permit proceedings was that the hearing officer again recommended against the cloud seeding, and, this time, the advisory committee concurred in the recommendation and the Natural Resources director, Ten Eyck, denied the permit. At bottom, the outcome had been determined by two major considerations: First, despite all the testimony of experts, the effects of cloud seeding simply are not predictable. Second, last November's straw vote showed conclusively that people in the San Luis Valley wanted the weather modification project stopped.

Under the new Colorado law, the applicant was required to show, among other things, that his proposed project (i) is technically feasible; (ii) involves no high risk of harming people, property, or the general environment; and (iii) is of economic benefit to the San Luis Valley and to Colorado. In his written opinion, Joseph Cook, the hearing officer, concluded that Atmospherics met the test on the first two, but not on the third. "The best judges of whether the people in the area are benefited are the people themselves," Cook said, referring to the straw vote.

On the other hand, the chairman of the advisory committee, Lewis O. Grant of Colorado State University (the meteorologist who demonstrated that the snowpack in the Rockies can be increased through cloud seeding), told *Science* that the straw vote was not decisive in his group's thinking. What was decisive, he believes, was the insufficiency of the information presented in support of the weather modification plan. Ten Eyck also found the applicant's case insufficient, but he says his judgment was strongly influenced by the outcome of the referendum.

In essence, the controversy over the San Luis Valley cloud seeding has posed two key policy questions:

- Should the state be allowing a purely commercial and *operational* (as opposed to experimental) weather modification project that involves the use of unproved methods having unpredictable effects?
- If the answer to the above is Yes, should it be qualified by adding that such a project must have the consent of a majority of the people in the area directly affected?

Although these questions were addressed somewhat obliquely in the San Luis Valley case, they were indeed addressed, with the answers being Yes to both questions. Therefore, barring an unlikely reversal of Ten Eyck's decision by the Colorado courts (as now sought by Atmospherics and Valley Growers, Inc.), the decision will stand as an important precedent. (It now appears that, even for the barley growers, the practical consequences of the decision will not be quite as bad as it first seemed when the Coors Company announced that most of its barley purchases in the valley would be phased out if the weather modification program were not continued. Coors is in fact carrying through with the cutback of purchases. But buyers for another brewery, who are not convinced that cloud seeding makes any difference, are now beginning to place contracts for barley with valley growers.)

Ten Eyck and his advisers are taking a clearly positive attitude toward weather modification projects that have an experimental emphasis. Already, permits have been granted for three such projects: the NCAR hail research project and two projects on increasing the snowpack in the Rockies (in one of the latter, the Bureau of Reclamation had redrawn the "target area" to exclude Ouray County because two small towns there want no more snow than nature alone provides).

Ten Eyck indicates that the San Luis Valley cloud seeding project would be more favorably regarded by him and his advisory committee if designed more as an experiment, with some randomization in the selection of clouds for seeding. The cost of a properly instrumented cloud seeding experiment would no doubt be well beyond the barley growers, however, even if, despite the high feeling in the San Luis Valley against *any* weather modification, a permit were indeed granted.

—LUTHER J. CARTER

Herbicide Panel Short on Fieldwork

The national controversy that has grown up about the impact of U.S. defoliation in Vietnam may be still far from settled after the report of the National Academy of Sciences' Committee on the Effects of Herbicides in Vietnam is released this fall. Last week, committee members working up the final document were admitting that they were unable to make the field studies in Vietnam on the scale and depth they had planned in view of the military situation there, and that the results would be less definitive than had been anticipated in 1970 when Congress assigned them the job of making a thorough study. The study has cost $1.25 million.

Even in March 1972, the committee interim report stated boldly: "It will be impossible to reach meaningful conclusions from random ground checks and qualitative aerial observations." But last week, committee chairman Anton Lang of Michigan State University and its executive director, Philip Ross, admitted in interviews that the security and logistics problems in the countryside had "hampered" or "impaired" systematic work on the ground. Lang said, "Since we did not do as much ground work as we expected, we have made extensive use of aerial photography and other means." Frank Golley, a committee member and executive director of the University of Georgia Institute of Ecology, said: "The committee did the best work possible under the circumstances, but it will not be the definitive study we had hoped it would be. We just couldn't get into the field to do the work because we would have been shot at." He said that they had resorted to aerial photographs, field trials outside Vietnam, and reading as alternative methods of study.

On 31 August the committee plans to give its final report to the Secretary of Defense, who in turn must release it unchanged in 30 days. The report will contain some field data, but some of it will have been gathered on a "hit or miss" basis, as one member said. Its approach will differ, then, from the ambitious program of quantitative analyses of various forest types, of the different agents and various times of application, of the cultural and psychological impact of the herbicide program, and, finally, of the sensitive issue of the persistence of the chemicals—including the known teratogen dioxin found in Agent Orange—in the Vietnamese environment, outlined in the 1972 interim report.

Not until the text of the report is made public will it be known how successfully the committee circumvented the problem of having "hit or miss" field data to work from. But at present it looks as though their report might leave some questions, anyway, unanswered.—D.S.