

## Cloud Seeding

### Background

#### *The Technology*

Cloud seeding attempts to artificially generate rain by implanting clouds with particles such as silver iodide crystals. Given the increasing emphasis on climate change and variability, the science of cloud seeding is gaining prominence.

Cloud seeding is usually carried out by sprinkling particles from above by a plane fitted with silver iodide burners mounted under each wing. Using weather forecasting techniques, suitable clouds are identified based on the location of the target area and the prevailing winds. A seeded cloud will take 30 minutes to precipitate and seeding areas are chosen upwind of the target.



Research has shown that given the appropriate conditions, cloud seeding can modify clouds and induce rain. This works in two ways: by producing rain when none would fall naturally; or by increasing the amount of rain that falls over a particular area.

However, cloud seeding relies on a number of factors to be in place before it can be considered a cost-effective water supply solution.

Firstly, cloud seeding is only effective in a limited number of weather conditions in certain locations. Also, cloud seeding requires existing clouds; it will not produce rain out of thin air. For this reason, cloud seeding works best in wet years where it can provide additional storage in dams.

Not all types of clouds are suitable for seeding. Research has shown clouds must be deep enough and of a suitable temperature (between -10 and -12 degrees Celsius) to be able to effectively seed them. The wind must also be below a certain speed. These conditions are most common in mountainous areas. This is a problem for much of the Australian mainland, including Perth, which is predominantly flat and generally un conducive to these conditions.

After extensive testing, the CSIRO has determined that cloud seeding is unlikely to be effective in much of Australia. The most successful cloud seeding to date has been conducted in Tasmania, mainly in the mountainous west.

Concerns have also been raised about the long term environmental effects of using silver iodide crystals. Precipitation containing this chemical is likely to be absorbed by animals and plants and to collect in groundwater reserves. The impact of this is still being debated.

There is some scientific concern that manipulating the natural pattern and location of precipitation may impact on ecosystems and adjacent farm areas reliant on certain rainfall patterns.

#### *Snowy Precipitation Enhancement Research Project (SPERP)*

In the Snowy Mountains region, small increases have occurred in both the daily average maximum and minimum winter temperatures since 1962. This has resulted in a decline in snow depths.

In addition, south-eastern Australia is currently in an extended period of drought, and dry conditions could persist for some time to come.

Snowy Hydro is conducting a \$40 million, six-year research project of winter cloud seeding to assess the feasibility of increasing snow precipitation in the Snowy Mountains. To enable this trial to occur, special enabling legislation was passed by Parliament (*Snowy Mountains Cloud Seeding Trial Act 2004* (NSW)).

The trial commenced in 2004 and is scheduled for completion in 2009. Initial results have suggested increases in snowfalls of 10% with possibilities of up to 25% at some sites.

#### *Hydro Tasmania*

Cloud seeding experiments have been undertaken in Tasmania since 1988, with an operational cloud seeding program for eight months each year. Their recent work has shown an increase in precipitation of approximately 5%.

#### *Water Corporation Study*

The Water Corporation engaged the Bureau of Meteorology to study the feasibility of cloud seeding in Perth. The aim was to consider the use of this technology to improve rainfall and streamflows within surface water dam catchment areas south-east of Perth. The report was finalised in September 2007.

In summary, the report concluded:

*“The evidence suggests that there is merit in conducting a preliminary cloud seeding (CS) experiment in the target area of this investigation. If the Water Corporation decides to pursue this potential for CS further, then,*

- *An initial 6-month CS experiment conducted from May to October would be a logical next step. This activity could be considered as a second part of the overall feasibility study.*
- *The initial experiment should include use of an appropriately instrumented aircraft for taking direct instrumented cloud physics measurements in the proposed study area, computer modelling studies, as well as the testing / application of different CS techniques.*
- *The outcomes of the 6-month CS trial would then provide the basis for assessing the feasibility for conducting a 5 to 10 year CS program.”*

Detailed cost estimates would be informed by the completion of the initial experiment proposed. It is thought that the trial costs could be in the order of \$5 million per year (a ten year trial may therefore cost \$50 million). While it is not possible to quantify potential yields at this time, an increase of precipitation of 5% could add 3-5 gigalitres a year to surface water supplies for the Perth area.

#### **Current Situation**

The study advised that precipitation enhancement should not be seen as a short term response to drought, but rather as a water management tool.

There are considerable uncertainties associated with this technology. Due to possible impacts on ecosystems, adjacent farmlands and communities, a decision to proceed with a trial would require

community and State Government support. The Bureau of Meteorology report commissioned by the Water Corporation has been made available to the Office of Climate Change, a Western Australian public sector agency.

## The Future

Cloud seeding does not have the potential to drought proof Western Australia, however, it may provide an option to improve surface water supplies.

Much more work and investigation is required from a whole of Government perspective to quantify the costs and benefits of this option.

## More Information

- Snowy Hydro website  
[www.snowyhydro.com.au](http://www.snowyhydro.com.au)
- Bureau of Meteorology website  
[www.bom.gov.au/bmrc/basic/events/cloudseeding](http://www.bom.gov.au/bmrc/basic/events/cloudseeding)
- Malcolm Turnbull website, Cloud Seeding Paper:  
<http://www.malcolmturnbull.com.au/Pages/Article.aspx?ID=707>
- Wikipedia website:  
[http://en.wikipedia.org/wiki/Cloud\\_seeding](http://en.wikipedia.org/wiki/Cloud_seeding)
- CSIRO technical report:  
<http://www.cmar.csiro.au/e-print/open/cloud.htm>

Western Australian Cloud Seeding Study  
Australian Government Bureau of Meteorology Final Report

- Part 1, Scientific Review and Analyses, June 2007
- Part 2, Findings and Recommendations, September 2007