

Public Comment from Friends of the Earth U.S. and Center for Biological Diversity

November 19, 2024

NOAA/National Oceanic and Atmospheric Administration
1401 Constitution Avenue NW, Room 5128
Washington, DC 20230

Submitted via [regulations.org](https://www.regulations.org).

Docket ID: [NOAA-OAR-2024-0091-0002](https://www.regulations.org/docket/NOAA-OAR-2024-0091-0002)

Re: Petition for Rulemaking: Maintaining Records and Submitting Reports on Weather Modification Activities

Executive Summary

The Weather Modification Reporting Act of 1972 (the “Reporting Act”) requires that no person may engage in any weather modification activities unless they have filed required reports with the Secretary of Commerce, which has delegated this responsibility to the National Oceanic and Atmospheric Administration (NOAA). The Reporting Act defines weather modification activities broadly as “any activity performed with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere.”

At the time it was enacted, this definition primarily encompassed cloud seeding activities: attempts to increase rainfall, increase snowfall, dissipate fog, or mitigate hail damage. In recent years, however, a broad range of geoengineering technologies have been proposed, tested, and even deployed with the stated goal of reversing negative impacts of climate change. Virtually all geoengineering technologies, which are traditionally divided into Greenhouse Gas Removal (GHGR) and Solar Radiation Modification (SRM), clearly fall under the Reporting Act’s definition of weather modification activities. Both GHGR and SRM activities attempt to alter Earth’s radiative balance, and thereby to cool surface temperatures by modifying the composition, behavior, and dynamics of the atmosphere.

However, in recent years many geoengineering activities have been conducted in the United States without filing weather modification reports with NOAA, in violation of the law. NOAA’s reporting forms still reflect an assumption that all weather modification activities are some form of cloud seeding, and the regulatory guidance for the Reporting Act ([15 CFR part 908](https://www.ecfr.gov/current/title-15/chapter-I/subchapter-B/part-908)) does not explicitly state that geoengineering is a form of weather modification.

Dangerous geoengineering technologies such as SRM and marine Carbon Dioxide Removal (mCDR), while largely experimental and at early stages of development, carry extraordinary

potential risks and should be prohibited at the national level. In the absence of such regulation, transparency around geoengineering activities is crucially important.

In our Comment below, Friends of the Earth U.S. and Center for Biological Diversity call on NOAA to:

1. Update regulations in [15 CFR part 908](#) to explicitly require that people conducting any geoengineering activities (including both GHGR and SRM) must file weather modification reports prior to conducting the activity, and these reports will be made easily accessible to the public;
2. Clarify that all activities conducted with the *intent* to modify the atmosphere - as required by the underlying statute - must file weather modification reports, regardless of the scope, effectiveness, duration, or impacts of the activity;
3. Clarify that weather modification activities must be reported to NOAA if any stage of the activity is conducted within or creates impacts on a U.S. jurisdiction, including the sourcing of materials through deployment, and inclusive of weather modification activities conducted by U.S. citizens or from U.S.-flagged vessels and aircraft anywhere in the world;
4. Update NOAA's reporting forms to reflect the broader range of weather modification activities currently being conducted in the U.S., and collect more detailed information about geoengineering activities, which generally carry much greater risks than cloud seeding;
5. Increase compliance and enforcement efforts, including the creation of a form where members of the public can report unauthorized weather modification activities for further investigation;
6. Not pursue a broader regulatory framework. While there is a desperate need in the United States for law prohibiting the use of potentially dangerous geoengineering technologies, we do not see any underlying statute that would empower NOAA to undertake a regulatory or permitting regime for geoengineering activities, including the National Weather Modification Policy Act of 1976.

In sum: a growing number of geoengineering activities are taking place in the United States with little to no public transparency, and the potential for significant harm to our environment, our public health, and human rights. The Weather Modification Reporting Act of 1972 was created precisely to establish transparency over intentional efforts to modify the atmosphere, such as geoengineering. Regulatory guidance for the Reporting Act should be updated to explicitly require transparent reporting on all geoengineering activities conducted in the U.S., regardless of their scope or other characteristics, and enforcement and compliance by NOAA should be increased.

Introduction

In 1972 Congress passed "[An Act to provide for the reporting of weather modification activities to the Federal Government](#)" (the "Reporting Act") which established that "**No person may**

engage, or attempt to engage, in any weather modification activity in the United States unless he submits to the Secretary [of Commerce] such reports with respect thereto, in such form and containing such information, as the Secretary may by rule prescribe” [emphasis added]. Cloud seeding was the primary weather modification activity that was widely conducted at the time with the goal of increasing rain, increasing snowpack, dissipating fog, or mitigating damage from hail, but Congress defined the scope of weather modification based on standard definitions of the weather to encompass “any activity performed with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere” - **a definition based on intentions, which notably remains neutral on the effectiveness, scope, duration, or impacts of the activities.**

More than 50 years later a wide array of geoengineering technologies, at various stages of development and deployment, have emerged as novel forms of weather modification. Geoengineering technologies aim to manipulate Earth’s climate systems on large global scales with the goal of addressing the impacts of climate change. While the range of geoengineering technologies is very diverse, almost all are intended to artificially change the composition, behavior or dynamics of the atmosphere. While most geoengineering activities clearly fall under the Reporting Act’s definition of weather modification, many of these activities have been conducted without submitting the required reports to the National Oceanic and Atmospheric Administration (NOAA), in violation of the law and without facing enforcement measures. In many cases companies are selling carbon credits or so-called “cooling credits” specifically for their impact on atmospheric dynamics – which could not be a more clear indicator of their intentions – without filing weather modification reports.

Geoengineering technologies represent an extraordinary threat to ecological systems, food security, and human rights. Solar geoengineering, if deployed at levels that could restore atmospheric temperatures to pre-industrial levels, could create potentially catastrophic side effects on the planet such as [reducing monsoon rainfall over Asia and Africa](#) threatening the food supply of two billion people, further [eroding the ozone layer](#), increasing the [risk of malaria for over one billion people](#), or [reducing rainfall over the Amazon](#). [Marine geoengineering approaches](#) would have to be conducted over vast areas of the ocean to have any impact on the climate, and would dramatically disrupt marine ecosystems and biodiversity, impacting the more than 3 billion people whose livelihoods depend on the sea.

These extraordinary risks have increasingly been recognized in international climate treaties, and placed under moratorium or prohibitions. The U.N. Convention on Biological Diversity (CBD) has since [2010 established a moratorium on all geoengineering deployments](#), resolving “that no climate-related geo-engineering activities that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, with the exception of small scale scientific research studies that would be conducted in a controlled setting.” The Parties to the CBD voted to re-affirm and strengthen the language of this geoengineering moratorium at COP16 this year. The London Convention/London Protocol (LC/LP) treaty on ocean pollution and dumping has also

established a prohibition on ocean fertilization - one approach to marine geoengineering - and has [encouraged countries to apply the same prohibition on other marine geoengineering technologies](#), as every technology they have examined “has the potential for deleterious effects that are widespread, long-lasting or severe; and there is considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean.” The LC/LP also makes an exception for legitimate scientific research that has passed a rigorous pre-screening assessment to protect the ocean environment.

Given these risks, we believe the United States desperately needs a non-use policy on geoengineering that would prohibit private or public actors from deploying technologies with the potential for significant harm. However, we do not find that NOAA has the statutory authority to establish any form of regulation of geoengineering research. Instead, NOAA should fully enforce the transparency requirements of the Reporting Act.

Friends of the Earth U.S. and Center for Biological Diversity urge that [15 CFR part 908](#) should be updated to reflect the proliferation of novel weather modification activities. The information collected on such activities should also be updated, and enforcement mechanisms improved given the high stakes of geoengineering technologies.

Based on the underlying statute, Friends of the Earth U.S. and Center for Biological Diversity call on NOAA to:

(1) Clarify the scope of weather modification activities subject to reporting requirements.

Section overview in brief:

- All geoengineering activities, including Greenhouse Gas Removals and Solar Radiation Modification, clearly meet the Reporting Act's criteria as "weather modification activities"
- NOAA should update the regulations in [15 CFR part 908](#) to make clear that anyone conducting geoengineering activities must file weather modification reports prior to and after carrying out those activities
- Current regulations state that "[m]odifying the solar radiation exchange of the earth or clouds, through the **release** of gases, dusts, liquids, or aerosols into the atmosphere" is a form of weather modification - this language should be updated to include activities that modify the solar radiation exchange through the **removal** of gases, dusts, liquids, or aerosols as well
- The Reporting Act's criteria for whether an activity is weather modification hinges on the intentions of the people carrying out the activity, which creates areas of ambiguity where multiple intentions are present, or where intentions may not have been publicly disclosed
- The language of the underlying statute points towards a broad scope, including all activities where one of the intentions is weather modification
- To avoid the potential for hidden or obscured intentions, we recommend that NOAA assign intent to a list of core geoengineering activities that will be presumed to have the intention of weather modification.

All Solar Radiation Modification (SRM) clearly falls under the definition of weather modification activities as described in the underlying statute, as well as in the current regulations, and must be reported. All SRM activities are intended to alter Earth's radiative balance, and therefore to modify atmospheric dynamics. Indeed, in the past year several SRM activities have been reported to NOAA as weather modification activities for the first time.

However, reporting requirements cannot be limited to a small subset of SRM activities such as stratospheric aerosol injection and marine cloud brightening. We would emphasize that there is a much broader range of climate interventions (or geoengineering) that clearly meet the criteria for weather modification activities, and must also be reported according to the underlying statute. Here we review the broad categories of such activities, and the application of the Reporting Act's definition of weather modification to each:

Greenhouse Gas Removal (GHGR) Activities

The most common of these is Carbon Dioxide Removal (CDR) activities, which seek to remove carbon dioxide (CO₂) from the atmosphere. CO₂ is a greenhouse gas that prevents longwave radiation from escaping earth's atmosphere, warming the planet and having other impacts such

as ocean acidification. Most CDR activities are clearly conducted “with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere” as their primary goal is changing the chemical composition of the atmosphere. The current regulatory guidance under [15 CFR part 908](#) explicitly extends reporting requirements to activities “[m]odifying the solar radiation exchange of the earth or clouds, through the release of gases, dusts, liquids, or aerosols into the atmosphere” (which would encompass most solar geoengineering) but **omits activities that modify the release of longwave radiation from Earth’s atmosphere through the removal of gases, dusts, liquids, or aerosols. We would recommend that NOAA revisit this regulatory language for clarity**, as the underlying statute does not draw a distinction between different methods of atmospheric modification (whether through additions or removals, or targeting incoming solar radiation or outgoing longwave radiation). However, the existing regulations also state that “In addition to the activities listed above, other similar activities falling within the definition of weather modification as set forth in [§908.1](#) are also subject to reporting,” which is sufficient to require that most CDR activities be reported as weather modification activities.

Given that the Reporting Act’s definition of weather modification activities hinges on intentions, one area of ambiguity arises in determining whether a CDR approach qualifies as a weather modification activity if CDR is one of several intended impacts of an intervention. This may be the case, for example, with afforestation/reforestation projects, which may be conducted with an intent to restore natural beauty, recreate sanctuaries for animal life, or protect biodiversity, in addition to CO₂ removal. The language of the Reporting Act points towards a fairly expansive interpretation of such ambiguous cases, if modification of the atmosphere is a clear intention (even if it isn’t the sole or the primary intention). CDR activities that are conducted for the sale of carbon credits should be considered *de facto* weather modification, since the basis of these sales is the incremental modification of atmospheric dynamics.

Another area of ambiguity arises from technologies often referred to as “carbon capture” that attempt to capture CO₂ at an emissions site, such as a factory or power plant, before it is emitted into the atmosphere. Such activities may be conducted with an intent to *prevent modification of the atmosphere* as a side-effect of human activities, rather than with an intent to modify the atmosphere directly. Carbon capture, therefore, although it may have similar impacts as approaches that remove CO₂ from the atmosphere, may be exempt on the basis of intentions.

Most categories of CDR, however, are typically conducted with the primary intention of atmospheric modification. These include terrestrial methods such as direct air capture, enhanced weathering, and the creation of biochar from biomass, as well as most marine CDR methods such as ocean fertilization, ocean alkalinity enhancement, biomass sinking, and artificial upwelling.

The Petitioners rightly highlight proposed experiments in [Atmospheric Methane Removal \(AMR\)](#) - a close but less developed cousin to Carbon Dioxide Removal - as another category of climate intervention clearly subject to reporting, and we would add to this list any activities designed to

remove other greenhouse gases from the atmosphere - in addition to CO₂ and methane - such as [nitrous oxide](#) or [halocarbons](#).

Solar Radiation Modification (SRM) Activities

SRM activities attempt to reflect solar radiation away from the Earth, and thereby to alter Earth's radiative balance and have a cooling effect on surface temperatures. Both the intended effects and the likely side-effects of SRM (such as altering precipitation patterns) involve altering atmospheric dynamics.

With regards to reporting of SRM activities, the Petitioners focus on Stratospheric Aerosol Injection (SAI) and Marine Cloud Brightening (MCB). However, there is a broader range of SRM approaches - including some that have moved to the field experiment or deployment phases - that are also aimed at altering Earth's radiative balance, and therefore artificially modifying the atmosphere.

Among these are a wide variety of [Surface Albedo Enhancement \(SAE\) techniques](#), which range from [painting rooftops white](#) and [genetically modifying crops](#) to have a lighter color, to the deployment of reflective glass [microbeads on arctic ice surfaces](#) or [microbubbles floating on ocean waters](#). SAE activities would clearly be subject to reporting requirements under [NOAA's current regulatory guidance](#), which includes any activities "Modifying the characteristics of land or water surfaces by dusting or treating with powders, liquid sprays, dyes, or other materials" as "Activities subject to reporting." **Although "land or water surfaces" may be inclusive of all ice cover, we would recommend that NOAA explicitly extend this guidance to include modification of ice (and all other) surfaces for clarity.** Multiple field trials of ice-based surface albedo enhancement have been conducted in the United States without submitting weather modification reports. These include experiments conducted by Ice911 (later the Arctic Ice Project) in [Alaska](#), [California](#), and [Minnesota](#).

There are additional areas of ambiguity introduced by the inclusion of SAE, though. For example, New York City has a ["CoolRoofs" program](#) that applies white, reflective surfaces to rooftops in the City. The stated goal of the program is to reduce temperatures in the underlying buildings, and thereby to reduce energy demand for air conditioning. The program's website does not characterize it as an SRM activity designed to affect Earth's radiative balance, even though painting rooftops white is a common SRM proposal. A very similar surface albedo enhancement program, ["Mirrors for Earth's Energy Rebalancing"](#) based in California, also installs reflective surfaces on rooftops (often mirrors), but with the explicit stated goal of cooling the Earth. This is an area where the intention-based criteria of the Reporting Act creates implementation challenges, since identical activities may or may not trigger the criteria depending on the stated and implied goals of the people carrying out the activity.

Lastly, there are several proposed techniques that are often categorized as Solar Radiation Modification that instead of reflecting solar radiation back into space, are designed to allow more longwave radiation to escape Earth's atmosphere - similar in a way to Greenhouse Gas

Removal approaches. This category of techniques includes [Cirrus Cloud Thinning \(CCT\)](#) and [Stratospheric Dehydration](#), which are currently in early stages of conceptual development. These interventions would unambiguously qualify as weather modification activities as well.

Clarifying Intention-Based Reporting Criteria

To ensure that NOAA gathers all pertinent data on the full range of geoengineering projects (including both Greenhouse Gas Removals and Solar Radiation Modification), and to prevent the creation of perverse incentives for people conducting weather modification activities to hide their intentions from the public, **we suggest that NOAA proactively assign intent to the key categories of geoengineering activity** including, at minimum, the following:

- Any activity conducted for the sale of carbon credits or “cooling credits”
- All greenhouse gas removals from the atmosphere
- Injection of any reflective materials into the atmosphere (inclusive of stratospheric aerosol enhancement and marine cloud brightening)
- Surface albedo enhancement

Assigning presumed intent to core geoengineering approaches would create clarity for the vast majority of people conducting weather modification activities, and outlier activities not falling into one of these categories would need to be reviewed on a case-by-case basis, based on the criteria of the Reporting Act and the updated regulatory guidance.

(2) Require reporting of all weather modification activities, regardless of scale and without categorical exclusions, and make data available to the public

Section overview in brief:

- The language of the Reporting Act requires that all activities conducted with the intention to modify the atmosphere must be reported. This statutory language does not make exceptions for the scope, scale, or impacts of an activity, or allow for categorical exemptions from reporting
- Many geoengineering activities would have a cumulative impact on the atmosphere, and indeed some are designed to impact the atmosphere through a large number of small-scale interventions. This is an additional reason that the scale and scope of activities should not potentially exempt them from reporting requirements
- The regulations in [15 CFR part 908](#) currently exempt several categories of “local” activities from reporting, including lightning discharge devices, fans, heat sources, and frost-prevention. None of these categories of activity are conducted with the intent to modify the atmosphere, and so these exemptions should be removed from the regs

In its Request for Information, NOAA asks for public comment on “the spatial scale of weather modification experiments and their intended effects for which NOAA should request in submitted reports.” The Reporting Act very clearly defines weather modification activities based on the intentions of the people conducting the activity, and not on the scale or impacts of the activity.

Many geoengineering methods are intended to be scaled up on a highly decentralized basis - this is particularly true for Greenhouse Gas Removal techniques such as CDR. Most proposals for reaching climate-relevant levels of CDR do not envision centralized deployment under a small number of large-scale projects, but rather thousands if not millions of local CDR projects across the globe. While none of these decentralized activities in isolation may have measurable impacts on global atmospheric dynamics, it is often verifiable that CO₂ is being removed from the atmosphere, and the activities are being conducted with the sole intention of contributing to a growing number of CDR activities that will incrementally induce changes in atmospheric dynamics.

Although currently the majority of Solar Radiation Modification researchers envision future deployment scenarios being coordinated by national or international governance structures, there are [already today commercial SRM enterprises, such as the company Make Sunsets, selling “cooling credits”](#) that embrace a more decentralized, scale-up approach similar to what we see in the CDR deployment space. These SRM deployments-for-sale are being conducted without any meaningful monitoring or verification, with disingenuous to outright fabricated promises of small releases of sulfur dioxide having a similar impact as planting millions of trees. Regardless of the integrity (or lack thereof) of proponents, a large number of small-scale SRM activities would also have a cumulative impact on the atmosphere, making tracking important regardless of the scale or scope of deployments.

Additionally, public interest in weather modification should not be limited by the potential impact of reportable weather modification activities. Cloud seeding - the original weather modification activity that was the focus of the Reporting Act - is a case in point. It was the case in the 1970s, as it is today, that there is no scientific consensus that cloud seeding is effective at increasing precipitation, snow, or any other desired or undesired outcome. Natural variations in the behavior of clouds and cloud systems are so large that it is difficult to establish controls or demonstrate cause and effect. This is, as evidenced in the record, why Congress established only a reporting regime for weather modification and never implemented a regulatory regime. In its [1979 report to the President and Congress on “National Weather Modification Policies & Programs.”](#) the Secretary of Commerce reported that, although weather modification has the potential for impacts that cross state and national boundaries, there is no “final scientific proof” that it actually works and “there is no need for the Federal Government to adopt a comprehensive legal regime for weather modification at this time. The private industry is small (less than \$6 million in gross annual contracts), and operations are generally localized within state boundaries and do not create major risks.”

The public interest in tracking geoengineering activities cannot therefore be limited to the scale, scope, or impact of each individual activity, but must additionally track the

cumulative efforts of activities small and large across the U.S., just as all cloud seeding activities are required to file reports regardless of their scale, scope, or impact.

The current regulatory guidance ([15 CFR part 908](#)) for compliance with the Reporting Act includes a curious categorical exemption from reporting requirements:

“The requirement for reporting shall not apply to activities of a purely local nature that can reasonably be expected not to modify the weather outside of the area of operation.

This exception is presently restricted to the use of lightning deflection or static discharge devices in aircraft, boats, or buildings, and to the use of small heat sources, fans, fogging devices, aircraft downwash, or sprays to prevent the occurrence of frost in tracts or fields planted with crops susceptible to frost or freeze damage. Also expected [sic] from the requirement for reporting are religious activities or other ceremonies, rites and rituals intended to modify the weather.”

[emphasis added]

Setting aside the language exempting religious activities and other ceremonies, rites and rituals, the remainder of this exception is curious because none of the activities explicitly exempted - lightning deflection/discharge, ground-level heating, or defrosting - are performed with the intention of modifying the atmosphere. There are thousands of activities that people conduct on a daily basis that have the effect of modifying the atmosphere - such as driving cars, heating homes, eating meat, landscaping of private property, and so on - but they are not *intended* to modify the atmosphere. They are *intended* to carry us to and from work, maintain safe temperatures at home, enjoy our favorite cuisines, beautify scenery, and so on. Even if we are aware that these activities impact the atmosphere, that side-effect is not our intent. Therefore, we do not believe that activities clearly *intended* to protect buildings from lightning damage, or *intended* to protect crops from frost damage, need to be categorically excluded in regulations, since they are no different from the thousands of other daily activities that impact Earth’s atmosphere as a side-effect. **It is not the “purely local nature” of these activities that exempts them, but rather the absence of intentionality.**

We believe there should be no categorical exclusions for local or small-scale weather modification (which, as discussed above, can have cumulative impacts on the atmosphere); the criteria established in the Reporting Act is clear and does not warrant categorical exclusions. This information should be promptly shared on a public-facing website, such as [NOAA’s Weather Modification Project Reports page](#). That page should be easy to navigate and sort by category of weather modification activity, with advanced search functions.

(3) Clarify the jurisdiction of reportable weather modification activities

Section overview in brief:

- The Reporting Act applies to all weather modification activities conducted “within the United States.”
- Based on extensive precedent, the regulations should make clear that this applies to:
 - Activities conducted in the U.S. exclusive economic zone or from U.S. registered/flagged vessels or aircraft
 - Activities conducted by a U.S. citizen or other persons otherwise subject to U.S. jurisdiction
 - Activities that may reasonably cause effects within the United States
 - Activities that involve the transport of materials from the United States for the purpose of weather modification

Petitioners have asked that NOAA clarify in regulation the scope of weather modification activities that are considered to take place “within the United States.” Specifically, Petitioners argue that regulations should clarify that the Reporting Act’s jurisdiction extends to 1) activities conducted in the U.S. exclusive economic zone or from U.S. registered/flagged vessels or aircraft, 2) activities conducted by a U.S. citizen or other persons otherwise subject to U.S. jurisdiction, and 3) activities that may reasonably cause effects within the United States.

We would suggest a fourth consideration: activities that involve the transport of materials from the United States for the purpose of weather modification. “Weather modification activity” should be inclusive of the entire process of weather modification, from the sourcing of materials, through deployment, and potential subsequent impacts, any stage of which occurring within U.S. jurisdiction should be subject to reporting.

Although the underlying statute relies on different jurisdictional language, we believe a helpful model is the [Environmental Protection Agency \(EPA\)’s newly established permitting regime for marine carbon dioxide removal activities under the Marine Protection, Research and Sanctuaries Act \(MPRSA\)](#). The EPA has clarified that MPRSA permits are required for any marine CDR activities conducted by:

- “Anyone transporting material from the United States for the purpose of dumping it into ocean waters.
- Anyone in a vessel or aircraft registered in the United States or flying the United States flag transporting material from any location for the purpose of dumping it into ocean waters.
- Any United States department, agency or instrumentality transporting material from any location for the purpose of dumping it into ocean waters.
- Any other person dumping material transported from a location outside the United States into the territorial sea of the United States, or into a zone contiguous to the territorial sea

of the United States, to the extent that it may affect the territorial sea or the territory of the United States.”

Because so many proposed marine CDR activities take place in international waters, the EPA’s regulations are particularly sensitive to U.S. jurisdiction in boundary cases. Novel geoengineering approaches, because they are often conducted at very high altitudes or at sea, are similarly much more likely than cloud seeding to involve boundary situations in which one but not all phases of the activity take place within the United States. Clarifying the jurisdictional reach of the reporting requirements is therefore important.

(4) Update reporting requirements to reflect the proliferation and diversity of weather modification activities

Section overview in brief:

- The reporting forms that NOAA currently provides for filing weather modification reports are limited to collecting information relevant to cloud seeding
- New reporting forms should be developed for Greenhouse Gas Removal activities and Solar Radiation Modification activities, collecting information specific to those categories of weather modification
- Because geoengineering activities carry substantially higher risks than cloud seeding, there is a public interest in collecting information related to those potential risks
- We suggest a range of information to collect related to the methodology, materials, scope, impacts, outcomes, and compliance with local, state, and federal laws of GHGR activities, SRM activities, or both

Petitioners have likewise suggested that NOAA collect additional information on Solar Radiation Modification (SRM) activities. Updating the reporting forms to reflect the new, more diverse range of weather modification activities is essential, as the current Initial ([NOAA Form 17-4](#)), Interim ([Form 17-4A](#)), and Final (also [Form 17-4A](#)) reporting forms are designed exclusively for cloud seeding operations. In the case of some Greenhouse Gas Removal (GHGR) and some SRM approaches, for example, questions about the “modification agents” used and their dispersal rates make no sense.

Geoengineering technologies are fundamentally different from cloud seeding activities in that they have the potential for much larger atmospheric impacts as well as side-effects on public health, land and ocean ecologies, commercial activities, and even national security. The Reporting Act gives the Secretary of Commerce (and by extension NOAA) carte blanche in determining what information to collect from persons engaging in weather modification activities, and it is in the public interest to collect a new range of relevant information about geoengineering activities.

NOAA's charge of maintaining a record of weather modification activities is particularly important when it comes to geoengineering projects, which are often publicly contentious and have led some researchers to state that [they plan to conduct future experiments in secret](#), or [with minimal public notice](#). For technologies with inadequate to non-existent federal controls, and the potential for major impacts, establishing a norm of public transparency is a minimum necessary first step, and one that the Reporting Act was created for.

Given the significant differences between cloud seeding, SRM, and GHGR activities, we would recommend either the use of separate reporting forms for each category, or a combined form with discrete sections for category-specific questions.

While there is no conclusive scientific evidence that cloud seeding results in positive or negative impacts, and individual trials that have shown positive results have generally found marginal impacts on weather, the emerging research on SRM and GHGR techniques show much larger potential impacts. As a consequence, there is a strong public interest in greater transparency and more detailed information about SRM and GHGR activities.

Below, we suggest three areas of information (A, B, and C) specific to SRM or GHGR activities (or both), which we feel are important for the public interest and, just as important, for tracking the extent and nature of climate interventions in the United States.

A) Information About Methodology, Materials, and Scope

- Given the diverse range of climate intervention technologies, we would suggest an open-ended question asking for a description of the methodology to be used. [Applicable for SRM and GHGR activities]
- Does the proposed activity involve the storage or transportation of any [Criteria Air Pollutant](#), [Hazardous Air Pollutant](#), [Toxic Pollutant](#), [Priority Pollutant](#), or [Hazardous Material](#)?
 - If so, does the proponent have a hazardous materials management plan?
 - If so, does the proponent have a Spill Management Plan in the case of an accidental spill, leak, or release?
 - If so, has the proponent purchased 3rd party insurance in the case of an accident or spill?
- Has the proponent conducted or are they intending to conduct a life-cycle analysis of greenhouse gas emissions and other environmental impacts of the activity, including supply-chain impacts? [Applicable to GHGR activities]
- Is the proponent conducting monitoring before, during, or after the weather modification activity? [Applicable to SRM and GHGR]
 - If so, describe what variables are being monitored, and at what stage of the activity.
- Is the proponent contracting 3rd party verification of the outcomes of their activity?
 - If so, what variables are being verified and by whom? [Applicable to SRM and GHGR activities]

B) Information About Impacts and Outcomes

- Has the proponent conducted an environmental impact assessment (EIA)? [Applicable to SRM And GHGR activities]
 - If so, attach the EIA.
- Are there any potential negative environmental impacts from the activity?
 - If so, describe the potential impacts as well as any mitigation efforts.
- Will monitoring data be made publicly available after conclusion of the activity? [Applicable to SRM and GHGR activities]
 - If not, under what justification?
- Is the proponent intending to submit results of the activity for peer-reviewed publication, or collaborating with researchers with that intent? [Applicable to SRM and GHGR activities]
- How much estimated solar energy will be/was screened by the activity? [Applicable to SRM]
- What quantity of which greenhouse gases are estimated to be/have been sequestered by the activity, and with what durability? [Applicable to GHGR]

C) Information About Compliance with Local, State, and Federal Law

A broad range of local and federal statutes are potentially applicable to geoengineering activities, and weather modification reports have the potential to screen activities for compliance - if not directly by NOAA, then indirectly through public scrutiny:

1. **Ownership of deployment area:** we support the Petitioners' suggestion that NOAA collect information on the ownership of deployment areas as well as other territory that may be impacted. Private and public property owners may have rights over the deployment of weather modification activities on or above their property, or that impacts their property. [GHGR, SRM]
2. **State weather modification control laws:** twenty-three states and the U.S. Virgin Islands have enacted [weather modification control laws](#), which may apply to some or all of the weather modification activities that fall under the Reporting Act. Most of these state laws require licensing of qualified operators and/or issuance of permits in order to conduct such activities. Information should be collected on whether the reported activity requires and has obtained state-level approval or oversight. [Applicable to GHGR, SRM]
3. **MPRSA and Clean Water Act NPDES permits:** the EPA has established [a new permitting regime](#) for marine Carbon Dioxide Removal (mCDR) and marine Solar Radiation Modification (mSRM) activities that involve the deposition of any materials into marine waters - this may include land-based climate interventions that result in runoff of materials into marine waters. Weather modification reports should ask whether the reported activity involves the deposition of any materials into marine waters, and if so whether they have received an MPRSA or an NPDES permit for the activity. [Applicable to cloud seeding, GHGR, SRM]

4. **Compliance with other relevant federal laws:** A broad range of federal statutes - beyond the MPRSA and Clean Water Act - potentially apply to geoengineering activities, depending on their methodology, materials used, location, and scale. These include the Clean Air Act, the Endangered Species Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, Federal Land Policy and Management Act, the National Forest Management Act, the Coastal Zone Management Act, the National Environmental Policy Act, the Magnuson-Stevens Fishery Conservation and Management Act, the Marine Mammal Protection Act, the River and Harbors Act, and others.¹ We urge NOAA to closely analyze the applicability of and compliance with these laws, and potentially others that may apply.

(5) Improve compliance and enforcement

Section overview in brief:

- The Reporting Act grants the Secretary of Commerce (by extension NOAA) the power of subpoena, and imposes up to a \$10,000 fine on anyone “knowingly and willingly” violating the Act’s reporting requirements
- NOAA has not historically prioritized enforcement actions, given high compliance rates and scientific uncertainty about whether cloud seeding is effective
- Geoengineering activities carry much higher risks and are widely being conducted in violation of the Reporting Act, and therefore enforcement should be prioritized under new regulations
- NOAA should create a web form where members of the public can report unauthorized weather modification activities for further investigation

The Reporting Act grants the Secretary of Commerce the power of subpoena to obtain information from people conducting weather modification activities, and imposes a fine of up to \$10,000 for any person convicted of “knowingly and willingly” violating the reporting requirements of the Act.

Active enforcement of the Reporting Law has not historically been a priority for NOAA, likely because the law is well-known to cloud seeding operators, and the stakes have been considered low in the absence of strong scientific evidence of positive or negative impacts from cloud seeding. The context is quite different for geoengineering activities, though: there is currently widespread deployment of activities that qualify as weather modification, particularly under the Carbon Dioxide Removal umbrella, which are not complying with Reporting Act requirements. Moreover, the potential impacts, side-effects, and international implications of geoengineering are much more significant, and in some cases extreme. With regards to Solar Radiation Modification (SRM), the [U.S. National Intelligence Council in 2021](#) found that “We assess that the lack of any country level dialogue or governance body to set regulations and

¹ See for example, Congressional Research Service, “[Geoengineering: Governance and Technology Policy](#),” 2013; Congressional Research Service, “[Solar Geoengineering and Climate Change](#),” 2023; and Webb et al eds, [Ocean Carbon Dioxide Removal for Climate Mitigation: The Legal Framework](#), 2023.

enforce transparency over research increases the possibility that state or nonstate actors will independently develop or deploy the technology— possibly covertly—in a manner that risks conflict if other nations blame them for a weather disaster they believe was caused by geoengineering.” While the Reporting Act does not provide a regulatory framework for SRM research, it does provide a transparency framework for SRM and other climate intervention activities.

We suggest that NOAA create a public web form where any individual can flag the existence of weather modification activities for which proponents may have failed to submit a weather modification report (i.e. a form where unaffiliated members of the public can make known to NOAA the existence of weather modification activities that may have been conducted illegally without required reporting). Accompanying this, NOAA should begin active enforcement steps where needed - investigating non-compliant activities, seeking compliance, and if persons are found to have “knowingly and willingly” evaded the Reporting Act’s requirements, holding them accountable. These are measures that likely would have been unnecessary in a weather modification landscape consisting exclusively of cloud seeding, but may become necessary with geoengineering proponents actively attempting to evade public scrutiny.

(6) Not pursue a broader regulatory strategy

Section overview in brief:

- NOAA has asked whether, under existing statutory authority, it should pursue “a broader regulatory strategy for solar radiation modification research and experimentation”
- Based on our evaluation of relevant statute we do not believe that NOAA has the authority to establish a regulatory or permitting regime over any type of weather modification activity, including SRM
- However, there is a desperate need for national legislation to prohibit the deployment of geoengineering technologies, which carry major international security concerns, as well as risks of transnational negative impacts

In its Request for Information, NOAA asks for public comment on “whether, under existing statutory authorities, NOAA should pursue a broader regulatory strategy for solar radiation modification research and experimentation.” Similarly, Petitioners have asked “that NOAA undertake a broader policy and rulemaking process to develop a comprehensive strategy that would govern private SRM research subject to its jurisdiction.”

We do not believe that existing statutes clearly grant NOAA the authority to implement a regulatory regime over SRM research and deployment, or any other form of weather modification. While the preamble of the [National Weather Modification Policy Act of 1976](#) does state that “It is therefore declared to be the purpose of the Congress in this Act to develop a comprehensive and coordinated national weather modification policy and a national program of weather modification research and development,” the actionable text of the law calls on the

Secretary of Commerce to 1) “conduct a comprehensive investigation and study of the state of scientific knowledge concerning weather modification, the present state of development of weather modification technology, the problems impeding effective implementation of weather modification technology, and other related matters,” and 2) “prepare and submit to the President and the Congress, within 1 year after the date of enactment of this Act, a final report on the findings, conclusions, and recommendations of the study.”

Congress clearly intended to consider implementing additional weather modification policy in future sessions based on the recommendations of the Secretary of Commerce, who was specifically asked to include in the Report “a recommended national policy on weather modification and a recommended national weather modification research and development program.” When the Secretary of Commerce submitted its final report on “National Weather Modification Policies & Programs” to the President and Congress in 1979, however, the Report recommended that no additional federal policy was needed based on its assessment of current weather modification activities.²

Currently, there is no federal statute designed specifically to prohibit or regulate the research, development, or deployment of climate intervention technologies. While many marine geoengineering activities will trigger the dumping provisions in the Clean Water Act or the Marine Protection, Research and Sanctuaries Act, and SRM activities may trigger Clean Air Act provisions if conducted at sufficient scales, these existing regulations are wholly inadequate for protecting public health, the environment, and human rights from potential harm. Given their potential for serious negative side-effects and trans-boundary effects, the United States urgently needs a non-use policy for SRM and marine geoengineering activities in particular, making exceptions only for legitimate - and safe - scientific research.

In Conclusion

A broad range of geoengineering activities - including Solar Radiation Modification (SRM) and Greenhouse Gas Removal (GHGR) - clearly qualify as weather modification activities as defined in the Weather Modification Reporting Act of 1972. These activities are being conducted largely without having submitted weather modification project reports to NOAA, in violation of the law. Worse, companies are selling carbon credits or cooling credits explicitly for their impacts on atmospheric dynamics, while still failing to file legally mandated reports. It is our view that all geoengineering activities, including both SRM and GHGR, are required to file weather modification reports even under current regulations.

We urge NOAA to update the regulatory guidance in [15 CFR part 908](#) to make clear that all climate intervention technologies, by definition, are a form of weather modification and are therefore subject to reporting requirements.

² “[T]here is no need for the Federal Government to adopt a comprehensive legal regime for weather modification at this time. The private industry is small (less than \$6 million in gross annual contracts), and operations are generally localized within state boundaries and do not create major risks.”

This broader range of weather modification techniques necessitates updating NOAA's current reporting forms ([NOAA Form 17-4](#) and [Form 17-4A](#)), which are tailored to collect information about cloud seeding activities. Given the much greater potential impact of geoengineering activities, we strongly recommend that NOAA collect more detailed information about such weather modification activities and make reports publicly accessible, in order to create transparency in these nascent and sometimes potentially dangerous industries. In particular, NOAA should collect information about the methodology, materials used, scope, potential impacts, outcomes, and compliance with local, state, and federal law of SRM and GHGR activities.

The determinative criteria established by the Weather Modification Reporting Act of 1972 revolves around the intentions of the people conducting weather modification activities, not their scale or impact. Thus, all weather modification activities should be required to report regardless of scope or potential impacts. Further, all geoengineering techniques have cumulative impacts on the atmosphere, and many are designed to reach climate-relevant scales through the decentralized deployment of a large number of small-scale activities. Therefore, the public's interest in transparency applies to the cumulative effect of all such activities conducted across the country, not just in individual large-scale deployments.

In addition to updating regulatory guidance, we call on NOAA to increase its enforcement activities of the Reporting Act. Geoengineering activities have much greater potential than cloud seeding for widespread and lasting negative impacts, which makes enforcement of transparency requirements more urgent.

Lastly, we do not believe that NOAA has the statutory authority to establish a regulatory regime for research, development, or deployment of SRM or any other weather modification activity. A non-use policy for all dangerous geoengineering activities is desperately needed, but has not yet been passed into law.

Signed,

Friends of the Earth U.S.

<https://foe.org/>

Center for Biological Diversity

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