

The Florida Senate
BILL ANALYSIS AND FISCAL IMPACT STATEMENT

(This document is based on the provisions contained in the legislation as of the latest date listed below.)

Prepared By: The Professional Staff of the Committee on Environment and Natural Resources

BILL: SB 56

INTRODUCER: Senator Garcia

SUBJECT: Weather Modification Activities

DATE: February 10, 2025 REVISED: _____

	ANALYST	STAFF DIRECTOR	REFERENCE	ACTION
1.	Barriero	Rogers	EN	Pre-meeting
2.			CJ	
3.			RC	

I. Summary:

SB 56 prohibits weather modification activities. Specifically, the bill prohibits the injection, release, or dispersion, by any means, of a chemical, a chemical compound, a substance, or an apparatus into the atmosphere within the borders of this state for the express purpose of affecting the temperature, weather, or intensity of sunlight. The bill increases the fine for any person who conducts a weather modification operation from \$500 to \$10,000. The bill repeals all other existing weather modification statutes.

The bill removes the authority for state agencies to study emergency-mitigation-related matters concerning weather modification at the Governor’s direction and pursuant to any other authority and competence they have. The bill also removes the Department of Environmental Protection’s authority to conduct programs of study, research, and experimentation and evaluation in the field of weather modification.

II. Present Situation:

Geoengineering and Weather Modification

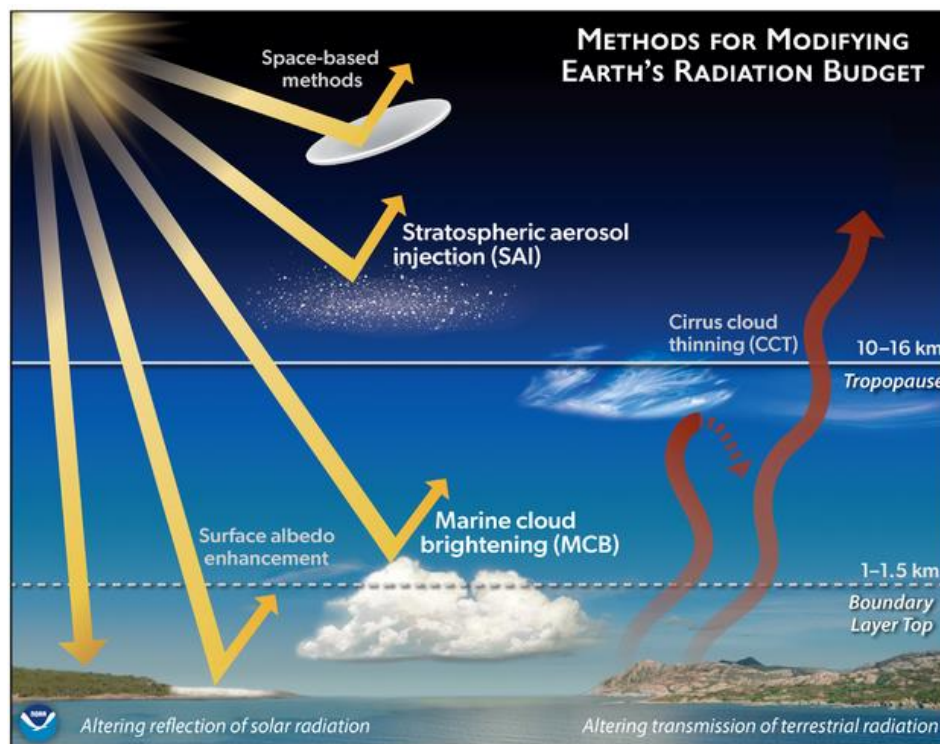
Geoengineering and weather modification are a range of techniques aimed at manipulating Earth’s climate systems to modify precipitation or mitigate the impacts of rising global temperatures. Weather modification, such as cloud seeding, involves altering local or regional atmospheric conditions to increase precipitation or reduce hailstorms. Geoengineering, such as solar radiation modification, focuses on larger-scale actions to reduce the amount of sunlight reaching Earth.

Solar Radiation Modification (SRM)

SRM refers to deliberate, large-scale actions intended to decrease global average surface temperatures by increasing the reflection of sunlight away from the Earth.¹ Extensive research efforts are underway to gain a comprehensive understanding of SRM technologies. This research focuses on developing and studying a range of potential future scenarios that combine SRM methods with emissions reductions and carbon dioxide removal technologies, to varying degrees and over varying timescales.²

Several SRM methods and technologies are being researched:

- Stratospheric aerosol injection (SAI): a strategy that involves injecting small reflective aerosols such as sulfate into the stratosphere to increase the reflection of incoming sunlight.
- Marine cloud brightening (MCB): a strategy for adding aerosol to the lower atmosphere over ocean regions to increase the reflectivity of low-lying marine clouds.
- Cirrus cloud thinning: a strategy for modifying the properties of high-altitude ice clouds to increase the transmission of outgoing terrestrial radiation to space.
- Surface albedo enhancement: increasing the reflectivity of surfaces through, for example, white roofs or land-cover changes.
- Space-based methods: proposed methods have primarily considered large “mirrors” in space to reflect sunlight.³



¹ NOAA, *Solar radiation modification: NOAA State of the Science factsheet*, <https://www.climate.gov/news-features/understanding-climate/solar-radiation-modification-noaa-state-science-factsheet> (last visited Feb. 6, 2025).

² *Id.*

³ *Id.* The SAI method is based on the observation that past volcanic eruptions that emitted large quantities of sulfates led to a reduction in the amount of incoming solar energy, resulting in a short-term cooling effect. U.S. Congressional Service, *Solar Geoengineering and Climate Change*, 5 (2023), available at <https://crsreports.congress.gov/product/pdf/R/R47551>.

SAI and MCB have been the subject of the most research due to their projected feasibility and estimated cost.⁴ Most of the current understanding of these technologies come from theoretical and modeling studies, not field experimentation. However, the risks and benefits of SAI and MCB are still poorly understood, including their technical feasibility, efficacy, and potential regional and global effects on the climate, agriculture, and ecosystems.⁵

In 2023, the federal government issued a report outlining a research plan and governance framework for investigating SRM as a potential climate intervention tool, focusing on SAI and MCB methods.⁶ The report emphasizes the need to better understand SRM's scientific, societal, and geopolitical implications. The plan aims to balance the exploration of SRM's benefits—such as temperature control and reduced climate risks—with its potential ecological, health, and ethical challenges. It also stresses the importance of transparency, international cooperation, and rigorous oversight in SRM research to build trust and inform decision-making. The report does not endorse SRM deployment but highlights the urgency of preparation in case of independent implementation by other actors, ensuring readiness through robust governance and coordinated research efforts.⁷

Cloud Seeding

Cloud seeding is the most common method of weather modification and focuses on producing short-term changes in precipitation, primarily to enhance rain or snowfall, or to suppress hail.⁸ The most frequently used cloud seeding approaches rely on the introduction of tiny particles, usually silver iodide, into certain cloud types to trigger the formation of ice crystals or rain droplets from water already within the cloud.⁹ Clouds amenable to these methods include “cold season clouds” associated with mountainous terrain and “warm season clouds” associated with

⁴ *Id.*

⁵ See U.S. Congressional Service, *Solar Geoengineering and Climate Change* at 10, available at <https://crsreports.congress.gov/product/pdf/R/R47551>; Samantha M. Tracy et al., *Stratospheric aerosol injection may impact global systems and human health outcomes*, *Elementa: Science of the Anthropocene*, vol. 1, 13-14 (2022), available at <https://online.ucpress.edu/elementa/article/10/1/00047/195026/Stratospheric-aerosol-injection-may-impact-global>. See generally Jessica S. Wan et al., *Diminished efficacy of regional marine cloud brightening in a warmer world*, *Nature Climate Change*, vol. 14 (2024), available at <https://www.nature.com/articles/s41558-024-02046-7>; Robert Monroe, Scripps Institution of Oceanography at the University of California San Diego, *Artificial Climate Controls Might Become Ineffective—Because of Climate Change* (2024), <https://scripps.ucsd.edu/news/artificial-climate-controls-might-become-ineffective-because-climate-change>; Katharine Ricke et al., *Hydrological Consequences of Solar Geoengineering*, *Annual Review of Earth and Planetary Sciences*, vol. 51 (2023), available at <https://www.annualreviews.org/content/journals/10.1146/annurev-earth-031920-083456>.

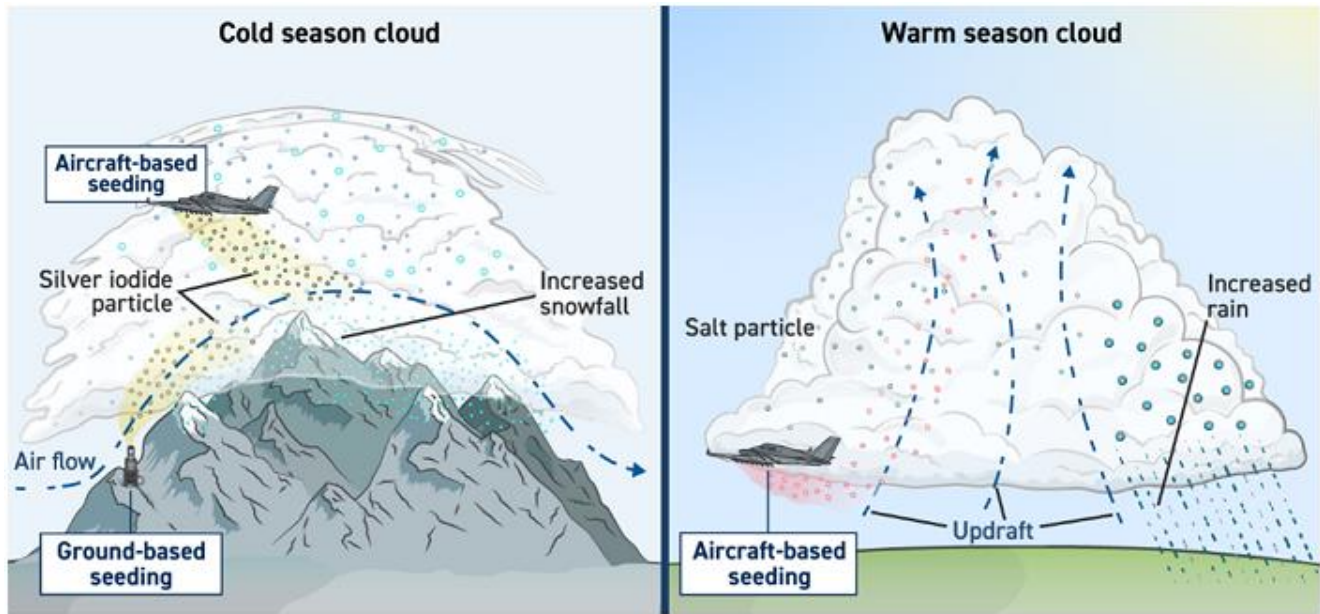
⁶ See White House Office of Science and Technology Policy, *Congressionally Mandated Research Plan and an Initial Research Governance Framework Related to Solar Radiation Modification*, 5 (2023), on file with the Committee on Environment and Natural Resources.

⁷ See *id.*

⁸ U.S. Government Accountability Office (GAO), *Technology Assessment: Cloud Seeding Technology*, 3, 5 (2024), available at <https://www.gao.gov/assets/gao-25-107328.pdf>. The use of cloud seeding technology for marine cloud brightening is also being researched. See C. C. Chen et al., *Climate Impact of Marine Cloud Brightening Solar Climate Intervention Under a Susceptibility-Based Strategy Simulated by CESM2*, *Journal of Geophysical Research: Atmospheres*, vol. 130, 2 (2025), available at <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2024JD041245?af=R>.

⁹ GAO, *Technology Assessment: Cloud Seeding Technology* at 5. Silver iodide is a preferred seeding agent because its crystalline structure is nearly identical to natural ice crystals. Texas Dep't of Licensing & Regulation, *Weather Modification: Frequently Asked Questions*, <https://www.tdlr.texas.gov/weather/weatherfaq.htm#3> (last visited Feb. 6, 2025).

convective systems, including thunderstorms.¹⁰ While cold season cloud seeding is reasonably well understood, substantial uncertainties remain regarding warm season cloud seeding.¹¹



Cloud seeding operations can be conducted from the ground or the air. Ground-based operations involve strategically positioning cloud seeding generators at higher elevations, usually on the windward side of mountains.¹² These generators, operated either manually or remotely, release silver iodide particles into the air; wind then transports the particles upward into the clouds where they facilitate the freezing of water molecules.¹³ This process is typically used to increase snowfall over targeted mountain areas.¹⁴ In airborne operations, aircrafts disperse the seeding agent into or above the clouds using pyrotechnic flares.¹⁵

¹⁰ GAO, *Technology Assessment: Cloud Seeding Technology* at 3, available at <https://www.gao.gov/assets/gao-25-107328.pdf>.

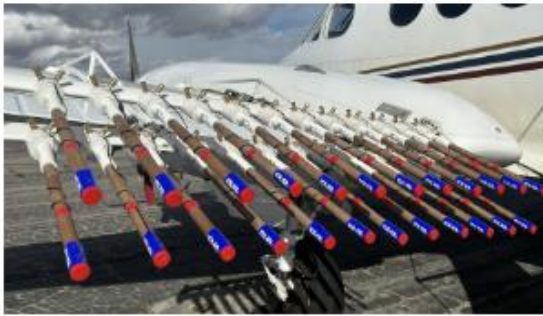
¹¹ *Id.* at 5. See also GAO, *Cloud Seeding Technology: Assessing Effectiveness and Other Challenges*, <https://www.gao.gov/products/gao-25-107328> (depicting graphic of cold and warm season cloud seeding).

¹² See Idaho Dep't of Water Resources, *Science Behind Cloud Seeding*, <https://idwr.idaho.gov/iwrp/programs/cloud-seeding-program/science-behind-cloud-seeding/> (last visited Feb. 6, 2025); Santa Ana Watershed Project Authority, *Cloud Seeding Pilot Program in the Santa Ana Watershed*, <https://sawpa.gov/santa-ana-river-watershed-cloud-seeding/> (last visited Feb. 6, 2025).

¹³ *See id.*

¹⁴ *See id.*

¹⁵ See GAO, *Technology Assessment: Cloud Seeding Technology* at 8, available at <https://www.gao.gov/assets/gao-25-107328.pdf>; Texas Dep't of Licensing & Regulation, *Weather Modification: Frequently Asked Questions*, <https://www.tdlr.texas.gov/weather/weatherfaq.htm#3> (last visited Feb. 6, 2025).



*Wing-Mounted Burn-In-Place Flares*¹⁶



*Ejectable Flares*¹⁷

Other cloud seeding approaches remain emergent or under development, including the use of balloons, drones, or plane-mounted electrostatic nozzles.¹⁸ In the latter technique, the nozzles charge water particles which are then carried up into the clouds and distributed by updrafts.¹⁹ The particles, which have the opposite electrical charge of the water in the clouds, act as cloud condensation nuclei and trigger the natural rainmaking process.²⁰

If successfully deployed, cloud seeding can potentially replenish reservoirs and aquifers, reduce air pollution and the risk of wildfires, prevent erosion, increase soil moisture, and improve agricultural productivity.²¹ However, several challenges hinder the development and effective implementation of cloud seeding, including limited scientific understanding, uncertain environmental impacts, and inadequate data collection.²² For example, while recent studies suggest that silver iodide does not pose an environmental or health concern at current levels, it is not known whether more widespread use would have an effect on public health or be a risk to the environment.²³ Further research is also needed to assess whether cloud seeding can affect precipitation outside the intended target area.²⁴ Moreover, estimates of how much additional rainfall cloud seeding can produce vary widely, from 0 to 20 percent for cold season cloud seeding.²⁵

¹⁶ Burn-In-Place wing mounted flares emit a fine silver iodide smoke directly into the cloud during flight. The flares are released directly in the cloud when the plane flies through the cloud, for as long as conditions remain suitable for the aircraft safety and for seeding to occur. Idaho Dep't of Water Resources, *Science Behind Cloud Seeding*, <https://idwr.idaho.gov/iwr/programs/cloud-seeding-program/science-behind-cloud-seeding/> (last visited Feb. 6, 2025).

¹⁷ Ejectable, belly mounted flares are released into the cloud when the plane flies above the cloud; the aircraft drops seeding material into the cloud system by ejecting it from the belly of the plane. This technique is used when the conditions in the cloud are too hazardous for the aircraft and its crew. *Id.*

¹⁸ See GAO, *Technology Assessment: Cloud Seeding Technology* at 8, available at <https://www.gao.gov/assets/gao-25-107328.pdf>; R. Giles Harrison et al., *Providing charge emission for cloud seeding aircraft*, AIP Advances, vol. 14, 3-4 (2024), available at <https://pubs.aip.org/aip/adv/article/14/9/095307/3312161/Providing-charge-emission-for-cloud-seeding>.

¹⁹ Agricultural Research Service, U.S. Dep't of Agriculture (USDA), *Seeding the Skies, Harvesting Rain*, <https://www.ars.usda.gov/oc/dof/seeding-the-skies-harvesting-rain/> (last visited Feb. 6, 2025).

²⁰ *Id.*

²¹ GAO, *Technology Assessment: Cloud Seeding Technology* at 11.

²² *Id.* at 16.

²³ *Id.* at 18.

²⁴ *Id.* at 18-19.

²⁵ *Id.* at 13. Estimates for warm season cloud seeding are not provided.

According to the U.S. Government Accountability Office, cloud seeding activities in the U.S. are primarily funded at the state level or below.²⁶ As of July 2024, cloud seeding programs were active in at least nine states: California, Colorado, Idaho, Nevada, New Mexico, North Dakota, Texas, Utah, and Wyoming.²⁷ Several other states have laws that address weather modification in some way. In 2024, Tennessee became the first state to ban cloud seeding and other weather modification operations in the state.²⁸ Similar bills have been introduced in at least eight other state legislatures between January 2023 and December 2024, including Illinois, Kentucky, Minnesota, New Hampshire, Pennsylvania, Rhode Island, South Dakota, and Texas.²⁹

Florida Weather Modification Regulations

Since 1957, Florida law has required a license for weather modification activities.³⁰ Applications must be submitted to the Department of Environmental Protection (DEP) and include:

- The name and post office address of the applicant or the person on whose behalf the weather modification operation is to be conducted if other than the applicant.
- The education, experience, and qualifications of the applicant.
- The nature, object, and general description of the proposed weather modification operation.
- The method, equipment, and materials the applicant proposes to use.³¹

Each application must be accompanied by a \$1,000 filing fee.³² Applicants must also provide proof of financial responsibility, namely, a certificate of insurance or a bond to prove their ability to pay damages for accidents arising out of their weather modification operations in the amount of:

- \$10,000 for bodily injury to or death of one person resulting from any one incident, and subject to said limit for one person,
- \$100,000 for bodily injury to or death of two or more persons resulting from any one incident, and
- \$100,000 for injury to or destruction of property of others resulting from any one incident.³³

Prior to beginning operations, the licensee must file with DEP a notice of intention to operate that includes the licensee's information and the area and approximate time of operations.³⁴ The notice must be published in a newspaper within the county or counties of operation, and proof of publication must be filed with DEP.³⁵

²⁶ GAO, *Technology Assessment: Cloud Seeding Technology* at 6, available at <https://www.gao.gov/assets/gao-25-107328.pdf>.

²⁷ *Id.*

²⁸ Tenn. Code. Ann. § 68-201-122 (2024).

²⁹ GAO, *Technology Assessment: Cloud Seeding Technology* at 9.

³⁰ Ch. 57-128, Laws of Fla.; section 403.301, F.S.

³¹ Section 403.311(1), F.S. DEP may also require the applicant to submit other pertinent information. *Id.*

³² Section 403.311(2), F.S.

³³ Sections 403.321(1) and (2), F.S.

³⁴ Section 403.351, F.S.

³⁵ Sections 403.361 and 403.371, F.S. The notice must be published at least once a week for two consecutive weeks in a newspaper having general circulation and published within any county or counties where the operation is to be conducted and in which the affected area is located. Section 403.361, F.S.

Licenses are required to maintain a record of all operations conducted pursuant to the license, including the method employed, the type and composition of materials used, the times and places of operation, and the name and post office address of each person participating or assisting in the operation other than licensee.³⁶ Such records must be made available to the public.³⁷

Any person in violation of these requirements is guilty of a second-degree misdemeanor and subject to penalties including imprisonment of up to 60 days and a \$500 fine.³⁸

Each license entitles the licensee to conduct the operation described in the application for the calendar year for which the license is issued unless the license is revoked or suspended.³⁹ The conducting of any weather modification operation or the use of any equipment or materials other than those described in the application shall be cause for revocation or suspension of the license. The license may be renewed annually by payment of a \$50 filing fee.⁴⁰ A weather modification license may be revoked or suspended if DEP finds that the licensee has failed or refused to comply with any of the provisions of the weather modification act.⁴¹

DEP may grant an emergency license and waive notice requirements if the operation appears to DEP to be necessary or desirable in aid of the extinguishment of fire, dispersal of fog, or other emergency.⁴²

There have been no applications for weather modification licenses in the past ten years.⁴³

In addition to regulating weather modification licenses, state law also authorizes DEP to study, research, and experiment in the field of weather modification.⁴⁴ However, there is no indication that DEP has been involved in such weather modification programs.

Federal Weather Modification Regulations

The Weather Modification Reporting Act of 1972 requires anyone who conducts weather modification activities within the United States to report such activities to the U.S. Secretary of Commerce at least 10 days prior to undertaking the activities.⁴⁵ The report must include, among other things, the project's purpose and location, as well as the modification agents used (e.g., carbon dioxide, sodium chloride, silver iodide).⁴⁶ Another report, which summarizes the project duration and total modification agents dispensed, is required within 45 days after completion of the project.⁴⁷ For ongoing projects, interim reports are required on January 1st of each year and

³⁶ Section 403.381(1), F.S.

³⁷ Section 403.381(2), F.S.

³⁸ Sections 403.411, 775.082(4)(b), and 775.083(1)(e), F.S.

³⁹ Section 403.331(2), F.S.

⁴⁰ Section 403.331(3), F.S.

⁴¹ Section 403.401, F.S.

⁴² Section 403.391, F.S.

⁴³ Email from DEP to Committee on Environment and Natural Resources (Jan. 28, 2025), on file with the Committee on Environment and Natural Resources.

⁴⁴ Section 373.026(6), F.S.

⁴⁵ 15 U.S.C. § 330a; 15 CFR 908.4(a).

⁴⁶ 15 CFR 908.4(a).

⁴⁷ 15 CFR 908.6.

must include the number of days weather modification activities took place, total hours of operation, and the amount of agent used.⁴⁸ Failure to adhere to these reporting requirements can result in fines of up to \$10,000.⁴⁹

Activities subject to these reporting requirements include:

- Seeding or dispersing of any substance into clouds or fog, to alter drop size distribution, produce ice crystals or coagulation of droplets, alter the development of hail or lightning, or influence in any way the natural development cycle of clouds or their environment;
- Using fires or heat sources to influence convective circulation or to evaporate fog;
- Modifying the solar radiation exchange of the earth or clouds, through the release of gases, dusts, liquids, or aerosols into the atmosphere;
- Modifying the characteristics of land or water surfaces by dusting or treating with powders, liquid sprays, dyes, or other materials;
- Releasing electrically charged or radioactive particles, or ions, into the atmosphere;
- Applying shock waves, sonic energy sources, or other explosive or acoustic sources to the atmosphere;
- Using aircraft propeller downwash, jet wash, or other sources of artificial wind generation; or
- Using lasers or other sources of electromagnetic radiation.⁵⁰

Reporting requirements do 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.⁵¹ This exception is 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 exempt are religious activities or other ceremonies, rites and rituals intended to modify the weather.⁵²

According to NOAA's website, NOAA is not currently researching or conducting weather modification experiments and has no plans to do so in the future. However, NOAA studies the stratosphere and marine boundary layer with instruments on balloons and aircraft to help fill important gaps in our knowledge and inform decisions about the potential risks and benefits of solar geoengineering.⁵³

III. Effect of Proposed Changes:

Section 1 repeals several sections of law related to weather modification, including ss. 403.281 (definitions), 403.291 (purpose), 403.301 (licensing requirements), 403.311 (application requirements), 403.321 (proof of financial responsibility requirements), 403.331 (license

⁴⁸ 15 CFR 908.5.

⁴⁹ 15 U.S.C. § 330d; 15 CFR 908.10.

⁵⁰ 15 CFR § 908.3(a). While all these activities are subject to initial reporting, NOAA may waive the subsequent reporting requirements. The decision to waive certain reporting requirements is based on the general acceptability, from a technical or scientific viewpoint, of the apparatus and techniques to be used. 15 CFR § 908.3(d).

⁵¹ 15 CFR § 908.3(c).

⁵² *Id.*

⁵³ NOAA, *Fact check: Debunking weather modification claims*, <https://www.noaa.gov/news/fact-check-debunking-weather-modification-claims> (last visited Feb. 6, 2025).

issuance and discipline provisions), 403.341 (filing and publication of notice of intention to operate requirements), 403.351 (required contents of notice of intention), 403.361 (publication of the notice of intention requirements), 403.371 (proof of publication requirements), 403.381 (records and reports of operations requirements), 403.391 (provision of emergency licenses), and 403.401 (suspension or revocation of licenses), F.S.

Section 2 amends s. 403.411, F.S., regarding weather modification penalties. The bill provides that the injection, release, or dispersion, by any means, of a chemical, a chemical compound, a substance, or an apparatus into the atmosphere within the borders of this state for the express purpose of affecting the temperature, the weather, or the intensity of sunlight is prohibited.

Under current law, any person in violation of weather modification laws is guilty of a misdemeanor of the second degree, punishable by a definite term of imprisonment not exceeding 60 days and a fine of up to \$500. The bill increases the fine to up to \$10,000.

Section 3 amends s. 252.44, F.S., regarding emergency mitigation. This statute currently provides that, at the Governor's direction, state agencies charged with various enumerated responsibilities including weather modification must make studies of emergency-mitigation-related matters. The bill removes the reference to weather modification from this section of law.

Section 4 makes conforming changes.

Section 5 amends s. 373.026, F.S., regarding the general powers and duties of the Department of Environmental Protection (DEP). The bill removes the requirement that DEP conduct programs of study, research, and experimentation and evaluation in the field of weather modification.

Sections 6 through 8 make conforming changes.

Section 9 provides an effective date of July 1, 2025.

IV. Constitutional Issues:

A. Municipality/County Mandates Restrictions:

None.

B. Public Records/Open Meetings Issues:

None.

C. Trust Funds Restrictions:

None.

D. State Tax or Fee Increases:

None.

E. Other Constitutional Issues:

None.

V. Fiscal Impact Statement:

A. Tax/Fee Issues:

None.

B. Private Sector Impact:

None.

C. Government Sector Impact:

None.

VI. Technical Deficiencies:

None.

VII. Related Issues:

None.

VIII. Statutes Affected:

This bill substantially amends the following sections of the Florida Statutes: 403.411, 252.44, 253.002, 373.026, 373.1501, 373.4598, and 373.470.

This bill repeals the following sections of the Florida Statutes: 403.281, 403.291, 403.301, 403.311, 403.321, 403.331, 403.341, 403.351, 403.361, 403.371, 403.381, 403.391, and 403.401.

IX. Additional Information:

A. Committee Substitute – Statement of Changes:

(Summarizing differences between the Committee Substitute and the prior version of the bill.)

None.

B. Amendments:

None.