *5.1 Dismissing the green house gas theory (GHGT) of global warming based on simple engineering principals*

To an experienced environmental engineer/neutral fact finder, the GHGT is a non starter in explaining any aspect of global warming. This is because it brazenly violates the first and second laws of thermodynamics and arises out of a demonstrably false premise. The false premise is that without a greenhouse-gas feedback-effect the temperature at the surface of the ocean would be minus 18 degrees C. To arrive at this false premise which takes into consideration the amount of sunlight scattered out of the top of the atmosphere, GHGT advocates have illogically presumed that there is a free exchange of radiant energy between the ocean surface and the atmosphere above it and that the ocean surface has an emissivity factor of 1. This false premise transparently misapplies certain laws of radiative heat transfer involving the so-called Planck constant in terms of what constitutes an actual free atmosphere. There are seven overriding engineering principals that quash the GHGT. (1) The ocean surface is in a state of dynamic thermal equilibrium with the MBL via the water cycle and buoyant convection; in this respect, it is certainly not a free atmosphere. (2) Rather, because of its

physical properties including its opacity to most thermal-infrared radiation emitted from the Earth's surface as it cools, the convective MBL must be considered an upward extension of the ocean's thermal skin; it is aptly treated as either part of the ocean's thermal skin or a distinctive convective-atmospheric-transition zone in terms of radiant energy exchange. (3) Bearing this out, the MBL is capped by an inversion layer that just so happens to have an average telltale temperature of minus 18 degrees C showing that this is where the energy exchange with the true free troposphere is taking place (Carillo et al. 2016) and (Diaz et al. 2019). Empirical evidence from sensors housed in satellites show that heat-shedding emittance by CO2 in the 13-17 micron absorption band occurs only in the frigid lower stratosphere and mid-lower mesosphere where the brightness temperature is about 220 deg K (Harries et al. 2008). Since the MBL is completely opaque at 13-17 microns (Harries et al. 2008), this means that the heat that CO2 is shedding is primarily related to ozone absorption of UV in the 0.28 to 0.4 micron band, visible radiation in the 0.4 to 0.75 band and upwelling water-vapor-window mid infrared in the 9-10 micron band. To wit, ozone sheds heat in a 13-16 micron band. (5) Given the extent of well-documented ozone depletion since 1972, particularly in the polar zones, the CO2 emittance from the lower stratosphere towards or away from Earth has to have been decreasing since 1972 under the first law of thermodynamics. (6) Under the first and second laws of thermodynamics the radiant heat emitted from the frigid lower stratosphere that comes from ozone's absorption in the 9-10 micron water-vapor window cannot return to warm the Earth. (7) Within the MBL you can't convert brightness temperature readings to upwelling or downwelling longwave flux using the Planck constant while assuming an emissivity factor of 1 without violating the first and second laws of thermodynamics.

### *5.2. How complex GCMs made Chappuis band absorption of visible radiation disappear into the thin air*

The NASA Goddard Institute for Space Studies (GISS) and the NOAA Geophysical Fluid-Dynamics Lab (GFDL) have been heavily involved with the IPCC going back to the late 1980s. Quoting from NASA GISS Global Climate Modeling 2021: "The GISS GCM is prominently featured in the Intergovernmental Panel on Climate Change (IPCC) reports (the upcoming AR6 as well as past reports), and over 50 TB of climate model results have been publicly archived for the 5th Coupled Model Intercomparison Project." Quoting from NOAA GFDL 2021: "GFDL contributed six of the models used [by IPCC] for the climate assessments and devoted the equivalent of more than 9 months of supercomputing time to produce climate simulations for the IPCC."

Quoting from the abstract of GFDL's Freidenreich and Ramaswamy 1993:

> A broadband parameterization for $CO_2$ absorption employed in several weather prediction and climate models is found to substantially underestimate the line by line heating rates throughout the atmosphere, most notably in the stratosphere (errors > 40%). This parameterization is modified such that the resulting errors are less than 20%.

See also Lacis and Oinas 1990 and Freidenreich and Ramaswamy 1995. Clearly, these greenhouse gas theory advocates/IPCC participants were using needlessly complex 3-dimensional GCMs to take the heating rates attributable to absorption of downwelling or back-scattered visible radiation in the Chappuis band in the lower-to-mid stratospheric and transfer/credit it to CO2 absorption of purely assumed upwelling longwave radiation along the outer edge of the 8-12 micron atmospheric window, namely at 13-14 microns. That is the reason that, right from the start, all IPCC reports released to policymakers and the public claim that stratospheric ozone absorbs significant shortwave radiation only in the ultraviolet (UV) region (0.25-0.4 micron) and wrongfully assert that ozone depletion produces a slight cooling effect at the ocean surface rather than a pronounced warming effect. As explained in Section 4.1, climate scientists were overconfident in the GHGT based on a demonstrably false scientific premise.

## 6. Conclusions

From the collective evidence presented in this paper, there is not the least question that Energetic particle precipitation related top-down depletion of ozone levels in the mid to upper stratosphere during Antarctic spring, summer and fall is the source of all warming trends in the Southern Hemisphere since the well-documented onset of GS Max conditions in 1937. As far as I could tell, the effects of ozone-depleting pollutants such as chloroflourocarbons (CFCs) are largely if not entirely restricted to the frigid-cold lower stratosphere and have no significant effect on climate change.

The stratospheric ozone layer dominates both short and long-term trends in the temperature of the middle stratosphere as well as the Ocean surface and its depths and the air above it. This is because ozone absorbs substantial incoming and reflected outgoing shortwave radiation in the UV (0.28-0.34 microns) and orange visible bands (0.55-0.65 microns) as well as substantial outgoing thermal radiation in the main water-vapor window (8-12 microns). Because the stratospheric ozone layer is profoundly affected by EPP associated with solar cycles of varying frequencies/periodicities that are likely associated with planetary alignments, it is likely responsible for all the sustained warming and cooling cycles during interglacial periods. Quoting Randall et al. 1998 pages 28361 and 28370:

> Observations of stratospheric odd nitrogen [NOy] are of primary importance in studies of ozone depletion and climate change because of the potential effects of odd nitrogen on the odd oxygen balance [ozone levels] of the stratosphere. Reactions involving NOy ($N + NO + NO_2 + NO_3 + N_2O_5 + HO_2NO_2 + ClONO_2$) dominate stratospheric odd oxygen loss above approximately 24 km. . . . We conclude that the enhanced levels of stratospheric $NO_2$ result from the downward transport of NOx formed in the mesosphere or lower thermosphere. This conclusion is in agreement with recent analysis of 1994 ATMOS and HALOE data. . . . This work is the first to use measurements of polar $NO_2$ and ozone throughout the winter and spring to confirm that vertical transport of $NO_2$ formed in the upper atmosphere during the polar night causes stratospheric ozone reductions [via indirect EPP].

So-called greenhouse gases play no role in climate change because the MBL covering more than 70% of the Earth's surface is opaque to all thermal infrared radiation that matters except the water-vapor window at 8-12 microns. Greenhouse gases do not trap heat in the free atmosphere where they shed exactly as much heat as they receive, no more, no less pursuant to the first law of thermodynamics and none of it returns to warm the Earth's surface pursuant to the second law of thermodynamics.

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*Data Availability Statement.*

A MS word table summarizing input and output for all 207 SMARTS2.9.5 runs is available upon request from the author.

## REFERENCES

Abdussamatov, H.I., (2016): The new little ice age has started, Chapter 17 of *Evidence-Based Climate Science: data opposing CO2 emissions as the primary source of global warming*, 2nd ed.; Easterbrook, A. Ed.; Elsevier: Amsterdam, Netherlands, pp. 307-328.

ASTM, (2020): Standard Tables for reference solar spectral irradiances: direct normal and hemispherical on 37 deg tilted surface," Active Standard ASTM G173: developed by subcommittee: G03.09: *Book of Standards*, 14.04.

Brindley H.E. and R.J. Bantges, (2016): The spectral signature of recent climate change. *Curr. Clim. Change Rep.* 2 112, pp. 1-16, https://doi: 10.1007/s40641-016-0039-5.

Brunetti M. and F. Prodi, (2015): The climate system. *The European Physical Journal Conferences*, pp. 1-16, https://doi: 10.1051/epjconf/20159802001.

Carillo, J., J.C. Geurra, E. Cuevas and J. Barrancos, (2016): Characterization of the marine boundary layer and the trade wind inversion over the sub-tropical North Atlantic. *Boundary Layer Meteorol.* 157 1, pp. 311-330, https://doi.org/1007/s10546-015-0081-1.

Cheng, L., and Coauthors, (2020): Record-setting warmth continues in 2019. *Adv. Atmos. Sci.* 37(2), pp. 137-142, https://doi.org/10.1007/s00376-020-9283-7.

Diaz, J.P., and Coauthors, (2019): Long term trends in marine boundary layer properties over the Atlantic Ocean. *J. Cli.* 32 10, pp. 2991-3004, https://doi.org/175Jcli-D-18-0219.1

Freidenreich S.M. and V. Ramaswamy, (1993): Solar radiation absorption by $CO_2$, overlap with $H_2O$, and a parameterization for general circulation models. *JDR Atmos.* 98 D4, pp. 7255-7264, https://doi.org/10.1029/92jD02887.

Freidenreich S.M. and V. Ramaswamy (1995): Stratospheric temperature response to improved solar CO2 and H2O parameterization. *J Geophy. Res.* 100 D8, pp. 16721-16725.

Federalregister.gov 2016: Revision of OMB Circular No. A-119, Federal participation in the development and use of Voluntary Consensus Standards and in Conformity Assessment activities: A notice by the Management and Budget Office on 01/27/2016. FR Doc. 2016-01606.

Fredrick J.E., and C. Leovy, (1985): co-chairmen, chapter 7, "Radiative Processes" in World Meteorological Organization Report No. 16: Atmospheric Ozone.

Gast, P.R. and J.I.F King, (1960): Chapter 16, part 2, "Solar Radiation" in *Handbook of Geophysics*; Macmillan, NY, NY; pp. 14-30.

Gordan, L.E., and Coauthors, (2017): The HITRAN2016 molecular spectroscopic database and HAWKS (HITRAN atmospheric workstation). *J. Quant. Spectrosc. Radiat. Transf.* 203, pp. 3-69.

Grytsai, A., and Coauthors, (2020): Investigation of the vertical influence of the 11-year solar cycle using SBUV and Antarctic ground-based measurements and CMIP6 forcing data. *Atmosphere* 11 8, pp. 1-20, https://doi:10.3390/atmos11080873.

Gueymard, C., (1995): A simple model of the atmospheric radiative transfer of sunshine: algorithms and performance assessment. FSEC-PF-270-95, pp.1-84.

Herrera V.M., B. Mendoza and G.V. Herrera, (2015): Reconstruction and prediction of the total solar irradiance from the Medieval Warm Period to the 21st Century. *New Astronomy* 84, pp. 221-233.

Inn E.C.Y. and Y. Tanaka, (1953): Absorption coefficient of ozone in the ultraviolet and visible regions. *J. Opt. Soc. Amer.* 43 10, pp. 870-873.

Harries, J., and Coauthors, (2008): The far infrared Earth. *Rev. Geophy.* 46 RG4004, pp. 1-34, https://doi.org/10.1029/2007RG000233.

HITRAN Online, (2021): Data access, absorption cross section list for ozone. Available online: https://hitran.org/xsc/

Jerlov, N.G., Ed., (1968): *Optical Oceanography*, 1st ed.; Elsevier: Amsterdam, Netherlands, 194 pp.

Kelleher, B., (2021): *Exposing the progressive left greenhouse gas charade*. KDP; 217 pp.

Labs D., and H. Neckel, (1968): The radiation of the solar photosphere from 2000 A to 100 microns, *Z. Astrophysik.* 69 (1), pp. 1-73.

Lacis A.A., and J.E. Hansen, (1974): A parameterization for the absorption of solar radiation in the Earth's atmosphere. *J. Atmos. Sci.* 31, pp. 118-133.

Lacis A.A. and V. Oinas, (1990): A description of the correlated k distribution and non-grey gaseous absorption, thermal emission, and multiple scattering in vertically inhomogeneous atmospheres. *J. Geophys. Res.* 96 D5, pp. 9027-9064.

Light, B., T. Grenfell and D.K. Perovich, (2008): Transmission and absorption of solar radiation by Arctic sea ice during the melt season. *J. Geophy. Res.* 113 CO3023, pp. 1-19, https://doi:10.1029/2006JC003977.

Lockwood, M., A.P. Rouillard and I.D. Finch, (2009): The rise and fall of open solar flux during the current grand solar maximum. *Astrophy. J.* 700, pp. 937-944, https://doi: 10.1088/0004-637X/700/2/937.

Moortgat G.K. and A.R. Ravishankara, (2015): chapter titled, Ozone depletion and related topics/Photochemistry of ozone, in *Encyclopedia of Atmospheric Sciences*, 2nd ed.; Elsevier: Amsterdam, Netherlands; pp. 370-379.

NASA Earth Observatory, (2020): World of Change: Antarctic sea ice. Available online: https://earthobservatory.nasa.gov/world-of-change/sea-ice-antarctic

NASA GISS Global Climate Modeling website, (2021). Available online: https://www.giss.nasa.gov/projects/gcm/

NASA GISS website, (2019): Surface Temperature Analysis (v.3). Available online: https://data.giss.nasa.gov/gistemp/graphs_v3/

NASA Ozone Watch facts, (2021): History of the ozone hole. Available online: https://ozonewatch.gsfc.nasa.gov/facts/history_SH.html

NASA Ozone Watch maps, (2021). Available online: https://ozonewatch.gsfc.nasa.gov/Scripts/big_image.php?date=1980-09&hem=S

Ndengue, S. S. Madronich, F. Gatti, H.D. Meyer, O. Motapon and R. Jost, (2014): Ozone photolysis: strong isotopologue/isotopomer selectivity in the stratosphere. *J. Geophy. Res. Atmos.* 119 7, pp. 4286-4302.

NOAA Climate.gov web site, (2019): News and Features article, Antarctica is colder than the Arctic but still losing ice. Available online: https://www.climate.gov/news-features/features/antarctica-colder-arctic-it%E2%80%99s-still-losing-ice

NOAA GFDL Models website, (2012). Available on line: https://www.gfdl.noaa.gov/model-development/

NOAA Satellite and Information Service website, (2021): Coral Reef Watch: Near real-time data: archived data and images. Available online: https://coralreefwatch.noaa.gov/product/5km/index.php

Ramaswamy V., (2001): as coordinating lead author of Chapter 6: Radiative forcing of climate change, pp 349-416 of IPCC: Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.

Ramaswamy, V. and Coauthors, (2006): Anthropogenic and natural influences in the evolution of lower stratospheric cooling. *Science* 311 1138, pp. 1138-1141.

Randall, C.E., R.M. Bevilacqua, K.W. Hoppel and J.D. Lumpe, (1998): Polar ozone and aerosol measurement (POAM) stratospheric NO2, 1993-1996. *J. Geophys. Res.* 103 D21, pp. 28361-28371, https://doi/10.1029/98JD02092.

Rignot, E., and Coauthors, (2019): Four decades of Antarctic ice sheet mass balance from 1979-2017. *PNAS* 1116 4, pp. 1095-1103, https://doi/10.1073/pnas.1812883116.

Rothman, L.S., and Coauthors, (1998): The HITRAN molecular spectroscopic database. *J. Quant. Spectrosc. Radiat. Transf.* 60 5, pp. 665-710.

Schdeider D.P. and E.J. Steig (2008): Ice cores record significant 1940s warming related to tropical climate variability. *PNAS* 105 (34), pp. 12154-12158, https://doi.org/10.1073/pnas.0803627105.

Solanki, S.K., I.G. Usoskin, B. Kromer, M. Schussler and J. Beer, (2004): Unusual activity of the Sun during recent decades compared to the previous 11,000 years. *Nature* 431, pp. 1084-1087.

Usoskin, I.G., S.K. Solanki and G.A. Kovaltsov, (2011): Grand minima of solar activity during the last millennia. Proceedings IAU Symposium No. 286, pp. 372-382, https://doi:10.1017/S174392131200511X.

Vaughan, D. and Coauthors, (2003): Recent rapid regional climate warming on the Antarctic Peninsula." *Climate Change* 60, pp. 243-274, https://doi:10.1023/A:1026021217991.

Vihma, T., M.M. Johansson and J. Launiainen, (2009): Radiative and turbulent surface heat fluxes over sea ice in the western Weddell Sea in early summer. *J. Geophy. Res.* 114 C04019, pp.1-18, https://doi: 10.1029/2008JC004995.

Woods Hole Oceanographic Institute, (2021): Polar Discovery website article titled: Antarctic's ocean circulation. Available online: https://polardiscovery.whoi.edu/antarctica/circulation.html

Exhibit 2 to June 1, 2021 Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 14, 2021: *Overwhelming empirical evidence that increases in atmospheric CO2 since 1937stem from stratospheric ozone depletion*

# Overwhelming empirical evidence that increasing atmospheric CO2 since 1937 stems from stratospheric ozone depletion

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ABSTRACT

This paper supplements my March 2021 paper currently in draft and under review by this journal titled "Overwhelming empirical evidence that global warming since 1937 is from stratospheric ozone depletion." All scientists endorsing the conclusions of the International Panel on Climate Change (IPCC) established in 1988 by the United Nations Environmental Program (UNEP) are of the firm opinion that the building up of the so-called greenhouse gas pollutant carbon dioxide (CO2) primarily via the combustion of fossil fuels has been causing global warming commencing as of approximately 1850 with the widespread mining and burning of coals. In this paper, I will apply basic environmental engineering practices and principals to empirical data and proxy data to prove definitively that increasing atmospheric CO2 levels commencing in the late 1700s are the direct result of a natural cycle of top-down ozone depletion in the mid to upper stratosphere and the associated sustained retreat of sea-ice and thawing of permafrost.

SIGNIFICANCE STATEMENT

This paper very likely represents the first rigorous top-tier private-sector environmental engineering analysis of the cause of increases in atmospheric CO2 commencing in 1937, in this case by an environmental engineer who developed and taught for credit a graduate-program course in water chemistry focused on the carbon and water cycles in the late 1970s, and with 30 years experience as a court-appointed neutral fact finder. My analysis picked up a deeply rooted flaw in how scientists have been using the gas laws to ascribe CO2 as a pollutant. In my first paper I offered overwhelming evidence that a 30 percent decrease in stratospheric ozone depletion causes a linear 30 percent increase in the amount of UVA and visible radiation in the orange spectral band entering the troposphere relative to the amount absorbed at baseline and that the increases are very substantial at high solar zenith angles characteristic of the polar zones.

## 1. Introduction

The average global concentration of atmospheric CO2 has risen from about 310 ppmv (0.031% by volume) in 1936 to about 410 ppmv (0.041% by volume) in 2020 (NOAA Climate.gov). According to the greenhouse gas theory of global warming (GHGT), the rise in the heat content of the Ocean is primarily due to the rising atmospheric CO2 levels. Is there any bona fide empirical evidence that CO2 emissions from the combustion of fossil fuel are causing the atmospheric CO2 levels to rise by

100 ppmv? Or is the rise caused in part or in full by something else? Is the incremental CO2 acidifying the Ocean?

Section 2 summarizes the overlooked existing empirical and proxy evidence that rising CO2 levels dating back to the end of the Little Ice Age are the result of mid to upper stratospheric top-down ozone depletion.

Section 3 identifies and explains the deeply rooted flaw I found in modern scientific use of the gas laws in promoting and defending the greenhouse gas theory of global warming (GHGT).

Section 4 describes the methods I used to provide further proof that increasing atmospheric CO2 is the result of predictable off-gassing rather than pollution. I used an NOAA/NCEI image maker to create the four illustrations in Fig. 8. They collectively serve to show the magnitude of seasonal sea-surface temperature deviations at approximately 58 deg N latitude in the heart of the sea-ice-loss-prone Bering Sea. I used the online image maker at the NASA GISS Surface Temperature Analysis (GIStemp v.4) website (2021) to create the fourteen illustrations in Figs. 9-15. They collectively serve to show that the rise of atmospheric CO2 and sea-surface warming both correlate with periods of high solar activity primarily affecting points north of 50 deg N and south of 50 deg S.

Section 5 discusses what is revealed by Figs. 8-15. Section 6 provides conclusions.

## 2. Summary of existing empirical evidence that is being ignored or misinterpreted

### *2.1 What the Pleistocene proxy data shows for temperature and CO2*

Fig. 1 reproduces the sole illustration from a NOAA NCEI website with a feature article titled "Temperature change and carbon dioxide change."

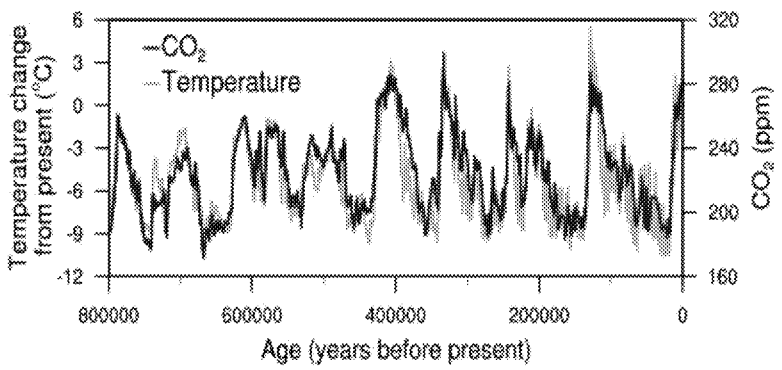



*Fig. 1. NOAA plot tracking running average near surface temperature and CO2 using polar ice core data. Ref.: NOAA NCEI website (2020), Fig.1.*

As depicted in Fig. 1, there is 800,000 years of polar-ice-core proxy data that establishes a close linear relationship between near-surface air temperatures and near-surface atmospheric CO2 levels when sea-ice and glaciers advance and retreat. For the most recent 400,000 years it shows that interglacial periods such as the Holocene have been characterized by stable atmospheric CO2 levels of about 280 ppmv.

The proxy data is clear that atmospheric $CO_2$ concentrations rise during periods of sea-ice retreat and fall during period of sea-ice and glacial advance. This makes perfect sense if one assumes that rising temperatures and sea-ice retreat are the result of top-down stratospheric ozone-depletion-

induced increases in shortwave radiation in the UVA and orange spectral bands. In fact, where else would the $CO_2$ be coming from if not from the amplified seasonal/diurnal warming and cooling of the Ocean surface, melting sea ice and thawing permafrost?

## *2.2 What the Holocene proxy data shows for temperature and CO2*

Fig. 2 reproduces the 1st illustration in Chapter 2 (Forster and Ramaswamy 2007), of the IPCC's fourth assessment report. It shows reconstructed atmospheric CO2, methane and Nitrous Oxide levels. It shows CO2 dropping from approximately 280 to approximately 275 ppmv during the Maunder minimum (1645-1719) which was a 70-year period of near-zero sunspot activity correlating with minimum air temperature. It then shows a steady climb of methane and CO2 commencing in the mid and late 1700s, respectively. Given the timing and considering the gas laws, there is no good reason to believe CO2 is tracking fossil fuel combustion which did not become a prominent anthropogenic source until the mid 20th century at which point the CO2 levels had already risen 35 ppmv from approximately 275 ppmv in 1780 to approximately 310 ppmv in 1935. In fact, CO2 has been closely tracking sea-ice advance and retreat for at least 800,000 years.

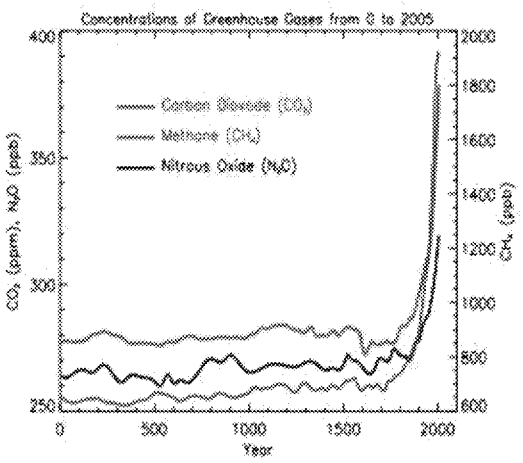



*Fig 2. Concentrations of greenhouse gasses from 0 AD to 2005. Ref.: Forster and Ramaswamy 2007, Fig. 2.1.*

## *2.3 How the Maunder Minimum (MM) and Little Ice Age (LIA) factor in*

Fig. 3 reproduces the 1st illustration in a paper by Owens et al. 2017 titled "The Maunder minimum and the Little Ice Age: an update from recent reconstructions and climate simulations." The caption reads as follows.

Exhibit 2 to June 1, 2021 Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 14, 2021: *Overwhelming empirical evidence that increases in atmospheric CO2 since 1937stem from stratospheric ozone depletion*

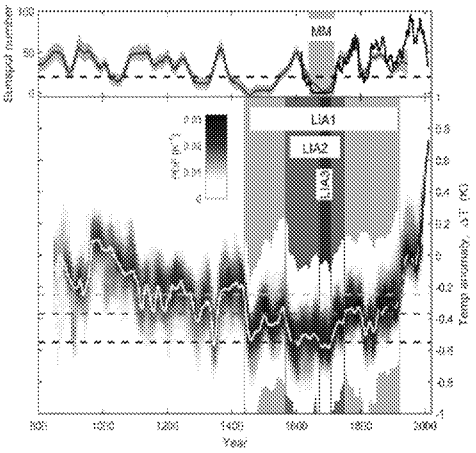



*Fig 3. A comparison of solar activity and northern hemisphere climate from AD 800 to AD 2016. Ref.: Owens et al. 2017, Fig 1.*

Top: Sunspot number, from direct telescopic observations (black; Lockwood et al. 2014) and reconstructed on the basis of 14C concentrations in tree trunks (red, with pink 1-sigma uncertainty band; (Usoskin et al. 2014). Taking a threshold smoothed sunspot number of 20 (dashed black line), the MM spans 1637–1719. Bottom: Northern hemisphere temperature anomaly, ΔT, (relative to the 1961–1990 mean) for paleoclimate reconstructions, as presented in the IPCC fifth assessment report (Masson-Delmotte et al. 2013). Colors, from white through red, show the probability density function (PDF), while the white line shows the PDF maximum value (or mode). The blue line shows ΔT from the instrumental record (HadCRUT4; (Morice et al, 2012). All data have been smoothed using an 11 year running mean. Taking thresholds of ΔT = −0.25 K, −0.37 K and −0.55 K (dashed grey lines) defines LIAs, LIA1, LIA2 and LIA3, respectively.

The grey to black shading in the lower portion of Fig. 3 (rather than dashed lines mentioned in the caption) shows the temporal spans of LIA 1, 2 and 3. This illustration shows a clear-cut correlation between solar activity and temperature, particularly commencing with the MM in 1645-1719 where the temperature is at a Holocene minimum. Temperatures rise as the MM gives way to the onset of solar maximum conditions from 1720-1790. The temperatures then fall back during the Dalton minimum (DM) from 1800-1835. Temperatures rise as the DM gives way to another solar maximum from 1840 to 1880. Temperatures fall during a lesser minimum from 1880 to 1935 just before the onset of the modern day Grand Solar maximum (GS max) in 1937. The temperatures are clearly tracking stratospheric ozone levels which peaked during the MM and declined since then in up and down fashion as a result of fluctuating solar activity.

### *2.4 The vertical, lateral and seasonal distribution of atmospheric CO2 in 2010*

There is vast empirical data generated during the satellite era confirming that rising atmospheric CO2 levels have been tracking stratospheric ozone depletion. Satellite measurements of rapidly diminishing stratospheric ozone levels in the high Arctic (70-90 deg N latitude) and sub Arctic (50-70 deg N) commenced in 1979/80. Since then, there have been short periods of high-solar-zenith-angle sunlight entering the open or partially open areas of the Arctic and Sub-Arctic seas each winter day with highly elevated levels of visible radiation in the orange spectral band. Despite subzero air temperatures, this created well-documented positive sea-surface temperature anomalies and resulting CO2 off-gassing. Moreover, during these short daylight hours the subsurface sea-ice that was exposed to the solar warmed open or partly open ocean was melting also creating a strong diurnal cycle of pulsing $CO_2$ off-gassing along the entire melt front. During the long frigid nights, sea-ice was reforming and advancing shedding its brine into the adjoining near-surface seawater. This phase change released heat energy into the adjoining water and dramatically increased its salinity. Both of

these conditions reduce gas-phase CO2 solubility thereby creating pulsing CO2 off-gassing during the Arctic and sub Arctic nights and mornings.

Based on recent bench-scale work, Barley et al. 2018 reported that brines that reach subzero temperatures without freezing contain supersaturated levels of dissolved-phase CO2 that are up to 19% higher than extrapolated in current climate models on the basis of published Henry's Law constants for freezing point sea-surface temperatures. This super saturation ostensibly enhanced off-gassing during Arctic and sub Arctic winter nights and mornings.

Fig. 4 reproduces the 6th illustration of a paper titled "Global distribution of CO2 in the upper troposphere and stratosphere" authored by Diallo et al. 2017. It is a series of twelve color-coded graphs showing the global distribution of atmospheric CO2 by month in 2010 from 5-45 km above mean sea level (AMSL). The plots are derived from a combination of modeling and empirical data collected by aircraft and weather balloons.

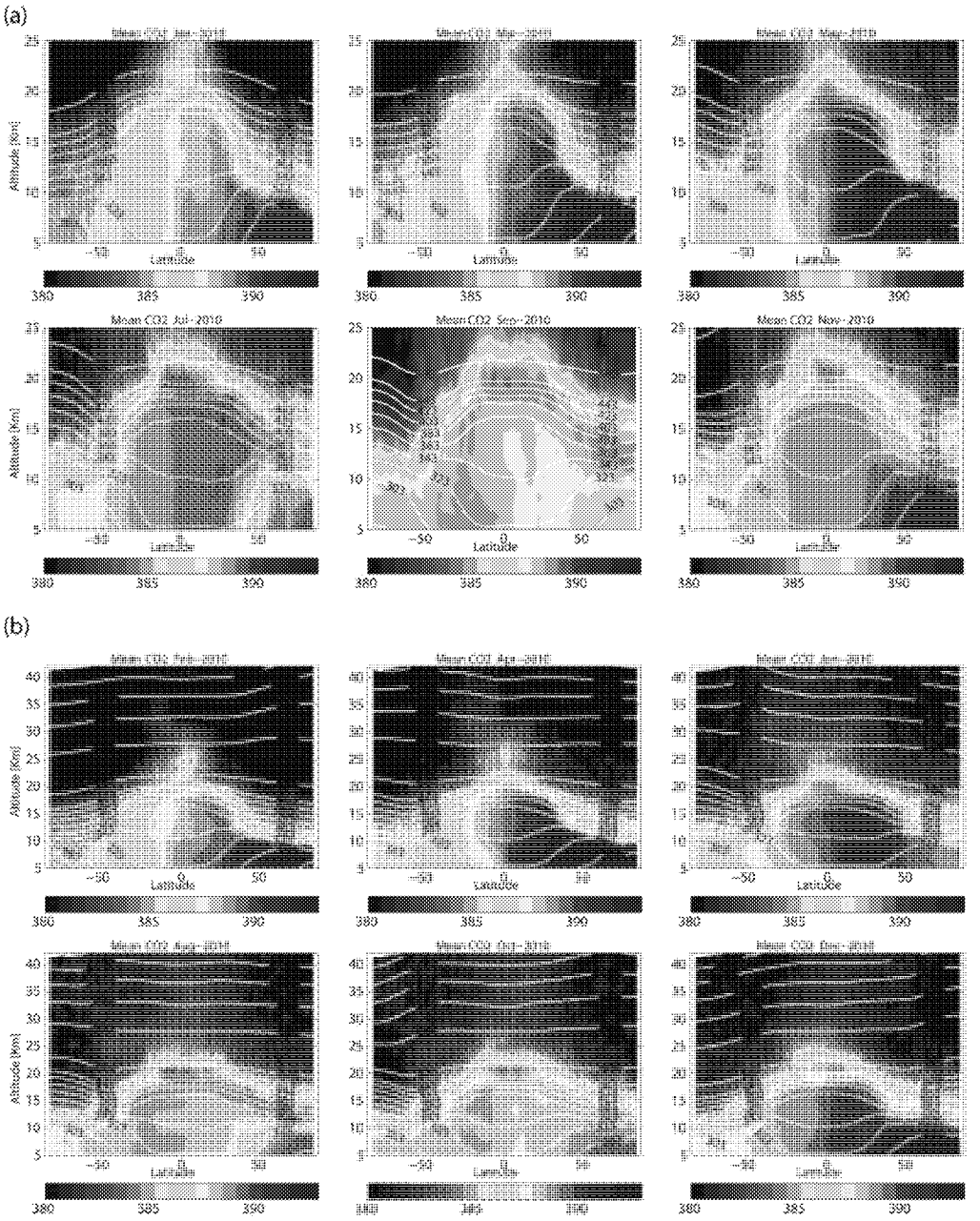



*Fig. 4. Distribution of CO2 from 5-40 km AMSL in 2010. Ref.: Diallo et al. 2017, Fig 6.*

Fig. 4 should be evaluated in conjunction with Fig. 5 comprised of two screen shots from a NASA Goddard Space Flight Center 2014 animation modeled from 2006 daily satellite data.

The CO2 off-gassing shown in Figs. 4 and 5 occurs along the sea-ice and submerged permafrost melt fronts primarily at points north of 50 deg N latitude and with much lesser amounts S of 50 deg S latitude. The peak off-gassing in polar spring and early summer is predictable under the gas laws taking into consideration the effects of seasonal increases in the orange spectral band of sunlight entering the open ocean and the associated magnitude of diurnal temperature fluctuations. Pursuant to Fick's law, over the course of the entire year the color-coded concentration gradients shown in Fig. 4 are preventing CO2 from the upper atmosphere from downwelling into the Ocean at all locations in

fall, winter and spring. Any effects of fossil fuel emissions in the polar zones are not apparent in either figure.

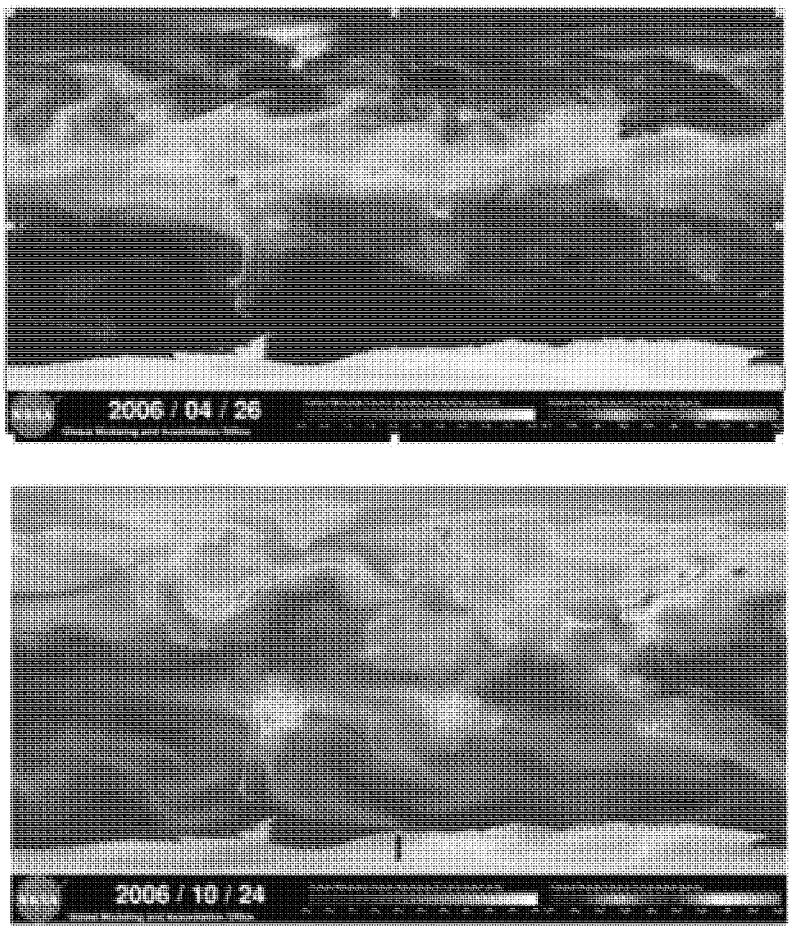



*Fig. 5. Two screen shots of a NASA GMAO video prepared using satellite measurements and a meteorological model comparing atmosphere CO2 distribution on April 10, 2006 and October 24, 2006. Ref: NASA GSFC website 2014. According to the scale for CO2, the dark blue is 380 ppmv, yellow is 382, red is 384 and darkest red is 386.*

The Lower half of Fig. 5 shows the relative contribution of CO2 emissions from industrial areas of the world with the largest contribution from China. The Northern Hemisphere industrial emissions peak in December-February. Lower Fig. 5 in conjunction with Fig. 4 collectively show that if the rise of CO2 in the tropopause and lower stratosphere associated with industrial areas were the source of global warming, the climatic impacts would be highest in the northern tropics from March through July. Instead the greatest warming occurs in the polar zones where ozone depletion is at its maximum levels in the spring and early summer.

Consistent with what is shown by 800,000 years of proxy data and hard empirical data, there is not the least question that the rise in global CO2 as of 2006-2010 is primarily from the seasonal off-gassing from the sea surface and melt/thaw front at points north of 50 deg N from November through May just after which CO2-consuming seasonal plankton and terrestrial vegetation uptake of atmospheric CO2 commences. The fact that 50 deg N latitude demarks the southern limit of Northern Hemisphere permafrost occurrence as well as the heaviest CO2 off-gassing is not a coincidence.

Bearing this out, Fig. 6 reproduces the first illustration in a paper written by Commane et al. 2017 titled "Carbon dioxide sources from Alaska driven by increasing early winter respiration from Arctic tundra." Quoting from the abstract:

> Here we combine aircraft and tower observations of atmospheric CO2 with remote sensing data . . . to derive temporally and spatially resolved year-round CO2 fluxes across Alaska during 2012-2014. We find that tundra ecosystems were a net source of CO2 to the atmosphere annually, with especially high rates of respiration during early winter (October through December). Long-term records at Barrow, AK, suggest that CO2 emissions rates from North Slope tundra have increased during the October through December period by 73% +/- 11% since 1975, and are correlated with rising summer temperatures.

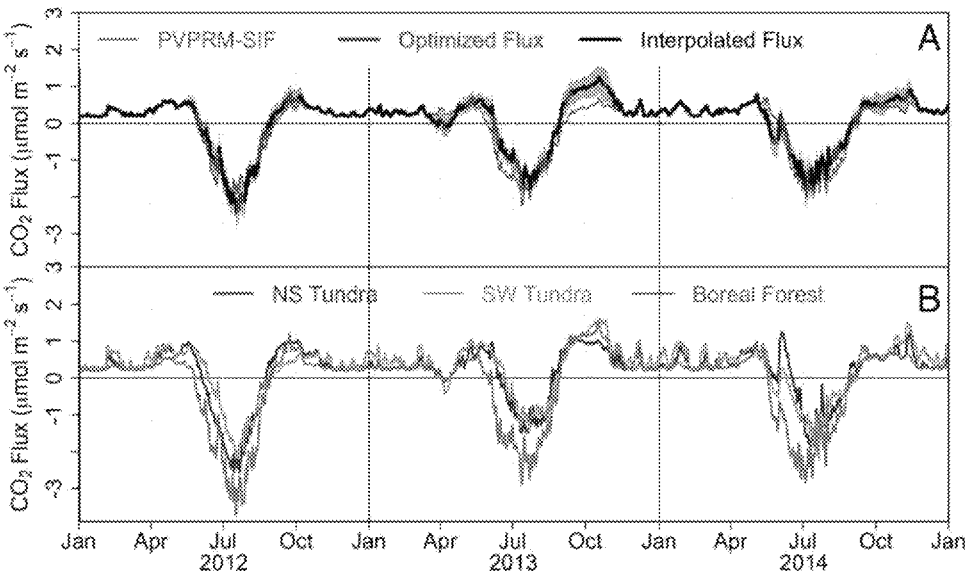



*Fig. 6. Time series of biogenic CO2 fluxes for Alaska during 2012-2014 calculated from CARVE aircraft data. Ref., Commane et al. 2017, Fig.1.*

The caption to the Commane et al. illustration reads as follows:

> (A) Mean daily net biogenic CO2 flux for Alaska during 2012-2014, with modeled (PVPRM-SIF) CO2 flux (red) and interpolated aircraft optimized net CO2 flux (black). Our approach for estimating these fluxes and the uncertainty range (shown without shading) is described in SI Appendix, Calculation of the additional flux correction. (B) Optimized biogenic CO2 fluxes for different regions in Alaska: NS tundra (blue), SW tundra (orange), and boreal forests (green).

Jeong et al. 2018 made similar findings using Barrow, Alaska data in a paper titled "Accelerating rates of carbon cycling revealed by atmospheric $CO_2$ measurements."

The recent warming has had a marked effect on the carbon cycle of the northern oceans, particularly in the continental shelf areas substantially increasing the amount of $CO_2$ off-gassing in the fall, winter and especially the spring. Anderson and Macdonald 2015, cover this topic in "Observing the Arctic Ocean carbon cycle in a changing environment."

## 3. How the gas laws are being improperly applied in ascribing CO2 as a greenhouse gas pollutant

Proponents of the GHGT of global warming are misapplying Henry's Law in predicting CO2 uptake by the Ocean based on rising atmospheric CO2 levels. Quoting Murray 2015, who seems to be

drawing from Emerson and Hedges 2012: "The atmosphere controls the ocean's gas contents for all gases except radon, CO2 and H2O."

CO2 is highly soluble because it readily reacts with an unlimited supply of highly reactive water molecules in forming carbonic acid which rapidly dissociates into highly reactive bicarbonate and hydrogen ions within what is referred to as the carbonate system. The carbonate system includes carbonic acid, bicarbonate ions and carbonate ions. The carbonate system strongly buffers the Ocean against changes in dissolved phase CO2 and pH partly because the calcium carbonate formed by the carbonate ions is insoluble and creates a sink. There is no limit to the amount of atmospheric CO2 that the Ocean can quickly absorb in reaching its saturation point at a given temperature. This is why it is impossible for combustion of fossil fuels to increase atmospheric CO2 concentrations and why the pH of the Ocean is very stable at 8.2.

There is no question that the solubility of CO2 in freshwater and seawater is temperature dependent and involves the carbonate system. Fig. 7 reproduced from the 4th illustration in "Solubility of gases in water," (engineeringtoolbox.com 2021) shows the amount of CO2 dissolved in distilled water in contact with 1 atmosphere of pure CO2 gas. Within the normal temperature range of seawater, the values range from 1,250 mg/kg at 30 deg to 3,300 mg/kg at O deg C. Under Dalton's Law we can calculate the solubility for an assumed baseline atmospheric CO2 concentration of 280 ppmv which is 0.028% by volume. This is the known equilibrium level for the Holocene. Including a 20% downward adjustment for salinity, the corrected solubility range is 28-74 mg/kg which would include the CO2 that created the carbonate system. This is referred to as TCO2 or the dissolved inorganic carbon. Please note the curve is near linear and that the rate of change is about 1.5 mg/kg of TCO2 per deg. C.

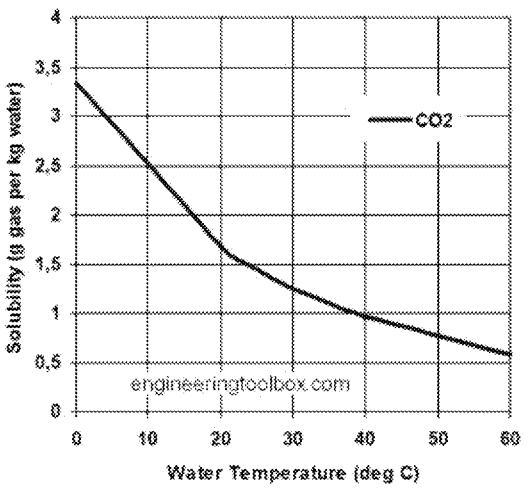



*Fig. 7. Plot of CO2 solubility in water in g/kg vs temperature under 1 atm of pure CO2. Ref: engineeringtoolbox.com web site 2021, Fig 4.*

Henry's Law is not useful or needed for addressing the effects of increasing atmospheric CO2 levels. It states that at equilibrium the partial pressure of CO2 in the atmosphere is proportional to the partial pressure of CO2 in near-surface seawater. The Henry's Law constant, however, is simply the ratio of these two values at different temperatures as determined by bench testing under controlled conditions. Thus, under equilibrium conditions, for a given sea-surface temperature, you can take the average partial pressure in the atmosphere and multiply it by the Henry's Law constant to calculate the average partial pressure at the Ocean surface. Using specialized equipment, you can also measure the instantaneous partial pressure at the Ocean surface which is referred to as pCO2aq.

Of utmost significance, however, it needs to be appreciated that the pCO2aq of seawater is nothing more than a measure of the bottom-up pressure that the dissolved CO2 exerts on the base of the atmosphere and otherwise has nothing to do with water chemistry. The fundamental problem is that the pCO2aq values increase with a rise in the temperature of the near-surface seawater as a result of off-gassing while the mass of CO2 dissolved in solution in mg/kg decreases as the temperature rises as a result of off-gassing. While pCO2aq is certainly related to the amount of CO2 dissolved in mg/kg, the reversible carbonate system reactions are temperature dependant. Moreover, under supersaturated conditions (off gassing), the measured pCO2aq can be much higher than the calculated pCO2aq. Thus, when you know off gassing is occurring based on rising sea-surface temperature a pCO2aq measurement is of no value.

Confirming this conclusion, according to Kanwisher 1960 of Woods Hole Oceanographic Institution: "Henry's Law is not valid [relevant] for the relationship between pCO2 [aq], and total CO2, since only that component present as a physically dissolved gas is responsible for the tension." By total CO2, he is referring to total dissolved inorganic carbon including the dissolved CO2, carbonic acid, and bicarbonate and carbonate ions. His figure 2 shows pCO2aq increasing from about 130 µatm at 10 deg C to 450 µatm at 22 deg C. He notes the local Cape Cod seawater had a surface temperature of approximately 10.8 deg C and was under-saturated with CO2 at the time having measured pCO2aq at 285 µatm vs 315 µatm pCO2atm. It is important to recognize, however, that the relationship between pCO2aq and pCO2atm is not that simple. As discussed above, there is much more location-specific variability in pCO2aq due to temperature and salinity effects while pCO2atm is aptly considered a regional or global average.

In their quest to prove that increasing atmospheric CO2 is acidifying the Ocean, scientists from around the World have collaborated in generating massive amounts of empirical data including measurements of pCO2aq, dissolved CO2, pH, acidity and alkalinity. Quoting from the abstract and introduction of a paper authored by NOAA's Takahashi and Southerland 2016:

> The approximately 13.5 million measurements of surface water pCO2 made over the global oceans during 1957-2018 have been processed to make a uniform data file in this Version 2018. Measurements made in open oceans as well as in coastal waters are included. . . . The seawater pCO2 depends on the temperature, the total amount of CO2 dissolved in seawater and the pH of seawater. Over the global ocean, it varies from about 100 µatm to 1000 µatm (1 µatm = 10-6 atm = 0.101325 Pascal). When seawater pCO2 is smaller than the atmospheric pCO2 (presently about 395 µatm), seawater takes up CO2 from the overlying air; when it is greater than the atmospheric pCO2, it emits CO2 to the air.

Given what is stated above about the variability of pCO2aq coupled with the fact that the atmosphere is currently supersaturated with CO2 and grossly out of equilibrium with the Ocean surface, I reject NOAA's assertion that you can tell when CO2 is off gassing or entering the Ocean using the ratio of pCO2aq vs pCO2atm. Rather, according to the gas laws and what is depicted on Fig. 7, I count it a certainty that CO2 will be off-gassing from the Ocean surface at the rates shown in Fig. 7 adjusted for partial pressure of 0.028 and salinity in response to rising sea-surface temperature whether the increase occurs in the frigid Arctic or the warm tropics and regardless of CO2's partial pressure in either phase.

On the other side of the coin, since pCO2aq increases with sea-surface temperature, the measured increasing pCO2aq trends reported by researchers such as Tjiputra et al 2014, have simply confirmed what is obvious from Figs. 4-15. Rather than establishing increasing uptake of CO2 or Ocean acidification, the upward pCO2aq trends are confirming widespread sea-surface warming and with attendant supersaturated pCO2aq levels resulting from massive stratospheric-ozone-depletion-related increases in shortwave radiation entering the Ocean surface in the UVA and orange spectral bands.

Along the same lines, Pighini et al. 2018 recently confirmed dissolved phase CO2 in μmol $L^{-1}$ was at supersaturated levels (off-gassing) in 40 lakes in the Alpine Region of Northern Europe at roughly 47 deg N latitude.

> At each sampling site, water temperature, dissolved oxygen (DO) and pH were measured in situ (about 20 cm depth) with a portable probe (Hach HQ 40d, LDO101, Loveland, CO, USA). pH was later used to recalculate the initial $CO_2$concentration of the sample. . . . The near-surface waters of all lakes, except for one (Schlegeis Speicher, a reservoir) where no methane could be measured, were supersaturated with both $CH_4$ and CO2, i.e. their dissolved concentrations were higher compared to the atmospheric concentration. . . . CO2 surface dissolved concentrations exceeded the atmospheric background by a factor of 3.27 ± 2.17, ranging from 1.07 to 10.95, with a range of concentration, of 2.14–150.41 μmol $L^{-1}$, and average of (± standard deviation) 36.23 ± 31.15 μmol $L^{-1}$, respectively.

Without even looking at it, I can state with confidence that the marine database shows no discernable impacts on the Ocean's carbonate system given the extent of natural variations. Moreover, I can also state with confidence that it is impossible that dissolved phase CO2 levels measured in mg/kg have increased since 1937 in the polar and sub polar zones given the extent of the empirical evidence of sustained sea-surface warming accompanied by sustained sea-ice loss.

Rather, the hard scientific empirical evidence of massive sea-surface warming in the polar and sub-polar regions since 1979 that is summarized in Section 5 and Figs. 8-15, provides hard scientific proof of massive CO2 off-gassing in the Arctic and sub Arctic since 1979. There is no other valid explanation for the rising atmospheric CO2 and supersaturated conditions.

In arguing that increasing atmospheric CO2 levels are from greenhouse gas pollution, those defending the GHGT are turning blind eyes to the evidence provided in Figs. 8-15. They are basically arguing that for the first time in 800,000 years, increases in sea-surface temperature are causing absorption of CO2 to increase rather than decrease. For example, here is how a NASA scientist who seems to share my interpretation of the limitations of Henry's Law addresses the conundrum of *unexpected* sharply rising atmospheric CO2 levels since 1937 (NASA Earth 2021) (*emphasis added*): "*Defying expectations*, scientists are beginning to find evidence that human-induced changes in the atmosphere also change the rate at which the ocean takes up carbon." In truth, there is no such evidence.

As another example, Woolf et al. 2015, aptly explain the inherent difficulties involved with modeling air-sea fluxes of CO2 in the presence of temperature and salinity gradients. In stressing the importance of the Ocean's less than 1-mm-thick thermal skin, however, they simply ignore the fact that whenever a layer of near-surface seawater underlying the thermal skin warms substantially during daylight hours due to receiving incremental amounts of shortwave radiation in the UVA and orange spectral bands, the CO2, O2, and N2 exiting solution will form bubbles that rise to the surface via buoyant convection. This is supersaturation.

In Chapter 10 titled "Gases and air-water exchange," of their monumental *Chemical Oceanography and the Marine Carbon Cycle*, Emerson and Hedges 2012 conducted an overly complicated analysis that was doomed to failure by the complete lack of knowledge of the dramatic effects of seasonal top-down stratospheric ozone loss on the orange spectral band of sunlight.

With such knowledge in hand, there is no mystery as to what has been going on at the air-sea interface in the polar and sub polar zones since the start of the modern day GS max in 1937. It is extremely easy for the incremental radiation in the orange spectral band of sunlight to warm near-surface seawater because it only penetrates the top 10 meters of crystal clear seawater with the top meter absorbing 15 percent of the heat energy (Jerlov 1968). Under increasingly turbid conditions representative of sea-ice melt fronts much larger percentages are absorbed in the top meter. Given that near-surface seawater is ordinarily saturated with CO2 due to the constant interchange with the

atmosphere, it is extremely easy for solar-warmed near-surface seawater to become supersaturated and shed CO2. As soon as the temperature starts to rise each morning, out goes the excess CO2. What's more, the CO2 in the atmosphere is currently supersaturated and cannot equilibrate as evidenced by rising atmospheric CO2 levels. They will continue to rise until the stratospheric ozone layer recovers to baseline levels of the early 1920s.

Why do levels of atmospheric CO2 increase dramatically during all sustained periods of global warming that correlate with sustained sea-ice retreat and permafrost thawing? First off, you simply can't have atmospheric CO2 at the air/Ocean interface entering into solution when the aqueous-phase CO2 levels are supersaturated due to solar warming and bubbling out of solution. Beyond that, under Fick's Law of diffusion with CO2 near-constantly off-gassing from the Ocean surface rising up into the base of the marine boundary layer (MBL) along the melt fronts, the CO2 molecules present in the air at the base of the MBL cannot move downward against the steep bottom-up concentration gradients. Fig. 4 shows color-coded concentration gradients resulting from off-gassing.

We find confirmation of the effects of Fick's Law in Fig. 1. It shows that over the past 400,000 years the long-term running average atmospheric CO2 levels have always risen to a level of 300-320 ppmv during periods of sustained sea-ice retreat only to quickly return to the normal equilibrium level of approximately 280 ppmv once the off-gassing from the Ocean and land surface subsided. The illustration further shows that during periods of global cooling with concurrent sea-ice and glacial advance, CO2 levels plummet as the near-surface temperature of seawater falls and areas of open Ocean diminish.

Given the long-term running-average nature of the proxy data that is used to show trends going back 800,000 years into the Pleistocene Era, I found no way of confirming or denying that the modern-day spike to over 400 ppmv is out of the ordinary. Based on engineering principals, however, I aptly assume that spiking is normal toward the end of any sustained period of sea-ice loss and permafrost thawing that is largely restricted to the Arctic and sub Arctic in the absence of definitive empirical evidence showing otherwise.

Although the burning of fossil fuels is possibly contributing to the $CO_2$ increase due to being seasonally trapped in the atmosphere pursuant to Fick's law of diffusion, there is no reason to believe from the NASA video or Diallo illustrations that there would be any increase in the absence of GS-Max conditions causing sustained diurnal/seasonal melting of sea ice and thawing of permafrost and associated bottom-up concentration gradients.

## 4. Methodology

To provide additional evidence on how much solar warming and CO2 off-gassing is occurring monthly in the Bering Sea during 2009, I used an NOAA/NCEI image maker website 2021 to create the four illustrations in Fig. 8 that serve to show the magnitude of sea-surface temperature fluctuations at approximately 58 deg N latitude in the spring and early summer.

To provide further evidence that the rise of atmospheric CO2 correlates with rising sea-surface temperatures at points north of 50 deg N and south of 50 deg S and with periods of high solar activity, I used the online image maker at the NASA "GISS Surface Temperature Analysis (GIStemp v.4) website (2021) to create the fourteen illustrations in Figs. 9-15, with each containing two. The baseline period is 1951-1980. Quoting from the website's first paragraph:

> The GISS Surface Temperature Analysis ver. 4 (GISTEMP v4) is an estimate of global surface temperature change. Graphs and tables are updated around the middle of every month using current data files from **NOAA** GHCN v4 (meteorological stations) and ERSST v5 (ocean areas), combined as described in our publications Hansen et al. (2010) and Lenssen et al. (2019). These updated files incorporate reports for the

previous month and also late reports and corrections for earlier months.

Each of the twelve illustrations in Figs. 9-14 plots one month of data correlating with an unusually large geomagnetic storm and/or solar proton event (SPE) or in two cases covering two clustered SPEs (March 1989 and November 2001). The plots are covering either the same month that the event(s) occurred or the month after. Fig. 9 covers the huge geomagnetic storms of March 24, 1940 (Nicholson 1940) and February 1956 (Wayman and Finch 1957) both of which were presumably associated with SPES or coronal mass ejections (CMEs). Fig. 10 covers the "Great Magnetic Storms" of May 1967 (Knipp et al. 2018) and August 1972 which Knipp et al. 2016 labeled a Carrington-class event. Figs. 11-14 use the empirical data provided on the NOAA Space Environmental Services Center (SESC) webpage, 2021 titled "Solar Proton Events since 1976." They show respectively the effects of two representative SPEs in the 1980s, 1990s, 2000s and 2010s with the following dates and magnitudes (million electron volts [MeV] at peak flux) as well as the magnitude of associated solar flares: April 24, 1994 at 2,500 MeV following an X13 solar flare; March 8 and 17, 1989 at 3,500 and 2,000 MeV following X15 and X6 solar flares; March 23, 1991 at 43,000 MeV following an X9 solar flare; November 4 and 22, 2001 at 31,700 and 18,900 MeV following X1 and M9 solar flares; March 7, 2012 at 6,530 MeV following an X5 solar flare; and September 10, 2017 at 1,490 MeV following an X8 solar flare.

Fig. 15 includes two illustrations that serve to compare annual average warming anomalies for the 5-year intervals 2005-09 to 2015-19.

To gain a broader perspective of what the NASA GISS temperature anomalies are showing I made use of the NASA Scientific Visualization Studio website (2019) video sequence titled "Global Temperature Anomalies from 1880-2019." The video is comprised of images of monthly anomalies generated using the same GIStemp v.4 database which I also carefully reviewed. The caption reads:

> This color-coded map in Robinson projection displays a progression of changing global surface temperature anomalies. Normal temperatures are the average over the 30 year baseline period 1951-1980. Higher than normal temperatures are shown in red and lower than normal are shown in blue. The final frame represents the 5 year global temperature anomalies from 2015-2019. Scale in degrees Celsius.

Exhibit 2 to June 1, 2021 Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 14, 2021: *Overwhelming empirical evidence that increases in atmospheric CO2 since 1937stem from stratospheric ozone depletion*

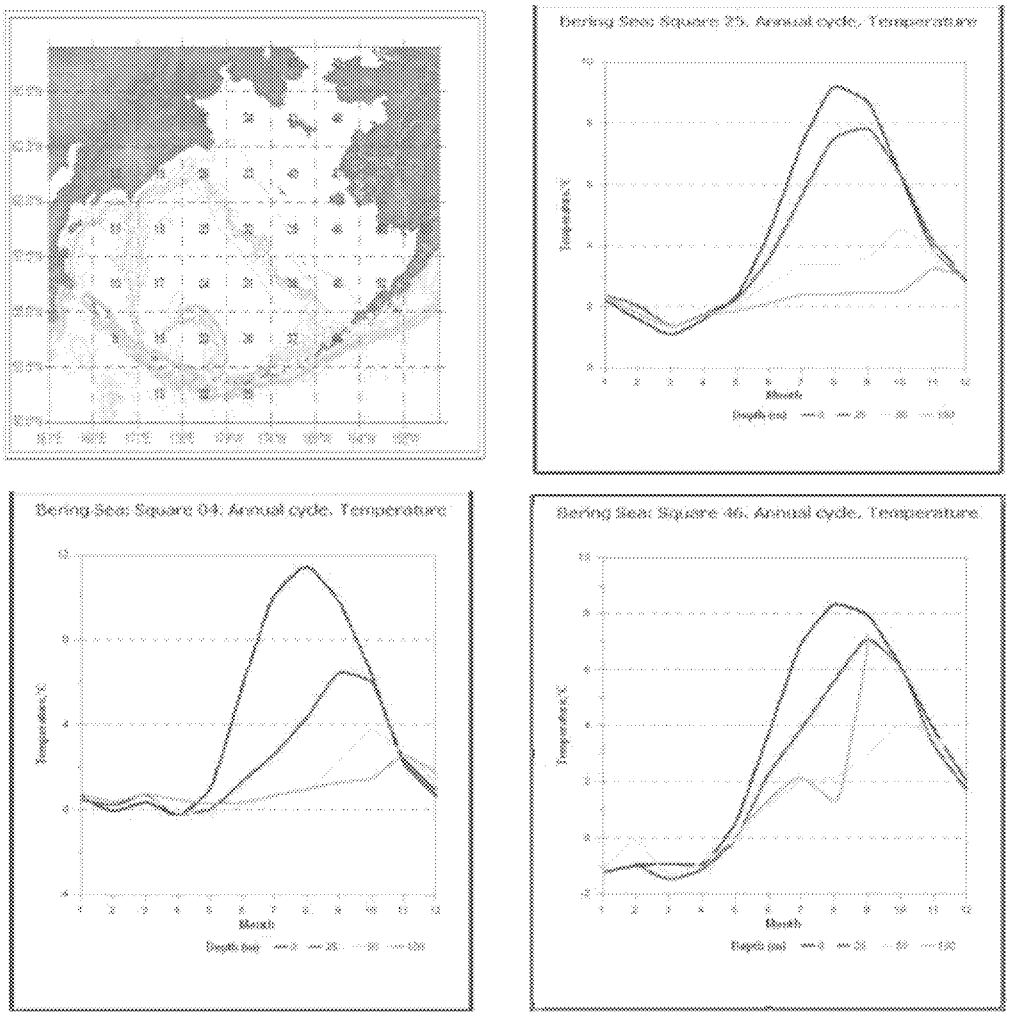
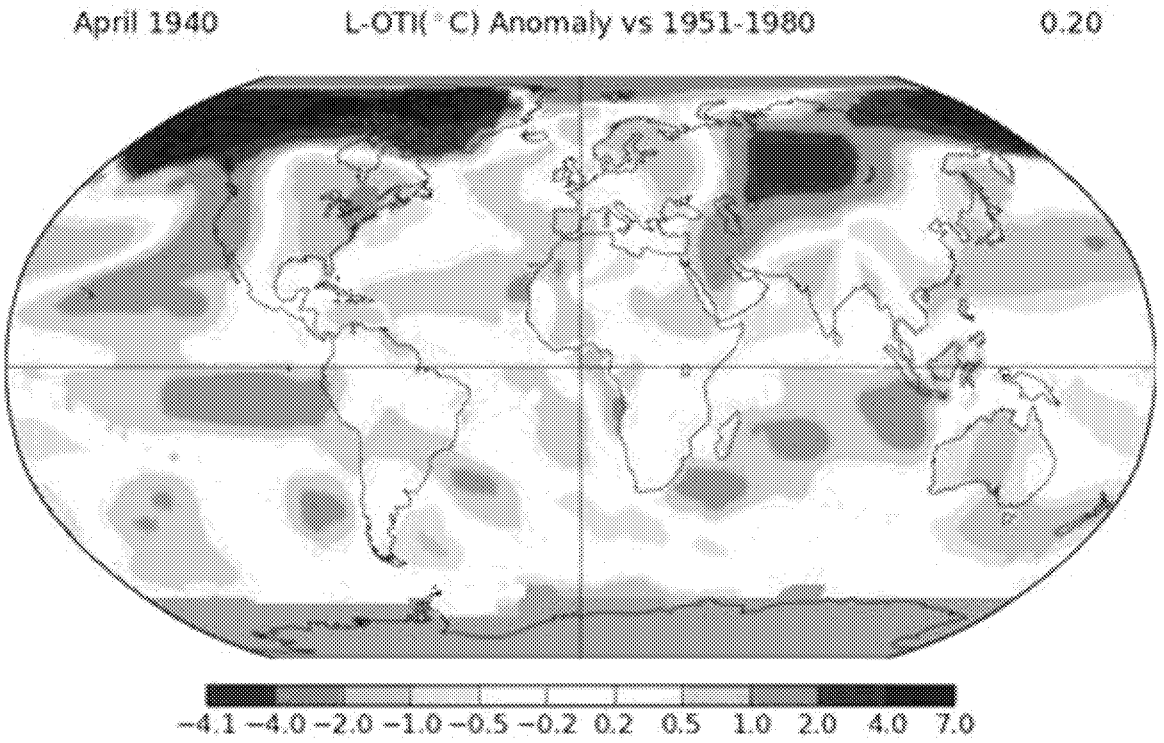



*Fig. 8. Four illustrations generated with the NOAA/NCEI (formerly NODC) OC5Pacific online image maker showing monthly temperature variations at three areas of open ocean within the Bering Sea at points just south of the sea-ice melt front. Ref.: NOAA NCEI website 2009.*

Exhibit 2 to June 1, 2021 Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 14, 2021: *Overwhelming empirical evidence that increases in atmospheric CO2 since 1937stem from stratospheric ozone depletion*



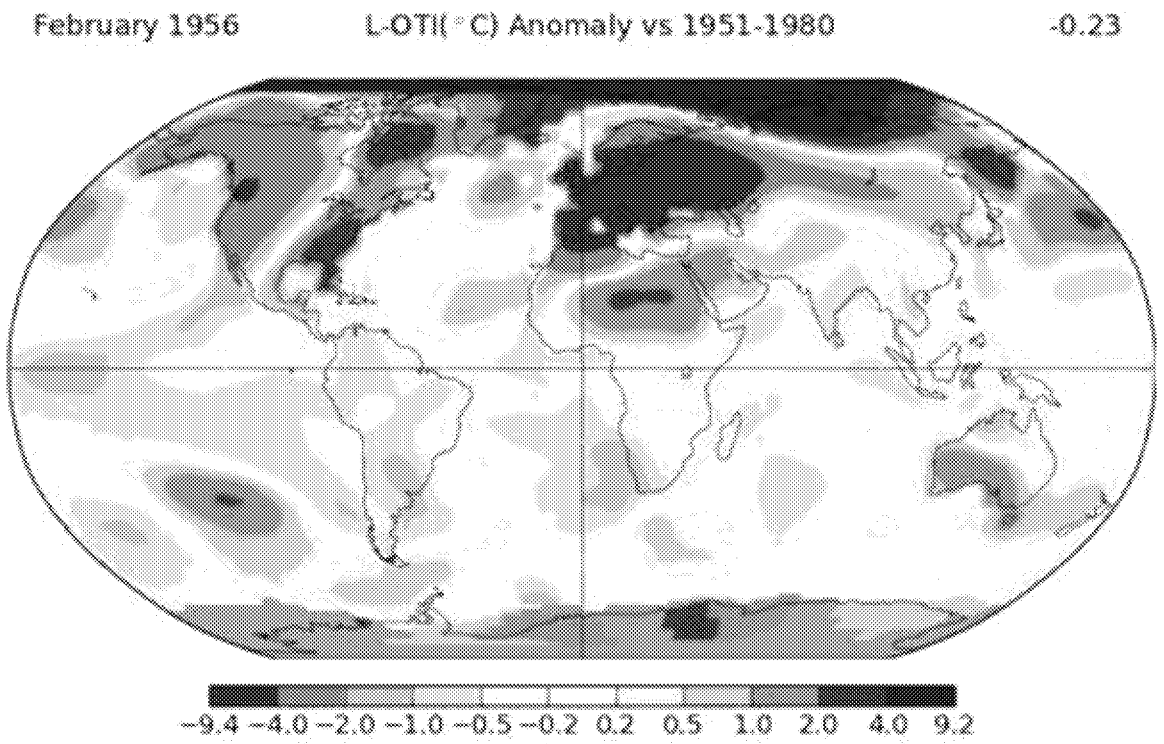




*Fig. 9. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the "Great Solar Storm" of March 24, 1940 which was accompanied by a massive coronal mass ejection (top) and another solar storm of February 23, 1956 that was accompanied by a massive ground level event of solar cosmic rays (bottom). Refs.: NASA GISS 2021, Nicholson 1940 and Wayman and Finch 1957.*

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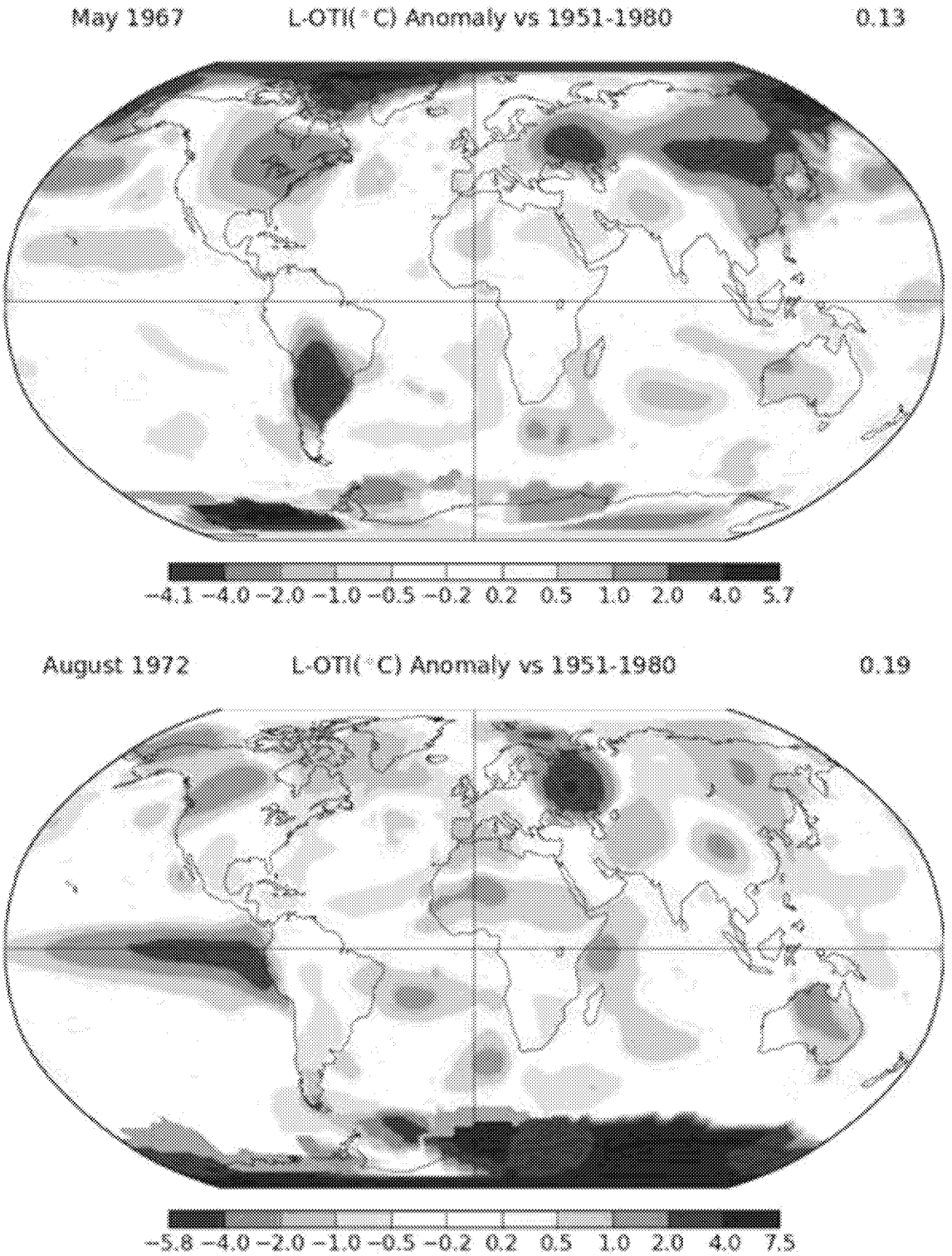
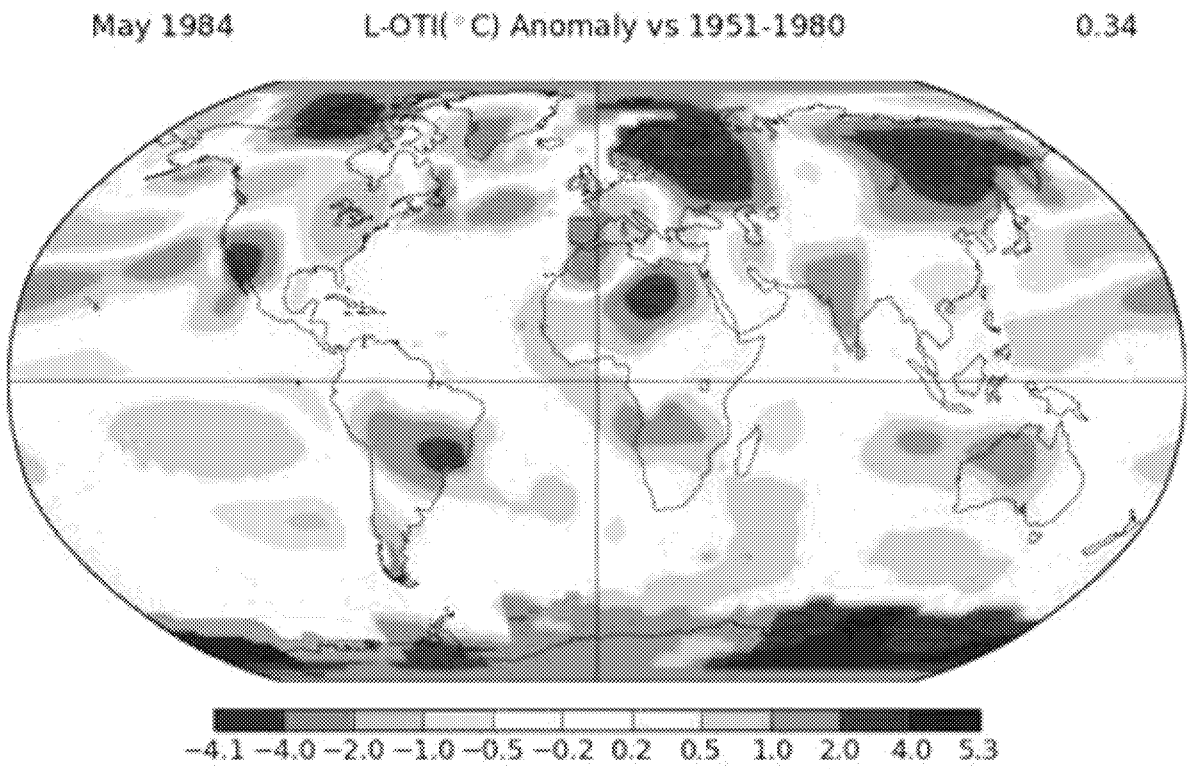



*Fig. 10. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the solar storm of May 23, 1967 which so disrupted communications it almost set off a nuclear war (top) and August 4, 1972 which is among the larges SPEs recorded in the satellite era (bottom). Refs.: NASA GISS 2021, Knipp et al. 2018 and Knipp et al. 2016.*

Exhibit 2 to June 1, 2021 Whistle blowing complaint concerning greenhouse gas regulations against eleven EPA employees: re-formated research paper by Brian. T Kelleher last submitted to AMS April 14, 2021: *Overwhelming empirical evidence that increases in atmospheric CO2 since 1937stem from stratospheric ozone depletion*



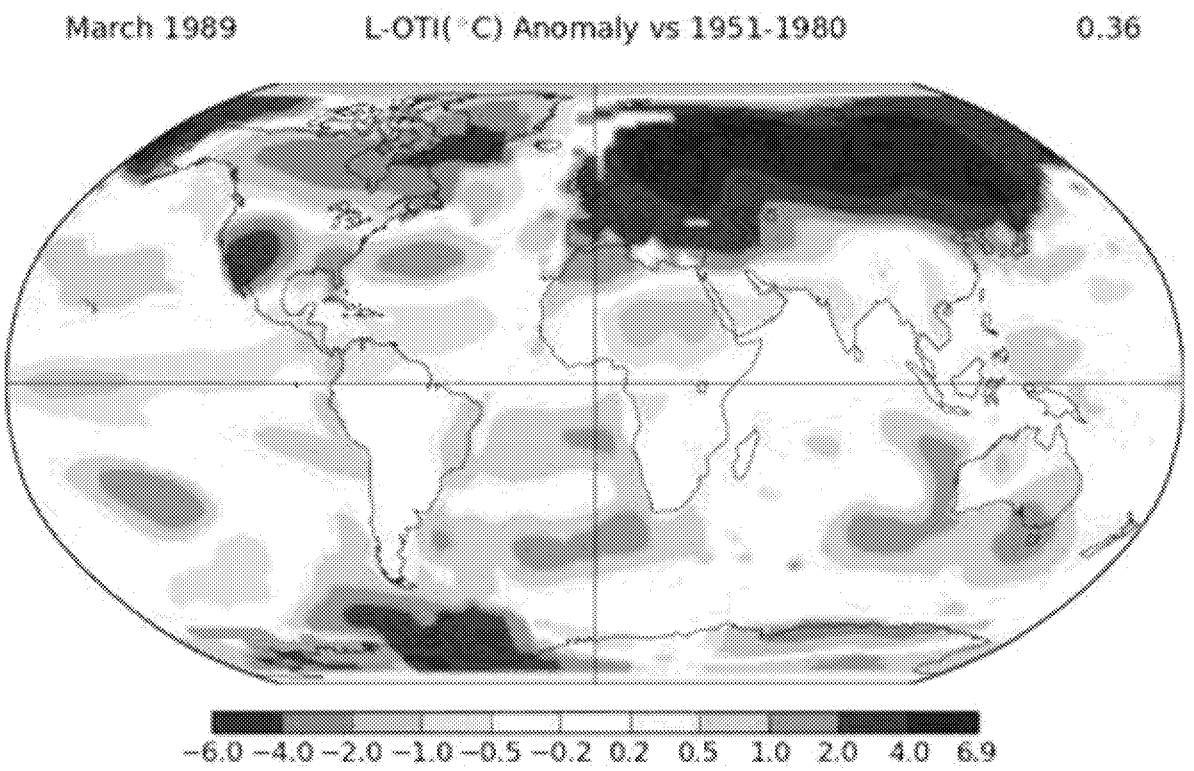




*Fig. 11. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the massive solar proton events of April 25, 1984 at 2,500 peak MeV and following a X13 solar flare (top) and clustered March 8 and March 17, 1989 at 3,500 and 2,000 peak MeV following X15*

*and X6 solar flares (bottom): Ref.: NASA GISS 2021 and NOAA SESC 2021.*

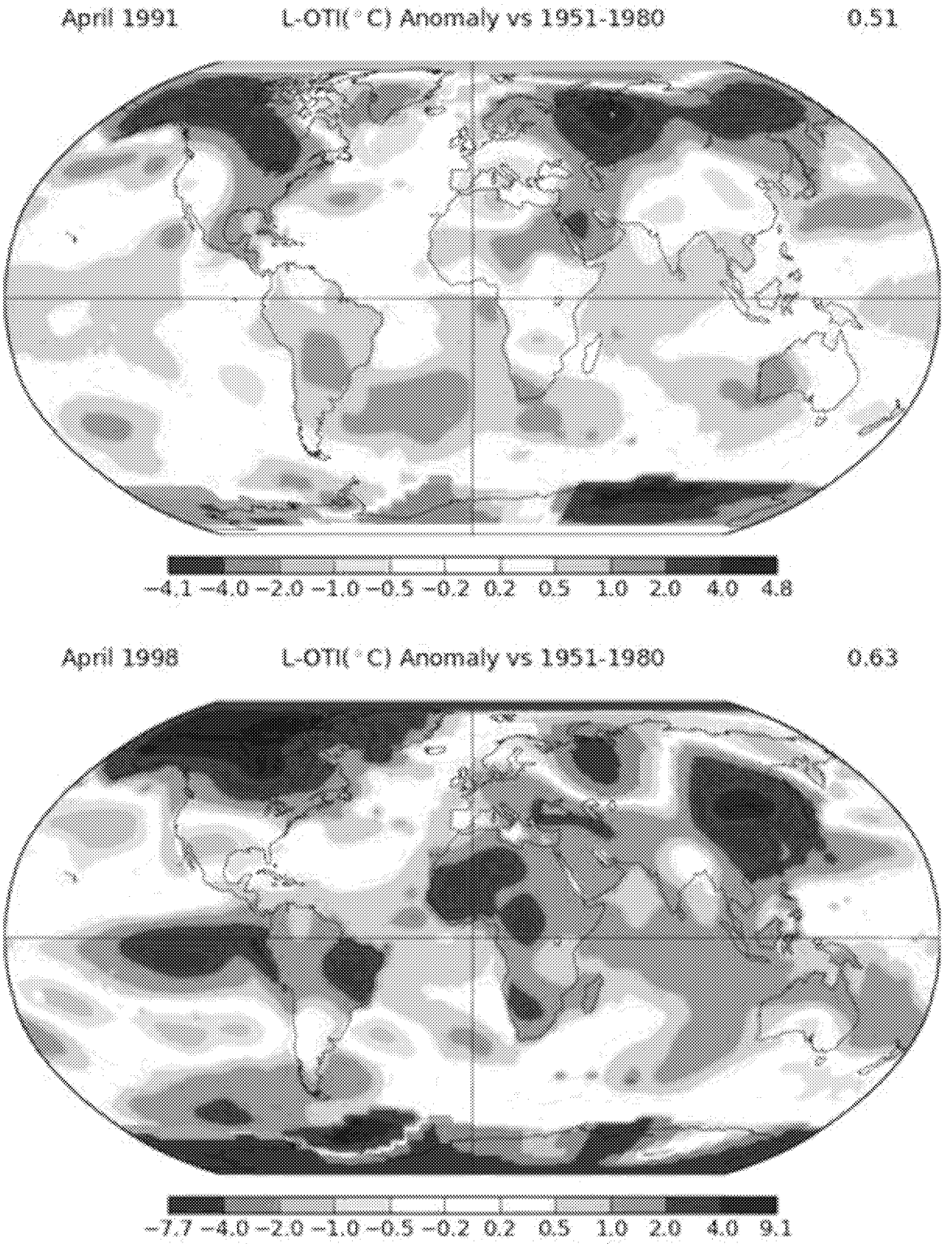



*Fig. 12. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the massive solar proton events of March 23, 1991 at 43,000 MeV following an X9 solar flare (top) and April 20, 1998 at 1,700 MeV following an M1 solar flare (bottom). Refs.: NASA GISS 2021*

*and NOAA SESC 2021.*

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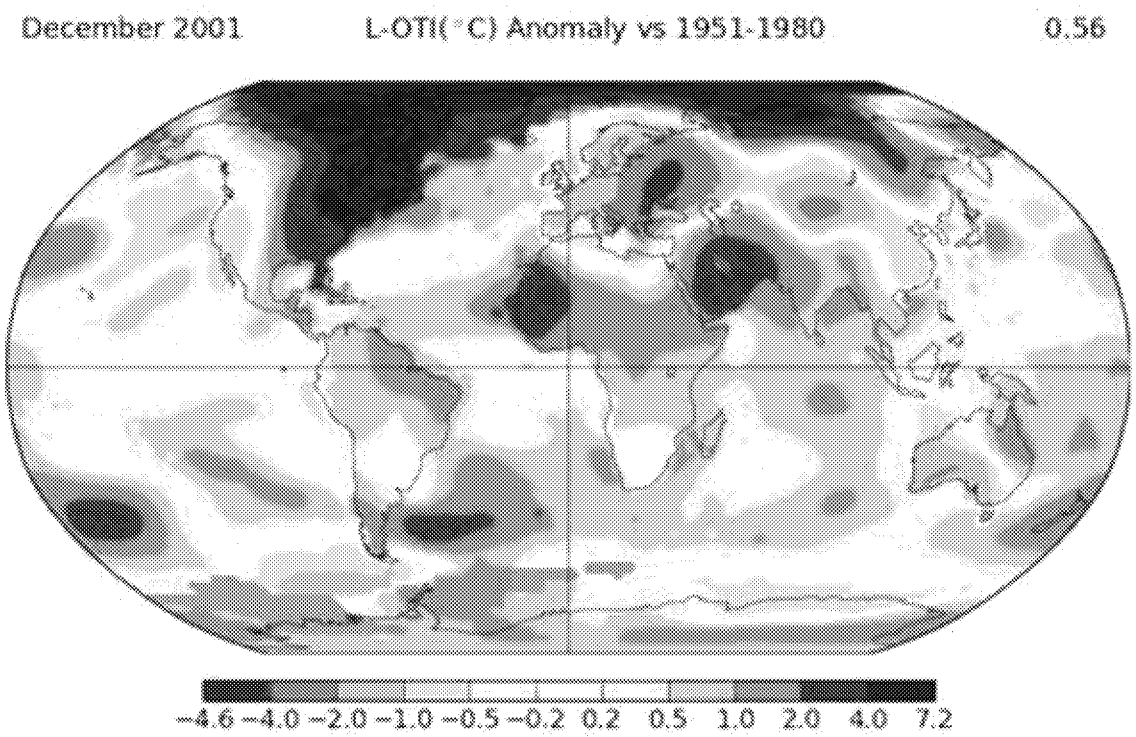


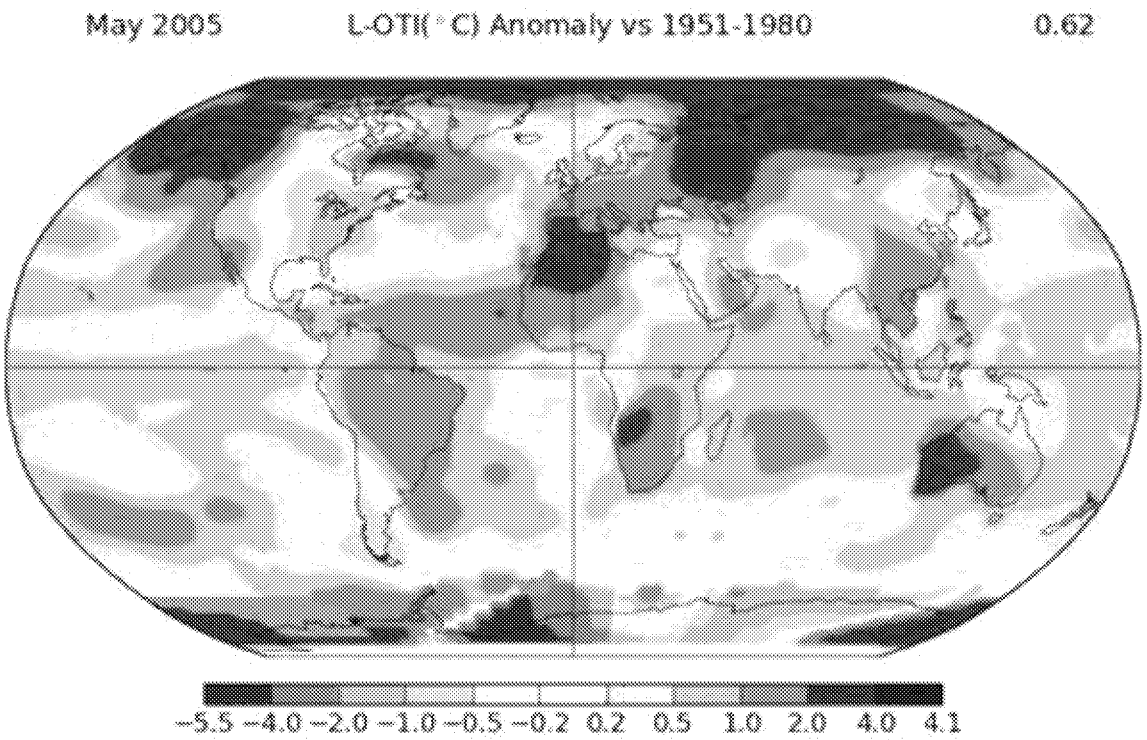
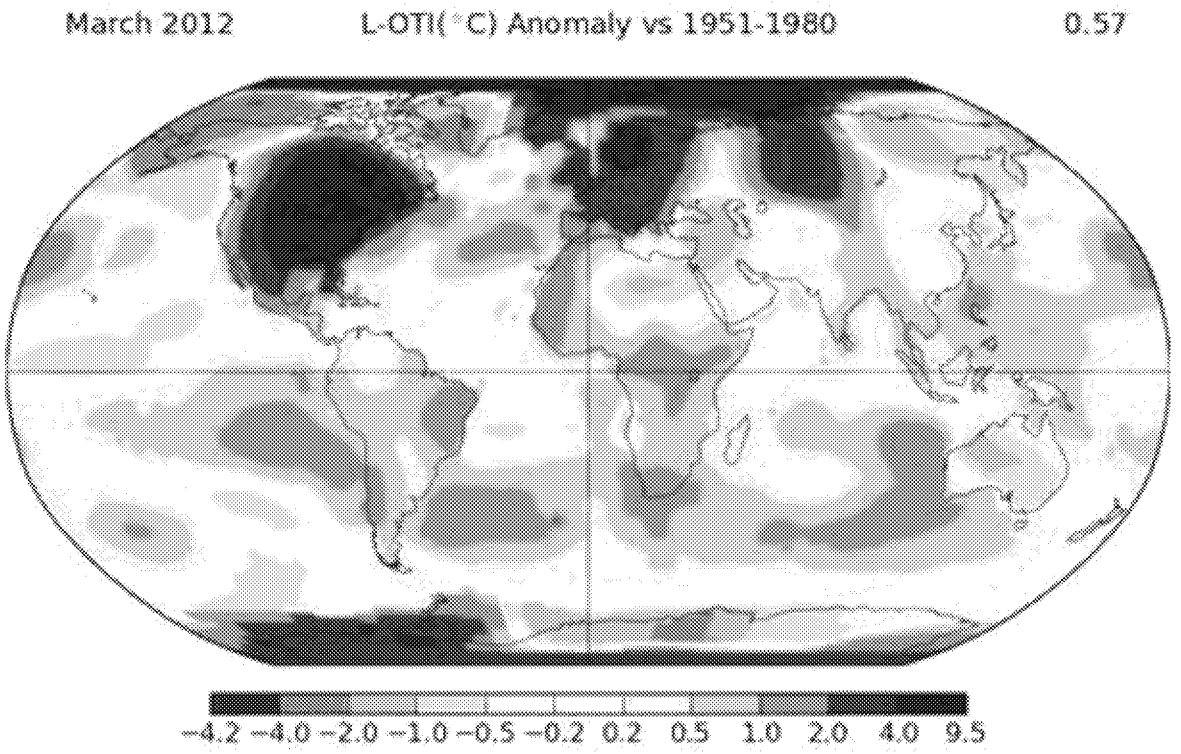




*Fig. 13. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the massive solar proton events of November 4 and 22, 2001 at 31,700 and 18,900*

*MeV following X1 and M9 solar flares (top) and May 14, 2005 at 3,140 MeV following an M8 solar flare (bottom). Refs.: NASA GISS 2021 and NOAA SESC 2021.*



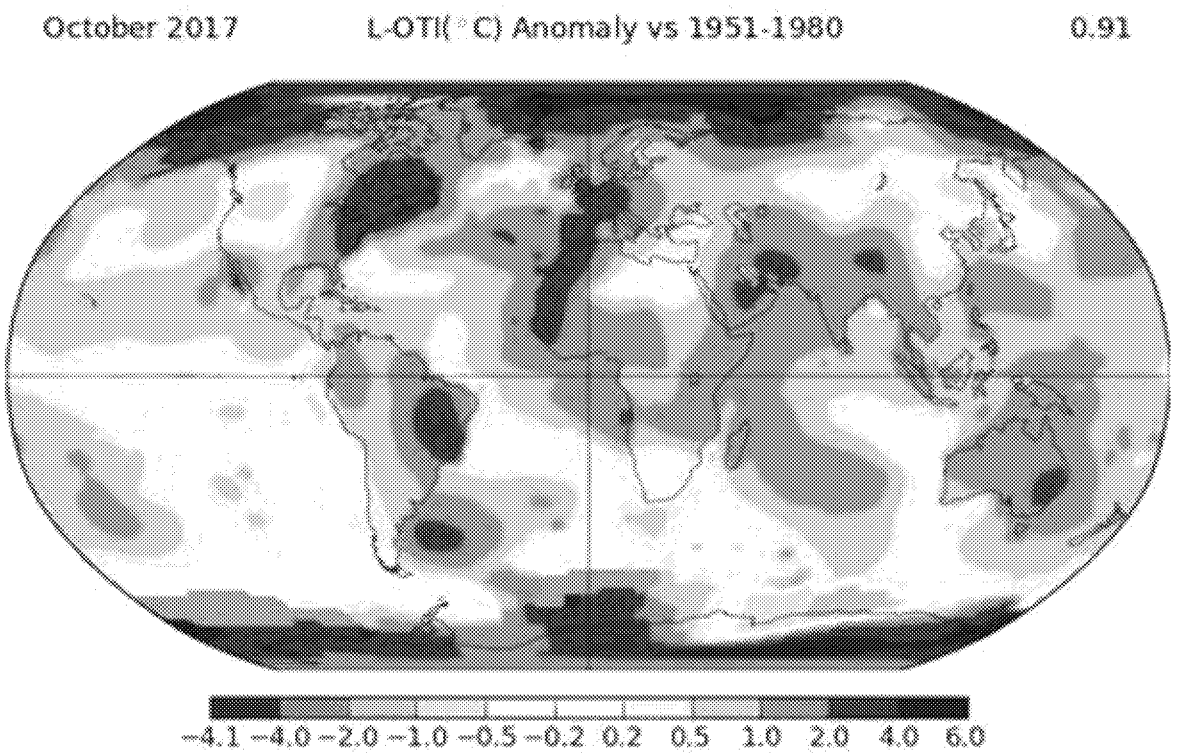
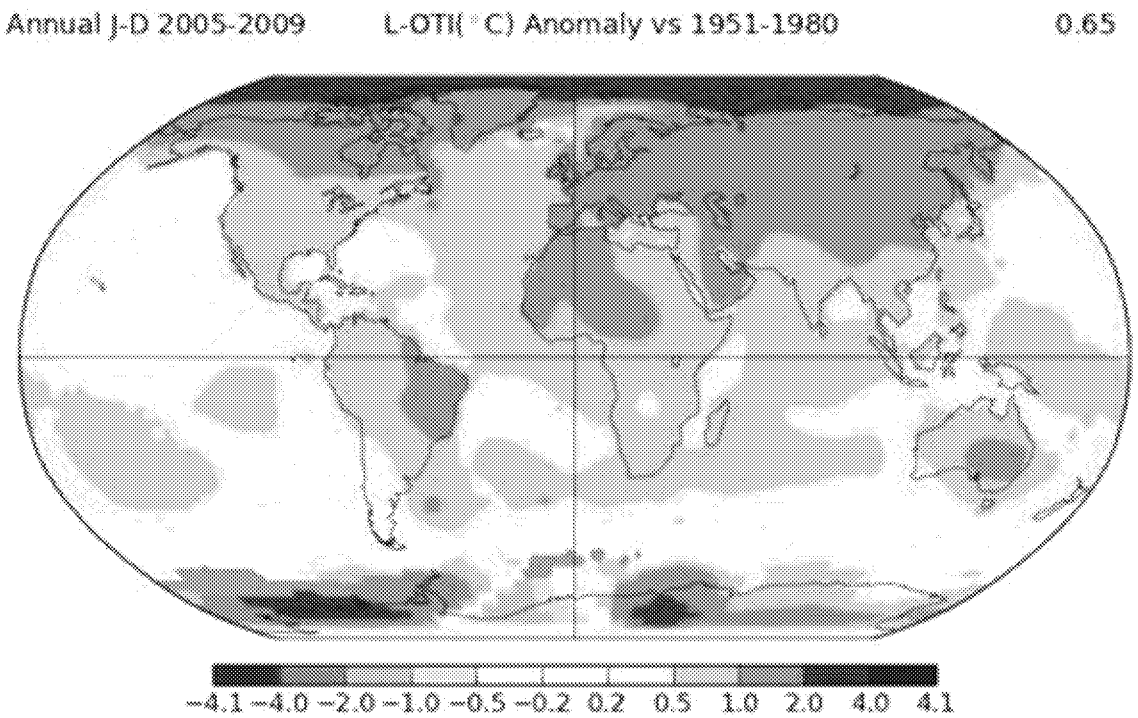



*Fig. 14. Two color-coded maps generated with the NASA GIStemp v.4 image maker showing the short term sea-surface warming effects of the massive solar proton events of March 7, 2012 at 6,530 MeV following an X5 solar flare (top) and September 10, 2017 at 1,490 MeV following an X8 solar flare (bottom). Refs.: NASA GISS 2021 and NOAA SESC 2021.*



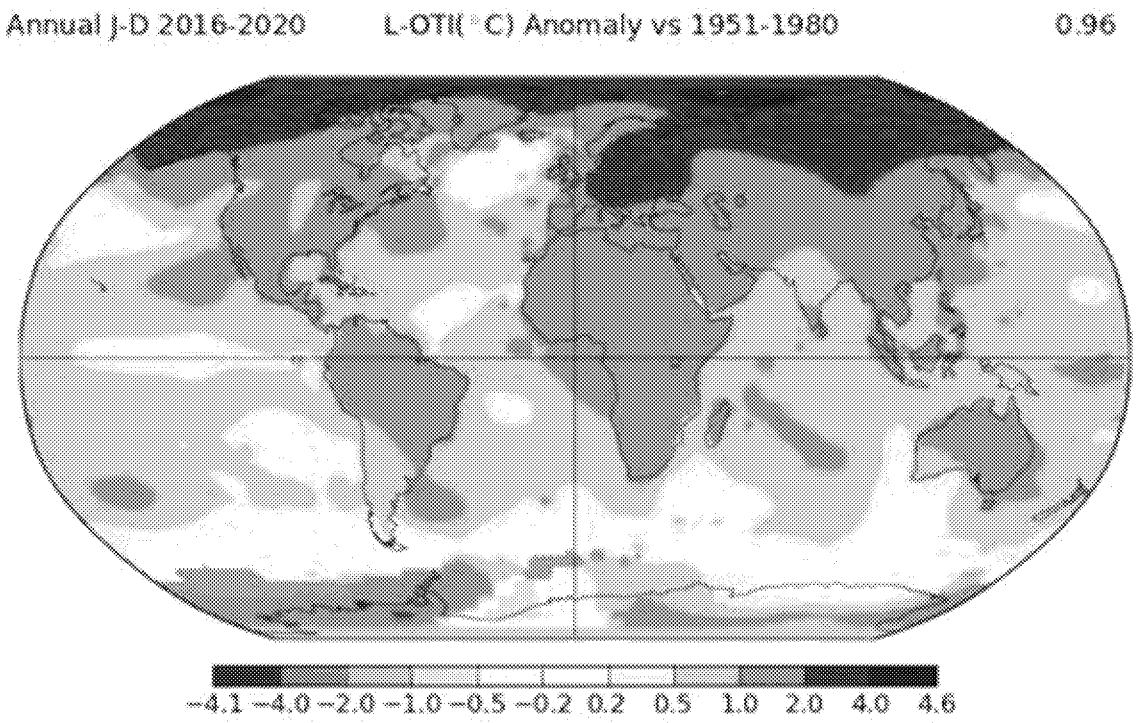




*Fig. 15. Two color-coded maps generated with the NASA GIStemp v.4 image maker comparing long-term*

*average annual sea-surface warming effects for the 5-year intervals 2005-2009 representing the aftermaths of the peak intensity period of solar cycle 23; and 2015-2019 representing the aftermaths of the peak intensity period of solar cycle 24 (bottom). Ref.: NASA GISS 2021.*

## 5. Discussion

The Fig. 8 data for squares 4 and 25 located in the western half of the Bering Sea shows that between mid April and the end of May 2009 during the early melt season, sea-surface temperatures rose about 4 deg C and then by another 4 deg C by the end of June which is in the heart of the melt season. For square 46 in the eastern Bering Sea, the data shows a rise of about 3 and 6 deg C. These are massive rapid seasonal increases in near-surface seawater temperature that are expected to correlate with massive levels of seasonal CO2 off-gassing.

Within the constraint of showing one to two representative events per decade in the midst of a period of heavy stratospheric ozone depletion that appeared to reach a floor level in the mid 1990s, the twelve illustrations in Figs. 9-14 using data compiled by NASA GISS reveal short periods of highly intensive sea-and-land-surface warming associated with the following examples of large to very large solar proton events primarily impacting either the Arctic (A), the Antarctic (AA) or both (B). March 24, 1940 (A); February 23, 1956 (B); May 23, 1967 (B); August 4, 1972 (AA); April 25,1984 (B); March 8 and 17, 1989 (B); March 23, 1991 (B); April 1998 (B); November 4 and 22, 2001 (A); May 14, 2005 (B); March 7, 2012 (B); and September 10, 2017 (B). The NASA GIStemp v.4 image maker data plots reveal that large SPEs produce dramatic levels of short-term warming in polar and sub-polar zones of generally from a few weeks to a few months duration. They also tend to show that even moderate intensity SPEs or CMEs that arrive outside the intervals of peak solar activity have disproportionately heavy warming effects.

Fig. 15 serves to show that during periods of GS-max atmospheric conditions, peak ozone loss and associated peak-incremental solar-forced warming is progressive and occurs in both the active and inactive phases of 11-year solar cycles 17-24. Clearly, there was an acceleration of global warming during and following the very intense active phase of solar cycle 23 and to a lesser extent during and after the active phase of solar cycle 24. The warming during the inactive period can be attributed to a combination of factors including the feedback effect of progressive sea-ice loss, well documented increases in the speed of solar winds, the continuous proliferation of geomagnetic sub storms, the build up of odd nitrogen reservoir species, sudden stratospheric warming events, final stratospheric warming events and indirect EPP (Randall et al, 1998 and 2021).

The following observations were drawn using the NASA Scientific Visualization Studio website (2019) video sequence titled "Global Temperature Anomalies from 1880-2019."

Northern Hemisphere – Except for a period of cooling from 1949-52, there was an early period of sea-and-land-surface warming from 1925-1960 that commenced with the active phase of solar cycle 16 and continued through the increasingly active phases of solar cycles 17-19. Following a period of cooling in the 1960s and 70s during solar cycle 20 and first half of solar cycle 21 where the impacts were largely restricted to the Antarctic, there was a second period of warming that commenced in 1979 with the active phase of solar cycle 21. The highest levels of intensity were from 1989-98 and from 2000-2019 covering very intense solar cycles 22-23 and the less intense 24.

Southern Hemisphere – There was faint sea-surface warming off the west coast of Antarctica from 1925-1948 that commenced with the active phase of solar cycle 16 and continued through the active phases of solar cycles 17 and 18. Following a period of cooling from 1949-1954 there was significant warming from 1954 to 1960 during the active phase of solar cycle 19. Following another

period of cooling from 1961-66, there was a second period of fairly intense sea-and-land-surface warming involving primarily the western and southern coasts of Antarctica that commenced in 1967 with the active phase of solar cycle 20. In the aftermath of the gargantuan SPE of August 1972, there were fairly high levels of intensity through 1998 covering solar cycles 20-22 and a very high level of intensity from 2000-2019 covering solar cycles 23 and 24. The deviations for the Antarctic warming in the 1950s and 1970s are diminished to some extent by the fact that these periods are included in the baseline.

In conducting my analysis, it became obvious that coronal mass ejections (CMEs) are behind much of the short and long term warming. They occur at much higher frequency than SPEs and also create direct and indirect EPP. Ground level events (GLEs) can also directly warm the oceans and melt sea ice and also seem to have an effect. My list of CMEs and GLEs for this current research was limited to November 1997 through September 2017 (NASA GOES 2017).

# 6. Conclusions

The empirical evidence depicted in Fig. 7 in conjunction with what is depicted in Figs 9-14 show that Henry's Law cannot be used to predict the mass in mg/kg of CO2 dissolved in near-surface seawater. Rather, as a general rule, it is reasonably assumed that near-surface seawater is saturated with CO2 according to its location and time specific temperature and salinity. Given the fact that the pCO2atm is comparatively very stable, it is also reasonable to assume that the Ocean's near-surface temperature and salinity are in complete control of CO2 off-gassing or entering at any particular time and location. Carefully examine Figs. 9 and 10 and imagine the extent of off-gassing that was going on in the frigid waters of the Arctic and Antarctic during these intervals. There is no way around it.

The mountains of empirical data generated since 1957 by testing the Ocean surface for pCO2aq is showing widespread sea-surface warming with attendant supersaturation of CO2 contained in the atmosphere and dissolved in the Ocean surface. The data serves to confirm massive stratospheric-ozone-depletion-related increases in shortwave radiation entering the Ocean surface in the UVA and orange spectral bands.

Proxy data from ice-core samples show that over the last 800,000 years, all periods of sustained global warming coupled with sea-ice and glacial retreat have been accompanied by rapid increases in atmospheric CO2 levels that can only be the result of CO2 off-gassing from the warmed Ocean surface and melt fronts. The rise of methane and CO2 commencing at the end of the Maunder minimum and Little Ice Age was predictable as was the acceleration of CO2 increases commencing in 1937.

The last 400,000 years of proxy data further shows that CO2 levels immediately return to a baseline level of 280 ppmv as fast as the melting stops. This is proof in and of itself that there is no possibility that the combustion of fossil fuels is causing atmospheric CO2 levels to rise. The proxy data is all pointing to stratospheric-ozone-depletion-related off-gassing.

The hard empirical data generated during the 20$^{th}$ and 21$^{st}$ centuries supports the above conclusion. It is showing that the rising CO2 since the onset of GS max conditions in 1937 is due to top-down stratospheric ozone depletion related increases in the amount of shortwave radiation in the UVA and orange spectral bands. The incremental radiation is entering and warming the top 10 meters and primarily the top meter of areas of open or partly open ocean, as well as sea-ice melt fronts and areas of frozen tundra. This occurs primarily at points north of 50 deg N latitude and to a lesser extent south of 50 deg S latitude.

The data is also clearly showing that the off-gassing is recurrent during daylight hours of winter, spring and early summer because the ocean surface warms during the day and cools during the nights.

There is additional diurnal off-gassing during night time hours of late fall and winter due to the release of heat and brine during sea-ice reformation. As confirmed by Fransson et al. 2006 for the southern Bering Sea, during periods of CO2 off gassing, aqueous-phase concentrations are supersaturated.

Because NOAA and other institutions such as the International Research Institute (IRI) have been mapping SST anomalies against long-term averages for the warming period rather than a pre-warming baseline, the empirical evidence published online on the source of the atmospheric CO2 increases has been subverted to some extent. The data published online by NASA GISS 2021 on its GIStemp v.4 website, however, tells the true story. It is clearly showing that both the CO2 increases and the atmospheric and SST warming are tracking polar and sub-polar stratospheric ozone loss dating back to the active phase of solar cycle 16 in 1926. The data confirms that the warming began in the ozone-depleted polar and sub-polar zones during periods of high solar activity. The data also confirms that commencing in year 2000 the warming accelerated and expanded toward the tropics during and following a period of extremely high solar activity.

The distribution of EPP fallout from the gargantuan August 1972 SPE helps explain why the second phase of ozone depletion in the Antarctic mid to upper stratosphere began a decade earlier than stratospheric ozone depletion in the Arctic

Consistent with the conclusions set forth in my first paper currently under peer review, I found not one shred of bona fide empirical evidence of any kind to support the doubtful claims that CO2 which is essential to life on Earth is an air or water pollutant.

While there is a case to be made that CO2 from fossil fuel emissions is being trapped in the atmosphere based on the ratio of carbon 13 to carbon 12, this provides no evidence that CO2 is a pollutant.

There is 800,000 years of ice-core proxy data showing that all periods of warming coupled with sustained sea-ice retreat were immediately followed by periods of cooling coupled with sustained sea-ice advance. On this basis, I am predicting that global cooling will eventually become a grave concern.

## Author Contributions

Brian T. Kelleher is the sole author. He is among the country's top private-sector environmental engineers (U Mass Lowell Dept of Civil Engineering, 1973). He has 15 years experience as an air quality engineer specifying and permitting emission control systems for geothermal and fossil fuel fired power plants and 30 years experience as a neutral fact finder assisting federal and CA Superior Court case special masters and mediators and countless litigating parties and insurance companies settle complex lawsuits stemming from the pollution of air land and water without the need for trial. In the late 1970 he developed and taught for civil engineering department credit, a graduate program night-school course in water chemistry and two self developed undergraduate courses in water pollution control.

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## Conflicts of Interest

The author declares no conflict of interest.

## References

Anderson, L.G. and Macdonald, R.W. (2015): Observing the Arctic Ocean carbon cycle in a changing environment, Polar Research, 34:1, 26891, pp. 1-12.

Barley, N., Papakyriakou, T.N., Bartels, C. and Wang, F. (2018): Henry's Law Constant for CO2 in aqueous sodium chloride solution at 1 atm and subzero (Celsius) temperature. Marine Chemistry, 267, pp. 26-32.

Commane, R., and Coauthors (2017): Carbon dioxide sources from Alaska driven by increasing early winter respiration from Arctic tundra. PNAS 114 21, pp. 5361-5366. www.pnas.org/cgi/doi/10.1073/pnas.1618567114.

Diallo, M., Legras, B., Ray, E., Engel, A. and Anel, J.A. (2017): Global distribution of $CO_2$ in the upper troposphere and stratosphere. Atmos Chem Phys 17, pp. 3861-3878. DOI:10.5194/acp-17-3861-2017.

Emerson, S., and Hedges, J. (2012). Chemical oceanography and the marine carbon cycle: Chapter 10: Gases and air-water exchange; Cambridge University Press, Cambridge, England.

Engineeringtoolbox.com 2021: Solubility of gases in water. Available online: https://www.engineeringtoolbox.com/gases-solubility-water-d_1148.html

Forster, P. and Ramaswamy, V. (2007) as coordinating lead authors of Chapter 2: Changes in atmospheric constituents and in radiative forcing, p. 135 of IPCC: Climate Change 2007: The Scientific Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomen, S., Qin, D., Manning, M., Chen, .Z., Marquis, M., Averyt, K.B., Tignor, M. and Miller, H.L. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. (2007).

Fransson, A., Chierici, M. and Nojiri, Y. (2006): Increased net CO2 outgassing in the upwelling region of the southern Bering Sea in a period of variable marine climate between 1995 and 2001. J. Geophys. Res.: Oceans 11 CB, pp. 1-21. https//doi/10.1029/2004JC002759.

Hansen, J.E., and Lebedeff, S. 1987: Global trends of measured surface air temperature. J. Geophys. Res. 92, pp. 13345-13372. https//doi:10.1029/JD092iD11p13345

Jeong, S.J., and Coauthors (2018): Accelerating rates of carbon cycling revealed by atmospheric $CO_2$ measurements. Sci Adv 4 (7), pp. 1-7.

Jerlov, N.G., Ed. (1968): *Optical Oceanography*, 1st ed.; Elsevier: Amsterdam, Netherlands, 194 pp.

Kanwisher, J. (1960): pCO2 in sea water and its effect on the movement of CO2 in nature. Tellus 12:2, pp. 209-215. https//doi10.3402/tellusa.v12i2.9361

Knipp, D.J., Fraser, B.J., Shea, M.A., and Smart, D.F. (2018): On the little known consequences of the 4 August 1972 ultra-fast coronal mass ejecta: facts, commentary and call to action. Space Weather 16 (11), pp. 1635-1643. https//doi.org/10.1029/20185W002024. https://doi.org/10.1002/2016SW001423.

Knipp, D.J. and Coauthors (2016): The May 1867 great storm and radio disruption event: Extreme space weather and extraordinary responses. Space Weather 14 (9), pp. 614-633

Lenssen, N., Schmidt, G., Hansen, J., Menne M., Persin, A., Ruedy, R. and Zyss, D. (2019): Improvements in the GISTEMP uncertainty model. *J. Geophys. Res. Atmos.*, **124**, no. 12, pp. 6307-6326. https//doi:10.1029/2018JD029522.

Lockwood, M., Owens, M.J. and Barnard, L. (2014): Centennial variations in sunspot number, open solar flux, and streamer belt width: 1. Correction of the sunspot number record since 1874. J Geophys Res 119: 5172–5182. DOI:10.1002/2014JA019970.

Masson-Delmotte V and Schulz, M. (2013) as coordinating lead authors of Chapter 5: Information from paleoclimate archives. 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., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Doschung, J., Nauels, A., Xia, Y., Bex ,V. and Midgley, P.M., eds. Cambridge: Cambridge University Press, pp. 383–464. DOI:10.1017/CBO9781107415324.013

Morice, C.P., Kennedy, J.J., Rayner, N.A. and Jones, P.D. (2012): Quantifying uncertainties in global and regional temperature change using an ensemble of observational estimates: The HadCRUT4 data set, J Geophys Res Atmos 117. DOI:10.1029/2011JD017187.

Murray, J.W. (2015). Power Point Lecture 7: Gases and Gas Exchange. University of Washington Dept of Oceanography course OCN400 – Winter 2015: Chemical Oceanography: Available online: https://www.ocean.washington.edu/courses/oc400/lecture_notes.html

NASA Earth Observatory website (2021): Features/Ocean Carbon: The Ocean's carbon balance. Available online: https://earthobservatory.nasa.gov/features/OceanCarbon

NASA GIStemp v.4 website (2021): GISS Surface Temperature Analysis. Available online: https://data.giss.nasa.gov/gistemp/maps/

NASA Goddard Space Flight Center (GSFC) website (2014): news release video titled A year in the life of Earth's CO2. Available online: https://svs.gsfc.nasa.gov/11719.

NASA GOES, 2017: web page: Major SEP Events, 1997-2017: Link: https://cdaw.gsfc.nasa.gov/CME_list/sepe/

NASA Scientific Visualization Studio website (2019): Video sequence titled Global Temperature Anomalies from 1880-2019. Available on line: https://svs.gsfc.nasa.gov/4787

Nicholson, S.B. (1940): The Great Magnetic Storm of March 24, 1940. Publ. Astron. Soc. Pac. 52 307, pp. 169-171.

NOAA Climate.gov website (2020): News and Features, questions and answers: If carbon-dioxide hits a new high every year why isn't every year hotter than the next?. Available online: https://www.climate.gov/news-features/climate-qa/if-carbon-dioxide-hits-new-high-every-year-why-isn%E2%80%99t-every-year-hotter-last

NOAA NCEI website (2020): Global warming/Temperature Change/Temperature change and carbon dioxide change. Available online: https://www.ncdc.noaa.gov/global-warming/temperature-change

NOAA/NCEI (formerly NODC) website (2009): OC5PACIFIC: Bering Sea, access to climate graphs, annual cycles, temperatures. Available on line: https://www.nodc.noaa.gov/OC5/PACIFIC2009/HTML/graph_ber.html.

NOAA Space Environmental Services Center (SESC) webpage (2021): Solar Proton Events since 1976. Available online: https://umbra.nascom.nasa.gov/SEP/

Owens, M.J., Lockwood, M., Hawkins, E., Usoskin, I., Jones, G.S., Barnard, L., Schurer, A., and Fasullo, J. (2017): The Maunder minimum and the Little Ice Age: an update from recent reconstructions and climate simulations, J Space Weather Space Clim 7. pp. 1-15. htpps://doi.org/10.1051/swsc/2017034.

Pighini, S, Ventura, M., Miglietta, F. and Wohlfahrt, G. (2018): Dissolved greenhouse gas concentrations in 40 lakes in the Alpine area. Aquat Sci 80 32. https://doi.org/10.1007/s00027-018-0583-2

Randall, C.E., Bevilacqua, R.M., Hoppel, K.W. and Lumpe J.D. (1998): Polar Ozone and Aerosol Measurement (POAM) stratospheric NO2, 1993-1996. J. Geophy. Res., 103 D21, pp. 28361-28371.

Randall, C.E. and Coauthors (2021): The middle atmosphere group home page. Available online: https://lasp.colorado.edu/home/mag/

Sverdrup, H.U., Johnson, M.W. and Fleming, R.H. (1942): The Oceans their chemistry and general biology: New York, Prentice Hall. Available online: http://ark.cdlib.org/ark:/13030/kt167nb66r/

Takahashi, T. and Sutherland, S.C. (2016): Global Ocean Surface Water Partial Pressure of CO2 database: measurements performed during 1957-2016. NOAA/NCEI/OCADS NDP=088 (V2016), pp. 1-16.

Tjiputra, J.F., Olsen, A., Bopp, L., Lenton, A., Pfeil, B., Roy, T., Segschneider, J., Totterdell, I. and Heinze, C. (2014): Long-term surface pCO2 trends from observations and models: Tellus B: Chem. and Phys. Meteorol. 66:1 23083, pp. 1-24. https//doi.org/103402/tellusb.v66.23083.

Usoskin, I.G., and Coauthors, (2014): Evidence for distinct modes of solar activity. Astron Astrophys 562. DOI:10.1051/0004-6361/ 20142339

Wayman, P.A. and Finch, H.F. (1957): Solar Activity and Geomagnetic storms. The Observatory Notes 896, pp.37-38.

Woolf, D.K, Land, P.E., Shutler, J.D., Goddijn-Murphy, L.M., and Donlon, C.J. (2016): On the calculation of air-sea fluxes of CO2 in the presence of temperature and salinity gradients. J. Geophy. Res. Oceans, 121, pp. 1229-1248. https//doi.10.1002/2015JC011427.

Message

**From**: Cynthia Giles Ex. 6 Personal Privacy (PP)
**Sent**: 6/14/2021 3:21:52 PM
**To**: Bunker, Byron [bunker.byron@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]
**CC**: Manners, Mary [manners.mary@epa.gov]; Gustafson, Kurt [Gustafson.Kurt@epa.gov]; Anderson, Robert [Anderson.Robert@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: Next Gen and RFS
**Attachments**: Giles Next Gen ideas for RFS 6-14-21.docx

I attach some compliance-improving suggestions for RFS. I hope this is helpful.

Happy to discuss -

Cynthia

Message

**From:** Huang, May [mhuang@law.harvard.edu]
**Sent:** 6/28/2021 2:29:56 PM
**To:** Curley, Kathleen [curley@law.harvard.edu]; Freeman, Jody [freeman@law.harvard.edu]; Lazarus, Richard [lazarus@law.harvard.edu]; Jenks, Carrie F. [cjenks@law.harvard.edu]; Peskoe, Ari [apeskoe@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Perls, Hannah [hperls@law.harvard.edu]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Laura Bloomer [Ex. 6 Personal Privacy (PP)]; Caitlin McCoy [Ex. 6 Personal Privacy (PP)] Davies, Kyra [kdavies@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]; Just, Robin L [rjust@law.harvard.edu]
**Subject:** Fwd: Farewell from EELP to Kathy! *ZoomUpdate*

Good morning all:
Friendly reminder that everyone can be reimbursed for food for today's party.
See you at 1:30 ET.
Thank you,
May :)

May Huang
Assistant to Professor Jody Freeman
Harvard Law School

[Ex. 6 Personal Privacy (PP)]

Begin forwarded message:

**From:** "Just, Robin L" <rjust@law.harvard.edu>
**Subject: Farewell from EELP to Kathy! *ZoomUpdate***
**Date:** June 28, 2021 at 9:45:42 AM EDT
**To:** "Curley, Kathleen" <curley@law.harvard.edu>, "Freeman, Jody" <freeman@law.harvard.edu>, "Lazarus, Richard" <lazarus@law.harvard.edu>, "Jenks, Carrie F." <cjenks@law.harvard.edu>, "Peskoe, Ari" <apeskoe@law.harvard.edu>, "Vizcarra, Hana V." <hvizcarra@law.harvard.edu>, "Perls, Hannah" <hperls@law.harvard.edu>, "Huang, May" <mhuang@law.harvard.edu>, "Goffman, Joseph" <Goffman.Joseph@epa.gov>, Laura Bloomer <[Ex. 6 Personal Privacy (PP)]>, Caitlin McCoy [Ex. 6 Personal Privacy (PP)], "Davies, Kyra" <kdavies@law.harvard.edu>, "Levy, Sara Burr" <slevy@law.harvard.edu>

Update! Lunch will be reimbursed up to $20 since HLS discontinued their account with GrubHub. May can help you with the forms for reimbursement.

Robin L Just is inviting you to a scheduled Zoom meeting.

Topic: Farewell to Kathy!
Time: Jun 28, 2021 01:30 PM Eastern Time (US and Canada)

Join Zoom meeting
https://harvard.zoom.us/[Ex. 6 Personal Privacy (PP)]

Password: [Ex. 6 Personal Privacy (PP)]

Join by telephone (use any number to dial in)

Ex. 6 Personal Privacy (PP)

International numbers available: https://harvard.zoom.us Ex. 6 Personal Privacy (PP)

One tap mobile: Ex. 6 Personal Privacy (PP) US (Washington DC)

Join by SIP conference room system
Meeting ID: Ex. 6 Personal Privacy (PP)
Ex. 6 Personal Privacy (PP) @zoomcrc.com

Message

**From:** Lazarus, Richard [lazarus@law.harvard.edu]
**Sent:** 6/24/2021 8:28:20 PM
**To:** Freeman, Jody [freeman@law.harvard.edu]; Huang, May [mhuang@law.harvard.edu]; Jenks, Carrie F. [cjenks@law.harvard.edu]; Peskoe, Ari [apeskoe@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Perls, Hannah [hperls@law.harvard.edu]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Laura Bloomer Ex. 6 Personal Privacy (PP) ; Caitlin McCoy Ex. 6 Personal Privacy (PP) ; Davies, Kyra [kdavies@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]; Just, Robin L [rjust@law.harvard.edu]
**Subject:** RE: kudoboard

Very nice! Thanks for letting us know.

---

**From:** Freeman, Jody
**Sent:** Thursday, June 24, 2021 12:59 PM
**To:** Huang, May <mhuang@law.harvard.edu>; Lazarus, Richard <lazarus@law.harvard.edu>; Jenks, Carrie F. <cjenks@law.harvard.edu>; Peskoe, Ari <apeskoe@law.harvard.edu>; Vizcarra, Hana V. <hvizcarra@law.harvard.edu>; Perls, Hannah <hperls@law.harvard.edu>; Goffman, Joseph <Goffman.Joseph@epa.gov>; Laura Bloomer Ex. 6 Personal Privacy (PP) ; Caitlin McCoy Ex. 6 Personal Privacy (PP) ; Davies, Kyra <kdavies@law.harvard.edu>; Levy, Sara Burr <slevy@law.harvard.edu>; Just, Robin L <rjust@law.harvard.edu>
**Subject:** Re: kudoboard

Thanks for sharing this, May. It really says a lot about Kathy to see all of these heartfelt notes.

JF

---

**From:** "Huang, May" <mhuang@law.harvard.edu>
**Date:** Thursday, June 24, 2021 at 9:51 AM
**To:** Jody HLS email <freeman@law.harvard.edu>, Richard Lazarus <lazarus@law.harvard.edu>, "Jenks, Carrie F." <cjenks@law.harvard.edu>, Ari Peskoe <apeskoe@law.harvard.edu>, Hana Vizcarra <hvizcarra@law.harvard.edu>, "Perls, Hannah" <hperls@law.harvard.edu>, Joe Goffman <Goffman.Joseph@epa.gov>, Laura Bloomer Ex. 6 Personal Privacy (PP) Caitlin McCoy Ex. 6 Personal Privacy (PP) >, "Davies, Kyra" <kdavies@law.harvard.edu>, "Levy, Sara Burr" <slevy@law.harvard.edu>, Robin Just <rjust@law.harvard.edu>
**Subject:** kudoboard

I am sharing the link to Kathy's Kudoboard which was set up by FSS.
EELP colleagues are welcome to sign it.

https://www.kudoboard.com Ex. 6 Personal Privacy (PP)

Thanks!
May :)

May Huang
Assistant to Professor Jody Freeman
Harvard Law School

phone: Ex. 6 Personal Privacy (PP)

Message

**From**: Ngo, Kim [Ngo.Kim@epa.gov]
**Sent**: 7/21/2021 12:31:29 AM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Garcia, David [Garcia.David@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]; Shaw, Betsy [Shaw.Betsy@epa.gov]
**CC**: Campbell, Ann [Campbell.Ann@epa.gov]; Robinson, Jeffrey [Robinson.Jeffrey@epa.gov]; Donaldson, Guy [Donaldson.Guy@epa.gov]; Feldman, Michael [Feldman.Michael@epa.gov]; Verhalen, Frances [verhalen.frances@epa.gov]; Kaleri, Cynthia [kaleri.cynthia@epa.gov]; Fuerst, Sherry [fuerst.sherry@epa.gov]; Schoellkopf, Lynde [Schoellkopf.Lynde@epa.gov]; Belk, Ellen [Belk.Ellen@epa.gov]
**Subject**: RE: Region 6 Virtual Visit
**Attachments**: OAR Goffman visit July 21, 2021.docx

Joe, we are all looking forward to OAR's visit. Attached is the agenda, with bios thanks to Thierry.

-----Original Appointment-----
**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, June 02, 2021 7:49 AM
**To:** Goffman, Joseph; Carbonell, Tomas; Nunez, Alejandra; Garcia, David; Ngo, Kim; Kim, Eunjung; Shaw, Betsy
**Cc:** Campbell, Ann; Robinson, Jeffrey; Donaldson, Guy; Feldman, Michael; Verhalen, Frances; Kaleri, Cynthia; Fuerst, Sherry; Schoellkopf, Lynde; Belk, Ellen
**Subject:** Region 6 Virtual Visit
**When:** Wednesday, July 21, 2021 1:00 PM-2:00 PM (UTC-05:00) Eastern Time (US & Canada).
**Where:** Microsoft Teams Meeting

---

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# RESULTS OF STRATEGIC FORESIGHT HORIZON SCANNING FOR FY 2022-2026 STRATEGIC PLANNING

Office of the Chief Financial Officer

Office of Planning, Analysis, and Accountability

July 7, 2021

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## INTRODUCTION AND OVERVIEW

OCFO undertook a 6-month strategic foresight horizon scanning effort to: (1) Increase EPA's ability to prepare for future threats and take advantage of emerging opportunities; (2) Develop strong and resilient program strategies that consider future uncertainties; and (3) Illuminate external factors that may impede or advance implementation of the FY 2022-2026 EPA Strategic Plan. This document provides summaries of the results of our scanning to help programs and regions develop strong and resilient strategies and identify external factors and emerging issues that could advance or impede EPA's FY 2022-2026 Strategic Plan.

While there are several foresight techniques available to organizations[1], we employed the horizon scanning approach. The project included contractor-led literature scans (more than 50 documents) and semi-structured interviews with 20 external and 19 EPA thought leaders in the following areas:

- Carbon Management
- Climate Change: Responsiveness/Preparedness
- Environmental Justice
- Children's Environmental Health
- Green Chemistry/Materials Management
- Implications of Electric Vehicle Industry
- Microplastics in Surface Waters and Oceans

The horizon scanning areas (and a preliminary list of interviewees) were chosen based on input from Agency career leadership, the Deputy Chief of Staff for Policy, and EPA subject matter experts, combined with an appreciation of what could be accomplished with the available time and resources.

In general, we explored with each interviewee the following kinds of questions. The intent of the questions was to guide (but not limit) the conversations:

- What has changed in the area over the past decade, and what has caused that change?
- What changes are anticipated in the future (10 or 15 years from now), and what would the ideal future look like?
- What are the most important drivers of future change (science, technology, political, policy, law, social, economic)?
- What is most worrisome? What are the best opportunities?
- What should be EPA's role?

As with all foresight efforts, the scanning results are not predictions; instead they highlight possible drivers of change and areas of uncertainty to stimulate our thinking about how we can strengthen our strategies to advance our strategic goals, objectives, and cross agency strategies.

The summaries describe past and potential future developments, visions of the future, challenges and opportunities, and interviewees' ideas for EPA's role in solving current and future environmental and human health challenges. Importantly, the summaries represent a compilation and not a consensus of the opinions of the interviewees and information gleaned from the literature. They do not represent EPA policy or guidance.

[1] For example, scenario planning, trend analysis, assumption testing, implications analysis, Delphi method, visioning, and backcasting.

# CARBON MANAGEMENT

## Developments Over the Past Generation

The prevailing view today is that the full range of what are being called "carbon management" technologies need to be pursued to reach Net Zero emissions by 2050, including decarbonization (renewable energy and energy storage, carbon emission prevention), carbon capture, direct air capture (DAC), biological capture, sequestration and storage, and carbon use in industrial processes and products. This is not a universally held view, however, as some experts believe that rapid development of renewable energy and energy storage technologies can be deployed quickly enough to make extensive use of carbon capture and sequestration technologies unnecessary. They argue it is more cost-effective in many cases to invest directly in renewables to minimize health and other social costs of continuing fossil fuel use.

Within the realm of carbon management, several important shifts have occurred in just the past few years. One is a change from seeing carbon management as primarily an R&D challenge, to seeing it more as a deployment challenge. Another shift is from an almost exclusive focus on carbon capture, to focusing more on transport and storage. Still another is a shift from a focus on storing $CO_2$ through enhanced oil recovery, to a focus on geological sequestration in Class VI wells that offer more legal and regulatory certainty and a smaller footprint. All these shifts suggest that carbon management may be nearing a "takeoff" point.

## Developments in Carbon Management Anticipated Over the Next 10-20 Years

The current expectation among advocates for carbon capture and storage (CCS) is that there will be a growing number of retrofits at industrial and electrical generation facilities over the next 10-20 years, with rapid early deployment in certain industries. $CO_2$ transport infrastructure deployment and storage development will proceed in parallel. Within ten years carbon capture and utilization (CCU) is likely to be a common process. Toward the end of this period there may be a scaling up of direct air capture (DAC) to remove $CO_2$ directly from the atmosphere. Biological-based carbon sequestration will play a role, but there are uncertainties about how large that role can be. Currently, none of these different carbon management methods are occuring at a large enough scale to make a substantial difference in reducing carbon to meet climate goals.

There are over 40 publicly announced carbon capture projects at industrial and power facilities in the U.S. that are likely to move ahead within the next few years. A study by the Great Plains Institute identified 1,517 industrial and power facilities across the U.S. that meet the standards for a 45Q subsidy (a tax credit for carbon sequestration) and 418 facilities that are the best candidates for near- and medium-term capture deployment within a narrower study area that includes the Western, Midwestern, Plains and Gulf regions of the country.

Direct air capture (DAC) technologies that remove $CO_2$ from the atmosphere by mechanical and chemical means are technically feasible but whether they can become affordable is still uncertain. A recent survey of experts found that most believe DAC costs will decline significantly over time but probably not to the level needed to make large-scale deployment possible by mid-century without subsidies. However, breakthroughs may be possible. An Israeli startup called High Hopes believes its

new approach can bring the cost down to $50-$60 a ton with scale compared to $600-$1,000/ton at Switzerland's Climeworks, the largest DAC facility operating today.
While most captured $CO_2$ would be sequestered, a global study commissioned by Bernard David, founder of the Global $CO_2$ Initiative, attempted to identify the full range of areas where profitable ways can be found to use $CO_2$ to make valuable products. The study estimated that $CO_2$ utilization can be a $0.5 to $2 trillion/year business opportunity and eventually lock up 2-8 Gigatons of $CO_2$/year in products that are either carbon-neutral or carbon negative. Construction materials (concrete, aggregates) offer by far the largest market opportunity followed by fuels and chemicals. Engineered materials, polymers, and agriculture can also make use of captured $CO_2$, but on a much smaller scale.

How quickly carbon capture projects can proceed depends on the timely parallel development of a transport infrastructure to deliver captured $CO_2$ to sites for utilization or long-term storage. Studies have demonstrated the economic advantages of creating a shared transport infrastructure rather than building on a project-by-project basis, and of sizing the system from the start with extra capacity eventually needed to meet climate goals. There are currently about 5,000 miles of $CO_2$ transport pipelines in the U.S. Economy-wide deployment of transport infrastructure is estimated to involve constructing over 29,000 miles of additional $CO_2$ transport routes in the medium-term.

Biological methods like bioenergy with carbon capture and sequestration (BECCS), afforestation and reforestation, "blue carbon" habitat restoration, and "carbon farming" with regenerative agriculture and biochar are important and have many co-benefits, but there are uncertainties about how large their contribution can be or how permanently they can sequester carbon. This is another area where breakthroughs may be possible. For example, proponents of large-scale ocean seaweed farms argue that they could draw down substantial amounts of carbon since seaweed grows at 30 to 60 times the rate of land-based crops, while also supplying large quantities of protein and helping to counter ocean acidification.

**Worries and Challenges**

**Ex. 5 Deliberative Process (DP)**

**Interviewee Suggestions: Potential Roles for EPA to Consider**

# Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Lee Beck**, Policy Innovation Director and International Director, Carbon Capture Program (joined by colleagues Jay Duffy, Jonathon Lewis, John Thompson), Clean Air Task Force
- **Brad Crabtree**, Vice President, Carbon Management, Great Plains Institute
- **Bernard David**, Founder, Global $CO_2$ Initiative; entrepreneur, educator, author
- **Jane Flegal**, Senior Director for Industrial Emissions, Council on Environmental Quality, Executive Office of the President
- **Volker Sick**, Arthur F. Thurnau Professor of Mechanical Engineering, DTE Professor of Advanced Energy Research, Director of Global CO2 Initiative, University of Michigan
- **Jennifer Wilcox**, Principal Deputy Assistant Secretary for Fossil Energy, U.S. Department of Energy

**Literature Reviewed**

Elizabeth Abramson and Dane McFarlane, Transport Infrastructure for Carbon Capture and Storage. Great Plains Institute, June 2020. Available: https://www.betterenergy.org/wp-content/uploads/2020/06/GPI_RegionalCO2Whitepaper.pdf

Clayton Cornell, "Cooling the Climate with Giant Seaweed Farming," Huffington Post, December 6, 2017. Available: https://www.huffpost.com/entry/cooling-the-climate-with-_b_8486822

CO2 Removal.org, Afforestation and reforestation: assessment results. 2020. Available: https://co2removal.org/assessment/results/

Bas den Hond, "Looking for Climate Solutions Down in the Dirt," Eos.org, April 17, 2019. Available: https://eos.org/articles/looking-for-climate-solutions-down-in-the-dirt

EPA Website, "Class VI – Wells used for Geological Sequestration of $CO_2$." Available: https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-co2

Robert Haberman, "Tracking the laws of carbon dioxide removal," China Dialogue. March 2, 2021. Available: https://chinadialogue.net/en/climate/tracking-laws-carbon-dioxide-removal/

International Energy Agency, Net Zero by 2050: A Roadmap for the Global Energy Sector. May 17, 2021. Available: https://www.iea.org/reports/net-zero-by-2050

International Energy Agency, Energy Technology Perspectives 2020: Special Report on Carbon Utilization and Storage. 2020. Available: https://www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage

Taylor Kubota-Stanford, "Carbon Capture Might Not be Such a Great Idea," Futurity, October 28, 2019. Available: https://www.futurity.org/carbon-capture-climate-change-2195712/

Ann Manning, "As a way to fight climate change, not all soils are equal," Science Daily, December 4, 2018. Available: https://www.sciencedaily.com/releases/2019/12/191204100537.htm

Jan Christph Minx and Gregory Nemet, "Opinion: The inconvenient truth about carbon capture." Washington Post, May 31, 2018. Available: https://www.washingtonpost.com/news/theworldpost/wp/2018/05/31/carbon-capture/

Soheil Shayegh, et. al., Future Prospects of Direct Air Capture Technologies: Insights From an Expert Elicitation Survey, Frontiers in Climate. May, 2021, pp. 1-14. Available: https://www.frontiersin.org/articles/10.3389/fclim.2021.630893/full

Jeff Tollefson, "Sucking carbon dioxide from air is cheaper than scientists thought," Nature. June 7, 2018. Available: https://www.nature.com/articles/d41586-018-05357-w

Phil Williamson, "Emissions reduction: Scrutinize CO2 removal methods, Nature. February 16, 2016. Available: https://www.nature.com/articles/d41586-018-05357-w

## CLIMATE CHANGE RESPONSIVENESS/PREPAREDNESS

**Developments Over the Past Generation**

Climate change has contributed toward increased occurrence and severity of natural disasters. Hurricane Katrina was severe and an early catastrophe that required a substantial response and recovery effort across many federal agencies but appeared to be a relatively isolated and unprecedented incident. In recent years however, the increased frequency and intensity of major events including Hurricanes Sandy, Irma, Maria, Harvey, and the ongoing wildfires in the western United States have shown that these disruptive events are becoming much more common and severe. At the same time, threats to homeland security are also growing due to the rise in terrorist activity, greater availability of dangerous biological agents, growing cybersecurity risks, and other security threats. There is also a growing threat that multiple events will occur simultaneously.

In addition to the actual increase in natural disasters and security threats, there is increased public visibility and expectations for an effective federal response. The 24-hour news cycle has heightened national public awareness of local and regional incidences, resulting in an increased number of situations deemed worthy of a national level response that requires rapid Agency-wide action. The growing level of day-to-day emergency response activities limit the Agency's ability to plan and prepare for future threats.

As a result of these developments, EPA's emergency response portfolio has expanded substantially to deal with the increasing number of events requiring national as well as local responses, including EPA-wide and interagency efforts.

**Developments Anticipated Over the Next 10 Years**

Demands on EPA are likely to continue to increase as the impacts of climate change become both more severe and more frequent and as security threats grow. In 2021, for example, above normal fire potential conditions exist across much of the western United States, while another above-normal Atlantic hurricane season is predicted. Simultaneously, events in the United Kingdom showed the ease with which people can now obtain fourth generation biological nerve agents, and ransomware attacks in the United States indicate the likelihood of growing threats to cybersecurity.

These developments will tax EPA and other federal resources and could overwhelm these resources if this situation is not addressed. Better local planning and preparedness for emergency response is needed, but these plans are often slow to develop and are subject to resistance due to political polarization. Although an increase in disasters may incentivize communities to prepare faster, they are not on pace to progress at the needed level within the next ten years.

**Vision of the Preferred Future**

**Ex. 5 Deliberative Process (DP)**

# Ex. 5 Deliberative Process (DP)

Worries and Challenges

Ex. 5 Deliberative Process (DP)

**Interviewee Suggestions: Potential Roles for EPA to Consider**

Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Adam Whelchel**, Director of Science, The Nature Conservancy
- **Andy Miller**, EPA, Associate Director for Climate, Air, Climate and Energy Research Program, ORD

- **Joseph Siegel**, EPA, Director, Region 2 Environmental Collaboration and Conflict Research Program and co-chair of the Climate Change Workgroup
- **Kathleen Salyer**, EPA, Acting Director, OLEM Office of Emergency Management (OEM)
- **Patty Gioffre**, EPA, Acting Director, Regulations Implementation Division, OEM
- **Tito Irizarry**, EPA, Director, Preparedness & Response Operations Division, OEM
- **Josh Woodyard**, EPA, Associate Director, Preparedness & Response Operations Division, OEM
- **Gina Perovich**, EPA, Director, Chemical, Biological, Radiological and Nuclear Consequence Management Advisory Division, OEM

**Literature Reviewed**

National Interagency Control Center. 2021. North American Seasonal Fire Assessment and Outlook: Outlook Period June through August 2021. Available: https://www.predictiveservices.nifc.gov/outlooks/NA_Outlook.pdf

National Oceanic and Atmospheric Administration. 2021. NOAA predicts another active Atlantic hurricane season. Available: https://www.noaa.gov/news-release/noaa-predicts-another-active-atlantic-hurricane-season

United States Geological Survey. 2021. How can climate change affect natural disasters? Available: https://www.usgs.gov/faqs/how-can-climate-change-affect-natural-disasters-1?qt-news_science_products=0#qt-news_science_products

# ENVIRONMENTAL JUSTICE

## Past Developments

Working with scholars and activists, EPA played an important role in involving the federal government in Environmental Justice (EJ). Beginning in the early 1970s, a growing body of literature documented the discriminatory siting of toxic waste facilities across the country. A 1990 Conference on Race and the Incidence of Environmental Hazards organized at the University of Michigan brought together researchers in this area and follow-up letters were sent to several federal agencies to solicit their involvement in efforts to address this problem. EPA Administrator William Riley responded, and a dialogue was initiated that led EPA to begin its own examination of the evidence for EJ issues. In 1992, the Agency released its findings in a report, *Environmental Equity: Reducing Risks to All Communities*, and set up an Office of Environmental Equity. The Clinton Administration expanded the office, changed its name to the Office of Environmental Justice, and brought together several agencies in meetings where EPA helped lead efforts to involve them in promoting environmental justice.

While scholars documented environmental racism, citizens in several poor, mainly African American communities organized to stop the waste facilities from being imposed on them. In 1979, Bean v. Southwestern Waste Management Corp., filed by African American residents of Houston, Texas, represented the first lawsuit charging discrimination in waste facility siting using civil rights laws. In 1982, an effort by residents in Warren County, North Caroline to block the state from shipping in 6,000 truckloads of soil contaminated with toxic PCBs became the focus of national media attention. These events sparked the development of the Environmental Justice Movement. Participants in this new movement looked to EPA to be their main ally within the federal government.

Since that time, EJ has ebbed and flowed under different administrations, researchers have systematically documented the disturbing scope of environmental inequalities, and the Environmental Justice Movement has become a major force for change. Within the government, the Biden Administration has elevated leadership on EJ to the level of the Executive Office of the President and created a White House Environmental Justice Interagency Council with representatives from 18 federal agencies. One of the President's first actions was to issue an Executive Order that creates a government-wide Justice 40 Initiative with the goal of delivering 40 percent of the overall benefits of relevant federal investments to disadvantaged communities.

## Anticipated Developments Over the Next 10-20 Years

The momentum behind current efforts to foster EJ creates a possibility that major progress can be achieved over the next 10-20 years. Many of the problems that need to be addressed have been well-known but unsolved for decades. Examples include:

- *Accounting for Cumulative Impacts and Risks*: Communities that have multiple industrial and energy facilities and are saturated with legacy pollution want to see EPA realign its enforcement in a way that provides guidance and tools for taking cumulative impacts and risks into account, even if they cannot be measured with precision. Permitting has always been done one facility at a time. If the facility meets regulatory requirements it is approved, no matter how many other facilities are in the same area and how much pollution they produce in total. There is no threshold to say when a community is overburdened, so it can be easier for a community that has seven facilities to get an eighth facility approved, than for a community that has no existing facilities to get one approved;

impacted communities can find no government agency – even EPA - to help them deal with this obvious unfairness. Minnesota, California, and New Jersey have passed laws to address this problem, but there has been no action from the federal government.

- *Locating Hazardous Waste Sites*: Living near hazardous waste sites cuts lifespans short by over a year, according to the first nationwide review of all hazardous waste sites and not just the 1,300 sites on the national priority list managed by the federal government. These sites are disproportionately located in or near low-income communities and communities of color. Because of housing segregation and discriminatory zoning patterns, many of these facilities and communities are in flood-prone areas, which increase the risk of exposure. The majority of Superfund sites are near EJ communities and 65 of them are subject to flooding.

New challenges are also emerging, especially around climate change.

- *Growing Impacts of Climate Change*: There is evidence that global warming is making hurricanes stronger, posing a threat to many communities, especially low-income communities of color. In the wake of Hurricane Harvey, for example, low-income neighborhoods were much more affected than wealthier ones because they were more concentrated in flood-prone parts of Houston. In the eight counties most severely affected by Harvey, only 17 percent of homeowners held flood insurance policies. Housing prices declined, poverty increased, and some people who could afford to move away did so, and poorer people moved in. Other climate impacts like heat waves, wildfires, poor air quality, drought, and floods all have disproportionate impacts.

- *Equitable Distribution of Benefits of New Technology*: Many policies for accelerating the shift to clean energy and transportation technologies have the effect of making them available to affluent and overwhelmingly white populations and not to minorities. As a result, a movement around Energy Justice has been growing to promote equitable access to new green technologies rather than leaving access to market forces alone. For example, policies like a "Cash for Clunkers" program can be designed to permanently retire older cars and give generous support to low-income people for buying used or new electric vehicles. Similarly, decisions about the placement of charging stations will strongly affect the ownership of electric vehicles in EJ communities.

- *Importance of Reducing Pollution as a Whole*: EJ citizen groups have always emphasized the importance of reducing pollution as a whole, and there is a concern today that if governments focus too exclusively on carbon reduction, we will not deal adequately with the pollution burdens low-income and minority communities still carry. Carbon capture technologies are the largest area of concern. There are worries that carbon capture is untried and might increase some forms of pollution. Communities are concerned that even if carbon capture slightly reduces pollution, it will still leave overburdened communities overburdened and that it makes it possible to continue using coal, with all the health and environmental impacts that entails. As one of our interviewees put it, "As we make our way to a just energy transition, we should go as directly as possible to the 'promised land' – no fossil fuels, all renewable energy – because with anything else the [adverse] impacts will come to EJ communities."

**Vision of the Preferred Future**

**Ex. 5 Deliberative Process (DP)**

Ex. 5 Deliberative Process (DP)

**Worries and Challenges**

Ex. 5 Deliberative Process (DP)

**Interviewee Suggestions: Potential Roles for EPA to Consider**

Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Robert Bullard**, Distinguished Professor of Urban Planning and Environmental Policy, Texas Southern University
- **Lisa Garcia**, Director of Fix, the climate solutions lab of Grist
- **Charles Lee**, EPA, Senior Policy Advisor, Office of Environmental Justice
- **Peggy Shepard**, Co-founder and Executive Director of WE ACT for Environmental Justice
- **Matthew Tejada**, EPA, Director, Office of Environmental Justice

**Literature Reviewed**

Robert Brulle and David Pellow, "Environmental Justice: Human Health and Environmental Inequalities," Annual Review of Public Health, April 21, 2006. Available: https://www.annualreviews.org/doi/full/10.1146/annurev.publhealth.27.021405.102124

Robert D. Bullard, "Environmental Justice: It's More Than Waste Facility Siting," Social Science Quarterly, September 1996. Available: https://www.jstor.org/stable/42863495

EPA, EJ 2020 Action Agenda, EPA strategic plan for advancing environmental justice for the years 2016-2020. Available: https://www.epa.gov/environmentaljustice/ej-2020-action-agenda-epas-environmental-justice-strategy

Executive Order 13985, Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. White House, January 20, 2021. Available: https://www.whitehouse.gov/briefing-

room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/

Eleanor Krause and Richard Reeves, "Hurricanes hit the poor hardest," Social Mobility Memos, Brookings Institution, September 18, 2017. Available: https://www.brookings.edu/blog/social-mobility-memos/2017/09/18/hurricanes-hit-the-poor-the-hardest/

"Life Expectancy Lower Near Superfund Sites: lower still for those with low incomes," Science Daily, April 13, 2021. Available: https://www.sciencedaily.com/releases/2021/04/210413144912.htm

National Environmental Justice Advisory Council, Superfund Remediation and Redevelopment for Environmental Justice Communities. EPA, May 21, 2021. Available: https://www.epa.gov/sites/production/files/2021-06/documents/superfund_remediation_and_redevelopment_for_environmental_justice_communities_may_2021_report.pdf

Renee Skelton and Vernice Miller, The Environmental Justice Movement, Natural Resources Defense Council, March 17, 2016. Available: https://www.nrdc.org/stories/environmental-justice-movement

X. Wu et. al, "Exposure to Air Pollution and COVID-19 Mortality in the United States: A Nationwide Cross-Sectional Study." AAAS Science Advances, November 4, 2020. Available: https://advances.sciencemag.org/content/6/45/eabd4049

## CHILDREN'S ENVIRONMENTAL HEALTH

### Developments Over the Past Generation

There is overwhelming evidence developed over many years that children are disproportionately exposed to health risks and safety hazards from the environments where they live, learn, and play. Children's typical behaviors expose them to more environmental risks than those experienced by most adults. Those exposures are particularly damaging to children because their neurological, immunological, digestive, and other body systems are still developing, and because they breathe, eat, and drink more per pound of body weight than an adult. Exposure of fetuses, infants, children, and adults of childbearing age can result in impacts not only in children, but also adults and in subsequent generations. In response to this growing evidence, EPA created its Office of Children's Health Protection (OCHP). This led to a stronger focus on considering children's health in chemical review and establishment of programs in areas like home and learning environments where children are likely to be exposed to health risks.

Although children's health risks have continued to be considered to some degree in decision-making, interest among the administrations, public and lawmakers has ebbed and flowed. OCHP's staffing declined by 19% and budget reduced by 31% since 2010, limiting the Agency's capability in this area. Although research continues to expand our understanding of threats to children's health, in recent years this has not led to an increased focus on mitigating those risks.

### Developments Anticipated Over the Next 10 Years

Chemical risk exposure continues to pose a major threat to children, especially as new industrial chemicals and pesticides are released. While there is regulation of these new chemicals, many of the most harmful effects are not realized until years of exposure results in visible health impacts. Exposures at early lifestages from preconception, through pregnancy, childhood and adolescence as well as to adults of childbearing age will continue to be one of the most vulnerable populations to new and existing environmental challenges In addition, studies on cumulative exposure risks, prenatal exposure, developmental neurotoxicity, and epidemiology are limited when it comes to children.

Some scientist believe that children are highly vulnerable to the effects of climate change, a challenge that only will worsen over the coming years. Increased temperature is damaging to both children and pregnant women's health, and children experience severe negative impacts from disruptive events like major storms, droughts, or wildfires. President Biden's recent Executive Order on the Climate Crisis establishes an Interagency Working Group to Decrease Risk of Climate Change to Children, the Elderly, People with Disabilities, and the Vulnerable, which may address some of these risks, but will likely need additional support. The President's Task Force on Environmental Health Risks and Safety Risks to Children, co-managed by EPA/OCHP and HHS is an interagency group chartered under EO 13045 and it is standing up a subcommittee to further explore and address health risks from children due to climate change and disasters. In addition, OCHP is in the process of commissioning a workshop from the National Academy of Science to explore current and future risks to children's environmental health and priorities to address them.

Finally, the COVID-19 Pandemic led to economic disruption for many families and changes in where children spent their time: the Pandemic prevented children living in toxic and unsafe home environments from leaving their houses for extended periods (e.g., at home rather than school),

reduced time spent outdoors, and increased exposure to potentially harmful chemicals (e.g., those that received emergency approval for disinfectant use and indoor air filtration).

Work on lead, PFAS, endocrine disrupters, pesticides and asthma disparities is far from complete and more effort and resources are needed to prevent and abate the associated risks

**Vision of the Preferred Future**

Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

**Worries and Challenges**

# Ex. 5 Deliberative Process (DP)

**Interviewee Suggestions: Potential Actions for EPA to Consider**

# Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Jeanne Briskin**, EPA, Director, Office of Children's Health Protection.
- **Nse Witherspoon**, Executive Director, Children's Environmental Health Network.
- **Rebecca Dzubow**, EPA, Division Director, Office of Children's Health Protection.
- **Tracey Woodruff**, Professor Ob/Gyn, Reproductive Sciences, School of Medicine, University of California, San Francisco.

**Literature Reviewed**

Biden, J. 2021. Executive Order on Tackling the Climate Crisis at Home and Abroad. US White House. Presidential Actions. Available: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

Barbara Bennett et al. 2016. Project TENDR: Targeting Environmental Neuro-Developmental Risks - The TENDR Consensus Statement. Environmental Health Perspectives;124(7):A118-22. doi: 10.1289/EHP358. Available: https://pubmed.ncbi.nlm.nih.gov/27479987/

Children's Environmental Health Network. 2015. A Blueprint for Protecting Children's Environmental Health: An Urgent Call to Action. Available: https://cehn.org/wp-content/uploads/2015/11/BluePrint_Final1.pdf

National Institute of Environmental Health Sciences. 2021. Children's Environmental Health. Available: https://www.niehs.nih.gov/health/topics/population/children/

Pellizzari, E. and Bennett, D. 2020. Program on Reproductive Health and the Environment. University of California, San Francisco. Available: https://prheucsf.blog/2020/03/25/so-many-chemicals-how-do-we-decide-which-ones-to-study/

Project TENDR: Targeting Environmental Neuro-Development Risks. Available: http://projecttendr.com/

US Environmental Protection Agency. 2019. America's Children and the Environment. Available: https://www.epa.gov/sites/production/files/2019-10/documents/ace2019-v17s.pdf

World Health Organization. 2021. Children's Environmental Health. Available: https://www.who.int/health-topics/children-environmental-health#tab=tab_1

## GREEN CHEMISTRY

### Developments Over the Past Generation

After the pivotal development of the concept of green chemistry at EPA in the 1990s, the Agency staked out a leadership position in the new field with the Green Chemistry Challenge Awards, the Safer Choice program, ORD funding for academic research in green chemistry, and other initiatives. New journals were created, and some leading universities began to teach courses in the field. In industry, several major companies embraced the concept early on. Since then, the practical impact has become very significant, with shifts occurring in thousands of companies in the U.S. and internationally.

In recent years there have been two lagging areas. One is academia: while many universities have created green chemistry courses and degree programs, many more have not. The other is EPA itself where, despite a competent and highly dedicated staff, budget cuts, competing demands and other factors have taken a toll. As one of our interviewees put it, "The Agency that introduced green chemistry to the world is now nearly invisible in the world of green chemistry."

### Developments Anticipated Over the Next 10 Years

The pace of progress in green chemistry is likely to increase for several reasons. In government, the recently passed Sustainable Chemistry Research and Development Act is catalyzing coordination of programs and activities across the federal government in support of green chemistry. In industry, many companies using hazardous materials in their production processes observe recent legal developments and the increased liability they could face and want to find ways to reduce business risks. Other companies see green chemistry as a competitive advantage – reducing costs of production through a wide variety of resource efficiencies. At the same time, green chemistry is evolving in important new directions such as interdisciplinary work that bridges chemistry and biology to learn from biomimicry how nature performs processes safely at ambient temperatures, whereas we still use hazardous chemicals and high temperatures.

### Vision of the Preferred Future

**Ex. 5 Deliberative Process (DP)**

**Worries and Challenges**

Ex. 5 Deliberative Process (DP)

**Interviewee Suggestions: Potential Roles for EPA to Consider**

Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Paul Anastas**, Professor in the Practice of Chemistry for the Environment, Yale University
- **Steve Devito**, EPA, OCSPP, Branch Chief, Data Gathering and Analysis Division, TRI/ Pollution Prevention/ Green Chemistry Analysis
- **John Katz**, EPA, Pollution Prevention Coordinator, Region 9
- **Jeff Scott**, EPA, Director, Land, Chemicals, and Redevelopment Division, Region 9
- **John Warner**, Co-founder, President, and Chief Technology Officer, Warner Babcock Institute for Green Chemistry
- **David Widawsky**, EPA, Director, Chemistry, Economics and Sustainable Strategies Division, Office of Chemical Safety and Pollution Prevention

**Literature Reviewed**

ACS Green Chemistry Institute, "Design Principles for Sustainable Green Chemistry and Engineering." Available: https://www.acs.org/content/acs/en/greenchemistry/principles.html

Paul Anastas and Julie Zimmerman, "Moving from Protection to Prosperity: Evolving the U.S. Environmental Protection Agency for the Next 50 Years," Environmental Science and Technology, February 15, 2021. Available: https://pubs.acs.org/doi/10.1021/acs.est.0c07287

EPA, Green Chemistry, EPA Web Site. Available: https://www.epa.gov/greenchemistry

Carles Estevez, "The Challenge of Green Chemistry," Green Chemistry Letters and Reviews, Volume 1, Issue 1, 2007. Available: https://www.tandfonline.com/doi/full/10.1080/17518250701642860

Robert Lempert et al., "Next Generation Environmental Technologies: Benefits and Barriers," RAND Corporation report, 2003. Available: https://www.rand.org/pubs/monograph_reports/MR1682.html

Julie Zimmerman, et. al, "Designing for a Green Chemistry Future," Science, January 24, 2020. Available: https://science.sciencemag.org/content/367/6476/397

John Warner and Jennifer Ludwig, "Rethink How Chemical Hazards Are Tested," Nature, August 16, 2016. Available: https://www.nature.com/articles/536269a

## RAPID GROWTH OF THE ELECTRIC VEHICLE INDUSTRY

### Developments Over the Past Generation

Electric vehicles (EVs) have moved from being not even a niche, more of an oddity, to entering the mainstream and being desirable. Questions about whether EVs are worth the effort to pursue have been answered and investment is now increasing rapidly.

Transportation has become the single largest carbon-emitting sector in the U.S., with automobiles and light-duty trucks responsible for the most emissions. EVs are one of the most important ways to decarbonize, so government policy is realigning to support EV industry growth.

In the private sector, Tesla's rapid growth has motivated automakers to avoid being left behind. General Motors' commitment to invest $27 billion in electric vehicles over the next five years and to stop making gas-powered cars, trucks, and sport utility vehicles by 2035 has put pressure on other auto companies to make equally ambitious commitments.

Progress in EV technology has accelerated. Lithium-ion has been the focus of battery development for the past three decades. Heavy investments were made a decade ago that finally paid off. Since 2010 the average cost of lithium-ion batteries has fallen by 85%. More recently a focus on the whole powertrain, designing the vehicle as an EV to start with rather than just adapting a gas-powered car, has produced a 100% increase in miles per unit of energy.

### Anticipated Developments

EVs will be increasingly attractive because they will have qualities that people want. They already provide fast acceleration and are quieter, more durable, and cost less to operate and maintain. Over the next few years, they will offer new functions, like the ability to provide backup power for homes, as offered initially on the Electric Ford-150. Eliminating the traditional engine will give designers flexibility to create attractive new shapes and new kinds of vehicles. Climate and clean air benefits of EVs will drive sales for people concerned with these issues.

Importantly, EVs are projected to be become cost-competitive with gas-powered cars. Continuing decreases in the cost of batteries will be a key factor, since the battery accounts for a third to half of the cost of an EV. The inherent simplicity of EVs will also be important: they are much easier to build because the electric motor has only one moving part, while internal combustion engines have hundreds of moving parts. One estimate is that EVs will reach purchase price cost parity by 2030, another is that this could happen by mid-decade.

By 2030, two disruptive technologies could begin to transform the economics of EV ownership. *Vehicle-to-grid technology* (VTG) will allow EVs to draw power from the grid when demand and prices are low and feed power into the grid during periods of peak demand when prices are high. Vehicle owners will get paid for the power their cars provide and utilities will avoid the cost of building new plants. Autonomous/self-driving capability could change the model of ownership as we know it. Many people in the generation growing up now are used to subscribing to things rather than always owning things. They might like an arrangement where they can subscribe to access a car that will come to them when needed, especially if it is much less costly than ownership.

Continuing improvement of lithium-ion batteries will bring advances in range, charging time, weight, and safety. Toward the decade's end, solid state batteries – often referred to as the "holy grail" of EV battery technology – are likely to become available, offering further performance improvements. Looking still further ahead, in-road charging could be implemented on major roads. This is not hard to do from a technical standpoint, but issues of cost and potential negative impacts need study.

"Lightweighting" car bodies will extend the range of EVs and make them more recyclable and flexible. Combining carbon fiber with thermoplastics can produce lightweight but extremely strong structural body parts that are fully recyclable. Thermoplastics can be heated and reformed over and over. With carbon fiber in it, the material is worth more than plastic alone, making recycling worthwhile. People may eventually be able to purchase one kind of vehicle, then later have the shell recycled and turn a sedan into an SUV or other kind of vehicle.

Using additive manufacturing to make tooling machines will transform the auto industry and especially benefit EV production. Creating the tooling needed to produce a new car model is costly and typically takes 5 years. Additive manufacturing can reduce the time to a year or less, and rapid retooling will allow rapid learning about how to best design EVs. Large-scale metal 3-D printing will cut the cost of creating rotors and other parts for electric motors.

Despite these positive developments, shifting the nation's transportation system to EVs rapidly enough to meet climate goals will be very difficult and cannot be done without steady policy support to accelerate both the growth of the EV industry and the rate that gas-powered vehicles are permanently retired.

**Vision of the Preferred Future**

**Ex. 5 Deliberative Process (DP)**

**Worries and Challenges**

**Ex. 5 Deliberative Process (DP)**

Ex. 5 Deliberative Process (DP)

Interviewee Suggestions: Potential Roles for EPA to Consider

Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

**People Interviewed**

- **Diana Bauer**, Senior Technical Manager for Strategy, Department of Energy
- **Sharyn Lie**, EPA, Director of Climate, Economics and Modeling Center, OAR Office of Transportation and Air Quality
- **Daniel Loughlin**, EPA, National Risk Management Research Laboratory, ORD
- **Ronnie Love**, Energy and Transportation Science Division, Oak Ridge National Laboratory
- **Shirley Meng**, Director, Sustainable Power and Energy Center and Professor, Department of Nanoengineering, UC San Diego.
- **Shriram Santhanagopalan**, Center for Integrated Mobility Sciences, National Renewable Energy Laboratory

**Literature Reviewed**

BloombergNEF, *Electric Vehicle Outlook 2019*. Available: https://about.bnef.com/electric-vehicle-outlook/

Department of Energy. 2011. *Critical Materials Strategy: Summary.* Available: https://www.energy.gov/policy/downloads/2011-critical-materials-strategy

Jack Ewing and Ivan Penn, "The Auto Industry Bets Its Future on Batteries," New York Times, Febuary 16, 2021. Available: https://www.nytimes.com/2021/02/16/business/energy-environment/electric-car-batteries-investment.html

Jody Freeman, "General Motors is Counting on Your Loving Electric Cars," New York Times, February 2, 2021. Available: https://www.nytimes.com/2021/02/02/opinion/GM-electric-cars.html

G. Harper et al., Nature. 6 November 2019. Recycling Lithium-Ion Batteries from Electric Vehicles. Available: https://www.nature.com/articles/s41586-019-1682-5

David Iaconangelo, "Ninety Percent of U.S. Cars Must Be Electric by 2050 to Meet Climate Goals, Scientific American, September 29, 2020. Available: https://www.scientificamerican.com/article/ninety-percent-of-u-s-cars-must-be-electric-by-2050-to-meet-climate-goals/

IEA, *Global EV Outlook 2020.* International Energy Agency, June 2020. Available: https://www.iea.org/reports/global-ev-outlook-2020

Daniel Oberhaus, "The Race to Crack Battery Recycling – Before It's Too Late," Wired magazine, November 20, 2020. Available: https://www.wired.com/story/the-race-to-crack-battery-recycling-before-its-too-late/

Mike Scott, "Electric Models to Dominate Car Sales by 2040, Wiping Out 13m Barrels a Day of Oil Demand," Forbes, June 10, 2019

Jess St. John, "How to Build an Equitable EV Infrastructure," Canary Media, April 8, 2021. Available: https://www.canarymedia.com/articles/how-to-build-an-equitable-electric-vehicle-infrastructure/

Bradley S. Van Gosen et. al, Rare Earth Element Mineral Deposits in the United States. USGS circular 1454, April 2019

## MICROPLASTICS IN SURFACE WATERS AND OCEANS

**Developments Over the Past Generation**

The EPA has been late to give microplastics the attention they deserve. Europe has had microplastics on its radar screen for 15 years, and organizations such as the European Chemicals Agency (ECHA) have funded microplastic research to a much greater extent (orders of magnitude) than the U.S. Over the last several years U.S. media has begun to cover microplastics, but 2020 was the first year they were included in ORD's National Research Program.

There are still many unanswered questions about the origin, transport, fate, and impacts of microplastics, not just due to limited research, but also because they are difficult to study. While formally defined as pieces of plastic between 1 nanometer and 5 millimeters in length (about the size of a sesame seed), many particles are only a few microns wide. In addition, plastics are comprised of many varying polymers with different chemical compositions and properties which can make them difficult to capture, identify and quantify. Nevertheless, research has produced some important - and alarming - findings.

- Microplastics are everywhere: in surface waters and oceans, in Antarctic sea ice, in snowfall in the Arctic, littering the ocean floor, near the summit of Mt. Everest, inside many forms of aquatic life, in table salt, the dust on floors, and human stool samples collected all around the world.

  There are many sources of microplastic input to aquatic systems. Degradation of plastic waste (single use plastics, food packaging, and other forms of improperly disposed plastic), tire wear particles, textiles, improperly disposed fishing gear, and to a lesser extent, scrubbers in cosmetics and other personal care products. Tire wear particles have recently been identified as a major source of microplastics. Tires are designed for abrasive wear; they shed through friction to increase traction with the road. The shed material washes into storm drains, creeks, rivers and eventually into lakes and oceans. Another major source is synthetic textile fibers like polyester and nylon that shed microplastics in normal use and especially in washing machines. The fibers move through sewage pipes and treatment plants and eventually into bodies of water. A recent study suggests the possibility that another large source could be protective hull coatings on ships. The hypothesis is that ships leave a kind of 'skid mark' in the water that is of similar significance in the ocean as tire wear particles from cars are on the land. As our analytical capabilities increase, our knowledge of sources will become more complete.

- All microplastic is not evenly dispersed in the ocean. A recent study of microplastics on the seafloor found that deep sea currents are acting as conveyor belts, creating hotspots of concentrated microplastic similar to the garbage patches that currents create on the ocean's surface. These plastic-transporting currents also carry nutrients, so microplastic pollution is concentrating in areas that are also biodiversity hotspots.

- Due to their small size, microplastics are easily mistaken for food and ingested by a wide range of aquatic life. The risk to these organisms is not only from the plastic itself, but also from chemical plasticizers, additives to make plastic flexible or colorful, and the ability of microplastics to absorb and concentrate environmental contaminants in seawater.

- Much remains to be learned about how the ingestion of different types and sizes of microplastics can harm different aquatic species, but a wide range of effects have been documented. Studies have shown that microplastics can reduce the feeding capability of coral, inhibit the photosynthetic efficiency of diatoms, reduce the fertilization rate of mollusks, affect the growth and development of arthropods, disrupt hermit crab's cognitive functioning and make it harder for them to find shells to live in, and cause aneurisms in fish. Most alarmingly, there is evidence that microplastics also adversely affect plankton, an essential component of the marine ecosystem.

- There is only incidental information about the transfer of microplastics from the aquatic environment to humans and little understanding of their effect on human health. Most of what we know about potential impacts on health is from medical research focused on plastic implants. We have learned, for example, that microplastics travel through the lymphatic system, but we do not know their impact. In any case, exposure through air may be a larger factor than through ingestion of food and drink, e.g., there may be potentially greater exposure from putting on a microfiber jacket than from eating seafood, but pathways have yet to be quantified.

**Anticipated Developments**

By one estimate, if business-as-usual continues, the amount of microplastics leaking into the environment will increase from 1.4 megatons per year in 2016 to 3.0 megatons per year in 2040. By another, there are concentrations of microplastics in some ocean areas that are 60 times greater today than just 15 years ago. The problem is accelerating, and we are not yet making significant strides to deal with it. It would not be surprising, then, if the situation is much worse 20 years from now. On the other hand, efforts to better understand the problem and develop effective solutions are also accelerating. What developments the future holds depend primarily on what we do now.

**Vision of the Preferred Future**

**Ex. 5 Deliberative Process (DP)**

**Interviewee Suggestions: Potential Roles for EPA to Consider**

**Ex. 5 Deliberative Process (DP)**

# Ex. 5 Deliberative Process (DP)

**Interviews**

- **Kathryn Beers**, Group Leader, Polymers and Complex Fluids Group, Materials Science and Engineering Division, NIST
- **Kay Ho**, EPA, Marine Eco-toxicologist, Environmental Effects Research Laboratory

**Literature Reviewed**

Subhankar Chatterjee and Shivika Sharma, "Microplastics in our oceans and marine health," Field Actions Science Reports. Special Issue: Reinventing Plastics. 2019, pp. 54-62. Available: https://journals.openedition.org/factsreports/5257

Global Citizen, "There are 60 Times More Microplastics in Oceans Today Than 15 Years Ago," June 19, 2021. Available: https://www.globalcitizen.org/en/content/pacific-ocean-microplastics-increase/?template=next&utm_source=paidsearch&utm_medium=usgrant&utm_campaign=verizon&gclid=CjwKCAjwq7aGBhADEiwA6uGZpzgfC210yqO4ZAWZFcKugoZxDVzzw5SQabO9bvI8tiy2Z2XAt8vhjRoChd0QAvD_BwE

Ben Coxworth, "Study points to ship hull coatings as a major source of microplastic pollution," New Atlas, February 25, 2021. Available: https://newatlas.com/environment/ship-hull-coatings-microplastic-pollution/

National Academies of Science, Engineering, and Medicine, Emerging Technologies to Advance Research and Decisions on the Environmental Health Effects of Microplastics: A Workshop, January 27-28, 2020. Keynote address paper and link to video available: https://www.nationalacademies.org/event/01-27-2020/emerging-technologies-to-advance-research-and-decisions-on-the-environmental-health-effects-of-microplastics-a-workshop

NOAA, Microplastic Marine Debris Fact Sheet. Marine Debris Program, Office of Response and Restoration, National Ocean Service. Available: https://marinedebris.noaa.gov/fact-sheets/microplastic-marine-debris-fact-sheet

Darna Noor, "The Seafloor is Absolutely Littered in Microplastic," GIZMODO, April 30, 2020. Available: https://gizmodo.com/the-seafloor-is-absolutely-littered-in-microplastic-1843184394

Anil Patri, FDA, "Understanding Human Exposure to Nanoplastics/Microplastics: Novel Agents Bring Novel Challenges." Presentation to NTP Board of Counselors Meeting, February 21, 2020. Available: https://ntp.niehs.nih.gov/ntp/about_ntp/bsc/2020/february/presentations/04patri_bsc_508.pdf

Christopher J. Rhodes, "Plastic Pollution and Potential Solutions," Environmental Science and Technology, September 1, 2018. Available: https://www.sfei.org/documents/think-global-act-local-local-knowledge-critical-inform-positive-change-when-it-comes

Chelsea M. Rochman et. Al., Think Global, Act Local: Local Knowledge is Critical to Inform Positive Change When it Comes to Microplastics." Environmental Science and Technology, 2021, 55, pp. 4-6. Available: https://pubs.acs.org/doi/10.1021/acs.est.0c05746

Huirong Yang et. Al., "Microplastics in the Marine Environment: Sources, Fates, Impacts and Microbial Degradation," Toxics, February 22, 2021. Available: https://pubmed.ncbi.nlm.nih.gov/33671786/

Message

**From**: Fugh, Justina [Fugh.Justina@epa.gov]
**Sent**: 9/17/2021 3:51:09 AM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: heads up -- possible semiconductor industry conflicts
**Attachments**: Signed recusal 4-8-21.docx; Joe Goffman Updated Recusal - signed 6-30-21.pdf

Hi Joe,
I wanted to send you this note to say that we are learning more about the AIM Act that directs EPA to address HFCs by phasing down the production and consumption of listed HFCs, managing the HFCs and their substitutes, and also facilitating the transition to next-generation technologies. Ex. 5 Deliberative Process (DP)
Ex. 5 Deliberative Process (DP)

Please note that Amazon, Apple, IBM and Microsoft all apparently design and manufacture semiconductors, so employees who own over the regulatory exemption levels will not be able to participate in the rulemaking that addressees this industry. If indeed they are affected, then we will be worried about:

- Ownership over $15,000 in any semiconductor manufacturer, which means an employee cannot work on a petition filed by that company;
- Ownership over $25,000 in any semiconductor manufacturer, which means that an employee also cannot work on any rulemaking that will affect this industrial sector; and
- Ownership over $50,000 in any sector fund that invests in the semiconductor industry, such as Direxion Daily Semiconductor Bull (SOXL), ProShares Ultra Semiconductors ETF (USD), Invesco Dynamic Semiconductors ETF (PSI), VanEck Vectors Semiconductor ETF (SMH), or iShares PHLX Semiconductor ETF (SOXX).

Although your 4/8/21 recusal statement included semiconductors, your updated recusal statement of 6/30/21 does not. Since we now believe that Amazon, Apple, IBM and Microsoft may be affected by the upcoming semiconductor rulemaking, we advise caution on your part.
Justina

Justina Fugh (she/her) | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

Message

**From:** Hockstad, Leif [Hockstad.Leif@epa.gov]
**Sent:** 10/27/2021 7:47:11 PM
**To:** OAR Briefings [OAR_Briefings@epa.gov]
**Subject:** RE: BC Rescission Final Rule Options Selection
**Attachments:** OAR BC Rescission Final Rule Options Select-102621-FINAL.docx

Please find attached briefing materials for tomorrow's "BC Rescission Final Rule Options Selection" meeting.

OAR BC Rescission Final ...

Thanks,
Leif

**LEIF HOCKSTAD** (HE/HIM) | LEADER, POLICY SUPPORT GROUP
OFFICE OF AIR POLICY & PROGRAM SUPPORT (OAPPS)
OFFICE OF AIR & RADIATION | U.S. EPA | WJC NORTH 5442B
1200 PENNSYLVANIA AVE. NW | MC 6103A | WASHINGTON, D.C. | 20460 | USA
Hockstad.Leif@epa.gov | **1-202-343-9432**

-----Original Appointment-----
**From:** Kabanda, Thierry <Kabanda.Thierry@epa.gov> **On Behalf Of** Goffman, Joseph
**Sent:** Friday, October 22, 2021 10:54 AM
**To:** Carbonell, Tomas; Hockstad, Leif; Tsirigotis, Peter; Sasser, Erika; Langdon, Robin; Dunham, Sarah; Sargeant, Kathryn; Helfand, Gloria; Grundler, Christopher; Adamantiades, Mikhail; Edwards, Jonathan; Lee, Raymond; Hoffer, Melissa; Ting, Kaytrue; Wolfson, Steve; Anderson, Lea; Srinivasan, Gautam; Talty, Mark; Arroyo, Victoria; Kopits, Elizabeth; Lamson, Amy; McGartland, Al; Starfield, Lawrence; Argentieri, Sabrina; Ayres, Sara; Fox, Radhika; Corona, Joel; Frey, Christopher; Cascio, Wayne; Ross, Mary; Benner, Tim; Kettl, Brian; Breen, Barry; Hoffman, Wendy; Mattick, Richard; McMinimy, Chris; Shoaff, John
**Cc:** Nunez, Alejandra; Campbell, Ann; Hooper, Daniel; Kim, Eunjung; Kabanda, Thierry; OP ADP Calendar; Banks, Dawn; Marks, Matthew; Fine, Philip
**Subject:** BC Rescission Final Rule Options Selection
**When:** Thursday, October 28, 2021 4:15 PM-5:00 PM (UTC-05:00) Eastern Time (US & Canada).
**Where:** Microsoft Teams Meeting

---

# Microsoft Teams meeting

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# Options Selection for Final Rule "Rescinding the Rule on Increasing Consistency and Transparency in Considering Benefits and Costs in the Clean Air Act Rulemaking Process"

Briefing for OAR Acting AA Goffman

**Date of Meeting: October 28, 2021**

## TOPICS FOR DISCUSSION

- Obtain decisions on path forward for Final Rule
- Consideration of Public Comments on Interim Final Rule
- Final Rulemaking timeline
- Appendix: Overview of rationales for rescission as included in Interim Final Rule

## BACKGROUND

- E.O. 13990 identified the 2020 Benefit-Cost Rule as one of the rules for EPA "*to consider publishing for notice and comment a proposed rule suspending, revising, or rescinding the agency action*"…"*as soon as possible*."
- EPA published the Interim Final Rule to rescind the 2020 Rule in its entirety on May 14, 2020, which became effective on June 14, 2020.
- Today's Options Selection Meeting focuses on issues raised by public commenters and options for finalizing the rescission.

## RECOMMENDATION

**Ex. 5 Deliberative Process (DP)**

# Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

# Ex. 5 Deliberative Process (DP)

Message

**From:** Just, Robin L [rjust@law.harvard.edu]
**Sent:** 1/22/2021 3:31:20 PM
**To:** Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject:** Fw: Animator/Educator Intro: Nick Hilditch & Joseph Goffman and Robin Just // Acid Rain

Hi Joe, here's the preview of our TEDEd video! I'll look at it later today. Should I have them go through me from now on, or add your EPA email to the thread? Either totally fine. I'm happy to thread this needle however is best for you ethically. Thanks!

---

**From:** TED-Ed Animation <TEDEdAnimation@ted.com>
**Sent:** Friday, January 22, 2021 10:28 AM
**To:** Nick Hilditch <nick@nickhilditch.com>
**Cc:** Bethany Cutmore-Scott <bethany@ted.com>; Goffman, Joseph <jgoffman@law.harvard.edu>; Just, Robin L <rjust@law.harvard.edu>
**Subject:** Re: Animator/Educator Intro: Nick Hilditch & Joseph Goffman and Robin Just // Acid Rain

Hi Nick,

Thank you for letting us know! I'm sharing the file with our team for review and also sharing it here, so that Joseph and Robin can take a look as well.

https://www.dropbox.com/sh/4hg5wqegm77mm48/AAC9t8NgZMtemQkAv0M3vVIsa?dl=0&preview=2010_01_A_JustRobin_GoffmanJoseph_AcidRain_Storyboard_210122.mp4

Thanks!
Sazia

On Fri, Jan 22, 2021 at 5:04 AM Nick Hilditch Ex. 6 Personal Privacy (PP) wrote:

Hi all,

I'm currently uploading the first complete animated draft of the film to your Work in Progress folder. It's going painfully slowly, but I'm hoping it'll be there by the time America starts work. The file is called:

2010_01_A_Goffman_Joseph_Just_Robin_AcidRain_WIP20210122.mp4

Looking forward to hearing what you think. Let me know if you'd like me to put an unlisted copy on YouTube for quick reference.
Kind regards

Nick

On Wed, 6 Jan 2021 at 14:45, Bethany Cutmore-Scott Ex. 6 Personal Privacy (PP) wrote:

Hi Nick,

Thank you for sending the boards! Everything looks good to us thus far!

Thanks,
Bethany

On Mon, Jan 4, 2021 at 3:42 PM TED-Ed Animation <TEDEdAnimation@ted.com> wrote:

Hi Nick,

Happy new year and thank you for the update! I've shared the storyboard with our team for review, and we'll change the deadline to the end of this month.

Thanks,
Sazia

On Mon, Jan 4, 2021 at 8:13 AM Nick Hilditch <Ex. 6 Personal Privacy (PP)> wrote:

Hi there,

Happy new year! I hope you were all able to have a good break at the end of the year.

I wanted to send you all a progress update so you can see how the visuals for the film are shaping up. I am not as far along as I'd like to be, and you'll see from these storyboards that some scenes are sketchier than others (especially towards the end of the film).

Nevertheless, this document should give you a strong sense of how the film will look, and indicate some of the ideas I have been developing.

I initially hoped to deliver the film in mid-January. This now seems a touch ambitious, but I'd still like to push towards completing the film by the end of this month. At this stage I have no specific questions, but happy to discuss any details. In the meantime, I will push on with the designs!

All the best,

Nick

On Mon, 7 Dec 2020 at 22:43, TED-Ed Animation <TEDEdAnimation@ted.com> wrote:

Hi Nick,

I hope all is well with you! I just wanted to check in on the progress of the Acid Rain lesson. Could you let us know when we can expect a WIP?

Looking forward to seeing how this lesson has come so far.

Best,
Abdallah

On Fri, Oct 23, 2020 at 11:55 AM Nick Hilditch <Ex. 6 Personal Privacy (PP)> wrote:

Nice to meet you Joseph and Robin,

I enjoyed the script, and look forward to getting my teeth into this animation soon!

Nick

On Fri, 23 Oct 2020 at 17:34, TED-Ed Animation <TEDEdAnimation@ted.com> wrote:

Hi Joseph and Robin,

Hope you're well! I'm Sazia, the Production Coordinator here at TED-Ed. Gerta, the Director of Production and Bethany, the Producer, both cc-ed, have been reviewing and sending feedback on the script for the past few months, and we're all really excited to move your lesson to visual production!

We'd like to introduce you to Nick Hilditch, the director working on your lesson. We're very excited to work with Nick again! He worked on a few TED-Ed lessons with us, which you can view here.

During the production process, there will be a few milestones we hope to have your feedback on:
-design frames
-storyboards and/or animatic (moving storyboards timed to the voice over)
-2-3 animation work-in-progress

We ask that you respond to the director within 48 hours, as our projects are on very tight deadlines. Please note that while we will be relying on your feedback for accuracy, the director will retain creative liberty of the design, art direction and animation style.

We'll follow up shortly with relevant paperwork.

Thank you!
Sazia

--
**Nick Hilditch**
http://nickhilditch.com
+36 70 944 3737

Watch my showreel.

--
**Nick Hilditch**
http://nickhilditch.com
+36 70 944 3737

Watch my showreel.

--

Bethany Cutmore-Scott
*she/her/hers*
Producer :: **TED-Ed**
**TED** Conferences, LLC | 330 Hudson Street, 12th Floor | New York, NY 10013

--

**Nick Hilditch**
http://nickhilditch.com
+36 70 944 3737

Watch my showreel.

Message

**From**: Jamie Banks [jamie@quietcommunities.org]
**Sent**: 2/8/2022 2:28:45 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: Rakosnik, Delaney [rakosnik.delaney@epa.gov]; Jefferson, Catrice [Jefferson.Catrice@epa.gov]; Lee, Michael [Lee.Mike@epa.gov]; Lubetsky, Jonathan [Lubetsky.Jonathan@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Shoaff, John [Shoaff.John@epa.gov]; Arline L Bronzaft PhD [Ex. 6 Personal Privacy (PP)]; David Sykes [Ex. 6 Personal Privacy (PP)]; Elkins, Chuck (SMD 3D01) [Ex. 6 Personal Privacy (PP)]; Joel Mintz [mintzj@nova.edu]; Rick Reibstein [Ex. 6 Personal Privacy (PP)]; Shapiro, Sidney [shapirsa@wfu.edu]
**Subject**: Follow-up to 2/1 meeting with Quiet Communities
**Attachments**: 2022.02.08_Goffman follow-up letter_Final.pdf

Dear Mr. Goffman,

Please find attached our letter as a follow up to our meeting last Wednesday (2/1/22).

We look forward to the opportunity to work with you and your team.

Sincerely,

--

Jamie L. Banks PhD, MS, President

Quiet Communities Inc.

quietcommunities.org

Chair, Noise & Health Committee

American Public Health Association

Web Facebook Twitter LinkedIn APHA Connect (members only)

Email: jamie@quietcommunities.org

Tel: 781.259.1717

*Quiet Communities, Inc. (QCi) is a national 501(c)(3) non-profit organization dedicated to protecting the public health, the environment, and quality of life for everyone -- by reducing noise and related pollution. QCi hosts 5 programs: Quiet Coalition, Quiet Outdoors, Quiet Conversation, Quiet Healthcare, and Quiet American Skies.*

Message

**From**: Carlson, Ann (NHTSA) [ann.carlson@dot.gov]
**Sent**: 1/28/2021 1:57:20 AM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: Re: connecting

You and David Hayes are sitting pretty ☺

I'm sure we'll see each other virtually before then but once I move and it's safe let's definitely get together in real life.

Get Outlook for iOS

---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, January 27, 2021 5:08:29 PM
**To:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Subject:** RE: connecting

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Ex. 6 Personal Privacy (PP) from 2017 until March, when Harvard went remote. Ex. 6 Personal Privacy (PP)

Ex. 6 Personal Privacy (PP)

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Sent:** Wednesday, January 27, 2021 7:46 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: connecting

Ex. 6 Personal Privacy (PP)

What about you?

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---

**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, January 27, 2021 4:41:44 PM
**To:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Subject:** RE: connecting

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Assuming we move past the current remote work regime, are you anticipating moving to DC? Would you consider it even sooner? Circadian rhythms are like dynamite – not to be played with in my experience.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Sent:** Wednesday, January 27, 2021 7:39 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** RE: connecting

Ex. 6 Personal Privacy (PP)

**From:** Goffman, Joseph [mailto:Goffman.Joseph@epa.gov]
**Sent:** Wednesday, January 27, 2021 7:36 PM
**To:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Subject:** RE: connecting

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Thanks, Ann! Appreciate the vote of confidence. Meanwhile, I was wondering/worried about the challenge of navigating time zones. Now, that's dedication.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

**From:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Sent:** Wednesday, January 27, 2021 7:27 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Re: connecting

Aww, thanks, Joe. I thought exactly the same when I heard about your appointment. So great to see what a team they're assembling. Very much looking forward to working together. You are so the right choice (though I was thinking that perhaps they should remove the "acting" title....)

Ex. 6 Personal Privacy (PP)

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**From:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Sent:** Wednesday, January 27, 2021 4:21:25 PM

**To:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Subject:** RE: connecting

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Hi, Ann. I was totally jazzed when I learned that you had taken your new position. Completely exciting for all concerned. Congratulations to DOT and NHTSA for a brilliant appointment.

Thank you very much for getting the ball rolling on connecting.

All best,
Joe

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

---

**From:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>
**Sent:** Wednesday, January 27, 2021 10:01 AM
**To:** Shulman, Sophie (OST) <Sophie.Shulman@dot.gov>; Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Putnam, John (OST) <john.putnam@dot.gov>
**Subject:** RE: connecting

Hi Joe – so glad you're where you are! Looking forward to working together.

---

**From:** Shulman, Sophie (OST)
**Sent:** Wednesday, January 27, 2021 9:56 AM
**To:** Goffman.Joseph@epa.gov
**Cc:** Carlson, Ann (NHTSA) <ann.carlson@dot.gov>; Putnam, John (OST) <john.putnam@dot.gov>
**Subject:** connecting

Hi Joe – Wanted to (re) connect you with our DOT team that will be working on CAFE, Ann Carlson (who I believe you know), NHTSA Chief Counsel, and John Putnam, Acting General Counsel. We are hoping to touch base on the interagency process and share notes on what we are hearing from our team – let us know if you want to loop in any of your colleagues, as well.

Thanks!

Sophie Shulman
Deputy Chief of Staff for Policy
Office of the Secretary
U.S. Department of Transportation
sophie.shulman@dot.gov

Message

**From**: Michael H. Levin [mhlevin@mhllawgrp.com]
**Sent**: 2/2/2021 10:17:55 PM
**To**: Goffman, Joseph [Goffman.Joseph@epa.gov]
**CC**: lazarus@law.harvard.edu; Joseph Goffman [Ex. 6 Personal Privacy (PP)]
**Subject**: Small refinery "hardship" waivers under Renewable Fuels Standard

FYI: https://www.biocycle.net/rins-hardship-waivers-rise-again/. Looks to me like one easy fix for the new Administration. ☺

Also have a piece coming in the next couple weeks on the ACE Rule vacatur, partly focused on whether the CADC panel's order vacated *the Rule's repeal of the CPP* as well as the ACR Rule itself -- & what options (besides a clean slate for a totally new rule) that might leave for the Biden EPA to pursue. Like, reaffirming the CPP to start & asserting all its implementation deadlines simply move *en bloc* by operation of law, then building from there. Might want to wait at least for denial of rehearing, though the majority opinion (which pretty clearly was written with mitigating the Supremes in mind) provides powerful arguments that speed now is more of the essence than ever. Curious what anyone thinks of that.

Best to all.

Mike

Michael H. Levin Law Group, PLLC
3605 Tilden Street NW, Washington DC 20008
Tel: 202-828-3212
Cell: 202-253-4674
W: www.mhllawgrp.com
www.carbonfs.com

Member:
NLGC, LLC
Carbon Finance Strategies LLC
Solar Shield LLC

Message

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 2/3/2021 4:18:48 PM
**To**: Joe Goffman Ex. 6 Personal Privacy (PP) Goffman, Joseph [Goffman.Joseph@epa.gov]
**Subject**: E.D. posting

Hi Joe, we'd appreciate if you could pass this along to anyone you think can keep up with us here at EELP
Thanks!

https://eelp.law.harvard.edu/2021/02/eelp-seeks-executive-director/

**Robin Just | Director of Outreach and Communications**
**Environmental & Energy Law Program | Harvard Law**
Web - https://eelp.law.harvard.edu
Twitter - https://twitter.com/HarvardEELP
LinkedIn - https://linkedin.com/school/harvard-law-environmental-energy-law-program
617.495.5391 | rjust@law.harvard.edu
Pronouns: she/her

Appointment

**From**: scheduling [scheduling@epa.gov]
**Sent**: 5/19/2021 3:50:48 PM
**To**: scheduling [scheduling@epa.gov]; Enobakhare, Rosemary [Enobakhare.Rosemary@epa.gov]; Michalos, Maria [Michalos.Maria@epa.gov]; Levy, Maxwell [Levy.Maxwell@epa.gov]; Lucey, John [Lucey.John.D@epa.gov]; Paul Billings [Paul.Billings@lung.org]; Ex. 6 Personal Privacy (PP) Laura Kate Bender' [Laura.Bender@lung.org]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Carbonell, Tomas [Carbonell.Tomas@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; 'kmendez@aafa.org' [kmendez@aafa.org]; 'Georges.Benjamin@apha.org' [Georges.Benjamin@apha.org]; 'katie@envirn.org' [katie@envirn.org]; 'Bob@ecoamerica.org' [Bob@ecoamerica.org]; 'twinders@allergyasthmanetwork.org' [twinders@allergyasthmanetwork.org]; 'msarfaty@gmu.edu' [msarfaty@gmu.edu]; 'jcarter@psr.org' [jcarter@psr.org]; 'mrice1@bidmc.harvard.edu' [mrice1@bidmc.harvard.edu]; 'President@neha.org' [President@neha.org]; Ex. 6 Personal Privacy (PP) Ex. 6 Personal Privacy (PP) 'mdelmonte@aap.org' [mdelmonte@aap.org]; 'hmarwah@gwmail.gwu.edu' [hmarwah@gwmail.gwu.edu]; 'jwendorf@napnap.org' [jwendorf@napnap.org]; 'pceo@NLN.ORG' [pceo@NLN.ORG]; 'acharles@nln.org' [acharles@nln.org]; 'JDiaz-Granados@apa.org' [JDiaz-Granados@apa.org]; 'acasalotti@naccho.org' [acasalotti@naccho.org]; 'Harold.Wimmer@Lung.org' [Harold.Wimmer@Lung.org]; jkeller@apa.org; jennar@aafa.org; Donald.Hoppert@apha.org; canderson@allergyasthmanetwork.org; bgottlieb@psr.org; gewart@thoracic.org; kristiet@cehn.org; zlaris@aap.org; dfarquhar@neha.org; mmitch3@gmu.edu; rebecca@ecoamerica.org; ebriggs@naccho.org; davem@masonconsultingllc.com; Linda.Rudolph@phi.org; sarah_hsu@brown.edu
**CC**: O'Brien, Grant [OBrien.Grant@epa.gov]

**Subject**: Video-Call: Remarks: Public Health & Medical Organization CEOs
**Location**: https://usepa.zoomgov.com Ex. 6 Personal Privacy (PP)

**Start**: 5/20/2021 3:15:00 PM
**End**: 5/20/2021 4:00:00 PM
**Show Time As**: Busy

**Required Attendees**: Enobakhare, Rosemary; Michalos, Maria; Levy, Maxwell; Lucey, John; Paul Billings Ex. 6 Personal Privacy (PP) 'Laura Kate Bender'; Nunez, Alejandra; Carbonell, Tomas; Goffman, Joseph; 'kmendez@aafa.org'; 'Georges.Benjamin@apha.org'; 'katie@envirn.org'; 'Bob@ecoamerica.org'; 'twinders@allergyasthmanetwork.org'; 'msarfaty@gmu.edu'; 'jcarter@psr.org'; 'mrice1@bidmc.harvard.edu'; 'President@neha.org'; Ex. 6 Personal Privacy (PP) 'mdelmonte@aap.org'; 'hmarwah@gwmail.gwu.edu'; 'jwendorf@napnap.org'; 'pceo@NLN.ORG'; 'acharles@nln.org'; 'JDiaz-Granados@apa.org'; 'acasalotti@naccho.org'; 'Harold.Wimmer@Lung.org'; jkeller@apa.org; jennar@aafa.org; Donald.Hoppert@apha.org; canderson@allergyasthmanetwork.org; bgottlieb@psr.org; gewart@thoracic.org; kristiet@cehn.org; zlaris@aap.org; dfarquhar@neha.org; mmitch3@gmu.edu; rebecca@ecoamerica.org; ebriggs@naccho.org; davem@masonconsultingllc.com; Linda.Rudolph@phi.org; sarah_hsu@brown.edu
**Optional Attendees**: O'Brien, Grant

*Do not forward this invitation. Please notify Scheduling & Advance if participant changes need to be made.*

-Administrator Regan
-John Lucey

Virtual:
-Rosemary Enobakhare, OPEEE
-Maria Michalos, OPA
-Max Levy, OPEEE
-Joe Goffman, OAR
-Tomas Carbonell, OAR
-Ale Nunez, OAR

-Harold Wimmer, American Lung Association
-Kenny Mendez, Asthma and Allergy Foundation of America
-Dr. Georges Benjamin, American Public Health Association
-Katie Huffling, Alliance of Nurses for Healthy Environments
-Bob Perkowitz, Climate For Health
-Tonya Winders, Allergy & Asthma Network
-Mona Sarfaty, Medical Society Consortium on Climate and Health -
-Jeff Carter, Physicians for Social Responsibility
-Mary Rice, American Thoracic Society
-Sandra Long, National Environmental Health Association
-Nse Obot Witherspoon, Children's Environmental Health Network
-Mark Del Monte, American Academy of Pediatrics
-Harleen Marwah, Medical Students for a Sustainable Future
-James Wendorf, National Association of Pediatric Nurse Practitioners
-Beverly Malone, National League for Nursing
-Dr. Jim Diaz-Granados, American Psychological Association
-Adriane Casalotti, National Association of County & City Health Officials

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Ex. 6 Personal Privacy (PP)
Join by H.323
Ex. 6 Personal Privacy (PP) (US West)
(US East)
Meeting ID: Ex. 6 Personal Privacy (PP)

Appointment

**From**: Just, Robin L [rjust@law.harvard.edu]
**Sent**: 6/28/2021 1:45:42 PM
**To**: Just, Robin L [rjust@law.harvard.edu]; Curley, Kathleen [curley@law.harvard.edu]; Freeman, Jody [freeman@law.harvard.edu]; Lazarus, Richard [lazarus@law.harvard.edu]; Jenks, Carrie F. [cjenks@law.harvard.edu]; Peskoe, Ari [apeskoe@law.harvard.edu]; Vizcarra, Hana V. [hvizcarra@law.harvard.edu]; Perls, Hannah [hperls@law.harvard.edu]; Huang, May [mhuang@law.harvard.edu]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Laura Bloomer Ex. 6 Personal Privacy (PP) ; Caitlin McCoy Ex. 6 Personal Privacy (PP) Davies, Kyra [kdavies@law.harvard.edu]; Levy, Sara Burr [slevy@law.harvard.edu]

**Subject**: Farewell from EELP to Kathy! *ZoomUpdate*

**Start**: 6/28/2021 5:30:00 PM
**End**: 6/28/2021 6:30:00 PM
**Show Time As**: Busy

**Recurrence**: (none)

Update! Lunch will be reimbursed up to $20 since HLS discontinued their account with GrubHub. May can help you with the forms for reimbursement.

Robin L Just is inviting you to a scheduled Zoom meeting.

Topic: Farewell to Kathy!
Time: Jun 28, 2021 01:30 PM Eastern Time (US and Canada)

Join Zoom meeting
https://harvard.zoom.us Ex. 6 Personal Privacy (PP)

Password: Ex. 6 Personal Privacy (PP)

Join by telephone (use any number to dial in)

Ex. 6 Personal Privacy (PP)

International numbers available: https://harvard.zoom.us/ Ex. 6 Personal Privacy (PP)

One tap mobile: Ex. 6 Personal Privacy (PP) US (Washington DC)

Join by SIP conference room system
Meeting ID: Ex. 6 Personal Privacy (PP)
Ex. 6 Personal Privacy (PP) @zoomcrc.com

Message

**From**: Fugh, Justina [Fugh.Justina@epa.gov]
**Sent**: 4/21/2021 3:49:32 AM
**To**: Campbell, Ann [Campbell.Ann@epa.gov]; Tsirigotis, Peter [Tsirigotis.Peter@epa.gov]
**CC**: Clarke, Victoria [clarke.victoria@epa.gov]
**Subject**: Please disregard any involvement by Joe Goffman in this request
**Attachments**: Signed recusal 4-8-21.docx

Hi there,
As made clear in Joe Goffman's attached recusal, signed 4/8/21, he is not permitted to participate in any specific party matter in which his former employer, Harvard University, is a party or represents a party because of his ethics pledge obligations. He erred in forwarding the email he received from a Harvard.edu email address and in suggesting any official course of action. Please utterly disregard his email and any statement or suggestion he made.

Ann – you are listed as the screener in Joe's recusal, so we should discuss how to handle this situation. I feel that we need to: Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP) I am happy to assist in any way.

Peter – Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP)

Justina

Justina Fugh | Director, Ethics Office | Office of General Counsel | US EPA | Mail Code 2311A | Room 4308 North, William Jefferson Clinton Federal Building | Washington, DC 20460 (for ground deliveries, use 20004 for the zip code) | phone 202-564-1786 | fax 202-564-1772

**From:** Tsirigotis, Peter <Tsirigotis.Peter@epa.gov>
**Sent:** Tuesday, April 20, 2021 6:51 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Cc:** Campbell, Ann <Campbell.Ann@epa.gov>; Kabanda, Thierry <Kabanda.Thierry@epa.gov>; Sasser, Erika <Sasser.Erika@epa.gov>; Shoaff, John <Shoaff.John@epa.gov>; Culligan, Kevin <Culligan.Kevin@epa.gov>; Carbonell, Tomas <Carbonell.Tomas@epa.gov>; Nunez, Alejandra <Nunez.Alejandra@epa.gov>
**Subject:** Re: Mercury science

I agree

On Apr 20, 2021, at 6:25 PM, Goffman, Joseph <Goffman.Joseph@epa.gov> wrote:

Please provide the usual response, but I think we should do this one. Thanks.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

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**From:** Lambert, Kathleen Fallon <klambert@hsph.harvard.edu>
**Sent:** Thursday, April 15, 2021 8:11 PM
**To:** Goffman, Joseph <Goffman.Joseph@epa.gov>
**Subject:** Mercury science

Joe,

Would it be possible to get on your schedule for a 30-minute meeting on mercury science update with Drs. Elsie Sunderland (Harvard), Charles Driscoll (Syracuse) and myself on April 29, 30, or May 3, 4, or 5?

Thank you,

Kathy Fallon Lambert
Senior Advisor, Center for Climate, Health and the Global Environment (C-CHANGE)
Harvard T.H. Chan School of Public Health
Co-founder, Science Policy Exchange
Tel. 802-436-1000
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skype name kathleen.lambert31

For information and updates on the Transportation, Equity, Climate and Health (TRECH) Study, visit: https://www.hsph.harvard.edu/c-change/news/trechstudy/

For stories of climate hope and action, subscribe to *The Climate Optimist* newsletter: https://hsph.me/ClimateOptimist