

## WEATHER MODIFICATION - WHAT IS IT?

Weather modification is the intentional treatment of one or more cloud systems to produce an effect beneficial for people or to the environment. Programs most often performed in the past have been for one of the following reasons: (1) to increase precipitation, either rain or snow, (2) to reduce crop-damaging hail or (3) to disperse fog.

Shortly after 1946 important scientific discoveries pertaining to weather modification were made. In those early years most of these discoveries were made by a renowned group of researchers from the General Electric Research Laboratories in Schenectady, New York. During this time they found they could alter the physical processes within clouds to cause rainfall. Numerous tests were conducted, mostly using dry ice or various complexes of iodine, usually silver iodide, as the material (or "seed") to be placed into the experimental clouds.

All air contains some moisture, often this moisture is described in terms of "relative humidity". If a sample volume of air has a relative humidity of 50% at a given temperature, it contains half the total moisture it can hold at that temperature. If the sample air becomes cooler (as when an air mass rises) it is less able to hold moisture and its relative humidity increases. Eventually, if the sample rises far enough, it can cool to the point where it reaches a relative humidity of 100% despite not having had any moisture added to it.

With sufficient cooling, as in our example, eventually moisture will begin to condense around microscopic particles present in the air (such as dust and smoke). These particles are called *cloud condensation nuclei*. Initially, atmospheric vapor needs these particles to condense upon. With further cooling, droplets will fall below freezing and become "supercooled". Other special, small particles are also found in the air, called *ice nuclei*. These particles cause supercooled droplets or supercooled water vapor to freeze when they become embedded in, or make contact with the droplets or vapor. When both supercooled water (or water vapor) and ice crystals begin existing together in a cloud, their subsequent interaction results in more ice crystals forming and ice crystals growing to a size capable of allowing them to fall to the ground as some form of precipitation. If there is sufficient warming, rain or drizzle occurs; otherwise, snow, hail or sleet may be the case.

The physical make-up of a cloud is, therefore, very important in the process. Cloud volume, moisture characteristics and distribution of nuclei all play significant roles. Cloud condensation nuclei are relatively abundant in the atmosphere, whereas, ice nuclei are comparatively rare. It is in the addition of ice nuclei to a cloud that cloud seeding can stimulate the beneficial effects desired.

Cloud seeding is simply a means of assisting a natural process to evolve. The explanation given above is a simplified representation of the normal circumstance. However, in reality, clouds are much more complex and depending on their individual make-up, they usually require a variety of seeding techniques or seeding materials to be effective in obtaining the desired result.

What about "downwind" and "environmental" effects? According to the Weather Modification Association, positive effects have been recorded for distances of 100 miles downwind of operational areas, while no significant indications of downwind rainfall decreases have been recorded from any long term seeding activity. Moreover, silver and iodine concentrations in rainwater where silver iodide has been used measure less than 1 part per billion - well below acceptable levels set by the US Public Health Service.

Does it work? According to the National Academy of Sciences, it does work. They report that properly designed program operated by competent directors can increase rainfall from 10-25% and decrease damaging hail by 30-70%. These figures are based on nearly 40 years of researching projects in over 40 countries of the world.

Questions concerning cloud seeding can be directed to either of the GMD offices - in Scott City or Colby. The next article will cover the cloud seeding activities on-going in other states as well as Kansas. Please watch your papers. Finally, the published references below have been provided to the area libraries for your convenience and review.

The reference materials for this article are: *Weather Modification - Some Facts About Seeding Clouds*, published in 1984 by the Weather Modification Association, Fresno, CA., and personal interview with Curtis Smith, Program Meteorologist of the Western Kansas Groundwater Management District No. 1 Weather Modification Program.

## WEATHER MODIFICATION - WHERE IS IT HAPPENING?

A variety of non-experimental weather modification programs have been performed in the U.S.A. and elsewhere around the world for several decades. These programs are each designed to address a particular weather-related problem for a specific area. For instance, snowpack augmentation in the Sierra Nevada mountains of California has been performed since the early 1950's by both hydro-electric utilities and irrigation districts. In Canada the Province of Alberta performed important hail research and seeding operations for many years. Although some of the following western European countries have had operational programs somewhere within their borders, it is not known whether all continue to do so now; they are: Greece, Italy, Turkey and Switzerland. Other eastern and western European countries have performed weather modification programs for one or more decades to reduce hail: France, USSR, Yugoslavia, Bulgaria and Spain. Mid-eastern, North-African and Asian countries have been more interested in winter rainfall stimulation for domestic and agricultural uses and have had periodic programs: Morocco, Libya, Jordan, Iran, United Arab Emirates, India, Thailand and the Philippines. Probably more than any other country, Israel has made the most progress toward scientifically understanding the rainfall process as it pertains to them and have been able to obtain statistically high results from their cloud seeding operations. Most weather modification research and operations in sub-Saharan African countries have been in Kenya, Zimbabwe (formerly Rhodesia) and South Africa. Only Zimbabwe is known to have an operational program at this time, but there is a strong governmental commitment to precipitation research in South Africa. Australia has conducted important research in rainfall. In Central and South America only Chile is known to have active weather modification programs now. Weather modification programs have been performed in Mexico, Panama, Venezuela and Argentina. The Caribbean countries of the Dominican Republic, Jamaica and Antigua have had rainfall stimulation programs at one time or another.

As the worldwide population has grown larger with time, the worldwide need for a reliable supply of water for domestic use, industry and agriculture has grown. Not surprisingly, worldwide interest in using weather modification as a water resource management tool has increased.

A variety of U.S. governmental organizations and concerned groups have sponsored weather modification-related activities, among them: the Bureau of Reclamation, Air Force, Navy, NOAA and National Science Foundation. Numerous academic Institutions have been active participants in research, but generally they have received their funding from one of the previously mentioned governmental agencies or grants from state agencies. Private funds have been devoted almost entirely to specific operational programs and not research. According to the Weather Modification Association (WMA), 19 universities are currently represented by virtue of faculty membership in that association. The WMA also lists a dozen private groups acting as consultants or operating commercial programs for sponsoring groups.

Kansas is one of 32 states which has enacted weather modification legislation to regulate the quality of activity within the state's borders. The responsibility for holding hearings, issuing licenses and permits and for monitoring weather modification programs rests with the Kansas Water Office. In 1989, the latest year for which statistics were available, NOAA reported 40 separate weather modification activities being performed in 16 states. Kansas and North Dakota were the only two states in the High Plains in which hail suppression and rainfall augmentation were performed last year.

Unrelatedly, we find it interesting that so much severe weather occurs at higher elevations relatively frequently, be it Western Kansas or the earth's equator. When hail occurs in Western Kansas, a high availability of moisture is implied -- usually it occurs seasonally between spring and fall. During periods of high moisture availability, various kinds of clouds form and weather modification can be employed to increase rainfall and reduce hail. The dual objectives of increasing rainfall and reducing hail has been the long-term goal of the successful 17-year program operated by Western Kansas Groundwater Management District #1. The operational headquarters of the program is based in Lakin, Kansas. The next article in this series will cover in depth the Lakin-based program -- Kansas' only active weather modification program.

The reference materials for this article are: *Weather Modification - Some Facts About Seeding Clouds*, published in 1984 by the Weather Modification Association, Fresno, CA., and personal interview with Curtis Smith, Program Meteorologist of the Western Kansas Groundwater Management District No. 1 Weather Modification Program.

## WEATHER MODIFICATION - THE LAKIN, KANSAS PROGRAM

Twenty-two years ago, the Western Kansas Groundwater Management District No. 1 endorsed a program to seed clouds to help alleviate the ever-increasing loss of sub-surface water in western Kansas. Per the provisions of the Kansas Weather Modification Act they wrote a detailed operational plan and then secured a license and a permit from the state of Kansas. They also had to secure their funding, which came from local GMD funds and special levies from the County Commissioners. They also had to locate critical equipment and technical expertise (borrowed from the Bureau of Reclamation) and find suitable aircraft (which they leased) before the program ever began in earnest. However, from these modest beginnings the program has gradually evolved each year into the sophisticated program it is today - operating also for hail suppression, authorized for nighttime seeding and owning all its own equipment, including radar, aircraft and building facility.

The 1995 program began in June 1994 when the commissioners were again approached about continued funding. Each year the Commissioners re-consider funding and participating in the program. If they decide to do so, they approve the county funding, which in 1995 was an amount equalling approximately 4.2 cents per acre of cropland plus 1.5 cents per acre of rangeland within the county. The participating counties in any given year comprise the "target area", which in 1995 was made up of Wallace, Greeley, Wichita, Scott, Lane, Hamilton, Kearney, Finney, Gray, Ford, Haskell, Grant and Stanton Counties. Throughout the duration of the program, as many as 16 Counties have been involved.

The 1995 program ran from May 1 through September 15, 1995. Each program day begins with a weather forecast by the project meteorologist and his staff using daily upper air soundings from the National Weather Service in Dodge City, and other weather data. Usually completed by mid morning, the daily operational plan is then telephoned to the pilots at the sites remote from Lakin, and the daily schedule is formulated. A visual and radar watch then commences, with the radar measuring such data as cloud height, location, intensity and other physical characteristics. All readings are electronically stored for review and/or evaluation at a later time. When the weather is right, the appropriate number of the project's five aircraft are sent up to either observe the developing storm or seed it. The program currently has 4 single engine Piper Comanches for seeding at cloud base (with wing-tip liquid fuel generators for silver iodide) and 1 twin-engine Piper Navajo (with a specially built dry ice dispenser) for seeding at or near the cloud tops. The Navajo is hangared at Dodge City while the Comanches are at Lakin, Johnson, Syracuse and Scott City.

The program had 55 operational days in 1995, conducting 411 total flights and seeding for 798 hours. From long term data, these are above average figures for the effort. Like many years before, most program problems resulted in too many storms on the active seeding days, indicating the need for additional aircraft. The 1995 Report recommendations are largely repeats from the 1994 final report. There were at that time needs regarding hanger space, a better rainfall observer network, enlarging the field office and additional planes for better coverage. They also recommended lengthing the program period by at least one week in order to better cover the expected hail incidence period. Program expansion was suggested for the first time for the NW Kansas area. Finally, better radio communications between the pilots and the meteorologist was recommended.

The reference materials for this article are: *Final Report Western Kansas Weather Modification Program, 1990*, published by Western Kansas Groundwater Management District No. 1, and personal interview with Curtis Smith, Program Meteorologist of the Western Kansas Groundwater Management District No. 1 Weather Modification Program.



## WEATHER MODIFICATION - A RECENT HISTORY OF NORTHWEST ACTIVITY

For this article the district wanted to take a recent historical look at what efforts our region of the state has dedicated to weather modification, concentrating on efforts beginning with the inception of the Bureau of Reclamation's High Plains Cooperative Program called HIPLEX.

The state actually got formally involved in 1955 when the legislature created the Kansas Water Resources Board (KWRB), charging this body with, among many other duties, the collection of water, soil and climate data in order to develop a state water plan adequately written to best manage the state's groundwater, surface water and atmospheric water. The KWRB began conducting field experiments in Kansas during the summer of 1972. Colby was the first of these three experiments, which became collectively known as the Kansas Cumulus Project, or KANCUP. These efforts introduced the Bureau of Reclamation (Bureau) into the state as it was their radar and computer facilities which were used.

In May, 1974 three sites were chosen by the Bureau to further study the effects of seeding clouds. Colby-Goodland was one of these areas in addition to Miles City, Montana and Big Spring-Snyder, Texas. Shortly thereafter cost-sharing agreements were formalized between these states and the Bureau. In general, the states were to be responsible for defining policy objectives while the Bureau was to handle scientific and field testing objectives. More specifically, the Miles City site was to conduct single-cloud experiments while the Colby-Goodland and Big Spring-Snyder sites were to conduct background data accumulation experiments in preparation for single-cloud seeding in the future.

Also in 1974 the Kansas Legislature passed the Kansas Weather Modification Act which became effective July 1, 1974. This law provided for state regulation of all seeding activities conducted within the state.

The HIPLEX activity continued at the Colby-Goodland site under the state/Bureau agreements until the middle of 1976 when there began a push to transform the project and integrate it with the operational seeding program being conducted out of SW Kansas under direction of the Scott City based Groundwater Management District. This push continued into 1977 with NW Kansas getting ever closer to losing their Colby-Goodland site. This message was beginning to be publicized by the newly formed Northwest Kansas GMD 4 who at their February, 1977 board meeting had already expressed sincere interest in developing an operational program in conjunction with HIPLEX.

GMD 4 began in March, 1977 polling the County Commissioners as to their interest in a local seeding program. In May, 1977 they also placed \$5,000 in their 1978 operational budget for a possible program. At that time, Gove, Sheridan and Thomas were the only counties to express an interest. Decatur never discussed the issue and Graham, Logan, Rawlins and Sherman Counties voted "no interest". The GMD Board continued their efforts and in August, 1977 applied for a grant from the state to conduct a 1-month operational program during 1978. This grant was approved for \$28,000. The June, 1978 program was conducted and the final report remains in the district office for public review. No further interest could be generated from the counties as the report was forwarded to them for review.

The issue of operational seeding laid dormant for nearly ten years following the 1978 program. In August, 1986 the Lakin, Kansas project contacted this district about adding our ten-county area to the existing program. During an October regional meeting of County Commissioners held in Oakley, Kansas, the issue was discussed and supported by 9 of the 12 counties present. It was then decided to meet again to formally discuss options and alternatives. All commissioners were invited to the working session which was scheduled for November 5, 1986. Seven commissioners representing 4 counties (Thomas, Sheridan, Rawlins and Logan) attended, and a procedure was developed to assess area interest. Each County was to express, by February 15, whether or not they wanted a detailed presentation of the proposal. Wayne Bossert was to then meet with each commission responding "yes", and fully explain the proposal and ask that by March 1, 1987 they decide whether or not they want to poll their voters - with no obligation to that point. By April 15, each county was to meet again with GMD4 staff to design a polling procedure acceptable to the commissioners. Finally, June 1, 1987 was a date each county was to decide to participate or not.

All Counties indicated "yes" to step 1, the presentation, and all counties received a special presentation in their own commissioners' rooms. When March 1 came, Thomas, Sherman, Sheridan, Graham, Gove and Wallace Counties indicated they would be willing to poll their voters, while Rawlins, Cheyenne, Decatur, Logan, and Trego Counties indicated they did not want the issue taken to the public and they were not interested in continuing discussions.

The next step, to meet again and design a method to poll public interest, was already underway with public meetings having been scheduled in Gove, Thomas and Wallace Counties to assess public support. These efforts were in fact unnecessary in that only six counties were going to remain in the program after step 3, which were not enough to operate a program. As a result, there was no need to continue any further, and on June 22, 1987, the proposal was abandoned.

The prospect was revived again in 1993 as the district identified it as an important step in its developing 4-prong program to control water table declines. So once again an effort was mounted to sell the concept of a NW Kansas program to the county commissioners. This effort got further along than any previous attempt, and actually found Sherman, Thomas and Sheridan County commissions agreeing to pass a funding resolution per limits identified in 1994 Final Report prepared by the Weather Modification Advisory Committee made up of county commission appointees. The effort finally failed again when the resolutions in Sherman and Sheridan County were voted down at the ballot following successful petitions in both these counties. Thomas County, as a result, never passed the funding resolution they had intended to.

BY 1995 the State Water Plan process had conducted an evaluation of the WKWMP and consequently included cost share funding to help local counties begin programs in the western 39 counties of the state. The issue again arose in the NW area and at the Northwest Kansas GMD 4 1996 annual meeting in Goodland, a group of irrigators asked the board to consider GMD funding in order to match with the SWP cost share money. Nineteen meetings, two public hearings, a newsletter ballot, and many personal contacts were held and made across the district, which ultimately resulted in 86% of the respondents supporting local funding on the water users to cover the local funding necessary to implement the program proposed back in 1994 by the Weather Modification Advisory Committee. In May, 1996, the board approved a revised 1997 operating budget that included \$181,000 for weather modification.

It is important to realize that as of May, 1996, 86% of all participants in the extensive public input process indicated support for the program, even recognizing that the water users would be paying the entire bill. In early 1997 (following tax statements) several petitions were circulated by persons opposing the program for various reasons. The petitions asked the Kansas Legislature to consider the process used by the local GMD and make whatever changes were appropriate to prohibit the board from being able to make similar decisions. The GMD board publicly expressed their disappointment in that the petitions were asking for the elimination of local control, which was considered to be a dangerous approach to this very local problem.

Following the revised 1997 budget hearing which resulted in locally funding 1/2 of the proposed program, the WKWMP went right to work and by January, 1997 put together most of the equipment needed to operate a NW facility. Three Piper Comanche aircraft were bought, an office was leased, a radar and tower were located and put in place, the necessary computer equipment was obtained and most of the pilots and program personnel were hired.

Today we are preparing for the 1997 annual meeting to be held in Colby, which will include a board-approved 1998 proposed budget with \$181,000 included for the continuation of the program. It should be a very interesting annual meeting for both those in favor of and those opposed to the program.

The reference materials for this article are: *Weather Modification Activities in Kansas 1972-1977, Bulletin 22*, Kansas Water Resources Board; KSA 74-2608 and KSA 82a-907; Memorandum of Tri-State HIPLEX Conference, Colby, KS, dtd August 30, 1976; Kansas Water Resources Board letter to Rep. Tom Beville, dtd February 22, 1977; and various GMD working files on weather modification.

## WEATHER MODIFICATION - EVALUATING THE EFFECTS

When most people are first introduced to the concept of seeding clouds to increase rainfall and reduce hail, the first question asked is, "Does it really work?" The answer is, "Yes, it really works – when performed at the proper time and under the proper conditions". History has taught us, sooner or later, all groups sponsoring long-term weather modification programs want to know how well their program is working, and eventually they conduct a program evaluation. In the evaluation game, however, we must all realize that different programs are designed for different purposes and are all operated differently. In addition, the standard statistical methods normally used have changed over time, and even on occasion more "creative" evaluation methods have been used. As a result of both these facts, program evaluations are very difficult to compare between each other if you're trying to generally quantify how well all modification programs work.

Normally things which can be counted and measured lend themselves well to standard statistics in which inferences are made about a group from a random sampling of it. Unfortunately, when it comes to something like clouds, no one knows exactly how much rain would have fallen from a given cloud had it not been seeded, or what size or number of raindrops or hailstones would likewise have fallen. Also, no one can know ahead of time exactly what amount of rain will fall over a growing season or how much hail damage to crops and property will occur with or without cloud seeding.

For these reasons, and others, weather modification programs generally have to be operated many years before "suggestions" of effect occurs or before any statistical results are accepted by the scientific community. Total agreement within the scientific community on such results are rare. In attempting evaluations, researchers usually develop a "target and control" approach in which an area of seeding effect is called the "target" and the "control" is, presumably, a nearby area unaffected by cloud seeding. Comparisons between the two areas are made, over time, in hopes of finding important differences between them that can be attributed to cloud seeding. Evidences of success are sometimes claimed through routinely collected data such as crop insurance (loss and liability), crop yields, and hail storm information including the sizes and numbers of hailstones, the frequency of hail events, etc.

It is again important to point out that different operational cloud seeding programs are conducted differently. In addition, over the period of time for which a program is being evaluated the program itself may not remain fixed: methods of delivering seeding agent into clouds can change; the type of seeding agent may change; aircraft numbers might change (increase or decrease); and even the target area size and shape may change from year-to-year. Furthermore, similar to many businesses, there can be important differences between the way commercial operators run their weather modification programs. Over extended time periods, rarely do two programs with similar objectives operate in exactly the same way as the other. Evaluational results, therefore, may vary widely for many reasons as well as from natural causes such as climatic shifts. Identical evaluational results are not to be expected from any two programs being compared.

Some evaluations of current and previous programs to reduce hail and to stimulate rain are of interest:

- (1) North Dakota - This hail reduction program, which has been operated in western North Dakota since the late 1950's, has shown a 43.5% reduction in crop-hail damage. Rainfall increases slightly less than 10% were also found.
- (2) Western Texas - An 8-year hail reduction program in the southern end of the Panhandle was found to reduce crop-hail damage by 48% and increase rainfall around 5%.
- (3) Kenya - An 8-year hail reduction program, where the number of yearly hail days averaged nearly 200, found a 28% reduction in hail damage and a 12% rainfall increase.
- (4) Southwest Texas - A rain stimulation program operating in and around Big Spring since 1971, was found to have a 10.3% increase in rainfall through 1986.
- (5) Northern Greece - A randomized hail reduction program operating in 1984 and 1985 found an averaged 75% reduction range for several hail parameters including: (a) number of hailstones; (b) maximum hailstone size; and (c) area over which hail fell.
- (6) Western Kansas - A combined hail reduction and rainfall stimulation program operating over 10-15 counties in Western and Southwestern Kansas since 1975. The most current evaluation for its first 11-years was done differently than other evaluations and found that "...the suggested (hail) suppression effect is a reduction in crop-hail damage of some 25 to 50 percent". That reduction was found to be significant in the eastern part of the target area. Although naturally drier weather occurred during the 11-year period, rainfall changes were found not to be statistically significant. It was noted that only if rainfall changes were on the order of 10% - 15%, or more, could statistical significance be found using their methods. If rainfall changes of this magnitude would have occurred in Kansas, it would rank among the best results of all worldwide programs. However, it was acknowledged the program had many fewer aircraft than it needed to properly service the size of their target area in order to obtain the best results for both hail reduction and increased rainfall.

There is no doubt that evaluations are going to continue for all such programs. Furthermore, the indications of all this work and evaluation clearly show that the scientific foundations of today's seeding are at least fundamentally correct. Therefore, most people in the field hold an optimistic future for the science of weather modification - one which can only improve its performance as more knowledge and experience are gained.

## WEATHER MODIFICATION - DEVELOPING A NORTHWEST KANSAS PROGRAM

This is the last article of the district's weather modification series of press releases. In article one the scientific principals of seeding were explored. Next we looked at where such activities were currently occurring. Articles 3-5 dealt with the Lakin, Kansas project in detail, the recent history of weather modification in Kansas and the scientific evaluations of the existing operational programs, respectively.

This entire process was supposed to give the residents and decision-makers of NW Kansas the answers to virtually any question they could ask regarding the subject, except for those questions regarding the specifics of a proposed program for NW Kansas. This last article will deal with this information.

Being proposed is a three aircraft, NW Kansas program covering the Counties of Cheyenne, Rawlins, Decatur, Sherman, Thomas, Sheridan, Graham, Wallace, Logan and Gove, which will be operated in complete cooperation with the existing program on-going in Lakin, Kansas. With a radar site and base in Colby, seeding aircraft would expect to be stationed in Goodland, Colby and St. Francis. The project meteorologist will coordinate all activities from the base, and do so in cooperation with the Lakin project base where practicable. This means that additional aircraft may be available for either program depending on the absence of seedable weather in the other's target area - a significant advantage for both programs.

Funding for such a program is expected to be approximately \$362,000.00 per year for the first five years as equipment are being bought, then reduce to approximately \$250,000.00 per year for continued operation. For the first year of the program, the local GMD will assess district water users an additional 20.5 cents per acre-foot of water rights to obtain 1/2 of the projected 362,000.00. The remaining \$181,000.00 will be requested from the state water plan fund. Since the state water plan fund cost share support is reconsidered every year, and limited to no more than 10 years maximum, other funding sources will eventually need to be obtained in order to continue beyond the period of state water plan support.

The program will simply be an expansion of the on-going WKWMP having been operated in Western and Southwestern Kansas for the past 22 years. Our relationship will be a contractual one with all funding paying for services to provide seeding support for the GMD 4 target area. All equipment will be owned by the WKWMP. Having but one program will allow it to operate as efficiently as possible, and will prevent the need to share or borrow equipment, services, or whatever. In this sense, we will be included in the WKWMP which will as a result have 9 aircraft to cover all or parts of 22 counties in western Kansas.

The program will operate under the Kansas Weather Modification Act, and a state-approved operational plan which considers the technical integrity of the program. This plan is revised every year and can only be approved if the program meets all insurance, personnel and technical requirements.

Program personnel have been working very closely with Colorado local officials to start a demonstration program in the very eastern areas of Colorado. If successful, this will allow our program to obtain a Colorado permit to seed clouds well into that state. This is an important issue for the western edges of our program in that seeding storms coming out of Colorado early enough will improve the program benefits to residents along the state border. To date, Yuma County, Colorado has agreed to request such a demonstration program for 1997 and is expected to support a Kansas request for a Colorado permit. More Colorado support will be sought in the future.

This concludes the series of informational articles designed to answer many questions people might have as they ponder the decision to support the program or not. If questions still linger, contact the GMD office at 1175 S. Range in Colby. The phone number is (913) 462-3915. The district also maintains a home page on the internet which has periodic update information regarding this program in addition to much other information. The URL is "<http://colby.ixks.com/~wbosser>".



## SUMMARY OF THE KANSAS WEATHER MODIFICATION ACT

### KSA 82a-1401 and sequence

82a-1401: Title

82a-1402: Definitions:

**Board** means Kansas Water Office;

**Person** means natural person, partnership, organization, corporation, municipality or any department or agency of the state

**Research & Development Operation** means an operation conducted solely for scientific & technical knowledge

**Weather Modification Activity** means any operation or experimental process trying to induce change in the composition, behavior or dynamics of the atmosphere.

82a-1403: The board is responsible for administering the act, and can make rules and regulations, issue licenses and permits, conduct hearings, and enter into contracts.

82a-1404: Repealed

82a-1405: The board may issue licenses per the act. Each project needs its own license, and can be comprised of one or more specific activities. Each permit shall describe: Geographic area of activity and affected area, and project duration. A license is issued only after the project is determined to provide substantial benefits or that it will advance scientific knowledge.

The board can also make investigations or studies to help it administer the act, and can hold hearings at their discretion.

The board can also expand its knowledge, pending funds, by research efforts in: Weather Mod Theory; use of weather mod for beneficial purposes; protection of life, health, property and the environment. It can also accept grants, gifts and donations for these purposes or the administration of the act.

The board can also contract for weather mod activities to seek relief from droughts, hail, storms, fires, fog or other weather conditions.

82a-1406: No person shall engage in weather mod activities without a permit and a license, or shall violate any term of their permit and license. The board may also exempt research and emergency activities from the required fees.

82a-1407: A license shall be issued to all who: apply in writing; pay the license fee; demonstrate they possess the skill and experience needed and demonstrate that they have either: 8 years of experience (3 years as a project director); have a related college degree and 3 years of experience; or have a related college degree, 25 hours of meteorology and 2 years experience.

82a-1408: \$100.00 license fee set for each year.

82a-1409: License can be suspended if permit conditions violated, fraud was used to obtain the license, negligent activity occurred or the act was violated. Complaints against any licensee must be filed in writing, specifying the charges. The board then may set hearings concerning the revocation of the license allowing the permit holder 30 days to respond.

82a-1410: Appeals for aggrieved persons.



82a-1411: Permit also conditioned upon: 1) proof of ability to respond to damages or accidents arising out of conducted activities. Must have a minimum of \$50,000 coverage against bodily injury or death; \$100,000 against bodily injury or death of two or more persons; and \$100,000 against property damage to others. State agencies and municipalities are exempt; 2) submission of a complete operational plan containing information as to how the program will be run, its objectives, target area, environmental statement of effects, the method(s) to be used to evaluate the program, and any other information required by the board; 3) publishing notice of intent to engage in seeding activities and conduct of a public hearing to hear all comments; 4) if a project for profit, demonstration of the economic benefit to the area; 5) if a project for research, demonstration as to how the project will expand knowledge; 6) an approved statement of the safeguards to protect public property, health, and welfare; and 7) an approved statement of how the project is designed to minimize risk and maximize economic and/or scientific gains.

82a-1412: Operations can take place only under the direction of the licensee.

82a-1413: \$100 fee shall be remitted to state treasurer and deposited to the state general fund.

82a-1414: A separate permit required for each calendar year activity. An emergency permit can be issued by the board without prior publication under certain instances.

82a-1415: The permit may be revised, suspended or modified by the board if the licensee is first notified and given a chance to respond, or an emergency exists which warrant such amendments. A licensee's refusal to comply with any such order shall be grounds for immediate revocation. It is the responsibility of the licensee to notify the board of any expected or anticipated emergency situations.

82a-1416: Licensee must confine operations to the conditions of the permit.

82a-1417: Must file reports required by the board. The board shall establish reporting guidelines and provide forms, etc.

82a-1418: Board may suspend or revoke a permit if the licensee no longer meets the operating qualifications. The board may also refuse to renew any license or issue any permit to any person failing to comply with the provisions of the act.

82a-1419: Board cannot suspend or revoke a license or permit without reasonable notice and opportunity to be heard.

82a-1420: State agencies and county and municipal employees shall be immune from liability resulting from activities.

82a-1421: Board may issue a cease and desist to anyone illegally operating.

82a-1422: The fact that a permit and license is issued does not absolve anyone from damages they may cause.

82a-1423: Makes it a class B misdemeanor to illegally conduct activities, make false statements to obtain a license, fail to file required reports, or otherwise operate outside the permit and license.

82a-1424: If any portion of the act is found invalid, it shall not affect the remainder of the act.

82a-1425: County commissioners may participate and may levy a tax not to exceed 2 mills upon assessed property to fund such activities, after sufficient public notice which must include information about the amount and duration of the levy. The act does exclude counties with population more than 180,000 but less than 220,000 and an assessed valuation more than 350,000,000 but less than 365,000,000 from this assessment authority. A petition of more than 5% of the qualified electors of a county filed within 60 days of the last publication will bring the issue to a county vote where a majority must approve it. Finally, commissioners may spend other funds on weather mod as well.