UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
AIR QUALITY

UTAH WINTER FINE PARTICULATE STUDY

Frequently Asked Questions

WHY IS THIS STUDY IMPORTANT?

Poor air quality harms the health and well-being of Utah residents, stifles economic development, and negatively impacts quality of life. Increased understanding of the chemical processes behind the formation of $PM_{2.5}$ will help the Division of Air Quality (DAQ) identify effective emission-control measures that reduce pollution and protect human health at the lowest cost.

WHAT DO WE KNOW ABOUT THE CHEMISTRY BEHIND THE FORMATION OF FINE PARTICULATES ($PM_{2.5}$) DURING INVERSIONS?

Most of the $PM_{2.5}$ present during inversions is created through secondary chemical reactions in the atmosphere. Precursor emissions that contribute to this secondary formation of $PM_{2.5}$ include nitrogen oxides (NOx), volatile organic compounds (VOCs), sulfur dioxide (SO2), and ammonia (NH3). A complex interplay of chemical and meteorological factors drive the reactions that form $PM_{2.5}$. Better understanding of the mechanisms behind these episodes and the pollutants most responsible for the formation of $PM_{2.5}$ will help DAQ develop effective control strategies to reduce particulate levels.

Utah Division of Air Quality

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WHAT MAKES THIS STUDY UNIQUE?

Air-quality research to date has focused on ground-level and near-ground observations, but this study will use a specially equipped Twin Otter airplane to investigate the chemistry in the upper inversion layers. The light aircraft will make daily flights, weather permitting, over the Wasatch Front and Cache Valley to survey chemical conditions. Researchers will also collect ground-based measurements at Smithfield and Logan in Cache Valley, the University of Utah, Hawthorne Elementary in Salt Lake Valley, and Lindon in Utah Valley. Scientists will compare ground-based observations with data collected by the Twin Otter to increase their understanding of the complex

interactions occurring between the chemical processes that form $PM_{2.5}$ and the meteorological processes that mix $PM_{2.5}$ and other pollutants within the inversion layer.

WHAT DO RESEARCHERS HOPE TO LEARN?

Comparison of these data will improve DAQ's understanding of the ways NOx, VOCs, and ammonia react to form $PM_{2.5}$ Scientists are particularly interested in answers to the following questions:

- What are the most important chemical mechanisms for the formation of ammonium nitrate, the major component of $PM_{2.5}$ during inversions?
- What are the sources of the chemical precursors?
- Where are the emission "hotspots" in each valley?
- How do the $PM_{2.5}$ and its precursors vary during particular times of the day, at ground level, and in the upper atmosphere, and how do these variations impact pollution levels?
- What is the role of the Great Salt Lake or Utah Lake in the formation of $PM_{2.5}$?

Answers to these questions will help DAQ scientists improve the performance of the computer model they use to develop effective regulatory controls.

HOW WILL THIS RESEARCH HELP UTAH RESIDENTS?

Fine particulate pollution has been linked to significant health problems, including increased respiratory symptoms, asthma, COPD, and premature death in people with lung or heart disease. Sound scientific research helps DAQ identify the best emission controls and pollution-reduction strategies to protect Utah residents from the health impacts from high fine particulate levels, particularly members of the population most vulnerable to the adverse health effects of $PM_{2.5}$ pollution.

HOW WILL THIS RESEARCH AFFECT BUSINESSES ALONG THE WASATCH FRONT?

Air-quality research will lead to effective control technologies that reduce pollution, meet federal requirements, and support economic development. Improved understanding of the factors that increase $PM_{2.5}$ formation in Utah will help DAQ scientists identify local solutions for local problems rather than costly, federally imposed "one-size-fits-all" solutions that may not improve the area's air quality. Identification of pollutant sources and effective control technologies will improve air quality, avoid business/economic constraints that could slow economic growth and development in the state, and protect Utah's quality of life.

WHO IS COLLABORATING WITH DAQ FOR THIS STUDY?

Thanks to $130,000 in legislative seed money, DAQ was able to leverage $2 million of in-kind equipment, laboratory analysis and scientific expertise from partner agencies and research institutions. Participating research institutions include the NOAA Earth System Research Laboratory (ESRL) and the Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder, the Environmental Protection Agency (EPA), United States Department of Agriculture (USDA), University of Utah, University of Washington, University of Toronto, University of Minnesota, Utah State University, and Brigham Young University.