Bingham Research Center
UtahStateUniversity

Fact Sheet: Influence of Regional and Global Pollution on Uinta Basin Air Quality

What We Know

- The Uinta Basin experiences wintertime temperature inversions that lead to a buildup of ozone. Ozone is a respiratory irritant regulated by EPA.
- Most of the ozone and other air pollutants during these inversion episodes is made locally, not transported from outside the Basin.
- The reverse is true in summer: background ozone makes up most of the ozone measured, while local emissions add little.

What is Background Ozone?

Background ozone is ozone that originates outside the Uinta Basin or from natural or uncontrollable sources. Sources of background ozone include air pollution from other parts of the U.S. and other countries, wildfire smoke, and ozone-rich air from the stratosphere.

- In the figure on the next page, background ozone is approximated as Uinta Basin average ozone over all years that didn't have persistent snow cover and wintertime temperature inversions.

Local ozone forms inside the Basin when local, human-caused emissions of volatile organic compounds (VOC) and nitrogen oxides (NO_x) — mostly from oil and gas operations — react in sunlight. This is the ozone that local pollution-control efforts can reduce.

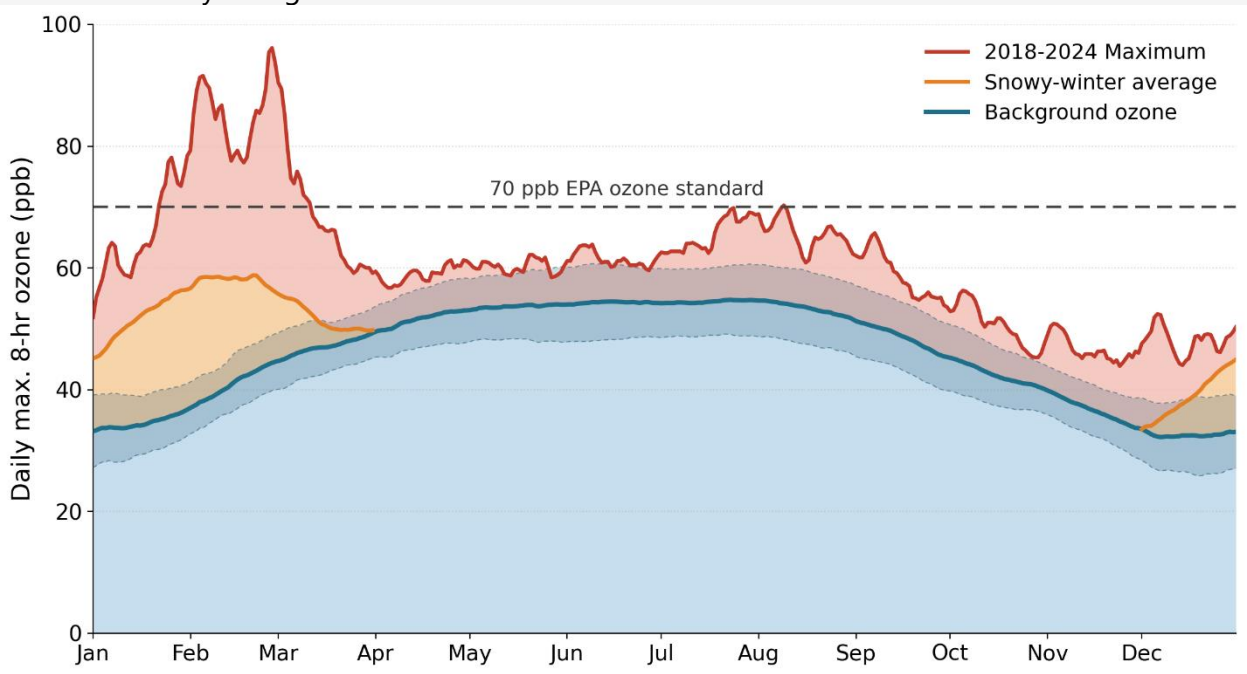
During Winter Inversion Episodes, Background Ozone is a Minor Player

Wintertime ozone forms when temperature inversions trap locally emitted VOC and NO_x near the ground, and sunlight provides the energy for them to react together to make ozone. We know high winter ozone come from local emissions, not background ozone, because:

1. **Without an inversion to trap local pollution, ozone stays low.** Typical wintertime background ozone is in the range of 30 to 40 parts-per-billion (ppb). Ozone higher than this appears only when strong temperature inversions trap local emissions near the surface.
2. **Winter ozone is unique to oil and gas basins.** The only two places in North America that regularly experience high winter ozone are the Uinta Basin and Wyoming's Upper Green River Basin — both with large oil and gas industries. Many other snowy, inversion-prone basins have air pollution and particulate haze problems, but not winter ozone.
3. **Winter pollution carries a local fingerprint.** VOC in the Uinta Basin during winter inversions has the "signature" of raw natural gas (high ethane and propane, low benzene and xylenes, for example), rather than the signature of large upwind urban areas.
4. **It falls when local emissions fall.** Winter ozone has declined over the past decade as local VOC and NO_x emissions have declined, even under similar weather. The improvement tracks local emission controls, not changes in background ozone or upwind urban areas.

In Summer, Background Ozone Dominates

- **Background alone is already close to the EPA standard.** The natural summertime background ozone level in the Uinta Basin region is roughly 55–65 ppb (close to the 70 ppb EPA standard) before any local contribution is added. The background level is higher in summer than winter because ozone depends on sunlight to form.
- **Summer exceedances are from background ozone.** When local ozone is higher than the EPA standard during spring or summer months, it is usually due mostly to events unrelated to local human-caused emissions: intrusions of ozone-rich air from the stratosphere and smoke from distant wildfires.
- **In years with low-ozone winters, the annual high is in summer.** During years with little or no winter ozone, the highest ozone of the entire year occurs in summer and is driven by background ozone.



What this Means for Air Quality Management

✓ **To reduce winter ozone, focus on local emissions**, especially VOC and NO_x from oil and gas operations. Background ozone is not the lever that lowers winter ozone.

✓ **Summertime exceedances are largely outside local control**, and often qualify as "exceptional events" (stratospheric intrusions, wildfire smoke) under EPA rules.

More Information

This fact sheet draws on a number of peer-reviewed publications and annual reports by USU's Bingham Research Center, which are available at https://www.usu.edu/binghamresearch/papers-and-reports. A technical summary of all Uinta Basin air quality research conducted to date is available at usu.edu/binghamresearch/cumulative-research-summary.

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