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Presentation Title: Summertime Ozone Production and its Sensitivity to NOx and VOCs in the Salt Lake Valley
Research Focus: Air quality
Institution: Utah Department of Air Quality
Presentation Type: Poster Presentation

Abstract:

Summertime Ozone Production and its Sensitivity to NOx and VOCs in the Salt Lake Valley
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Ozone within the lower troposphere is a significant hazard to human health. Unfortunately, ozone is frequently formed during the summer season due to the combination of sunlight and anthropogenic/biogenic emissions. The two main precursors of ozone production are Volatile Organic Compounds (VOCs) and Nitric Oxides (NOx), which are common emissions from vehicles and industry sources. High maximum daily ozone levels (> 69 ppb) are often observed within the Salt Lake Valley during the summertime. These high ozone levels are not only an acute and chronic public health problem but also exceed the National Ambient Air Quality Standard for ozone. Previous research has shown that developing a VOC to NOx ratio can help characterize how ozone production functions within an airshed. Results from a VOC to NOx ratio analysis allow a characterization of an airshed as VOC-limited, NOx-limited, or transitional, where ozone production is limited by VOCs, NOx emissions, or both, respectively. Understanding if ozone formation is NOx- or VOC-limited can help develop more targeted and effective controls. The objective of this investigation was to develop an in-depth observational analysis of the VOC to NOx ratio in the urban SL airshed, thus aiding the formulation of future control strategies to decrease ozone within the Salt Lake Valley. The ratio analysis focuses on hourly GC data and DNPH-cartridge data gathered every third day from the Hawthorne UDAQ site during Jun-Aug 2021. Additionally, a weekday vs. weekend analysis between ozone and NOx is developed from observations of MD8A ozone and NOx from the Erda and Hawthorne sites during the years 2017-2021. Observations of VOC species and NOx as well as cartridge samples are used in the calculation of a VOC to NOx ratio. A few different methods are utilized for tabulating total VOC emissions, including VOC concentration weighted by Maximum Incremental Reactivity (MIR) (i.e. reactivity respective to ozone production/per unit VOC). On average, results exhibit hourly and daily ratio values that fall within a transitional regime. Provided a transitional regime, controls (reductions) on both VOCs and NOx emissions are noted as a potential strategy to decrease ozone levels.