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Reference: HB 2106

Senate Energy and Natural Resources Committee:

As an atmospheric scientist with 30 years of experience, published author on over 25 peer-review publications in highly rated scientific journals, and past Editor of the Journal of Weather Modification, I would like to provide testimony related to North Dakota House Bill SB 2106. These comments are my personal opinions and do not represent the opinion of my current employers, past employers, scientific organizations that I am a member of, nor sponsors of research grants that I have received.

The North Dakota House Bill 2106 prohibits weather modification and cloud seeding activities in the State of North Dakota. The current practice of conducting cloud seeding to modify the weather focuses on increasing precipitation and reducing hail. Cloud seeding entails releasing small particles into clouds to affect their development. Supercooled clouds (clouds with droplets at a temperature below 0 °C) can be seeded with ice nuclei, such as silver iodide. The introduction of silver iodide into supercool cloud regions by aircraft creates ice crystals (snow) which enhance the efficiency of precipitation production. Ice particles quickly grow in mixed-phase clouds at the expense of water droplets, obtaining sizes large enough to fall, pass into warm air, melt, and land as rain drops. The ice nuclei that typically occur naturally in the atmosphere only produce ice at cold temperatures (< -15 to -25 °C), while cloud seeding can produce ice in warmer (-5 to -15 °C) supercooled clouds. Production of ice at warmer temperatures increases the precipitation production efficiency of clouds, which is similar to how educated workers improve the efficiency of a factory.

Numerous scientific studies, including my own published papers, indicate that cloud seeding can increase precipitation 5 to 10 percent on a seasonal average. The 5 to 10 percent increase is relatively small compared to the 200 to 400 percent seasonal difference between precipitation that occurs year-to-year in North Dakota. However, even such a small percentage has been shown to have a positive economic benefits to local communities. The effect of weather modification are also confined to county size areas, not areas the size of the State of North Dakota. It is important to note that rainstorms only remove approximately 10 percent of the water vapor for an atmospheric region; therefore, there is always sufficient water vapor available to produce precipitation in other locations. Hence, it makes sense to **maintaining local control when it comes to making decisions regarding weather modification activities.**

In addition, to the economic benefits of reduced hail and increase precipitation, conducting weather modification enables increase understanding of the atmospheric and clouds. Precipitation formation processes involve scales from the very small, nanometer, to scales as large as hundreds of kilometers (100 miles). Conduct scientific research on these scales is not possible in the laboratory. Hence, weather modification activities enables scientific research to be conducted that improves our understanding of the atmosphere, which can not easily be

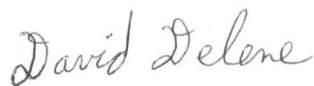
conducted with any other method. Such scientific understanding is important for determine the impact that different activities have the atmosphere and weather systems.

It is important to note what science research indicates that Weather Modification can not do. It does not curtain the development of large rain producing storms. Some people may see weather modification activities and then observer that a storm does not produce a lot of precipitation; however, such observations are correlations not causation. It is a very important to base decisions on a statistical analysis with a know uncertainty assessment than on the observations of a few people that may not be repressive.

Based on several scientific publications, the materials used to seed clouds are not environmentally harmful, and only a small amount of material is used relative to the area seeded. As may confuse many people, it is important to note the difference between the cloud seeding material, silver iodide and silver, which is a heavy metal. Silver iodide is insoluble in water and hence, very difficult to affect animals and humans. As a scientist that has conducted air quality research, I can state that the lead emitted from burning aviation fuel of the seeding aircraft has more of an impact on the environment that the cloud seeding materials release. Additionally, the environmental impacts of weather modification indicate little to no impact to plants and animals, and any such impacts are short term and local. While people's concerns with environmental impacts of human activities are important, eliminating weather modification actives due to possible environmental impact is a distraction from much more important issues, such as the use of lead containing fuels for general aviation. It is important to address concerns with allergies, illnesses, and health using science, and not based decision on the select opinions of a very un-informed individuals.

I am against the proposed bill HB 2106 and believe the current system protects the environment, promotes scientific research, and enables local control of weather modification activities.

Sincerely,

A handwritten signature in cursive script that reads "David Delene".

Dr. David Delene, Scientist