Department of Regulatory Agencies

Office of Policy, Research and Regulatory Reform

2010 Sunset Review: Weather Modification Act of 1972

October 15, 2010

Consumer Protection

Department of Regulatory Agencies

Executive Director's Office
Barbara J. Kelley
Executive Director

Bill Ritter, Jr.
Governor

October 15, 2010

Members of the Colorado General Assembly
c/o the Office of Legislative Legal Services
State Capitol Building
Denver, Colorado 80203

Dear Members of the General Assembly:

The mission of the Department of Regulatory Agencies (DORA) is consumer protection. As a part of the Executive Director's Office within DORA, the Office of Policy, Research and Regulatory Reform seeks to fulfill its statutorily mandated responsibility to conduct sunset reviews with a focus on protecting the health, safety and welfare of all Coloradans.

DORA has completed the evaluation of the Weather Modification Act of 1972. I am pleased to submit this written report, which will be the basis for my office's oral testimony before the 2011 legislative committee of reference. The report is submitted pursuant to section 24-34-104(8)(a), of the Colorado Revised Statutes (C.R.S.), which states in part:

> The department of regulatory agencies shall conduct an analysis of the performance of each division, board or agency or each function scheduled for termination under this section...
>
> The department of regulatory agencies shall submit a report and supporting materials to the office of legislative legal services no later than October 15 of the year preceding the date established for termination….

The report discusses the question of whether there is a need for the regulation provided under Article 20 of Title 36, C.R.S. The report also discusses the effectiveness of the Executive Director of the Colorado Department of Natural Resources in carrying out the intent of the statutes and makes recommendations for statutory changes in the event this regulatory program is continued by the General Assembly.

Sincerely,

Barbara J. Kelley
Executive Director

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2010 Sunset Review:
Weather Modification Act of 1972

Summary

What Is Regulated?
Weather modification is considered to be any program, operation, or experiment intended to induce changes in the composition, behavior, or dynamics of the atmosphere by artificial means. Examples of current weather modification operations in Colorado include hail cannons and wintertime cloud seeding.

Why Is It Regulated?
Colorado claims, in the name of the people of the state, the right to all moisture suspended in the atmosphere which falls or is artificially induced to fall within its borders.

Who Is Regulated?
Between fiscal years 04-05 and 09-10, the Director of the Colorado Water Conservation Board (Director and CWCB, respectively) issued nine weather modification permits: eight for wintertime cloud seeding and one for a hail cannon.

How Is It Regulated?
To obtain a permit, an operator must, among other things, pay the required fee; provide information regarding the qualifications of the operator; publish notice of the intent to modify the weather; provide evidence of liability insurance and submit a complete operational plan. A public hearing is held on each permit applied for.

Permits for wintertime cloud seeding are valid for an initial five-year period, with one five-year renewal option. After this, such permits may be renewed for 10-year periods.

Permits for hail cannons are valid for one year periods, although the notice and hearing requirement is followed every five years.

What Does It Cost?
The application fee is $100. A commercial fee of two percent of the value of the contract between the project sponsor(s) and the operator is also assessed.

What Disciplinary Activity Is There?
There have been no disciplinary actions. However, between fiscal years 04-05 and 09-10, there were 15 suspensions of weather modification operations due to high avalanche risk or high snowpack levels.

Where Do I Get the Full Report?
The full sunset review can be found on the internet at: www.dora.state.co.us/opr/oprpublications.htm.

Key Recommendations

Continue the Weather Modification Act of 1972 for nine years, until 2020.
The efficacy of weather modification is far from a settled question. It is this uncertainty that justifies continued State involvement in and oversight of weather modification operations. Water is a precious commodity in Colorado and one in which the State of Colorado has a direct interest. As such, continued State involvement in this area is justified.

Require the Executive Director to promulgate new rules no later than January 1, 2012.
The rules pertaining to weather modification have not been revised in 24 years. In that time, things have changed. For example, prior to 1996, weather modification operators themselves were licensed. While this is no longer the case, according to statute, the rules still contain provisions pertaining to operator licensing. These rules create confusion, because they conflict with the statute, and they exceed the Director's statutory authority. The rules should be revised.

Major Contacts Made During This Review

California Department of Water Resources
City of Durango
Colorado Attorney General's Office
Colorado Avalanche Information Center
Colorado Department of Public Health and Environment, Air Pollution Control Division
Colorado Department of Natural Resources
Colorado Environmental Coalition
Colorado Press Association
Colorado Springs Utilities
Colorado State University
Denver Water
Desert Research Institute
Dolores Water Conservancy District
Durango Mountain Resort
Gunnison County
Metro Water District of Southern California
New Mexico Interstate Stream Commission
National Center for Atmospheric Research
North American Weather Consultants
Pagosa Area Water and Sanitation District
Pine River Irrigation District
Sierra Club – Rocky Mountain Chapter
Southern Colorado Farms
Southwestern Water Conservation District
U.S. Department of Agriculture, Natural Resources Conservation Service
Utah Division of Water Resources
Western Weather Consultants
Wyoming Water Development Office
Vail Resorts

What is a Sunset Review?

A sunset review is a periodic assessment of state boards, programs, and functions to determine whether or not they should be continued by the legislature. Sunset reviews focus on creating the least restrictive form of regulation consistent with protecting the public. In formulating recommendations, sunset reviews consider the public's right to consistent, high quality professional or occupational services and the ability of businesses to exist and thrive in a competitive market, free from unnecessary regulation.

Sunset Reviews are Prepared by:
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www.dora.state.co.us/opr

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Background

Introduction

Enacted in 1976, Colorado's sunset law was the first of its kind in the United States. A sunset provision repeals all or part of a law after a specific date, unless the legislature affirmatively acts to extend it. During the sunset review process, the Department of Regulatory Agencies (DORA) conducts a thorough evaluation of such programs based upon specific statutory criteria[1] and solicits diverse input from a broad spectrum of stakeholders including consumers, government agencies, public advocacy groups, and professional associations.

Sunset reviews are based on the following statutory criteria:

- Whether regulation by the agency is necessary to protect the public health, safety and welfare; whether the conditions which led to the initial regulation have changed; and whether other conditions have arisen which would warrant more, less or the same degree of regulation;
- If regulation is necessary, whether the existing statutes and regulations establish the least restrictive form of regulation consistent with the public interest, considering other available regulatory mechanisms and whether agency rules enhance the public interest and are within the scope of legislative intent;
- Whether the agency operates in the public interest and whether its operation is impeded or enhanced by existing statutes, rules, procedures and practices and any other circumstances, including budgetary, resource and personnel matters;
- Whether an analysis of agency operations indicates that the agency performs its statutory duties efficiently and effectively;
- Whether the composition of the agency's board or commission adequately represents the public interest and whether the agency encourages public participation in its decisions rather than participation only by the people it regulates;
- The economic impact of regulation and, if national economic information is not available, whether the agency stimulates or restricts competition;
- Whether complaint, investigation and disciplinary procedures adequately protect the public and whether final dispositions of complaints are in the public interest or self-serving to the profession;
- Whether the scope of practice of the regulated occupation contributes to the optimum utilization of personnel and whether entry requirements encourage affirmative action;
- Whether administrative and statutory changes are necessary to improve agency operations to enhance the public interest.

[1] Criteria may be found at § 24-34-104, C.R.S.

Types of Regulation

Consistent, flexible, and fair regulatory oversight assures consumers, professionals and businesses an equitable playing field. All Coloradans share a long-term, common interest in a fair marketplace where consumers are protected. Regulation, if done appropriately, should protect consumers. If consumers are not better protected and competition is hindered, then regulation may not be the answer.

As regulatory programs relate to individual professionals, such programs typically entail the establishment of minimum standards for initial entry and continued participation in a given profession or occupation. This serves to protect the public from incompetent practitioners. Similarly, such programs provide a vehicle for limiting or removing from practice those practitioners deemed to have harmed the public.

From a practitioner perspective, regulation can lead to increased prestige and higher income. Accordingly, regulatory programs are often championed by those who will be the subject of regulation.

On the other hand, by erecting barriers to entry into a given profession or occupation, even when justified, regulation can serve to restrict the supply of practitioners. This not only limits consumer choice, but can also lead to an increase in the cost of services.

There are also several levels of regulation.

Licensure

Licensure is the most restrictive form of regulation, yet it provides the greatest level of public protection. Licensing programs typically involve the completion of a prescribed educational program (usually college level or higher) and the passage of an examination that is designed to measure a minimal level of competency. These types of programs usually entail title protection – only those individuals who are properly licensed may use a particular title(s) – and practice exclusivity – only those individuals who are properly licensed may engage in the particular practice. While these requirements can be viewed as barriers to entry, they also afford the highest level of consumer protection in that they ensure that only those who are deemed competent may practice and the public is alerted to those who may practice by the title(s) used.

Certification

Certification programs offer a level of consumer protection similar to licensing programs, but the barriers to entry are generally lower. The required educational program may be more vocational in nature, but the required examination should still measure a minimal level of competency. Additionally, certification programs typically involve a non-governmental entity that establishes the training requirements and owns and administers the examination. State certification is made conditional upon the individual practitioner obtaining and maintaining the relevant private credential. These types of programs also usually entail title protection and practice exclusivity.

While the aforementioned requirements can still be viewed as barriers to entry, they afford a level of consumer protection that is lower than a licensing program. They ensure that only those who are deemed competent may practice and the public is alerted to those who may practice by the title(s) used.

Registration

Registration programs can serve to protect the public with minimal barriers to entry. A typical registration program involves an individual satisfying certain prescribed requirements – typically non-practice related items, such as insurance or the use of a disclosure form – and the state, in turn, placing that individual on the pertinent registry. These types of programs can entail title protection and practice exclusivity. Since the barriers to entry in registration programs are relatively low, registration programs are generally best suited to those professions and occupations where the risk of public harm is relatively low, but nevertheless present. In short, registration programs serve to notify the state of which individuals are engaging in the relevant practice and to notify the public of those who may practice by the title(s) used.

Title Protection

Finally, title protection programs represent one of the lowest levels of regulation. Only those who satisfy certain prescribed requirements may use the relevant prescribed title(s). Practitioners need not register or otherwise notify the state that they are engaging in the relevant practice, and practice exclusivity does not attach. In other words, anyone may engage in the particular practice, but only those who satisfy the prescribed requirements may use the enumerated title(s). This serves to indirectly ensure a minimal level of competency – depending upon the prescribed preconditions for use of the protected title(s) – and the public is alerted to the qualifications of those who may use the particular title(s).

Licensing, certification and registration programs also typically involve some kind of mechanism for removing individuals from practice when such individuals engage in enumerated proscribed activities. This is generally not the case with title protection programs.

Regulation of Businesses

Regulatory programs involving businesses are typically in place to enhance public safety, as with a salon or pharmacy. These programs also help to ensure financial solvency and reliability of continued service for consumers, such as with a public utility, a bank or an insurance company.

Activities can involve auditing of certain capital, bookkeeping and other recordkeeping requirements, such as filing quarterly financial statements with the regulator. Other programs may require onsite examinations of financial records, safety features or service records.

Although these programs are intended to enhance public protection and reliability of service for consumers, costs of compliance are a factor. These administrative costs, if too burdensome, may be passed on to consumers.

Sunset Process

Regulatory programs scheduled for sunset review receive a comprehensive analysis. The review includes a thorough dialogue with agency officials, representatives of the regulated profession and other stakeholders. Anyone can submit input on any upcoming sunrise or sunset review via DORA's website at: www.dora.state.co.us/pls/real/OPR_Review_Comments.Main.

The regulatory functions of the Executive Director of the Department of Natural Resources (Executive Director and DNR, respectively) as enumerated in Article 20 of Title 36, Colorado Revised Statutes (C.R.S.), shall terminate on July 1, 2011, unless continued by the General Assembly. During the year prior to this date, it is the duty of DORA to conduct an analysis and evaluation of the administration of the weather modification permitting program by the Executive Director pursuant to section 24-34-104, C.R.S.

The purpose of this review is to determine whether the currently prescribed regulation of weather modification operations should be continued for the protection of the public and to evaluate the performance of the Executive Director. During this review, the Executive Director must demonstrate that the regulation serves to protect the public health, safety or welfare, and that the regulation is the least restrictive regulation consistent with protecting the public. DORA's findings and recommendations are submitted via this report to the legislative committee of reference of the Colorado General Assembly.

Methodology

As part of this review, DORA staff attended a meeting of the DNR's Colorado Water Conservation Board (CWCB); interviewed DNR staff, representatives of project sponsors, operators, and environmental organizations; reviewed DNR records, Colorado statutes, DNR rules, and the laws of other states; and performed a literature review.

Weather Modification

Water is an important commodity in Colorado, and indeed, in the entire Western U.S. Eighty percent of Colorado's surface water comes from snowpack runoff.[2] Snowpack, and its resulting runoff, are vital to consumers, agriculture and the wintertime sports industry.

As Colorado's population continues to grow, so, too, does the stress on the state's water supplies. As a result, water managers are constantly exploring new ways to increase the supply of water, whether through storage or increased precipitation.

Weather modification, put simply, refers to that area of endeavor that attempts to increase precipitation over a particular area (also referred to as a target area) or to alter the form in which that precipitation falls to the ground (i.e., rain, snow or hail).

Although there are a variety of techniques utilized in weather modification efforts, only two are utilized in Colorado: ground-based wintertime cloud seeding and hail cannons.

To understand how these techniques attempt to alter the weather, it is first necessary to explore the general nature of how precipitation forms naturally.

In very general terms, as moist air rises, the water vapor in the air condenses to form a cloud of tiny water droplets of supercooled liquid water (SLW). The SLW coalesces around nuclei, such as dust particles or other substances, until they become so heavy that they drop out of the cloud as precipitation. To form precipitation, then, a sufficient supply of both SLW and nuclei must be present in the cloud. If either is missing or there is an insufficient supply of either, there may be no precipitation.

Obviously, weather systems are much more complex than this description indicates. However, this general description is suitable for providing a rudimentary understanding of weather modification as it occurs in Colorado.

Given the proper conditions, when the SLW coalesces around the nuclei, it freezes to form snow. Theoretically, then, the greater the number of nuclei present, the greater the snowfall.

To enhance this process, ground-based wintertime cloud seeding operations attempt to increase the nuclei, or seeds, in the cloud. Most operations in Colorado consist of placing a propane-fired generator that burns silver iodide at high elevation. When a suitable storm approaches, the generator is activated and silver iodide is released into the atmosphere. This silver iodide then acts as the nuclei for snow formation.

[2] Colorado Climate Center, *Drought Resources: Q&A About Drought.* Retrieved on September 16, 2010, from http://climate.colostate.edu/droughtqanda.php

In a typical scenario, a water district or a water utility, or a consortium of such, may determine that it desires to increase precipitation in the area that supplies its water so as to increase water supplies. These program sponsors secure the services of a cloud seeding operator, which, in turn, conducts the necessary studies to determine the target area and the ideal sites for the seed generators. The operator will also obtain the necessary permits.

The operator contracts with those who own the land upon which the operator seeks to place the generators. Such a contract may also provide that the land owner will turn the generator “on” and “off” when the operator so requests. Alternatively, some generators can be turned “on” and “off” using cellular telephone technology.

The second type of weather modification technique utilized in Colorado, the hail cannon, requires another brief lesson in meteorology. Hail forms when the water droplets that form around the nuclei are carried by winds higher aloft into the cloud, where the air is cooler. Rather than forming crystals, as in the case of snow, the droplets freeze and begin to fall. As they fall through the cloud, they accrete more water before they are, once again, carried higher aloft by winds. As this process repeats, the hail stones grow increasingly larger and heavier until, at last, the hail stone is too heavy for the wind to carry it higher aloft and, instead, it falls out as hail.

The theory behind the hail cannon, then, is to disrupt hail formation so that the precipitation falls out as rain, rather than hail, or not at all. Its use in Colorado is currently limited to a single farm in the San Luis Valley. This technique is used in an attempt to prevent hail damage to sensitive agricultural crops.

The hail cannon itself basically consists of a 20-foot long barrel that is aimed skyward. The cannon mixes acetylene and air, and when ignited with a spark from a spark plug, sends an acoustical wave into a cloud to disrupt hail formation. Since this acoustical wave essentially pulverizes the hail stones, the timing of cannon activation must be such that hail formation is disrupted while the hail stones in the cloud are still relatively small.

Legal Framework

History of Regulation

In 1951, the General Assembly enacted the Weather Control Act (WCA), and in doing so, claimed the right to all moisture suspended in the atmosphere that fell into or became part of the natural streams of Colorado. The WCA also proclaimed the State's right to increase precipitation by artificial means, so long as doing so did not cause material damage to others.

The WCA created a five-member, Governor-appointed commission and required anyone conducting weather control or weather modification operations to obtain a license from the Commissioner of Agriculture.

Applicants for licensure had to demonstrate that they possessed the skill and experience reasonably necessary to accomplish weather control without damage to property or people, and financial responsibility. The license fee was set at $100.

In 1963, administration of the WCA was transferred from the Commissioner of Agriculture to the Executive Director of the Department of Natural Resources (Executive Director and DNR, respectively).

By 1971, the number of weather modification projects in Colorado had increased substantially, leading many to worry that the WCA was inadequate. As a result, the General Assembly enacted the Weather Modification Act of 1972 (Act) with the passage of House Bill 72-1019, which, among other things:

- Created a 10-member technical advisory committee;
- Required each weather modification operation to be individually permitted;
- Required publication of proposed weather modification operations; and
- Required public hearings to be held before permits are issued.

House Bill 79-1127 increased the criminal penalty for operating without a permit from a misdemeanor to a felony. It further required the Executive Director to report to the Federal Aviation Administration anyone operating a weather modification operation from an airplane without a permit.

In 1987, the Executive Director delegated the authority to administer the Act to the Director of the DNR's Colorado Water Conservation Board (Director and CWCB, respectively).

The General Assembly repealed the technical advisory committee in 1992, and in 1995 the Act underwent its first sunset review.

Senate Bill 96-90 implemented sunset recommendations that repealed the licensing requirements for individuals involved in weather modification operations, and repealed specific reporting requirements and authorized the Executive Director to establish them by rule.

Weather Modification Act of 1972

Colorado claims, in the name of the people of the State, the right to all moisture suspended in the atmosphere which falls or is artificially induced to fall within its borders.[3]

Weather modification is considered to be any program, operation, or experiment intended to induce changes in the composition, behavior, or dynamics of the atmosphere by artificial means.[4]

In passing the Act, the General Assembly recognized the economic benefits to be derived from weather modification and determined that operations, research, experimentation and development in the field of weather modification should be encouraged, provided proper safeguards are in place in order to minimize possible adverse effects.[5]

The Executive Director is charged with administering the Act[6] and is authorized to, among other things:

- Issue permits to weather modification operations;[7]
- Establish standards and instructions to govern research and development or commercial operations in order to minimize danger to land, health, safety, people, property or the environment;[8]
- Make studies or investigations, obtain information and hold any hearings necessary to assist the Executive Director in the administration of the Act;[9]
- Represent the State in matters pertaining to plans, procedures or negotiations for interstate compacts relating to weather modification, recognizing that the consent of the General Assembly and approval of the Governor is needed prior to implementation of any such compact;[10]
- Participate in and promote continuous research and development in the theory, development and utilization of weather modification;[11]
- Conduct and contract for research and development activities relating to weather modification; and[12]
- Accept federal grants, private gifts and donations from any source.[13]

[3] § 36-20-103, C.R.S.
[4] § 36-20-104(10), C.R.S.
[5] § 36-20-102, C.R.S.
[6] § 36-20-105(1), C.R.S.
[7] § 36-20-108(1), C.R.S.
[8] § 36-20-108(2), C.R.S.
[9] § 36-20-108(3)(a), C.R.S.
[10] § 26-20-108(4)(a), C.R.S.
[11] § 36-20-108(5), C.R.S.
[12] § 36-20-108(6), C.R.S.

Each weather modification operation must have its own permit that describes the specific geographic area authorized to be affected and the specific time period during which the operation will be conducted. A permit for a ground-based operation that does not involve cloud seeding is valid for one year. A permit for a ground-based operation that conducts cloud seeding is valid for five years during the initial and first renewal periods, and for 10 years for subsequent renewals.[14] The Executive Director may refuse to renew a permit if the applicant has failed to comply with any provision of the Act.[15]

To initiate the permitting process, an applicant must:[16]

- Pay the required fee;
- Provide information regarding the qualifications, education and experience of the operator;
- Publish, in the counties to be affected, a notice of intent to modify weather, along with a description of the primary target area and the time and place of the hearing regarding the proposed operation;
- Provide evidence of liability insurance of at least $1 million to meet any obligations reasonably likely to be attached to or result from the proposed weather modification operation; and
- Submit a complete operational plan that includes:
    - Statement of objectives;
    - Map of the proposed operating area that specifies the primary target area and shows the area reasonably expected to be affected;
    - A description of how the project will be carried out, including location of offices, weather data used, aircraft types, seeding devices and materials, seeding rates, etc.;
    - Name and address of the operator;
    - Nature and object of the intended operation;
    - Person or organization on whose behalf the operation is to be conducted (i.e., the operation's sponsor); and
    - Statement showing any expected effect on the environment.

[13] § 36-20-108(8), C.R.S.
[14] §§ 36-20-108(1) and 36-20-114(1), C.R.S.
[15] § 36-20-119(2), C.R.S.
[16] § 36-20-112(1), C.R.S., and Rule (C)(1)(c).

The permit fee must be at least $100 and must be sufficient to cover the direct costs of reviewing the permit application, the public hearings regarding the application, and monitoring of permit operations.[17] The Executive Director may exempt from the permit fee requirement, those operations that involve:[18]

- Research, development and experiments by state and federal agencies, state institutions of higher education, and bona fide nonprofit research organizations;
- Laboratory research and experiments; and
- Activities of an emergency nature for protection against fire, frost, hail, sleet, smog or drought.

Prior to issuing a permit, the Executive Director must determine that the project:[19]

- Is reasonably expected to benefit the people in the area or of the state;
- Is scientifically and technically feasible;
- Does not involve a high degree of risk of substantial harm to land, people, health, safety, property, or the environment;
- Is designed to include adequate safeguards to prevent substantial damage to land, water rights, people, health, safety or the environment;
- Will not adversely affect another project; and
- Is designed to minimize risk and maximize scientific gains or economic benefits to the residents of the area or the state.

A permit holder must maintain, for each day a weather modification activity is undertaken, a log that records:[20]

- Date;
- Starting and ending time of the activity;
- Primary target area;
- Generator number or other location identifier;
- Wind direction;
- Seeding material used, including the dispersal rate and total amount used; and
- Total number of hours the activity lasted.

This log must be made available for inspection by the Executive Director or the public. Additionally, the permit holder must submit biweekly and annual reports to the Executive Director.[21]

[17] § 36-20-113, C.R.S.
[18] § 36-20-109(2), C.R.S.
[19] § 36-20-112(3), C.R.S.
[20] Rule (C) and Form WM3.
[21] Rule (C).

Once issued, a permit may be modified by the Executive Director if it appears necessary to protect the health or property of any person or to protect the environment, and the operator is given notice and reasonable opportunity for a hearing.[22] However, if an emergency situation exists or is pending that could endanger life, property or the environment, the Executive Director may suspend or modify a permit, provided a hearing is held no more than 10 days after such an action.[23]

The Executive Director may suspend or revoke a permit if it appears that the operator no longer has the qualifications necessary for the issuance of an original permit.[24] A hearing to revoke or suspend a permit must be held before an administrative law judge.[25]

Any person who operates a weather modification program without a permit, or who knowingly violates the conditions of a permit commits negligence *per se*.[26] The Executive Director may order such person to cease and desist. [27]

A person commits a Class 6 felony, which is punishable by between 12 and 18 months' imprisonment, a fine of between $1,000 and $100,000, or both,[28] if he or she:

- Conducts a weather modification operation without a permit;[29]
- Pays another person known to be without a permit to conduct a weather modification operation;[30] or
- Fails to comply with the Executive Director's order to cease and desist from operating without a permit. [31]

Finally, the Executive Director must report to the Federal Aviation Administration any person who conducts a weather modification operation from an airplane without a permit to do so.[32]

[22] § 36-20-115(1), C.R.S.
[23] § 36-20-115(2), C.R.S.
[24] § 36-20-119(1), C.R.S.
[25] § 36-20-121(2), C.R.S.
[26] § 36-20-123(2)(a), C.R.S.
[27] § 36-20-123(2)(b), C.R.S.
[28] §§ 18-1.3-401(1)(a)(III)(A) and (1)(a)(V)(A), C.R.S.
[29] § 36-20-126(1)(a), C.R.S.
[30] § 36-20-126(1)(a), C.R.S.
[31] § 36-20-123(2)(b), C.R.S.
[32] § 36-20-126(1)(b), C.R.S.

Program Description and Administration

Although the Executive Director of the Department of Natural Resources (Executive Director and DNR, respectively) is statutorily charged with administering the Weather Modification Act of 1972 (Act), this authority has been delegated to the Director of the DNR's Colorado Water Conservation Board (Director and CWCB, respectively).

The Director, in turn, employs 1.0 full-time equivalent employee to oversee the day-to-day operations associated with the Act. This employee is responsible for issuing, denying, suspending and revoking weather modification permits, and for monitoring conditions to determine whether weather modification operations should be suspended.

Permitting

All weather modification operators in Colorado must obtain a permit from the Director.

The process typically begins with the project sponsor selecting an operator. In practice, the operator generally assumes responsibility for obtaining the permit.

The operator submits an application to the Director to begin the process. The application must outline the locations where equipment is to be sited, as well as all target areas. Additionally, the application must provide information as to the identity of the project sponsors, the value of the contract between the sponsor(s) and the operator, and the operator's qualifications. Finally, the operator must submit evidence of having liability insurance.

The Director, along with the Attorney General's Office (AGO), drafts a Notice of Intent to be published in the newspapers of the counties in which the target areas are located, as well as in the newspapers of all counties that touch the target area counties. The operator ensures that these publications take place.

The Director then holds public hearings on the permit. Following this, a Record of Decision is drafted and the permit is issued.

Permits for ground-based cloud seeding operations are issued for five years. They may be renewed for an additional five-year period. All renewals after that may be 10-year periods. Between fiscal years 04-05 and 09-10, there have been eight active permits:

- Central Rockies Cloud Seeding Program sponsored by Denver Water.
- Eastern San Juan Mountains Cloud Seeding Program sponsored by City of Durango, Florida Water Conservancy District, Pagosa Water and Sanitation District, Pine River Irrigation District and Southwestern Water Conservation District.
- Grand Mesa Cloud Seeding Program sponsored by Water Enhancement Authority.[33]
- Gunnison County Cloud Seeding Program sponsored by Gunnison County and Upper Gunnison River Water Conservancy District.
- Telluride Ski Area Cloud Seeding Program sponsored by Dolores Water Conservancy District, Southwestern Water Conservation District and Telluride Ski and Golf Company.
- Upper Roaring Fork River Cloud Seeding Program sponsored by Colorado Springs Utilities.
- Vail/Beaver Creek Cloud Seeding Program sponsored by Vail & Associates.
- Western San Juan Mountains Cloud Seeding Program sponsored by Animas La Plata Water Conservancy District, Dolores Water Conservancy District, Durango Mountain Resort and Southwestern Water Conservation District.

Permits for ground-based non-cloud seeding operations, such as hail cannons, are valid for one year, although the notice and hearing requirement is followed every five years. Only one permit for hail cannon operations has been granted -- in the San Luis Valley.

The Director charges two fees associated with weather modification permits: an application fee and a commercial fee. Both fees are used to cover the direct costs of reviewing permit applications, public hearings held on the permit applications, and monitoring permitted weather modification operations. The application fee is $100.

The commercial fee is calculated as two percent of the value of the contract between the project sponsor(s) and the operator, or, if the sponsor and the operator are one and the same, as is the case with the hail cannon permit, the fee is based on the costs of running the actual weather modification program.

[33] Water Enhancement Authority comprises City of Grand Junction, Collbran Water Conservancy District, Crawford Water Conservancy District, Fruitland Mesa Water Conservancy District, Grand Mesa Water Conservancy District, Kannah Creek Water User Association and Overland Ditch and Reservoir Company.

Table 1 illustrates, for fiscal years 04-05 through 09-10, the amount of revenue generated by the commercial fees.

Table 1
Revenues Realized from Commercial Fees

Fiscal Year	Revenue from Commercial Fees
04-05	$19,032
05-06	$9,452
06-07	$9,899
07-08	$11,233
08-09	$11,024
09-10	$10,499
Total	$71,139

The high level of fees collected in fiscal year 04-05 can be attributed to the fact that one operator paid two years' worth of fees at one time.

Subsequent fluctuations occur because the fees are based on the value of the contract between the operator and project sponsor, and may be driven by the number of days seeding occurs.

Suspensions

One of the more crucial aspects of the permitting program administered by the Director is the ability to suspend cloud seeding operations. Although the suspension criteria are outlined in each permit, as opposed to a rule or statute, the criteria are consistent from one permit to another.

An operator must suspend cloud seeding operations when:

- The National Weather Service forecasts a storm that is expected to produce unusually heavy precipitation that could contribute to avalanches or unusually severe weather conditions in the project area (Avalanche Suspension);
- The Colorado Avalanche Center issues an avalanche forecast warning for avalanche areas located in the target area (Avalanche Warning Suspension);
- The Director or the project sponsors order suspension of seeding for any reason; or
- The snow water equivalent of the snowpack in the target area measures at or above (Snowpack Suspension):
    - 175 percent of historical average on December 1;
    - 175 percent of historical average on January 1;
    - 160 percent of historical average on February 1;
    - 150 percent of historical average on March 1; or
    - 140 percent of historical average on April 1.

Although the Director is authorized to "order" the suspension of seeding operations, in practice, such suspensions are more collaborative in nature. For example, when one of the conditions above is present, staff of the CWCB contacts the operator, typically by phone, and both parties agree that operations will be suspended. CWCB staff reports that no operator has refused an informal request to suspend operations.

Table 2 illustrates, for fiscal years 04-05 through 09-10, the number of suspensions put into effect.

Table 2
Suspended Cloud Seeding Operations, by Fiscal Year

Type of Suspension	04-05	05-06	06-07	07-08	08-09	09-10	Total
Avalanche	3	0	1	5	1	0	10
Avalanche Warning	2	0	0	0	0	0	2
Snowpack	0	0	0	3	0	0	3
Total	5	0	1	8	1	0	15

As these data demonstrate, cloud seeding has not been suspended often, but the suspension criteria have been utilized an average of 2.5 times each year.

Analysis and Recommendations

Recommendation 1 – Continue the Weather Modification Act of 1972 for nine years, until 2020.

The first sunset criterion asks whether regulation is necessary to protect the public health, safety or welfare. With respect to weather modification, it is reasonable to question the efficacy of weather modification operations. If such operations are effective, then perhaps regulation is necessary. If such operations are not effective, regulation may not be necessary.

Recall that the two types of weather modification operations conducted in Colorado are ground-based, wintertime cloud seeding and hail cannons.

If cloud seeding works, then it is reasonable to expect snowfall, and thus, snowpack to increase. This can create dangerous conditions in terms of hazardous driving conditions and increased risk of avalanches and springtime floods.

Similarly, if hail cannons work and disrupt the mechanics of a particular storm system, the damage caused by the hail may be less extensive than would have otherwise occurred. However, the disrupted mechanics of the storm may also disrupt or redistribute rainfall.

In both instances, the risk of public harm is clear, and would seem to warrant regulation.

However, if cloud seeding does not work, and snowfall is not impacted by seeding operations, is there any harm that would justify regulation? Recall that cloud seeding generators release silver iodide into the atmosphere. At first blush, this would appear to be grounds to regulate: a foreign substance is released into the air, and that substance must fall to the ground at some point.

However, some research does not support this conclusion: "Accumulations [of silver] in the soil, vegetation, and surface runoff have not been large enough to measure above natural background."[34]

Indeed,

> The toxicity of silver and silver compounds (from silver iodide) was shown to be of low order . . . the small amounts of silver used in cloud seeding are 100 times less than industry emissions into the atmosphere in many parts of the country or individual exposure from tooth fillings.[35]

[34] Steven Hunter, *Optimizing Cloud Seeding for Water and Energy in California,* prepared for California Energy Commission, March 2007, p. 17.
[35] Steven Hunter, *Optimizing Cloud Seeding for Water and Energy in California,* prepared for California Energy Commission, March 2007, p. 16.

Based on this evidence, then, it is reasonable to conclude that if cloud seeding does not work, then regulation is not necessary because the risk of harm to the public is remarkably low.

Similarly, if a hail cannon does not work, the public harm is, at worst, the nuisance presented by the sound of the cannon being fired. Again, it is reasonable to conclude that regulation is not necessary.

Unfortunately, the efficacy of weather modification, in all of its many forms, is far from a settled question, and is likely to remain so for the foreseeable future. The problem rests with the weather itself. No two storms are identical, follow the same track or impact the same areas. As a result, it is difficult, if not impossible, to run a control to determine what happens when weather modification occurs and when it does not.

As such, the regulation afforded by the Weather Modification Act of 1972 (Act) is sufficient. The Act requires operations to be permitted so that operations can be halted when snowpack reaches certain thresholds, requires operators to maintain records of when they operate, and, at least with respect to cloud seeding operations, to record how much silver is used. These are reasonable requirements and do not represent an overly burdensome process.

On the other hand, California has a robust cloud seeding industry and no state regulation. According to officials there, the lack of regulation has had no negative impacts primarily because most cloud seeding operations are sponsored by public entities, such as water districts (as is the case, for the most part, in Colorado).

Thus, the California experience tends to argue in favor of sunsetting the Act – no known negative outcomes have resulted from the lack of regulation.

However, the very uncertainty of the efficacy of weather modification justifies continued State involvement. Water is a precious commodity in Colorado and one in which the State of Colorado has a direct interest. As such, continued State involvement in this area, via the Act, is justified.

For all these reasons, the General Assembly should continue the Act for nine years, until 2020.

Recommendation 2 – Require the Executive Director to promulgate new rules no later than January 1, 2012.

Section 36-20-107, Colorado Revised Statutes, requires the Executive Director to promulgate rules "necessary to effectuate the purposes of" the Act. This has not been done since 1986.

The Colorado Weather Modification Rules and Regulations (Rules) address pertinent provisions relating to the permitting process, notification requirement, and required reports.

However, the Rules also address the licensing requirements for operators.[36] The statutory authority to issue such licenses was repealed in 1996, following the last sunset review of the Act.

Additionally, the rules require permit holders to have $1 million in insurance to meet any obligations reasonably likely to be attached to or result from the weather modification operations. Given that this standard was put in place 24 years ago, it is reasonable to question its continued adequacy.

The simple fact that the Rules have not been revised in 24 years is not, in and of itself, problematic. If nothing had changed in those 24 years, there would be no problem. However, a lot has changed, and the Rules currently exceed the Executive Director's statutory authority.

Worse, perhaps, the rules are confusing. The Executive Director does not issue licenses to operators, yet the Rules create the perception that such a license is required.

Ordinarily, this type of issue would result in an administrative recommendation to the agency. However, the 1995 sunset report of the Act contained an administrative recommendation that recommended that the rules be updated since, at the time, they had not been updated since 1986. That recommendation was not followed, and the rules have become only more obsolete. Therefore, the General Assembly should require the Executive Director to promulgate new rules no later than January 1, 2012.

[36] Rule B.