**From:** Trish Spencer
**To:** Lara Weisiger
**Subject:** Fwd: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
**Date:** Monday, June 3, 2024 1:59:02 PM

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---------- Forwarded message ----------
From: Chris Rutherford <info@CIEL.org>
Date: Jun 3, 2024 1:46 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

> Jun 3, 2024
>
> Councilmember Trish Herrera Spencer
>
> Dear Councilmember Herrera Spencer,
>
> I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.
>
> The experiment aims to test technology that would advance Marine Cloud Brightening -- a form of solar radiation modification that involves spraying saltwater particles into the air to thicken or brighten clouds, theoretically increasing their reflectivity and partially blocking the sun's rays.
>
> Deploying Marine Cloud Brightening at scale would bring a host of new environmental and social impacts, potentially putting billions of peoples' human rights at risk. Like all geoengineering techniques, it is impossible to test for its intended climate impact without large-scale deployment, which would lock in any harmful consequences. Small-scale experiments like this one therefore tend to serve as technology development.
>
> Deployed at scale, Marine Cloud Brightening would not reverse the climate crisis but create a different climate change potentially exacerbating droughts, hurricanes, and flooding far from the deployment site. It would also result in increased and uncontrollable salt deposition on land and in waterways, corroding infrastructure and harming agriculture, while the use of huge volumes of seawater would kill substantial marine life with cascading impacts on ocean food chains, fisheries, and coastal communities.
>
> While this is a local decision, it has far reaching consequences since the experiment risks legitimizing this highly speculative and harmful technology and everyone on the planet could be affected by large scale

deployment.

You may already be aware that governments around the world have agreed to a global moratorium on geoengineering and are moving to introduce more restrictive regulations for marine geoengineering. Many civil society organizations around the world have called for an end to marine geoengineering experiments.

https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Mr. Chris Rutherford
1753 Park St
Livermore, CA 94551-2843
(510) 648-7838
yz125frem@aol.com

| | |
|---|---|
| **From:** | Kelly Wanser |
| **To:** | CityCouncil-List; Marilyn Ezzy Ashcraft |
| **Cc:** | Tony Daysog; Tracy Jensen; Trish Spencer; Malia Vella; Jennifer Ott; Abby Thorne-Lyman; Alesia Strauch; Alexandra Reeves; Sarah J. Doherty; Laura Fies |
| **Subject:** | [EXTERNAL] Agenda item 7-B of the June 4th City Council meeting: CAARE Program Engagement Overview |
| **Date:** | Monday, June 3, 2024 4:18:39 PM |
| **Attachments:** | CAARE Engagement Overview-3.pdf |

Dear Mayor Ashcraft, Alameda City Council Members and Staff,

We are writing to share an overview of proposed exhibit, education and engagement activities for the CAARE program at the USS Hornet Sea, Air and Space Museum.

We appreciate the remarkable opportunity that the unique environment of the Hornet and the vibrant community of Alameda offer for engaging many ages and types of people with both historical and new ways of studying the climate and atmosphere.

Kind regards,

Kelly Wanser
Executive Director, SilverLining
Senior Advisor, University of Washington MCB Program

Sarah Doherty
Sr. Research Scientist
Program Director, MCB Program
University of Washington

Alexandra Reeves
CAARE Local Coordinator
SilverLining

COASTAL ATMOSPHERIC AEROSOL RESEARCH AND ENGAGEMENT

# CAARE at the USS Hornet Sea, Air and Space Museum: *Engagement Possibilities Overview*

June 3, 2024

Alexandra Reeves, CAARE Local Coordinator, SilverLining
Kelly Wanser, Executive Director, SilverLining
Sarah Doherty, Program Director, University of Washington MCB Program

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# Introduction

The Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet Sea, Air and Space Museum is a program with two key elements: 1) scientific research on the atmosphere and 2) community engagement and education efforts. The CAARE team chose the Hornet as the location for the program due to its unique ability to support both missions.

As a Smithsonian Affiliate with a mission to utilize the USS Hornet and its collections, exhibitions and educational programming to promote awareness and understanding of history, science, technology, and service, the USS Hornet Museum provides an incredible opportunity to engage with students, educators, and community members. For the CAARE effort, it is highly valuable to leverage the Hornet Museum's highly engaged network of students, educators, youth organizations, visitors, volunteers, and collaborators, and we hope to provide mutual value to their organization through high-quality educational and engagement offerings and the unique opportunity to engage with critical climate research and the world-class scientists who comprise the CAARE team.

The research at the CAARE Facility has also drawn interest from scientists, government officials, Indigenous leaders, youth organizations and members of the public from California and around the world. The unique opportunity to help people engage more directly with advanced climate research with implications for society creates many opportunities for educational experiences and events.

# 1. Museum Exhibit

The USS Hornet Museum is a spectacular example of an in situ museum experience, where visitors are able to experience the retired aircraft carrier in its original form, augmented and extended by educational exhibits. The CAARE team has deep respect for the Hornet Museum experience and is in the process of crafting a similarly intentioned exhibit, wherein visitors are able to visit the working research elements of the CAARE facility, and engage with educational materials to further their understanding of not only the CAARE research, but of climate change and climate science more broadly.  They also can experience what

it's like to be a climate researcher, and engage with the tools and instruments of climate research in a field research setting.

## Flight Deck Experiences

The CAARE team developed the beginnings of our Coastal Atmospheric Aerosol Research and Engagement exhibit around the research installation on the Flight deck, beginning with a panel installation describing the real-world relevance, scientific context, and importance of engagement in these studies. This first panel is seen below, installed on the side of a storage container on the flight deck.

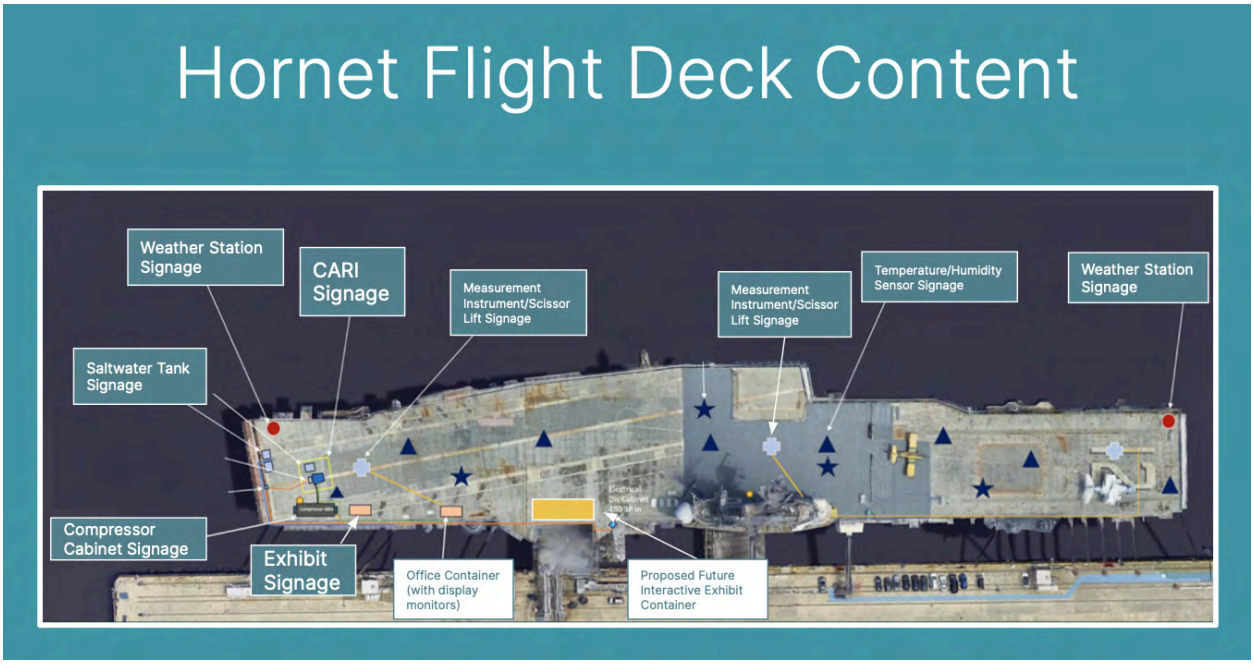

*Program Director, Dr. Sarah Doherty, with youth climate leader Joshua Amponsem, in front of the CAARE education panel installed on the Hornet Flight Deck.*


*The CAARE education panel installed on the Hornet Flight Deck.*

This panel is the first element of a planned, more extensive exhibit of installations across the Flight Deck, including both large panels and signage on instrument stations and on the Cloud Aerosol Research Instrument (CARI) explaining:

- the science behind and the purpose of CARI, the Cloud Aerosol Research Instrument at the heart of the CAARE studies;
- the specialized research instruments collecting the study data along the length of the Flight Deck;
- the program's specialized weather stations distributed throughout the Flight Deck, measuring things such as wind speed, wind direction, and humidity;
- the deep meteorological history of the Hornet, which was an early example of advanced technologies like weather balloons, and how this connects to the research studies of the CAARE program.

These educational supplements will be located at various positions across the Flight Deck, as depicted in the layout shown below. The Flight Deck is the primary focus of our exhibit planning, as it is the site of the CAARE study setup, but unguided programming will also extend into the interior of the ship.




*The proposed layout of educational and interactive content on the Hornet Flight Deck.*

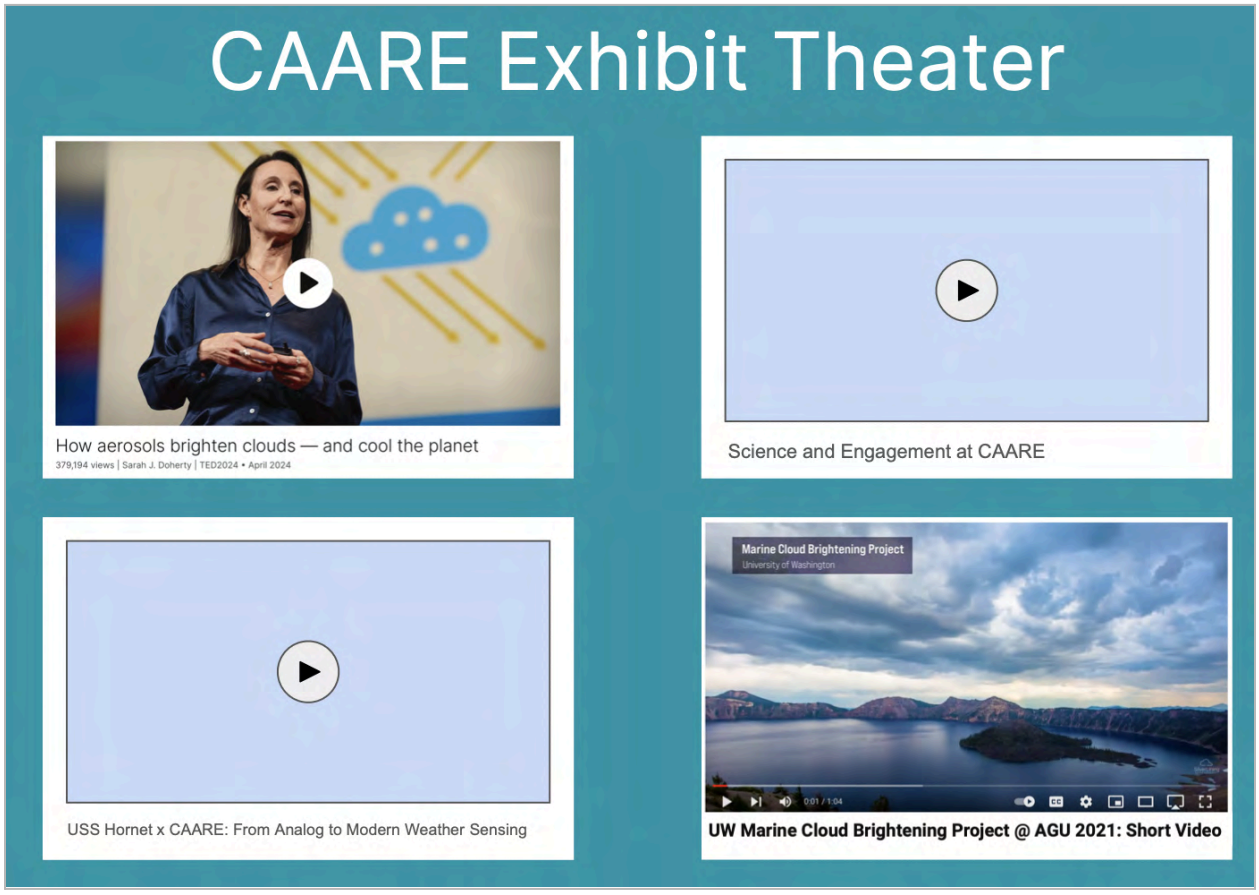
## Interactive Science

Moving forward, the CAARE Facility hopes to further extend the exhibit component of the program to include an exhibit container, similar to the existing office container, on the Hornet's Flight Deck. This would provide an opportunity for all visitors to the Museum to experience, at their own pace, a scaled-down version of the Field Trip and Experiential Learning opportunities we have developed, featuring a single nozzle from the CARI nozzle matrix, an additional TV screen playing the aforementioned videos, handheld particle counters to contextualize the specialized CAARE research instruments, and additional displays further explaining the importance of atmospheric aerosol research in the current climate science landscape.

## Hangar Deck Experiences

On the Hangar Deck, where visitors enter the USS Hornet Museum, the CAARE exhibit will include video kiosks for individuals and small groups to select videos and a mini-theater featuring a large-scale screen for groups, with options to play short, high-quality educational videos related to the CAARE studies and climate and atmospheric science:

- A TED Talk by the program's director, Dr. Sarah Doherty, on the science questions and research being explored at CAARE.
- A video short produced by the American Geophysical Union on the University of Washington's Marine Cloud Brightening Program
- *In production:* A CAARE-produced video with an overview of the scientific research efforts of the CAARE Facility and interactions with visitors
- *In production:* A video produced in collaboration with the Hornet Museum on the meteorological history of the USS Hornet, climate change and the City of Alameda, and the connections to atmospheric and climate science and the CAARE Facility studies.




*The video selection available for visitors to choose from in the Hangar Deck theater.*

Other video content and programming will be explored over time.

# 2. Educational Experiences and Opportunities

Just as the CAARE Facility aims to engage in high-quality scientific research, it is also a top priority to engage the community with this research. One of the most exciting ways that this will manifest at the Museum is through Educational Experiences aboard the Hornet, in which students are taught history and science concepts in an interactive and fun manner that dives deeper into certain areas of relevant STEM and history learning.

The CAARE team is fortunate to have the opportunity to build off of the incredible work of the Hornet Museum's educational team and have developed additional CAARE-related subjects and activities for educators to choose from when they pick programming for their student visits to the ship. Having received organic outreach from teachers wanting to bring their students to the Museum to witness and experience the CAARE facility, we are delighted to launch this component of the CAARE Facility in the fall, when school groups resume visits to the ship.

K-2 Students:

- As part of the STEM to Stern Junior program, the CAARE Facility will offer "Cool Clouds," an activity station educating the Museum's youngest visitors about clouds, sunlight, and sea salt. Students will learn the basics of cloud reflectivity, how sunlight affects temperature, and how clouds are formed over the ocean by particles like sea salt. *This will include an activity studying how best to reflect a flashlight beam.*
- As part of the existing Flight Deck Module, students will be introduced to the CAARE facility, and the role of climate science in the time of the Hornet's service and now.

3-8 Students:

- As part of the STEM to Stern Junior program, the CAARE Facility will offer "What's Up in the Air?," an activity station designed to familiarize students with the basic concepts of atmospheric aerosols, the differences between greenhouse gas pollution and particulate pollution, and the basic concepts of the CAARE studies. *Students will use handheld particle counters to simulate the data collection of the specialized CAARE instruments, and to better understand the idea of background aerosol content. Students can*

*learn about science communication as they self-develop a way to present their findings.*

- As part of the existing Flight Deck Module, students will be introduced to the CAARE facility, the role of climate science in the time of the Hornet's service and now, and the importance of sensing and data collection in climate science.

High School Students:

- As part of the STEM to Stern program, the CAARE Facility will offer "Is Your Head in the Clouds?," an introduction to the CAARE studies and the basic science principles underlying the research. Students will learn about the unique coastal advantages provided by the Bay Area climate, and devise new versions of the CAARE study with modifications to certain variables, learning about research design and the creativity of the scientific process.
- As part of the existing Flight Deck Module, students will be introduced to the CAARE facility, the role of climate science in the time of the Hornet's service and now, and the importance of sensing and data collection in climate science. Students will use hand-held instruments and compare these with findings from the computer displays showing the more sophisticated instruments' graphs, in the context of learning more about particulate pollution, and connecting this to California's wildfires. They will learn the differences between particulate and greenhouse gas pollution, and discover the counterintuitive cooling effects of particulate pollution.

Special Student Events:

- For any student or youth group wanting to learn more about the CAARE Facility, our team will work collaboratively to customize our educational offerings to their needs and interests. For certain events, we are excited to offer interactions with the scientists leading the CAARE Facility, and to offer tours of the CAARE Facility Office, the compressor cabinet, and an up close look at the Cloud Aerosol Research Instrument (CARI) and associated measurement equipment.

School and Youth Group Outreach Education:

- The CAARE program has already received requests for its scientists to speak in local schools and to local groups including Girls Inc. of the Island

City. The CAARE Program is women led and diverse in composition, providing opportunities for representation and engagement that supports sensitivity to a wide array of stakeholders.

Adults:

- Adults are also welcome to engage with the CAARE Facility and the CARI system. This opportunity will focus on the distinction between particulate and greenhouse gas pollution, and their respective cooling and heating effects. Visitors will learn more about climate modeling, and how the CAARE studies aim to contribute to higher-resolution models. This activity will culminate in a discussion about open science, and strategies for discussing climate topics in simple and accurate ways.
- The CAARE team has received requests from local communities (Woodstock Homes), Philanthropic Foundations, businesses, Universities and technology groups to arrange guided visits as a group. It has also received requests from international research teams, Indigenous organizations and even a specialty tour company, to arrange group visits. There are many opportunities to support these engagements for local Bay Area groups and interested non-local groups.

# 3. Field Trips

General Hornet Field Trips

The Hornet operates many field trips for students on school and extracurricular visits. These trips involve multiple stops throughout the USS Hornet including a visit to the Flight Deck. The Flight Deck is a stop on these tours, and as we return to school-focused programming in the fall, a CAARE Facility stop could be rolled into the existing Field Trip stop list. As such, these tours would then include stops for students to:

- Tour the historic Navigation Bridge where the captain commanded
- Learn how aircraft were launched and recovered on the Flight Deck with its catapults and control tower

- ***Learn how the early analog technology of the Hornet connects to the modern day technology of the CAARE Facility research studies***
- Learn how 15 men worked together to fire the big 5-inch guns
- See historic aircraft on the Hangar Deck
- Experience how the crew lived below decks in their own "city"
- Walk on the footprints of the astronauts' first steps back on earth
- See the Mobile Quarantine Facility used by the Apollo 14 astronauts and an Apollo 11 test capsule.

The flight deck is a beloved part of the Hornet Museum. It is often where school groups choose to eat their lunches and enjoy free time. The CAARE team is thrilled to further enhance this portion of the museum by providing an additional engagement point for students to connect the rich history of the ship with modern science inquiry.

CAARE-Focused Field Trips

We are also excited to offer CAARE-Focused field trips at the Museum, taking advantage of the unique access to the CAARE Exhibit, CAARE Educational Programming, and the CAARE Research Facility. For student groups, extracurricular STEM groups, or any other interested organization, field trip content will be tailored by age group along the lines of the prior descriptions. In general, these tours will include:

- A video introduction to the CAARE Facility and its climate and atmospheric science, featuring CAARE team members in addition to youth climate leaders, discussing the science problem at hand, the research conducted at CAARE, and the importance of engagement with students, community members, and the public in the scientific process.
- A visit to the USS Hornet's island, the ship's large turret, where students will learn about the aircraft carrier's historic connection to weather technology and meteorology. This stop on the trip will expose students to the impressive analog instruments that were used on the Hornet during her service, and their role in contributing to the development of weather technologies that we enjoy today.

- This stop will then transition to the Flight Deck of the ship, where students will learn more about the coastal aerosol studies taking place at the museum. This part of the tour will begin with a look at the CAARE Facility's weather stations, and how these exist as an evolution of the Hornet's weather sensing capabilities.
- After a familiarization with the research set-up on the Flight Deck, students will have the opportunity to take this research into their own hands. With handheld particle counters, the students will have the opportunity to measure the background aerosol present in the Bay air, and to understand how this relates to the very similar use of the Cloud Aerosol Research Instrument and its complementary, specialized measurement instruments. Students will also have an activity opportunity to map the data that they can see on paper, and to compare this to monitor screens showing the data collected from the advanced sensing instruments.
- *Where it is possible to include demonstration of the CARI instrument, students can use their handheld instruments to experience being part of a scientific research study, seeing the generation of salt-spray, measuring particles and viewing the changes in the measurements on the instruments screens, with interactive dialogue on what the measurements — and the science — are saying.*
- The tour will conclude with a contextualization of this research in the climate science space, and a brief video that conveys the exciting careers available in climate science research, and the importance and optimism of such a career in the face of our changing climate.
- All of these special tours will be led by docents specially trained in the CAARE Effort and the basic science that underlies the CAARE Facility research in addition to the rich history of the USS Hornet as a meteorological facility.
- For special programming events, these tours will be led in part by, and concluded by, a talk with the scientists that work on these studies.
    - One example of a key priority group for the CAARE team is young women interested in STEM. The CAARE effort is led by women, and in that vein, some of the first experiences that we are working to arrange are with Girls Inc. of the Island City and with the Hornet Museum's Women in STEM events.


*Two particle sensing instruments to be used for student and engagement activities at the CAARE Facility.*

# 4. Community Engagement Events

The CAARE Facility is delighted to operate within the engaged communities of the USS Hornet Sea, Air and Space museum and the broader City of Alameda. While climate science, climate research, and climate interventions can be polarizing topics, the CAARE team values the opportunity to collaborate with the local community to engage in learning and dialogue with one another, alongside CAARE leadership, visiting scientists, and global climate leaders.

The USS Hornet Museum offers a special opportunity for events big and small — the ship can comfortably host an intimate dialogue with ten people, or a lecture series seating hundreds. The CAARE team is excited to collaborate with local organizations, alongside the City leadership, to determine what events are of interest and value to the local community — from parent/child activity days, to panel discussions with visiting experts, to climate science career events.

The CAARE team understands that engagement and dialogue is crucial to the human side of the studies being undertaken, and to climate science more broadly. We hope that the Alameda community will see this facility as a foundation to explore, educate, and discuss these important and challenging issues.

Proposed events include:

- July 2024: CAARE Exhibit Grand Opening — coinciding with the Hornet's Celebration of the Apollo Splashdown, an official opening of the CAARE Exhibit recognizing city leaders and their team and including a cross section of community members, supporters and climate science stakeholders.
- September 2024: Climate Resiliency Dialogue — this will be a convening of local and global experts to discuss relevant topics in climate resiliency research and policy at the local and global level. With a dialogue for adults and science activity for children, this event will be open to all community members and focus on the context of Alameda's resiliency efforts while maintaining a view to similar conversations globally.


*CAARE team members speaking at the 2024 Woodstock Homes Earth Day Fest.*

# 5. Expert Visits and Workshops

The CAARE Facility is a very unique platform globally. There are very few real-world research studies on this crucial topic in climate science: cloud aerosol

interactions. Equally importantly, no similar projects operate in an open, publicly accessible format that encourages public participation and engagement.

This facility was designed with transparency and collaboration at its core, and this means exposing the facility to global experts in science and engagement beyond the core CAARE team. We are excited, throughout the lifespan of the CAARE Facility, to host global experts, government agencies, youth climate leaders, Indigenous Peoples, emerging career researchers, and more, at the Museum. Not only do we know that they will add value to our research, but we hope to offer useful and innovative programming to further this field of research both globally and domestically.

This will also be a unique opportunity for the Alameda community to engage with these stakeholders. Those experts who we have spoken to about the CAARE efforts are deeply impressed by the open nature of this science, and hope to connect meaningfully with the local community when they visit the CAARE Facility.

Proposed events include:

- November 2024: Global Young Leaders Workshop — coinciding with the Hornet's youth science fair, bringing together young climate leaders from different parts of the world to engage with the CAARE Facility and CAARE scientists together with local youth.
- Fall 2024: Atmospheric science workshop — convening scientific research experts from leading institutions and government agencies in the US and other countries to engage with studies and meet on atmospheric science.

| | |
|---|---|
| **From:** | Sarah Doherty |
| **To:** | Carol Gottstein |
| **Cc:** | Trish Spencer; City Clerk; Griff Neal |
| **Subject:** | [EXTERNAL] Re: 6-4-2024 Council Agenda Item: Alameda USS Hornet Marine Cloud Brightening |
| **Date:** | Monday, June 3, 2024 4:10:46 PM |
| **Attachments:** | AlamedaCityCouncil_June4Meeting_UWMCBsubmission_2024May31.pdf |

Dear Carol,

Thank you for the interest and inquiry.

It appears that the Correspondence file you have does not include the most recent information we sent to the city (which is in an updated Correspondence file posted on the agenda site). Please see attached. There you will note that the earlier error in reference to boride/Br has been corrected.

I hope the attached gives you clarity on the analyses that were conducted and shared with Terraphase (the City's consultants that assessed the safety of the CAARE activities).

Kind regards,
Sarah

———

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Program
University of Washington
Seattle, Washington USA
TED Talk: Aerosols, clouds & MCB

On Jun 3, 2024, at 2:56 PM, Carol Gottstein <carolgottstein@yahoo.com> wrote:



Dear Dr. Doherty

As an Alameda resident, I receive copies of the City Council agendas for

upcoming meetings. I am also aware of the cloud brightening experiments on the deck of the USS Hornet. I wasn't that interested until I noticed in the Public Correspondence for this agenda item a thread between Griff Neal and Sarah Doherty, et al., which contained scientifically confusing information.
Mr. Neal appeared to be asking about boric acid salts, not about bromine. Your response to his query, however, assigned the wrong atomic symbol to a salt of boric acid (boride).
Boron, atomic number 5, symbol B, is a solid at room temperature. Its salts include borides. Bromine, atomic number 35, symbol Br, is a brownish-red liquid at room temperature. It does not form boride.

Your letter repeatedly refers to "Boride (Br)", including "EPA (Br)". Although the symbols are similar, I am sure the EPA would not confuse the exposure limits for these two very different elements. It is not at all clear which element you are referring to in your response.

I do not know Mr. Neal, nor am I a climate scientist. However, I do have a B.S. in Chemistry from the University of California at Berkeley, 1978. I checked and the Periodic Table symbols for Boron and Bromine have not changed.

I hope your council presentation will clarify matters.

Carol Gottstein
Alameda 94501

May 31, 2024

Dear Alameda City Council Members and Staff,

We are writing in response to questions raised through recent correspondence from a community member.

We would like to emphasize that we have tried over the past weeks to address questions from the public and the city as completely and accurately as possible. The aim of this correspondence is to answer the outstanding questions that we are currently aware of.

In the official correspondence, it is clear there are still some open questions or confusion from certain members of the community. Some of these questions had previously been answered in direct correspondence, including with the City's consultant, Terraphase. For maximum clarity and transparency, below we have compiled responses to these questions.

Kind regards,
Sarah Doherty
Sr. Research Scientist
Program Director, MCB Program
University of Washington

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**Submission to City of Alameda for consideration at June 4, 2024 City Council Meeting**
From: Sarah Doherty, Director, Marine Cloud Brightening Program
Date: May 31, 2024
Re: CAARE Research Facility operations

1. *A question was raised about the maximum quantity of salt that is emitted during a test.*

This information was provided to the city and its consultant (Terraphase) through correspondence and to all community members who requested it via correspondence.

**The Cloud-Aerosol Research Instrument (CARI) emits a maximum of 1 kg (2.2 pounds) of sea salt aerosol for every 10 minutes of spraying.**

*2. Concerns were raised regarding the seven chemical compounds that are components of sea-salt. Specific concerns were raised regarding Boric Acid (regulated by OSHA) and Strontium Chloride.*

Our team elicited a specialized assessment from an outside expert on atmospheric aerosols, air pollution and health (Jeffrey Pierce, PhD, Chemical Engineering; Professor, Dept. of Atmospheric Sciences, Colorado State University) to assess the human exposure to the total sea salt and to the strontium chloride and boric acid within the sea salt produced by the CAARE studies. Prof. Pierce's analysis: 1. assumes that these constituents are present in the generated aerosol in the same ratio as in the sea salt standard and 2. Accounts for the size of the aerosol in calculating the deposition rate of the aerosol in the airway/lungs.

**—> <u>In summary</u>: Prof. Pierce's analysis shows that, assuming the sea salt constituents are present in the generated particles in the same ratio as they are present in the sea salt used to make the aerosols, both boric acid and strontium chloride are present at concentrations about a factor of 1000 or more below the limits considered safe by the EPA (strontium chloride) and OSHA (boric acid).**

Prof. Pierce's analysis shows:

- **Strontium / Sr**
    - OSHA does not have a standard for Sr exposure that could be used as a metric, but the concentrations produced are at or below that present in background air in a coastal environment on the flight deck, and well below that of background air at distances downwind of the Hornet.
    - The fraction of aerosol deposited to the lungs/airway is actually lower for the size aerosol we are generating than for naturally produced sea salt aerosol
    - Exposure to Sr from CARI is a factor of >10,000 below that set by the EPA as acceptable for ingestion in drinking water.

      <u>Analysis detail</u>
    - The concentration of Sr drops to <0.003 micrograms/m^3 within 200 meters of CARI (which is the length of the Hornet flight deck), and below 0.001 micrograms/m^3 within 400 meters of CARI.
    - As a reference point, the background concentration of Sr in a coastal environment is 0.001 micrograms/m^3
    - The respiratory deposition of strontium to someone *standing in the plume over the full duration (30min) of CARI emissions* in a day is <0.1 micrograms for all locations on the flight deck, and <0.003 micrograms for locations downwind of the flight deck (dropping to <0.001 at 500m distance and <0.0003 at 1km distance)
        - Prof. Pierce's analysis notes that this is "trivial" compared to what one would ingest drinking 1 liter of water that meets the EPA standard for drinking water (4000 micrograms per liter).
- **Boric Acid / B**
    - OSHA sets limits for airborne exposure to boric acid of 2,000 micrograms/m^3 for longer-term exposures and 6,000 micrograms/m^3 for shorter-term (10-15min) exposures
    - Prof. Pierce's analysis finds that the boric acid concentrations in the atmosphere are <3 micrograms/m^3 for all locations on the flight deck, and <1 microgram/m^3 for locations downwind of the flight deck (dropping to <0.3 at 500m and <0.1 at 1km).
    - **As such, the analysis concludes that the boric acid concentration during emissions time periods are less than 1/500th the OSHA limit on the flight deck, and less than 1/1000th the OSHA limit at locations downwind of the flight deck.**

*The question was raised as to whether these constituents could be getting concentrated in the process of aerosolization such that their concentrations became hazardous.* **Based on the above analysis, this would require that these species become amplified by a factor of 1000 (or more) in the process of spraying.**

Addressing this was the basis for a second analysis, done in the lab by our colleagues at SRI. Using a technique called SEM-EDS (see below for a technical description) our colleagues analyzed the chemical composition of the individual particles produced in a lab by the nozzles used in CARI, as well as that of the sea salt aerosol used to make the saline solution that goes into CARI.

**—> <u>In summary</u>: The SEMS analysis shows that B and Sr are not amplified by more than a factor of 2 in the process of aerosolization; therefore, the compounds boric acid and strontium chloride can not, in turn, be more than doubled in the process of aerosolization. This is orders of magnitude below the amplification required to reach thresholds for hazard.**

- Importantly, even this sophisticated analysis technique can only give accurate concentrations for constituents that are present at >0.1-0.2% of the total particles' weight; below this, constituents are effectively undetectable.
- Both boron and strontium are present in the sea salt standard at smaller fractions than this (concentrations of boric acid is 0.071% and strontium chloride is 0.095% by weight). **This means that both constituents are present in the sea salt standard at levels that are undetectable with SEM-EDS analysis. However, if these constituents become concentrated in the process of spraying by a factor of ~2 or more they will become detectable.**
- The SEM-EDS analysis found that B and Sr were not present at >0.1-0.2% in the generated aerosol; in other words, they remained undetectable after aerosolization with the CARI nozzle.

**—> <u>Overall summary</u>: Boric acid and strontium chloride in the sea salt standard used in CARI would need to be amplified by a factor of >1000 in order to be present at hazardous levels, and lab analysis shows that, if indeed their concentrations are somehow being amplified through the process of aerosolization, it is by less than a factor of 2.**

These results were shared with Terraphase, the City of Alameda's consultants assessing the safety of the CAARE studies, who communicated independently with Prof. Pierce.

*3. The question was raised of why Magnesium Chloride, the second most prevalent chemical in the sea salt used in the system, was not analyzed in Prof. Pierce's analysis.*

The classification of magnesium chloride is as follows on its material safety data sheet:
"This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)." As such, OSHA does not set thresholds for magnesium chloride exposure.

Magnesium chloride is used in much higher concentrations for other purposes. For example, magnesium chloride is regularly sprayed in very large quantities on roads and construction sites as a dust suppressant.

Magnesium chloride is a medical supplement to treat the common problem of low magnesium (<u>https://www.webmd.com/drugs/2/drug-10702/magnesium-chloride-oral/details</u>), and is given at concentrations of 1-40 *grams* daily intravenously medically for low-magnesium individuals.

Given the total salt concentrations and respiratory absorption rates calculated by Prof. Pierce, maximum exposure to the CARI plume would result in the absorption of magnesium chloride at levels <u>orders of magnitude below</u> that <u>recommended</u> for use as a dietary supplement.

*4. A question was raised regarding the possible influence of the size of the sea salt particles the CARI system produces, which when dried has a diameter of 40 nm, as this is quite a bit smaller than naturally produced sea salt aerosol. As such, concern was raised that these smaller*

*particles would be inhaled and retained by the body more efficiently than natural sea salt, so could present a more significant health risk than natural sea salt.*

**—> Summary: The concentrations in the sea salt plume produced by CARI are comparable to or lower than the concentrations of sea salt in a coastal environment with breaking waves, such as at the beach, and a smaller fraction of the aerosols produced by CARI are retained in the respiratory system than with naturally produced sea salt aerosols.**

Prof. Pierce's analysis accounts for the size of the aerosol generated by the CARI system. His analysis cites Kodros et al (2018) in showing that the small particles produced by CARI actually have a lower deposition rate in the airway and lungs than do larger particles, such as those in natural sea salt aerosol. This is because the smaller particles don't impact on the surfaces of the airway, so 80% of them are breathed in and then breathed right back out with the exhale. In other words, only about 20% is retained in the body. (See Figure 1 of Kodros et al, 2018).

In addition, the very brief exposure periods for the CARI operations (30min/day) vs the time spent at the beach (24/7 for people who live there, or at least a few hours for people visiting the beach) combined with the fact that only ~20% of the CARI-generated salt will be deposited in the lungs, vs. ~50% of the naturally-produced sea salt aerosol, means that the absorption of sea salt from CARI would be less than that of going to the beach for the day.

Calculations our team did in advance of establishing the CAARE facility at the Hornet (see question and reply below) and Prof. Pierce's more recent calculations show the mass concentrations of sea salt produced by CARI at various distances downwind of the instrument. The results from both of these analyses were provided to Terraphase, the consultants the City of Alameda brought in to assess the safety of our studies.

Kodros, J. K., Volckens, J., Jathar, S. H., & Pierce, J. R. (2018). Ambient particulate matter size distributions drive regional and global variability in particle deposition in the respiratory tract. GeoHealth, 2, 298–312. https://doi.org/ 10.1029/2018GH000145.

5. *Information was requested on the total particle concentration (of all salt types; i.e. of the total aerosol) at different locations downwind of CARI, including very close to the instrument.*

**—> Summary: Based on our calculations and those of Prof. Pierce, both Prof. Pierce and Terraphase have concluded that the aerosol concentrations resulting from operation of CARI, including at close proximity, do not present a health or environmental risk.**

Knowing the concentration of sea salt aerosol CARI would produce at different distances downwind of the instrument is of significant interest to the team, both because this is important for our science studies and also because we wanted to assure the safety of our studies to both our own team and the public. As such, in advance of establishing the CAARE facility, our team used a model that simulates atmospheric conditions and motions to calculate the expected sea salt aerosol concentrations downwind of the CARI system. Concentrations of the sea salt aerosol were calculated from the location right at the output of the CARI instrument to 14 km downwind of the instrument. In the interest of safety, these calculations were specifically done using very high end estimates of the mass of sea salt aerosol being emitted by the CARI instrument.

The results of these calculations were provided to Terraphase and H.T. Harvey and Associates, the City's consultants, as part of the review process, and to the Alameda citizen who requested this information (in emails on May 12 and 13).

Prof. Pierce independently also analyzed the concentrations of the total sea salt aerosol, as well as the concentrations of the boric acid and strontium chloride in the sea salt, from the output of the CARI instrument to a distance 5 km downwind of the instrument.

**From:** Theo Therone
**To:** CityCouncil-List
**Subject:** [EXTERNAL] Support for Agenda Item 7-B 2024-4063 -- grant consent for sea salt study
**Date:** Monday, June 3, 2024 4:06:15 PM

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As a long-time Alameda homeowner, I am asking the Council to authorize the City Manager to grant Landlord Consent to resume Small-Scale Atmospheric Sea Salt Process Studies on the U.S.S. Hornet. (Base Reuse and Economic Development 29061822).

Science is exciting, and atmospheric research aligns particularly well with Alameda's climate action objectives.

Back in 2015, local news outlets applauded our city's embrace of science, writing: "Green energy projects are a good match for Alameda's eco-minded culture and inventive spirit" https://www.mercurynews.com/2015/06/16/how-google-turned-alameda-into-a-mad-science-laboratory/#. Sadly, that eco-minded inventiveness is now overshadowed by headlines suggesting a conspiracy of supposedly nefarious tests being kept "secret" from our citizens https://www.eenews.net/articles/geoengineering-test-launched-with-salt-flecks-and-secrecy/.

This type of journalism injects fear. Let's not risk having the island's spirit deflated by it.

Folks with little research experience are sometimes manipulated to conflate science with politics, producing undue controversy. I suggest our community should lean into education to stop panicky reactions to responsible experimentation. I was happy to see the CAARE team sharing knowledge about marine cloud brightening at the 6/1/24 Alameda Point Open House. Perhaps the city could offer educational insights into other intriguing investigations happening on the island.

Education might counter some of the disingenuous messaging coming from groups like Friends of the Earth U.S. and the Center for International Environmental Law, who promote a binary between saying "no to geoengineering and yes to a health planet" https://www.sfchronicle.com/weather/article/alameda-geoengineering-environmental-19487181.php?utm_content=cta&sid=63fbe14fb16a58d4bd0255df&ss=A&st_rid=null&utm_source=newsletter&utm_medium=email&utm_term=headlines&utm_campaign=sfc_morningfix.Theirs is a false logic, since we already *do not have a healthy planet*. Our real choice involves balancing the increasing dangers of climate change, against the unknowns of geoengineering and other potential mitigation strategies. Research is the only road to discovering that balance.

I am a scientist who has worked with several Alameda startups; I value patient, thorough research. I do not know if marine brightening will "work," but that is the point of investigating. I *do* know that if we shove away the idea out of fear (or a too-fierce clutch on "transparency"), we will also lose the opportunity to explore possible adverse effects. Later, if other climate modification attempts fail, desperate last-ditch efforts might be made to dust off these and other untested ideas for immediate use, despite being blind to their consequences.

Serious research *now* is necessary to help us discover which climate tools are indeed the best solutions. Scientists have the curiosity to ask the right questions, and the tenacity to answer them by compiling solid data. Let them do their work without manufactured crises over a clerical error that was quickly corrected by the Hornet and the city. Please grant Landlord Consent to resume the sea-salt spray studies on the U.S.S. Hornet.

**From:** Richard Charter
**To:** CityCouncil-List
**Subject:** [EXTERNAL] Item 7-B: Please Reject Renewal of Marine Cloud Brightening Experiments
**Date:** Monday, June 3, 2024 3:26:06 PM

June 3, 2024

Alameda City Council

Re: Agenda Item 7-B, Please Reject Renewal of Marine Cloud Brightening Experiments.

Dear Councilmembers:

Please reject any effort to advance Marine Cloud Brightening.

Deploying Marine Cloud Brightening at scale would bring a host of new environmental and social impacts, potentially putting our marine and terrestrial ecosystems at risk. Like all geoengineering techniques, it is impossible to test for its intended climate impact without large-scale deployment, which would lock in any harmful consequences.

Deployed at scale, Marine Cloud Brightening would not reverse the climate crisis but create a different and unpredictable climate change scenario potentially exacerbating droughts, hurricanes, and flooding far from the deployment site. It would also result in increased and uncontrollable salt deposition on land and in waterways, corroding infrastructure and harming agriculture, while the use of huge volumes of seawater would kill substantial marine life with cascading impacts on ocean food chains, fisheries, and coastal communities.

Marine Cloud Brightening is one of those unproven technologies which do nothing to tackle the root causes of climate change; rather it increases reliance on speculative technofixes while delaying vital action to cut greenhouse gasses. None of these techniques have been able to demonstrate they can effectively sequester carbon or store it with any permanence, while efforts to cool the climate by increasing reflectivity are inherently unpredictable and risk further destabilizing an already destabilized climate system. It is highly likely that marine geoengineering would change the chemistry of oceans, cause changes in nutrient levels, and lead to subsequent changes in abundance of species, thereby altering delicate equilibriums of interactions between species.

We echo parties to the London Convention / London Protocol (LC/LP) who last year

stated in relation to four key categories of marine geoengineering “there is considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean”, and expressed concern about “the potential for deleterious effects that are widespread, long-lasting or severe”.

A *de facto* moratorium on geoengineering under the Convention on Biological Diversity (CBD), has been in place since 2010, and in addition to the current process pending controls may bring several additional categories of marine geoengineering under strict regulatory control under the London Convention / London Protocol (which already prohibit commercial ocean fertilization activities).

To even begin to influence the global climate would require intervening at enormous scales in highly complex and fragile ocean ecosystems, putting at risk natural relationships that we’ve yet to fully understand.

Thank you for your kind consideration.

Sincerely,

Richard Charter

Senior Fellow

The Ocean Foundation

waterway@monitor.net

| | |
|---|---|
| **From:** | Trish Spencer |
| **To:** | Lara Weisiger |
| **Subject:** | Fwd: [EXTERNAL] Protect our planet and vote NO on marine geoengineering |
| **Date:** | Monday, June 3, 2024 3:22:28 PM |

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---------- Forwarded message ----------
From: Shereen McDade <info@CIEL.org>
Date: Jun 3, 2024 3:21 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

Jun 3, 2024

Councilmember Trish Herrera Spencer

Dear Councilmember Herrera Spencer,

I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.

The experiment aims to test technology that would advance Marine Cloud Brightening -- a form of solar radiation modification that involves spraying saltwater particles into the air to thicken or brighten clouds, theoretically increasing their reflectivity and partially blocking the sun's rays.

Deploying Marine Cloud Brightening at scale would bring a host of new environmental and social impacts, potentially putting billions of peoples' human rights at risk. Like all geoengineering techniques, it is impossible to test for its intended climate impact without large-scale deployment, which would lock in any harmful consequences. Small-scale experiments like this one therefore tend to serve as technology development.

Deployed at scale, Marine Cloud Brightening would not reverse the climate crisis but create a different climate change potentially exacerbating droughts, hurricanes, and flooding far from the deployment site. It would also result in increased and uncontrollable salt deposition on land and in waterways, corroding infrastructure and harming agriculture, while the use of huge volumes of seawater would kill substantial marine life with cascading impacts on ocean food chains, fisheries, and coastal communities.

While this is a local decision, it has far reaching consequences since the experiment risks legitimizing this highly speculative and harmful technology and everyone on the planet could be affected by large scale deployment.

You may already be aware that governments around the world have agreed to a global moratorium on geoengineering and are moving to introduce more restrictive regulations for marine geoengineering. Many civil society organizations around the world have called for an end to marine geoengineering experiments.

https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Ms. Shereen McDade
3613 Arlington Ave
Los Angeles, CA 90018-4314
(323) 481-1752
zeechannel@yahoo.com

**From:** Carol Gottstein
**To:** Sarah Doherty; Trish Spencer; City Clerk; Griff Neal
**Subject:** [EXTERNAL] 6-4-2024 Council Agenda Item: Alameda USS Hornet Marine Cloud Brightening
**Date:** Monday, June 3, 2024 2:56:54 PM

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Dear Dr. Doherty

As an Alameda resident, I receive copies of the City Council agendas for upcoming meetings. I am also aware of the cloud brightening experiments on the deck of the USS Hornet. I wasn't that interested until I noticed in the Public Correspondence for this agenda item a thread between Griff Neal and Sarah Doherty, et al., which contained scientifically confusing information.
Mr. Neal appeared to be asking about boric acid salts, not about bromine. Your response to his query, however, assigned the wrong atomic symbol to a salt of boric acid (boride).
Boron, atomic number 5, symbol B, is a solid at room temperature. Its salts include borides. Bromine, atomic number 35, symbol Br, is a brownish-red liquid at room temperature. It does not form boride.

Your letter repeatedly refers to "Boride (Br)", including "EPA (Br)". Although the symbols are similar, I am sure the EPA would not confuse the exposure limits for these two very different elements. It is not at all clear which element you are referring to in your response.

I do not know Mr. Neal, nor am I a climate scientist. However, I do have a B.S. in Chemistry from the University of California at Berkeley, 1978. I checked and the Periodic Table symbols for Boron and Bromine have not changed.

I hope your council presentation will clarify matters.

Carol Gottstein
Alameda 94501

**From:** Abigail Dillen
**To:** CityCouncil-List
**Subject:** [EXTERNAL] Agenda Item 7-B of June 4 City Council Meeting
**Date:** Monday, June 3, 2024 2:22:33 PM
**Attachments:** CAARE Comment 6.3.24.pdf

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Mayor Ashcraft and Members of the Alameda City Council,

Thank you for considering the attached comment.

Abigail Dillen

June 3, 2024

Abigail Dillen
1234 Grizzly Peak Boulevard
Berkeley, CA 94708

Mayor Marilyn Ezzy Ashcraft
cc: Vice Mayor Tony Dasog
Councilmember Tracy Jensen
Councilmember Trish Herera Spencer
Councilmember Malia Vel

**Re: Agenda Item 7-B of June 4, 2024 City Council Meeting**

Dear Mayor Ashcraft and Members of the Alameda City Council,

Thank you for the opportunity to comment on the Coastal Atmospheric Aerosol Research and Engagement (CAARE) project that is proposed to go forward on the USS Hornet. I am writing in my personal capacity as an Alameda County resident.

For the last 24 years, I have worked in the field of public interest environmental law, and climate change has been an area of deep focus over the last two decades.

As the climate crisis accelerates, it is essential to support the best possible climate science and modeling. How aerosols interact with clouds to affect our climate system is a question of urgent importance. This small-scale field study sponsored by the University of Washington promises to advance scientific understanding without threatening harm to human health or the environment.

I am aware of expressed concerns about the prospect of geo-engineering in connection with this project. My understanding is that this team of scientists, housed within a respected academic institution, is undertaking transparent research to understand how marine cloud brightening might work in practice, and whether it would ever be appropriate to deploy. In other words, this is early, foundational work of the kind that will be needed to inform reasoned and responsible policy-making that avoids unilateral and otherwise dangerous climate interventions. Crucially, any decision to attempt marine cloud brightening must occur within a governance system that does not yet exist and a policy framework that is not yet adequately supported scientifically.

My own climate work is premised on the imperative to zero out greenhouse gas emissions by mid-century, ensuring no community is left behind in the social and economic transformation that is now underway. There is no substitute for a swift transition away from fossil fuels and industrial practices that drive climate change. Given the political influence and social entrenchment of fossil fuels interests, investment in technological “fixes” that distract from energy transition do present moral hazard problems – especially at a time when very problematic ideas are circulating relative to carbon management and solar radiation management. But, in the face of ongoing climate shocks and likely overshoot of the 1.5 ℃ threshold, at least temporarily, I believe that we must responsibly explore the least harmful ways to triage in what is already an emergency for millions of people around the world.

I believe this project is consistent with such responsible exploration based on its stated goals, its methodology and minimal environmental impacts, and how it is publicly situated on the USS Hornet.  Importantly, Alameda is well-positioned to host this project given California's strong laws and climate commitments.

Thank you for your consideration,

Abigail Dillen

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: [EXTERNAL] RE: Fwd: Response to open questions
**Date:** Monday, June 3, 2024 1:44:20 PM
**Attachments:** image002.png
image006.png
image007.png

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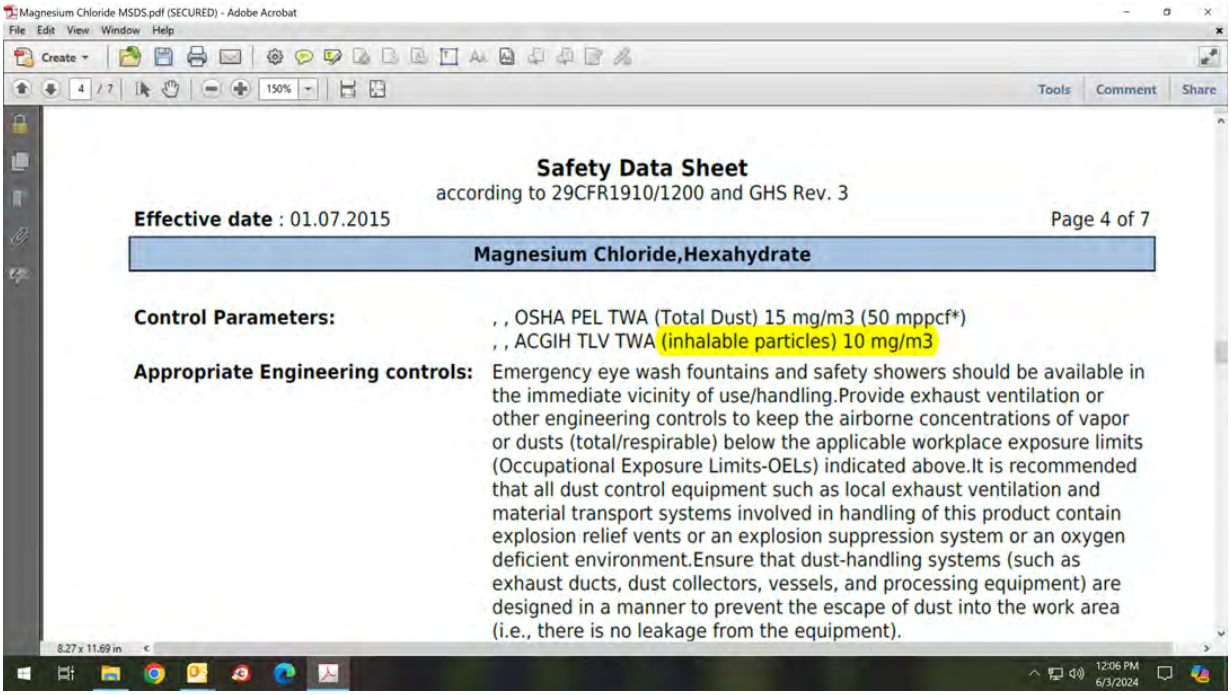
---------- Forwarded message ----------
From: Griff Neal <gneal@encaptech.com>
Date: Jun 3, 2024 12:31 PM
Subject: [EXTERNAL] RE: Fwd: Response to open questions
To: Trish Spencer <tspencer@alamedaca.gov>
Cc: Jennifer Ott <jott@alamedaca.gov>,Tracy Jensen <tjensen@alamedaca.gov>

Thanks, I'll hope we can talk prior to the council meeting.

One of my employees who is much more adept at explaining complex things suggested I share the following:

From the CARRE submission, Magnesium Chloride Hexahydride is 26.5% of the composition which is sprayed

The OSHA respiratory limit for this chemical is 10 milligrams per cubic meter of airspace


Magnesium Chloride MSDS.pdf (SECURED) - Adobe Acrobat

**Safety Data Sheet**
according to 29CFR1910/1200 and GHS Rev. 3

**Effective date** : 01.07.2015 Page 4 of 7

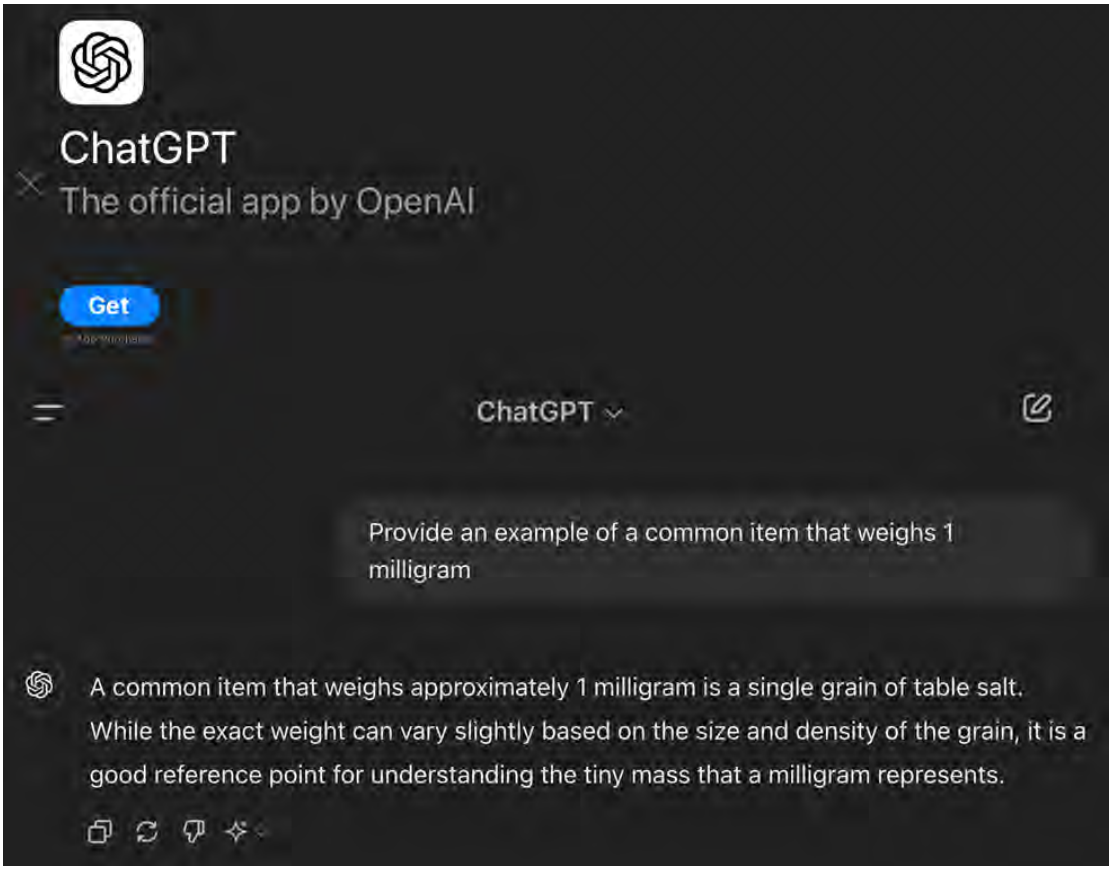
**Magnesium Chloride,Hexahydrate**

| | |
|---|---|
| **Control Parameters:** | , , OSHA PEL TWA (Total Dust) 15 mg/m3 (50 mppcf*)<br>, , ACGIH TLV TWA (inhalable particles) 10 mg/m3 |
| **Appropriate Engineering controls:** | Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use/handling.Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or dusts (total/respirable) below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment.Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). |

8.27 x 11.69 in

12:06 PM 6/3/2024

10 milligrams is roughly equivalent to 10 grains of table salt




Does the cloud of salt in this photo appear to show more or less than 10 grains of salt in each 3 foot cube of cloud?

# *A Test of Cloud-Brightening Machines Poses No Health Risk, Officials Say*

After halting a test of controversial technology to fight global warming, the city of Alameda, Calif., said it had found no "measurable health risk" from the giant salty-mist-spraying fans.



Salty mist sprayed across the deck of an old aircraft carrier during an April test. Ian C. Bates for The New York Times

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**From:** Trish Spencer [mailto:tspencer@alamedaca.gov]
**Sent:** Monday, June 03, 2024 11:09 AM
**To:** Griff Neal
**Cc:** Jennifer Ott
**Subject:** Re: Fwd: Response to open questions

Dear Mr. Neal/Griff,

I shared this with City Manager Jennifer Ott this morning. It's my understanding that she is going to try to coordinate this with you. I've also included her in this email.

Thank you for your continued efforts on this important issue.

Sincerely,

Trish

Trish Herrera Spencer

Councilmember

On Jun 3, 2024 7:55 AM, Griff Neal <gneal@encaptech.com> wrote:

Hi Trish & Tracy,

There is some useful information here, but once again they seem to be relying on modeling of unrelated elements not the chemicals OSHA regulates.

I'm troubled by the refusal to provide actual measured chemical concentrations from the past Hornet tests. Same for an explanation of why CARRE doesn't need to consider OSHA, ATSDR, EPA requirements.

The Terraphase letter to the city states their analysis was based upon a phone call with CARRE in April. A few weeks before we raised the concerns about toxicity, OSHA limits, 40 nanometer particles and cumulative salt buildup.

I would like to discuss the Terephase report with the author to better understand his thinking and to ensure he has considered the issues we've raised.

Are you able to get Jen Ott to facilitate a call before tomorrows meeting?

Thanks,

Griff

Griff Neal

President

Encap Technologies

(510)-337-2700 (o)

(415)-902-6600 (m)

Begin forwarded message:

> **From:** Sarah Doherty <sdoherty@uw.edu>
> **Date:** June 2, 2024 at 5:19:24 PM PDT
> **To:** Trish Spencer <tspencer@alamedaca.gov>, Griff Neal <gneal@encaptech.com>, Liz Taylor <liz@doermarine.com>
> **Cc:** Kelly Wanser <kwanser@silverlining.ngo>
> **Subject: Response to open questions**
>
> Hello Trish, Griff and Liz,
>
> Trish and Liz, it was nice to see you at the Alameda Point Open House yesterday.
>
> We prepared responses to what have been raised as open concerns in the Comments to the City and wanted to share with you the officially submitted document (see attached).

Regards,

Sarah

———

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Program
University of Washington
Seattle, Washington USA
TED Talk: Aerosols, clouds & MCB

| | |
|---|---|
| **From:** | Kelly Wanser |
| **To:** | CityCouncil-List |
| **Cc:** | Tony Daysog; Tracy Jensen; Trish Spencer; Malia Vella; Jennifer Ott; Abby Thorne-Lyman; Alesia Strauch |
| **Subject:** | [EXTERNAL] Agenda item 7-B of the June 4th City Council meeting: Expert letter of support for Coastal Atmospheric Aerosol Research facilit |
| **Date:** | Monday, June 3, 2024 10:27:53 AM |
| **Attachments:** | CAARE Response to May 29 HOME! Alliance Statement.pdf |

Dear Alameda City Council Members and Staff,

We are writing in response to a request from Mayor Ashcraft and to respond to issues raised in the May 29 Hands off Mother Earth (HOME!) Alliance Statement on Marine Geongineering Experiments funded by the Heinrich Boell Foundation in Germany. We note that the statement includes a number of issues associated with climate intervention activities that are not applicable to the CAARE studies on the USS Hornet.

We appreciate the opportunity to address concerns from the community members, civil society organizations and other stakeholders. The aim of this correspondence is to address issues and claims raised in the statement.

Kind regards,

Kelly Wanser
Executive Director, SilverLining
Senior Advisor, University of Washington MCB Program

Sarah Doherty
Sr. Research Scientist
Program Director, MCB Program
University of Washington

Submission to City of Alameda for consideration at June 4, 2024 City Council Meeting
From: Kelly Wanser, Executive Director, SilverLining
Date: June 3, 2024
Re: May 29 HOME! Alliance Statement

## The CAARE Studies in the Context of Societal Concerns

The Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility effort at the USS Hornet Sea, Air and Space Museum, a Smithsonian Affiliate, in Alameda, California, supports basic science research to study the near-source transport and dispersal of sea-salt aerosol particles, in order to test and improve models used to study the atmosphere

and climate. ***The CAARE studies are not able or designed to alter clouds or any other aspect of the local weather or climate. The studies are not cloud brightening activities or climate intervention experiments or activities.***

The CAARE studies are part of a larger research program led by scientists from the University of Washington to study how clouds respond to particles — also called aerosols — in the atmosphere, and how these effects on clouds influence climate. This research is relevant to a number of problems in atmospheric science, including both the effects of pollution aerosols and investigating the idea that marine clouds might be intentionally brightened to reduce climate warming. Although the CAARE studies do not have environmental impacts and are not climate intervention activities, they do tie into larger conversations about climate intervention (sometimes called "geoengineering").

These conversations have moral and ethical dimensions related to human welfare, the protection of natural systems, and justice and equity in society. ***Consideration of the ethical and moral dimensions of the research being undertaken in the CAARE studies has been provided by an expert submission from Professor James W. Hurrell of Colorado State University.***

The CAARE studies are relevant to ethical considerations beyond climate intervention. New studies, including from prominent climate scientist and advocate James Hansen, indicate that reductions in particulate (aerosol) pollution are accelerating warming, and may have significantly contributed to record warming of the oceans and climate in 2023. Some of this warming may be attributable to a reduction in particulate pollution from ships — an influence that the CAARE studies' efforts to improve models of localized evolution of particles in the marine atmosphere may directly help understand. ***Given these particulate pollution-related warming risks, controlled studies designed to improve models of these aerosol effects are increasingly critical to improving tools for planning and responding to climate change to better protect people and ecosystems.***

Warming is projected to exceed critical thresholds even in the most successful scenarios for reducing emissions. This warming is projected to significantly increase mortality, food and water scarcity, migration, disasters and a host of other damaging impacts in the next few decades. These impacts are the greatest on the most vulnerable communities. Research on SRM has similarities to research in medicine: for healthier patients, essential lifestyle changes are sufficient, but as a condition worsens, intervention may be required to help address acute symptoms and stabilize the patient. SRM research is aimed at evaluating whether various interventions are safe and effective options for constraining warming to safe levels while greenhouse gases in the atmosphere are reduced to safer levels. ***Research that improves projections of warming, and evaluates options for reducing it rapidly, is now critical to the safety and welfare of vulnerable people and communities in the context of climate change. Consideration of these factors was***

***highlighted in a submission by Professor Anna Bershtwyn of New York University.***

The importance to society of research that provides transparent, objective scientific information on the potential benefits and risks of reflecting sunlight to cool climate, or "solar radiation modification" (SRM; a form of climate intervention), has led to official publications calling for scientific research on SRM from bodies in the U.N., U.S., E.U., and other governments. These include, in 2023 alone, reports from United Nations Environment Programme (UNEP), United Nations Educational, Science and Cultural Organization (UNESCO), European Commission and US Federal Government recommending research on SRM. A joint report from the US National Oceanic and Atmospheric Administration (NOAA) and Department of Energy (DOE) describes the research recommended to understand marine cloud brightening, including outdoor experiments that do not have an effect on climate.

The United States, United Kingdom, and European Union have all initiated publicly funded scientific research programs on SRM. The World Climate Research Programme, a body that operates under the World Meteorological Organization (WMO) to support international scientific cooperation, recently launched a Lighthouse Activity on SRM research.

Today, SRM research is concentrated in scientific centers in the U.S., Europe, and other countries in the Global North. Outdoor research studies and advanced technologies and instruments, and the scientists that use them, are not accessible to non-science stakeholders in these countries, or to people elsewhere in the world. To promote more democratic and informed dialogue and decision-making and more equitable access to scientific research on SRM, the CAARE studies were established at the USS Hornet Sea, Air and Space Museum to enable people from across society and around the world to access studies, tools and information directly. ***In this way, the CAARE Facility promotes more equitable and just consideration of SRM research by all people, but especially by stakeholders from vulnerable communities that are most impacted by climate change. Consideration of these factors was highlighted in a submission by Pirita Näkkäläjärvi.***

While there is opposition to climate intervention research in some parts of the environmental community, there is also support. In recent years, an array of environmental and youth organizations and governmental and intergovernmental bodies have called for research on climate intervention and SRM. Citing issues of generational equity and concern for the future; these include the youth organizations Operaatio Arktis, Green Africa Youth Organization, Sustenta Honduras, Sustainability Week Qatar and SRM Youth Watch. Environmental and climate activist groups, including the Natural Resources Defense Council (NRDC), the Environmental Defense Fund (EDF) and Ocean Visions in the United States, as well as iForest, DEGREES, Carnegie Climate Geoengineering Governance initiative (C2G), and others internationally, have called for, recommended or supported

SRM research.

The CAARE studies are designed to provide basic scientific information for improving models and analysis of one form of SRM, marine cloud brightening. Research at the CAARE Facility aligns with the recommendations of UN bodies, governmental and intergovernmental research programs and a number of climate advocacy organizations. At the same time, we appreciate and share some of the concerns expressed by some climate activist organizations. ***We want to highlight that many of these concerns do not apply to academic research efforts or small-scale field research studies like CAARE.***

The CAARE Studies and the May 29 HOME! Statement

To promote better and more accurate understanding, the CAARE leadership would like to address assertions in the May 29 statement from Geoengineering Watch submitted to the City of Alameda. It is important to note that most claims in the May 29 statement do not apply to non-commercial academic research or to small-scale outdoor studies in support of improving models to evaluate the potential benefits and risks of large-scale activities, both critical distinctions of the CAARE program.

Many statements in the letter also do not apply to the potential climate intervention relevant to the research at the CAARE facility: marine cloud brightening. Instead, many pertain to various ocean carbon dioxide removal approaches that introduce something novel into the marine environment. Critically, sea salt and sea salt interactions with the atmosphere and with clouds are part of the natural environment and natural atmospheric processes.

There are many youth, Indigenous, global south and climate activist stakeholders who support, rather than oppose, research on SRM, and small scale field studies such as the CAARE studies. This could even include some of the organizations that signed this statement, which is primarily aimed at scaled or commercial climate intervention activity.

Regarding specific claims in the statement, we provide additional information below.

***Claim 1: None of these technologies does anything to tackle the root causes of climate change.*** The root cause of climate change is human greenhouse gas emissions, which must be rapidly reduced as the top priority for climate action. Studies indicate, however, that increased warming increases energy consumption, diverts public funding away from transition, and reduces public support for measures that reduce fossil fuels. Because of this, limiting warming in the near-term could benefit transitioning away from fossil fuels. Dangerous levels of warming are no longer avoidable through emissions reductions alone. As official reports note, the only approach to reducing substantial climate warming rapidly enough to avoid dangerous thresholds is through SRM.

***Claim 2: While techniques vary considerably, what they share in common is the fact that to even begin influencing the global climate would require intervening at enormous scales.*** As researchers, we absolutely agree with this. This is an argument for, not against, scientific research on climate interventions. It is precisely because climate intervention approaches require such a large scale to be meaningful that it is so important to undertake studies at very small scales to improve model projections of their impacts and risks at large scales.

***Claim 3: What many of these techniques also have in common is carbon markets as a driving force, with start-ups running outdoor experiments selling or pre-selling commitments for carbon credits without any reliable evidence that they will 'work'.*** It is important to note that the University of Washington Marine Cloud Brightening Program and the CAARE Facility on the USS Hornet are philanthropically-funded academic research and public engagement and education efforts. At CAARE, we are researching the basic science of aerosol effects on clouds and climate and science related to marine cloud brightening to inform open and rigorous assessment of its potential to reduce the risks and impacts of climate change. The organizations involved do not have any commercial objectives or interests, and in no way have or will support the sale of carbon or climate credits for the use of marine cloud brightening or other SRM approaches. In fact, one of us published an academic paper and commentary, and has submitted comments to the US Federal Trade Commission (FTC), describing why credit products are not viable for SRM approaches and should be prohibited.

***Claim 4: It might be interpreted from the submission of the statement to the City of Alemeda that the studies being undertaken at the CAARE facility are "in defiance of international agreements" including that "the Convention on Biological Diversity (CBD) has had a de facto moratorium on climate intervention experiments in place since 2010".*** This is not true. There are no international agreements banning small-scale atmospheric research studies related to SRM in international waters and all countries have sovereignty over their own coasts and territorial waters, to be governed by local authorities. The relevant CBD Decisions allow and endorse research experiments.

**Claim 5: *"Geoengineering our oceans is a dangerous distraction from the real solutions to the climate crisis and gives the fossil fuel industry a potential escape hatch while putting our oceans and coastal communities at serious risk."***

This claim implies that reducing emissions is sufficient to address all climate warming, including near-term warming that, in every scenario for emissions evaluated by the UN Intergovernmental Panel on Climate Change (IPCC), is projected to rise above 2℃ by the mid-century. Research on climate interventions is recommended by scientists and official

bodies due to their potential to reduce warming faster than even the most successful emissions reductions efforts can achieve. Climate interventions represent possibilities to “bend the curve” of warming to reduce mortality, suffering and ecosystem damage that is currently baked into the most optimistic projections for emissions reductions, and to reduce the risks of breaching catastrophic climate tipping points. Emissions reductions alone cannot reduce these risks and impacts of warming.

This claim also appears to assert that research on SRM in general, and small scale research studies in particular, create a dynamic that makes it easier for fossil fuel companies to continue polluting. This is based on the idea that research on SRM reduces the motivation of individuals and policymakers to support transitioning away from fossil fuels (known as a “moral hazard”). We are sympathetic to this concern.  Fossil fuel interests and others have promoted less effective or ineffective actions and solutions that support the dynamics of delay. UW MCB Program scientists and many of our colleagues have a deep commitment to a sustainable climate and environment, and to reducing greenhouse gas emissions, and have also examined these questions.

In addition to studies describing ways that projected global warming may increase emissions, empirical studies[vi] and expert reviews have found that awareness of climate intervention and climate intervention research did not reduce motivation for reducing greenhouse gas emissions. A prominent paper from Harvard suggested that research on SRM might send a disaster signal to society of the seriousness of the climate problem that motivates reducing fossil fuels.  Research also exposes the substantial challenges and the nature of any risks that would be posed by SRM and other climate interventions, helping to minimize the possibility of “magical thinking” that there are easy solutions that can be implemented at the last minute.

This claim as part of a submission to the Alameda City Council’s consideration of the CAARE Facility could also be read to imply that the CAARE studies and similar small-scale research studies are “putting our oceans and coastal communities at serious risk.”  Multiple detailed environmental assessments by experts commissioned by the City of Alameda and the University of Washington found that there are no health or environmental impacts from the CAARE studies. In general, the conflation of small-scale research studies designed to inform models with large-scale climate intervention activities is one of the reasons the open environment of the CAARE Facility is important. Engaging directly in a way that helps people better understand the realities of the research and of climate intervention approaches is what will help everyone — from students and members of the local community to scientists and stakeholders from around the world — to make more informed decisions about them.

June 3, 2024

Dear Alameda City Council Members and Staff,

We are writing in response to a request from Mayor Ashcraft and to respond to issues raised in the May 29 Hands off Mother Earth (HOME!) Alliance Statement on Marine Geongineering Experiments funded by the Heinrich Boell Foundation in Germany. We note that the statement includes a number of issues associated with climate intervention activities that are not applicable to the CAARE studies on the USS Hornet.

We appreciate the opportunity to address concerns from the community members, civil society organizations and other stakeholders. The aim of this correspondence is to address the issues and claims raised in the statement.

Kind regards,

Kelly Wanser
Executive Director, SilverLining
Senior Advisor, University of Washington MCB Program

Sarah Doherty
Sr. Research Scientist
Program Director, MCB Program
University of Washington

Submission to City of Alameda for consideration at June 4, 2024 City Council Meeting
From: Kelly Wanser, Executive Director, SilverLining
Date: June 3, 2024
Re: May 29 HOME! Alliance Statement

## The CAARE Studies in the Context of Societal Concerns

The Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility effort at the USS Hornet Sea, Air and Space Museum, a Smithsonian Affiliate, in Alameda, California, supports basic science research to study the near-source transport and dispersal of sea-salt aerosol particles, in order to test and improve models used to study the atmosphere and climate. ***The CAARE studies are not able or designed to alter clouds or any other aspect of the local weather or climate. The studies are not cloud brightening activities or climate intervention experiments or activities.***

The CAARE studies are part of a larger research program led by scientists from the University of Washington to study how clouds respond to particles — also called aerosols — in the atmosphere, and how these effects on clouds influence climate. This research is relevant to a number of problems in atmospheric science, including both the effects of pollution aerosols and investigating the idea that marine clouds might be intentionally brightened to reduce climate warming. Although the CAARE studies do not have environmental impacts and are not climate intervention activities, they do tie into larger conversations about climate intervention (sometimes called "geoengineering").

These conversations have moral and ethical dimensions related to human welfare, the protection of natural systems, and justice and equity in society. ***Consideration of the ethical and moral dimensions of the research being undertaken in the CAARE studies has been provided by an expert submission from Professor James W. Hurrell of Colorado State University.***

The CAARE studies are relevant to ethical considerations beyond climate intervention. New studies, including from prominent climate scientist and advocate James Hansen, indicate that reductions in particulate (aerosol) pollution are accelerating warming, and may have significantly contributed to record warming of the oceans and climate in 2023. Some of this warming may be attributable to a reduction in particulate pollution from ships — an influence that the CAARE studies' efforts to improve models of localized evolution of particles in the marine atmosphere may directly help understand. ***Given these particulate pollution-related warming risks, controlled studies designed to improve models of these aerosol effects are increasingly critical to improving tools for planning and responding to climate change to better protect people and ecosystems.***

Warming is projected to exceed critical thresholds even in the most successful scenarios for reducing emissions. This warming is projected to significantly increase mortality, food and water scarcity, migration, disasters and a host of other damaging impacts in the next few decades. These impacts are the greatest on the most vulnerable communities. Research on SRM has similarities to research in medicine: for healthier patients, essential lifestyle changes are sufficient, but as a condition worsens, intervention may be required to help address acute symptoms and stabilize the patient. SRM research is aimed at evaluating whether various interventions are safe and effective options for constraining warming to safe levels while greenhouse gases in the atmosphere are reduced to safer levels. ***Research that improves projections of warming, and evaluates options for reducing it rapidly, is now critical to the safety and welfare of vulnerable people and communities in the context of climate change. Consideration of these factors was highlighted in a submission by Professor Anna Bershtwyn of New York University.***

The importance to society of research that provides transparent, objective scientific information on the potential benefits and risks of reflecting sunlight to cool climate, or "solar radiation modification" (SRM; a form of climate intervention), has led to official publications calling for

scientific research on SRM from bodies in the U.N., U.S., E.U., and other governments. These include, in 2023 alone, reports from United Nations Environment Programme (UNEP), United Nations Educational, Science and Cultural Organization (UNESCO), European Commission and US Federal Government recommending research on SRM. A joint report from the US National Oceanic and Atmospheric Administration (NOAA) and Department of Energy (DOE) describes the research recommended to understand marine cloud brightening, including outdoor experiments that do not have an effect on climate.

The United States, United Kingdom, and European Union have all initiated publicly funded scientific research programs on SRM. The World Climate Research Programme, a body that operates under the World Meteorological Organization (WMO) to support international scientific cooperation, recently launched a Lighthouse Activity on SRM research.

Today, SRM research is concentrated in scientific centers in the U.S., Europe, and other countries in the Global North. Outdoor research studies and advanced technologies and instruments, and the scientists that use them, are not accessible to non-science stakeholders in these countries, or to people elsewhere in the world. To promote more democratic and informed dialogue and decision-making and more equitable access to scientific research on SRM, the CAARE studies were established at the USS Hornet Sea, Air and Space Museum to enable people from across society and around the world to access studies, tools and information directly. ***In this way, the CAARE Facility promotes more equitable and just consideration of SRM research by all people, but especially by stakeholders from vulnerable communities that are most impacted by climate change. Consideration of these factors was highlighted in a submission by Pirita Näkkäläjärvi.***

While there is opposition to climate intervention research in some parts of the environmental community, there is also support. In recent years, an array of environmental and youth organizations and governmental and intergovernmental bodies have called for research on climate intervention and SRM. Citing issues of generational equity and concern for the future; these include the youth organizations Operaatio Arktis, Green Africa Youth Organization, Sustenta Honduras, Sustainability Week Qatar and SRM Youth Watch. Environmental and climate activist groups, including the Natural Resources Defense Council (NRDC), the Environmental Defense Fund (EDF) and Ocean Visions in the United States, as well as iForest, DEGREES, Carnegie Climate Geoengineering Governance initiative (C2G), and others internationally, have called for, recommended or supported SRM research.

The CAARE studies are designed to provide basic scientific information for improving models and analysis of one form of SRM, marine cloud brightening. Research at the CAARE Facility aligns with the recommendations of UN bodies, governmental and intergovernmental research programs and a number of climate advocacy organizations. At the same time, we appreciate and share some of the concerns expressed by some climate activist organizations. ***We want to highlight that many of these concerns do not apply to academic research efforts or small-scale field research studies like CAARE.***

The CAARE Studies and the May 29 HOME! Statement

To promote better and more accurate understanding, the CAARE leadership would like to address assertions in the May 29 statement from Geoengineering Watch submitted to the City of Alameda. It is important to note that most claims in the May 29 statement do not apply to non-commercial academic research or to small-scale outdoor studies in support of improving models to evaluate the potential benefits and risks of large-scale activities, both critical distinctions of the CAARE program.

Many statements in the letter also do not apply to the potential climate intervention relevant to the research at the CAARE facility: marine cloud brightening. Instead, many pertain to various ocean carbon dioxide removal approaches that introduce something novel into the marine environment. Critically, sea salt and sea salt interactions with the atmosphere and with clouds are part of the natural environment and natural atmospheric processes.

There are many youth, Indigenous, global south and climate activist stakeholders who support, rather than oppose, research on SRM, and small scale field studies such as the CAARE studies. This could even include some of the organizations that signed this statement, which is primarily aimed at scaled or commercial climate intervention activity.

Regarding specific claims in the statement, we provide additional information below.

***Claim 1: None of these technologies does anything to tackle the root causes of climate change.*** The root cause of climate change is human greenhouse gas emissions, which must be rapidly reduced as the top priority for climate action. Studies indicate, however, that increased warming increases energy consumption, diverts public funding away from transition, and reduces public support for measures that reduce fossil fuels. Because of this, limiting warming in the near-term could benefit transitioning away from fossil fuels. Dangerous levels of warming are no longer avoidable through emissions reductions alone. As official reports note, the only approach to reducing substantial climate warming rapidly enough to avoid dangerous thresholds is through SRM.

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***Claim 4: It might be interpreted from the submission of the statement to the City of Alemeda that the studies being undertaken at the CAARE facility are "in defiance of international agreements" including that "the Convention on Biological Diversity (CBD) has had a de facto moratorium on climate intervention experiments in place since 2010".*** This is not true. There are no international agreements banning small-scale atmospheric research studies related to SRM in international waters and all countries have sovereignty over their own coasts and territorial waters, to be governed by local authorities. The relevant CBD Decisions allow and endorse research experiments.[1]

## Claim 5: *"Geoengineering our oceans is a dangerous distraction from the real solutions to the climate crisis and gives the fossil fuel industry a potential escape hatch while putting our oceans and coastal communities at serious risk."*

This claim implies that reducing emissions is sufficient to address all climate warming, including near-term warming that, in every scenario for emissions evaluated by the UN Intergovernmental Panel on Climate Change (IPCC), is projected to rise above 2℃ by the mid-century. Research on climate interventions is recommended by scientists and official bodies due to their potential to reduce warming faster than even the most successful emissions reductions efforts can

[1] Specifically, the relevant CBD Decision (X/33) makes non-binding recommendations only and it does not direct a moratorium or ban on geoengineering activity. Small-scale research studies are explicitly permitted, and its reference to Article 14 on impact assessment suggests that projects that do not adversely impact biodiversity are allowed. The language of the Decision also affirms the authority of member countries over their own territorial activity by stating that "*responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction*." Subsequent CBD Decision XIII/14, paragraph 5, has endorsed the view that increased scientific research is necessary noting that *"more transdisciplinary research and sharing of knowledge among appropriate institutions is needed in order to better understand the impacts of climate-related geoengineering on biodiversity and ecosystem functions and services, socio-economic, cultural and ethical issues and regulatory options*."

achieve. Climate interventions represent possibilities to "bend the curve" of warming to reduce mortality, suffering and ecosystem damage that is currently baked into the most optimistic projections for emissions reductions, and to reduce the risks of breaching catastrophic climate tipping points. Emissions reductions alone cannot reduce these risks and impacts of warming.

This claim also appears to assert that research on SRM in general, and small scale research studies in particular, create a dynamic that makes it easier for fossil fuel companies to continue polluting. This is based on the idea that research on SRM reduces the motivation of individuals and policymakers to support transitioning away from fossil fuels (known as a "moral hazard"). We are sympathetic to this concern. Fossil fuel interests and others have promoted less effective or ineffective actions and solutions that support the dynamics of delay. UW MCB Program scientists and many of our colleagues have a deep commitment to a sustainable climate and environment, and to reducing greenhouse gas emissions, and have also examined these questions.

In addition to studies describing ways that projected global warming may increase emissions, empirical studies[2,3,4,5] and expert reviews[6] have found that awareness of climate intervention and climate intervention research did not reduce motivation for reducing greenhouse gas emissions. A prominent paper from Harvard[7] suggested that research on SRM might send a disaster signal to society of the seriousness of the climate problem that motivates reducing fossil fuels. Research also exposes the substantial challenges and the nature of any risks that would be posed by SRM and other climate interventions, helping to minimize the possibility of "magical thinking" that there are easy solutions that can be implemented at the last minute.

This claim as part of a submission to the Alameda City Council's consideration of the CAARE Facility could also be read to imply that the CAARE studies and similar small-scale research studies are "putting our oceans and coastal communities at serious risk." Multiple detailed environmental assessments by experts commissioned by the City of Alameda and the University of Washington found that there are no health or environmental impacts from the CAARE studies. In general, the conflation of small-scale research studies designed to inform models with large-scale climate intervention activities is one of the reasons the open environment of the

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[2] Merk, C., & Wagner, G. (2024). **Presenting balanced geoengineering information has little effect on mitigation engagement.** *Climatic Change*, *177*(1), 11. https://doi.org/10.1007/s10584-023-03671-5

[3] Cherry T.L. et al Climate cooperation in the shadow of solar geoengineering: an experimental investigation of the moral hazard conjecture. *Environmental Politics*, 1–9.

[4] Merk, C., Pönitzsch, G., & Rehdanz, K. (2019). Do climate engineering experts display moral-hazard behaviour? *Climate Policy*, *19*(2), 231–243. https://doi.org/10.1080/14693062.2018.1494534

[5] Merk, C., Pönitzsch, G., & Rehdanz, K. (2016). **Knowledge about aerosol injection does not reduce individual mitigation efforts.** *Environmental Research Letters: ERL [Web Site]*, *11*(5), 054009. https://doi.org/10.1088/1748-9326/11/5/054009

[6] Bodansky, D., & Parker, A. (2021). Research on Solar Climate Intervention Is the Best Defense Against Moral Hazard. Issues in Science and Technology, 37(4), 19–21. https://issues.org/geoengineering-solar-intervention-climate-moral-hazard/

[7] Aldy JE, Zeckhauser R. Three prongs for prudent climate policy. *South Econ J*. 2020; 87: 3–29. https://doi.org/10.1002/soej.12433

CAARE Facility is important. Engaging directly in a way that helps people better understand the realities of the research and of climate intervention approaches is what will help everyone — from students and members of the local community to scientists and stakeholders from around the world — to make more informed decisions about them.

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|---|---|
| **From:** | Pirita Näkkäläjärvi |
| **To:** | CityCouncil-List |
| **Subject:** | [EXTERNAL] Agenda item 7-B of the June 4th City Council meeting: Expert letter of support for Coastal Atmospheric Aerosol Research facility |
| **Date:** | Monday, June 3, 2024 8:01:30 AM |
| **Attachments:** | Letter to Alameda City Council_Pirita Näkkäläjärvi.pdf |

Dear Madams and Sirs,

Please find attached below an expert letter for your urgent attention.

Yours sincerely,
Pirita Näkkäläjärvi
Member of the Sámi Indigenous People/Nation in Finland

Alameda City Council
California, USA CITYCOUNCIL-List@alamedaca.gov

Subject: 7-B of the June 4th City Council meeting on launching of the Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet in Alameda, California

June 3, 2024
Dear Mayor Ashcraft and Alameda City Council,

I am writing regarding your upcoming decision on whether to allow the University of Washington to continue the Coastal Atmospheric Aerosol Research and Engagement (CAARE) studies at the U.S.S. Hornet Sea, Air and Space Museum in your city.

I am writing as a member of an Arctic Indigenous People/Nation, the Sámi in Finland. My day job is acting as a political leader of our Indigenous People that is already severely impacted by climate warming, and whose way of life is threatened by the warming projected in the coming decades but I write this letter in private capacity.

I saw the letter to the City of Alameda from Hands O[ Mother Earth citing opposition from Indigenous groups to “marine geoengineering experiments” and to research on climate interventions more broadly. Indigenous Peoples are broad and diverse globally. They include a growing number, like me, who believe that because global warming is a mortal threat to our lands and waters and way of life, in addition to immediately and aggressively reducing greenhouse gas emissions and other destructive practices, as a society, we must also research options that could help protect the natural lands and waters that sustain Indigenous Peoples’ way of life as well as life on Earth.

Especially worrying are the Arctic climate system tipping points. Beyond 1.5°C of warming, the tipping of the Greenland ice sheet and the abrupt thaw of the boreal permafrost become likely. The continuous loss of Arctic sea ice, sea level rise from ice sheets, and growing emissions from the permafrost, threaten not only Arctic Indigenous Peoples, but societies globally. This is a strong motivation for me to support research on climate interventions.

The Arctic region where I live is warming four times as fast as the planet as a whole. We are

witnessing rapid climate change around us and experiencing the devastation of our lands and the loss of our way of life that it brings. Climate change is an existential threat to all Sámi traditional livelihoods, including our family's livelihood, reindeer herding. Reindeer herding is not only a livelihood that many of our families depend on economically but it also carries our Sámi languages, culture, traditional knowledge and way of life to the next generations. It is vital that we and other Indigenous Peoples share in generating information and making decisions on climate interventions that could help



reduce warming and its impacts, and help all of our traditional livelihoods to adapt to climate change and the loss of biodiversity.

I believe that Indigenous traditional knowledge has the potential to make a positive contribution to all climate change related research, including research on climate interventions. We already have positive examples in the Arctic, where representatives of the Indigenous Sámi People are engaged in assessing 61 potential climate intervention technologies in cooperation with academia (https://www.uarctic.org/news/2023/10/saving-the-frozen-arctic-a-new-assessment- evaluates-potential-climate-action-measures-and-their-feasibility/). In fact, we reindeer-herding Indigenous Sámi are actively engaged in climate interventions, as reindeer herding has been identified as one of these 61 climate intervention technologies being assessed in the UArctic study. By gobbling up shrubs, reindeer help increase the reflectivity of snow and ice (BBC, December 2023, https://www.bbc.com/future/article/20231219-how-reindeer-help-fight-climate-change).

It will only be possible to make decisions on climate interventions equitably and e[ectively if we have strong scientific understanding of how marine cloud brightening and other climate interventions could change climate impacts in di[erent parts of the world, and if this research is conducted in a way that is accessible by rights holders and stakeholders in the Indigenous Peoples most vulnerable to climate change, including ours.

I am familiar with the University of Washington Marine Cloud Brightening Program, and have followed the e[ort in Alameda. I believe that the approach they are taking of pursuing rigorous, objective academic research into marine cloud brightening while providing open access to Indigenous Peoples, researchers, students, community- members and the public, promotes justice and equity and is a model of how this research should be pursued.

I appreciate your service to Alameda and the e[ort you are making in evaluating and considering this project. I believe it will be a benefit to your community that will also benefit society, and especially those most vulnerable to and a[ected by climate change. I hope that you will support the continuation of this e[ort in Alameda and that I will be able to meet you there.

Yours sincerely,

Ms Pirita Näkkäläjärvi
Member of the Sámi People/Nation in Finland
Sámi expert
MSc Economics, MSc Media & Communications, Doctoral student in Music http://linkedin.com/in/pirita/

Email: pirita.nakkalajarvi@gmail.com
Mobile: 00358405361137

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Pirita Näkkäläjärvi
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00358405361137
https://www.linkedin.com/in/pirita

Alameda City Council

California, USA

CITYCOUNCIL-List@alamedaca.gov

Subject: 7-B of the June 4th City Council meeting on launching of the Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet in Alameda, California

June 3, 2024

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I saw the letter to the City of Alameda from Hands Off Mother Earth citing opposition from Indigenous groups to “marine geoengineering experiments” and to research on climate interventions more broadly. Indigenous Peoples are broad and diverse globally. They include a growing number, like me, who believe that because global warming is a mortal threat to our lands and waters and way of life, in addition to immediately and aggressively reducing greenhouse gas emissions and other destructive practices, as a society, we must also research options that could help protect the natural lands and waters that sustain Indigenous Peoples’ way of life as well as life on Earth.

Especially worrying are the Arctic climate system tipping points. Beyond 1.5°C of warming, the tipping of the Greenland ice sheet and the abrupt thaw of the boreal permafrost become likely. The continuous loss of Arctic sea ice, sea level rise from ice sheets, and growing emissions from the permafrost, threaten not only Arctic Indigenous Peoples, but societies globally. This is a strong motivation for me to support research on climate interventions.

The Arctic region where I live is warming four times as fast as the planet as a whole. We are witnessing rapid climate change around us and experiencing the devastation of our lands and the loss of our way of life that it brings. Climate change is an existential threat to all Sámi traditional livelihoods, including our family’s livelihood, reindeer herding. Reindeer herding is not only a livelihood that many of our families depend on economically but it also carries our Sámi languages, culture, traditional knowledge and way of life to the next generations. It is vital that we and other Indigenous Peoples share in generating information and making decisions on climate interventions that could help

reduce warming and its impacts, and help all of our traditional livelihoods to adapt to climate change and the loss of biodiversity.

I believe that Indigenous traditional knowledge has the potential to make a positive contribution to all climate change related research, including research on climate interventions. We already have positive examples in the Arctic, where representatives of the Indigenous Sámi People are engaged in assessing 61 potential climate intervention technologies in cooperation with academia (https://www.uarctic.org/news/2023/10/saving-the-frozen-arctic-a-new-assessment-evaluates-potential-climate-action-measures-and-their-feasibility/). In fact, we reindeer-herding Indigenous Sámi are actively engaged in climate interventions, as reindeer herding has been identified as one of these 61 climate intervention technologies being assessed in the UArctic study. By gobbling up shrubs, reindeer help increase the reflectivity of snow and ice (BBC, December 2023, https://www.bbc.com/future/article/20231219-how-reindeer-help-fight-climate-change).

It will only be possible to make decisions on climate interventions equitably and effectively if we have strong scientific understanding of how marine cloud brightening and other climate interventions could change climate impacts in different parts of the world, and if this research is conducted in a way that is accessible by rights holders and stakeholders in the Indigenous Peoples most vulnerable to climate change, including ours.

I am familiar with the University of Washington Marine Cloud Brightening Program, and have followed the effort in Alameda. I believe that the approach they are taking of pursuing rigorous, objective academic research into marine cloud brightening while providing open access to Indigenous Peoples, researchers, students, community-members and the public, promotes justice and equity and is a model of how this research should be pursued.

I appreciate your service to Alameda and the effort you are making in evaluating and considering this project. I believe it will be a benefit to your community that will also benefit society, and especially those most vulnerable to and affected by climate change. I hope that you will support the continuation of this effort in Alameda and that I will be able to meet you there.

Yours sincerely,

Ms Pirita Näkkäläjärvi
Member of the Sámi People/Nation in Finland
Sámi expert
MSc Economics, MSc Media & Communications, Doctoral student in Music
http://linkedin.com/in/pirita/
Email: pirita.nakkalajarvi@gmail.com
Mobile: 00358405361137

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|---|---|
| **From:** | LP |
| **To:** | CityCouncil-List |
| **Cc:** | Tony Daysog; Abby Thorne-Lyman; Marilyn Ezzy Ashcraft; sdoherty@uw.edu |
| **Subject:** | [EXTERNAL] Comment 6.4.24 7-B 2024-4063/ Marine Cloud Brightening |
| **Date:** | Sunday, June 2, 2024 5:06:17 PM |

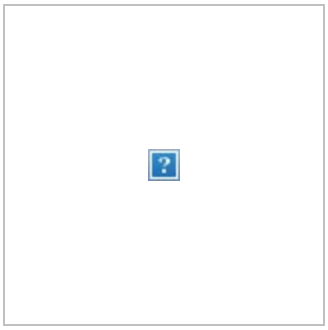
Alameda City Council:

I **support your approving the use** of the University of Washington's testing of experimental equipment, which emits aerosol saltwater at the aft deck of the USS Hornet, in an effort to gather valuable data on the viability of employing marine cloud brightening (MCB) to mitigate global warming.

Subsequent to your approving the use, I **support your authorizing the City Manager to grant landlord consent** so that the MCB Program may continue with appropriate guidelines, as indicated in Terraphase Engineering's Technical Memorandum and recommended by Abby Thorne-Lyman, Director of Base Reuse & Economic Development.

**Thank you for your consideration.**

**L. Perillo**
**Alameda**



**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Saturday, June 1, 2024 8:58:42 AM

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---------- Forwarded message ----------
From: Jan Herbert <info@CIEL.org>
Date: Jun 1, 2024 8:21 AM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

> Jun 1, 2024
>
> Councilmember Trish Herrera Spencer
>
> Dear Councilmember Herrera Spencer,
>
> I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.
>
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> While this is a local decision, it has far reaching consequences since the experiment risks legitimizing this highly speculative and harmful technology and everyone on the planet could be affected by large scale

deployment.

You may already be aware that governments around the world have agreed to a global moratorium on geoengineering and are moving to introduce more restrictive regulations for marine geoengineering. Many civil society organizations around the world have called for an end to marine geoengineering experiments.

https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Ms. Jan Herbert
768 Glen Miller Dr
Windsor, CA 95492-7537
(707) 837-8146
jpherbert@aol.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Saturday, June 1, 2024 8:58:20 AM

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---------- Forwarded message ----------
From: Kenneth Lapointe <info@CIEL.org>
Date: Jun 1, 2024 8:46 AM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

> Jun 1, 2024
>
> Councilmember Trish Herrera Spencer
>
> Dear Councilmember Herrera Spencer,
>
> I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.
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https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Mr. Kenneth Lapointe
2781 Mozart
Los Angeles, CA 90031-0032
(354) 820-7745
incredistical@outlook.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Friday, May 31, 2024 6:09:20 PM

---

---------- Forwarded message ----------
From: Monica Romero <info@CIEL.org>
Date: May 31, 2024 5:15 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

May 31, 2024

Councilmember Trish Herrera Spencer

Dear Councilmember Herrera Spencer,

I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.

The experiment aims to test technology that would advance Marine Cloud Brightening -- a form of solar radiation modification that involves spraying saltwater particles into the air to thicken or brighten clouds, theoretically increasing their reflectivity and partially blocking the sun's rays.

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https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Ms. Monica Romero
878 19th St
Pacific Grove, CA 93950-4801
(831) 869-3086
fractalmonkey7@gmail.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Friday, May 31, 2024 6:08:59 PM

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---------- Forwarded message ----------
From: Cheryl Weiden <info@CIEL.org>
Date: May 31, 2024 5:15 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

May 31, 2024

Councilmember Trish Herrera Spencer

Dear Councilmember Herrera Spencer,

I'm writing to you to ask you to prevent the highly contentious geoengineering experiment planned for the Bay Area from going ahead, when you meet to discuss the proposal on 4 June.

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As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Mrs. Cheryl Weiden
91 Solana Dr
Los Altos, CA 94022-2327
(650) 941-8751
weidenc@gmail.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Friday, May 31, 2024 6:08:44 PM

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---------- Forwarded message ----------
From: Alexandra Mummery <info@CIEL.org>
Date: May 31, 2024 5:15 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

May 31, 2024

Councilmember Trish Herrera Spencer

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https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Ms. Alexandra Mummery
2433 Buena Vista Ave
Apt A
Alameda, CA 94501-1563
(415) 730-7957
alex_mummery@yahoo.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Friday, May 31, 2024 6:08:20 PM

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---------- Forwarded message ----------
From: Venetia Large <info@CIEL.org>
Date: May 31, 2024 5:15 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

> May 31, 2024
>
> Councilmember Trish Herrera Spencer
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https://www.geoengineeringmonitor.org/2024/05/marine-geoegineering-statement/

As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Ms. Venetia Large
PO Box 6572
Altadena, CA 91003-6572
(909) 922-8118
bionlyvlal@yahoo.com

**From:** Trish Spencer
**To:** City Clerk
**Subject:** Fwd: Protect our planet and vote NO on marine geoengineering
**Date:** Friday, May 31, 2024 6:07:32 PM

---

---------- Forwarded message ----------
From: Heidi Paris <info@CIEL.org>
Date: May 31, 2024 5:45 PM
Subject: [EXTERNAL] Protect our planet and vote NO on marine geoengineering
To: Trish Spencer <tspencer@alamedaca.gov>
Cc:

> May 31, 2024
>
> Councilmember Trish Herrera Spencer
>
> Dear Councilmember Herrera Spencer,
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As a citizen of California, I strongly urge you to consider the wider consequences of this project when you discuss the matter on June 4, and do the right thing by acting to ensure the experiment cannot go ahead.

Sincerely,

Miss Heidi Paris
Church Avenue
Chula Vista, CA 91910
(619) 427-3834
hxgirl@hushmail.com

| | |
|---|---|
| **From:** | Kate Stirr |
| **To:** | CityCouncil-List |
| **Cc:** | Jennifer Ott; Allen Tai; Brian McGuire |
| **Subject:** | [EXTERNAL] National Hydropower Association Letter of Support for Natel Test Loop Expansion |
| **Date:** | Friday, May 31, 2024 11:44:11 AM |
| **Attachments:** | NHA_LetterofSupport_Natel.pdf |

Dear Councilmembers and Staff,

Please find attached a letter from Malcolm Woolf, President and CEO of the National Hydropower Association, in support of the expansion of Natel Energy's hydraulic test loop. (2024-4095 Natel Use Permit.)

Thank you for your consideration,

Kate Stirr

Kate Stirr (she/her)
Vice President, External Affairs
+1 (503) 449-8669
natelenergy.com

The National Hydropower Association, Inc.
200 Massachusetts Ave NW, Suite 320, Washington, DC 20001 • 202.805.5057 • www.hydro.org

Malcolm Woolf
President and Chief Executive Officer
National Hydropower Association
200 Massachusetts Ave NW
Suite 320
Washington, DC 20001
202.805.5057

May 31, 2024

Alameda City Council
City Hall
2263 Santa Clara Avenue, Room 320
Alameda, CA 94501

Dear Members of the Alameda City Council,

I am writing to express my strong support for Natel Energy's Use Permit application to expand their hydraulic testing facility at Alameda Point. My name is Malcolm Woolf, and I am the CEO of the National Hydropower Association, a nonprofit national association devoted to promoting the growth and utilization of clean, renewable, and affordable hydropower and marine energy.

The hydropower industry can be slow to embrace change, but Natel is successfully pushing the needle on sustainable practices across the industry. The expansion of Natel's hydraulic test loop is a crucial step toward advancing their innovative technology. Unique in the nation, the facility has enabled Natel to conduct and publish scientific research that has advanced the industry's understanding of how turbines can be made safe for fish.

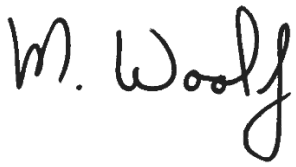
Hydropower provides 29% of total renewable energy in the US, balancing intermittent renewables like wind and solar and providing 40% of the country's "black start" capabilities to restart the grid in a major outage. However, this critical resource is at risk. Most hydro sites in the US are over 50 years old and in need of refurbishment to improve safety, environmental performance and power generation. By pioneering a direct turbine replacement solution that promotes biodiversity conservation alongside renewable energy production, Natel is doing critical work to help keep the existing hydro fleet online while also improving fish passage and power generation.

If we are going to ensure a sustainable, clean, and secure electric system in North America, hydropower must be part of the solution. Natel Energy's continued ability to

bring innovative solutions to the industry through the expansion of their test facility will support a stronger, greener, energy future for all of us.

Thank you for your consideration.

Sincerely,



Malcolm Woolf
President and Chief Executive Officer
National Hydropower Association

| | |
|---|---|
| **From:** | Prof. Nana Ama Browne Klutse |
| **To:** | CityCouncil-List |
| **Subject:** | [EXTERNAL] Letter of support: 7-B of the June 4th City Council meeting on launching of the Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet in Alameda, California |
| **Date:** | Friday, May 31, 2024 10:46:31 AM |
| **Attachments:** | Support for CAARE.pdf |

Dear Sir/Madam,

Kindly find attached a letter of support for your consideration on the subject.

Thank you.


## Prof. Nana Ama Browne Klutse

Professor|IPCC WGI Vice-Chair

Head of Department

Department of Physics

University of Ghana

**Address:** P. O. Box LG 63, Legon, Accra - Ghana

**Telephone:** +233(0)244 983637

**Email:** nklutse@ug.edu.gh

Departmen of Physics
University of Ghana
Legon, Accra
Accra
nklutse@ug.edu.gh

31st May 2024

Alameda City Council
California, USA
CITYCOUNCIL-List@alamedaca.gov

Dear Sir/Madam,

**Letter of support: 7-B of the June 4th City Council meeting on launching of the Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet in Alameda, California**

I am writing to express my support for the launch of the Coastal Atmospheric Aerosol Research and Engagement (CAARE) Facility aboard the USS Hornet in Alameda, California. This innovative initiative represents a significant advancement in our understanding of atmospheric aerosols and their impact on coastal environments and public health.

The launch is both timely and critical, as these sea-salt particles play a crucial role in climate regulation, weather patterns, and air quality. The results will improve our understanding of how these particles move in the local atmosphere in order to test and improve models used to study the atmosphere and climate. Given the relevance of this research to near-term climate safety, it is imperative that stakeholders and the public have more information and access to this research. Launching the facility aboard the USS Hornet Museum, provides an excellent opportunity for students, scientists, the community, and the public - including stakeholders from vulnerable communities and the Global South - to engage directly with this important research.

As a leading scientist from the Global South, I recognize the immense value of a facility that allows for direct, open engagement with cutting-edge research. The CAARE Facility democratizes access to scientific knowledge and promotes equitable influence on critical topics related to climate and atmospheric sciences. It will serve as a hub for cutting-edge research, promoting collaboration among scientists, engineers, and students from various institutions. Its presence will undoubtedly enhance our ability to monitor and analyze aerosol particles, providing valuable insights into their sources, composition, and effects. It will also help raise awareness about the importance of aerosol research and its implications for environmental policy and public health.

I support the launch of the CAARE Facility and look forward to witnessing the valuable contributions it will make to the field of atmospheric science and beyond. Please do not hesitate to contact me if I need to provide further support for this remarkable project.

Yours faithfully,

Prof Nana Ama Browne Klutse

| | |
|---|---|
| **From:** | Mary Church |
| **To:** | CityCouncil-List |
| **Cc:** | Eesha Rangani |
| **Subject:** | [EXTERNAL] Re: Concerns Regarding Cloud Brightening Experiment at USS Hornet Museum |
| **Date:** | Friday, May 31, 2024 10:34:03 AM |

Respected Members of Alameda City Council,

I am writing to draw to your attention the recent statement on Marine Geoengineering Experiments published by the Hands off Mother Earth (HOME) Alliance, which has attracted over 70 endorsements from civil society, Indigenous Peoples and grassroots organizations around the world, at the time of writing.

The statement relates to a range of Marine Geoengineering techniques including Marine Cloud Brightening, and calls on governments to prevent outdoor experiments. The full text of the statement is pasted below for ease of reference and you can also find it online here.

I trust this information will be of assistance as you consider the decision before you on 4 June regarding the Marine Cloud Brightening Project's planned experiment in the Bay Area.

With kind regards

Mary

On behalf of the HOME! Alliance

## HOME! Alliance Statement on Marine Geoengineering Experiments

We, civil society, Indigenous Peoples and grassroots organizations from around the world, are deeply concerned by the proliferation of open air and water marine geoengineering experiments that are planned or already underway, many of which are selling carbon offsets, in defiance of international agreements.

Increasingly, our oceans are at threat not only from the impacts of overexploitation and the climate crisis, but also from these misguided attempts to manipulate earth systems with the aim of countering some of the symptoms of climate change. The oceans' vastness, vulnerability and comparatively pristine nature are still poorly understood, but they sustain life on earth and are our greatest ally in the fight against climate change: to misuse them in this way presents incalculable uncertainty and risk, and the effects of marine geoengineering on them are unpredictable.

Theoretical and experimental attempts at geoengineering in the marine environment currently include increasing the reflectivity of marine clouds or the ocean surface; marine carbon dioxide removal - dumping minerals or biomass in the ocean to increase carbon uptake, running electric currents through seawater, or pumping colder water from the deep

ocean to the surface; and efforts to stop ice melt by spreading microbeads or pumping saltwater on its surface.

None of these technologies does anything to tackle the root causes of climate change; rather reliance on speculative technofixes delays vital action to cut greenhouse gasses. None have been able to demonstrate they can effectively sequester carbon or store it with any permanence, while efforts to cool the climate by increasing reflectivity are inherently unpredictable and risk further destabilizing an already destabilized climate system. It is highly likely that marine geoengineering would change the chemistry of oceans, cause changes in nutrient levels, and subsequent changes in abundance of species, thereby altering delicate equilibriums of interactions between species[1].

We echo parties to the London Convention / London Protocol (LC/LP) who last year stated in relation to four key categories of marine geoengineering "there is considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean", and expressed concern about "the potential for deleterious effects that are widespread, long-lasting or severe".

Despite the *de facto* moratorium on geoengineering under the Convention on Biological Diversity (CBD), in place since 2010, and the current process that may bring several additional categories of marine geoengineering under strict regulatory control under the London Convention / London Protocol (which already prohibit commercial ocean fertilization activities), outdoor experiments in all of these categories have recently been carried out or are currently taking place, with many new experiments proposed.

While techniques vary considerably, what they share in common is the fact that to even begin to influence the global climate would require intervening at enormous scales, in highly complex and fragile ocean ecosystems. Ocean alkalinity enhancement, artificial upwelling, and ocean iron fertilization would theoretically require manipulating approximately 10% of the ocean's surface for any meaningful climate impact. However, even scales identified for 'testing' can be enormous with a now postponed marine cloud brightening trial proposing an experiment over an area of 10,000 sq km in the Pacific North East, while a planned mega-farm of floating seaweed will grow modularly to reach 94,000 km² in the southern Atlantic - that is a larger area than that of Portugal. Then there is the scale of associated infrastructure and transportation. In the case of ocean alkalinity enhancement, a massive increase in mining - with all its associated environmental and carbon impacts - would be required given that it theoretically takes approximately 2 tonnes of rock material to absorb 1 tonne of carbon.

What many of these projects also have in common is carbon markets as a driving force, with start-ups running outdoor experiments selling or pre-selling commitments for carbon credits without any reliable evidence that they will 'work', and despite the fact that a

commercial interest is a significant factor in putting them at odds with existing and emerging regulation. Any failure and leaks in the future would effectively cause a net increase of emissions. These companies also operate with little transparency regarding monitoring of either intended impacts or harmful consequences. Negotiations under Article 6 of the Paris Agreement risk legitimizing and entrenching these highly speculative, risky techniques.

Marine geoengineering additionally brings new risks to the livelihoods of Indigenous Peoples, traditional communities and fisherfolk who rely on marine and coastal ecosystems. The Human Rights Council report on the issue has found that climate altering technologies, including some marine geoengineering techniques, “could seriously interfere with the enjoyment of human rights for millions and perhaps billions of people” and that “the potential deployment of [geoengineering technologies] would have a massive and disproportionate impact on Indigenous Peoples whose traditional lands and territories are particularly exposed and at risk of experimental uses”.

**Geoengineering our oceans is a dangerous distraction from the real solutions to the climate crisis and gives the fossil fuel industry a potential escape hatch while putting our oceans and coastal communities at serious risk.**

**We therefore call on governments to**:

- Prevent outdoor marine geoengineering experiments from taking place;
- Protect oceans, marine ecosystems and the communities and Indigenous Peoples that depend on them, including by upholding the precautionary principle, the right to Free Prior and Informed Consent, and the rights of access to information, public participation in decision making and access to justice;
- Uphold, enforce and strengthen the *de facto* moratorium under the Convention on Biological Diversity on all forms of geoengineering, in place since 2010;
- Support the development of strong precautionary regulatory controls under the London Convention / London Protocol on ocean alkalinity enhancement; biomass cultivation for carbon removal; marine cloud brightening; and surface albedo enhancement involving reflective particles and/or other materials, to be at least as stringent as those already in place for ocean fertilization;
- Urgently prioritize real solutions to the climate crisis by equitably phasing out fossil fuels and greenhouse gas emissions reduction, and supporting the many decentralized, diverse and readily available alternatives for socially and ecologically

sustainable production and consumption patterns, including provision of climate finance by wealthy countries in accordance with their fair shares/equity.

**Endorsements:**

Amnesty International
AbibiNsroma Foundation
Adéquations, France
Afrihealth Optonet Association (AHOA)
Asia Indigenous Peoples Network on Extractive Industries and Energy (AIPNEE)
Association KANDILI, Niger
Association pour la Conservation et la Protection des Écosystèmes des Lacs et l'Agriculture Durable (ACOPELAD), DRC
Biofuelwatch (BFW)
BlueGreen, Coastal Resource Centre, Kerala India
Carbon Market Watch
CartoCrítica, Mexico
Center for International Environmental Law (CIEL)
Centre pour la Justice Environnementales Togo (CJE-Togo)
Centro Ecológico, Brasil
CESTA Friends of the Earth El Salvador
Climate Action for Lifelong Learners (CALL), Canada
Climate Justice Alliance (CJA)
Community Action For Health And Development (CAHED), Kenya
Conexiones Climáticas, Mexico
Congo Basin Conservation Society (CBCS Network), DRC
Continental Network of Indigenous Women of the Americas-ECM
Corporate Europe Observatory (CEO)
Deutsche Stiftung Meeresschutz
Disability Peoples Forum, Uganda
Dr Uzo Adirieje Foundation (DUZAFOUND)
Durable (ACOPELAD), DRC
ENGENERA (Energía, Género y Ambiente), México
Environmental Investigation Agency (EIA)
Equidad de género: ciudadanía, trabajo y familia, México
ETC Group
European Environmental Bureau (EEB)
Friends of the Earth International (FOEI)
Friends of the Earth Japan
Friends of the Earth Malta
Friends of the Earth Scotland

Friends of the Earth U.S.
Global Forest Coalition (GFC)
Global Justice Ecology Project
GlobalChoices, USA/UK
Grassy Hills Center for Holistic - Wellbeing and Empowerment Foundation
Group for the Development of Women and Girls – GDMR, Mozambique
Health of Mother Earth Foundation (HOMEF)
Heinrich Boell Foundation (hbf)
Indian Confederation of Indigenous and Tribal Peoples (ICITP)
Indigenous Environmental Network (IEN)
Institute for Policy Studies Climate Policy Program
Just Transition Alliance
Justiça Ambiental/ Friends of the Earth Mozambique
Keepers of the Water
Les Amis de la Terre-Togo
National Fishworkers Forum (India)
NOAH Friends of the Earth Denmark
Ocean, Coastal and Ecological Alliance Network (O.C.E.A.N)
OceanCare
Office against Discrimination, Racism and Intolerance (ODRI)
Red de Coordinación en Biodiversidad
Reforest The Earth, UK
Regional Advocacy for Women's Sustainable Advancement (RAWSA)
Sciaena - Ocean # Conservation # Awareness
Scientists for Global Responsibility, UK
Seas At Risk
Servicios Ecumenicos para Reconciliacion y Reconstrucction, USA
Société Civile environnementale et Agro Rural du Congo SOCEARUCO Sud Kivu, DRC
Society for Conservation and Sustainability of Energy and Environment in Nigeria (SOCSEEN)
The Gaia Foundation
The Pacific Network on Globalisation (PANG)
Third World Network (TWN)
UBINIG (Policy Research for Development Alternative), Bangladesh
Village Farmers Initiative (VFI), Nigeria
WECF International - Women Engage for a Common Future
Whale and Dolphin Conservation (WDC)
WhatNext?
Women's International League of Peace and Freedom (WILPF) UK

On 21 May 2024, at 21:32, Eesha Rangani <marine@handsoffmotherearth.org> wrote:

Respected Members of the Alameda City Council,

I am writing on behalf of the Hands Off Mother Earth (HOME) Alliance to express our concerns regarding the recent marine cloud brightening (MCB) experiment initiated by the University of Washington at the USS Hornet Sea, Air, and Space Museum.

The Hands Off Mother Earth Alliance (HOME) is a global civil society coalition providing scrutiny, education, and resistance to geoengineering. HOME has members on nearly every continent and includes the participation of scientists, environmental campaigners, Indigenous Peoples representatives, and residents of environmentally overburdened areas.

The term “geoengineering” refers to a set of proposed technologies to deliberately intervene in and manipulate Earth’s systems in an attempt to roll back some of the effects of climate change. Those interventions can take place over land, in the oceans, or the atmosphere and be aimed at removing CO2 or manipulating radiative forcing. Geoengineering technologies do nothing to tackle the root causes of climate change; they are inherently unpredictable and risk further destabilizing an already destabilized system with more and new extremes.

Techniques such as the one tested in Alameda - if ever deployed at scale - would introduce a whole host of new environmental and social risks that are likely to impact those already suffering the worst impacts of climate change the hardest. In addition, as the IPCC has confirmed, reliance on speculative and unproven technologies risks delaying action to cut greenhouse gasses in the critical decade ahead.

We fully support the Alameda City Council’s decision to halt the marine cloud brightening experiment that was begun in nearby San Francisco Bay. While we understand that the unregulated nature of the project has jurisdictional implications for those who, like the members of this Council, are at the frontlines of ensuring the safety of your city and the health of the people who live and work in it, we would like to share with you some of the additional risks of scaled-up marine cloud brightening attempts.

While the Alameda experiment is designed to be carried out at a small scale for now, the intent of such geoengineering technologies is ultimately to manipulate the climate at a global scale. No computer models could ever predict with absolute certainty the real impacts of such intervention—the only way to test their climate impact would be to deploy them, putting ecosystems and millions of human lives at risk.

The following risks are among those associated with marine cloud brightening at scale:

- Altering of the land-sea temperature gradient will influence regional climatology and shift rainfall patterns. Modeling has shown that this could exacerbate drought or hurricanes, often far from the deployment site (Stjern et al, 2017).
- It would significantly increase salt density in clouds, while its deposition would be uncontrollable. Greater salt loads that fall on land would corrode

infrastructure, pollute waterways, and harm the productivity of agricultural lands (Russell et al., 2013; Muri et al., 2015).

- Pumping, filtration, and spraying of vast quantities of seawater would be required in larger marine cloud brightening operations. Such extraction would kill significant numbers of marine organisms, including fish larvae, thereby additionally impacting the fishing industry (CaliforniaWaterBoards, 2010; Nielsen et al., 2024).

In light of these risks and the broader transboundary and global implications of marine cloud brightening, we call on the Alameda City Council to put an end to the experiment on the USS Hornet Museum and put in place legislation to prevent further such outdoor experiments from taking place in your jurisdiction. Allowing the experiment to take place would risk putting us on a slippery slope toward the development and deployment of this technology while also serving to legitimize these highly controversial climate manipulations.

As civil society experts, we echo the state parties to the London Convention / London Protocol who last year stated in relation to four key categories of marine geoengineering (including marine cloud brightening) that "there is considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean," and expressed concern about "the potential for deleterious effects that are widespread, long-lasting or severe." We also call to respect and protect the *de facto* moratorium on geoengineering under the Convention on Biological Diversity (CBD), in place since 2010.

We would be happy to discuss any of the concerns we raise in this communication with you, as well as any others you may have. Please do not hesitate to contact us.

Sincerely,

--

Eesha Rangani

*Pronouns: she/her/hers*

<a5fe6a51.jpeg>

**Marine Geoengineering Working Group Coordinator**

**The Hands Off Mother Earth! (HOME) Alliance**

**Website | LinkedIn | Twitter | Facebook**

Geoengineering Monitor website: www.geoengineeringmonitor.org
Interactive World Map: www.map.geoengineeringmonitor.or

Mary Church
Geoengineering Campaign Manager
Center for International Environmental Law (CIEL)
Email: mchurch@ciel.org | Signal / Whatsapp: +447708098051
Pronouns: she/her | Timezone: UCT

Connect with CIEL online: www.ciel.org | facebook | twitter | linkedin

**From:** Trish Spencer
**To:** Lara Weisiger
**Subject:** Fwd: Please vote against the Marine Cloud Brightening Project
**Date:** Friday, May 31, 2024 12:04:11 AM

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---------- Forwarded message ----------
From: Doris Smith <urmigram@hotmail.com>
Date: May 30, 2024 5:56 PM
Subject: [EXTERNAL] Please vote against the Marine Cloud Brightening Project
To: Marilyn Ezzy Ashcraft <MEzzyAshcraft@alamedaca.gov>,Tony Daysog <TDaysog@alamedaca.gov>,Tracy Jensen <tjensen@alamedaca.gov>,Trish Spencer <tspencer@alamedaca.gov>,Malia Vella <MVella@alamedaca.gov>
Cc:

> Dear Alameda City Council Members:
>
> I'm a resident of Oakland, and the people of the Bay Area are counting on you to hold back still another untested science experiment that could have unforeseen disastrous effects on our planet. We don't know how this salt would interact with other elements of the biosphere that has already been damaged by man's inventions. We have seen it before, too many times. I have great grandchildren in the Bay Area who need you to think of their future. They already have so many things impacting their health, and the health of many species of plants and animals. I know that you are always keeping these future generations in mind, and it is a difficult decision, but isn't it better to err on the side of caution instead of letting science control everything—science which is experimental by nature and ever-changing?
>
> Thank you for listening,
> Doris Smith
> Oakland senior

**From:** Trish Spencer
**To:** Lara Weisiger
**Subject:** FW: Silver Lining/University of Washington climate/spray experiments on USS Hornet
**Date:** Thursday, May 30, 2024 4:04:02 PM

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---------- Forwarded message ----------
From: Griff Neal <gneal@encaptech.com>
Date: May 30, 2024 3:37 PM
Subject: [EXTERNAL] FW: Silver Lining/University of Washington climate/spray experiments on USS Hornet
To: Trish Spencer <tspencer@alamedaca.gov>,Jennifer Ott <jott@alamedaca.gov>,Alesia Strauch <astrauch@alamedaca.gov>,Yibin Shen <yshen@alamedaca.gov>
Cc:

Hi All,

The attached response from the CAARE team is extremely disappointing. The responses they provide don't address the underlying toxicity issues or lack of regulatory compliance. They are intentionally misleading and I believe frame the basis of a fraud claim by the Hornet Museum, and perhaps the city, against S.R.I. & Silver Lining.

Griff

---

**From:** Griff Neal [mailto:gneal@encaptech.com]
**Sent:** Thursday, May 30, 2024 3:09 PM
**To:** Sarah Doherty
**Cc:** Trish Spencer; Liz Taylor; Alexandra Reeves; Kelly Wanser
**Subject:** Re: Silver Lining/University of Washington climate/spray experiments on USS Hornet

Hi Sarah,

Thank you for the response. I outlined concerns with the seven chemical compounds you are spraying that are OSHA regulated health hazards. The data you share below for Strontium and Bromine (boride referenced in your note is an ion) while interesting is irrelevant.

You need to examine Boric acid & Strontium chloride which have OSHA limits of 2mg/m3. Magnesium Chloride is the second most prevalent chemical used in your test. Why did the professor analyze subcomponents of the lowest concentration chemicals not the highest concentration compound ?

We also discussed the average crystal size of 40 nm being a fraction of that of a coronavirus particle. Inhalation of NaCl, & KCl crystals in this size will bypass the pulmonary membrane leading to direct blood absorption. Sodium & Potassium ions impact electro cardio function. We agreed that you would obtain ATSDR data on safe blood levels and back calculate to determine acceptable exposure concentrations.

Also unanswered is the maximum quantity of salt that will be emitted during a test? Also unanswered is the total particle concentration (of all salt types) at the nearest particle measurement station at the end of this maximum salt test.

These are serious questions that must be adequately answered.

Griff

We also discussed

Griff Neal

President

Encap Technologies

(510)-337-2700 (o)

(415)-902-6600 (m)

On May 30, 2024, at 1:22 PM, Sarah Doherty <sdoherty@uw.edu> wrote:

Hello Trish, Griff and Liz,

I wanted to follow up on the two additional concerns raised on our call of a couple weeks ago, as we now have analyses to address both.

One concern was about potential impacts on local bird colonies, or other local environmental impacts. As you'll have I'm sure seen, the agency the City works with, H. T. Harvey and Associates, conducted this assessment and concluded they "do not expect the Marine Cloud Brightening Program's testing to result in any adverse effects on California least terns or other sensitive species".

The other concern was around the trace species strontium (Sr) and boride (Br) that are present in the sea salt standard we are using in CARI, and specifically whether the spray generation process could result in these species being present in the atmosphere at hazardous levels. These conversations prompted two analyses:

First, Prof. Jeffrey Pierce of Colorado State University did an analysis of the expected concentrations and respiratory deposition rates of both of these substances downwind of CARI. Prof. Pierce is not involved in the UW MCB Program and is an expert in both atmospheric aerosols and their deposition rates in respiratory systems.

His analysis:

- Assumes that these constituents are present in the generated aerosol in the same ratio as in the sea salt standard
- Accounts for the size of the aerosol in calculating the deposition rate of the aerosol in the airway/lungs

The analysis shows:

- **Strontium (Sr)**
- 
    - The concentration of Sr drops to <0.003 micrograms/m^3 within 200 meters of CARI (which is the length of the Hornet flight deck), and below 0.001 micrograms/m^3 within 400 meters of CARI.
    - As a reference point, the background concentration of Sr in a coastal environment is 0.001 micrograms/m^3
    - The respiratory deposition of strontium to someone *standing in the plume over the full duration (30min) of CARI emissions* in a day is <0.1 micrograms for all locations on the flight deck, and <0.003 micrograms for locations downwind of the flight deck (dropping to <0.001 at 500m distance and <0.0003 at 1km distance)
- 
    - 
        - The analysis notes that this is “trivial" compared to what one would ingest drinking 1 liter of water that meets the EPA standard for drinking water (4000 micrograms per liter).
- 
    - Note that OSHA does not have a standard for Sr exposure that could be used as a metric, but **the analysis notes that:**
- 
    - 
        - **the concentrations produced are at or below that present in background air in a coastal environment on the flight**

**deck, and well below that of background air at distances downwind of the Hornet.**
    - **The fraction of aerosol deposited to the lungs/airway is actually *lower* for the size aerosol we are generating than for naturally produced sea salt aerosol**
    - **exposure to Sr from CARI is a factor of >10,000 below that set by the EPA as acceptable for ingestion in drinking water.**

- **Boride (Br)**

-
    - OSHA sets limits for airborne exposure to boric acid of 2,000 micrograms/m^3 for longer-term exposures and 6,000 micrograms/m^3 for shorter-term (10-15min) exposures
    - Prof. Pierce's analysis finds that the boride concentrations in the atmosphere are <3micrograms/m^3 for all locations on the flight deck, and and <1microgram/m^3 for locations downwind of the flight deck (dropping to <0.3 at 500m and <0.1 at 1km).
    - **As such, the analysis concludes that the boric acid concentration during emissions time periods are less than 1/500th the OSHA limit on the flight deck, and less than 1/1000th the OSHA limit at locations downwind of the flight deck.**

**—> <u>In summary</u>: Prof. Pierce's analysis shows that, assuming the sea salt constituents are present in the generated particles in the same ratio as they are present in the sea salt used to make the aerosols, both boride and strontium are present at concentrations about a factor of 1000 or more below the limits considered safe by the EPA (Br) and OSHA (Sr).**

Griff, you had also raised the question of whether these constituents could be getting concentrated in the process of aerosolization such that their concentrations became hazardous. **Based on the above analysis, this would require that these species become amplified by a factor of 1000 (or more) in the process of spraying.**

Addressing this was the basis for a second analysis, done in the lab by our colleagues at SRI.

Using a technique called SEM-EDS (see below for a technical description) our colleagues analyzed the chemical composition of the individual particles produced in a lab by the nozzles used in CARI, as well as that of the sea salt aerosol used to make the saline solution that goes into CARI.

Importantly, even this sophisticated analysis technique can only given accurate concentrations for constituents that are present at >0.1-0.2% of the total particles' weight; below this, constituents are effectively undetectable.

- Both boride and strontium are present in the sea salt standard at smaller fractions than this (for boric acid, 0.071%; for strontium chloride, 0.095%). **This means that both constituents are present in the sea salt standard at levels that are undetectable. However, if these constituents become concentrated in the process of spraying by a factor of ~2 or more they will become detectable.**
- The SEM-EDS analysis found that Br and Sr were not present at >0.1-0.2% in the generated aerosol; in other words, they remained undetectable after aerosolization with the CARI nozzle.

**—> <u>In summary</u>: We can conclude that the concentrations of boride and strontium were not amplified by more than a factor of 2 in the process of aersolization.** (We are unable to determine via these tests if they are amplified by some amount less than this).

**—> <u>Overall summary</u>: Boride and strontium in the sea salt standard used in CARI would need to be amplified by a factor of >1000 in order to be present at hazardous levels, and our lab analysis shows that, if indeed their concentrations are somehow being amplified through the process of aerosolization, it is by less than a factor of 2.**

Finally, note that these results have been shared with Terraphase, whom the City hired to assess the study. They communicated directly with Prof. Jeff Pierce on his analysis, and we shared with them the SEM-EDS analysis.

Kind regards,

Sarah

———

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Program
University of Washington
Seattle, Washington USA
TED Talk: Aerosols, clouds & MCB

On May 13, 2024, at 11:36 AM, Sarah Doherty <sdoherty@uw.edu> wrote:

Hello Griff et al.,

Thanks again for talking this morning and providing ideas for how to move forward and get the data needed to assure everyone is safe.

I wanted to confirm the number I gave on the call that we conservatively estimate that we are generating 1 kg of salt every 10 min.

I also wanted to attached the plots that I shared via the google drive link below, since Griff seems to have had trouble accessing them.

Cheers,

Sarah

___

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Project
University of Washington

Seattle, Washington USA

<AerosolImpactDownstreamAtSurface_Emissions5e13_FirstKilometer-2024-03-21.png><AerosolImpactDownstreamAtSurface_Emissions5e13-2024-03-21.png>

On May 12, 2024, at 4:50 PM, Sarah Doherty <sdoherty@uw.edu> wrote:

Thank you, Griff, we appreciate your questions and the care that you and others in the community are taking with this. As atmospheric scientists, we are driven by similar motivations. Please see answers (in italics) to your questions below. I look forward to speaking with you tomorrow.

- What is the particle size range and the percentage particle size distribution for each of the 10 salts your equipment emits during the testing?

*The sea salt aerosols being generated are almost all (>99.8% of the total number) in the 10-200 nm dry diameter size range. Based on our lab measurements using the same nozzles, the dry aerosols have a log-normal size distribution with a mode at 40 nm and a standard deviation of 2.5. At ambient relative humidity, the aerosol diameter will be about double this size.*

*The 10 components within the sea-salt compound do not differentiate in the process of producing the aerosols, because the sizing is determined by mechanical processes that break up the whole salt. As such, each component should be present in the aerosols in the ratios of the salt standard we are using. As such, the size distribution for the components will scale in proportion to their relative ratios in the original salt standard, and we are not separately measuring the size distribution of each component.*

*As we have only turned the system on about half a dozen times for < 5 min each we have not yet been able to make sufficient measurements on the Hornet to determine exactly what the size distribution is for the 60-nozzle array being used, but we do not expect it will differ substantially from that of our four-nozzle tests made in the lab, in terms of impacts on PM2.5.*

- At the end of the three tests, what particle concentrations are you presently measuring for each of the 10 types of salt crystals?

*As above, we are not measuring components, but sea-salt equivalent aerosol particles with fixed ratios of these components. We have made initial measurements that are consistent with our lab estimates, but have not yet been able to make sufficient measurements to determine the total particle concentrations with more certainty.*

*Based on our lab studies of the aerosols being produced by individual nozzles we have made conservative (upper-bound) calculations of the expected concentrations at different distances downwind of the system, up to 10 km. See answers below.*

- What is the distance of these measurements from the salt emitting

equipment?

*Presently we have three stations, with a fourth being configured. These are located on the scissor lifts, which can be moved to different locations on the Hornet flight deck. They are arranged at variable but relatively equidistant positions from ~20m to ~200m from the CARI system. We are currently adding additional measurement instruments, including visual plume mapping, that will help us refine calculations and modeled estimates.*

The “Assessment Of Approval Processes” conducted by Farallon Strategies states: “The Study team may place additional temporary sensors within the area of possible dispersion within the property boundary of the USS Hornet and beyond the permit area to monitor any possible effects that may occur outside of the Study area of the USS Hornet.”

The slide presentation shared with council member Spencer depicts measurement stations 1 & 2 kilometers from the salt spray system. The CAARE Faq document states “the operation of the site may be extended into 2025 and beyond”

- Are you presently measuring and monitoring anywhere outside of the Hornet?
  *We are not currently making measurements outside of the Hornet, but as stated planned to do so, and were very interested in input from City stakeholders*

*We are in the process of purchasing PurpleAir PM2.5 sensors to be placed at a range of locations that we would like to determine with input from City stakeholders. The soccer field and Encinal school would be obvious first choices, but clearly we would only want to do this in coordination with the city and the selected locations. Note that there are quite a few of these sensors already around the Alameda area, and the data are available in real time.*

*We do not generally anticipate differentiated readings from background aerosols at these locations, but support the generation of continuous, open data to help community members confirm this for themselves.*

*Our plans include use of a LiDAR system (the miniMPL) to measure the plume distribution at locations from the end of the Hornet flight deck to up to a couple km downwind. This was planned for a later phase of the studies, after we had honed in the observations on the Hornet flight deck. This would help observe particles present in trace amounts in ways that are scientifically helpful for our transport studies, but not relevant to human or environmental impacts.*

- The Marine Cloud Brightening Program website highlights advanced modeling of aerosol
  interactions. Would you please share the models of salt emission and expected maximum particle concentration, for each of the 10 types of salt crystals, at the 1 & 2 kilometer distances?

*Sea-salt is a commonly studied substance, as a compound, in atmospheric and environmental science. As the 10 components do not differentiate in the process of producing the aerosols, they should be present in the aerosols in the ratios of the salt standard we are using. As with the measurements, the modeling is of the concentration of the sea salt aerosol in total.*

*The model calculations are of PM2.5 as a function of distance downwind and distance from the center of the plume. They are based on taking the maximum amount of sea salt aerosol produced per nozzle measured in the lab.*

*The results showing this within the first 1 km downwind are here:*

*https://drive.google.com/file/d/1koJRGfDTP-Mf1o156tKa-vxhMGWC-JOM/view?usp=drive_link*

*The results showing this within the first 10 km downwind are here:*

*https://drive.google.com/file/d/1zP7_9zf8-bpC5dCoY6PtR5GZd83uq92B/view?usp=sharing*

*Note that the concentrations given here are in the plume, so in terms of exposure one would need to be standing in the plume for the duration of the aerosol generation period to be continuously exposed to these concentrations. Given that the wind varies, continuous exposure to the heart of the plume would require actually moving around to follow it.*

*Also note that these calculations were for open ocean atmospheric conditions, where the plume will be less efficiently lifted above the surface because there isn't any solar heating of the surface as there is on the Hornet or over the pavement or land surfaces. With the Hornet flight deck close to 100' (~30 m) above the surface, and the plume being lifted by surface heating, surface/ground-level concentrations downwind of the Hornet would likely be lower than in our calculations. (In other words, downwind of the Hornet the "core" of the plume likely won't reach the surface~)*

The CAARE Faq document states "the operation of the site may be extended into 2025 and beyond". The Farallon document highlights "The first phase of the Study"

- What are the contemplated future phases of the study and will they be performed in Alameda?

*Right now there are no specific plans for future phases, as that will very much depend on the results of the first phase, the City's current process, the community's interest in having the facility as an interactive educational facility on climate science, interest from other study groups to use the capabilities developed there, and of course continuing to be welcomed on the Hornet.*

*As an example of possible other studies that could also be scientifically useful and a good opportunity for STEM education: There is some interest in*

*using the facility to understand how atmospheric chemistry in coastal regions is altered by the presence of natural sea salt aerosols.*

- Will this future testing increase the quantity of salt emitted if so by how much?

*We do not plan to scale up the number of nozzles being used, or to increase the quantity of salt being emitted.*

The Farallon Assessment is limited to environment analysis. It does not include analysis of potential adverse health effects or governmental exposure limits by particle size or chemical composition.

- What human and animal toxicological assessments have been performed for the 10 salts?

- What human and animal toxicological assessments have been performed for the component salt ions in bloodstream?

- What analysis has been performed to confirm exposure does not exceed MRL's for each component salt?

- What analysis has been performed to confirm exposure does not exceed bloodstream MRL's for each component salt Ion?

- What analysis has been performed to confirm compliance with EPA 16202 air quality standards for particulate matter?

*As with other scientific studies, we have relied on the assessment of the regulatory agencies that determine what emissions threshold constitute a health hazard. As reported in the Farallon findings, the emissions we are producing do not exceed thresholds that would trigger permitting for air quality. Sea salt is a substance that has a wide range of applications with human exposure and is not considered a toxin.*

*Beyond this, we did do our own calculations of the concentration of salt at various distances, per the plots linked to above. Putting these in the context of the integrated exposure over time (given that we'd be generating the plume for brief windows a few times a day) vs. other exposures to sea salt, such as when one goes to the beach for the day or lives on the seashore by the open ocean, we concluded that the exposure was comparable to or less than what humans experience with natural exposures to sea salt aerosol.*

*Finally, we have engaged closely with the City's hazardous materials consultants to support independent review to assess physical safety. Their*

*report should confirm that the emissions we are producing do not present a physical risk to human health or the environment.*

*(Somewhat of an aside, but perhaps of interest in this context: It has recently been pointed out to us that breathing in very small salt and pure sea salt aerosols either dry or in a fine mist has been shown to have therapeutic effects for lung problems – resulting in "halotherapy" spas; e.g. see www.seasalttherapy.com, in San Jose).*

Kind regards,

Sarah

___

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Project
University of Washington

Seattle, Washington USA

On May 10, 2024, at 12:37 PM, Griff Neal <gneal@encaptech.com> wrote:

My error, I will attend Monday.

Griff Neal

President

Encap Technologies

(510)-337-2700 (o)

(415)-902-6600 (m)

On May 10, 2024, at 12:30 PM, Sarah Doherty <sdoherty@uw.edu> wrote:

Hello Griff,

A note that we have our call as being scheduled for 10:00am Monday. Can you confirm that's the day/time you have?

I can confirm that I will email answers to your questions by the end of the weekend.

Kind regards,

Sarah

___

Sarah Doherty
sdoherty@uw.edu
Associate Prof., Dept. of Atmospheric Sciences
Sr. Research Scientist, CICOES
Program Director, Marine Cloud Brightening Project
University of Washington

Seattle, Washington USA

On May 10, 2024, at 11:39 AM, Griff Neal <gneal@encaptech.com> wrote:

Dear Dr. Doherty,

To make our call more efficient, before we talk on Tuesday, will you please respond with answers to the questions in the attachment.

Thanks,

Griff

**From:** Kelly Wanser [mailto:kwanser@silverlining.ngo]
**Sent:** Monday, May 06, 2024 4:40 PM
**To:** Trish Spencer
**Cc:** gneal@encaptech.com; Liz Taylor; Sarah J. Doherty; Alexandra Reeves; Stephanie Layman
**Subject:** Re: Silver Lining/University of Washington climate/spray experiments on USS Hornet

Dear Councilmember Spencer,

Thank you very much for your email, and for the introduction. We continue to be impressed by the thoughtfulness and engagement of Alameda's leadership and community.

Mr. Neal and Ms.Taylor, it's a pleasure to meet you. We really appreciate your interest and support for the community in these areas. Some of the answers to your questions are available in an FAQ document attached here, but I am also connecting you with Program Director and atmospheric scientist, Sarah Doherty, to support a zoom meeting to address additional questions from all of you.

Could you all share available windows this week for a Zoom? I will make myself available at your disposal, though Dr. Doherty is much more critical. (Please note that I have copied our Local Coordinator, Alexandra Reeves, and my assistant, Stephanie, to assist with scheduling.)

Best regards,

Kelly

--

Kelly Wanser

Executive Director, SilverLining

Senior Advisor, University of Washington Marine Cloud Brightening Program

On Mon, May 6, 2024 at 7:19 PM Trish Spencer <tspencer@alamedaca.gov> wrote:

> Hi all,
>
> I want to introduce you to each other. I want to thank Ms. Wanser and Silver Lining/University of Washington for offering to discuss this with members of the Alameda community. I want to also thank Mr. Neal and Ms. Taylor for looking further look into this.
>
> Below are Mr. Neal's initial questions.
>
> I'm happy to join a meeting in-person or via zoom to further my understanding.
>
> Sincerely,
>
> Trish Herrera Spencer
>
> Councilmember
>
> 510-552-0555
>
> ---
>
> **From:** Griff Neal <gneal@encaptech.com>
> **Sent:** Thursday, April 25, 2024 1:33:48 PM
> **To:** 'Trish Spencer' <tspencer@alamedaca.gov>
> **Cc:** 'Jennifer Ott' <jott@alamedaca.gov>; 'Abby Thorne-Lyman' <athornelyman@alamedaca.gov>; 'Alesia Strauch' <astrauch@alamedaca.gov>

**Subject:** [EXTERNAL] RE: Items I would like to discuss with the CARI Team

Hi Trish,

I appreciate your willingness to coordinate a meeting with the research team. Would you please reiterate to them that I am supportive of their underlying research. My interest is in mitigating potential health risks.

Would you let them know that I would like to discuss the following topics with them.

1) How long does each test last?

2) How many kilograms of salt are emitted over that testing period?

3) What is the particle size range and distribution percentages of each of the 10 salts that are emitted by the sprayer?

4) At the end of the test, what is the particle concentration per cubic meter for each of the 10 types of salt crystals at the measuring station on the Hornet deck which is furthest from the salt sprayer?

5) What is the expected maximum particle concentration per cubic meter for each of the 10 types of salt crystals at the 1 & 2 kilometer distances highlighted in the slide presentation they shared with you?

You mentioned others who have similar questions and concerns. Please feel free to share this email with them and let them know I'm happy to talk.

Best,

Griff

--

--

Kelly Wanser

Executive Director, SilverLining

Senior Advisor, University of Washington Marine Cloud Brightening Program

Phone: +1-415-734-6790

**TEDTalk**: Emergency Medicine for Climate

**Report:** Near Term Climate Risk and Intervention: A Roadmap for Research

**Podcast:** Volts with David Roberts - How to Think About Climate Intervention

<Questions for the CAARE team.pdf>

| | |
|---|---|
| **From:** | Bershteyn, Anna |
| **To:** | CityCouncil-List |
| **Subject:** | [EXTERNAL] Agenda item 7-B of the June 4th City Council meeting: Expert letter of support for Coastal Atmospheric Aerosol Research facility |
| **Date:** | Thursday, May 30, 2024 6:15:51 AM |
| **Attachments:** | LOS_CoastalAtmosphericAerosolResearch_Bershteyn_NYU.pdf |

To:
Marilyn Ezzy Ashcraft
Mayor of Alameda

CC:
Jenn Ott, Alameda City Manager
Members of the Alameda City Council

Dear Mayor Ashcraft,

As a scientist and educator, I write to express my support for the Coastal Atmospheric Aerosol Research facility and museum exhibit being proposed by the University of Washington's Marine Cloud Brightening program at Alameda County's at the USS Hornet Sea, Air and Space Museum.

I am an Associate Professor of Population Health within the Division of Comparative Effectiveness and Decision Sciences at NYU's Grossman School of Medicine. I hold a PhD in Materials Science and Engineering from MIT and have devoted my career to multi-scale modeling to inform public health policy. I have over 80 research publications and have made over 80 media appearances on matters at the interface of scientific research and public health policy. I currently lead Project HEATWAVE (Heat Emergency Avoidance Technologies Working to Adapt to Vulnerabilities Equitably), which aims to determine how to save the most lives from extreme heat through optimal placement of cooling shelters and other heat-reducing technologies.

**I applaud the care and attention that the City of Alameda has taken in ensuring the protection of public health** and safety through the robust environmental review that has been completed. It is reassuring that the review confirmed no measurable detriment to public health, as would be expected given the **lack of health harms** of saltwater mist compared to day-to-day pollution produced by aviation, automobiles, energy, and other sectors. The proposed experiments are also exceedingly small in magnitude compared to these day-to-day pollutants, and compared to changes in air quality associated with rising global temperatures, e.g., wildfire smoke. The conclusion that the experiments pose no public health harm is consistent with my scientific understanding.

I wish to underscore the **value of the proposed scientific studies to public health**. The studies will improve understanding how aerosols move in the atmosphere, with applications for understanding and forecasting climate change. The research will also improve mathematical

models such as mine, which policy-makers such as yourselves can use to evaluate options in the event of an extreme heat emergency. Given current trends in carbon emissions, it is likely that many millions and potentially billions of people reside in areas where heat will reach fatal levels in coming decades. The research that would come from the proposed experiments will help mathematical modelers like me **anticipate when and where heat emergencies and heat-related air quality issues are most likely**, and to **provide the most accurate possible scenario options to authorities such as yourselves** so that you can decide how best to protect the public in heat emergencies.

The proposed research will be particularly valuable **because results are planned to be made available to scientists such as myself**, as well as stakeholders across a range of disciplines, and the general public. Indeed, I would very much like for my team to visit the USS Hornet Museum to learn from the exhibit and gain a first-hand view of this important research.

Again, allow me to express strong support for this research. It is of tremendous scientific value and, given accelerations in global warming, it is of public health necessity.

A signed copy of this letter is attached for your consideration.

Sincerely,

Anna Bershteyn, PhD
Associate Professor of Population Health
Division of Comparative Effectiveness and Decision Sciences
NYU Grossman School of Medicine
New York, NY

| | |
|---|---|
| **From:** | Shelby S |
| **To:** | Trish Spencer; City Clerk; Tony Daysog; Malia Vella; Tracy Jensen |
| **Subject:** | [EXTERNAL] 7-B 2024-4063Hornet nanoparticles-- Comment--OK now send those "reports" the the appropriate agencies |
| **Date:** | Thursday, May 30, 2024 12:49:08 AM |

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Councilmembers-

Clearly you can see the nebulous-conclusions-without-data supplied by the Consultants' reports (attached to the item in support of the fake nano-particle sized artificial "Sea salt" I-swear-its-the-same-just-believe-me) supply NO INFORMATION WHATSOEVER.

WOW!!!

The City of Alameda does not have the authority to OK this Project based on the information provided--unless you are ready for a sh**load of lawsuits.

The actual legal next step for this project is to submit those "reports" to the appropriate regulatory agencies--they are the only ones who determine if a permit is needed or not.

**All projects are ALWAYS subject to the permit process from every applicable agency, until and unless the regulatory agency makes an affirmative determination that it is not.**

Period.

Shelby
510-435-9263

| | |
|---|---|
| **From:** | Trish Spencer |
| **To:** | Jennifer Ott; Yibin Shen; City Clerk |
| **Subject:** | Re: Geoengineering Our Planet"s Atmosphere Could Trigger A Vitamin D Deficiency Pandemic |
| **Date:** | Wednesday, May 29, 2024 9:08:49 AM |

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---------- Forwarded message ----------
From: Harvey Sherback <harveysherback@yahoo.com>
Date: May 29, 2024 8:49 AM
Subject: Re: Geoengineering Our Planet's Atmosphere Could Trigger A Vitamin D Deficiency Pandemic
To: Marilyn Ezzy Ashcraft <MEzzyAshcraft@alamedaca.gov>
Cc: Tony Daysog <TDaysog@alamedaca.gov>,Tracy Jensen <tjensen@alamedaca.gov>,Trish Spencer <tspencer@alamedaca.gov>,Malia Vella <MVella@alamedaca.gov>,cpakearney@sbcglobal.net,kevin@kevinkennedyllc.com

City of Alameda
Alameda City Council & Staff Members
Marilyn Ezzy Ashcraft
Mayor

May 28th, 2024

Hello Mayor Ashcraft, Alameda City Council & Staff Members,

Thanks for all that you do to create a better world for us, our children, and future generations, it's very much appreciated.

The harmful effects of Vitamin D deficiency are not well known to the general public but, in my estimation, they present one of the most important arguments to oppose the geoengineering of our planet's lower and upper atmosphere.

As you have witnessed, many geoengineers are proposing, and are actively working on, the creation of reflective aerosols to be deposited into our Earth's atmosphere. A major problem with this sunscreen concept is that it could cause a pandemic of "Vitamin D deficiency".

Currently, there are approximately one billion people who are Vitamin D deficient and approximately 35% of adults in the United States are vitamin D deficient (1). We all need Vitamin D (the sunshine vitamin) to stay healthy, especially during this time of viral infections brought on by Covid-19 and its variants (2).

Unfortunately, Vitamin D deficiency is not innocuous: it can lead to a number of debilitating problems such as Osteomalacia, which is the loss of bone density (3). This means that our bones become thin, brittle and/or misshapen causing them to bend, fracture and break. Vitamin D helps our body absorb calcium to maintain bone strength and hardness.

In addition, the lack of Vitamin D is also associated with Rheumatoid Arthritis (4) and Osteoporosis (5). Being deficient in Vitamin D makes it difficult for children to

maintain proper calcium and phosphorus levels in their bones which can lead to the onset of childhood rickets (6). At the same time, Vitamin D deficiency is implicated in the acceleration of insulin resistance (7).

Many medical research studies have shown an inverse association between an insufficient serum Vitamin D concentration and the incidence of several cancers, including breast, colorectal, kidney, lung, pancreatic, and prostate cancer. It has also been shown that Vitamin D deficiency increases the risk of breast cancer among both "pre- and postmenopausal" women (8).

According to University of California's Anthony Norman, Vitamin D, once linked to bone diseases, is now considered a major player in the overall health of the human body. He lists 36 organ tissues whose cells can be biologically impacted by Vitamin D deficiency including the colon, intestine, kidney, lung, prostate, retina, skin, stomach and the uterus (9).

A February 2018 study demonstrated that pregnant mothers are at a higher risk of developing Vitamin D deficiency and that babies born to Vitamin D deficient mothers can end up with autism as well as other schizophrenic-like disorders (10).

Other symptoms of Vitamin D deficiency are fatigue, not sleeping well, dementia, dizziness, headaches, depression, feelings of sadness, muscle weakness, achiness, loss of appetite, getting sick more often and hair loss. Additionally, Vitamin D deficiency affects our immune and cardiovascular systems as well as erectile and reproductive functions.

Georgetown University Medical Center researchers have found that sunlight, through a mechanism separate from vitamin D production, energizes T cells that play a central role in human immunity (11).

New evidence also suggests that a high prevalence of vitamin D deficiency in pulmonary TB patients is a risk factor for the development of active tuberculosis (12).

It's not just we humans that suffer from Vitamin D deficiency. The ultraviolet region of the spectrum plays an important role for many animals in their biological functions, including the metabolism of calcium.

Animals may consume plenty of calcium but, without enough Vitamin D3, the active form of Vitamin D, they cannot utilize this calcium. Unfortunately, insufficient Vitamin D levels can lead to congestive heart failure in dogs (13).

Simply put, geoengineering our planet's atmosphere could cause a lot more damage than good. This subject has to be thoroughly investigated, especially when it comes to our personal health and the well being of our loved ones.

Harvey Sherback
Berkeley, California

Footnotes:

1) Vitamin D Deficiency:

Vitamin D deficiency is a common global issue. About 1 billion people worldwide are Vitamin D deficient and approximately 35% of adults in the United States are vitamin D deficient.

https://my.clevelandclinic.org/health/diseases/15050-vitamin-d-vitamin-d-deficiency

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2) February 6, 2022 - Headline: Vitamin D Deficiency Linked With Increased COVID-19 Severity And Mortality

In a study published on February 3, 2022, in the journal "PLOS ONE", researchers from the Azrieli Faculty of Medicine of BarI-lan University in Safed, Israel and the Galilee Medical Center in Nahariya, Israel have shown a correlation between Vitamin D deficiency and COVID-19 severity and mortality.

https://scitechdaily.com/vitamin-d-deficiency-linked-with-increased-covid-19-severity-and-mortality/

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3) Osteomalacia:

Anyone who doesn't have enough Vitamin D is at risk developing Osteomalacia. The best source of Vitamin D is sunshine on skin. Some people don't get enough sunshine on their skin and this increases their risk.

https://medlineplus.gov/ency/article/000376.htm

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4) April 3, 2018 - Headline: Can Vitamin D Help Relieve Your Rheumatoid Arthritis?

Studies also have found that a lack of Vitamin D is linked to Rheumatoid Arthritis, an autoimmune disease characterized by swollen, aching joints and numbness and tingling in the hands and feet.

https://www.keckmedicine.org/blog/could-more-vitamin-d-help-relieve-your-rheumatoid-arthritis/

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5) Osteoporosis

When Vitamin D is lacking, the body cannot absorb adequate amounts of calcium from the diet to prevent Osteoporosis. Vitamin D deficiency can result from dietary deficiency, lack of sunlight, or lack of intestinal absorption of the vitamin such as occurs in Celiac Sprue and Primary Biliary Cirrhosis.

https://www.medicinenet.com/osteoporosis/article.htm

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6) Rickets In Children

Rickets is the softening and weakening of bones in children, usually because of an extreme and prolonged Vitamin D deficiency. Vitamin D helps your child's body absorb calcium and phosphorus from food. Not enough Vitamin D makes it difficult to maintain proper calcium and phosphorus levels in bones, which can cause Rickets.

https://www.mayoclinic.org/diseases-conditions/rickets/symptoms-causes/syc-20351943

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7) April 6, 2019 - Headline: Analysis Of Association between Vitamin D Deficiency And Insulin
Resistance

It was shown that Vitamin D prevents epigenetic alterations associated with insulin resistance and diabetes. In conclusion, Vitamin D deficiency is one of the factors accelerating insulin resistance formation.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6520736/

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8) Vitamin D And Breast Cancer: Latest Evidence And Future Steps

Vitamin D deficiency increased the risk for breast cancer among both pre- and postmenopausal women.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5802611/

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9) Vitamin D A Key Player In Overall Health Of Several Body Organs, Says Biochemist

Vitamin D, once linked to bone diseases, is now recognized as a major player in contributing to overall human health, emphasizes UC Riverside's Anthony Norman, an international expert on Vitamin D. He lists 36 organ tissues in the body whose cells respond biologically to Vitamin D.

The list includes bone marrow, breast, colon, intestine, kidney, lung, prostate, retina, skin, stomach and the uterus. According to Norman, Vitamin D deficiency can impact all 36 organs.

https://www.sciencedaily.com/releases/2008/10/081009162743.htm

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10) The Role of Vitamin D in Brain Health:

In this article, we will discuss how Vitamin D aids in the function of neuronal and glial tissue.

Some of the effects of Vitamin D deficiency including the development of dementia caused by the increase of cerebral soluble and insoluble amyloid-ß (Aß) peptides as well as a decrease of its anti-inflammatory/antioxidant properties by a reduction of the buffering of increased calcium in the brain.

Vitamin D deficiency in expecting mothers is linked to the development of autism and schizophrenic-like disorders, hypoxic brain injury, and other mental illnesses.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6132681/

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11) December 20, 2016 - Headline: Sunlight Offers Surprise Benefit – It Energizes Infection Fighting T Cells

Sunlight allows us to make vitamin D, credited with healthier living, but a surprise research finding could reveal another powerful benefit of getting some sun.

Georgetown University Medical Center researchers have found that sunlight, through a mechanism separate from vitamin D production, energizes T cells that play a central role in human immunity.

https://gumc.georgetown.edu/news-release/sunlight-offers-surprise-benefit-it-energizes-infection-fighting-t-cells/#

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12) Impact Of Vitamin D On Infectious Disease-Tuberculosis-A Review

Emerging evidence suggests the relation of vitamin D deficiency in establishing tuberculosis. High prevalence of vitamin D deficiency in pulmonary TB patients indicates that vitamin D is a risk factor for the development of active tuberculosis.

https://www.sciencedirect.com/science/article/pii/S235293931930017X

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13) Vitamin D Deficiency in Dogs

What happens if an animal doesn't get enough Vitamin D?

Its muscles and nerves require Vitamin D for proper functioning. Insufficient Vitamin D levels can lead to congestive heart failure in dogs, as well as an increased risk for complications due to heart disease and bone disorders.

https://www.nasc.cc/pet-university/vitamin-d-deficiency-dogs/

| | |
|---|---|
| **From:** | Kim Stanley Robinson |
| **To:** | CityCouncil-List |
| **Cc:** | Tony Daysog; Tracy Jensen; Trish Spencer; Malia Vella; Jennifer Ott |
| **Subject:** | [EXTERNAL] comment on agenda item 7-B of the June 4 City Council meeting |
| **Date:** | Wednesday, May 29, 2024 3:02:08 AM |

Dear Alameda City Council and manager,

it is good of you to consider providing a permit for the CAARE project to be conducted at the Hornet Sea, Air and Space Museum.

I am a California science fiction writer, and since publishing my novel *The Ministry for the Future* in 2020, I have been talking with people all over the world about how humanity might cope with climate change in the coming decades. These discussions include talks with people at the UN, the IPCC, the Pentagon, NASA, the Federal Reserve, NSF, and many other organization in the US and abroad. While I am not a scientist, I have had to study and learn the scientific and policy issues involved in the kind of considerations you have to make in the case before you.

My sense is that this CAARE project is a harmless experiment with no potential negative side effects for humans or the environment. While it presents no dangers, it will nevertheless provide scientists and engineers with valuable data as they do their work in trying to figure out potential solutions for future rising temperatures that could become catastrophic. The information gained from this project will be extremely valuable to them in their modeling exercises, and their ongoing judgments as to whether this is a potential solution worth investigating further.

I think it's legitimate for you all to wonder if endorsing this particular project means you are also making some more general endorsement of all similar projects, or even more global notions of "geoengineering." I don't think it does. I think you can make these important distinctions clear in how you express your approval.

The truth is that in the coming decades we are going to have to cope with climate change in many ways involving both technologies and social decisions. Learning more about possible mitigations is crucial going forward. So this CAARE project, limited in itself to harmless procedures, also has the advantage of exploring a mitigation method that is potentially very significant, while also being localized, modular, and reversible. These are qualities that aren't often attributed to geoengineering, which is thought of as global and irreversible; but it depends on the method being discussed. Clarifying these distinctions is one of the chief values of conducting this experiment; not only do we create valuable data, we also create more public awareness of the stakes involved and the possibilities we have to help get through this crisis. So it's not just an experimental project, but also an educational project; which is what your Hornet is there for.

So I recommend approval of the project, and commend you again for taking it under consideration.

yours, Kim Stanley Robinson

Kim Stanley Robinson

2414 Elendil Lane
Davis, CA 95616
kimstanleyrobinson@gmail.com
+1 530 902 2705

**From:** Dan Tell
**To:** CityCouncil-List; City Clerk; Manager Manager
**Subject:** [EXTERNAL] Public Correspondence on June 4 2024 Council Meeting Item 7-B
**Date:** Friday, May 24, 2024 12:05:37 PM
**Attachments:** Tell D Climate Change Letter.pdf

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Good day Alameda City Council and City Manager,

I wish to submit the following correspondence as public comment for the June 4 2024 City Council Meeting on Item 7-B: Recommendation to Consider Granting Landlord Consent for Small-Scale Atmospheric Sea Salt Process Studies on the U.S.S. Hornet. (Base Reuse and Economic Development 29061822)

Please find the text of my correspondence below, and attached as a pdf.

To the Alameda City Council and City Manager of Alameda:

I am writing as a concerned citizen of Alameda about the City's recent reactions to the cloud brightening experiments conducted by the University of Washington at the USS Hornet Sea, Air and Space Museum. I wish to strongly voice my support in favor of granting Landlord Consent for Small-Scale Atmospheric Sea Salt Process Studies on the U.S.S. Hornet, and express my dismay that City Management halted this experiment after it received press attention.

I have worked for over 20 years in science communication and outreach with special focus in climate science and education. In addition, I served as a lead organizer, content development chair, and day-of logistics chair for the 2017 March for Science - San Francisco, and subsequently served as president of that organization for the 2018 March for Science - Bay Area. I stand by the founding principle of those organizations and behind those marches that good policy should be informed by evidence, and the scientific process is the means to gather evidence. Like many in the science community, I recognize climate change as one of the most important scientific and policy issues of our time. I am deeply troubled by the City's negative reactive response to the cloud brightening test that resulted in the initial hold on this research.

The 1.5 degrees celsius target set by the International Panel on Climate Change has not been an achievable target by emissions reductions for much of the last decade. Current scientific estimates place the likely result of anthropogenic climate change at nearly 3 degrees celsius by the end of this century, and research has long noted that even a total cessation of greenhouse gas emissions today would still result in decades of warming due to the slow process of natural carbon sequestration and the ongoing damage of various climate feedback loops. Just last year I worked with climate activists from the Marshall Islands, who lamented that even the conservative goals will still result in a predicted 2 meter sea level rise from pre-20th century levels, completely inundating their islands, destroying their culture, and degrading the containment of the storage dome on Runit

Island which contains the radioactive waste from United States nuclear weapons tests conducted in the archipelago. This is just one small example of the widespread, dangerous effects of unmitigated climate change, which will likely include mass migrations of climate refugees, increased resource-driven conflicts, and irreversible damage to our natural world and its habitability.

Although uncomfortable for some, we are at a point where we cannot fight climate change without new, large-scale solutions that may include geo-engineering. Among the many proposed solutions, saline cloud brightening is among the least invasive, most reversible, and a great first step to management of climate by simply increasing the reflectivity of clouds. Saline cloud brightening has long been proposed as an experimental solution to climate change and its temporary effects mean any unintended consequences can be easily corrected. As your own engineering consultants from Terraphase have highlighted, this is an experiment entirely using naturally occurring substances already found in the Bay and Bay air, and amplifying an existing natural process to help combat climate change without any toxic side effects.

The last two centuries of greenhouse gas emissions since the industrial revolution have *already* geo-engineered the planet unintentionally. We cannot sit idly by with a misguided "hands-off" policy to the damage we have already wrought to this planet. Human beings and human activities have created this scenario at a pace that far outstrips any natural processes' ability to repair. It is time to use our ability to innovate to help the planet rather than continue to harm it.

The University of Washington's tests on the USS Hornet should be viewed as positive first steps and embraced by our community–especially as a low-elevation island with large amounts of land fill, we too are among the locations that will be most challenged by the ongoing effects of climate change and sea level rise. Instead of being a beacon and icon in the fight to save our Earth, we have already made ourselves an embarrassment in the scientific community, with city staff reacting to voices on social media, rather than scientists and engineers. Rather than trust in the robust work of University research review boards and the Bay Area Air and Water Districts, the City has positioned itself as the final arbiter of science and has chosen to stand in the way of progress and hope–an image that will look poor when we look back on today from the future.

Furthermore, this kind of reaction should be deeply concerning for the economic future of our city. We need to be attracting investment from science and technology firms, especially ones that can use the unique asset of the Alameda Point properties, not scaring them away with unfounded concerns and reactionary, unpredictable policy that doesn't fit an overall strategic goal. City staff's recent comments in the *New York Times* indicate the City was first contacted about this experiment in November, but did not respond or react until community complaints happened on social media as the experiment approached. This is no

way to gather community feedback, and no way for a professional city to engage in science and policy discussion.

Beyond this specific incident, I would also strongly encourage the City to reconsider how it engages with the public through social media. We have already seen the incredible damage that social media can do to good science and good policy during the COVID-19 pandemic, and I would urge the City to deeply consider more robust and balanced methods of community outreach and engagement. We already witnessed the embarrassment of the City's response to the Portola Music Festival in San Francisco, urged on by social media complaints about the Festival's volume, which the City ultimately had to walk back after its response had no legitimate grounds. I urge you as our elected representatives to help support a thoughtful, judicious, well-informed, and forward-looking city government, and not one mired in reactionary complaints.

Thank you sincerely for your time and attention,

Dan Tell

| | |
|---|---|
| **From:** | Eesha Rangani |
| **To:** | CityCouncil-List |
| **Subject:** | [EXTERNAL] Concerns Regarding Cloud Brightening Experiment at USS Hornet Museum |
| **Date:** | Tuesday, May 21, 2024 1:41:37 PM |

Respected Members of the Alameda City Council,

I am writing on behalf of the Hands Off Mother Earth (HOME) Alliance to express our concerns regarding the recent marine cloud brightening (MCB) experiment initiated by the University of Washington at the USS Hornet Sea, Air, and Space Museum.

The Hands Off Mother Earth Alliance (HOME) is a global civil society coalition providing scrutiny, education, and resistance to geoengineering. HOME has members on nearly every continent and includes the participation of scientists, environmental campaigners, Indigenous Peoples representatives, and residents of environmentally overburdened areas.

The term “geoengineering” refers to a set of proposed technologies to deliberately intervene in and manipulate Earth’s systems in an attempt to roll back some of the effects of climate change. Those interventions can take place over land, in the oceans, or the atmosphere and be aimed at removing CO2 or manipulating radiative forcing. Geoengineering technologies do nothing to tackle the root causes of climate change; they are inherently unpredictable and risk further destabilizing an already destabilized system with more and new extremes.

Techniques such as the one tested in Alameda - if ever deployed at scale - would introduce a whole host of new environmental and social risks that are likely to impact those already suffering the worst impacts of climate change the hardest. In addition, as the IPCC has confirmed, reliance on speculative and unproven technologies risks delaying action to cut greenhouse gasses in the critical decade ahead.

We fully support the Alameda City Council’s decision to halt the marine cloud brightening experiment that was begun in nearby San Francisco Bay. While we understand that the unregulated nature of the project has jurisdictional implications for those who, like the members of this Council, are at the frontlines of ensuring the safety of your city and the health of the people who live and work in it, we would like to share with you some of the additional risks of scaled-up marine cloud brightening attempts.

While the Alameda experiment is designed to be carried out at a small scale for now, the intent of such geoengineering technologies is ultimately to manipulate the climate at a global scale. No computer models could ever predict with absolute certainty the real impacts of such intervention—the only way to test their climate impact would be to deploy them, putting ecosystems and millions of human lives at risk.

The following risks are among those associated with marine cloud brightening at scale:

- Altering of the land-sea temperature gradient will influence regional climatology and shift rainfall patterns. Modeling has shown that this could exacerbate drought or hurricanes, often far from the deployment site (Stjern et al. 2017).
- It would significantly increase salt density in clouds, while its deposition would be uncontrollable. Greater salt loads that fall on land would corrode infrastructure, pollute waterways, and harm the productivity of agricultural lands (Russell et al., 2013; Muri et al., 2015).
- Pumping, filtration, and spraying of vast quantities of seawater would be required in larger marine cloud brightening operations. Such extraction would kill significant numbers of marine organisms, including fish larvae, thereby additionally impacting the fishing industry (CaliforniaWaterBoards, 2010; Nielsen et al., 2024).

In light of these risks and the broader transboundary and global implications of marine

cloud brightening, we call on the Alameda City Council to put an end to the experiment on the USS Hornet Museum and put in place legislation to prevent further such outdoor experiments from taking place in your jurisdiction. Allowing the experiment to take place would risk putting us on a slippery slope toward the development and deployment of this technology while also serving to legitimize these highly controversial climate manipulations.

As civil society experts, we echo the state parties to the London Convention / London Protocol who last year stated in relation to four key categories of marine geoengineering (including marine cloud brightening) that "there is considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean," and expressed concern about "the potential for deleterious effects that are widespread, long-lasting or severe." We also call to respect and protect the *de facto* moratorium on geoengineering under the Convention on Biological Diversity (CBD), in place since 2010.

We would be happy to discuss any of the concerns we raise in this communication with you, as well as any others you may have. Please do not hesitate to contact us.

Sincerely,

--

Eesha Rangani

*Pronouns: she/her/hers*

**Marine Geoengineering Working Group Coordinator**

**The Hands Off Mother Earth! (HOME) Alliance**

**Website | LinkedIn | Twitter | Facebook**

Geoengineering Monitor website: www.geoengineeringmonitor.org
Interactive World Map: www.map.geoengineeringmonitor.or

**From:** Christopher Michael Baehr
**To:** CityCouncil-List
**Subject:** [EXTERNAL] Support for Marine Cloud Brightening Research
**Date:** Friday, May 17, 2024 1:42:19 PM

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To the City of Alameda,

I write in support of allowing the University of Washington's marine cloud brightening research project (MCBP) to continue on the U.S.S. Hornet. While I understand the City's safety concerns, this valuable scientific research should be allowed to proceed with proper oversight.

Per my understanding, the MCBP team uses small quantities of sterile aquarium-grade sea water, posing little risk of environmental contamination/ill effects. With monitoring and the ability to quickly halt operations if needed, this experiment should be allowed to continue to further our understanding of marine cloud brightening.

Climate change is an existential threat. Marine cloud brightening could help reduce global temperatures by reflecting more sunlight, but its feasibility and impacts require responsible study first. The MCBP is conducting vital research as part of identifying potential solutions to the climate crisis.

I recently connected with the MCBP team, who presented their work and answered community questions at the Woodstock Homes Cooperation Earth Day event, demonstrating their commitment to public outreach, which I hope will continue in the city of Alameda.

I urge the City to allow this research to proceed after evaluating any reasonable additional precautions. The city of Alameda should support the pursuit of multiple approaches like emissions reductions and studying interventions like marine cloud brightening. I support advancing this critical scientific inquiry.

Thank you for your consideration

Christopher M. Baehr, PhD
Postdoctoral Scholar | Wilson Lab
Email: cmbaehr@berkeley.edu
Phone: 614-564-7224

**From:** Lisjan Nation
**To:** City Clerk
**Subject:** [EXTERNAL] City Council Meeting Re: Cloud Brightening Study Presentation
**Date:** Friday, May 17, 2024 12:43:28 PM

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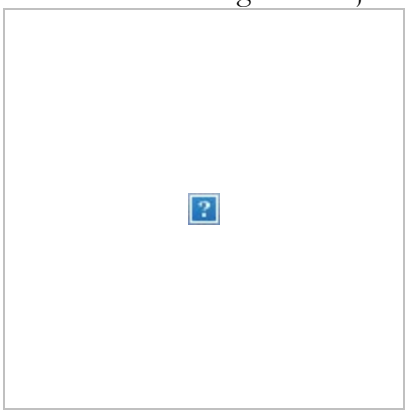
Hello,

We are interested in learning more about the cloud brightening study that was being conducted on the USS Hornet, as this area is within the Tribal territory of the Confederated Villages of Lisjan Nation. We were unable to find specific information on the website about when the City Council meeting on this issue will take place, so if you could let us know when this is scheduled, we would greatly appreciate it. We hope to attend the presentation and learn more.

**'Uni (Respectfully),**

***Lucy Gill, Cultural Resource Manager II***
Confederated Villages of Lisjan Nation



**From:** Edwards, Anthony
**To:** City Clerk; Manager Manager
**Subject:** [EXTERNAL] Urgent: City of Alameda halts marine cloud brightening experiment
**Date:** Sunday, May 12, 2024 3:04:12 PM

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Dear city of Alameda,
I am sorry to have to contact you on Mother's Day, but wanted to let you know that the Chronicle will be publishing a story this afternoon about the City of Alameda halting the marine cloud brightening experiment atop the USS Hornet.
https://www.facebook.com/cityofalameda/posts/pfbid0e86yfsZqoEZBCzHMorkHoz6nRvRmhrKZ7QEaruP9YzjgPT3awEBQ16qxCU1cNwoVl

I am wondering if city council will vote to resume the experiments in June after the public comments, or when voting might take place. What is the timeline for experiments to resume?

I would appreciate adding this information to the story.

Thank you very much.

Anthony Edwards
Newsroom Meteorologist, San Francisco Chronicle
anthony.edwards@sfchronicle.com
(425) 622-7968