Utah Department of Environmental Quality
Division of Air Quality

Fact Sheet

January 2014

Uinta Basin Ozone Study 2014

The Uinta Basin Ozone Study (UBOS) is a multi-year effort to identify the sources and conditions that create ozone during winter inversions. The 2014 Study will focus on the ways snow chemistry and aerosol chemistry contribute to the formation of ozone. The Division of Air Quality (DAQ) will use this data to support development of effective strategies for reducing ozone concentrations to meet federal regulatory air quality standards in the Basin.

Background

Winter ozone levels increase in the Uinta Basin when there is snow cover and a strong temperature inversion that concentrates pollution emissions close to the ground.Under these conditions, volatile organic compounds (VOCs) and oxides of nitrogen (NOx) rapidly react to form ozone. Most of the scientific research on ozone to date has focused on the factors responsible for summertime, rather than wintertime, ozone.

2014 Study

One area of focus in this year's study will be on quantifying the contribution of nitrous acid (HONO) and formaldehyde (HCHO) to the chemical reactions responsible for ozone formation. Prior studies in the Basin showed that the radical chemistry that drives ozone production is dominated by HONO and formaldehyde, which are unconventional sources for ozone formation compared to conventional sources (ozone photolysis) in typical urban summertime ozone episodes. Scientists believe that snow is the source of the HONO. Researchers will study HONO concentrations, ground/snow sources, and vertical distribution of HONO (how quickly HONO concentrations drop off with altitude) to understand these photochemical reactions better.

The proposed 2014 Intensive study will address uncertainties in the radical source chemistry so the Division of Air Quality can recommend control strategies with greater confidence. Preliminary modeling indicates that Basin ozone air chemistry will respond to VOC controls, but this year scientists will also look at whether HONO will respond to NO_x controls.

Other key research being conducted is an evaluation of oil and gas field sources of fugitive carbonyl emissions, especially formaldehyde, which has been shown to be important in ozone formation in the Basin. Accurate knowledge of formaldehyde sources, is critical for development of cost-effective mitigation strategies.

Long-term baseline monitoring of meteorology, ozone, and precursors at Roosevelt, Horsepool, Rabbit Mountain, Vernal, and Fruitland will be enhanced with five portable monitors sited at strategic locations throughout the Basin.

This information serves to:

- ensure a long term dataset to understand factors that control ozone formation at different locations around the Basin;
- provide information to determine effectiveness of NO_x versus VOC controls;
- validate air quality models that are critical to the regulatory process; and,
- show the effectiveness of mitigation efforts over time.

Uinta Basin Web Site

www.deq.utah.gov/locations/uintahbasin/index.htm

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History

Research from the first three studies yielded important information about VOC and NO_x emissions, emission sources, and the chemical processes that lead to high ozone levels.

2011 Study

A three month winter ozone monitoring program measured baseline ozone concentrations. An intensive, week-long monitoring program measured ozone, VOCs, NO_x, $PM_{2.5}$ and their vertical profiles during inversions.

2012 Study

Ozone levels during the second study year remained below the federal regulatory standards because there was little snow cover. Researchers used this opportunity to learn more about emission sources and develop an emissions inventory. Analysis of 2012 data suggested that ozone formation was VOC limited (VOC reductions would produce ozone reductions), but NO_x reductions might be counterproductive.

2013 Study

Persistent snow cover led to inversions, which in turn resulted in ozone concentrations well above the federal regulatory standards. Elevated ozone coincided with elevated levels of VOCs and NO_x, the primary chemical precursors of ozone. Scientists found that the reflection of sunlight from the snow surface significantly increased the rate of ozone formation. Researchers found that HONO and formaldehyde were the biggest contributors to the creation of the chemically reactive radicals that drive ozone formation.

Schedule

The study period will begin January 15, 2014, and run through February 15, 2014. Researchers will be in the field for a total of four weeks during the intensive study.

Costs

Hard costs for the project are approximately $900,000. In-kind contributions from research collaborators will provide an additional $1.2 million dollars.

Funding Partners

Funding partners include the National Oceanic and Atmospheric Administration, Utah State University, the Department of Environmental Quality, the Uintah Impact Mitigation Special Service District, the Bureau of Land Management, and the Western Energy Alliance.

Research Partners

Research partners include the National Oceanic and Atmospheric Administration, Utah State University, Department of Environmental Quality, Environmental Protection Agency, University of Utah, University of California Los Angeles, University of Houston, University of Toronto, Environment Canada, University of Calgary, and University of Washington.