

"NON-REVIEWED"

DEVELOPMENT OF STANDARD PRACTICES  
FOR DESIGNING AND CONDUCTING  
WEATHER MODIFICATION PROJECTS

by  
George W. Bomar  
Texas Natural Resource Conservation Commission  
Austin, Texas

**Abstract.** The American Society of Civil Engineers' Atmospheric Water Management Standards Committee has begun the process of formulating a set of standard practices for designing and implementing various kinds of weather-modification projects. Subcommittees are working on standard practice documents for precipitation-enhancement, hail-suppression, and fog dispersion. A Standards Committee balloting process will be initiated in 1999 to finalize these standard practice documents, with the aim of publishing the documents once the full membership of the ASCE has engaged in a review and comment process on the documents.

## 1. INTRODUCTION

Because it is viewed increasingly for its potential to augment the supply of fresh water as well as a reliable means for mitigating certain hazardous weather conditions, the use of weather-modification technology has flourished in recent decades. Cloud-seeding projects have sprouted throughout the semi-arid western U. S. in hopes that they will prompt moisture-laden clouds to process and deliver increased amounts of rain water and snowfall. Other projects, particularly in vulnerable areas of the Great Plains, have embraced the seeding of clouds to lessen the likelihood of ruinous hail from large thunderstorms or to dissipate dense fog to facilitate the movement of air traffic.

This increased usage of weather-modification technology prompted the American Society of Civil Engineers (ASCE) to establish a Weather Modification Committee, whose responsibilities included the development of a manual of professional practice for augmenting precipitation (ASCE, 1983). Subsequently, a task committee of the ASCE Climate and Weather Change Committee expanded and updated this report (ASCE, 1995). This revised manual, *Guidelines for Cloud Seeding to Augment Precipitation* (ASCE Manual No. 81), provides water-resource managers and others who might become involved in the decision-making process for implementing a cloud-seeding project with the necessary guidance.

With specific guidelines in place for conducting cloud-seeding operations to augment

precipitation, the ASCE's Atmospheric Water Management (AWM) Standards Committee in 1996 began to develop a set of standard practices for designing and implementing these cloud-seeding projects. The AWM chose to develop a set of standard practices, not only for the enhancement of precipitation (rainfall and snowfall), but for the suppression of hail and the dispersal of fog as well. The Committee established a subcommittee to originate a draft document of standard practices for each of the three facets of present-day weather modification technology.

The three subcommittees of the AWM Standards Committee in recent months have written draft documents on standard practices for precipitation augmentation, hail suppression, and fog dispersion. This paper gives a description of these documents as well as the procedures to be followed in order to finalize and, thus, qualify them for publication by the ASCE.

## 2. CONTENTS OF THE DOCUMENTS

Each of the three documents provides an historical overview of the evolution of the technology of cloud modification applicable to each of the objectives.

The documents also summarize current perceptions of the respective technologies. Policy and capability statements issued by the American Society of Civil Engineers, American Meteorological Society, World Meteorological Organization, and Weather Modification Association are cited as summaries of present opinions on the scientific establishment of the technologies.

The user of the standards documents will also find a succinct description of the primary requisite atmospheric conditions that are conducive to the development of fog and rain-bearing and hail-producing thunderstorms. Various concepts that explain why some clouds materialize to pose a fog problem or develop to produce rainfall or hailfall are discussed to a limited extent. The role of numerical cloud models in characterizing the dominant microphysical and dynamical processes operative within fog and convective clouds is also covered succinctly.

The bulk of the documents addresses the general requirements for the conduct of cloud-seeding or fog-dispersal operations. The guidelines provide an extensive treatment of such considerations as selection of seeding agent(s), delivery systems, support equipment, targeting concepts, recognition of seeding opportunities, and personnel requirements.

Some limited discussion is provided on various legal and environmental considerations to be factored into designing and implementing weather-modification operations. Each document has a section containing suggestions on steps to be taken to ensure public safety and mitigate public concerns.

The issue of how to evaluate weather-modification activity is addressed in each of the three documents. Constraints on project design are discussed, including the merits and disadvantages of both randomized and non-randomized activities. Evaluations that shed much insight on the efficacy of weather-modification approaches may use either direct (pads, gages) or secondary (insurance, crop-yield) data.

Finally, each document provides a comprehensive glossary of acronyms and terms as well as a thorough listing of references.

### 3. PROCESS FOR ADOPTION OF A STANDARD

The ASCE Atmospheric Water Management Standards Committee will initiate certain ASCE-prescribed procedures in 1999 that will eventually lead to approval and publication of each of the three standard-practice documents.

#### 3.1 The Balloting Process

Any standard proposed for either precipitation-enhancement, hail-suppression, or fog-dispersion will have been discussed at a meeting of the ASCE AWM Standards Committee. A majority of

those present for the meeting must approve, by motion, for the standard to be submitted to a committee letter ballot. The letter ballot, including abstentions, must represent not less than 15 Committee members, or at least 65 percent of the approved AWM Committee membership. Of all the votes cast during the ballot process, affirmative votes must be at least 75 percent.

The period for letter balloting, to be established by the Committee during the spring of 1999 for at least one of the three draft documents, must be at least 30 days in duration and cannot begin before at least 30 days from the time the draft document is mailed to Committee members. Within 30 days of the end of the voting period, all letter ballots will have been counted and reported. Results of all letter ballots will remain confidential to Committee officers until the voting period is closed.

In the event negative votes on any draft document are cast, certain procedures will be followed by the Committee chair, who will review each negative vote with the member so voting. Any and all negative votes must be accompanied by an explanation, as well as a suggested change, to overcome the negative vote. Otherwise, the negative vote will be regarded as non-persuasive and will be reported by the chair as unresolved.

If a modification (other than editorial) to a proposed standard is required, the modified standard will be evaluated by the Standards Committee and voted on in another committee letter ballot. If the modified standard is not accepted, the negative vote in each instance will be designated non-persuasive and the negative voter so notified. If the modified standard is accepted, however, it along with commentary is then sent through the AWM Standards Committee to the Codes and Standards Activities Committee (CSAC) of the ASCE.

Once the CSAC reviews and approves the documents to ensure their compliance with ASCE rules, the proposed standards document can be sent to the full membership of the Society. A notice of the availability for review of the proposed standard with commentary is published in the *ASCE News*. A notice of the availability of a public ballot on the standard, and notification of the closing date for the balloting process, are also included in the *ASCE News*. The commentary is furnished with the public ballot for information and comment but is not to be voted on.

Anyone who is not a member of ASCE can request a ballot and participate in the public ballot on

the standard. Voting on the public ballot will close six weeks after the notice is published in the *ASCE News*, with all ballots sent to ASCE headquarters, where they will be counted within 30 days of the end of the voting period. Any negative votes will be processed by the Standards Committee in the same way (described above) that was followed when Committee members engaged in the balloting process.

Once due process is afforded for all negative votes cast, the CSAC will determine whether the standard and commentary were developed in compliance with ASCE Rules. Then, and only then, may the CSAC submit the standard to the American National Standards Institute for approval as an American National Standard.

### 3.1 Proposed Schedule for the Balloting Process

The AWM Standards Committee expects to initiate the balloting process on one, or more, of the standard-practice documents in 1999. Whether any of

the three documents can proceed to the CSAC for notification in the *ASCE News* before the end of 1999 will depend on the nature, and number, of negative votes cast by members of the full Standards Committee once the balloting process is underway during the spring/summer of 1999.

## 4. REFERENCES

ASCE, 1995: *Guidelines for Cloud Seeding to Augment Precipitation*, ASCE Manual of Professional Practice No. 81, American Society of Civil Engineers, New York City, 145 pp.

"Guidelines for Cloud Seeding to Augment Precipitation," 1983. *Journal of Irrigation and Drainage Engineering*, Vol. 109, No. 1, pp. 111-182.