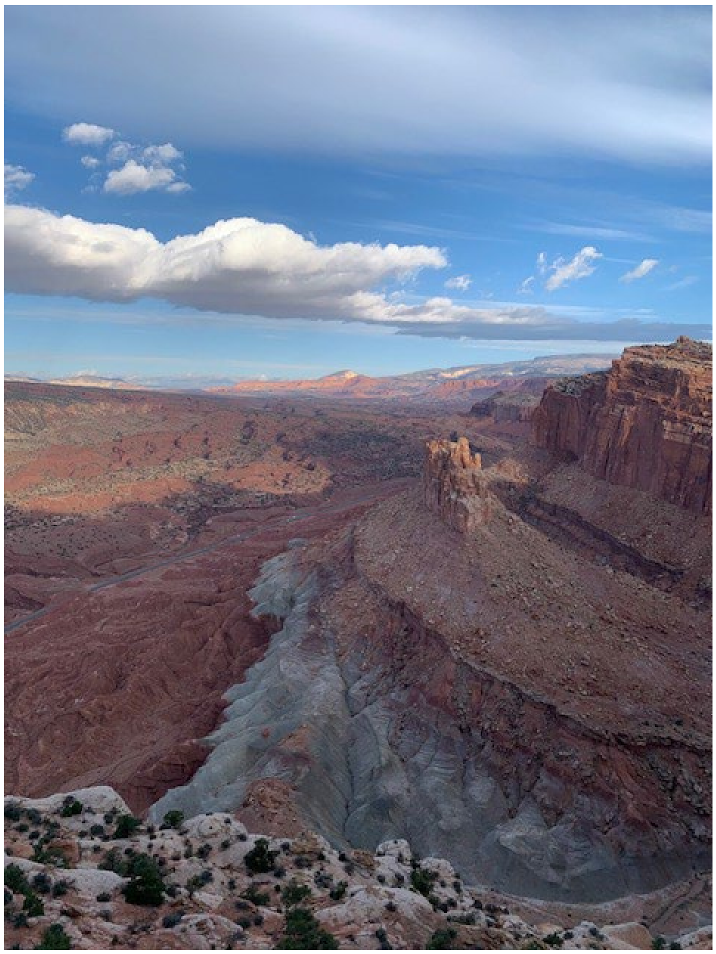
UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
AIR QUALITY

Utah Air Quality Monitoring Network
Five-year Network Assessment



Utah Division of Air Quality
Air Monitoring Section
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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) on October 17, 2006, amended its ambient air monitoring regulations to include a requisite that all state and local air quality monitoring agencies prepare a technical assessment of their monitoring networks once every five years. This document describes the Utah Division of Air Quality (UDAQ) 2025 Ambient Air Monitoring Network Assessment. The technical assessment of Utah air monitoring network was conducted, in accordance with federal regulations (40 CFR, section 58.10) and intend to identify if new sites are needed, or existing sites are no longer needed or where new technologies are appropriate for incorporation in the ambient air monitoring network and whether the network meets monitoring objectives.

The monitoring objectives included evaluating whether the network supports compliance with the NAAQS, Air Quality Index (AQI) reporting, air quality models, air pollution research studies as well as the State Implementation Plan (SIP) development and maintenance.

The Utah five-year monitoring plan considered in its evaluation process the population growth, air pollution levels, monitoring network data, areas where additional monitoring would improve regional and background pollution assessments.

To ensure comprehensive and effective air quality monitoring throughout Utah, DAQ is proposing targeted improvements to the statewide monitoring network. These enhancements aim to support regulatory modeling efforts and improve understanding of pollution sources and trends, contingent upon available funding.

The proposed modifications include:

- Installing new monitoring sites in the following locations:
    - Summit County: Anticipated to meet the Metropolitan Statistical Area (MSA) population threshold; proposed monitoring: O_3, NO_x and $PM_{2.5}$.
    - West Davis County (Layton/Syracuse area): Focus on PM_{10} dust from Farmington Bay and O_3, NO_x and $PM_{2.5}$.
    - Western Great Salt Lake Desert: Background site to assess pre and post lake transport of pollutants; monitor O_3, NO_x and PM_{10}.
    - Beck Street (North Salt Lake): Evaluate PM_{10} from mining activity and O_3 and $PM_{2.5}$ from I-15 corridor refineries.
    - Northern Utah County (East of I-15): Urban monitoring of O_3, NO_x and $PM_{2.5}$
    - Logan, Cache Valley: Second site near southeast Logan to supplement existing coverage.
    - Ogden, Weber County: Additional site to support representativeness beyond Harrisville station.
    - Delta, Millard County: Background site for all pollutants, especially PM_{10} from southern dust transport.

- Additional dust monitoring sites may be established, contingent on available funding.

- Possible relocation:
  - **Spanish Fork** site is located near the local Spanish Fork airport, which is undergoing continuous infrastructure modifications. It is unclear whether the monitoring station can remain at this location in the long term.
  - **Lindon** site is located at an elementary school that is projected to close in the near future. Therefore, it is uncertain whether the monitoring site will be able to continue operating at this location.
  - **Hawthorne** site is located on the property of an elementary school that was closed in 2024. The future of the site is uncertain and may depend on how the property is repurposed, which could require relocating the monitoring station.

- Continue evaluation of possible redundancy:
  - The analysis also suggested a high correlation in measurements for some pollutants between the Environmental Quality (EQ) and Rose Park (RP) stations, indicating potential redundancy. However, differences in local sources warrant continued evaluation before considering any consolidation.

- Network updates:
  - The data loggers at the network sites are being replaced with a digital data logging system. This new system is based on the Campbell Scientific CR6 platform and collects data using the Modbus protocol. Main advantages of the digital system include increased flexibility in scheduling PZS sequences and the elimination of issues common to analog data collection, such as overrange events, calibration imprecisions, and voltage irregularities caused by power disruptions. Additionally, the digital platform enables the collection of diagnostic data from gaseous and particulate monitoring instruments. This diagnostic information helps operators identify and resolve instrument malfunctions more quickly, reducing downtime and minimizing data loss or invalidation. Digital loggers are now in use at 14 of the 23 stations. These stations are: Brigham City (BG), Bountiful (BV), Copperview (CV), Herriman (H3), Heber (HB), Lake Park (LP), Moab (M7), Near Road (NR), Price (P2), Red Butte (RB), Rose Park (RP), Spanish Fork (SF), Smithfield (SM), and Prison (ZZ). The rest of the stations will be upgraded to the CR6 loggers as resources permit.

The Utah Division of Air Quality will continue reviewing all stations to ensure they meet the required acceptance criteria and monitoring objectives. Any sites that do not meet these requirements will be evaluated for future action.

Utah Air Quality Monitoring Network Five-year Network Assessment

1. Background and Overview

1.1 Meteorology and Topography

Utah's unique topography and meteorology contribute to persistent air quality challenges, particularly in the Salt Lake Valley along the Wasatch Front and the Uinta Basin. The Wasatch Mountains to the east, the Oquirrh Mountains to the west, and the Traverse Mountains to the south create a basin-like topography. The valley remains open to the Great Salt Lake to the northwest, where weak nighttime down-valley winds transport polluted air over the lake. This air then returns to the valley as a lake breeze the following day.

The Uinta Basin, located in northeastern Utah, is an enclosed basin bordered by the Uinta Mountains to the north, the Tavaputs Plateau to the south, the Wasatch Range to the west, and elevated terrain separating it from the Piceance Basin in Colorado to the east. The Basin exhibits significant topographical variations, ranging from tens to hundreds of feet, and primarily encompasses Duchesne and Uintah Counties.

During winter, high-pressure weather systems and high solar zenith lead to cold-air pools, periodically trapping precursor gases in both the Uinta Basin and Salt Lake Valley, worsening air quality.

1.2 Major Pollutants and Emission Sources

The air basins along Utah's Wasatch Range, a region with 3,271,616 million residents (2020 Census[1]). In recent years, Utah has been among the top five fastest-growing states in the U.S. in terms of population growth.

After experiencing some of the most severe fine particulate matter ($PM_{2.5}$) air pollution in the United States in previous years, Utah continues to comply with the EPA's updated $PM_{2.5}$ standards, even with the stricter annual limits introduced in 2024. This achievement reflects nearly two decades of efforts, including industry emission controls, federal regulations, state policies, and public awareness initiatives. Although this progress is significant, the Division continues to prioritize addressing emerging concerns related to other health-based pollutants, including PM_{10} and ozone[2].

[1] https://www.census.gov/quickfacts/fact/table/utahcountyutah,UT/POP010220

[2] Utah Division of Air Quality 2024 Annual Report, https://deq.utah.gov/division-air-quality

During winter inversions, Utah often experiences elevated levels of ozone in the Uinta Basin and fine particulate matter ($PM_{2.5}$) along the Wasatch Front and the Cache Valley. High-pressure weather systems create cold-air pools that trap precursor gases, primarily volatile organic compounds (VOCs) and nitrogen oxides (NO_x), in valleys between the Wasatch and Oquirrh Mountains. In the stagnant air, these gases react to form ozone and $PM_{2.5}$, occasionally causing pollution levels to exceed federal National Ambient Air Quality Standards (NAAQS). Snow cover can further enhance ozone formation by increasing sunlight reflection (surface albedo) into the atmosphere. The complex chemical reactions and unique conditions driving these pollutants make it challenging to develop effective control strategies. In addition to wintertime pollution, summertime ozone formation over the Great Salt Lake and along the Wasatch Front is also a concern.

Efforts to address $PM_{2.5}$ pollution during wintertime temperature inversions have focused on reducing precursor emissions, such as oxides of nitrogen (NOx) and volatile organic compounds (VOCs). Between 2011 and 2020, VOC emissions decreased by 55%, while NOx emissions declined by 46% 2. These same pollutants also contribute to summertime ozone formation when sunlight triggers complex atmospheric reactions, leading to ground-level ozone that can cause severe respiratory issues. Despite substantial year-round reductions in precursor emissions, ozone concentrations have remained stagnant over the past 14 years 2. While ozone is primarily a summertime concern along the Wasatch Front, it poses a wintertime issue in the Uinta Basin due to emissions from oil and gas extraction. Regulatory oversight in the basin is complex, with the Division managing approximately 25% of emissions from state lands, while the EPA enforces the Clean Air Act on Tribal lands, which account for around 75% of emissions. The Division will continue to address and adapt to these regulatory challenges in the years ahead.

Beyond ozone concerns, the exposure of the Great Salt Lake (GSL) lakebed presents another air quality challenge. Over the past 40 years, 50% of the lakebed has been exposed, increasing the risk of windblown dust in areas where 80% of Utahns reside. In 2022, the GSL reached a historic low, exposing approximately 2,072 km^2 (800 square miles) of playa[2]. When the surface crust is weak or broken, this exposed playa can become a significant source of airborne dust.

Major industrial sources in the Salt Lake Valley include Kennecott Copper mine and smelter located at the base of the Oquirrh Mountains. In addition, state has a variety of energy resources, comprising crude oil, coal, and natural gas energy. Utah's five oil refineries, all located in the Salt Lake City area, process nearly 207,000 barrels of crude oil per calendar day, the state accounted for about 1 in every 100 barrels of oil produced in the United States[3] and 1 in 16 of every barrels produced in the Rocky Mountain Region[3]

Utah's refineries, which have almost two-fifths of the refining capacity in the Rocky Mountain region, produce mostly motor gasoline, diesel fuel, and jet fuel [4,5].

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[3] U.S. EIA, Crude Oil Production, Annual-Thousand Barrels, 2018-23

[4] Vanden Berg, Michael D., Utah's Energy Landscape, Circular 127, Utah Geological Survey (2020), p. 34, 36

[5] Vanden Berg, Michael, Utah's Energy Landscape, Circular 127, Utah Geological Survey (2020), p. 24

Oil and gas drilling operations and producing wells are concentrated in the Uinta Basin in northeastern Utah, which displayed a considerable increase in production in recent years. The state's natural gas output grew consistently for 30 years beginning in the mid-1980s, reaching its highest level in 2012. Since then, annual production declined each year due to lower market prices for natural gas and reduced crude oil drilling. However, production saw an uptick in 2022 for the first time since 2012 and continued to increase in 2023 [4].

Utah was the 12th largest coal producing state in 2018, about four-fifths of the coal consumed in Utah is mined in the state, and almost all of the coal is used for electric power generation[3]. After a brief increase in 2019 due to higher overseas export demand, Utah's coal production resumed its long-term decline. By 2023, output had dropped to its lowest level in 49 years, partly due to temporary closures and operational challenges at the Lila Canyon, Skyline, and Coal Hollow mines. Additionally, reduced demand from the U.S. electric power sector led to further declines and mine shutdowns[6].
Coal-fired power plants including; Bonanza, with capacity to generate power of 500-megawatt, Hunter, with capacity of 1320-megawatt and Huntington, with capacity of 1073-megawatt operate in the Utah basin and Emery county.

There is also some agricultural production, primarily alfalfa and corn along with other hay and grain crops. Major roadways in the valley consist of Interstates 15, 80 and 215. I-15 spans the length of the Salt Lake Valley from north to south, while I-80 runs from east to west across the valley and through Salt Lake City. I-215, on the other hand, forms a loop around the northern portion of the valley.

1.3 Demography

The state of Utah can be divided into 10 Core Based Statistical Areas (CBSAs) with population estimates as shown in Table 1. Each CBSA corresponds to a metropolitan or micropolitan statistical area (MSA and µSA, respectively), depending on its population size. The list of CBSAs was derived from the U.S. Census Bureau while the population estimates for each CBSA were retrieved from the sub-county population projections report produced by Utah's Governor's Office of Management and Budget[7]. The reported projections were derived using 2020 Census data as a baseline. Population data from the 2020 Census and the population density map are shown in Figure 1[8]

[6] https://www.eia.gov/state/analysis.php?sid=UT
[7] https://gomb.utah.gov/budget-policy/utahseconomy/
[8] https://opendata.gis.utah.gov/datasets/utah::blocks-popdensity-5ormore-albers-equal-area/about

Table 1. Core Based Statistical Areas (CBSAs), including metropolitan and metropolitan statistical areas (MSA and µSA, respectively), and their corresponding population estimates in the State of Utah[7].

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	% Change (2020-2033)
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	16
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	38
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	16
Heber µSA	Wasatch, UT	34,788	43,826	47,368	36
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	25
Saint George MSA	Washington, UT	180,279	252,964	268,790	49
Cedar City µSA	Iron, UT	57,289	78,144	80,074	40
Price µSA	Carbon, UT	20,412	21,275	21,703	6
Vernal µSA	Uintah, UT	35,620	37,920	38,673	9
Summit Park µSA	Summit, UT	42,357	46,717	48,376	14

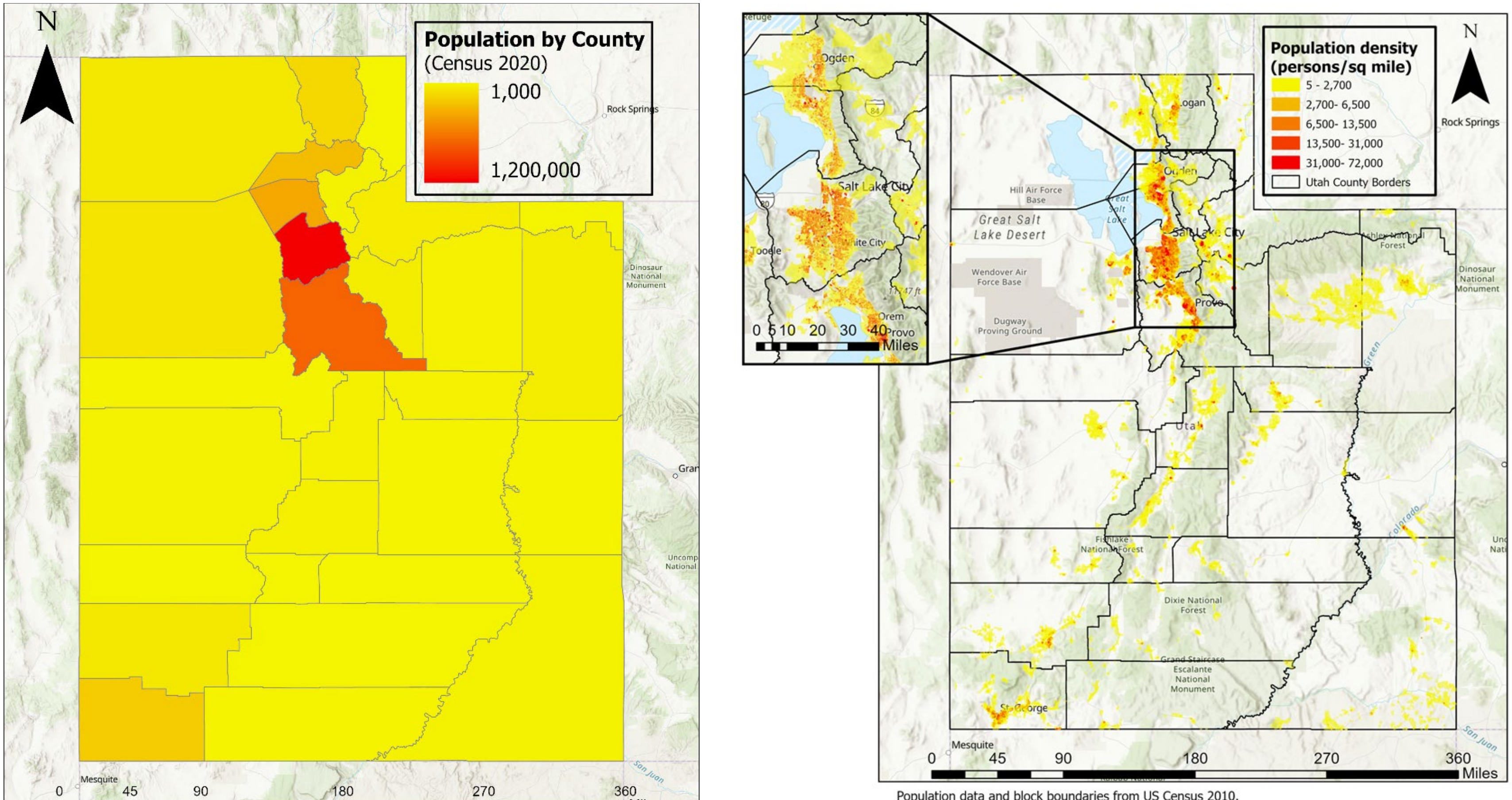


Figure 1. Utah's total population distribution (left) and population density (right) by county.

1.4 Emission Inventories

Table 2 lists the emission rates (in tons/year) of criteria and hazardous air pollutants, including CO, NOx, PM10, PM2.5, SOx, and VOCs, by county. Data was acquired from the 2020 triennial emissions inventory, which was the most current inventory available at the time of writing.

The inventory covers over 485 individual point sources, 154 area source categories, 36 on-road categories, 56 non-road categories, and 66 oil and gas categories. Statewide source-specific emission estimates (in tons/year) for common criteria and hazardous air pollutants are shown in Figure 2. Maps of Utah counties showing annual point source emissions (in tons per year) for PM_{10}, $PM_{2.5}$, SO_x, NO_x, VOCs and CO are presented in Figures 3-5.

Table 2. 2020 emission inventory estimates (tons/year) by county for CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2 and VOCs [9,10]

County	PM_{10}	$PM_{2.5}$	SOx	NO_x	VOCs	CO
Beaver	2,250	457	14	1,354	9,730	5,246
Box Elder	7,493	1,886	199	3,720	11,141	20,388
Cache	9,919	1,536	42	1,888	8,442	10,115
Carbon	3,382	516	454	1,771	8,946	5,298
Daggett	1,311	692	56	1,152	5,143	8,067
Davis	3,555	964	150	4,521	7,866	24,398
Duchesne	43,779	33,720	2,558	10,049	117,652	408,130
Emery	4,351	1,074	4,586	15,142	8,842	11,693
Garfield	1,819	258	3	839	15,678	4,292
Grand	1,478	228	6	2,086	11,687	6,634
Iron	4,306	1,127	61	2,604	16,337	14,805
Juab	3,951	2,229	193	2,022	12,385	25,667
Kane	2,592	544	31	917	15,170	7,251
Millard	8,286	4,337	2,509	13,450	19,138	40,535
Morgan	1,453	239	339	2,523	4,310	2,537
Piute	1,076	382	18	255	4,781	4,211
Rich	1,839	265	1	299	2,754	1,870
Salt Lake	19,695	4,770	745	19,028	21,809	97,263
San Juan	4,235	736	53	1,734	20,831	8,647
Sanpete	5,597	876	18	854	8,466	5,250
Sevier	5,480	1,451	87	1,311	10,593	13,883
Summit	4,477	853	143	2,335	8,977	9,625
Tooele	4,070	1,415	115	3,949	11,199	15,912
Uintah	6,019	1,262	143	8,676	58,166	13,330
Utah	15,835	3,523	177	7,135	20,130	47,868
Wasatch	5,405	906	23	916	7,729	7,146
Washington	5,683	1,355	123	3,370	14,518	23,009
Wayne	887	140	1	364	5,065	1,713
Weber	5,848	1,315	49	3,629	7,785	19,041
Statewide Totals	186,069	69,056	12,898	117,893	475,269	863,823
Point Source Portables	*120*	*31*	*17*	*460*	*25*	*145*
Total	186,189	69,204	12,933	118,353	477,321	858,718

[9] https://deq.utah.gov/air-quality/2020statewide-emissions-inventories

[10] https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei

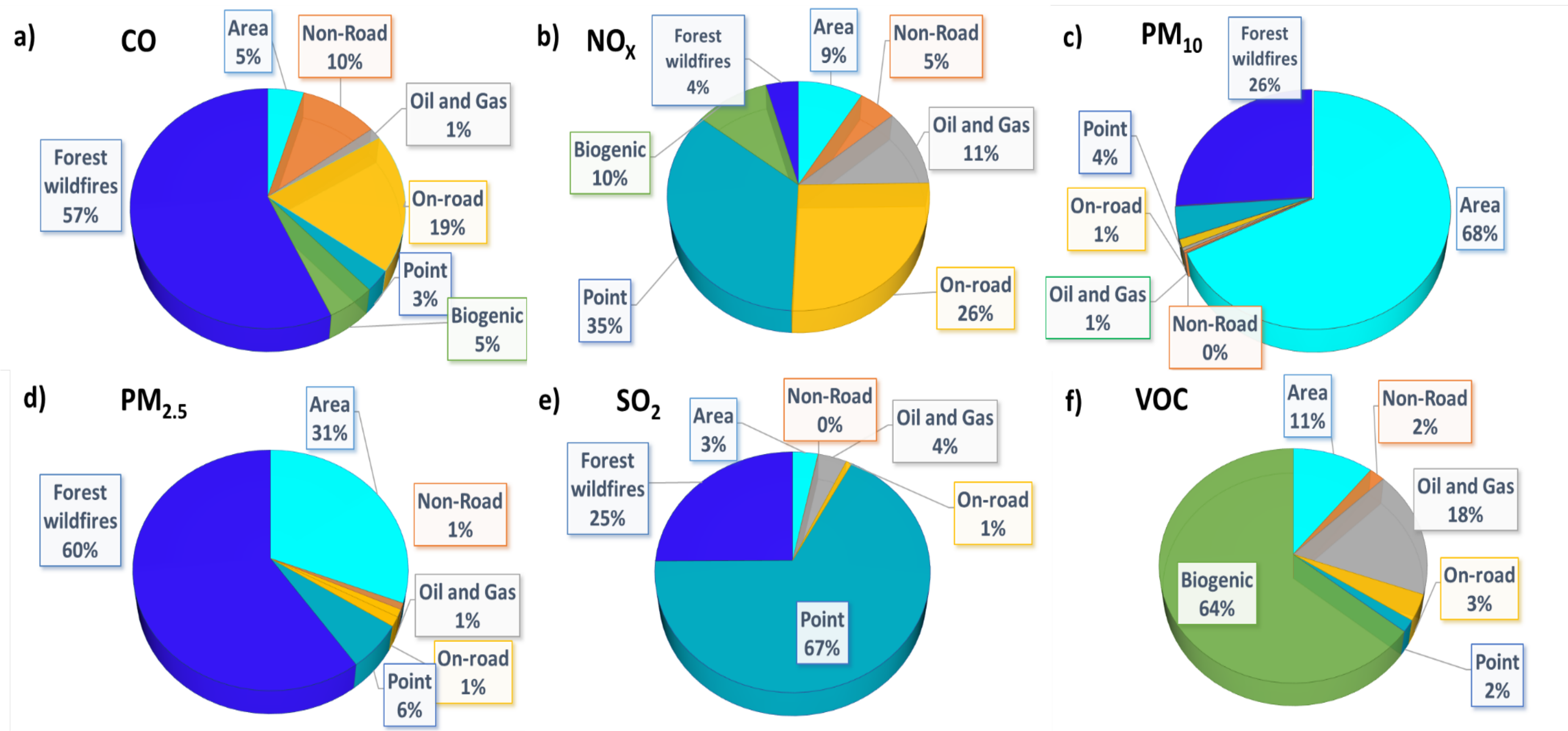


Figure 2. 2020 Statewide emissions inventory (percent contribution) by source category for: a) CO, b) NOx, c) PM10, d) PM2.5, e) SO_2, and f) VOCs. The point source percentage includes emissions from both point sources and EPA-designated point sources.

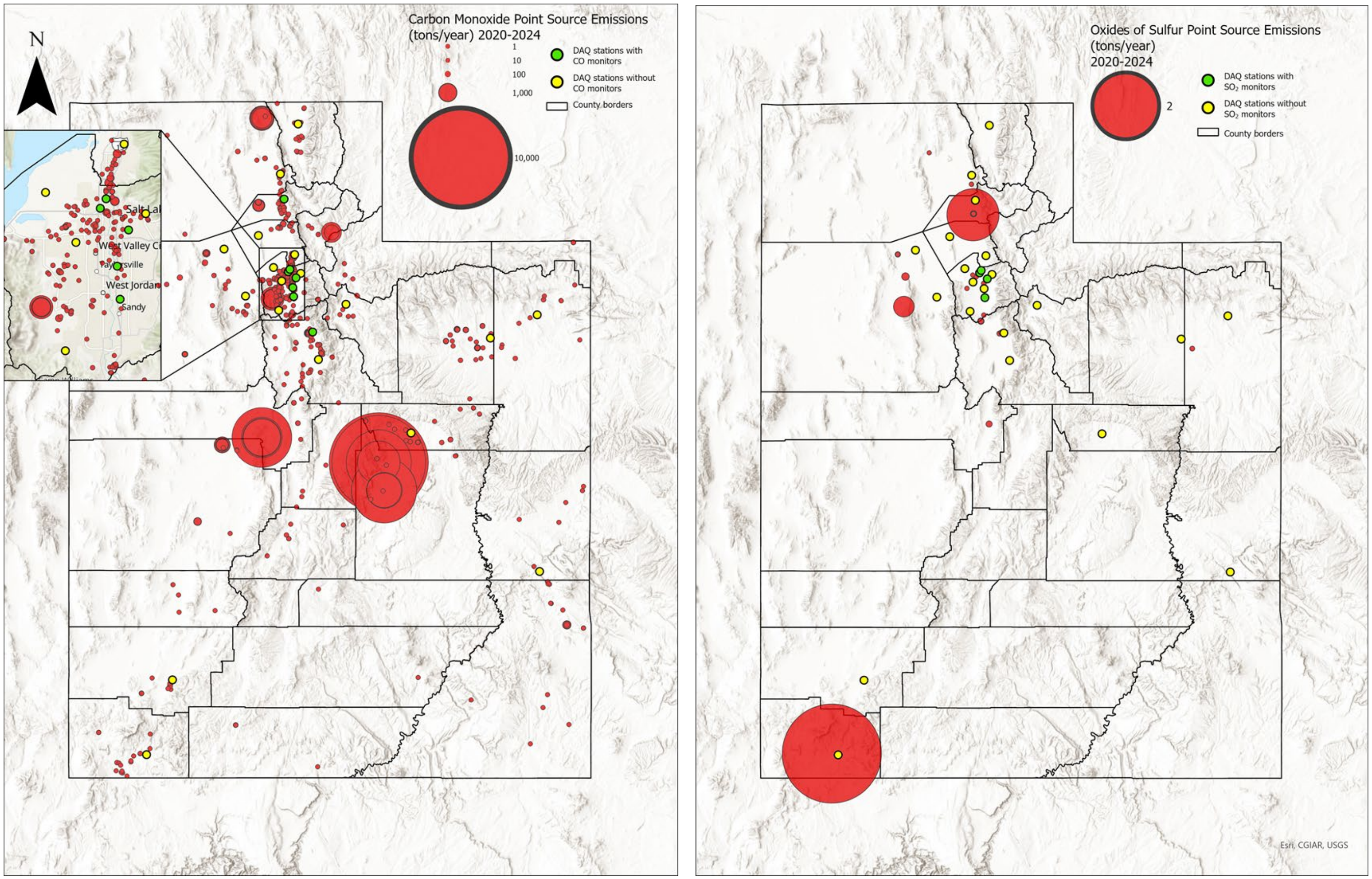


Figure 3. Map of Utah counties showing annual **point source emissions** (in tons per year) of carbon monoxide (CO) (left) and sulfur oxides (SO_x)(right). Ambient air monitoring stations are also shown: green circles represent stations with active CO or SO_2 monitors, while yellow indicate stations without such monitors.

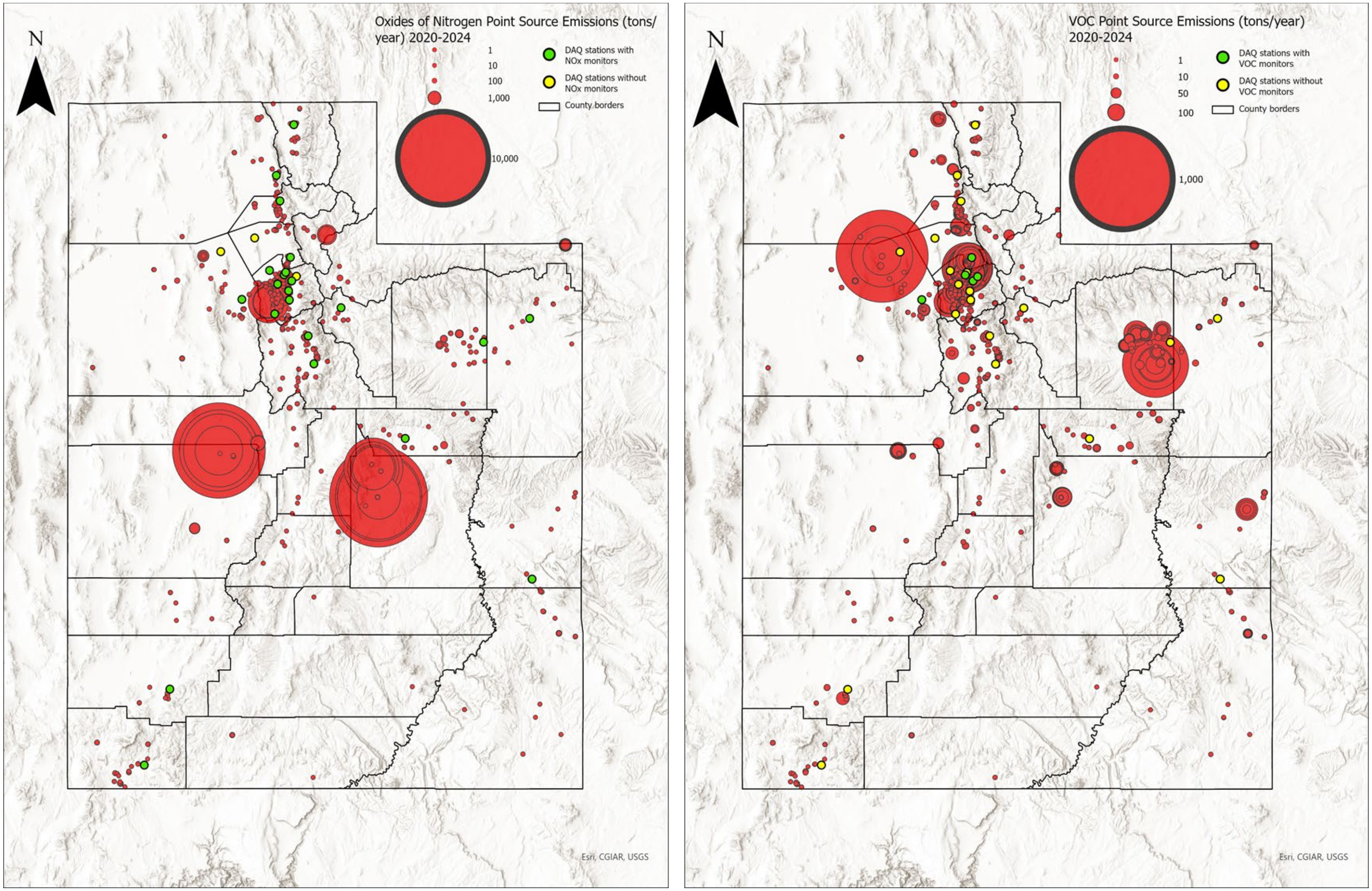


Figure 4. Map of Utah counties showing annual **point source emissions** (in tons per year) of oxides of nitrogen (NO_x) (left) and volatile organic compounds (VOCs) (right). Ambient air monitoring stations are also shown: green circles indicate stations with active NO_x or VOC monitors, while yellow circles indicate stations without such monitors.

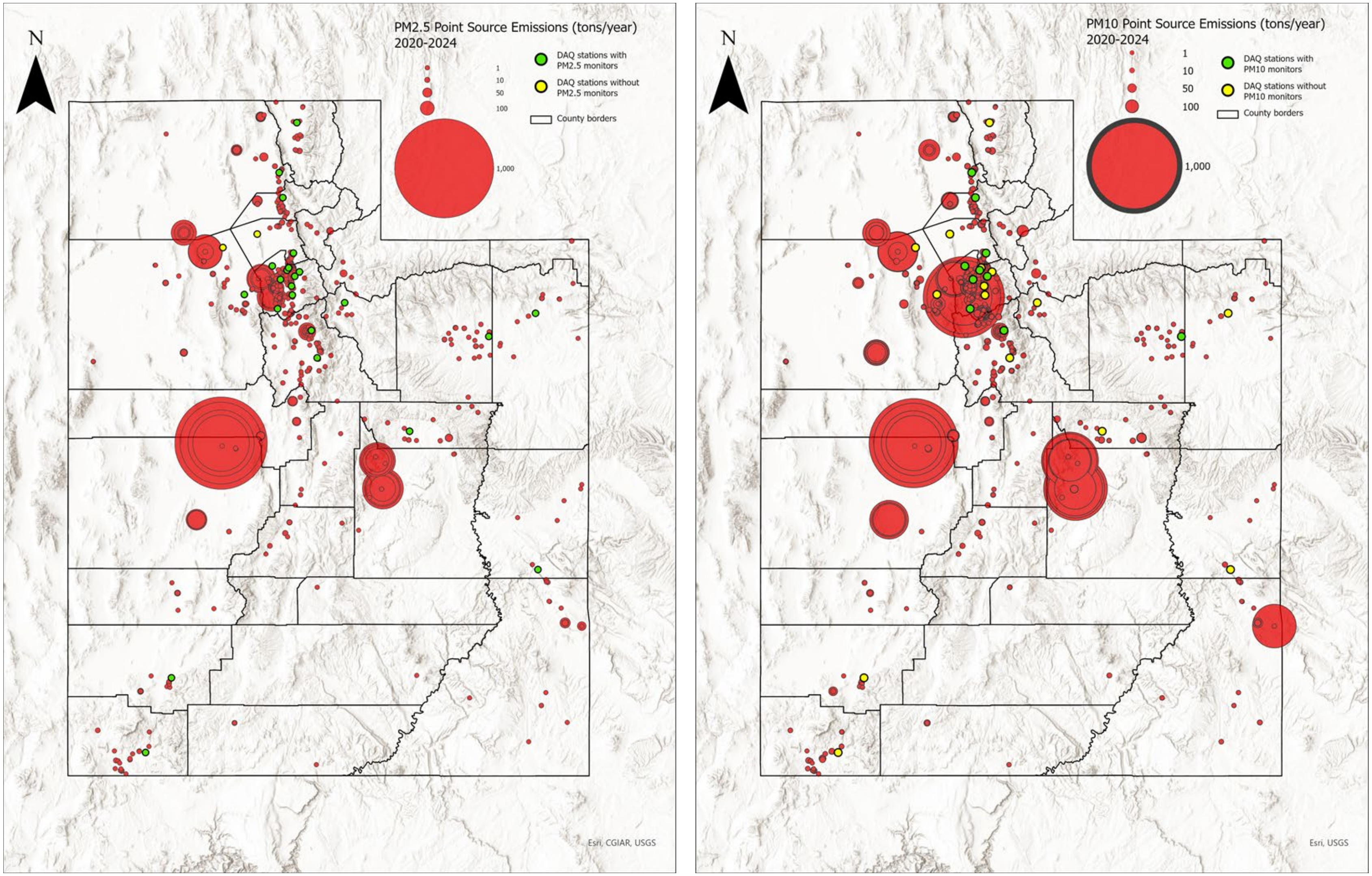


Figure 5. Map of Utah counties showing annual **point source emissions** (in tons per year) of $PM_{2.5}$ (left) and PM_{10} (right). Ambient air monitoring stations are also shown: green circles indicate stations with active $PM_{2.5}$ or PM_{10} monitors, while yellow circles indicate stations without such monitors.

2. Air Monitoring Network Design

The Air Quality Monitoring Network currently operates monitors at 25 locations statewide. Two of these monitoring sites were established in accordance with Utah Senate Bill 144, which directs the Department of Environmental Quality to set up and maintain monitoring facilities to assess the environmental impact of the Inland Port development project. These sites are the Lake Park site (LP) and the Prison site (ZZ).

Most of the Utah DAQ sites and monitors are identified as SLAMS. SLAMS monitors meet specific siting and quality assurance criteria defined in federal regulations. Utah DAQ also operates some monitors identified as SPMs, which are used to fulfill very specific and usually short-term monitoring goals. SPM monitors are also required to meet certain federal regulations established in 40 CFR Part 58, Appendix *A*. If they operate for more than two years, their data can be used by the U.S. EPA to determine compliance with the NAAQS.

The Utah DAQ monitoring stations are strategically located to measure both local and regional levels of air pollutants, including particulate matter (PM), gaseous pollutants, and meteorological variables. Currently, $PM_{2.5}$ is measured at 23 locations, PM_{10} at ten locations, O_3 at 23 locations, NOX/NO/NO_2 at 23 locations, CO at seven locations, and SO_2 at four locations.

Out of the 23 $PM_{2.5}$ monitoring sites, 15 use filter-based equipment, while seven out of 11 PM_{10} sites also use filter-based equipment. Four of the filter-based PM_{10} sites are part of the Dust study, and all sites collecting $PM_{2.5}$ filter-based measurements are equipped with continuous monitors. Meteorological parameters, including wind speed, wind direction, temperature, relative humidity, and solar radiation, are measured at most sampling sites. The location and elevation of the monitoring sites, the EPA Air Quality System (AQS) site codes, and the measured variables at each station are provided in Table 3 and Table 4 respectively. A Map of Utah showing the location of all monitoring sites in the DAQ monitoring Network is displayed in Figure 3.

Moreover, the network includes stations that participate in several EPA monitoring programs, including the National Core (NCore), Speciation Trends Network (STN), Chemical Speciation Network (CSN), Photochemical Assessment Monitoring Stations (PAMS), National Air Toxics Trends Stations (NATTS), the Ammonia Monitoring Network (AMoN), and near-road monitoring stations

Data collected at these stations is primarily used for the following objectives:

- Evaluating population exposure to air pollutants
- Tracking the spatial distribution of air pollutants
- Assessing historical trends in air pollution
- Supporting compliance with ambient air quality standards (primary and secondary)
- Supporting air quality models and research studies
- Informing the general public of air pollution levels via mobile apps and web pages

- Developing State Implementation Plans (SIPs) and legislative air pollution control measures
- Tracking the effectiveness of air pollution control strategies
- Activating control measures during high air pollution episodes, such as restricting wood burning during winter-time inversions
- Monitoring of specific emission sources and air pollutants

The sampling sites are strategically located to support the monitoring objectives outlined above. Certain sites are selected to measure PM concentrations in densely populated areas, while others are chosen to evaluate ozone and precursor transport. The Utah DAQ continually works to optimize the monitoring instruments across its network. Appendix A lists the equipment used at the Utah DAQ monitoring sites, while Appendix B provides a detailed list of monitoring instruments, site-specific objectives, spatial scales, measured parameters, sampling frequencies, and methods.

However, considering the continuously evolving federal air quality standards, growing economy and population, as well as budgetary constraints, efficient and representative pollution monitoring in Utah demands further optimization of the air monitoring network.

This includes adding new sites or sampling equipment, focusing on monitoring pollutants of current and local concern (e.g. air toxics, ozone and its precursors), and conducting special studies to address pressing air quality issues, as discussed in the subsequent sections. To that end, the following factors were considered in the air monitoring network review:

- EPA siting requirements (40 CFR, part 58).
- Compliance with the NAAQS
- Air Quality Index (AQI) reporting and forecasting
- SIP development and maintenance
- Air quality models and control strategy selection
- Air quality research studies and special monitoring programs
- Population growth
- Funding
- Logistical issues

Table 3. Utah Air Monitoring Network: Sites and Locations.

County	AQS code	Station Name	Station Address	Latitude	Longitude	Elevation (meters)
Cache	49-005-0007	Smithfield (SM)	675 West 220 North, Smithfield	41.84267	-111.852064	1379
Box Elder	49-003-0005	Brigham City (BG)	350 West 1175 South, Brigham City	41.485039	-112.021484	1316
Weber	49-057-1003	Harrisville (HV)	425 West 2550 North, Harrisville	41.302685	-111.986476	1320
Davis	49-011-0004	Bountiful (BV)	171 West 1370 North, Bountiful	40.902945	-111.884505	1309
	49-011-6001	Antelope Island (AI)	Great Salt Lake	41.039404	-112.231541	1355
Salt Lake	49-035-2005	Copperview (CV)	8449 South Monroe St., Midvale	40.597911	-111.894162	1343
	49-035-3015	Environmental Quality (EQ)	1950 West 240 North, Salt Lake City	40.777028	-111.94585	1284
	49-035-3006	Hawthorne (HW)	1675 South 600 East, Salt Lake City	40.734367	-111.872221	1308
	49-035-3013	Herriman #3 (H3)	14058 Mirabella Drive, Herriman	40.496412	-112.036329	1534
	49-035-3014	Lake Park (LP)	2782 South Corporate Park Dr., West Valley City	40.709905	-112.008684	1295
	49-035-4002	Near Road (NR)	5001 South Galleria Dr, Murray	40.662868	-111.901874	1305
	49-035-3018	Red Butte (RB)	2195 Red Butte Canyon Rd., Salt Lake City	40.76656	-111.828	1517
	49-035-3010	Rose Park (RP)	1400 West Goodwin Ave., Salt Lake City	40.795514	-111.930996	1283
	49-035-3016	Prison Site (ZZ)	1480 North 8000 West	40.80793	-112.087772	1287
Wasatch	49-051-0001	Heber (HB)	Heber City Site #1 Water Conservation District lot, 626 E 1200 S Heber City	40.497962	-112.036329	1524
Utah	49-049-4001	Lindon (LN)	50 North Main St., Lindon	40.339505	-111.713486	1444
	49-049-5010	Spanish Fork (SF)	2050 N. 300 W., Spanish Fork (airport)	40.136369	-111.658011	1380
Tooele	49-045-0004	Erda (ED)	2135 West Erda Way, Erda	40.600565	-112.355782	1321
	49-045-6001	Badger Island (BI)	Great Salt Lake	40.94212	-112.561943	1285
Duchesne	49-013-0002	Roosevelt (RS)	290 South 1000 West, Roosevelt	40.294175	-110.008961	1585
Uintah	49-047-1004	Vernal #4 (V4)	600 North 1650 West, Vernal	40.464812	-109.560731	1667
Carbon	49-007-1003	Price #2 (P2)	351 South 2500 East, Price	39.595749	-110.770097	1737
Iron	49-021-0005	Enoch (EN)	201 Thoroughbred Way, Enoch	37.747409	-113.055482	1693
Grand	49-019-0007	Moab (M7)	691 S Mill Creek Dr. Moab	38.566055	-109.537167	1259
Washington	49-053-0007	Hurricane (HC)	147 North 870 West, Hurricane	37.179138	-113.305105	992

Table 4. Measured parameters at the sampling stations in Utah air monitoring network.

County	Site	$PM_{2.5}$				PM_{10}																		
		FRM	Co-located (FRM)	Real-time	Co-located (Real-time)	FRM	Co-located	Real-time	PM Coarse	Speciation $PM_{2.5}$	O_3	NO_x NO_2 NO	True NO_2	NO_y	SO_2	CO	NH_3	Toxics	Carbonyls	VOCs PAMS	Formaldehyde (HCHO)*	HCL*	BC	MET
Cache	Smithfield	1/1	1/1	X	X					1/6	X	X											X	X
Box Elder	Brigham City	1/1		X		1/1					X	X												X
Weber	Harrisville	1/1		X				X			X	X				X								X
Davis	Bountiful	1/1		X		1/1				1/6	X	X	X	X				X	X	X	X	X	X	X
	Antelope Island																							X
Salt Lake	Copperview	1/1		X							X	X			X	X								X
	Environmental Quality	1/1		X		1/1		X	X		X	X			X	X	X			X	X			X
	Hawthorne	1/1		X	X	1/1		X	X	1/3	X	X	X	X	X	X			X	X	X			X
	Herriman #3			X	X			X			X	X												X
	Lake Park			X		1/1					X	X											X	X
	Near Road	1/1		X							X	X				X								X
	Red Butte			X							X		X	X						X	X			X
	Rose Park	1/1	1/1	X							X	X			X	X								X
	Prison			X		1/1					X	X									X	X	X	X
Tooele	Erda	1/1		X							X	X	X	X						X	X	X		X
	Badger Island																							X
Wasatch	Heber	1/1		X							X	X												X
Utah	Lindon	1/1	1/6	X				X		1/6	X	X				X							X	X
	Spanish Fork	1/1		X							X	X												X
Uintah	Vernal	1/1		X							X	X												X
Duchesne	Roosevelt	1/1	1/1	X	X	1/1	1/6	X	X		X	X												X
Carbon	Price #2			X							X	X												X
Iron	Enoch			X							X	X												X
Grand	Moab			X							X	X												X
Washington	Hurricane			X							X	X												X

*Non-regulatory monitor; sites in *italic font* corresponds to remote stations; 1/1 are sampled daily; 1/3 are sampled every three days; 1/6 are sampled every sixth day. Note: Co-located means an additional monitor(s) that can either be of the same type or of a different type. It can be an FRM and an FEM or a pair of FRM's or a pair of FEM's or in some cases it may also mean a third or fourth monitor at the same location.

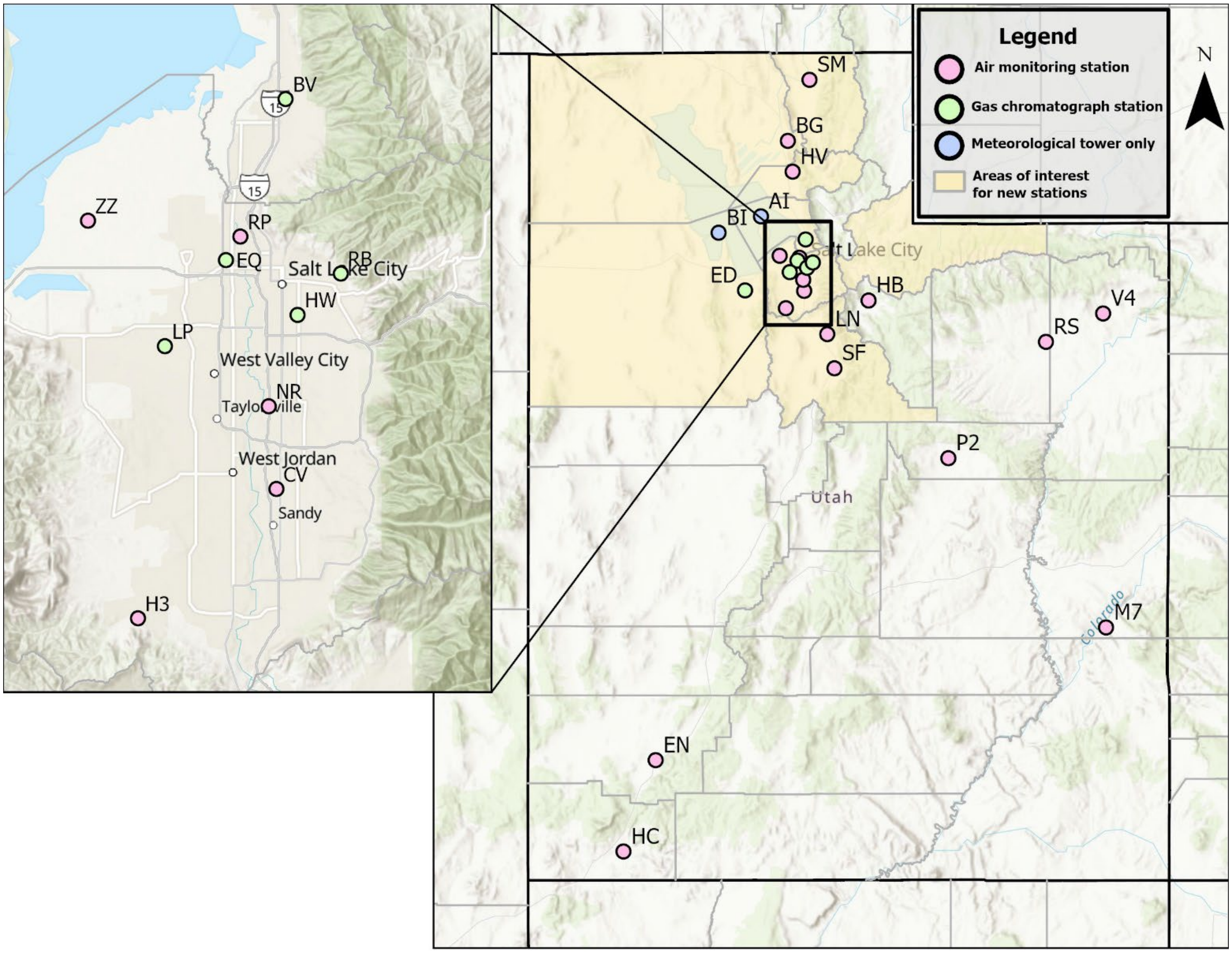


Figure 6. Map of Utah showing the location of all monitoring sites in Utah Air Monitoring Network.

3. Network Technical Assessment

The network assessment was conducted using the EPA Ambient Air Monitoring Network Assessment Guidance[11]. The evaluation considered each monitoring site's objectives and spatial scales (40 CFR Part 58, Appendix D) to determine whether sites were redundant or if additional sites were needed within specific geographic areas. The assessment also examined whether the number of monitors within each CBSA met the minimum federal monitoring requirements (40 CFR Part 58, Appendix D, Section 4.7), and whether the sites complied with EPA siting criteria (40 CFR Part 58).

To assess the Utah DAQ network, monitors were considered individually and in relation to the network as a whole, considering factors such as the monitor's regulatory value, the population and area served by each monitor, the monitor purpose, historical data trends, design value, deviation from the NAAQS, the number of instruments at each site, participation in EPA national programs or special studies, traffic counts, source impacting the site and site to site comparisons.

Population estimates for each CBSA were based on the most recent U.S. Census data and population projections from Utah's Governor's Office of Management and Budget 1. Site redundancy was assessed using the correlation matrix and removal bias tools[11]. The correlation matrix provides the Pearson correlation coefficient (r^2), relative concentration differences, and distance between site pairs. Potentially redundant sites exhibit a low average relative differences, high correlations with nearby monitors. The removal bias tool estimates the concentration at a site if its monitor were removed by interpolating a value from surrounding monitors. The bias is then calculated as the difference between the estimated and actual concentration. A near-zero bias indicates that removal would have minimal impact, while a positive or negative bias suggests nearby monitors would overestimate or underestimate concentrations, respectively.

Comparison analyses for $PM_{2.5}$, PM_{10}, and O_3 monitors were conducted using various indicators (Table 5) selected to represent a range of relevant variables. The resulting rankings supported further evaluations to identify potentially redundant sites for possible removal. Monitors that received lower scores should be carefully reviewed, as there may be valid reasons to retain them despite their ranking. Following the scoring process, monitors were categorized as "High," "Moderate," or "Low" to simplify the interpretation of results.

$PM_{2.5}$ and PM_{10} monitors participating in special programs, studies, or required by regulation were evaluated using the same criteria as other monitors. However, regardless of their final score, they were assigned a "High" classification due to their required or special status. For O_3 monitors, although scoring was performed, all were assigned a "High" classification because their design values exceeded 85% of the NAAQS. Most NO_2 monitors were installed to support ozone (O_3) modeling efforts and were not included in the full comparison analysis. Instead, they were directly assigned a final classification. The

[11] https://www.epa.gov/amtic/ambient-air-monitoring-network-assessment-guidance-documents

same approach was applied to CO and SO_2 monitors, which were also directly assigned a final classification score.

The proposed new monitoring sites have been identified through an assessment conducted by the Technical Analysis Group. These recommendations are primarily aimed at enhancing Utah DAQ's ability to evaluate regulatory air quality modeling results. This information will be combined with the findings of the Assessment and presented at the end of the report.

Please note that quality control and quality assurance of the instruments used in the network are beyond the scope of this assessment. For additional information on quality control and assurance practices, refer to the UDAQ Monitoring Quality Assurance Project Plan (QAAP) and the relevant Standard Operating Procedures (SOPs). Additionally, the data for the criteria pollutants used in this assessment have already been validated by the DAQ validation team, meaning they have met all requirements established in the Code of Federal Regulations (40 CFR Part 58, Appendix A)[12] and EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II[13].

Table 5 Site-to-site comparison analyses used in this report.

Analysis	Objective	Score (Max=4, Min=1)
Number of parameters monitored	Assess the economic value of the site	A higher number of parameters leads to a higher ranking. Sites with same number of parameters were ranking equally
Area served	Evaluates the spatial coverage of the monitoring network	Serving a larger area results in a higher ranking
Population	Assess the population coverage of each monitor	Serving a larger population results in a higher ranking
Historical records	Evaluate the value of long-term trends	Sites with more years of continuous data receive higher rankings
Deviation from the NAAQS	Assess the regulatory significance of each site	Sites closer to the NAAQS receive higher rankings
Monitor to monitor correlation	Evaluate temporally correlations of concentrations to ensures adequate spatial coverage	Sites with lower correlation (R^2) receive higher rankings
Removal Bias	Evaluate the spatial coverage required for accurate model predictions	Sites with higher Absolute Mean Removal Bias receive higher rankings
The site's regulatory role or its involvement in national programs or special studies	This analysis aims to determine the strategic importance of each site in the network by considering factors such as regulatory role, program participation, and study involvement	A higher number of parameters leads to a higher ranking. Sites with same number of parameters were ranking equally

3.1 Particle Monitoring

$PM_{2.5}$ network

The Utah DAQ currently operates 24-hour Federal Reference Method (FRM) and Federal Equivalent Method (FEM) $PM_{2.5}$ samplers across the state to demonstrate compliance with the National Ambient

[12] https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-58/appendix-Appendix%20A%20to%20Part%2058
[13] https://www.epa.gov/sites/default/files/2020-10/documents/final_handbook_document_1_17.pdf

Air Quality Standards (NAAQS), evaluate population exposure, support State Implementation Plan (SIP) development, and assess model performance. These monitors also help track $PM_{2.5}$ levels in both source and receptor areas.

Currently, the Utah DAQ uses 15 FRM $PM_{2.5}$ monitors and 27 FEM continuous $PM_{2.5}$ samplers at 23 monitoring sites throughout the state. Some continuous monitors are co-located with FRM filter-based instruments to allow for comparability assessments. Data from the continuous monitors are used to support forecasting, mobile apps, web pages, and to report Air Quality Index (AQI) information on the AIRNow website.[14]

Area and population served

Table 6 presents the area and population served by each $PM_{2.5}$ monitor, including sensitive groups such as the elderly and children.

Table 6. Area and population served by $PM_{2.5}$ samplers in Utah air monitoring network.

Site	County	Total Population	Total Male	Total Female	Aged 0 to 4	Aged 65 and over	Area Served (Km^2)
Enoch	Iron	112,016	56,852	55,164	7,618	17,676	80,773
Erda	Tooele	84,746	42,877	41,869	6,575	8,348	42,791
Hurricane	Washington	200,236	99,227	101,009	12,657	42,540	40,527
Moab	Grand	38,009	18,966	19,043	2,023	7,979	29,032
Price	Carbon	53,323	26,897	26,426	3,287	9,781	27,473
Brigham City #3	Box Elder	69,412	35,185	34,227	5,363	9,353	17,356
Roosevelt	Duchesne	23,595	11,950	11,645	1,775	3,320	13,679
Vernal #4	Uintah	36,555	18,196	18,359	2,935	4,431	13,415
Spanish Fork	Utah	241,194	122,032	119,162	20,007	22,001	9,729
Smithfield	Cache	128,026	63,773	64,253	10,127	13,047	5,266
Bountiful Viewmont	Davis	260,873	130,468	130,405	19,142	31,581	4,312
Red Butte	Salt Lake	101,328	51,280	50,048	4,981	15,379	2,891
Harrisville	Weber	372,081	187,931	184,150	27,548	41,780	1,645
Lindon	Utah	378,939	190,285	188,654	30,219	36,875	1,276
Herriman #3	Salt Lake	252,451	126,322	126,129	25,813	12,836	1,234
Prison	Salt Lake	11,411	5,752	5,659	1,074	895	348
Copper View	Salt Lake	354,416	177,434	176,982	22,481	46,507	313
Lake Park	Salt Lake	230,785	116,312	114,473	17,146	20,221	305
Near Road	Salt Lake	179,452	89,220	90,232	11,439	25,338	93
Hawthorne	Salt Lake	140,436	71,074	69,362	7,193	17,064	64
Environmental Quality	Salt Lake	25,402	13,096	12,306	1,766	1,866	48
Rose Park	Salt Lake	47,328	24,616	22,712	2,940	4,456	42

[14] https://www.airnow.gov/?city=Salt%20Lake%20City&state=UT&country=USA

Historical trends and deviations from NAAQS

The National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ were initially established in 1997 and were revised in December 2006, 2012, and 2024. In 2006, the EPA lowered the 24-hour $PM_{2.5}$ standard from 65 µg/m³ to 35 µg/m³. In 2012, it lowered the annual standard from 15 µg/m³ to 12 µg/m³, and in 2024, the standard was further lowered to 9 µg/m³. Both standards are evaluated based on data collected over a three-year period. The 24-hour standard is met when the three-year average of the 98th percentile 24-hour values is less than or equal to 35 µg/m³. The annual standard is met when the three-year average of the annual mean is below 9 µg/m³.
Figure 7 and Figure 8 display the 98th percentile of 24-hour $PM_{2.5}$ concentrations (µg/m³) and the 3-year average of these 98th percentile values for the period 2000–2024. Figure 9 and Figure 10 show the annual mean $PM_{2.5}$ concentrations and the corresponding 3-year averages over the same period. Dashed horizontal lines in the figures indicate the applicable NAAQS levels.

Recent changes in the $PM_{2.5}$ monitoring network are reflected in historical trends shown in Figures 7-10. The Brigham City station was discontinued on June 23, 2019, due to a construction project expanding the school parking lot where it was located. A new station was installed in Brigham City in 2023 to continue monitoring in the area.

In June 2019, the Ogden#2 station was combined with the Harrisville station. The original Ogden#2 site was repurposed for city development, and a $PM_{2.5}$ sampler was installed at Harrisville, which is within the same CBSA area and approximately 11 km away.

Since the 2020 network review, additional $PM_{2.5}$ monitors have been established in Salt Lake (Lake Park, Prison, Red Butte), Grand (Moab), and Wasatch (Heber) counties to enhance forecasting and evaluate population exposure. As shown in the figures, the state has maintained compliance with the annual $PM_{2.5}$ standard for over a decade, including with the most recent revision in 2024, which lowered the standard to 9 µg/m³. Although the 24-hour $PM_{2.5}$ standard of 35 µg/m³ is occasionally exceeded in some areas, the three-year $PM_{2.5}$ design values have not exceeded the standard.

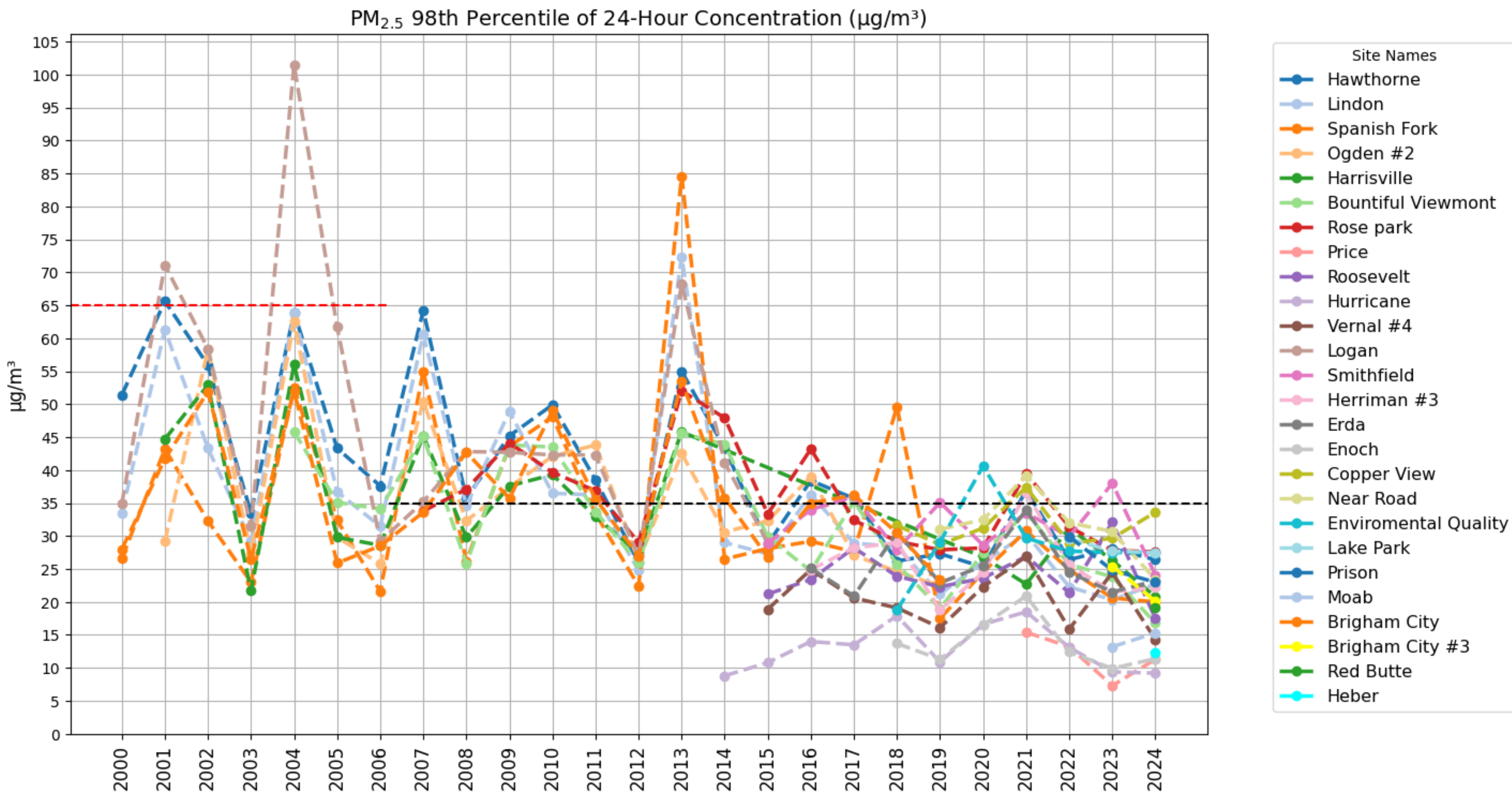


Figure 7. $PM_{2.5}$ 98th percentile 24-hr (ug/m^3) and comparison to NAAQS for $PM_{2.5}$ during the period 2000-2024.

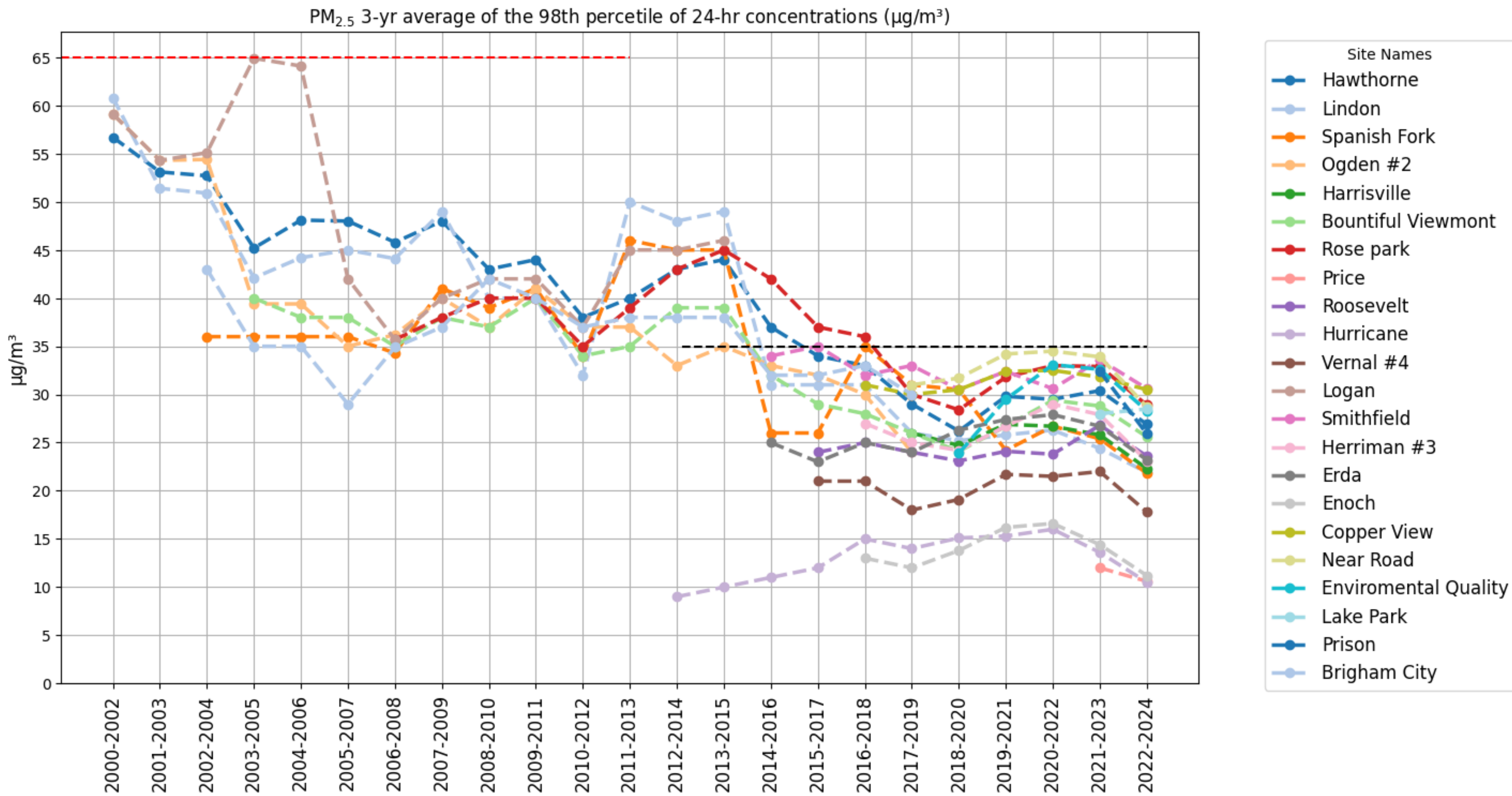


Figure 8. $PM_{2.5}$ 3-year average of the 98th percentile 24-hour (ug/m^3) and comparison to NAAQS (2000-2024).

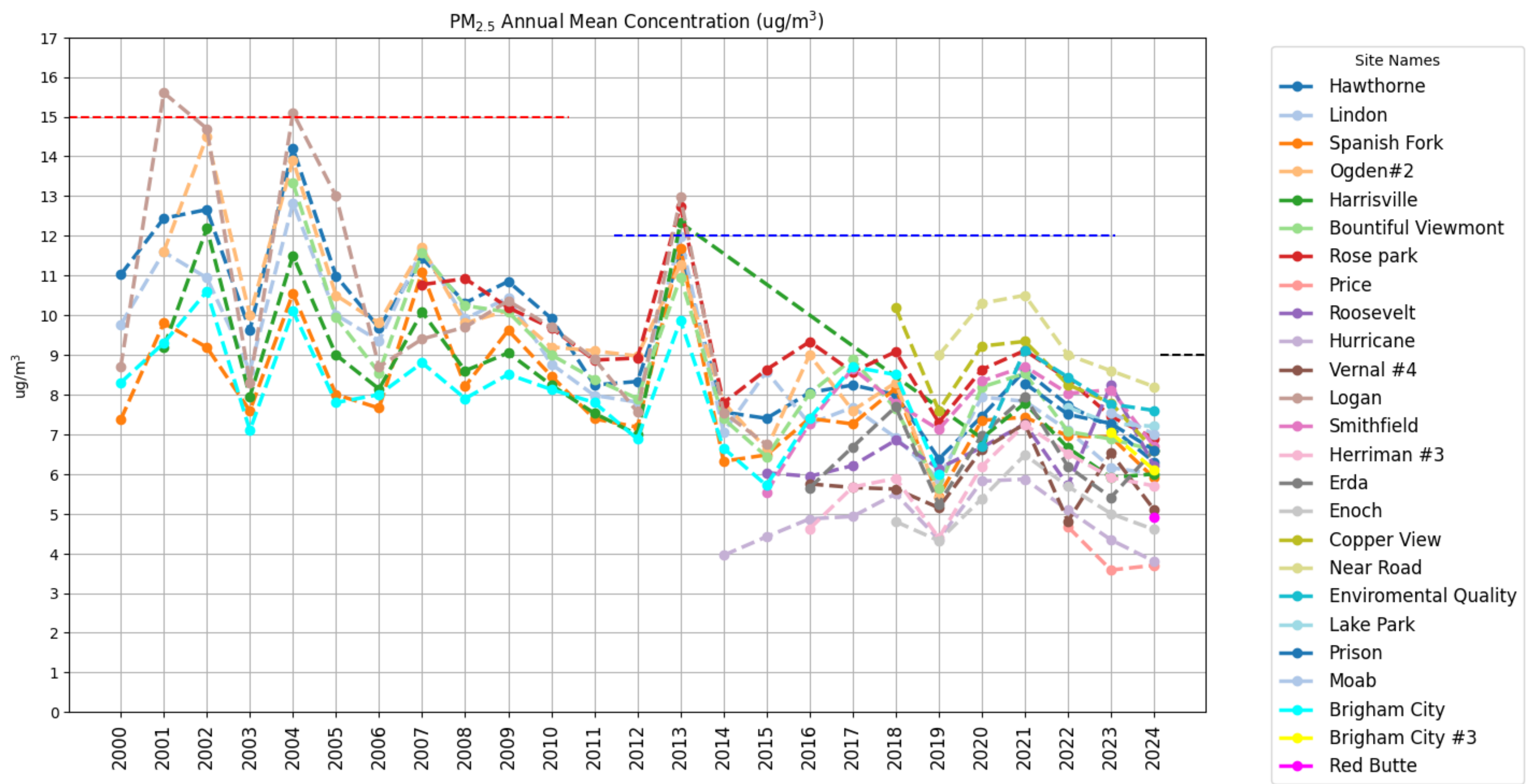


Figure 9. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024).

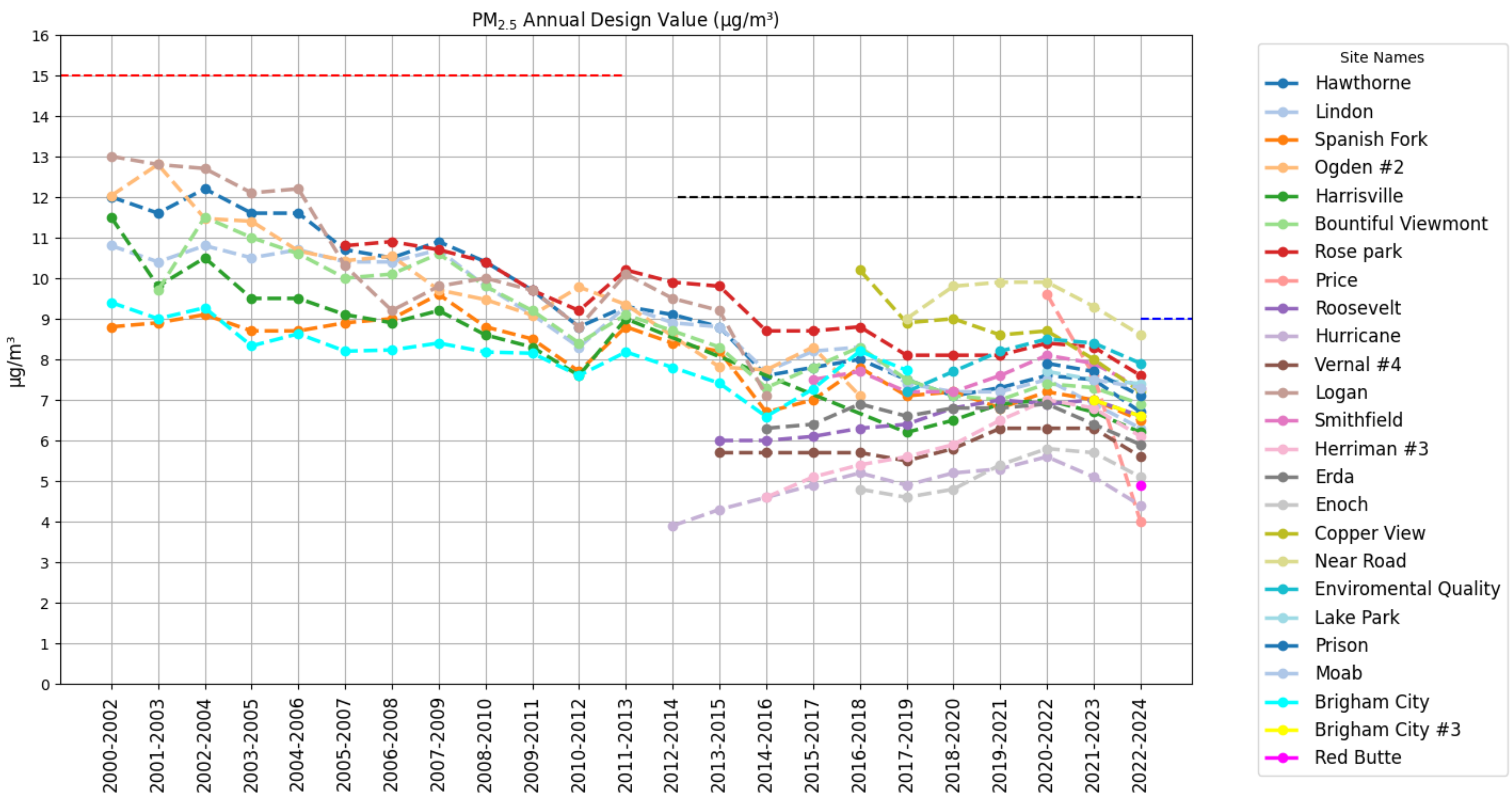


Figure 10. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024).

Site-by-site analysis

Federal regulations require state and local agencies to operate $PM_{2.5}$ monitoring sites at various locations, depending on MSA boundaries, population size, and the most recent three-year design value, expressed as a percentage of the $PM_{2.5}$ NAAQS (40 CFR, part 58, appendix D). Minimum federal monitoring requirements for $PM_{2.5}$ sampling, along with the number of active $PM_{2.5}$ monitors in each CBSA, are provided in Table 7 and Table 8.

Table 7. Minimum monitoring requirements for $PM_{2.5}$.

MSA population	Most recent 3-year design value ≥ 85% of any $PM_{2.5}$ NAAQS	Most recent 3-year design value <85% of any $PM_{2.5}$ NAAQS
>1,000,000	3	2
500,000-1,000,000	2	1
50,000-<500,000	1	0

Table 8. Number of active $PM_{2.5}$ monitors in each CBSA.

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	Minimum number of required monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	3	10
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	2	2
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	2	3
Heber µSA	Wasatch, UT	34,788	43,826	47,368	0	1
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	1	1
Saint George MSA	Washington, UT	180,279	252,964	268,790	0	1
Cedar City µSA	Iron, UT	57,289	78,144	80,074	0	1
Price µSA	Carbon, UT	20,412	21,275	21,703	0	1
Vernal µSA	Uintah, UT	35,620	37,920	38,673	0	1
Summit Park µSA	Summit, UT	42,357	46,717	48,376	0	0

Salt Lake City CBSA

The Utah DAQ currently operates ten $PM_{2.5}$ monitors in the Salt Lake City CBSA, in compliance with federal monitoring requirements (Table 7). According to federal regulations (40 CFR, Part 58, Appendix D, Table D-5), a CBSA with a population greater than 1,000,000 and a three-year design value for $PM_{2.5}$ concentrations exceeding 85% of the NAAQS must have a minimum of three active $PM_{2.5}$ monitors.

Figure 11 displays a map showing the spatial distribution of the monitoring sites and the corresponding areas they serve. All the monitors have been following the 24-hour standard over the last 3 years and continue to meet the annual standard, even after the threshold was lowered for 2024 as shown in Figure 12 and Figure 13.

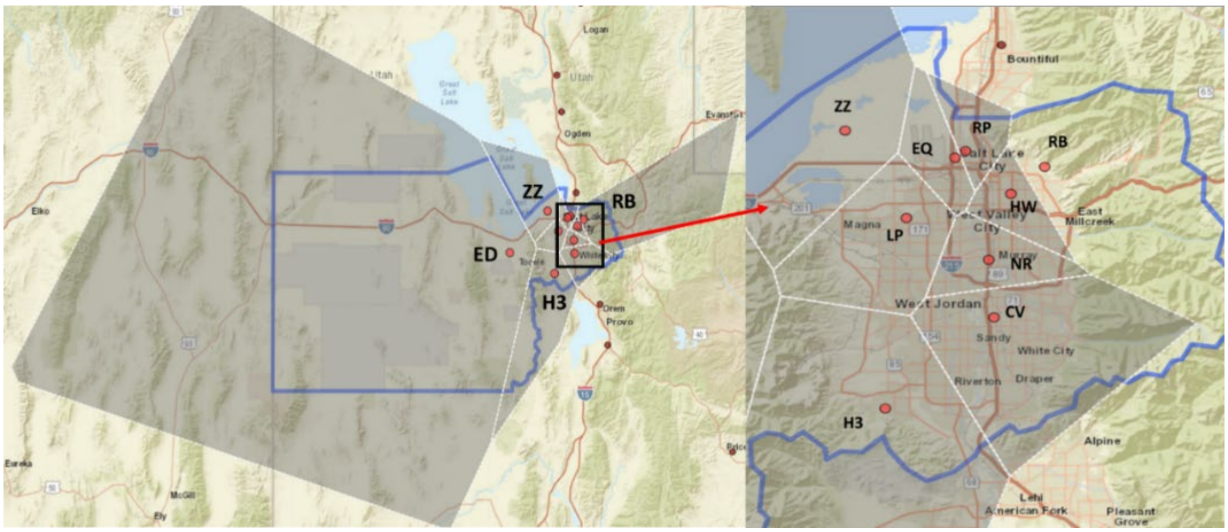


Figure 11. Map showing the spatial distribution of $PM_{2.5}$ monitoring sites in the Salt Lake City CBSA and the areas they serve.

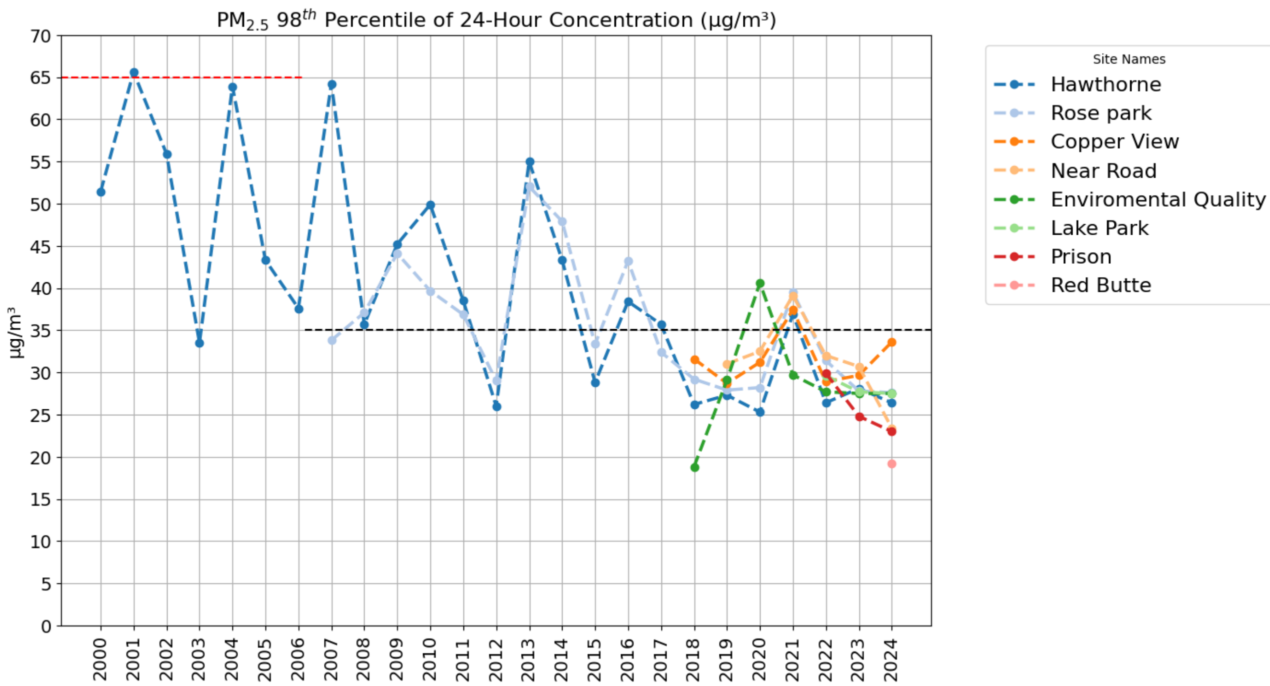


Figure 12. $PM_{2.5}$ 98th percentile 24-hr (ug/m3) and comparison to NAAQS (2000-2024) for monitors in the Salt Lake City CBSA.

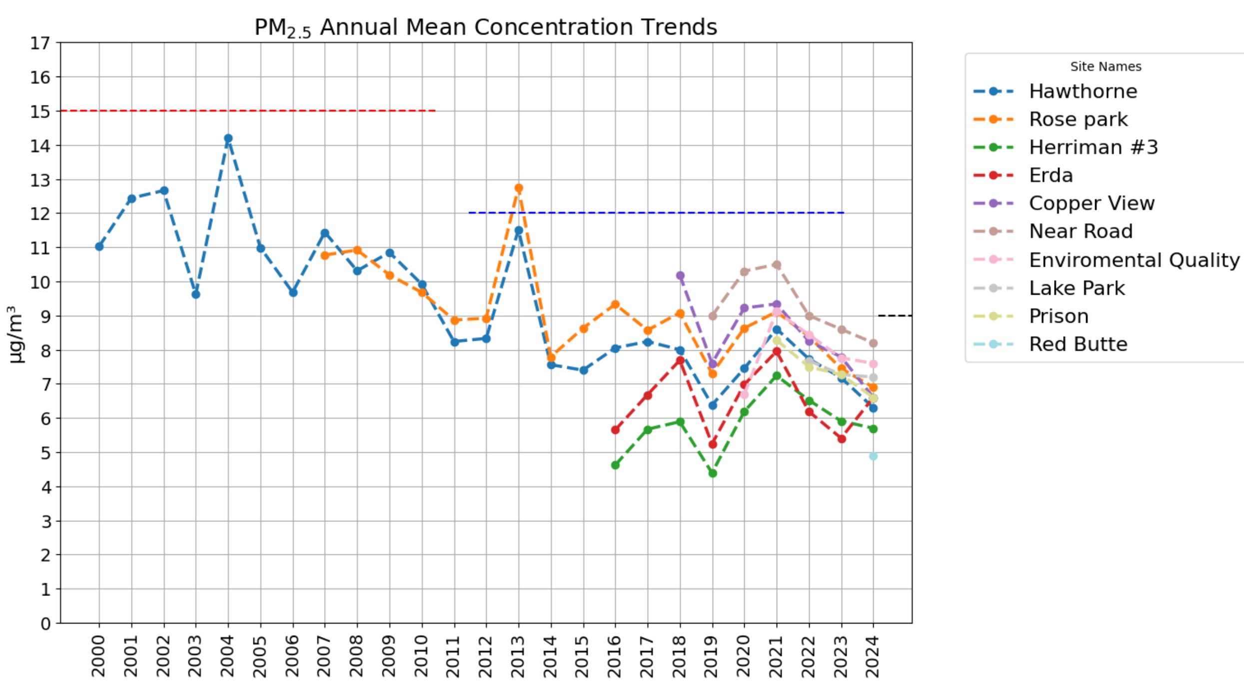


Figure 13. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024) for monitors in the Salt Lake City CBSA.

Correlations and removal Bias

Figure 14 presents a correlation matrix of Pearson correlation coefficients between $PM_{2.5}$ monitoring sites in the Salt Lake City CBSA, with color intensity indicating the distance between sites. Strong correlations ($r^2 \geq 0.90$) were observed among Hawthorne (HW), Rose Park (RP), Copperview (CV), Lake Park (LP), Prison (ZZ), Environmental Quality (EQ), and Near Roar (NR), particularly among geographically closer sites. In contrast, Erda (ED) and Herriman (H3) exhibited moderate correlations with the other sites.

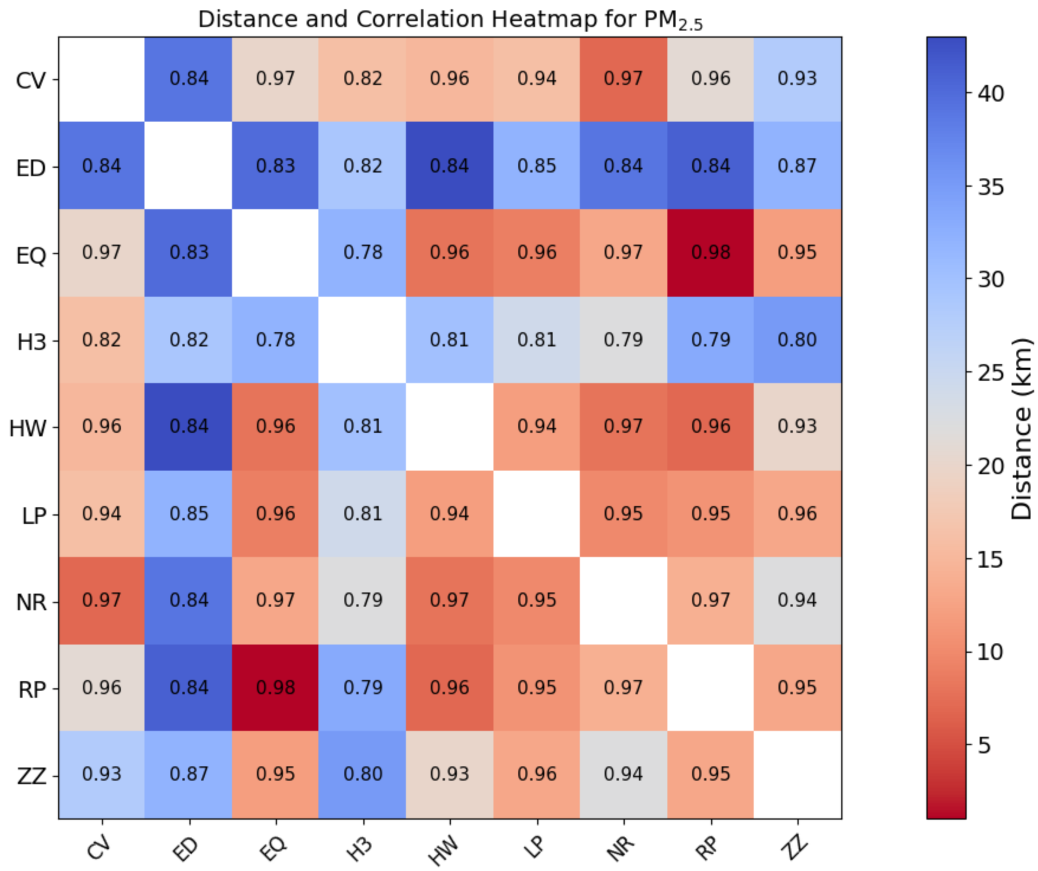
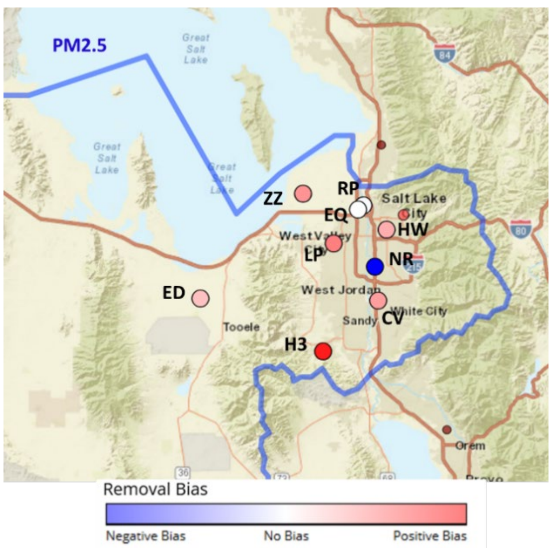


Figure 14. Correlation matrix of pairwise correlation coefficients between $PM_{2.5}$ monitoring sites in the Salt Lake City CBSA, with color intensity indicating the strength of correlation as a function of inter-site distance.

Figure 15 displays the removal bias analysis for all the sites in the Salt Lake City CBSA. The results suggest that if the monitors at Herriman (H3) and Near Road (NR) were removed, they would introduce a positive and negative bias on the predicted concentrations, respectively. In contrast, the removal of sites such as Hawthorne (HW), Rose Park (RP), Copperview (CV), Lake Park (LP), Prison (ZZ), and Environmental Quality (EQ) would have a minimal effect on the predicted concentrations. Near Road (NR) exhibits the highest negative bias of -1.44, suggesting its removal would likely lead to a slightly underestimation of concentrations at this site. Conversely, Herriman (H3) shows the highest positive bias of 1.28, meaning its removal would result in a slightly overestimation of concentrations at this site. This supports the notion that clustered sites, due to their redundancy, typically have low individual biases and could be candidates for removal. In contrast, sites with higher biases are more crucial for developing accurate interpolations of concentrations across the domain.



Site	Mean Removal Bias (ug/m^3)
CV	0.55
HW	0.46
RP	-0.04
H3	1.28
LP	0.72
EQ	-0.01
ZZ	0.61
NR	-1.44
ED	0.35

Figure 15. Removal bias results for the $PM_{2.5}$ monitors in the Salt Lake City CBSA

Provo-Orem CBSA

The Utah UDAQ operates two $PM_{2.5}$ monitors within the Provo-Orem CBSA, in accordance with federal monitoring requirements (see Table 8). These monitors are located at the Lindon (LN) and Spanish Fork (SF) monitoring sites and operate on a daily schedule.

The locations of the monitors in the Provo-Orem CBSA, along with the areas they serve, are shown in Figure 16. Figure 17 present trends for 24-hour $PM_{2.5}$ concentrations while Figure 18 trends for annual concentrations. Both monitors have adhered to the 24-hour standard over the last 3 years and continue to meet the annual standard, even after the threshold was lowered for 2024.

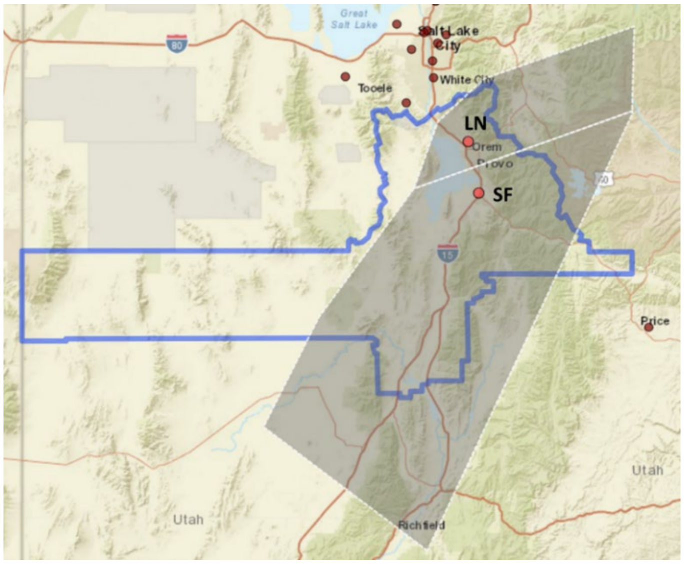


Figure 16. Map showing the spatial distribution of $PM_{2.5}$ monitoring sites in the Provo-Orem CBSA and the areas they serve.

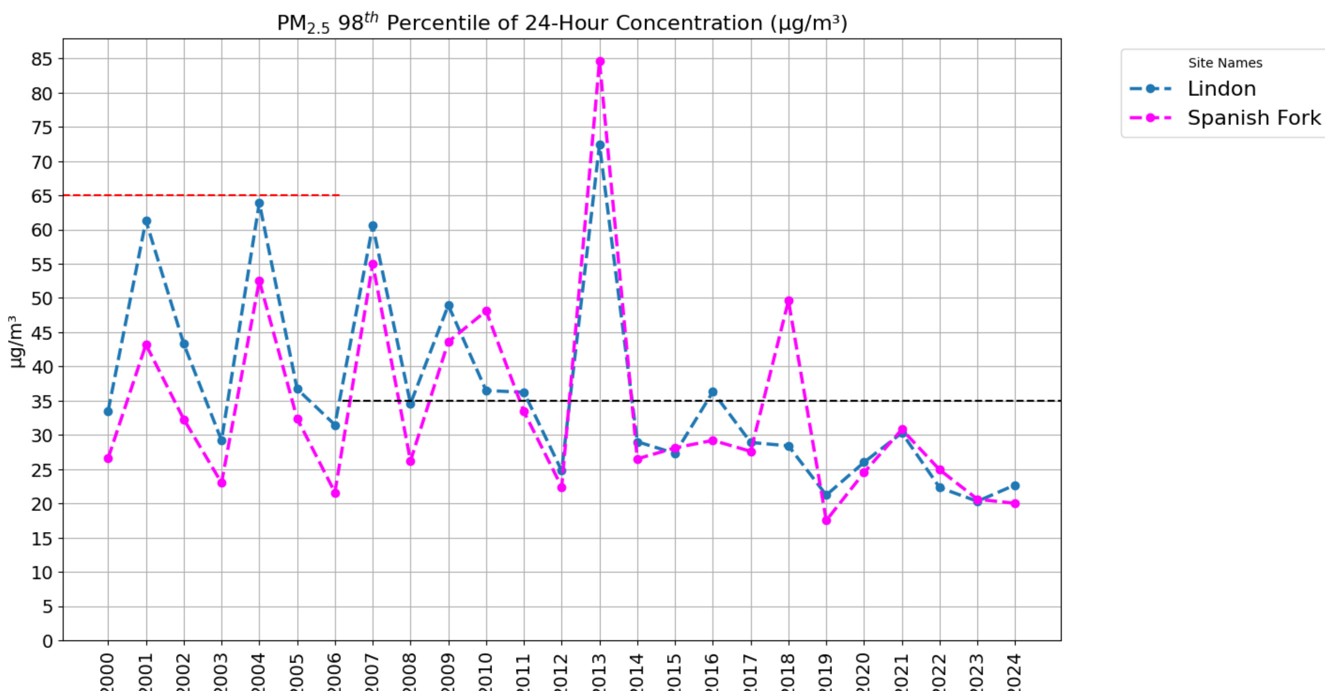


Figure 17. $PM_{2.5}$ 98^{th} percentile 24-hr (ug/m3) and comparison to NAAQS (2000-2024) for monitors in the Provo-Orem CBSA.

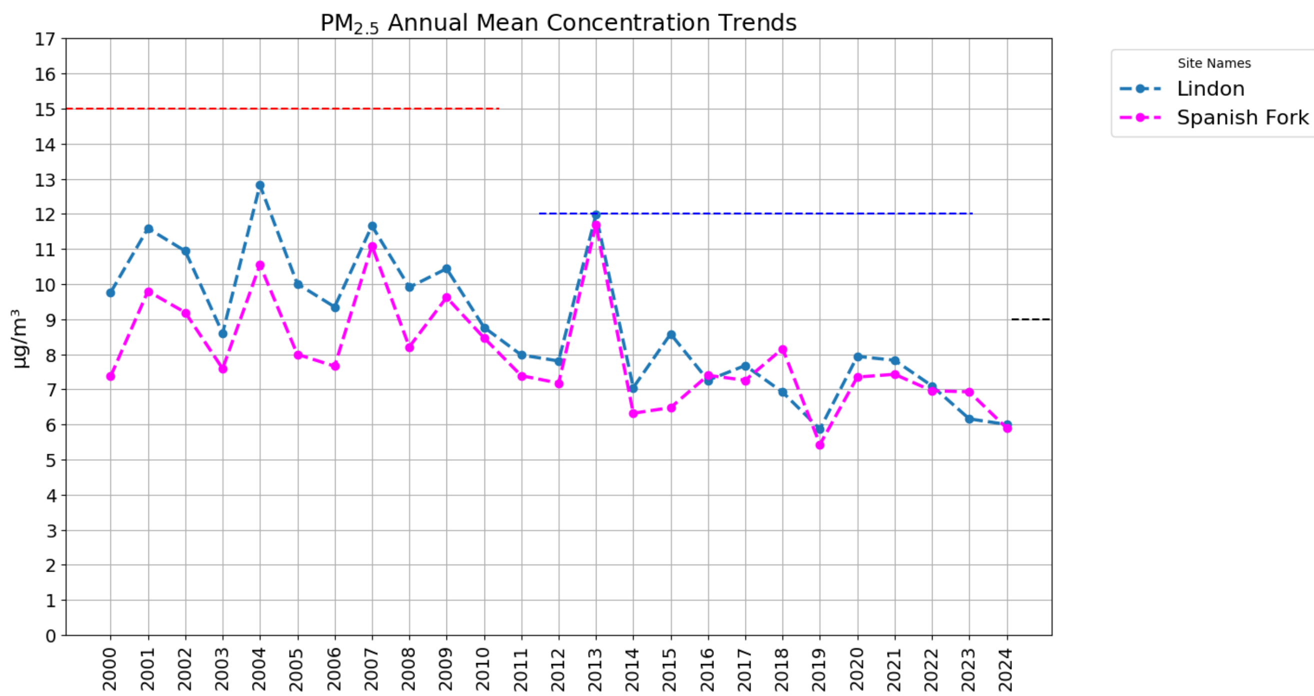


Figure 18. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024) for monitors in the Provo-Orem CBSA

Correlation and Removal Bias

Table 10 displays the Pearson correlation coefficients, the average relative concentration difference, and the distance between site pairs. These two sites, Lindon (LN) and Spanish Fork (SF), exhibited a moderate correlation, with an r^2 value of 0.87 and a small mean relative concentration difference of 1.9 µg/m³.

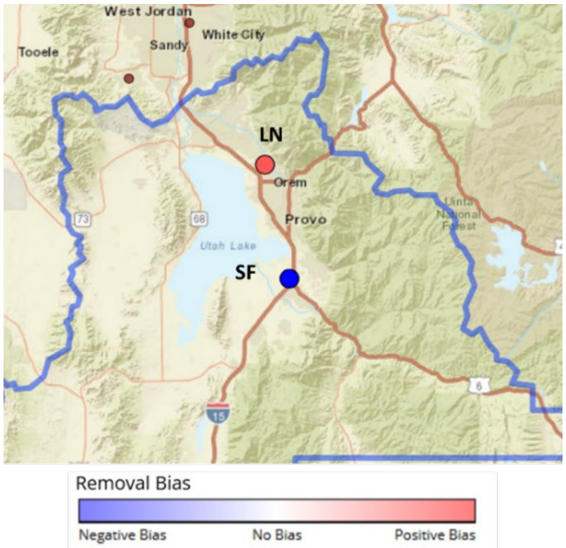
The Spanish Fork site was relocated in November 2021, with the new location within a few hundred feet of the original station.

The Utah DAQ will continue monitoring $PM_{2.5}$ at these sites and, subject to budget approval, plans to establish a third location within the CBSA due to projected population growth.

Table 9. Pearson correlation coefficients and average relative concentration differences between pairs of sites in the Provo-Orem CBSA.

Site 1	Site 2	Distance (km)	# Observations	Correlation	Mean Difference (ug/m3)
LN	SF	23	1052	0.87	1.9

Figure 19 displays the removal bias analysis for all sites in the Provo-Orem CBSA. The results suggest that removing either the Spanish Fork (SF) or Lindon (LN) monitor would likely not introduce bias in the predicted concentrations.



Site	Mean Removal Bias (ug/m3)
LN	0.18
SF	-0.27

Figure 19. Removal bias results for the $PM_{2.5}$ monitors in the Provo-Orem CBSA.

Ogden-Clearfield CBSA

The Utah DAQ operates three $PM_{2.5}$ monitors within the Ogden-Clearfiled CBSA in accordance with federal monitoring requirements (see Table 8). These monitors are located at the Bountiful Viewmont (BV), Harrisville (HV), and Brigham City #3 (BG) monitoring sites and operate on a daily schedule.

The locations of the monitors in the Ogden-Clearfield CBSA, along with the corresponding areas they serve, are shown in Figure 20. Figure 21 and Figure 22 present trends for 24-hour and annual $PM_{2.5}$ concentrations, respectively. All the sites have met both the 24-hour and annual standards, as shown in these figures.

The Ogden #2 and Brigham City monitoring stations, which operated until 2019, were either discontinued or relocated in mid-2019. Consequently, a $PM_{2.5}$ FRM sampler was installed at the Harrisville station, located within the same CBSA as Ogden #2 and approximately 11 km away. Additionally, the Brigham City #3 was established in 2023.

Bountiful Viewmont (BV) and Harrisville (HV) monitors have adhered to the 24-hour standard over the past three years and continue to meet the annual standard, even after the threshold was lowered for 2024. The recently installed and Brigham City #3 (BG) monitor has also met the annual standard.

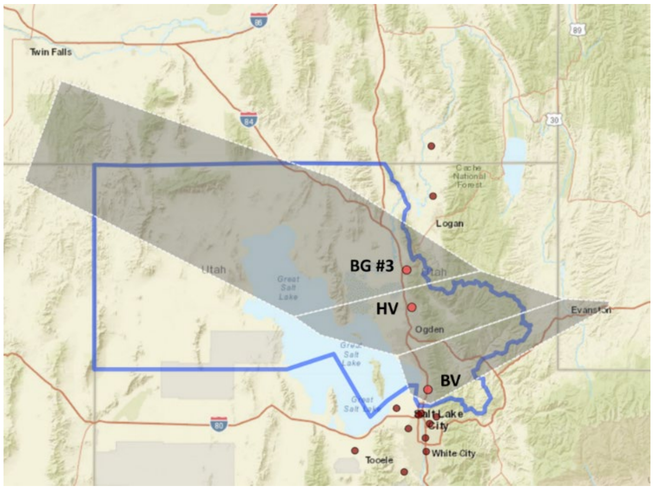


Figure 20. Map showing the spatial distribution of monitoring sites in the Ogden-Clearfield CBSA, and the areas they serve.

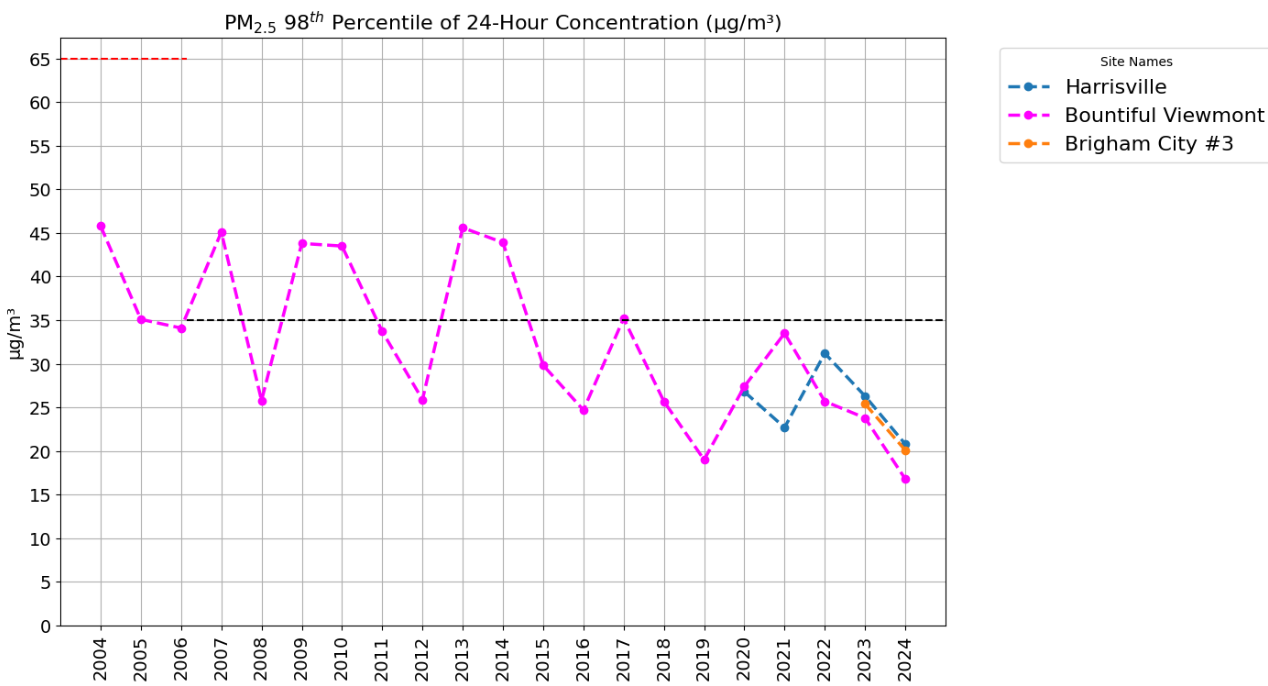


Figure 21. $PM_{2.5}$ 98[th] percentile 24-hr (ug/m3) and comparison to NAAQS (2000-2024) for monitors in the Ogden-Clearfield CBSA.

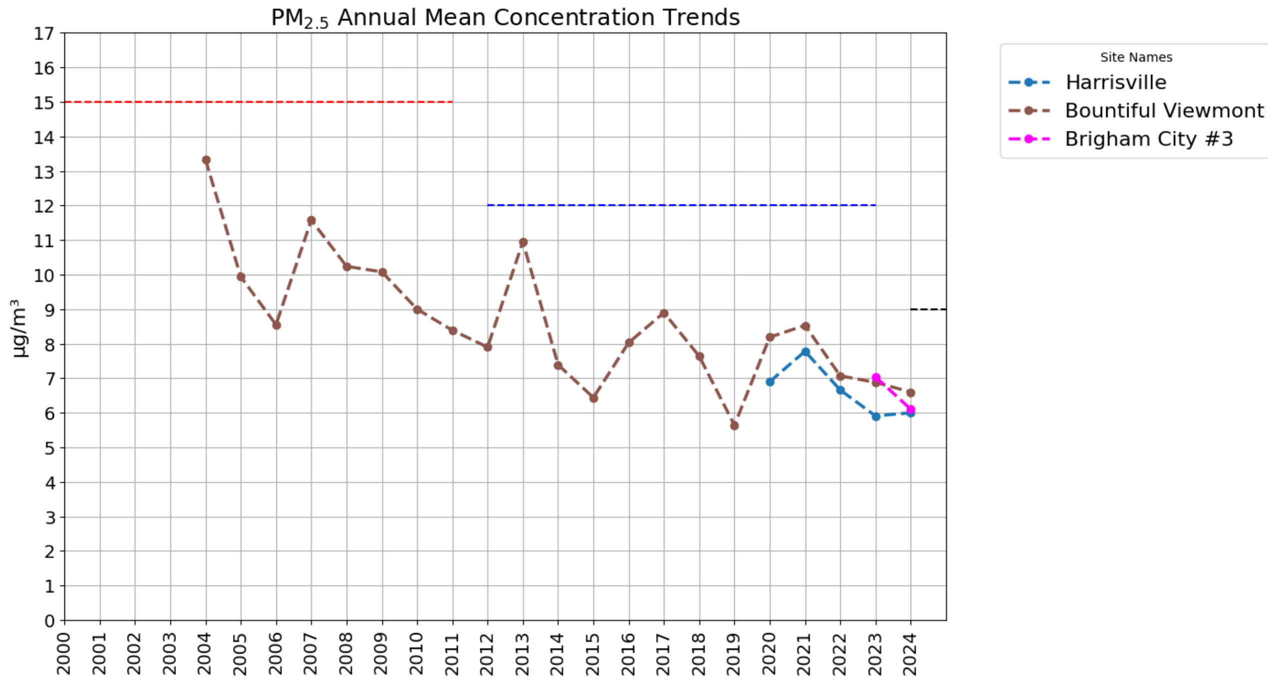


Figure 22. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024) for monitors in the Ogden-Clearfield CBSA.

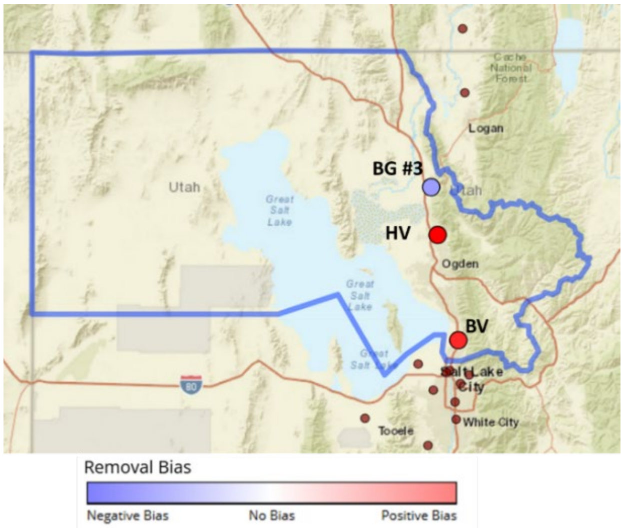
Correlation and Removal Bias

Table 10 presents the Pearson correlation coefficients, average relative concentration differences, and distances between site pairs. The Bountiful Viewmont (BV) and Harrisville (HV) sites showed a strong correlation, with an r^2 value of 0.94 and a small mean relative concentration difference of 1.69 µg/m^3, in contrast, both monitors showed only moderate concentration with the recently installed and Brigham City #3 (BG) monitor.

Table 10. Pearson correlation coefficients and average relative concentration differences between pairs of sites in the Ogden- Clearfield CBSA.

Site 1	Site 2	# Observations	Correlation	Mean Difference (ug/m3)
BV	HV	1062	0.94	1.69
BG	HV	181	0.73	1.82
BG	SM	181	0.71	2.71

Figure 23 displays the removal bias analysis for all sites in the Ogden-Clearfield CBSA. The results suggest that removing any of these monitors would likely introduce no bias in the predicted concentrations. Note that the number of data points used in the bias calculation for BG is smaller compared to those available for the other two sites.



Site	Mean Removal Bias (ug/m^3)
BG	-0.32
BV	0.69
HV	0.82

Figure 23. Removal bias results for the $PM_{2.5}$ monitors in the Ogden-Clearfield CBSA.

Logan CBSA

The Utah DAQ operates one $PM_{2.5}$ monitors within the Logan CBSA in accordance with federal monitoring requirements (see Table 8).

The location of the monitor in the Logan CBSA, along with the corresponding area it serves, is shown in Figure 24. Figure 25 and Figure 26 present trends for 24-hour $PM_{2.5}$ concentrations and annual concentrations, respectively.

The Smithfield (SM) station, established by UDAQ in January 2015 to replace the Logan site, is located in the same county but farther north. Over the past five years, the Smithfield (SM) monitoring site has reported values near or slightly exceeding the 24-hour NAAQS, as shown in Figure 25, but it has consistently met the annual standard (see Figure 26).

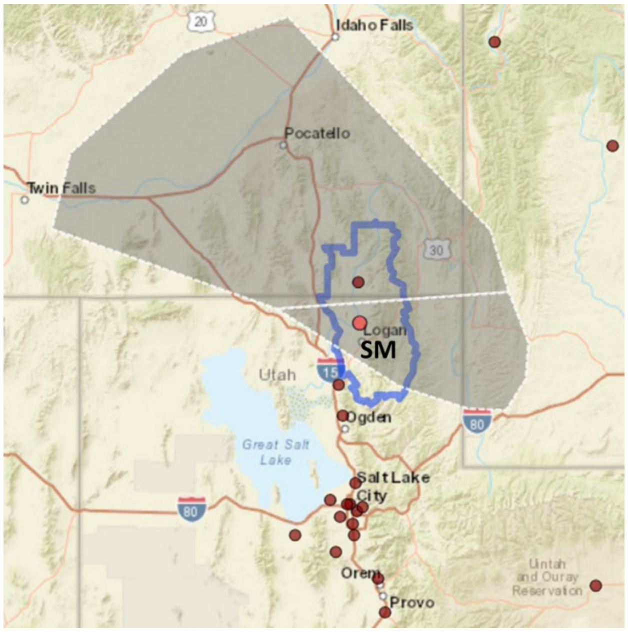


Figure 24. Map showing the spatial location of the monitoring site in the Logan CBSA and the area it serves.

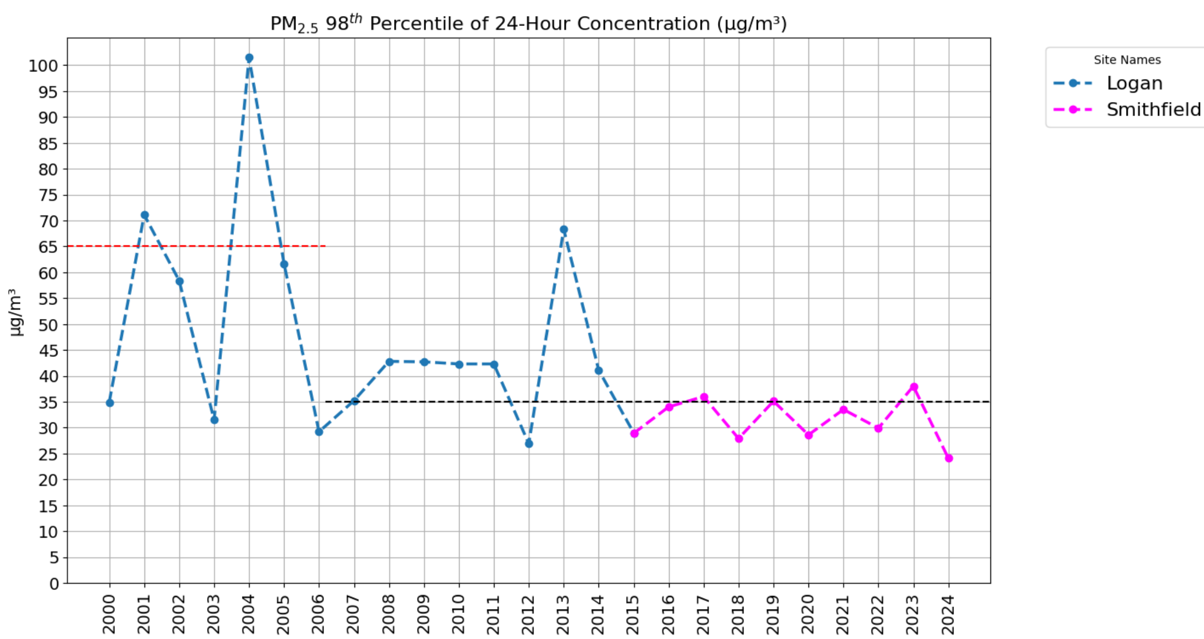


Figure 25. $PM_{2.5}$ 98th percentile 24-hr (ug/m3) and comparison to NAAQS (2000-2024) for the monitor in the Logan CBSA.

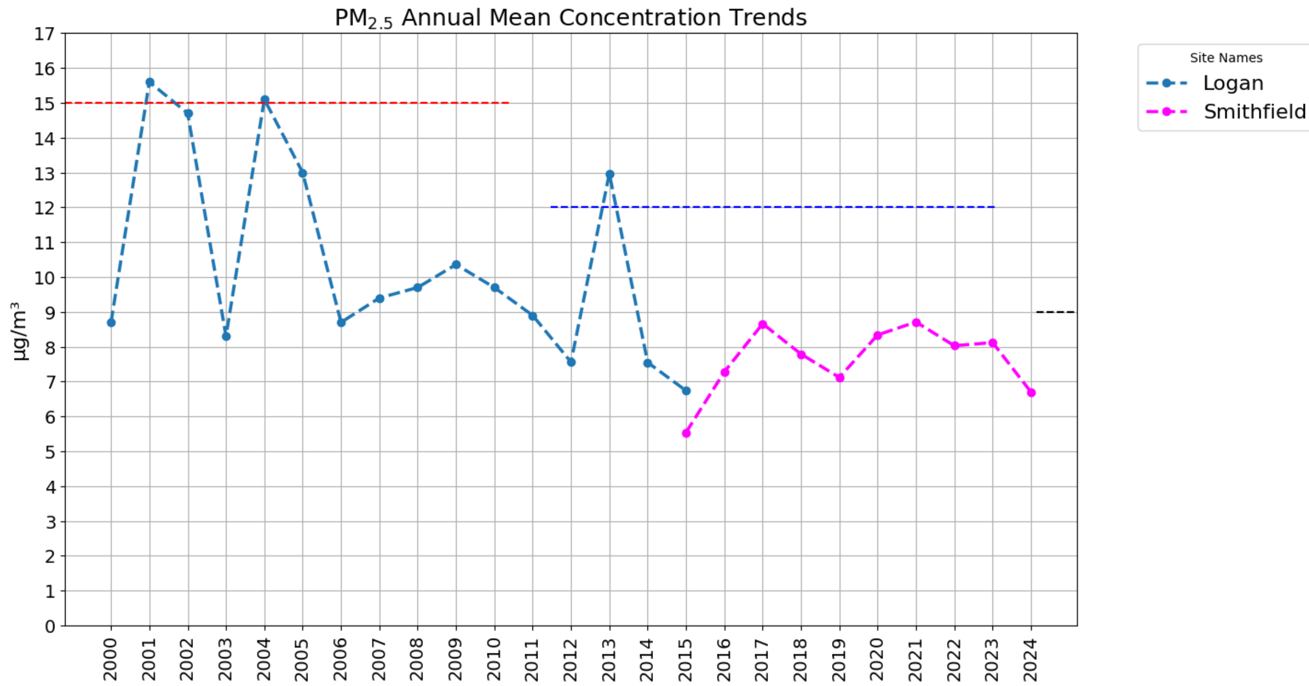


Figure 26. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024) for the monitor in the Logan CBSA

Heber, Saint George, Cedar City, Price, Vernal, and Summit CBSAs

The Utah DAQ operates $PM_{2.5}$ monitors in George and Cedar City CBSAs. The Cedar City monitor was established in 2018 because of the expected increase in population to 57,055 by 2020, which is above the threshold of federal monitoring requirements.

Additionally, $PM_{2.5}$ monitors are in operation at Price and Vernal CBSAs. The measurements reported from these continuous monitors provide hourly data to update the AQI on our local website, as well as on AIRNow (www.airnow.gov).

$PM_{2.5}$ measurements began at Heber CBSA in August 2024. The Utah DAQ, in coordination with the Local Health Department (LHD), local officials, and DAQ modelers, is working to select a suitable location for a $PM_{2.5}$ monitor in Summit CBSA. This station is expected to be fully operational by Q4 of 2025.

Figure 27 and Figure 28 present trends for 24-hour $PM_{2.5}$ concentrations and annual average concentrations, respectively. All sites located in these CBSAs are significantly below the 24-hour NAAQS and the annual standard values.

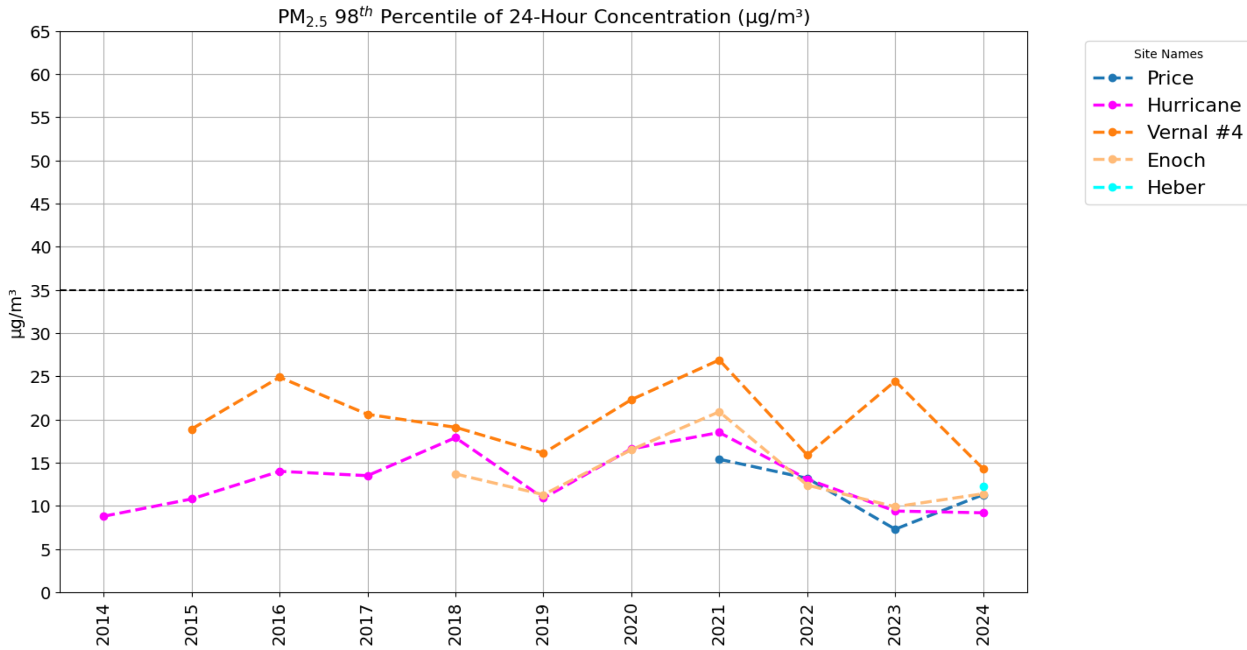


Figure 27. $PM_{2.5}$ 98th percentile 24-hr (ug/m3) and comparison to NAAQS (2000-2024) for the monitors in the Heber, Saint George, Cedar City, Price and Vernal CBSAs.

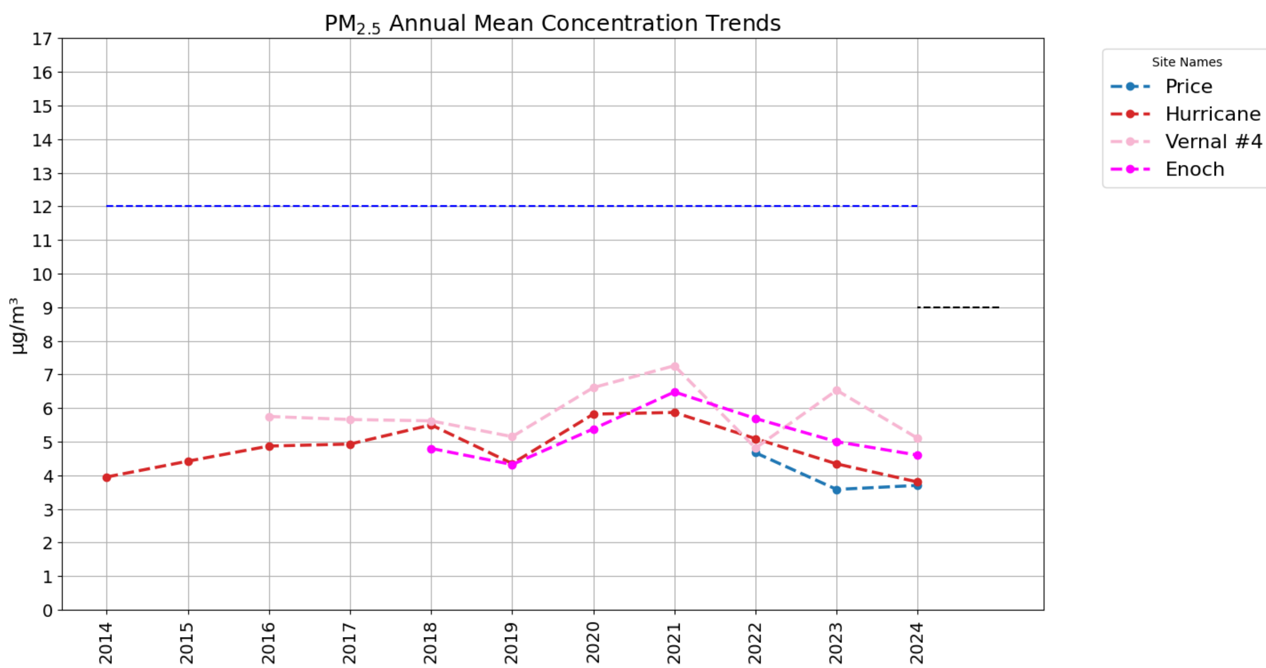


Figure 28. Annual $PM_{2.5}$ design value trends (ug/m^3) and comparison to NAAQS (2000-2024) for the monitors in the Heber, Saint George, Cedar City, Price and Vernal CBSAs.

Summary of Correlation and Removal Bias for all the $PM_{2.5}$ monitors in the Network

Figure 29. presents a combined distance and correlation matrix for 24-hour $PM_{2.5}$ concentrations across monitoring sites. The background shading represents inter-site geographic distances, while the overlaid numerical values indicate the Pearson correlation coefficients for $PM_{2.5}$ concentrations. The analysis shows a clear spatial relationship: monitoring sites in close proximity generally exhibit higher correlation coefficients (often >0.80), reflecting consistent $PM_{2.5}$ patterns likely influenced by shared emission sources. For instance, strong correlations are observed among central Wasatch Front sites such as Bountiful (BV), Copperview (CV), Lake Park (LP), and Hawthorne (HW).

In contrast, sites located at greater distances, such as Hurricane (HC) and Moab (M7) relative to other stations, tend to have lower correlation values (typically <0.40), indicating more site-specific $PM_{2.5}$ behavior, potentially due to distinct topographic, meteorological, or source influences. Despite this overall trend, a few site pairs demonstrate relatively high correlations despite moderate distances. These results support the spatial coherence of $PM_{2.5}$ across urbanized areas while also revealing differences between monitoring sites highlighting the importance of the spatial distribution of the Utah DAQ $PM_{2.5}$ monitors.

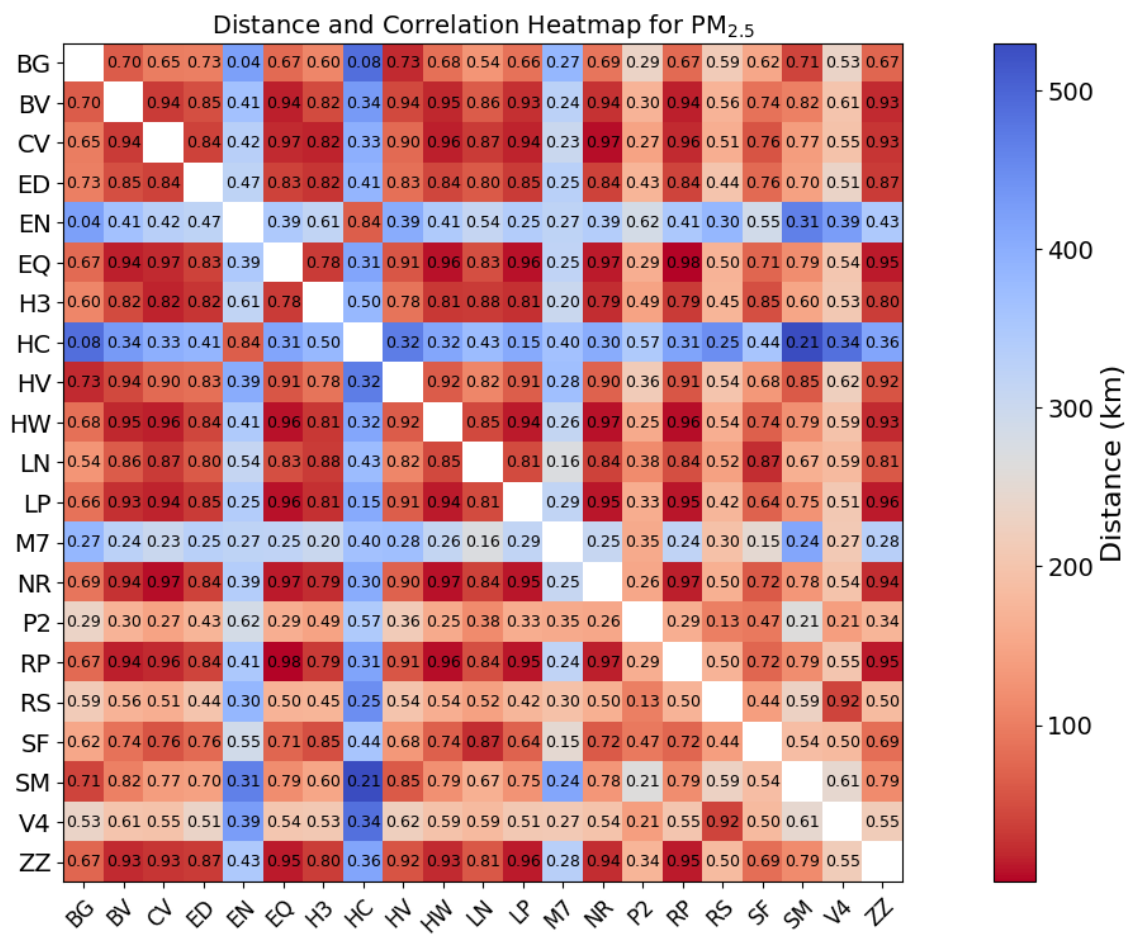


Figure 29. Distance and correlation matrix for $PM_{2.5}$ concentrations among all monitoring sites in the UDAQ network.

The $PM_{2.5}$ removal bias results, shown in Figure 30, across monitoring sites indicate a generally small range of biases, mostly within ±3 µg/m³. The highest positive bias is observed at site Price (P2) (4.19 µg/m³), while the largest negative bias is observed at Moab (M7) (-2.93 µg/m³). This suggests potential overestimation at Price and underestimation at Moab if the removal process is applied. Other sites, such as Smithfield (SM) (-2.36 µg/m³), Near Road (NR) (-1.44 µg/m³), and Roosevelt (RS) (-1.08 µg/m³), also show slightly negative biases. On the other hand, sites like Herriman (H3) (1.28 µg/m³), Vernal (V4) (0.95 µg/m³), and Lake Part (LP) (0.72 µg/m³) display slightly positive biases. Overall, most sites show only minor deviations, suggesting that the removal process of highly correlated $PM_{2.5}$ monitors has a limited impact on $PM_{2.5}$ concentrations, with the exceptions of Price (P2) and Moab (M7).

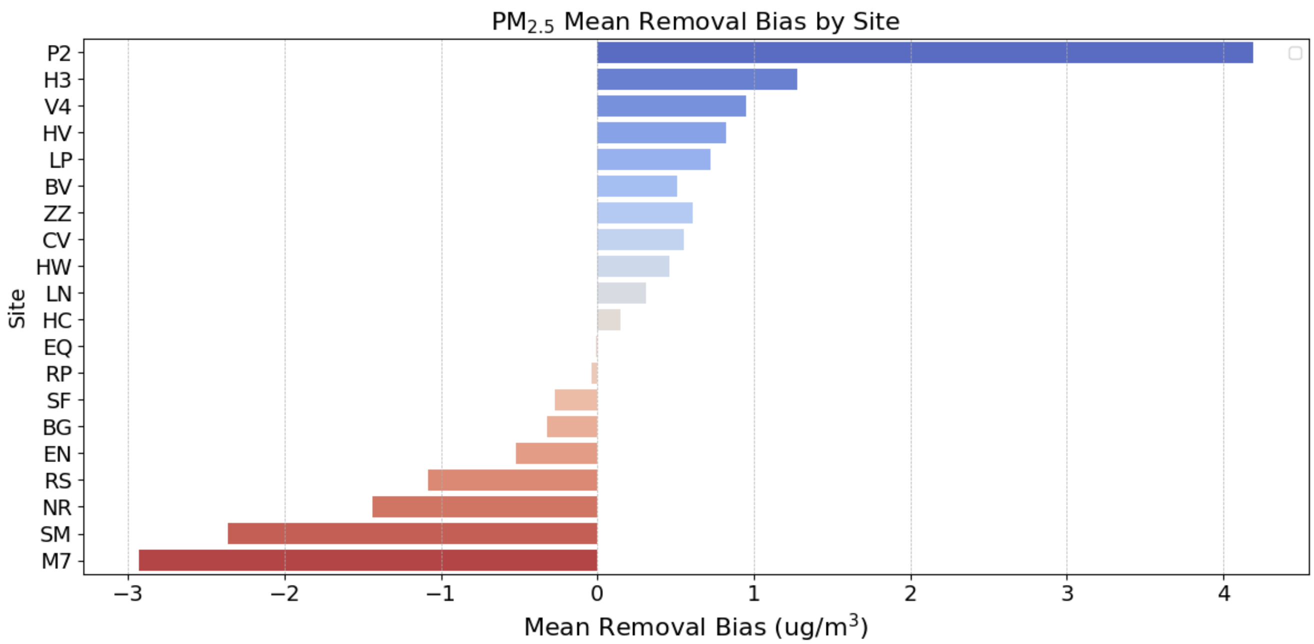


Figure 30. Removal bias results for all PM2.5 monitors in the UDAQ network.

Table 11 presents the score results for each $PM_{2.5}$ monitor, and the final recommendation is summarized in Table 12.

Table 11. Score Results for the PM2.5 monitors in the UDAQ network.

Site	County	Total Number of Parameters Monitored	Area Served (Km^2)	Total Population	Length of continuous monitoring (years)	Percentage of the 98th Percentile of 24-Hour $PM_{2.5}$ NAAQS value (%)	Percentage of the Annual mean $PM_{2.5}$ 2024_NAAQS (%)	Max correlation value	Number of sites with $r^2 > 0.8$ relative to this site	Mean Removal Bias	Traffic counts & proximity to a point source	Site part of a National program or Special Study	Total (%)	Score
BV	Davis	4	3	4	3	2	3	1	1	2	4	4	7.0	**High**
SM	Cache	3	3	2	2	4	3	2	3	4	1	2	6.5	**High**
HW	Salt Lake	4	1	3	4	2	2	1	1	2	3	4	6.1	**High**
NR	Salt Lake	4	2	4	4	2	2	2	1	1	1	2	5.9	**High**
LN	Utah	2	1	3	2	3	4	1	1	3	4	2	5.6	**High**
SF	Utah	2	3	3	4	2	2	2	3	1	2	1	5.6	**High**
EQ	Salt Lake	4	1	1	1	3	4	1	1	1	4	3	5.4	**High**
CV	Salt Lake	3	1	4	2	4	3	1	1	2	2	1	5.4	**High**
H3	Salt Lake	4	3	1	2	2	2	1	3	3	1	1	5.2	Moderate
RS	Duchesne	2	2	4	2	2	2	2	2	3	1	1	5.2	Moderate
P2	Carbon	1	4	1	1	1	1	4	4	4	1	1	5.2	Moderate
EN	Iron	3	1	3	1	3	3	1	1	2	2	1	5.2	Moderate
LP	Salt Lake	1	4	3	2	1	2	3	3	1	1	3	5.0	**High**
HC	Washington	3	4	2	2	2	2	2	1	1	1	1	5.0	Moderate
ED	Tooele	1	4	2	2	1	1	3	3	2	2	2	5.0	**High**
HV	Weber	3	2	4	1	2	2	1	1	2	1	1	4.5	Moderate
RP	Salt Lake	3	1	1	3	3	3	1	1	1	2	1	4.5	Moderate
ZZ	Salt Lake	3	1	1	1	2	2	1	1	2	1	2	3.8	Low
V4	Uintah	2	3	1		1	1	1	3	3	1	1	3.8	Low
BG	Box Elder	2	3	2	1			3	4	1	2	2		New
M7	Grand	1	4	1	1			1	1	4	1	1		New
RB	Salt Lake	3	2	2							1	2		New

Table 12. $PM_{2.5}$ monitoring sites recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	DV 98th Percentile of 24-Hour PM2.5 Concentrations ($\mu g/m^3$). NAAQS 35 (ug/m^3)	DV Annual mean PM2.5 Concentrations (µg/m3). NAAQS (9 ug/m^3)	Value	Recommendation
Bountiful Viewmont (BV)	Davis	SLAMS	Population Neighborhood	Population exposure Air Quality Index	25.6 (73%)	6.9 (76.6 %)	**High** – **Required**- NATTS site - CSN site - EMP site - Supports model performance evaluation and SIP development - Provide insight into historical trends -The site also monitors emissions from nearby oil refineries and local sand and gravel operations - GSL monitoring site	Continue monitoring
Smithfield (SM)	Cache	SLAMS	Population Neighborhood	Population exposure Air Quality Index	30.6 (87%)	7.3 (81 %)	**High** - Close to $PM_{2.5}$ NAAQ - CSN site	Continue monitoring
Hawthorne (HW)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	26.9 (76.9 %)	6.8 (75.5%)	**High** - **Required** -Utah NCore site -PAMS site -Provide insight into historical trends	Continue monitoring
Lindon (LN)	Utah	SLAMS	Population Neighborhood	Population exposure Air Qualty Index	21.9 (62.6 %)	6.3 (70%)	**High** - CSN site - Supports model performance evaluation - Provide insight into historical trends	Continue monitoring

Near Road	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	28.7 (82%)	8.6 (96%)	**High** – **Required**- Close to $PM_{2.5}$ NAAQ. - Part of the Near-Road Monitoring Program - Support the assessment of air quality near major roadways	Continue monitoring
Spanish Fork	Utah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	21.8 (62%)	6.5 (72%)	**High** - Supports AQI reporting/forecasting - Provide insight into historical trends	Continue monitoring
Environmental Quality	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	28.3 (81 %)	7.9 (88%)	**High** - Supports research and testing - EMP site - NADP site - Near interstate freeways and Salt Lake City International Airport	Continue monitoring
CopperView	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	30.5 (87%)	7.2 (80%)	**High** – Established for the purpose of assessing population exposure in southeast Salt Lake County - Supports measurement comparisons in south Valley with those at the NCORE station	Continue monitoring
Roosevelt	Duchesne	SLAMS	Population Neighborhood	Population exposure Air Quality Index	23.6 (65.7%)	6.6 (73%)	**Moderate** – Supports AQI reporting/forecasting - Supports studies in Utah's oil and gas basins - The only monitor that provides $PM_{2.5}$ monitoring for Duchesne county	Continue monitoring
Herriman #3	Salt Lake	SLAMS	Population Neighborhood	Air Quality index	23.1 (66%)	6.1 (68%)	**Moderate** – Supports AQI reporting/forecasting	Continue monitoring

Price	Carbon	SLAMS	Population Neighborhood	Air Quality index	11 (31 %)	4 (44%)	**Moderate** – Supports AQI reporting/forecasting	Continue monitoring
Lake Park	Salt Lake	SLAMS	Population Neighborhood	Air Quality index	28.5 (81%)	7.4 (82 %)	**High** – Established to assess the environmental impact of the Utah Inland Port. Monitors air quality to assess emissions leaving the port area. - EMP site - GSL dust monitoring site	Continue monitoring
Hurricane	Washington	SLAMS	Population Neighborhood	Air Quality index	10.5 (30%)	4.4 (49%)	**Moderate** - Only monitor that provides $PM_{2.5}$ monitoring for Washington county	Continue monitoring
Erda	Tooele	SLAMS	Population Neighborhood	Population exposure Air Quality Index	23.2 (66%)	5.9 (66%)	**High**– It exhibits temporary variations related to the others SLAMS located in Salt Lake	Continue monitoring
Enoch	Iron	SLAMS	Population Neighborhood	Air quality index	11.2 (32%)	5.1 (56.7%)	**Moderate** - Only monitor that provides $PM_{2.5}$ monitoring for Iron county	Continue monitoring
Harrisville	Weber	SLAMS	Population Neighborhood	Population exposure Air Quality Index	22.3 (63.7 %)	6.2 (69%)	**Moderate** - Only monitor that provides $PM_{2.5}$ monitoring for Weber county. - Supports model performance evaluation	Continue monitoring
Rose Park	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	28.9 (83%)	7.6 (84%)	**Moderate** – Close to $PM_{2.5}$ NAAQ - Supports model performance evaluation	Continue monitoring

Prison	Salt Lake	SLAMS	Population Neighborhood	Air Quality index	25.9 (74%)	7.1 (79%)	**Moderate**– Established to assess the environmental impact of the Utah Inland Port. Monitor emissions entering the port area - EMP site - GSL dust monitoring site	Continue monitoring
Vernal #4	Uintah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	17.8 (51%)	5.6 (62 %)	**Low**- The only monitor that provides $PM_{2.5}$ monitoring for Uintah county	Continue monitoring
Brigham City #3	Box Elder	SLAMS	Population Neighborhood	Population exposure Air Quality Index			**New** - Establish with purpose to replace the previous station Brigham City that closed in summer 2019 due to infrastructure issues. The site will help assess population exposure in this area and will help the forecasters in the $PM_{2.5}$ predictions -GSL dust monitoring site	Continue monitoring
Moab	Grand	SLAMS	Population Neighborhood	Air Quality index			**New** - Site established to support air quality forecasting	Continue monitoring
Red Butte	Salt Lake	SPM		Support modeling			**New**-This site is established to support air quality models and research studies	Continue monitoring

PM_{10} network

The Utah DAQ currently operates eight 24-hour FRM PM_{10} and six FEM continuous PM_{10} samplers monitors throughout the state (Figure 31). Among these, the FRM monitors at Hawthorne (HW), Environmental Quality (EQ), and Roosevelt (RS) operate year-round. These, along with the continuous monitors, are eligible for use in demonstrating compliance with the NAAQS.

The Utah DAQ currently operates four FRM PM_{10} monitors in Salt Lake County, as well as one FRM monitor each in Box Elder, Davis, and Duchesne counties. Four of the FRM instruments were recently installed at Brigham City (BG), Lake Park (LP), Prison (ZZ) and Bountiful (BV) as part of the Great Salt Lake (GSL) dust special study. The FRM monitors previously located at Herriman (H3), Harrisville (HV), and Lindon (LN) were removed in early of January 2024 and replaced by FEM PM_{10} instruments, which have been continuously reporting PM_{10} measurements at these sites. Additionally, the Roosevelt site in Duchesne is equipped with two FRM monitors and one FEM monitor.

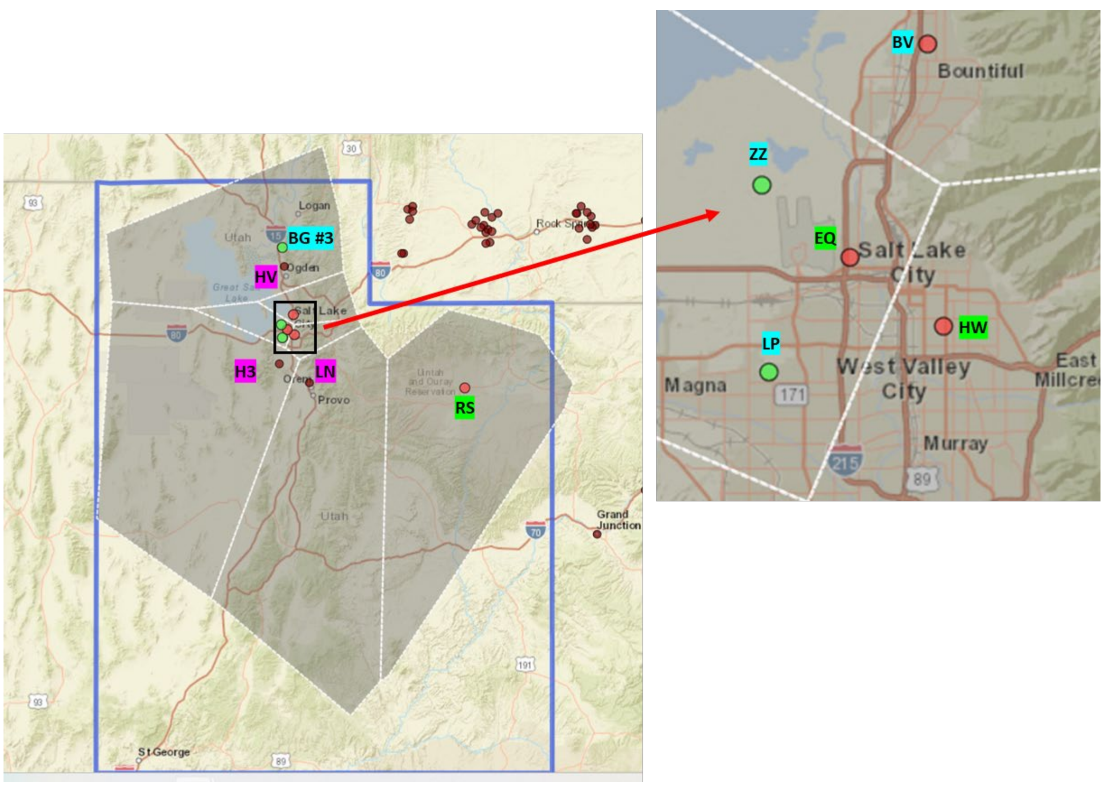


Figure 31. Location of the PM_{10} monitoring sites. Sites highlighted in green represent locations currently operating both filter-based and continuous measurements. Sites highlighted in blue indicate filter-based measurements only, while sites highlighted in pink indicate continuous measurements only.

Area and population served

Table 13 presents the area and population served by each PM_{10} monitor, including sensitive populations such as children and the elderly.

Table 13. Area and population served by PM_{10} samplers in Utah air monitoring network

Site	County	Total Population	Total Male	Total Female	Aged 0 to 4	Aged 65 and over	Area Served (Km^2)
Bountiful Viewmont (BV)	Davis	254,812	127,449	127,363	18,704	30,672	3,678
Environmental Quality (EQ)	Salt Lake	260,040	132,129	127,911	19,062	23,956	898
Harrisville (HV)	Weber	570,352	287,264	283,088	43,128	64,134	19,998
Hawthorne (HW)	Salt Lake	580,966	290,992	289,974	33,277	82,270	1,192
Herriman #3 (H3)	Salt Lake	562,198	282,379	279,819	47,616	44,351	44,292
Lindon (LN)	Utah	689,686	347,475	342,211	54,526	70,125	39,643
Roosevelt (RS)	Duchesne	78,540	39,331	39,209	5,849	11,178	33,558

Historical trends and deviations from NAAQS

In 1987, the EPA established a 24-hour National Ambient Air Quality Standard for PM_{10} at 150 $\mu g/m^3$. Compliance with this standard is determined by ensuring that exceedances occur no more than once per year on average over a three-year period.

Shortly after the standard was established, Salt Lake County and Utah County were designated as nonattainment areas for PM_{10}. Ogden City also received a nonattainment designation due to elevated PM_{10} levels recorded in 1992. However, Ogden was later reclassified as meeting the standard in January 2013. Salt Lake and Utah Counties were officially reclassified as attainment areas for PM_{10} effective March 27, 2020. These areas are now subject to EPA-approved maintenance plans, which require continued compliance with the standard for at least the initial 10-year maintenance period.

Utah is occasionally affected by exceptional events such as dust storms and wildfires, which can result in elevated PM_{10} concentrations. Excluding data influenced by these events, Utah has remained in compliance with the PM_{10} NAAQS. Figure 32 presents the second-highest 24-hour PM_{10} concentration after excluding values impacted by exceptional events; the horizontal dashed line in the figure represents the applicable NAAQS level.

Only one exceedance of the 24-hour PM_{10} standard was recorded during the 2021–2022 period, as shown in Table 14.

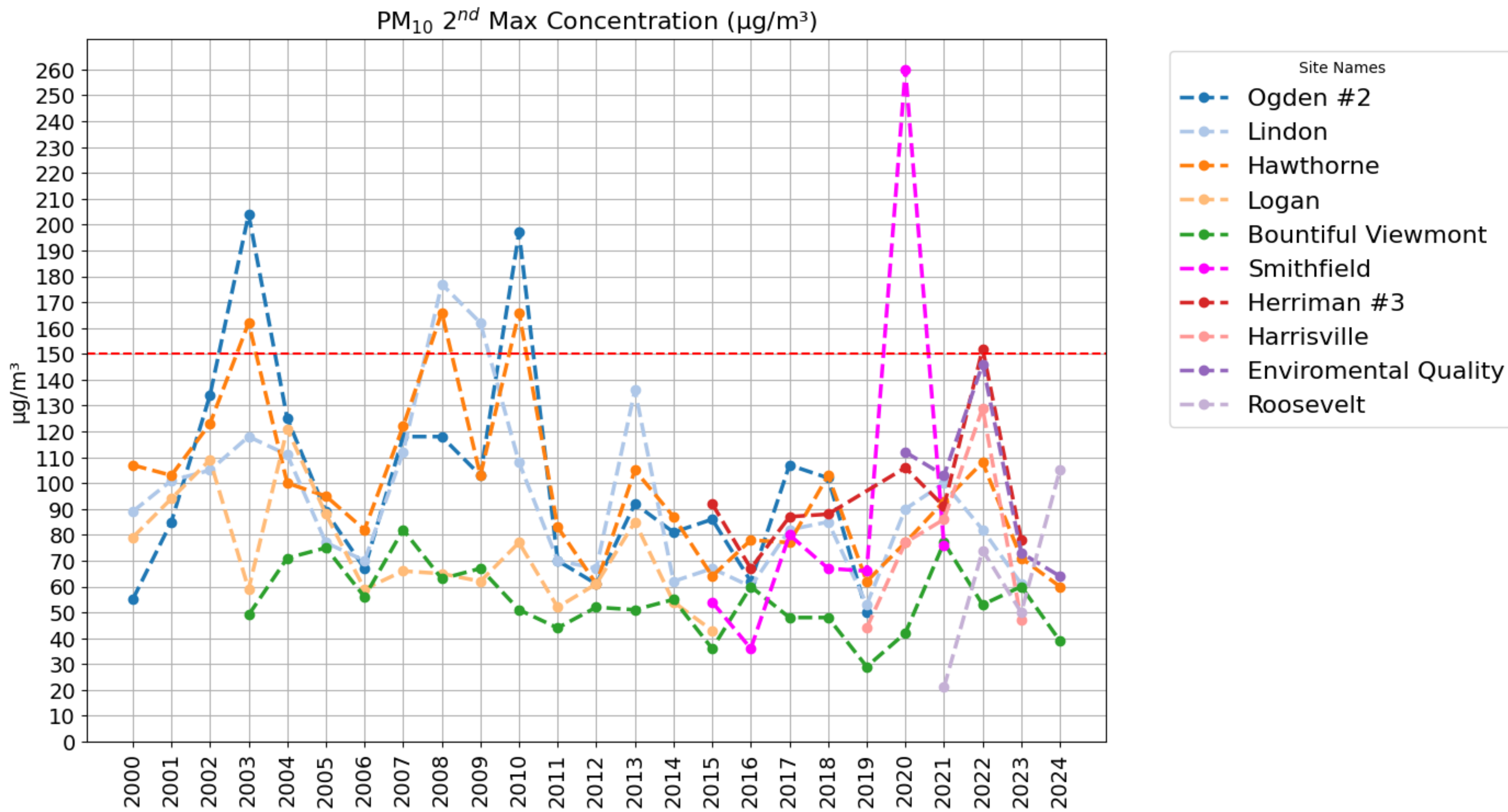


Figure 32. Comparison to the NAAQS and trends in the second-highest 24-hour PM_{10} concentrations for the period 2000–2024.

Table 14. Number of exceedances of the 24-hour PM_{10} NAAQS (2006 standard) for the period 2022–2024.

Site	2022	2023	2024
Bountiful Viewmont (BV)*	0/0	0/0	0/0
Environmental Quality (EQ)	0/0	0/0	0/0
Hawthorne (HW)	0/0	0/0	0/0
Roosevelt	1/1	0/0	0/0

*operates 1 in 6 days

Site-by-site analysis

Federal regulations require state and local agencies to operate PM_{10} monitoring sites at various locations, based on MSA boundaries, population size, and ambient PM_{10} concentrations relative to the PM_{10} NAAQS (40 CFR Part 58, Appendix D). The minimum federal monitoring requirements for PM_{10} sampling and the number of active FRM PM_{10} monitors in each CBSA are presented in Table 15 and Table 16, respectively.

Table 15. Minimum monitoring requirements for PM_{10}.

MSA population	High concentration[1]	Medium concentration[2]	Low concentration[3]
>1,000,000	6-10	4-8	2-4
500,000-1,000,000	4-8	2-4	1-2
250,000-500,000	3-4	1-2	0-1
100,000 -250,000	1-2	0-1	0

[1]High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20 percent or more.
[2]Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80 percent of the PM_{10} NAAQS.
[3]Low concentration areas are those for which ambient PM_{10} data show ambient concentrations less than 80 percent of the PM_{10} NAAQS.

Table 16. Number of active FRM/FEM PM_{10} monitors in each CBSA.

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	Minimum number of required monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	2-4*	**7** (2-FRM, 2-FRM/dust study & 3 - FEM)
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	1-2	**1** (1- FEM)
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	1-2	**3** (2-FRM/dust study & 1-FEM)
Heber µSA	Wasatch, UT	34,788	43,826	47,368	0	
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	0	
Saint George MSA	Washington, UT	180,279	252,964	268,790	0	
Cedar City µSA	Iron, UT	57,289	78,144	80,074	0	
Price µSA	Carbon, UT	20,412	21,275	21,703	0	
Vernal µSA	Uintah, UT	35,620	37,920	38,673	0	
Summit Park µSA	Summit, UT	42,357	46,717	48,376	0	

*Excluding special events. **Note:** Two additional FRM instruments are operating at the Roosevelt station, one on a daily schedule and one every six days. In addition, Roosevelt operates one FEM instrument.

Salt Lake City CBSA

The Utah DAQ currently operates two Federal Reference Method (FRM) PM_{10} monitors daily in the Salt Lake City Core-Based Statistical Area (CBSA), which meets federal monitoring requirements. According to federal regulations (40 CFR Part 58, Appendix D, Table D-5), a CBSA with a population above 1,000,000 and ambient PM_{10} concentrations below 80 percent of the PM_{10} NAAQS must operate a minimum of two active PM_{10} monitors.

In addition to the regulatory network, two FRM monitors were installed, one at the Lake Park (LP) and one at Prison (ZZ) sites in September 2024 as part of the GSL dust monitoring special study. These GSL monitors began collecting data in mid-September 2024, continued through November 30, 2024, and resumed sampling on February 1, 2025. Since dust events in Utah are most likely to occur between February and September, the monitors will initially operate during those months. The Utah DAQ also operates continuous PM_{10} FEM monitors at the Hawthorne (HW), Environmental Quality (EQ), and Herriman (H3) sites. Please note that only the PM_{10} filter-based instruments which operate year-round, along with the continuous monitors, can be used to demonstrate compliance with the NAAQS. The PM_{10}

filter-based monitors associated with the Dust Study operate only from February 1 through September 30.

Provo-Orem_CBSA

The Utah DAQ operates one FEM PM_{10} monitor within the Provo-Orem CBSA, which satisfies minimum federal monitoring requirements (Table 16). This is located at LN monitoring site.

Ogden-Clearfield CBSA

The Utah DAQ operates one FEM PM_{10} monitor within the Ogden-Clearfield CBSA, which satisfies the minimum federal monitoring requirements (Table 16). This monitor is located at the Harrisville (HV) site. Two additional FRM monitors were installed at the Bountiful (BV) and Brigham City (BG) sites as part of the GSL dust project. The monitor at the Bountiful (BV) site began collecting data in mid-September 2024, continued through November 30, 2024, and resumed sampling on February 1, 2025. The monitor at Brigham City (BG #3) began operating in February 2025.
As previously mentioned, these GSL monitors will initially operate from February 1 to September 30.

Additionally, the Roosevelt site in Duchesne is equipped with two FRM monitors and one FEM monitor.

Correlation and Bias

Figure 33 presents a combined distance and correlation matrix for 24-hour PM_{10} concentrations across monitoring sites. Results show that concentrations measured at the Hawthorn (HW) and Environmental Quality (EQ) sites were strongly correlated ($r^2 \geq 0.93$). These sites also showed moderate correlations with Herriman (H3), Harrisville (HV), and Lindon (LN), with r^2 values ranging from 0.74 to 0.85. All sites showed moderate correlations with Bountiful (BV) and lower correlations with Roosevelt (RS). The monitor at Bountiful (BV), not the one recently installed for the GSL dust project, operates every six days rather than daily, which may explain the observed differences. Roosevelt (RS) is located in the Utah Basin and represents a different airshed, contributing to the lower correlation. Overall, r^2 values were inversely related to the distance between monitors, higher for nearby pairs and lower for more distant ones. The mean relative concentration differences between sites ranged from 5.4 to 13 µg/m³, with the smallest difference between Bountiful (BV) and Harrisville (HV) and the largest between Environmental Quality (EQ) and RS Roosevelt (RS).

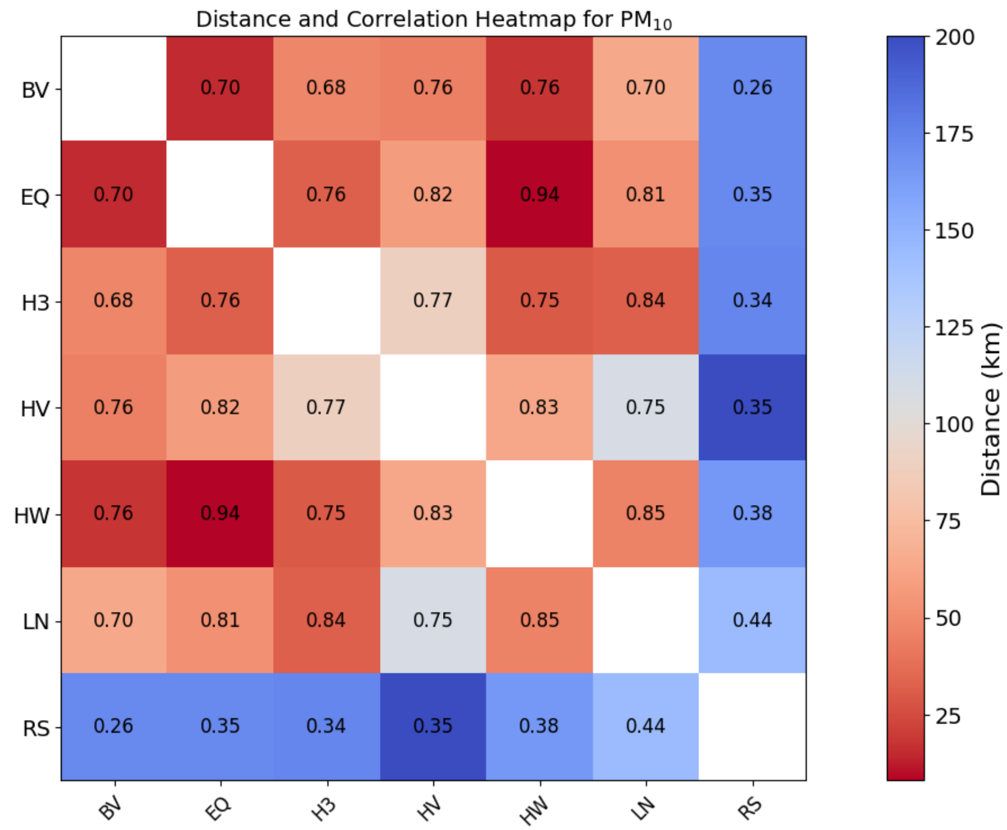


Figure 33. Distance and correlation matrix for PM_{10} concentrations among all monitoring sites in the UDAQ network.

Figure 34 displays the removal bias analysis for all PM_{10} sites in the UDAQ network. The results suggest that removing the monitors at Bountiful (BV), Harrisville (HV), or Hawthorne (HW) would introduce a slight positive bias in the predicted concentrations, with Hawthorne (HW) contributing the most. In contrast, Environmental Quality (EQ) and Roosevelt (RS) show the largest negative biases of -4.94 and -5.4, respectively, indicating that their removal would likely lead to a slightly underestimation of concentrations. The removal of Herriman (H3) or Lindon (LN) appears to have minimal impact on predicted values.

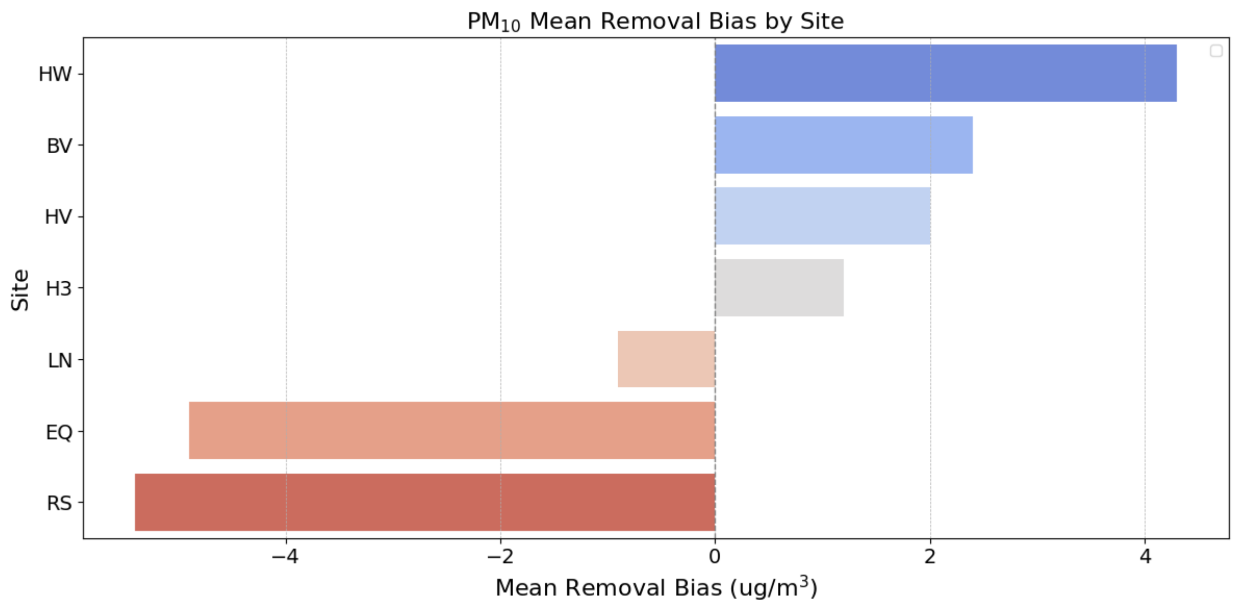


Figure 34. Removal bias results for all PM_{10} monitors in the UDAQ network

The comparison analyses conducted for each PM_{10} monitor are presented in Table 17, while Table 18 summarizes the final recommendations. The scores across all PM_{10} monitors were relatively consistent, ranging from 12% to 19%. Although Bountiful (BV) scored slightly higher, it operated on a 6-day sampling schedule, unlike the other monitors, which sampled daily. Ultimately, all monitors received a "High" rating.

Table 17. Score Results for the PM_{10} monitors in the UDAQ network.

Site	County	Total Number of Parameters Monitored	Area Served (Km^2)	Total Population	Length of continuous monitoring (years)	Design Value	Max correlation value	Number of sites with $r^2 > 0.8$ relative to this site	Mean Removal Bias	Traffic counts & proximity to a point source	Site part of a National program or Special Study	Total (%)	Score
BV	Davis	4	2	2	4	1	3	4	3	4	4	19	High*
RS	Duchesne	3	4	1	1	4	4	4	2	2	2	16	High
HW	Salt Lake	4	1	3	4	2	1	1	3	3	4	15	High
EQ	Salt Lake	3	1	2	2	3	1	1	4	4	2	13	High
LN	Utah	2	4	4	4	1	2	1	2	2	2	13	High
H3	Salt Lake	1	4	3	3	3	2	3	1	1	3	12	High
HV	Weber	2	3	3	2	3	2	2	1	2	1	12	High
BV	Davis												New**
LP	Salt Lake												New
ZZ	Salt Lake												New
BG	Box Elder												New

*The monitor at Bountiful (BV) operates every six days as part of the NATTS Program. ** Monitor recently installed for the GSL dust project.

Table 18. PM_{10} monitoring sites recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	Design Value	Value	Recommendation
Bountiful Viewmont	Davis	SLAMS	Population Neighborhood	Population exposure	79	**High** – **Required**- NATTS site -CSN site - EMP site - Provide insight into historical trends - The site also monitors emissions from nearby oil refineries and local sand and gravel operations - GSL dust monitoring site	Continue monitoring
Roosevelt	Duchesne	SLAMS	Population Neighborhood	Population exposure	248	**High** - Supports studies in Utah's oil and gas basins	Continue monitoring
Hawthorne	Salt Lake	SLAMS	Population Neighborhood	Population exposure	105	**High** – **Required**-Utah NCore site - PAMS site - Provide insight into historical trends - Site supports PM_{10} maintenance demonstration	Continue monitoring
Environmental Quality	Salt Lake	SLAMS	Population Neighborhood	Population exposure	140	**High** – Supports research and testing - EMP site - NADP site - Near interstate freeways and Salt Lake City International Airport	Continue monitoring
Lindon	Utah	SLAMS	Population Neighborhood	Population exposure	93	**High** – CSN site - Provide insight into historical trends - Site supports PM_{10} maintenance demonstration	Continue monitoring

Harrisville	Weber	SLAMS	Population Neighborhood	Population exposure	126	**High** - Only monitor that provides PM_{10} monitoring for Weber county. - Site supports PM_{10} maintenance demonstration	Continue monitoring
Herriman #3	Salt Lake	SLAMS	Population Neighborhood	Population exposure	124	**High** - Site established to assess population exposure in southwest Salt Lake County	Continue monitoring
Bountiful Viewmont	Davis	SLAMS	Population Neighborhood	Population exposure		**New** -GSL dust monitoring site	Continue monitoring
Lake Park	Salt Lake	SLAMS	Population Neighborhood	Population exposure		**New** - Established to assess the environmental impact of the Utah Inland Port. Monitors air quality to assess emissions leaving the port area. - EMP site - GSL dust monitoring site	Continue monitoring
Prison	Salt Lake	SLAMS	Population Neighborhood	Population exposure		**New** - Established to assess the environmental impact of the Utah Inland Port. Monitor emissions entering the port area - EMP site - GSL dust monitoring site	Continue monitoring
Brigham City #3	Box Elder	SLAMS	Population Neighborhood	Population exposure		**New** -GSL dust monitoring site	Continue monitoring

3.2 Gaseous monitoring

Ozone Network

The Utah (UDAQ) currently operates ten ozone monitors in Salt Lake County, two in Utah County, and one monitor each in Davis, Weber, Box Elder, Cache, Wasatch, Uintah, Duchesne, Carbon, Iron, Grand, and Washington counties.

Area and Population Served

Table 19 presents the area and population served by each ozone monitor, including data on sensitive demographic groups.

Table 19. Area and population served by ozone (O_3) monitors in Utah air monitoring network.

Site	County	Total Population	Total Male	Total Female	Aged 0 to 4	Aged 65 and over	Area Served (Km^2)
Erda	Tooele	77,831	39,314	38,517	6,047	7,518	26,713
Enoch	Iron	87,453	43,827	43,626	6,112	13,276	25,518
Price	Carbon	50,837	25,658	25,179	3,158	9,165	21,099
Hurricane	Washington	176,752	87,385	89,367	11,153	38,725	15,514
Smithfield	Cache	153,177	76,462	76,715	11,961	17,286	12,651
Spanish Fork	Utah	241,194	122,032	119,162	20,007	22,001	9,729
Moab	Grand	9,669	4,810	4,859	482	1,799	9,512
Vernal #4	Uintah	26,091	13,002	13,089	2,208	3,080	3,579
Red Butte	Salt Lake	101,328	51,280	50,048	4,981	15,379	2,891
Bountiful Viewmont	Davis	258,123	129,081	129,042	18,954	31,147	2,030
Brigham City #3	Box Elder	57,756	29,312	28,444	4,252	8,058	1,664
Harrisville	Weber	372,081	187,931	184,150	27,548	41,780	1,645
Lindon	Utah	378,939	190,285	188,654	30,219	36,875	1,276
Herriman #3	Salt Lake	252,451	126,322	126,129	25,813	12,836	1,234
Inland Port	Salt Lake	11,411	5,752	5,659	1,074	895	348
Copper View	Salt Lake	354,416	177,434	176,982	22,481	46,507	313
Lake Park	Salt Lake	230,785	116,312	114,473	17,146	20,221	305
Near Road	Salt Lake	179,452	89,220	90,232	11,439	25,338	93
Roosevelt	Duchesne	8,507	4,258	4,249	755	783	71
Hawthorne	Salt Lake	140,436	71,074	69,362	7,193	17,064	64
Environmental Quality	Salt Lake	25,402	13,096	12,306	1,766	1,866	48
Rose Park	Salt Lake	47,328	24,616	22,712	2,940	4,456	42

Exceedance Probability

Figure 35 presents a surface probability map showing the likelihood that ozone levels will exceed 70 ppb on at least one day per year. Thirteen of the twenty-two monitors are located in areas with a maximum exceedance probability of approximately 100%. Site-specific probabilities are shown in Figure 36. All monitors in Salt Lake, Davis, and Weber counties exhibit exceedance probabilities near 100%. The monitor at Lindon (LN) site also shows a similar high probability, while Spanish Fork (SF) has a slightly lower probability of about 88%. Moderate probabilities were observed at Erda (ED), Brigham City (BG), Price (P2), and Vernal (V4), whereas Hurricane (HC), Enoch (EN), and Moab (M7) show probabilities below 20%. Note that probability estimates for the newest monitors are based on fewer data points, and the Heber site was not included in the analysis)

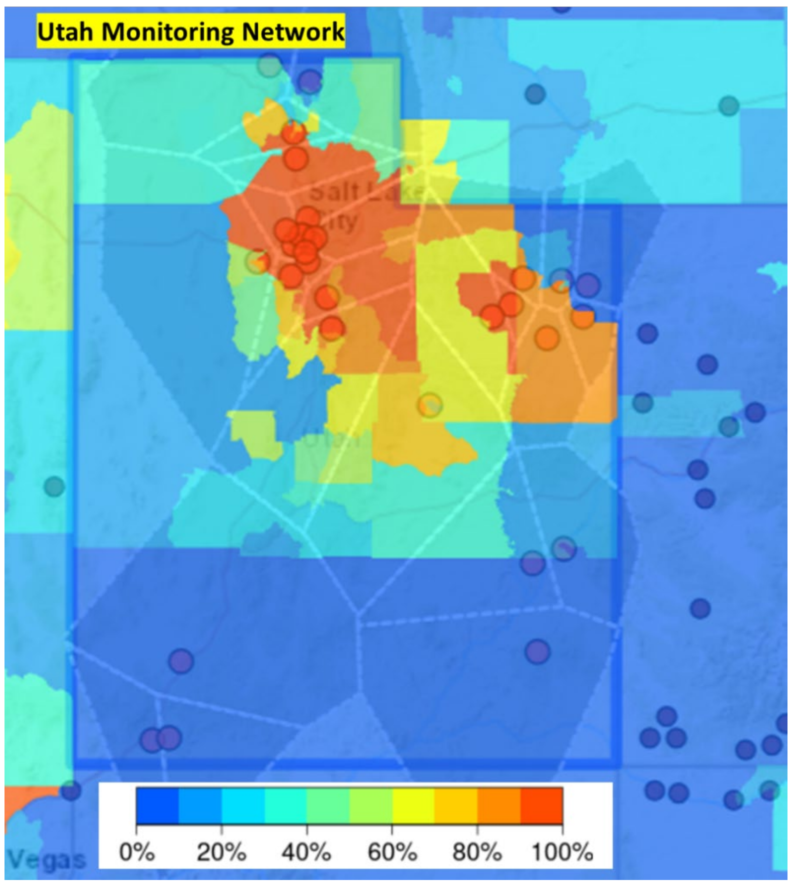


Figure 35. Area served and surface probability map for ozone[15]

[15] https://rconnect-public.epa.gov/NetAssess2025/

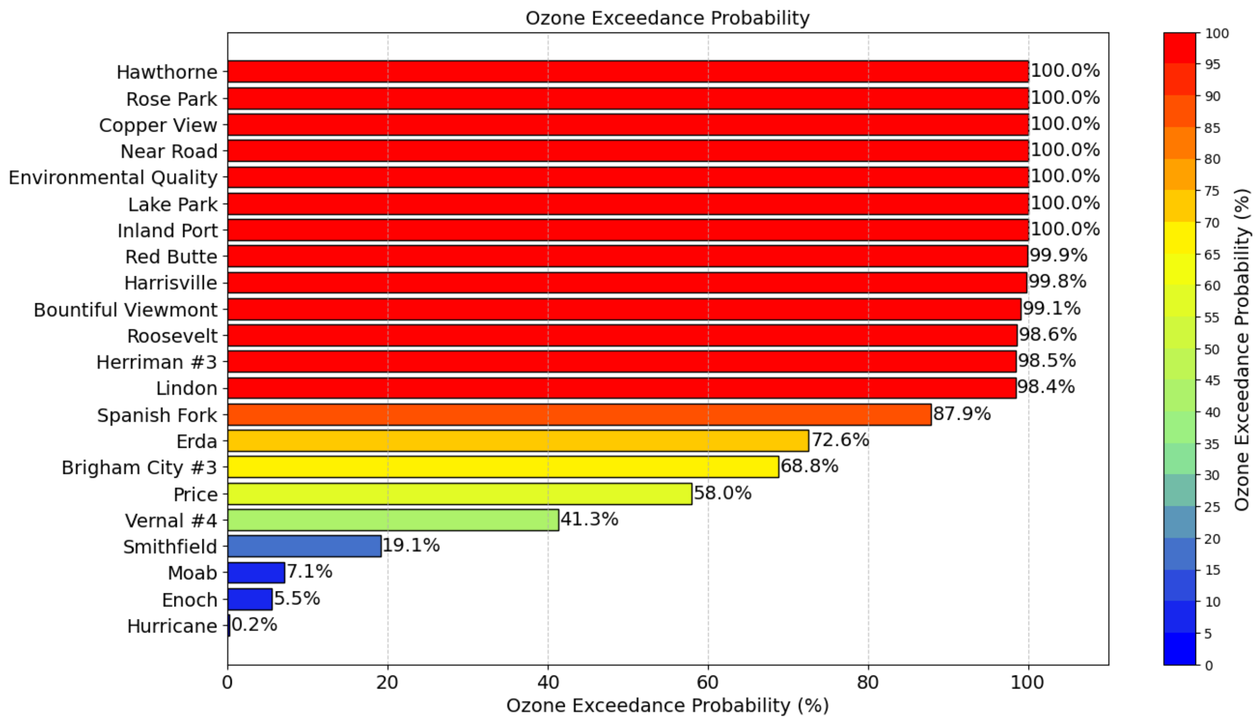


Figure 36. Ozone Exceedance Probability by site.

Historical trends and deviations from NAAQS

Ozone (O_3) is formed through photochemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Its production occurs year-round, with the highest levels generally observed during summer when solar radiation and temperatures are strongest. However, Utah can also experience elevated ozone levels during wintertime inversions in the Uinta Basin.

During winter, high-pressure systems and a high solar zenith angle can lead to the formation of cold-air pools that trap ozone precursor gases, most notably VOCs and NO_x, in the valleys between the Wasatch and Oquirrh Mountains. These precursors then react in the stagnant air to form ozone. Snow cover further enhances ozone formation by increasing surface albedo, which reflects more sunlight into the atmosphere.

The current 8-hour NAAQS for ozone is 70 parts per billion (ppb) or 0.070 (ppm). Compliance is determined using the three-year average of the annual 4th highest daily maximum 8-hour ozone concentrations.

Figure 37 and Figure 38 present the annual 4th-highest 8-hour ozone concentrations across monitoring sites statewide, along with historical design values. In these figures, the horizontal dashed lines represent the applicable NAAQS thresholds, with the blue horizontal dashed line representing the current standard of 0.070 ppm.

In 2024, monitors along the Wasatch Front recorded exceedances of the standard on more than four days at 14 of the 15 monitoring sites. However, the three-year design value (DV) for 2022–2024 showed slight improvement due to relatively favorable conditions in 2022 and 2023.

The Uinta Basin did not experience the typical winter conditions, prolonged temperature inversions combined with persistent snow cover, that are often associated with elevated ozone levels. As a result, no wintertime violations of the ozone standard occurred. While all monitors in the Basin recorded exceedances of the standard during July and August, none reported a 4th highest value exceeding 0.070 ppm; and therefore, the standard was not violated. These summertime exceedances were likely influenced by nearby wildfires.

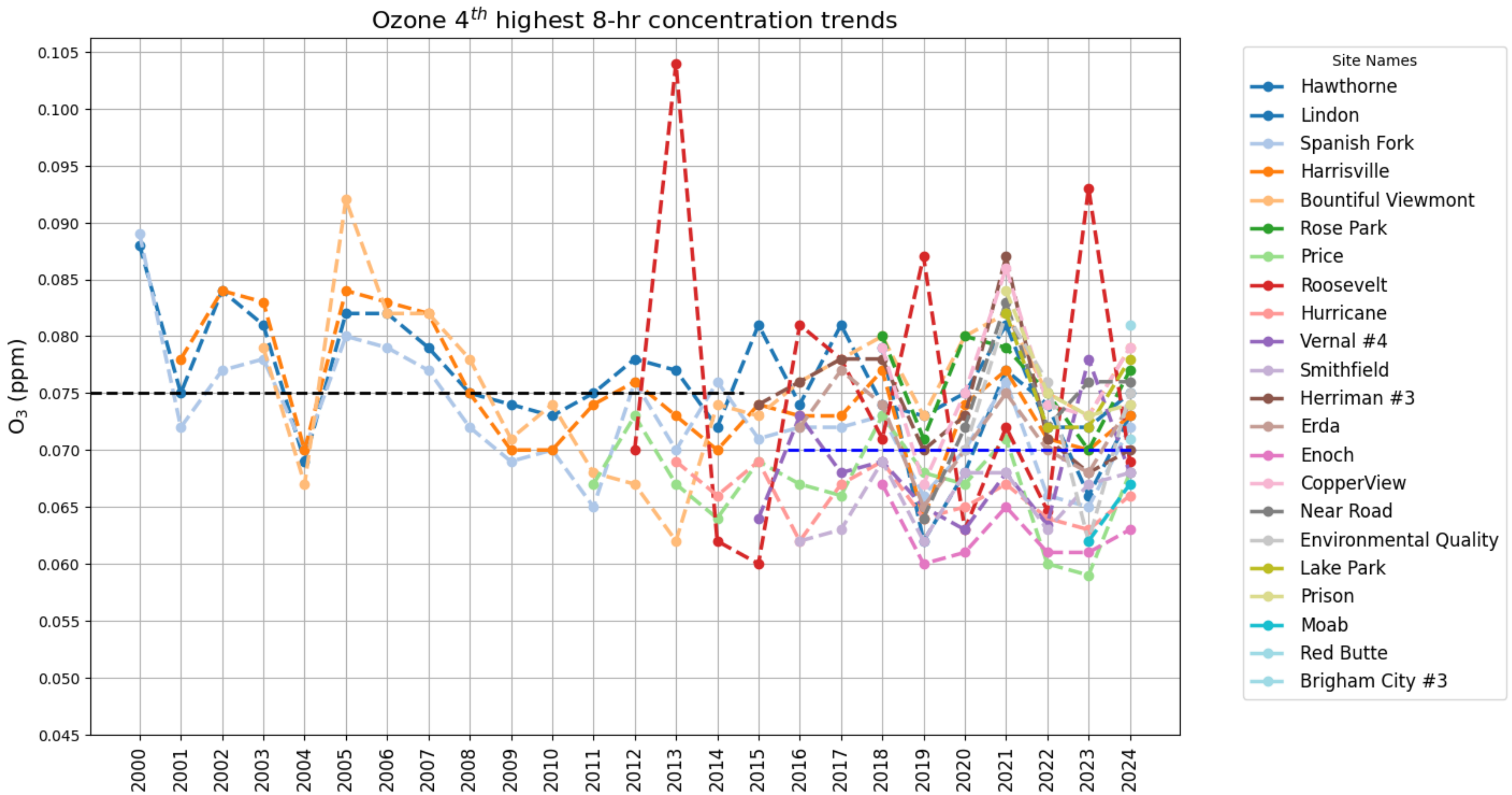


Figure 37. Trends in annual fourth-highest eight-hour ozone concentration and comparison to NAAQS.

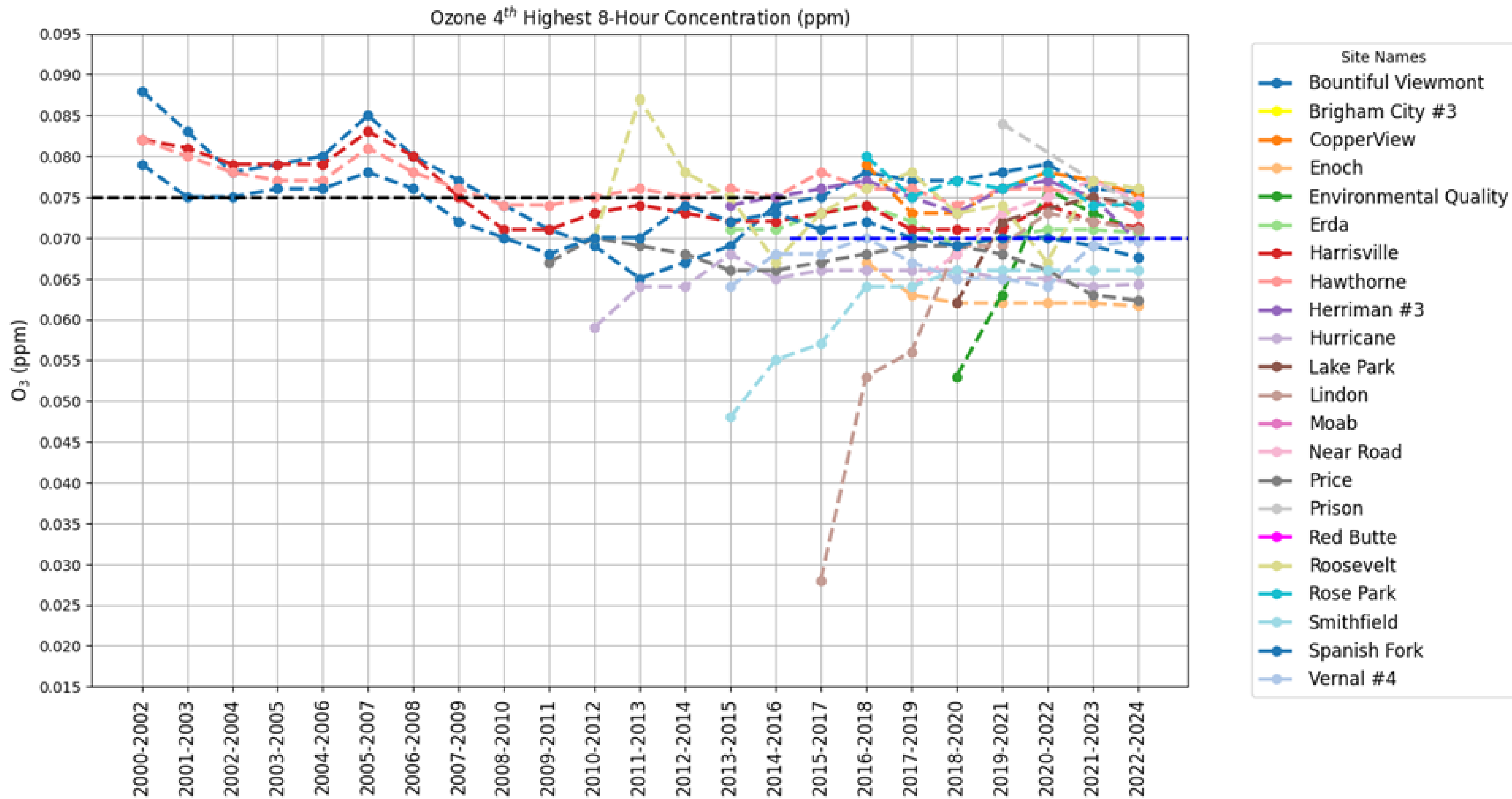


Figure 38. 8-hr design value trends and comparison to NAAQS for ozone during the period 2000-2024

Site-by-site analysis

Federal regulations require state and local agencies to operate ozone monitoring sites based on MSA boundaries, population size, and the most recent three-year design value as a percentage of the ozone NAAQS (40 CFR Part 58, Appendix D). Minimum federal monitoring requirements for ozone along with the number of active monitors in each CBSA, are shown in Table 20 and Table 21, respectively.

For Salt Lake City, Provo-Orem and Ogden-Clearfield CBSAs, the requirements based on population and design value call for a maximum of two monitors per CBSA. For Logan, St. George and Cedar City, only one monitor is required per CBSA. In the Heber, Vernal, Price, and Summit Park CBSAs, where the population is less than 50,000, no monitor is required. However, the Utah DAQ has implemented additional monitors to better characterize spatial patterns, support air quality modeling, forecasting, and aid in the development of control strategies.

Table 20. Minimum monitoring requirements for ozone.

MSA population	Most recent 3-year design value ≥ 85% of any Ozone NAAQS	Most recent 3-year design value <85% of any Ozone NAAQS
>10,000,000	4	2
4,000,000-10,000,000	3	1
350,000-<4,000,000	2	1
50,000-<350,000	1	0

Table 21. Number of active ozone monitors in each CBSA.

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	Minimum number of required monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	2	10
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	2	2
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	2	3
Heber µSA	Wasatch, UT	34,788	43,826	47,368	0	1
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	1	1
Saint George MSA	Washington, UT	180,279	252,964	268,790	1	1
Cedar City µSA	Iron, UT	57,289	78,144	80,074	1	1
Price µSA	Carbon, UT	20,412	21,275	21,703	0	1
Vernal µSA	Uintah, UT	35,620	37,920	38,673	0	1
Summit Park µSA	Summit, UT	42,357	46,717	48,376	0	0

Salt Lake City CBSA

According to federal regulations (40 CFR Part 58, Table D-2), a CBSA with a population between 350,000 and 4,000,000 and a most recent 3-year design value greater than 85% of the ozone NAAQS must have a minimum of two active ozone monitors. Furthermore, at least one ozone site in each MSA or CBSA must be designed to record the maximum concentration for that area.

The Utah DAQ currently operates 10 ozone monitors in the Salt Lake City CBSA. Four of these monitors were established or had instruments installed within the last seven years, including two, Lake Park (LP) and Prison (ZZ), added in the past four years to assess the environmental impact of the Utah Inland Port. An additional monitor at Red Butte (RB) was installed in 2023 as a Special Purpose Monitor (SPM).

Figure 39. displays a map showing the spatial distribution of the ozone monitors in the Salt Lake City CBSA and the areas they serve, while Figure 40 presents trends in the highest 8-hour maximum concentrations. All monitors, except for Herriman (H3), exceeded the standard in 2024 by 4 to 11 ppb. Red Butte (RB) recorded the 4th highest 8-hour concentration, at 81 ppb. This site is located near Red Butte Garden, the largest botanical garden in the Intermountain West, and is strongly influenced by biogenic emissions.

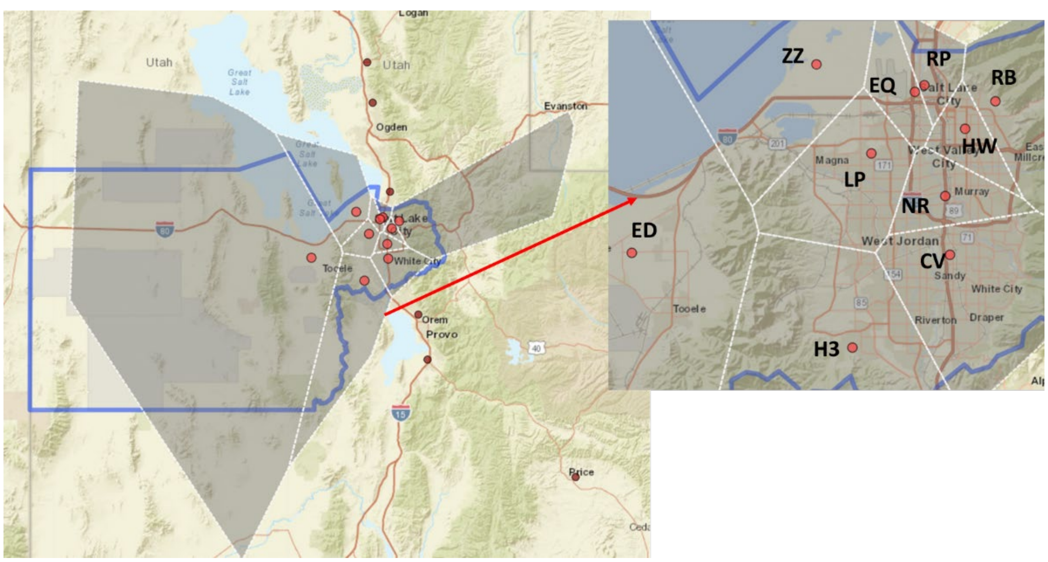


Figure 39. Map showing the spatial distribution of the Ozone (O_3) monitoring sites in the Salt Lake City CBSA and the areas they serve.

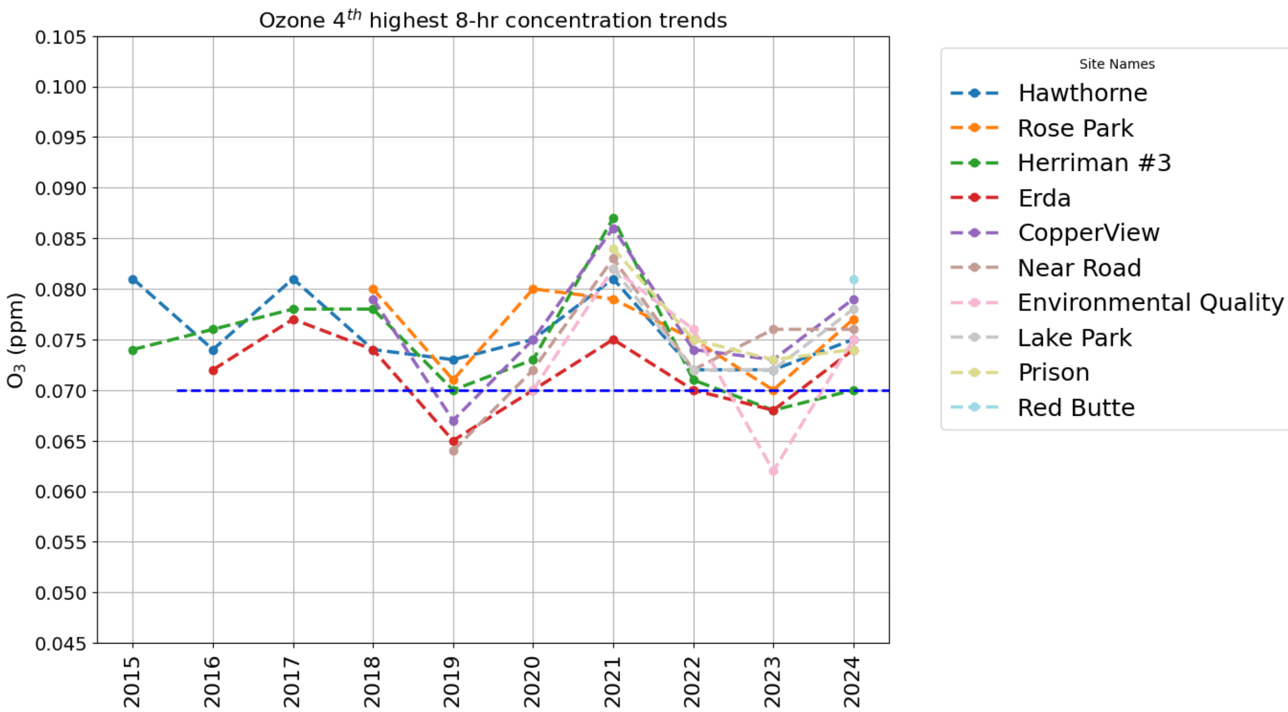


Figure 40. Fourth-highest 8-hour ozone concentration trends for the monitoring sites in the Salt Lake City CBSA.

Correlation and Bias

Figure 41 presents a correlation matrix of Pearson correlation coefficients between ozone monitoring sites in the Salt Lake City CBSA, with color intensity indicating the distance between sites. Concentrations measured at all sites within the CBSA were strongly correlated. About one-third of the site pairs showed very strong correlations ($r^2 \geq 0.95$), while most of the remaining pairs still exhibited strong correlations (r^2 between 0.90 and 0.95). The lowest correlation was observed between sites ED and EQ ($r^2 = 0.88$), which is still considered a moderate correlation.

The mean difference (ppb) in pollutant concentrations between site pairs, excluding ED and H3 both of which were associated with the highest mean differences and longest distances, ranges from 2.4 to 4.7 ppb, with an average of approximately 3.5 ppb. Most site pairs fall within the 3 to 4 ppb range and for site pairs with high correlation coefficients (≥0.97) generally exhibit lower mean differences (2.4–2.9 ppb), reflecting strong agreement in measurements.

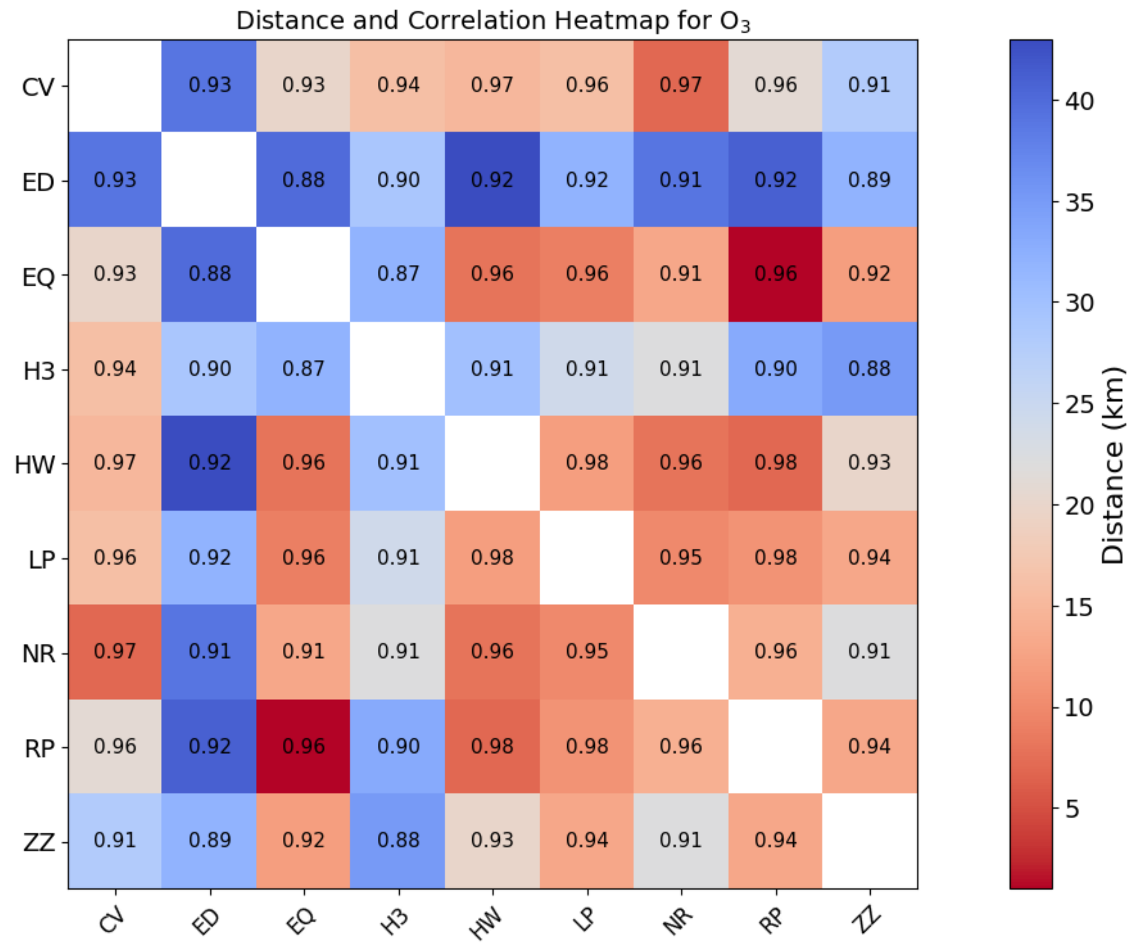


Figure 41. Correlation matrix of pairwise correlation coefficients between Ozone (O_3) monitoring sites in the Salt Lake City CBSA, with color intensity indicating the strength of correlation as a function of inter-site.

Provo-Orem CBSA

The Utah Department of Air Quality (UDAQ) currently operates two ozone monitors within the Provo CBSA, which meets the minimum federal monitoring requirements for CBSAs with populations between 350,000 and 4,000,000. These monitors are located at Lindon (LN) and Spanish Fork (SF) monitoring sites. The Lindon station began monitoring ozone in 2018 following its merger with the North Provo station.

The Pearson correlation coefficient (r^2) between the two sites is shown in Table 22. Correlation analysis indicates a strong relationship between the concentrations measured at the two sites ($r^2 = 0.96$), with a relative difference of approximately 2.8 ppb. The 2022–2024 three-year design values were 67 ppb for Spanish Fork (SF) and 71 ppb for Lindon (LN), both close to the standard. Based on the minimum federal monitoring requirements, the Utah DAQ will continue monitoring ozone at these sites.

Table 22. Pearson correlation coefficients and average relative concentration differences between both ozone sites in the Provo-Orem CBSA.

Site 1	Site 2	# Observations	Correlation	Mean Difference (ppb)
LN	SF	1069	0.9614	2.8

Ogden-Clearfield CBSA

The Utah DAQ currently operates three ozone monitors within the Ogden-Clearfield CBSA, meeting the minimum federal monitoring requirements for CBSAs with populations between 350,000 and 4,000,000. These monitors are located at the Bountiful (BV), Harrisville (HV), and the newly installed Brigham City (BG) sites.

Correlation analysis, shown in Table 24, indicates that ozone concentrations measured at Bountiful (BV) and Harrisville (HV) are strongly correlated ($R \geq 0.95$). UDAQ will continue measuring ozone at both locations within the CBSA.

The Bountiful monitor is located in a well-urbanized, densely populated area and is essential for capturing ozone concentrations at the neighborhood scale. Additionally, the site collects NOx and VOC data, providing a more comprehensive understanding of ozone formation. Harrisville monitor is crucial for tracking elevated ozone levels in the northern part of the CBSA.
To address the gap left by the removal of the original Brigham City (BR) monitor in 2019, UDAQ installed a new site (BG) in Brigham City in 2023, which began reporting ozone data in January 2024.

Table 23. Pearson correlation coefficients and average relative concentration differences between the two ozone monitoring sites in the Ogden-Clearfield CBSA. Note that the recently installed Brigham City station was not included in this analysis.

Site 1	Site 2	# Observations	Correlation	Mean Difference (ppb)
BV	HV	1063	0.9506	3.7

Roosevelt site, Price and Vernal CBSAs

The Utah DAQ operates one ozone monitor at each of these CBSAs, which exceeds the minimum federal monitoring requirements (Table 21). The monitors at Roosevelt (RS) and Vernal (V4) were installed to investigate unusually high wintertime ozone levels in the Uinta Basin. Therefore, UDAQ does not recommend making any changes to these ozone monitoring sites.

Logan, St. George and Cedar City CBSAs

The Utah DAQ operates one ozone monitor in each of these CBSAs, meeting or exceeding the minimum federal monitoring requirements (Table 21). These monitors were installed to represent population exposure in their respective counties. UDAQ does not recommend any changes to the ozone monitoring network within these CBSAs.

Summary of Correlation and Removal Bias for all the Ozone (O_3) monitors in the Network

Figure 42. presents a combined distance and correlation matrix for 8-hour ozone concentrations across monitoring sites. The background shading represents inter-site geographic distances, while the overlaid numerical values indicate the Pearson correlation coefficients for ozone concentrations.
The correlation and mean difference analysis among ozone monitoring sites reveals a generally strong agreement in measurements across most site pairs. The majority of site pairs, especially those within shorter distances (under approx. 50 km), show very high correlations (above 0.90), indicating consistent ozone readings. The strongest correlations, up to 0.979, are observed between nearby sites such as Hawthorne (HW), Rose Park (RP), and Lake Park (LP). Even at greater distances, correlations often remain above 0.80, though they gradually decline, with the lowest correlations around 0.62–0.65 observed between the most distant sites Overall, the results suggest good regional consistency in ozone monitoring data, with distance playing a notable role in reducing correlation strength.

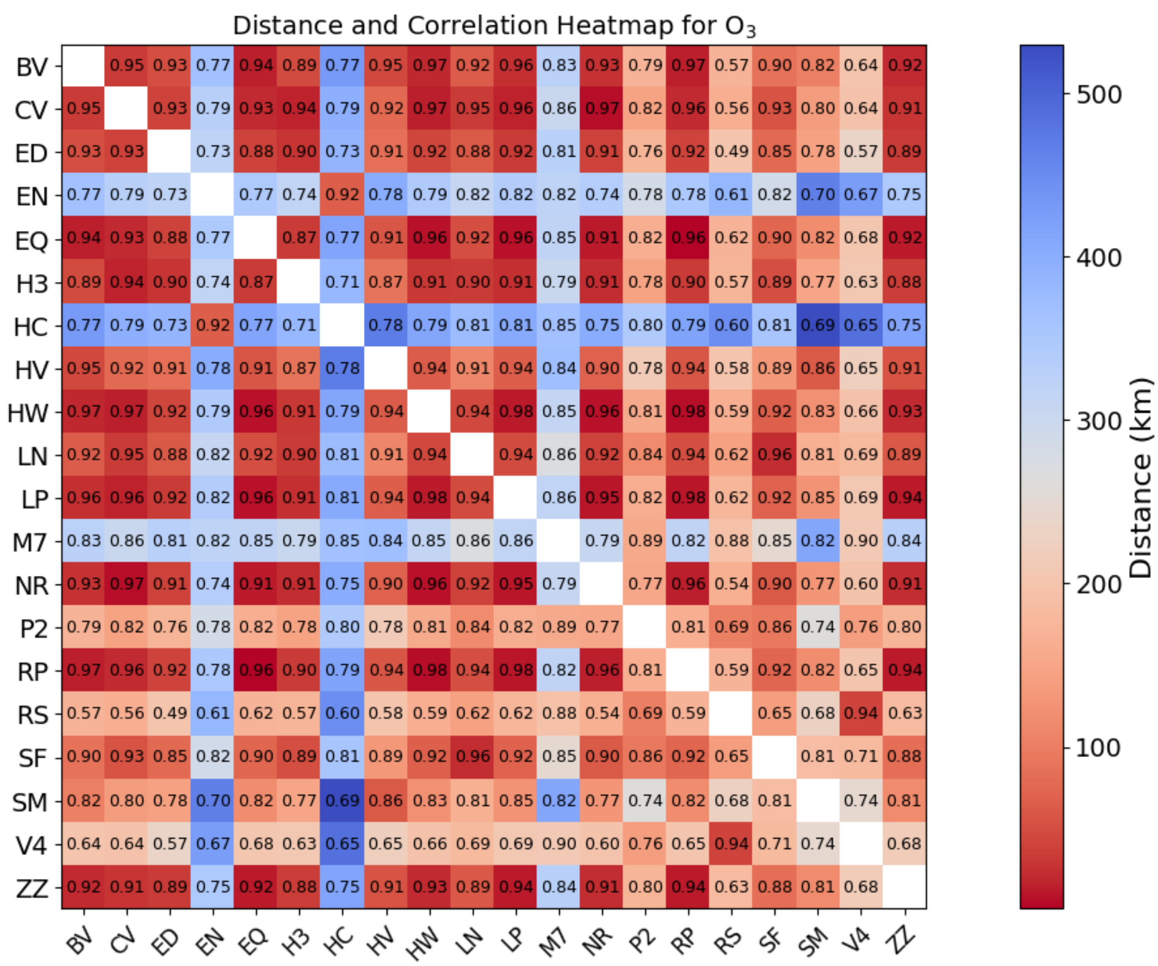


Figure 42. Distance and correlation matrix for 8-hour ozone concentrations among all monitoring sites in the UDAQ network.

The removal bias analysis excludes Heber, Red Butte, and Brigham City due to the limited number of data points available at those sites.

An analysis of the O_3 Mean Removal Bias across 20 monitoring sites (Figure 43) shows a relatively balanced distribution: 11 sites exhibit a positive bias, while 9 sites show a negative bias. The average bias is approximately +0.275 ppb, indicating that removing any single site would have minimal impact on the overall ozone concentrations.

However, three sites, Enoch (EN) (+3.2 ppb), Near Road (NR) (+2.8 ppb), and Erda (ED) (+2.2 ppb), display moderately higher positive biases, meaning their removal would likely result in a slight overestimation of ozone concentrations. Conversely, Smithfield (SM) shows the most negative bias at (-2.0 ppb), suggesting that its removal would lead to a slight underestimation. Most sites have biases within ±1.5 ppb.

These results support the idea that clustered sites, due to their redundancy, tend to have low individual biases and may be considered for potential removal. In contrast, sites with higher individual biases are more critical for accurately interpolating concentrations across the domain.

Despite some redundancy, the monitoring network in the Salt Lake City CBSA plays a vital role in ensuring data quality. Redundant measurements help detect instrument drift, expand spatial coverage to capture localized pollution events such as wildfires or transport episodes, enhance forecasting capabilities, and improve the reliability of spatial interpolations and predictive models.

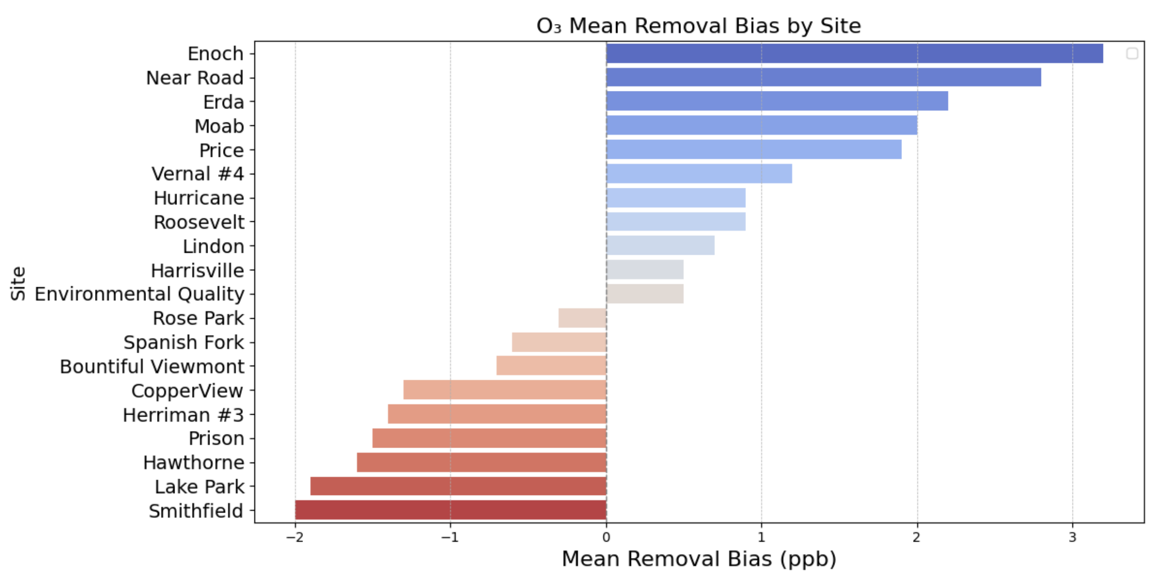


Figure 43. Removal bias results for all ozone monitors in the UDAQ network.

The score results for each ozone (O_3) monitor are presented in Table 24, while the final recommendation is summarized in Table 25 . Ultimately, all monitors received a “High” rating because their design values exceeded 85% of the NAAQS.

Table 24. Score Results for the ozone (O_3) monitors in the UDAQ network.

Site	County	Total Number of Parameters Monitored	Area Served (Km^2)	Total Population	Length of continuous monitoring (years)	2022-2024 Design Value	2024 Design Value	Max correlation value	Number of sites with $r^2 > 0.8$ relative to this site	Mean Removal Bias	Site part of a National program or Special Study	Total (%)	Score
HW	Salt Lake	4	1	3	4	3	4	1	4	3	4	6.89	**High**
BV	Davis	4	2	4	4	4	4	1	1	1	4	6.44	**High**
ED	Tooele	4	4	2	2	3	3	3	2	4	2	6.44	**High**
SM	Cache	3	3	3	2	2	2	4	2	3	2	5.78	**High**
NR	Utah	3	1	3	1	4	4	2	2	4	2	5.78	**High**
P2	Carbon	2	4	2	3	1	2	4	3	3	1	5.56	**High**
LP	Salt Lake	3	1	4	1	4	4	1	1	3	3	5.56	**High**
LN	Utah	4	2	4	2	3	3	2	1	1	2	5.33	**High**
SF	Utah	1	3	4	4	2	3	2	3	1	1	5.33	**High**
RS	Duchesne	4	1	1	3	4	2	3	4	1	1	5.33	**High**
EN	Iron	2	4	2	2	1	1	3	4	4	1	5.33	**High**
HV	Weber	3	2	4	4	3	3	2	1	1	1	5.33	**High**
CV	Salt Lake	3	1	4	2	4	4	1	1	2	1	5.11	**High**
EQ	Salt Lake	4	1	1	1	3	4	2	1	1	3	4.67	**High**
HC	Washington	1	3	3	3	1	1	3	4	1	1	4.67	**High**
V4	Uintah	1	2	1	2	2	2	3	4	2	1	4.44	**High**
ZZ	Salt Lake	1	1	1	1	4	3	3	1	2	2	4.22	**High**
H3	Salt Lake	1	2	4	2	2	2	1	1	2	1	4.00	**High**
RP	Salt Lake	1	1	1	2	4	4	1	1	1	1	3.78	**High**
BG	Box Elder												New
M7	Grand												New
RB	Salt Lake												New

Table 25. List of ozone monitors in UDAQ network and recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	2022-2024 Design Value	Value	Recommendation
Hawthorne (HW)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.073 (104.3 %)	**High** – **Required**-Utah NCore site - PAMS site - Design value location for ozone is above the NAAQS level - Provide insight into historical trends - Supports model performance evaluation and ozone maintenance demonstration	Continue monitoring
Bountiful Viewmont (BV)	Davis	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.076 (108%)	**High-** NATTS site - CSN site - EMP site - Design value location for ozone is above the NAAQS level - Supports model performance evaluation and SIP development -Provide insight into historical trends - The site also monitors emissions from nearby oil refineries	Continue monitoring
Erda (ED)	Tooele	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.071 (100.9 %)	**High** - Design value location for ozone is above the NAAQS level	Continue monitoring
Smithfield (SM)	Cache	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.066 (94.3%)	**High** - CSN site - Design value location for ozone exceeds 85% of the NAAQS level - Established to assess population exposure, provide a baseline of levels in Logan area	Continue monitoring

Near Road (NR)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.075 (106.6 %)	**High** – Design value location for ozone is above the NAAQS level - Part of the Near-Road Monitoring Program - Support the assessment of air quality near major roadways	Continue monitoring
Price (P2)	Carbon	SLAMS	Population Neighborhood	Air quality index	0.062 (89 %)	**High-** Design value location for ozone exceeds 85% of the NAAQS level	Continue monitoring
Lake Park (LP)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	0.074 (105.7 %)	**High** – Design value location for ozone is above the NAAQS level - Established to assess the environmental impact of the Utah Inland Port. Monitors air quality to assess emissions leaving the port area. -EMP site	Continue monitoring
Lindon (LN)	Utah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.071 (105.7 %)	**High**– CSN site - Design value location for ozone is above the NAAQS level - Supports model performance evaluation - Provide insight into historical trends	Continue monitoring
Spanish Fork (SF)	Utah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.068 (96.6 %)	**High**– Design value location for ozone exceeds 85% of the NAAQS level - Provide insight into historical trends - Supports model performance evaluation/ozone maintenance demonstration	Continue monitoring
Roosevelt (RS)	Duchesne	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.076 (108.6 %)	**High**- Design value location for ozone is above the NAAQS level -Supports studies in Utah's oil and gas basins – Site established to determine maximum ozone concentrations in Duchesne county	Continue monitoring

Enoch (EN)	Iron	SLAMS	Population Neighborhood	Air quality index	0.062 (88 %)	**High**- Design value location for ozone exceeds 85% of the NAAQS level -Established to assess population exposure provide a baseline of levels in the Cedar City MSA; monitor is the only monitor that provides ozone monitoring for Iron County.	Continue monitoring
Harrisville (HV)	Weber	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.071 (101.9 %)	**High**-– Design value location for ozone is above the NAAQS level - Site established in response to an ozone saturation study	Continue monitoring
CopperView (CV)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.075 (107.6 %)	**High** – Design value location for ozone is above the NAAQS level -Established for the purpose of assessing population exposure in southeast Salt Lake County. -Supports measurement comparisons in south Valley with those at the NCORE station	Continue monitoring
Environmental Quality (EQ)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.071 (101.4 %)	**High** -Design value location for ozone is above the NAAQS level -Supports research and testing - EMP site - NADP site - Near interstate freeways and Salt Lake City International Airport	Continue monitoring
Hurricane (HC)	Washington	SLAMS	Population Neighborhood	Air quality index	0.064 (91.9 %)	**High**- Design value location for ozone exceeds 85% of the NAAQS level –Established to provide a baseline of levels in the St. George MSA	Continue monitoring

Vernal #4 (V4)	Uintah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.070 (99.4 %)	**High**-– Design value location for ozone is at the NAAQS level - Established to replace Vernal site (VL), which was established in response to an ozone study and displayed a design value above ozone NAAQS	Continue monitoring
Prison (ZZ)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	0.074 (105.7 %)	**High**– Design value location for ozone is above the NAAQS level - Established to assess the environmental impact of the Utah Inland Port. Monitor emissions entering the port area -EMP site	Continue monitoring
Herriman #3 (H3)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	0.070 (99.4 %)	**High**– Design value location for ozone is at the NAAQS level - Site established to assess population exposure in southwest Salt Lake County	Continue monitoring
Rose Park (RP)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.074 (105.7 %)	**High** – Design value location for ozone is above the NAAQS level - Identified in assessment as area for assessing population exposure -Monitoring gaseous species started in 2018 -station supports model performance evaluation	Continue monitoring
Vernal #4 (V4)	Uintah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	0.070 (99.4 %)	**High**– Design value location for ozone is at the NAAQS level - Established to replace Vernal site (VL), which was established in response to an ozone study and displayed a design value above ozone NAAQS	Continue monitoring

Brigham City #3 (BG #3)	Box Elder	SLAMS	Population Neighborhood	Population exposure Air Quality Index		**New** – Establish with purpose to replace the previous station Brigham City that closed in summer 2019 due to infrastructure issues. The site will help assess population exposure in this area	Continue monitoring
Moab (M7)	Grand	SLAMS	Population Neighborhood	Air quality index		**New**- Site established to support air quality forecasting	Continue monitoring
Red Butte (RB)	Salt Lake	SPM		Support modeling		**New**-This site is established to support air quality models and research studies	Continue monitoring

Sulfur Dioxide (SO_2) Network

The Utah DAQ currently operates four SO_2 monitors within Salt Lake County (Figure 44). The monitor at Hawthorne (HW) is designated as population-oriented and meets NCore requirements. The remaining monitors are located at Environmental Quality (EQ), Rose Park (RP), and Copperview (CV).

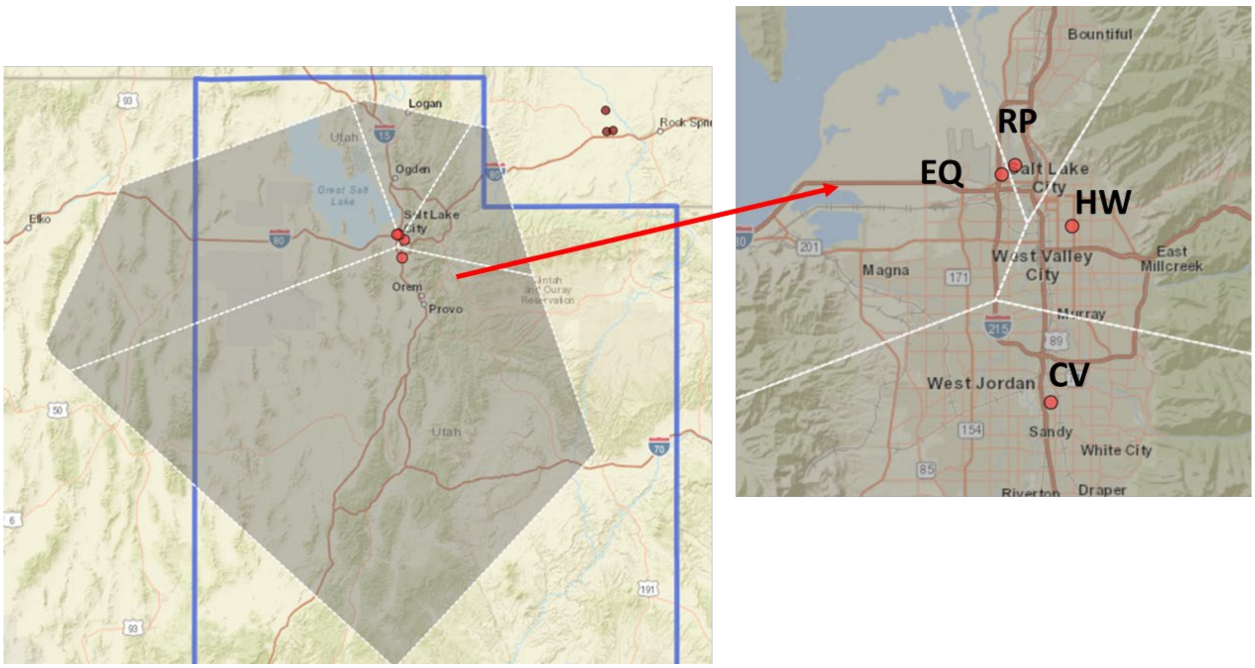


Figure 44. Map showing the spatial distribution of SO_2 monitoring sites in UDAQ network and the areas they serve.

Historical trends and deviations from NAAQS

The EPA has established two primary sulfur dioxide (SO_2) standards: a 1-hour standard of 75 parts per billion (ppb) and a 24-hour standard of 0.14 parts per million (ppm). In addition, there is a 3-year average standard based on the 99th percentile of daily maximum 1-hour concentrations, which must not exceed 75 ppb.

On December 10, 2024, the EPA revised the secondary standard for SO_2, changing it from a 3-hour average of 0.5 ppm (500 ppb), not to be exceeded more than once per year, to an annual standard of 10 ppb, averaged over three years.

The Utah Department of Air Quality (UDAQ) currently operates all four SO_2 monitors within the Salt Lake City CBSA. In the past, monitors were also located at Beach (B4), Magna (MG), North Salt Lake (N2), Bountiful Viewmont (BV), and Roosevelt (RS). The monitors at Beach (B4), Magna (MG), North Salt Lake (N2), within the Salt Lake City CBSA, were shut down in 2013–2014 due to consistently low.

concentrations; 75% of the recorded values between 2011 and 2013 were at or below 8 ppb, with only occasional hourly spikes that rarely approached the 1-hour NAAQS.

SO_2 monitoring at Bountiful Viewmont (BV) and Roosevelt (RS) was discontinued in 2012–2013 because the samplers did not record any exceedances of the 1-hour NAAQS.

The Magna (MG) monitor was relocated from its previous site at 2935 South 8560 West, Magna, to a new location at 9228 West 2700 South, Magna, to better assess emissions from the Kennecott Utah Copper coal-fired power plant. The new Magna station began operating on January 1, 2019, but monitoring lasted only one year, as the power plant was shut down later that year.

The standard is met when the 99th percentile of 1-hour daily maximum concentrations, averaged over three years, is below 75 ppb. As shown in Figure 45 and Figure 46 and, no SO_2 NAAQS violations were recorded in Utah from 2021 to 2024. Furthermore, all monitored sites show a decreasing trend in SO_2 concentrations, with levels falling below 10 ppb.

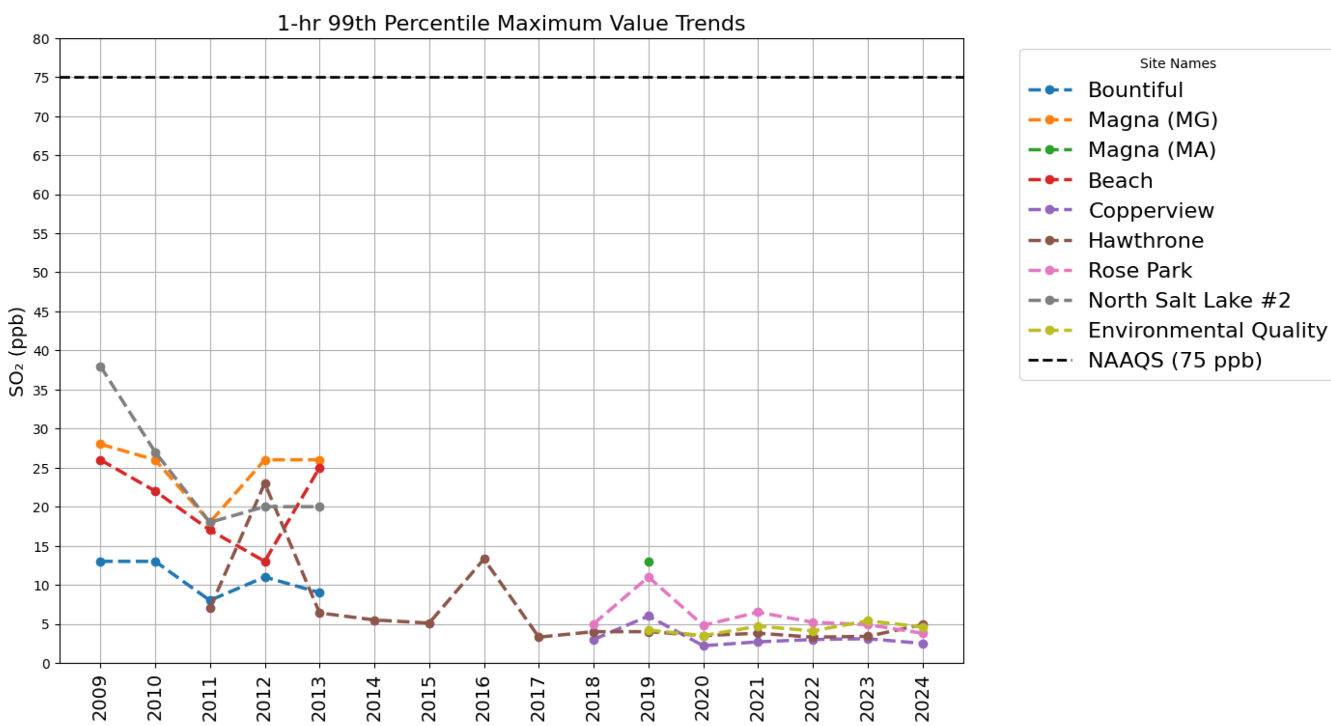


Figure 45. 1-hr 99th percentile maximum value trends and comparison to NAAQS for SO_2 during the period 2009-2019

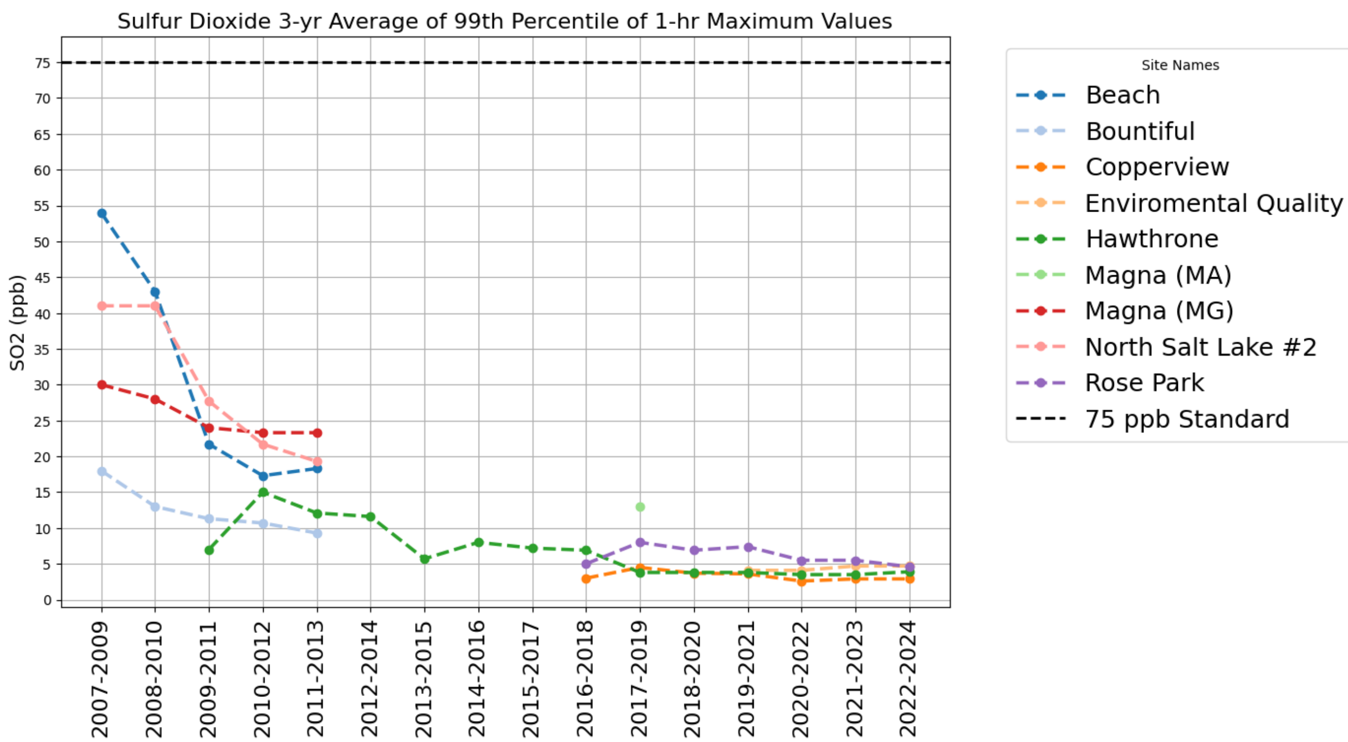


Figure 46. 1-hr average of 99th percentile value trends and comparison to NAAQS for SO_2 during the period 2021-2024.

Site-by-site analysis

Given the consistent decrease in SO_2 concentrations, the non-violation of the NAAQS, and compliance with both NCore and minimum monitoring requirements, UDAQ has maintained SO_2 monitoring at the Hawthorne site (HW), Copperview (CV), Rose Park (RP), and the Environmental Quality (EQ). Copperview (CV) and Rose Park (RP) began SO_2 monitoring in 2018, while the Environmental Quality (EQ) started in 2019.

Federal regulations require a minimum number of SO_2 monitors within a Core-Based Statistical Area (CBSA) based on the calculated Population Weighted Emissions Index (PWEI). The PWEI is determined by multiplying the CBSA population by the total SO_2 emissions (in tons per year) within the CBSA and dividing the result by one million. Population estimates are based on the most recent census data, while SO_2 emissions are calculated using the latest county-level data from the National Emissions Inventory. The minimum monitoring requirements by PWEI are as shown in Table 26.

Table 26. Minimum monitoring requirements for SO_2.

CBSA PWEI*	Minimum Number of SO2 Monitors Required
≥1,000,000	3
≥100,000 - < 1,000,000	2
≥5000 - < 100,000	1

*Core Based Statistical Area Population Weighted Emissions Index.

PWEI for the Salt Lake CBSA is 1,081 suggesting that no monitor is needed within these CBSAs (Table 27). However, the monitor at Hawthorne satisfies minimum monitoring requirements for NCore station. Utah DAQ would therefore like to maintain the current SO_2 network unchanged.

Table 27. Number of active SO_2 monitors in each CBSA and minimum number of required monitors.

CBSA	Counties	Census 2020	SO2 (tons/year)	PWEI 2020	PWEI Population estimate (2033)	Minimum number of required monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	859	1,081	1,255	1 The PWEI value is less than 5000; however, one monitor is still required for the NCore site	4
Provo-Orem MSA	Utah, UT Juab, UT	673,917	370	249	343	0	0
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	737	512	596	0	0
Heber µSA	Wasatch, UT	34,788	23	1	1	0	0
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	42	6	7	0	0
Saint George MSA	Washington, UT	180,279	123	22	33	0	0
Cedar City µSA	Iron, UT	57,289	61	3	5	0	0
Price µSA	Carbon, UT	20,412	424	9	9	0	0
Vernal µSA	Uintah, UT	35,620	143	5	6	0	0
Summit Park µSA	Summit, UT	42,357	142	60	0	0	0

Correlation and Bias

The correlation analysis between sites (Figure 47) measuring SO_2 reveals mostly weak to moderate linear relationships. Among all site pairs, Rose Park (RP) and Environmental Quality (EQ), the closest sites (1 km apart), show the strongest correlation at 0.55, indicating a moderate correlation that suggest that these two sites may be influenced by similar emission sources or meteorological conditions. In contrast, all site comparisons involving Copperview (CV) (CV–HW, CV–RP, CV–EQ) show weak correlations ranging from 0.26 to 0.32, suggesting localized emission differences. Overall, the data suggests that as the distance between sites increases, the correlation tends to decrease and the mean difference increases, pointing to spatial variability in the measurements.

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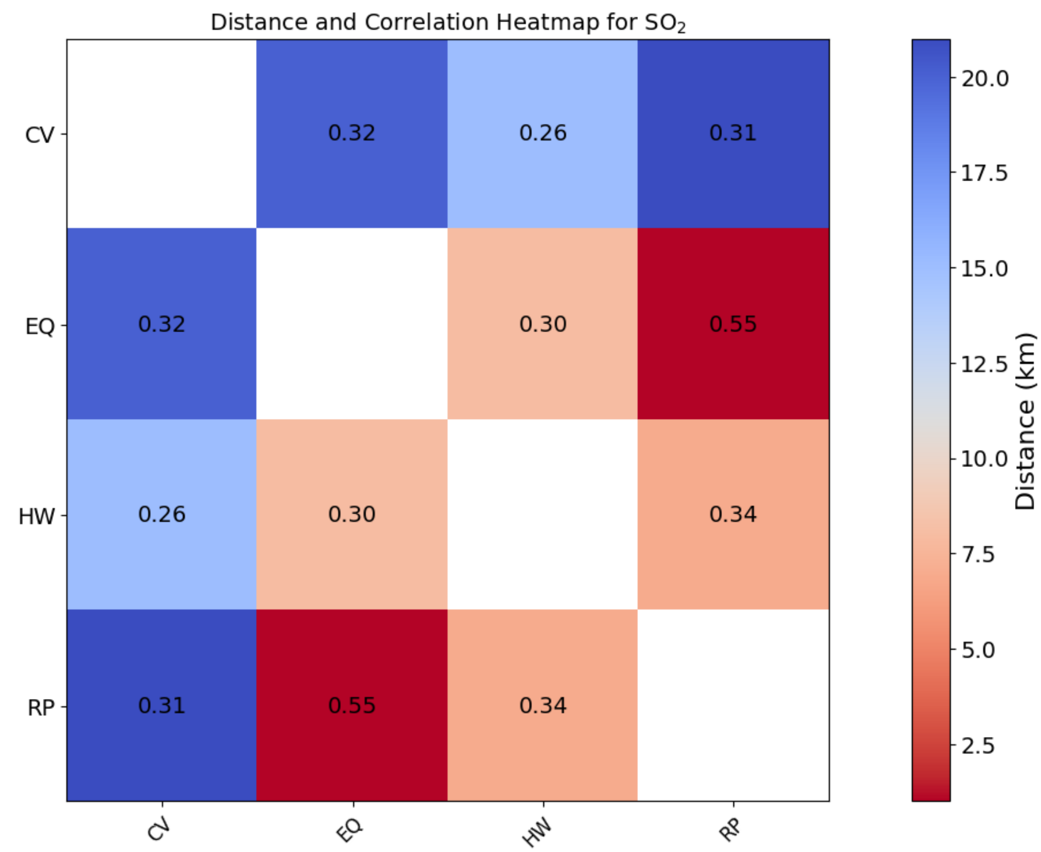

Figure 47. Distance and correlation matrix for SO_2 concentrations among all monitoring sites in the UDAQ network.

The analysis of the mean removal bias for SO_2 monitors (Figure 48) at four sites shows that three of the sites, Copperview (CV), Hawthorne (HW) and Rose park (RP), exhibit a positive bias, indicating slightly higher SO_2 values when one of these sites is removed. In contrast, Environmental Quality (EQ) site shows a negative bias of -0.2, indicating a slight underestimation if the site is removed.
UDAQ will continue monitoring SO_2 at all sites and will take appropriate action if any changes are required.

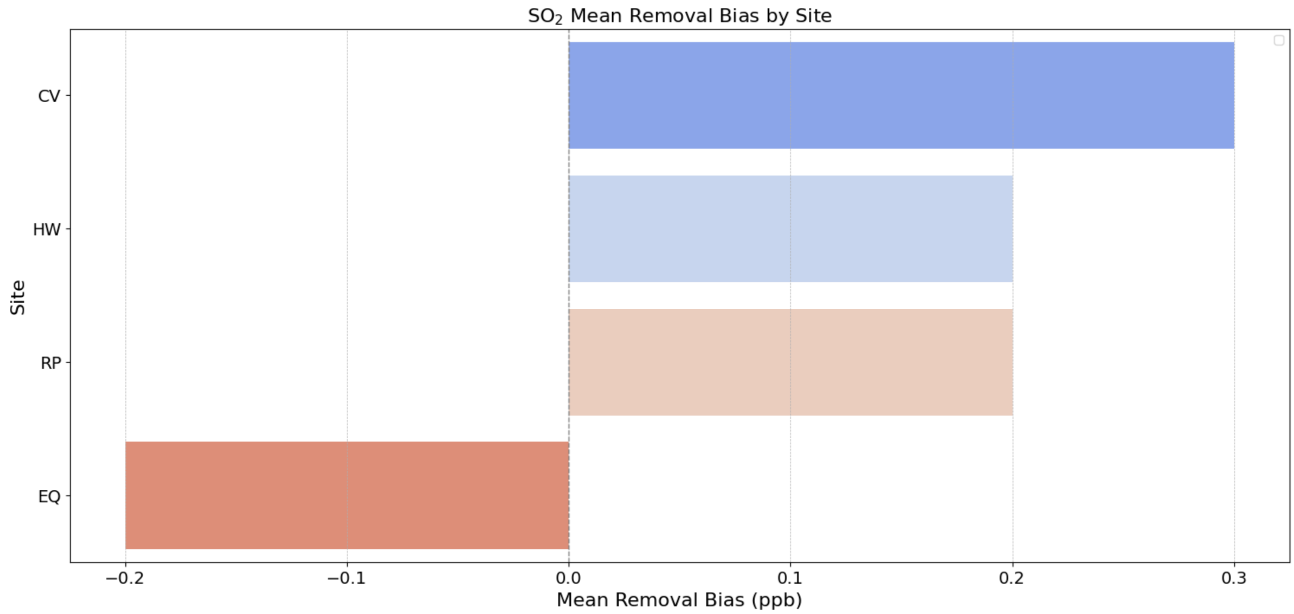

Figure 48. Removal bias results for all SO_2 monitors in the UDAQ network.

Table 28 summarizes the final recommendation for all the SO_2 monitors in the network. Ultimately, all monitors received a “High” rating.

Table 28. List of SO_2 monitors in UDAQ network and recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	Value	Recommendation
Hawthorne (HW)	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** – Utah NCore site	Continue monitoring
Rose Park (RP)	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High**- monitoring gaseous species started in 2018	Continue monitoring
Copperview (CV)	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** -Identified as area for assessing population exposure in southeast Salt Lake County	Continue monitoring
Environmental Quality (EQ)	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** - Near interstate freeways and Salt Lake City International Airport	Continue monitoring

Nitrogen Dioxide (NO_2) Network

The Utah DAQ currently operates NO_2 monitors in 23 out of the 25 monitoring stations that are presently operational.

Historical trends and deviations from NAAQS

The EPA has set two national limits for NO_2: one for hourly concentrations and one for annual levels. The hourly limit is 100 ppb, measured as the three-year average of the 98th percentile of the highest daily one-hour average concentrations. The annual NO_2 limit is 53 ppb, calculated as the yearly average (mean), as shown in Figure 49. Figure 50 and Figure 51 show both the 98th percentile of daily 1-hr max and 1-hr design value trends, respectively.

The NO_2 annual mean concentration trends shows a slight downward trend for most of sites. Environmental quality (EQ) and Near road (NR) have the highest annual mean concentrations (between 14 and 16 ppb), followed by Hawthorne (HW), Copperview (CV) and Rose Park (RP), with concentrations consistently around or above 12 ppb. Lindon (LN), Harrisville (HV), Spanish Fork (SF), Enoch (EN) generally range between 6–11 ppb, while Price (P2), Vernal (V4), Moab (M7), Hurricane (HC), Erda (ED), Heber (HB), and Smithfield (SM) have lower NO_2 levels, typically below 6 ppb.
Prison (ZZ) and Lake Park (LP) show mid-level NO_2 (between 7 and 10 ppb) concentrations, with a decreasing trend in recent years and Prison reporting the lower concentrations.

According to Figure 49-51, Utah has never exceeded the NO_2 standards.

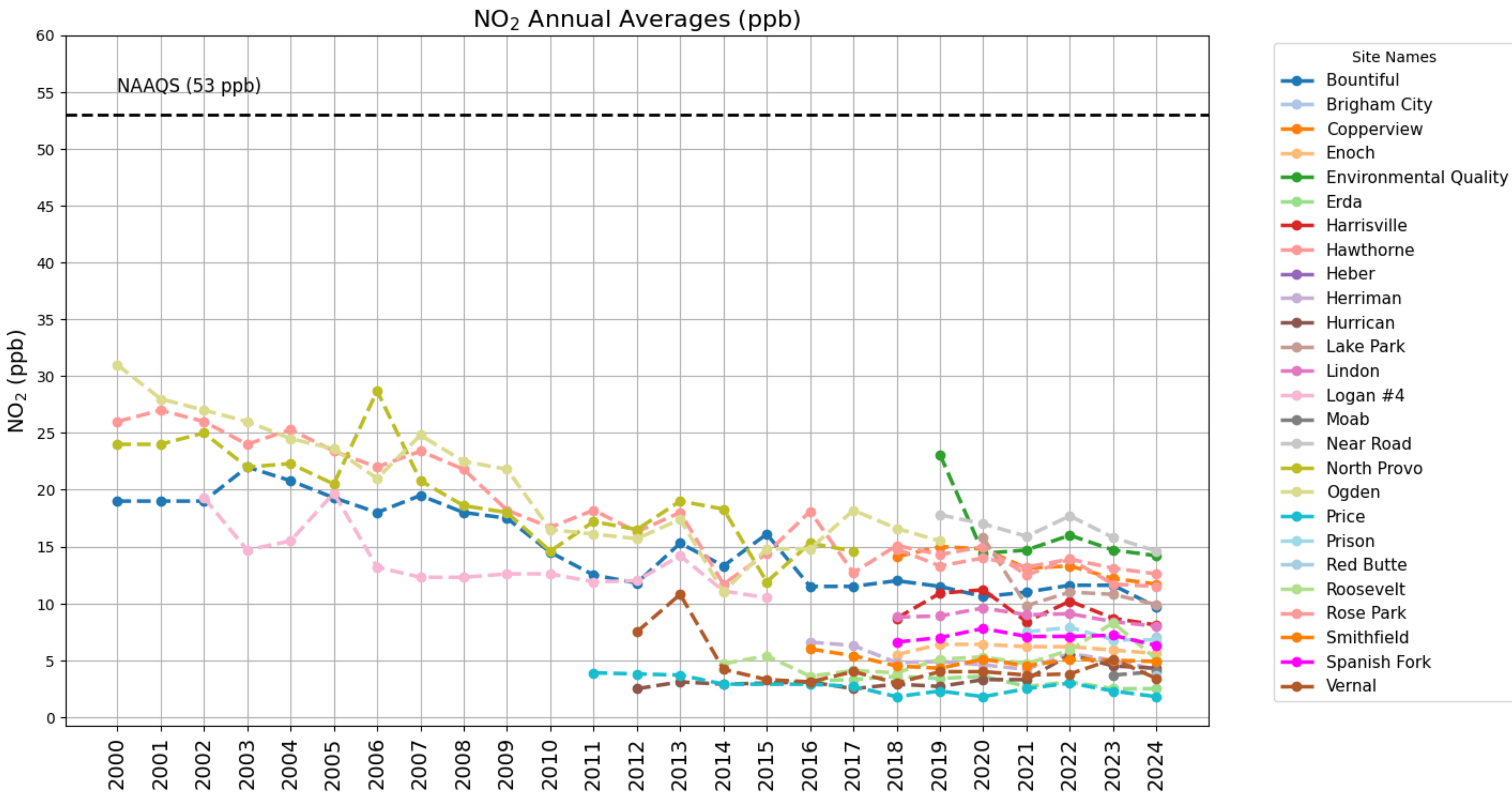

Figure 49. NO_2 annual average trends and comparison to NAAQS for NO_2 during the period 2000-2024

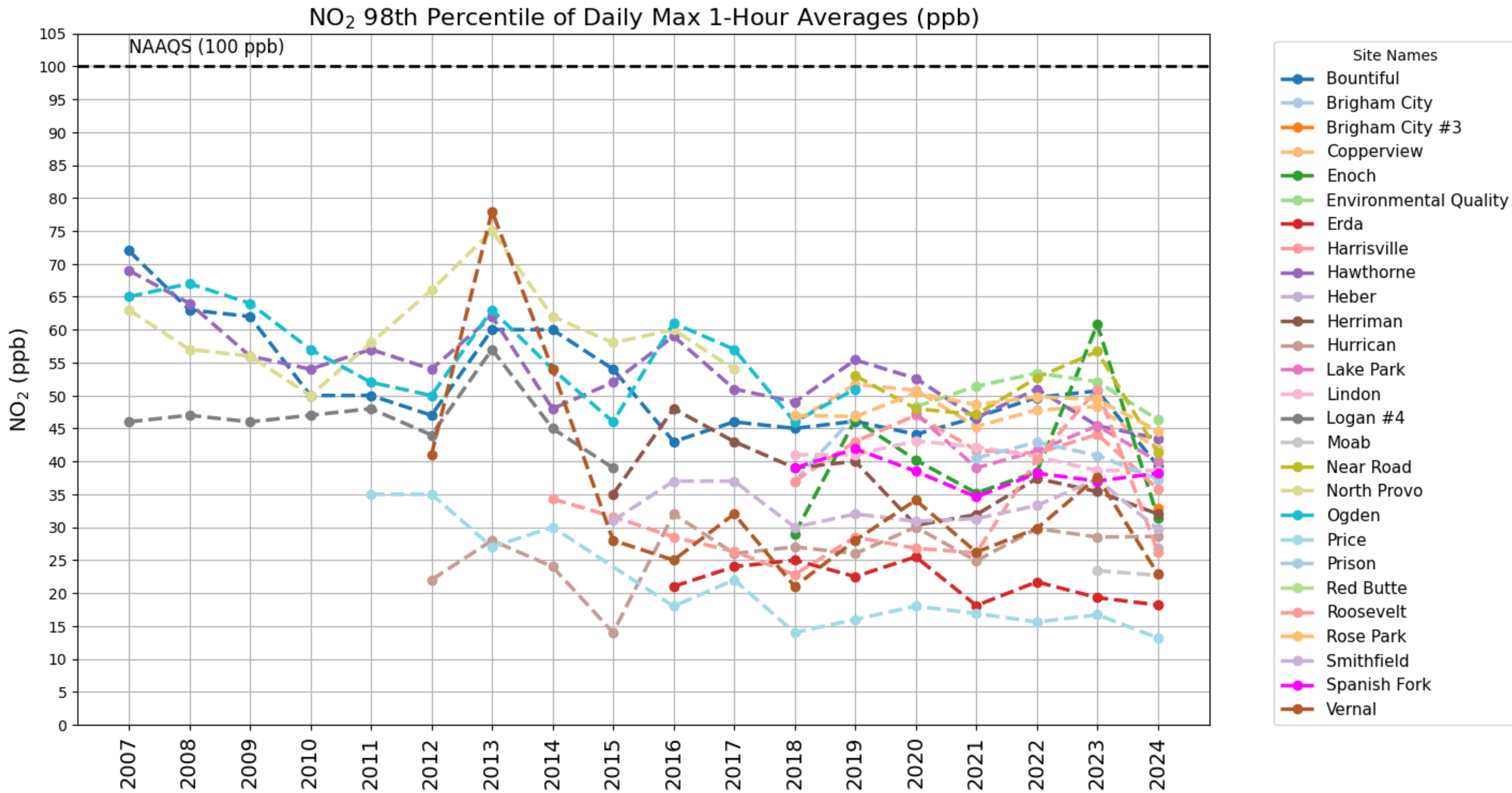

Figure 50. Annual design value trends and comparison to NAAQS for NO_2 during the period 2007-2024.

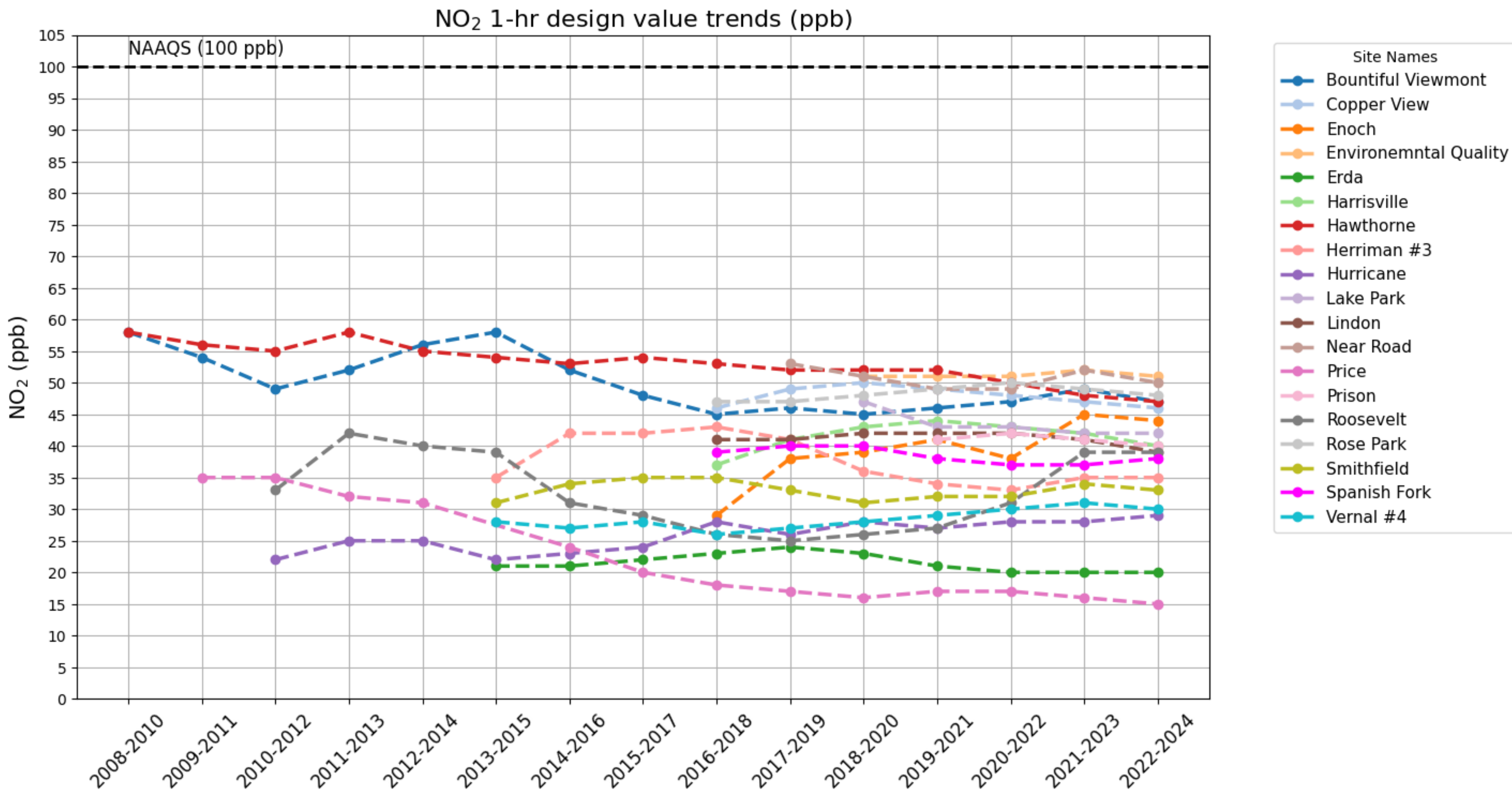

Figure 51. 1-hr design value trends and comparison to NAAQS for NO_2 during the period 2008-2024.

Site-by-site analysis

The Utah Department of Air Quality (UDAQ) currently operates NO_2 monitors in 23 out of 25 monitoring stations that are currently operational. Although Utah has demonstrated compliance with NO_2 standards, UDAQ would like to maintain NO_2 monitoring at all sites since emissions of this pollutant can lead to increased ozone and $PM_{2.5}$ formation, often resulting in pollution levels exceeding the NAAQS. Photochemical reactions between NO_2 and volatile organic compounds lead to the formation of ground-level ozone along the Wasatch Front and the Uinta Basin during summer and winter, respectively[16,17]. NO_2 can also react with ammonia to form nitrate-$PM_{2.5}$ during winter. Therefore, to support efforts towards understanding and controlling high $PM_{2.5}$ and ozone levels, UDAQ would like to maintain NO_2 monitoring at all current sites.

The 40 CFR Part 58, Appendix D, Section 4.3.3 mandates that each CBSA with a population of 1,000,000 or more must operate at least one area-wide ambient air quality monitoring site for nitrogen dioxide (NO_2). These sites must be located in areas expected to have the highest NO_2 concentrations and should represent either the neighborhood or urban spatial scale.

In addition, Section 4.3.2 of the same appendix requires the placement of one microscale near-road NO_2 monitor near a major road with high annual average daily traffic in each CBSA with a population of 1,000,000 or more. A second near-road monitor is required for CBSAs with populations of 2,500,000 or more.

According to 2020 U.S. Census Bureau population estimates for Utah, only the Salt Lake City CBSA meets the population threshold requiring area-wide NO_2 monitoring. Currently, UDAQ operates ten NO_2 monitors within the Salt Lake City CBSA.

A Near-Road monitoring station was established in January 2019 along I-15 at 5001 Galleria Dr, Murray, to satisfy federal regulatory requirements. These regulations mandate that at least one NO_2 monitor be located near a major road in urban areas with populations greater than or equal to 500,000, and that monitors be placed in other areas where maximum concentrations are expected.

With the exception of the Salt Lake City, Provo-Orem, and Ogden-Clearfield CBSAs, all monitoring sites meet the minimum federal NO_2 monitoring requirements, some even exceed them. Table 29 provides the minimum number of required NO_2 monitors and the current count of active NO_2 monitors in the UDAQ network.

[16] UDAQ, 2012 Utah Ozone Study
[17] UDAQ, 2014 Uinta Basin Winter Ozone Study Final Report

Table 29 shows that UDAQ is meeting all community-based (area-wide) NO_2 monitoring requirements; however, it is not yet meeting all near-road monitoring requirements. A near-road monitor is required within this CBSA, as well as in the Provo-Orem and Ogden-Clearfield CBSAs.

Table 29. Number of active NO2 monitors in each CBSA and minimum number of required monitors

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	Minimum number of required near-road monitors	Minimum number of required area-wide monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	1	1	10 9 (area-wide) 1 (near-road)
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	1	0	2 (area-wide)
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	1	0	3 (area-wide)
Heber µSA	Wasatch, UT	34,788	43,826	47,368	0	0	1
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	0	0	1
Saint George MSA	Washington, UT	180,279	252,964	268,790	0	0	1
Cedar City µSA	Iron, UT	57,289	78,144	80,074	0	0	1
Price µSA	Carbon, UT	20,412	21,275	21,703	0	0	1
Vernal µSA	Uintah, UT	35,620	37,920	38,673	0	0	1
Summit Park µSA	Summit, UT	42,357	46,717	48,376	0	0	0

Correlation and Bias

The correlation analysis among NO_2 measurements for each site pair (Figure 52) reveals a wide range of relationships, with correlation coefficients ranging from as low as 0.16 between Price (P2) and Enoch (EN) to as high as 0.89 between Environmental Quality (EQ) and Rose Park (RP). The strongest correlations are observed between sites in close proximity, such as CV–LP (0.886), EQ-RP (0.89), LP–EQ (0.845), and HW–HV (0.841), suggesting that spatial proximity enhances agreement in NO_2 concentrations. In contrast, lower correlations are associated with greater distances or differing environmental conditions. These findings highlight the importance of spatial variability throughout the monitoring network.

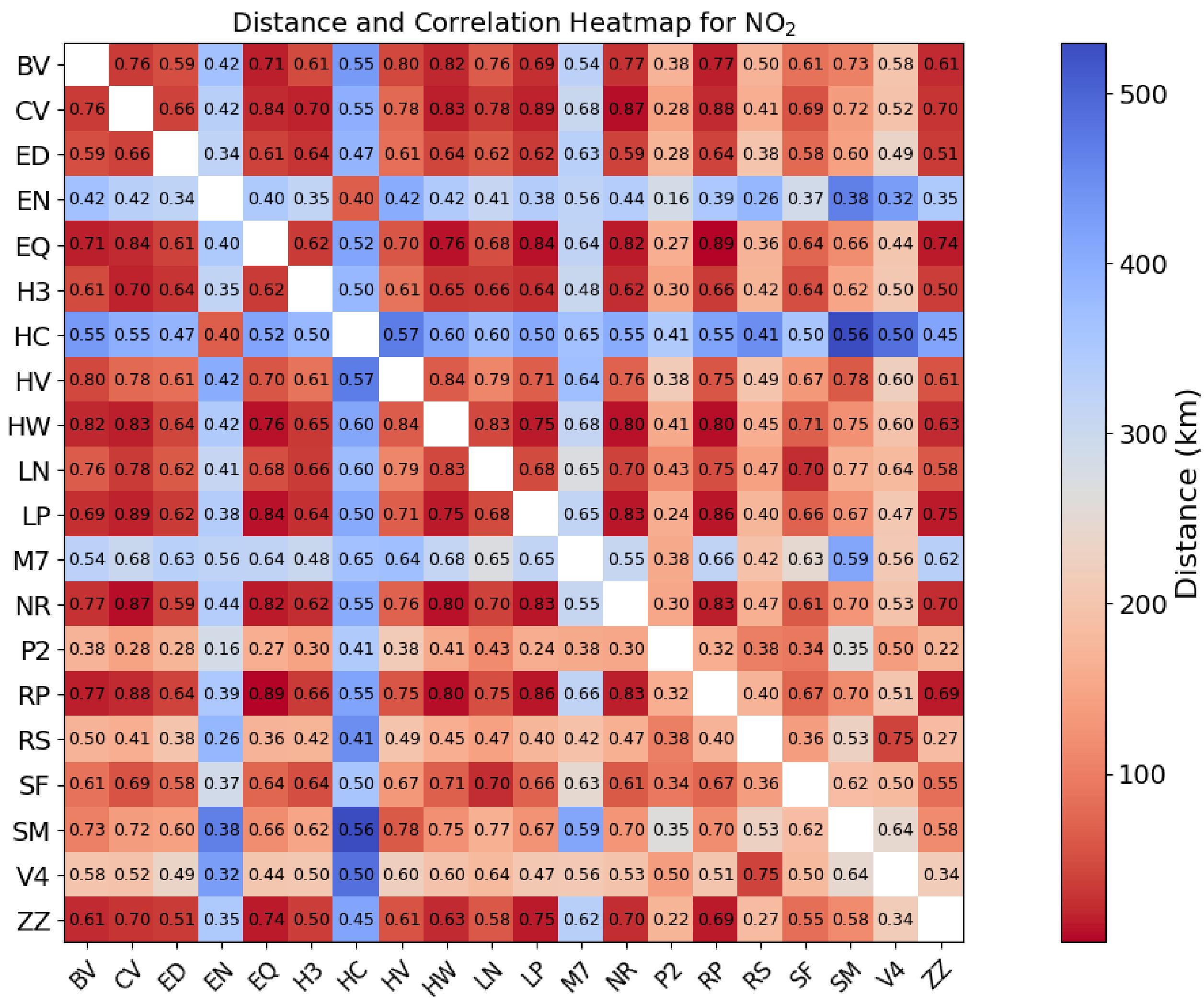

Figure 52. Distance and correlation matrix for NO_2 concentrations among all monitoring sites in the UDAQ network.

Figure 53 displays the results from the removal bias analysis, which includes most of the monitoring sites in the network. As previously mentioned, Heber (HB), Red Butte (RB) and Brigham City (BG) were excluded due to having fewer data points compared to the other sites.

The mean removal bias across the included sites shows a mix of positive and negative values, indicating significant variability between locations. Sites such as Herriman (H3) (+9.5 ppb) and Erda (ED) (+10.8 ppb) exhibit the highest positive biases, while Roosevelt (RS) (-6.3 ppb) and Enoch EN (-6.4 ppb) show the largest negative biases. Most sites show moderate positive or negative biases, while a few sites, such as Copperview (CV) (+0.5 ppb), Lindon (LN) (+0.9 ppb) and Spanish Fork (SF) (-1.4 ppb) display relatively small biases.
A summary of the final recommendations for all NO_2 monitors in the network is shown in Table 30.

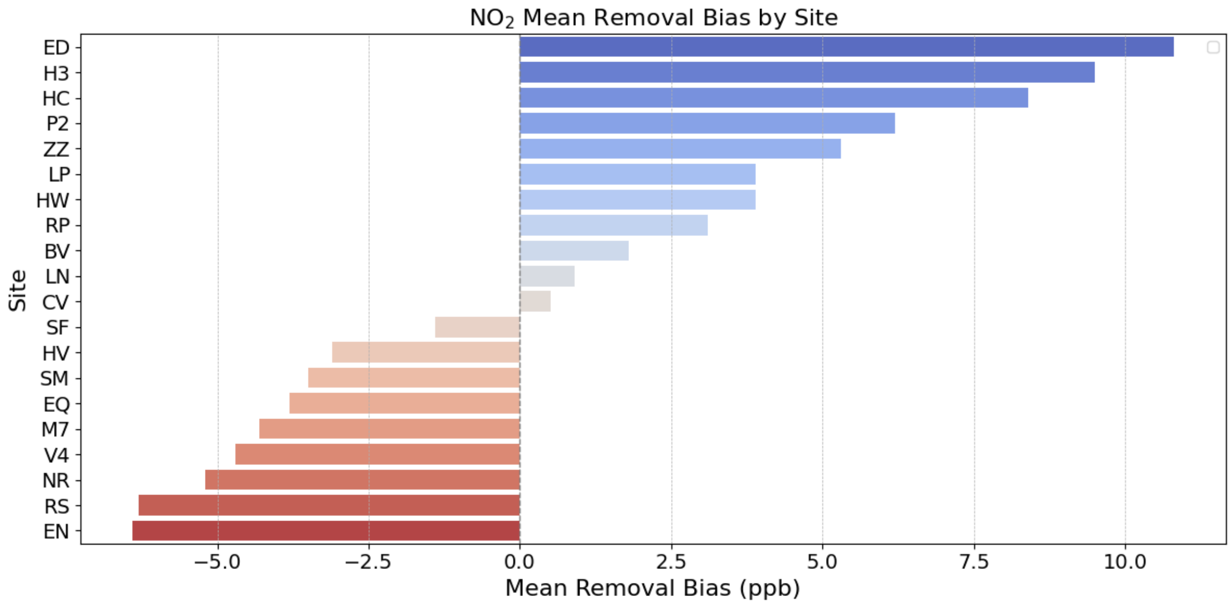

Figure 53. Removal bias results for all NO_2 monitors in the UDAQ network.

Table 30. List of NO_2 monitors in Utah air monitoring network and recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	Value	Recommendation
Hawthorne (HW)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** – **Required**-Utah NCore site -PAMS site - Design value location for ozone is above the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. - Supports model performance evaluation and ozone maintenance demonstration - Helps to differentiate between primary vs. secondary $PM_{2.5}$ -Provide insight into historical trends	Continue monitoring
Bountiful Viewmont (BV)	Davis	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** – NATTS site -CSN site -EMP site - Design value location for ozone is above the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. - Supports model performance evaluation and SIP development - Provide insight into historical trends - The site also monitors emissions from nearby oil refineries	Continue monitoring

Erda (ED)	Tooele	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** - Design value location for ozone is above the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. -There is a higher negative mean removal bias for NO_2 across the network - Supports model performance evaluation	Continue monitoring
Smithfield (SM)	Cache	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** - CSN site -Design value location for ozone exceeds 85% of the NAAQS level -Close to PM2.5 NAAQ -NO_2 measurements will enhance our understanding of the chemical processes involved in ozone and secondary PM2.5 formation -Established to assess population exposure in Logan area	Continue monitoring
Near Road (NR)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** – **Required**-Design value location for ozone is above the NAAQS level -Part of the Near-Road Monitoring Program -Support the assessment of air quality near major roadways	Continue monitoring
Price (P2)	Carbon	SLAMS	Population Neighborhood	Air quality index	**Low**- Design value location for ozone exceeds 85% of the NAAQS level	Continue monitoring
Lake Park (LP)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	**High**– Design value location for ozone is above the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. - Established to assess the environmental impact of the Utah Inland Port. Monitors air quality to assess emissions leaving the port area. -EMP site	Continue monitoring

Lindon (LN)	Utah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High**– CSN site - Design value location for ozone is above the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. - Supports model performance evaluation	Continue monitoring
Spanish Fork (SF)	Utah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High**– Design value location for ozone exceeds 85% of the NAAQS level - NO_2 data will provide better understanding of ozone formation chemistry. -Supports model performance evaluation/ozone maintenance demonstration; local high-ozone concentration area	Continue monitoring
Roosevelt (RS)	Duchesne	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High**- Design value location for ozone is above the NAAQS level -NO_2 data will provide better understanding of ozone formation chemistry. -Supports studies in Utah's oil and gas basins – Site established to determine maximum ozone concentrations in Duchesne county	Continue monitoring
Enoch (EN)	Iron	SLAMS	Population Neighborhood	Air quality index	**Moderate**- Design value location for ozone exceeds 85% of the NAAQS level -Established to assess population exposure provide a baseline of levels in the Cedar City MSA	Continue monitoring
Harrisville (HV)	Weber	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High -** Design value location for ozone is above the NAAQS level -Site established in response to an ozone saturation study -NO_2 data will provide better understanding of ozone formation chemistry.	Continue monitoring

CopperView (CV)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** – Design value location for ozone is above the NAAQS level -NO_2 data will provide better understanding of ozone formation chemistry. -Established for the purpose of assessing population exposure in southeast Salt Lake County. -Supports measurement comparisons in south Valley with those at the NCORE station	Continue monitoring
Environmental Quality (EQ)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** -Design value location for ozone is above the NAAQS level NO_2 data will provide better understanding of ozone formation chemistry. -Higher Average daily traffic counts- Supports research and testing - EMP site - NADP site - Near interstate freeways and Salt Lake City International Airport	Continue monitoring
Hurricane (HC)	Washington	SLAMS	Population Neighborhood	Air quality index	**Moderate** - Design value location for ozone exceeds 85% of the NAAQS level –Established to provide a baseline of levels in the St. George MSA	Continue monitoring
Vernal #4 (V4)	Uintah	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**Moderate** – Design value location for ozone is at the NAAQS level NO_2 data will provide better understanding of ozone formation chemistry. - Established to replace Vernal site (VL), which was established in response to an ozone study and displayed a design value above ozone NAAQS	Continue monitoring

Prison (ZZ)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	**Moderate**– Design value location for ozone is above the NAAQS level -NO_2 data will provide better understanding of ozone formation chemistry. -Established to assess the environmental impact of the Utah Inland Port. Monitor emissions entering the port area -EMP site	Continue monitoring
Herriman #3 (H3)	Salt Lake	SLAMS	Population Neighborhood	Air quality index	**High**- Design value location for ozone is at the NAAQS level -NO_2 data will provide better understanding of ozone formation chemistry -There is a higher positive mean removal bias for NO_2 across the network -Site established to assess population exposure in southwest Salt Lake County	Continue monitoring
Rose Park (RP)	Salt Lake	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**High** –Design value location for ozone is above the NAAQS level -NO_2 data will provide better understanding of ozone formation chemistry. - Identified in assessment as area for assessing population exposure -Monitoring gaseous species started in 2018 -Station supports model performance evaluation	Continue monitoring
Moab (M7)	Grand	SLAMS	Population Neighborhood	Air quality index	**New**- Site established to support air quality forecasting	Continue monitoring

Brigham City #3 (BG)	Box Elder	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**New** – Establish with purpose to replace the previous station Brigham City that closed in summer 2019 due to infrastructure issues. The site will help assess population exposure in this area	Continue monitoring
Red Butte (RB)	Salt Lake	SPM		Support modeling	**New**-This site is established to support air quality models and research studies	Continue monitoring
Heber (HB)	Wasatch	SLAMS	Population Neighborhood	Population exposure Air Quality Index	**New**-This site is established to assess population exposure in Wasatch county	Continue monitoring

Carbon Monoxide (CO) Network

The Utah DAQ currently operates seven CO monitors, five in Salt Lake County and one each in Utah and Weber counties. These monitors assess population exposure to emissions from anthropogenic activities and support CO maintenance plans. To meet EPA requirements, monitors are placed near roadways in urban areas to evaluate traffic-related CO concentrations. Additionally, a CO monitor is co-located with a nitrogen dioxide (NO_2) monitor at the Near-Road (NR) site along I-15 at 5001 South Galleria Drive in Murray. The locations of the CO monitors are shown in Figure 54

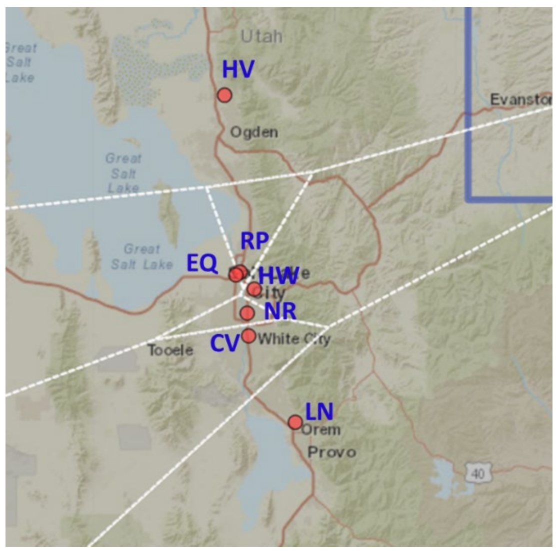

Figure 54. Map showing the spatial distribution of the CO monitoring sites in the UDAQ.

Historical trends and deviations from NAAQS

The national 1-hour and 8-hour standards for carbon monoxide (CO) are 35 ppm and 9 ppm, respectively. These standards are not to be exceeded more than once per year. If a location exceeds these limits, it is designated as a nonattainment area.

At one time, three cities in Utah, Salt Lake City, Ogden, and Provo, were designated as nonattainment areas for CO. However, due to improvements in motor vehicle technology, these areas were successfully re-designated as attainment areas in 1999 (Salt Lake City), 2001 (Ogden), and 2006 (Provo).

Currently, all areas in Utah meet the CO NAAQS, as shown in Figure 55 and Figure 56. CO monitoring at The Washington Boulevard and Cottonwood stations was discontinued in 2013 and 2012, respectively. The Cottonwood station was closed due to violations of EPA siting criteria and data redundancy with the nearby Hawthorne site. The Washington Boulevard site was shut down because CO was the only pollutant measured there, and the data were considered redundant with measurements from the Ogden site, located about one mile to the south.

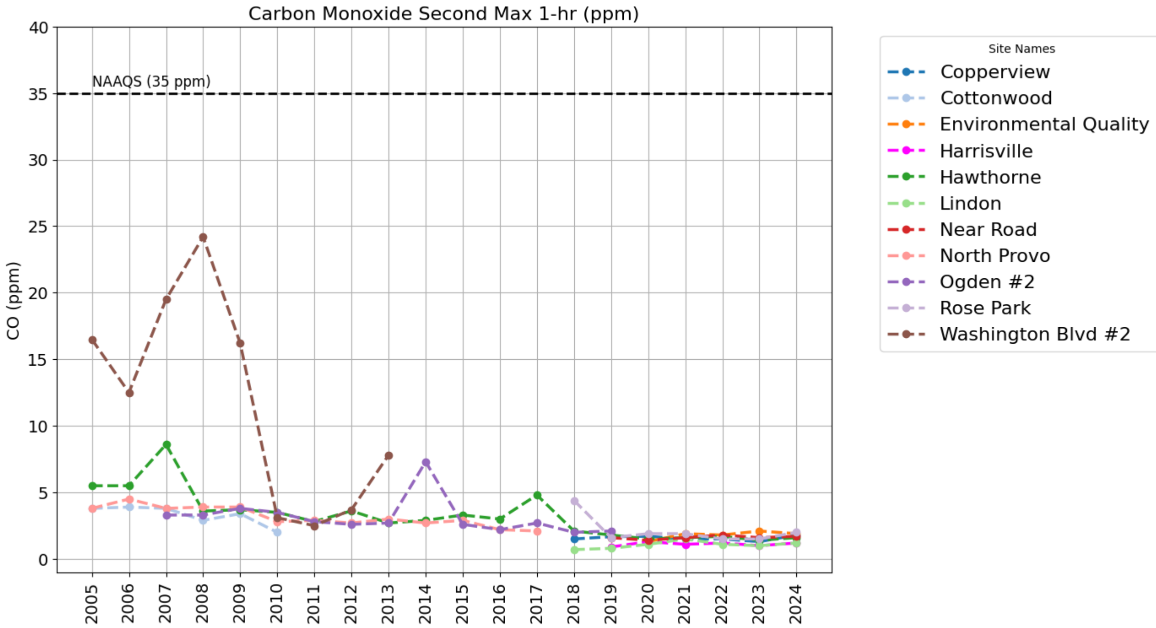

Figure 55. Second-highest 1-hr concentration trends and comparison to NAAQS for CO during the period 2000-2019.

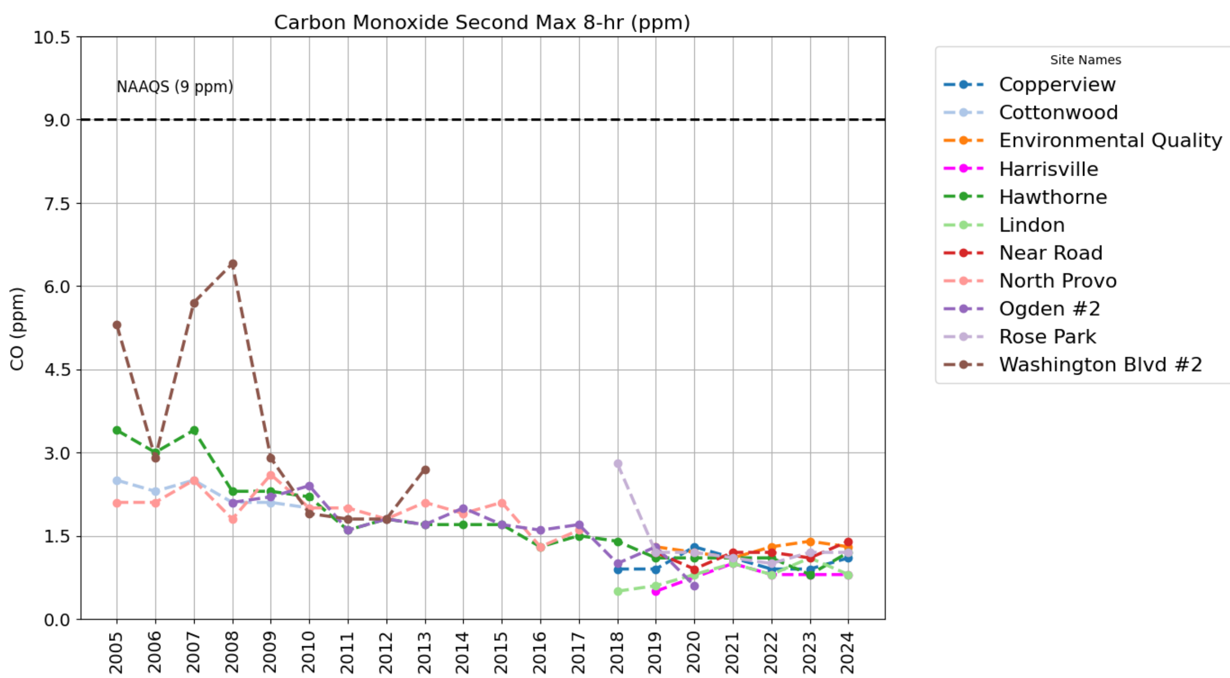

Figure 56. Second-highest 8-hr concentration trends and comparison to NAAQS for CO during the period 2000-2019.

Site-by-site analysis

The number of CO monitors required in a monitoring network is determined primarily by population size and local air quality conditions. According to 40 CFR Part 58, Appendix D, at least one CO monitoring site is required in each CBSA with a population greater than 1,000,000. These monitors must be placed in areas of expected maximum concentrations, typically near busy roadways or areas with heavy traffic congestion. Additional CO monitors may be required if historical data or modeling indicates potential violations of NAAQS for CO. However, because CO concentrations have declined significantly over the years, many areas have received approval to reduce the number of active CO monitors if long-term monitoring data demonstrate sustained compliance with the NAAQS. Minimum federal monitoring requirements for CO, as well as an evaluation of CO monitors in the UDAQ network, are provided in Table 31.

Salt Lake City CBSA

According to federal regulations, one CO monitor is required to operate co-located with one required near-road NO_2 monitor in CBSAs with a population of 1,000,000 or more. If a CBSA has more than one required near-road NO_2 monitor, only one CO monitor is required to be co-located within the CBSA. UDAQ currently operates CO monitors at the NCore Hawthorne site (HW), Rose Park station (RP), Environmental Quality (EQ), Copperview (CV), and at the Near Road station (NR).

Provo-Orem and Ogden-Clearfield CBSAs

The Utah Department of Air Quality (UDAQ) currently operates one CO monitor in each of the Provo-Orem and Ogden-Clearfield CBSAs, exceeding minimum federal monitoring requirements. The samplers located at Lindon (LN) and Harrisville (HV) are used to monitor population exposure to emissions from anthropogenic activities in the area, as well as to support CO maintenance plans. The Utah DAQ would therefore like to maintain CO monitoring at these sites.

Table 31. Number of active CO monitors in each CBSA and minimum number of required monitors.

CBSA	Counties	Census 2020	Population estimate (2030)	Population estimate (2033)	Minimum number of required near-road monitors	Minimum number of required CO monitors	Number of active monitors
Salt Lake City MSA	Salt Lake, UT Tooele, UT	1,257,936	1,413,865	1,461,290	1	1 (co-located with near-road NO_2 monitor)	4 (area-wide) 1 (with near-road NO2 monitor)
Provo-Orem MSA	Utah, UT Juab, UT	673,917	876,381	927,020	1	0	1 (area-wide)
Ogden-Clearfield MSA	Box Elder, UT Davis, UT Morgan, UT Weber, UT	694,863	776,576	808,661	1	0	1 (area-wide)
Heber µSA	Wasatch, UT	34,788	43,826	47,368	0	0	0
Logan UT-ID MSA	Cache, UT Franklin, ID	133,154	159,402	166,167	0	0	0
Saint George MSA	Washington, UT	180,279	252,964	268,790	0	0	0
Cedar City µSA	Iron, UT	57,289	78,144	80,074	0	0	0
Price µSA	Carbon, UT	20,412	21,275	21,703	0	0	0
Vernal µSA	Uintah, UT	35,620	37,920	38,673	0	0	0
Summit Park µSA	Summit, UT	42,357	46,717	48,376	0	0	0

Correlation and Bias

The correlation matrix (Figure 57) illustrates the strength of the relationship between the CO monitoring stations. The colorbar on the right side represents the distances between monitoring sites in kilometers. Most site pairs show moderate to high positive correlations, suggesting that the stations are influenced by similar CO pollution sources. These relationships are strongest among nearby sites. A few weaker correlations suggest that local environmental conditions or site-specific factors may affecting CO levels differently.

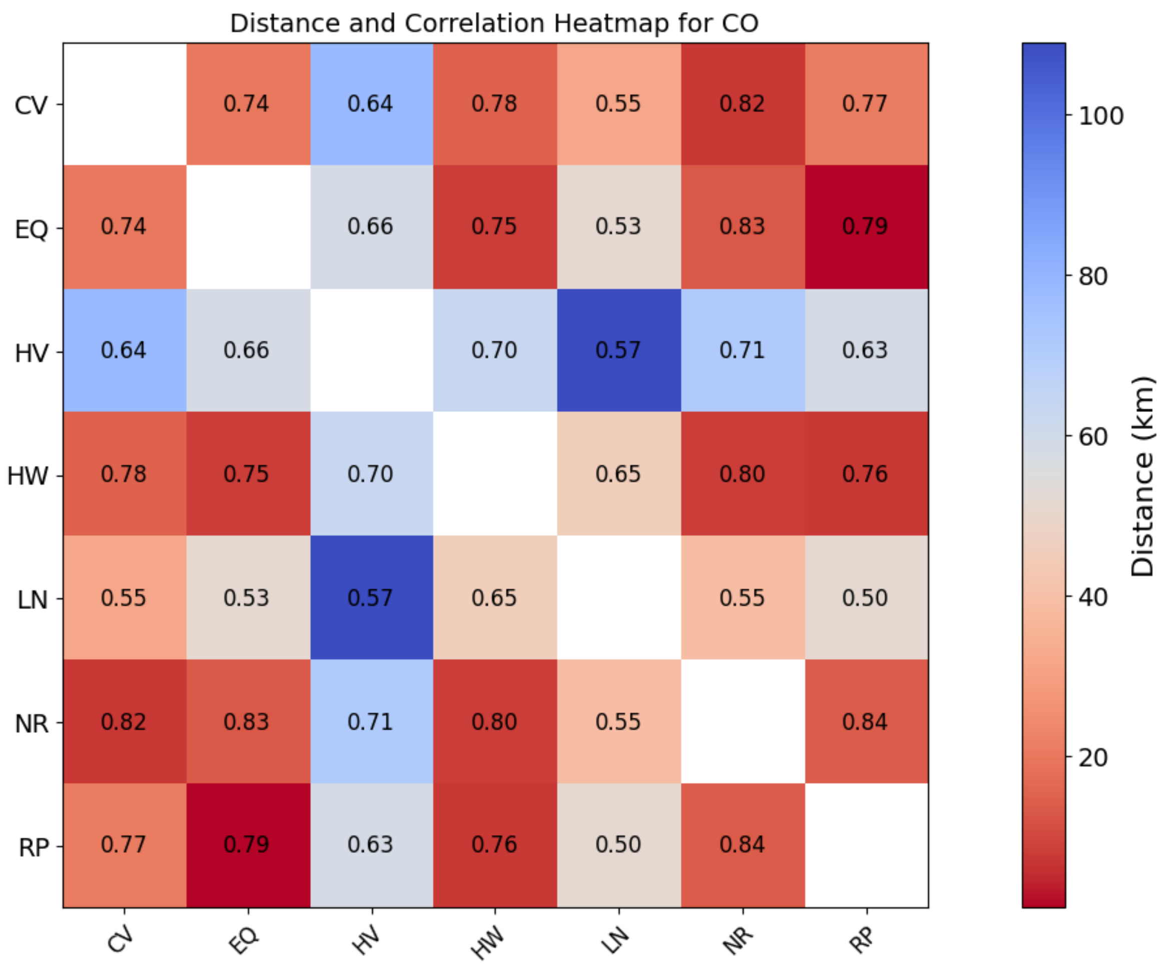

Figure 57. Distance and correlation matrix for CO concentrations among all monitoring sites in the UDAQ network.

The mean removal bias (Figure 58) across the sites shows a mix of small negative and positive values with most sites experiencing slight biases, with no extreme variations in either direction. Rose Park (RP) site exhibits the highest positive bias at 0.13, while Environmental Quality (EQ) has the highest negative bias at -0.13. The rest of the sites have a nearly neutral bias.

A summary of the final recommendations for all CO monitors in the network is shown in Table 32.

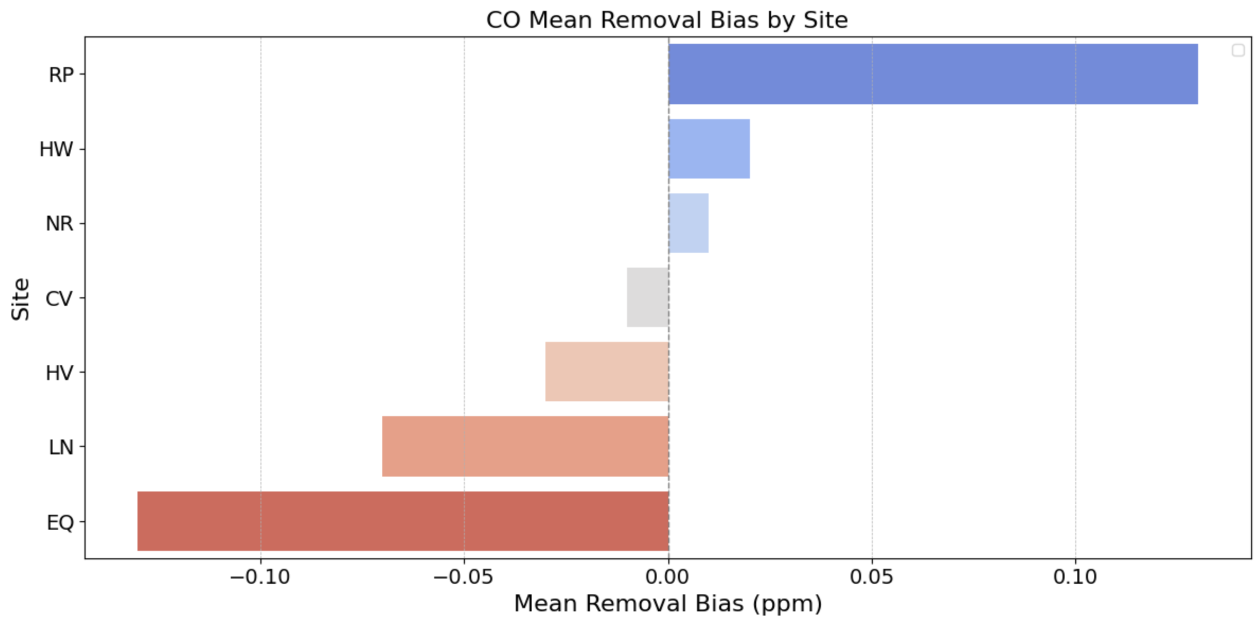

Figure 58. Removal bias results for all CO monitors in the UDAQ network.

Table 32. List of CO monitors in Utah air monitoring network and recommendations for network modification.

Site	County	Monitor Type	Spatial scale	Monitoring objective	Value	Recommendation
Hawthorne	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** – **Required**-Utah NCore site -Supports CO maintenance plan and model performance evaluation -Provide insight into historical trends	Continue monitoring
Near Road	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** – **Required**-Part of the Near-Road Monitoring Program -Support the assessment of air quality near major roadways	Continue monitoring
Lindon	Utah	SLAMS	Population Neighborhood	Population exposure	**High**- Supports CO maintenance plan/model performance evaluation; design value location for CO NAAQS	Continue monitoring
Harrisville	Weber	SLAMS	Population Neighborhood	Population exposure	**High**-started in 2019 to monitoring CO as Ogden #2 station was shut down -Supports CO maintenance plan and model performance evaluation	Continue monitoring
CopperView	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**Moderate** –Supports measurement comparisons in south Valley with those at the NCORE station	Continue monitoring
Environmental Quality	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**High** -Higher Average daily traffic counts - Near interstate freeways and Salt Lake City International Airport	Continue monitoring
Rose Park	Salt Lake	SLAMS	Population Neighborhood	Population exposure	**Low**- Identified in assessment as area for assessing population exposure -Monitoring gaseous species started in 2018	Continue monitoring

3.3 Lead (Pb)

Historically, major sources of lead emissions came from combustion of leaded fuel as on-road motor vehicle fuel emissions. However, given that leaded gasoline for automobiles was completely eliminated by the end of 1995 in the U.S., the only sources of lead in Utah include extraction and processing of metallic ores as well as piston-engine aircrafts' emissions.

On November 12, 2008, the EPA revised the primary and secondary NAAQS for lead to 0.15 $\mu g/m^3$ in total suspended particles (TSP). This updated standard is ten times lower than the previous standard of 1.5 $\mu g/m^3$, which was issued by the EPA in 1978. To comply with the standard, a rolling three-month average lead concentration must not exceed 0.15 $\mu g/m^3$.

The State of Utah has been in compliance with the lead NAAQS since 1982, and in 2005, the EPA authorized the discontinuation of lead monitoring in the state. However, following the establishment of new lead monitoring requirements by the EPA in 2008 and 2010, DAQ resumed lead monitoring at Magna, a site near the Kennecott copper smelter, from 2010 until June 2017. Due to the extremely low concentrations observed, the EPA approved the discontinuation of monitoring at this site in 2017. That waiver has expired, and DAQ is now initiating a new waiver application.

Moving forward, DAQ and the EPA will continue to monitor the requirements, including source emission thresholds, population changes, and any revisions to the NAAQS that may trigger the need to resume lead monitoring in Utah. Additionally, the DAQ will assess any new or existing lead sites with changes in emission levels to determine if further monitoring is necessary.

3.4 Chemical Speciation (CSN)

The Utah Department of Air Quality (UDAQ) currently operates four $PM_{2.5}$ chemical speciation sites, including Hawthorne (HW), Bountiful Viewmont (BV), Lindon (LN), and Smithfield (SM). Hawthorne (HW) site in Salt Lake County is an EPA-designated CSN monitoring station, operating on a 1-in-3-day sampling schedule. Bountiful Viewmont (BV) in Davis County, Lindon (LN) in Utah County, and Smithfield (SM) in Cache County are SLAMS $PM_{2.5}$ speciation sites, operating on a 1-in-6-day sampling schedule. Data from the speciation network is primarily used to determine $PM_{2.5}$ chemical composition and sources as well as the spatial and temporal variation in its components. There are over 50 species consisting of ions, elements, and carbon species reported by the CSN sites. A list of parameters measured in the CSN sites are provided in Table 33. The Utah DAQ does not intend to propose any modifications to the CSN network.

Table 33. List of parameters measured at the DAQ monitoring CSN sites.

Parameter (Method)	Compounds
$PM_{2.5}$ Speciation (Met One SASS/SuperSASS Nylon)	Ammonium Ion, Sodium Ion, Potassium Ion, Nitrate Ion, Sulfate Ion
$PM_{2.5}$ (Met One SASS/SuperSASS Teflon)	Antimony, Arsenic, Aluminum, Barium, Bromine, Cadmium, Calcium, Chromium, Cobalt, Copper, Chlorine, Cerium, Cesium, Iron, Lead, Indium, Manganese, Nickel, Magnesium, Phosphorus, Selenium, Tin, Titanium, Vanadium, Silicon, Silver, Zinc, Strontium, Sulfur, Rubidium, Potassium, Sodium, Zirconium
$PM_{2.5}$ (URG 3000N w/Pall Quartz filter and Cyclone Inlet)	Elemental carbon (*E1 CSN, E2 CSN, E3 CSN, EC CSN TOR, EC CSN TOT*). Organic carbon (*OC1 CSN, OC2 CSN, OC3 CSN, OC4 CSN, OC CSN TOR, OC CSN TOT, OP CSN TOR*), OP CSN TOT, TC CSN

3.5 Multipollutant Monitoring Network (NCore)

The Utah UDAQ currently operates one multi-pollutant network NCore site, Hawthorne (HW), located in Salt Lake County. This site is equipped with several advanced measurement systems to monitor PM ($PM_{2.5}$ and PM_{10}), ozone, NO_2, true-NO_2, trace levels of CO, SO_2, total reactive nitrogen (NO_y), carbonyl compounds, organic, and elemental carbon as well as meteorological parameters including the Mixing Layer Height. This site satisfies federal requirements for the Photochemical Assessment Monitoring Station (PAMS) network program.

3.6 Photochemical Assessment Monitoring System (PAMS) and Enhanced Monitoring Plan (EMP)

The Utah UDAQ currently operates one PAMS site at Hawthorne (HW), located in Salt Lake County. The PAMS program is designed with the objective to produce an air quality database to be used to evaluate and refine ozone prediction models. In addition, the program will assist to identify and quantify the ozone precursors, establish the temporal patterns and associated meteorological conditions to assist and refine the control strategies. UDAQ is measuring the following parameters at the PAMS required site:

- Carbonyls
- Meteorological parameters: ambient temperature, wind direction, wind speed, atmospheric pressure, relative humidity, precipitation, mixing layer height, solar radiation, and UV radiation
- Speciated VOCs
- True NO_2
- NO/NO_y
- Ozone

- Continuous Formaldehyde

The Utah DAQ PAMS site collects hourly speciated VOC measurements with a Markes/Agilent autoGC (Figure 59) which operates on a year-round basis. Carbonyl species are collected in a three 8-hour averaged samples per day on a 1-in-3-day schedule from June 1 to August 31 and 1 in 24-hour on a 1-in-3-day for the remaining part of the year. The list of the speciated VOCs and carbonyls measured at the site are listed in Table 34.

Figure 59. Markes/Agilent autoGC.

Table 34. List of PAMS VOCs and Carbonyls measured at the UDAQ PAMS site.

Parameter	Compounds
VOCs	Total NMOC (non-methane organic compound), n-Dodecane, Ethane, Ethylene, Propane, Propylene, Acetylene, n-Butane, Isobutane, trans-2-Butene,cis-2-Butene, 1,3-Butadiene, n-Pentane, Isopentane, 1-Pentene, trans-2-Pentene, cis-2-Pentene, 3-Methylpentane, n-Hexane, n-Heptane, n-Octane, n-Nonane, n-Decane, Cyclopentane, Isoprene, 2,2-Dimethylbutane, 1-Hexene, 2-Methyl-1-pentene, 2,4-Dimethylpentane, Cyclohexane, 3-Methylhexane, 2,2,4-Trimethylpentane, 2,3,4-Trimethylpentane, 3-Methylheptane, Methylcyclohexane, Methylcyclopentane, 2-Methylhexane, 1-Butene, 2,3-Dimethylbutane, 2-Methylpentane, 2,3-Dimethylpentane, n-Undecane, 2-Methylheptane, 2-Methylheptane, m/p Xylene, Benzene, Toluene, Ethylbenzene, o-Xylene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, n-Propylbenzene, Isopropylbenzene, o-Ethyltoluene, m-Ethyltoluene, p-Ethyltoluene, m-Diethylbenzene, p-Diethylbenzene, Styrene, 1,2,3-Trimethylbenzene
Carbonyls	Formaldehyde, Acetaldehyde, Propionaldehyde, Butyraldehyde, Hexanaldehyde, Valeraldehyde, Crotonaldehyde, Acetone, Methyl ethyl ketone, Benzaldehyde

The Utah DAQ is developing an Enhanced Monitoring Plan (EMP) in fulfillment of federal regulations, 40 CFR Part 58, Appendix D 5(h). These regulations, require that any states with any area designated moderate and above 8-hour O_3 nonattainment, and any state within the Ozone Transport Region (OTR), develop, implement, and submit an EMP for O_3 to the regional office of the Environmental Protection Agency (EPA) no later than October 1, 2019, or two years following the effective date of a designation to a classification of moderate or above O_3 nonattainment. The EMP is intended to provide monitoring organizations the flexibility to implement any additional monitoring beyond the minimum requirements for the State and Local Air Monitoring Stations (SLAMS) to complement the needs of their area.

The Utah DAQ, in collaboration with the Technical Analysis Section SIP modelers and the Air Monitoring Section, identified additional measurements and strategic sampling locations needed to better understand ozone formation and transport in the state. As part of the EMP, hourly averaged measurements of speciated volatile organic compounds (VOCs) (PAMS target list compounds), True NO_2 using Cavity Attenuated Phase Shift (CAPS) spectroscopy, and total reactive nitrogen (NOY) are planned for six sites along the Wasatch Front. These measurements are currently being reported at Bountiful (BV), Erda (ED), and Red Butte (RB). In addition, hourly averaged speciated VOC data are collected at the Environmental Quality (EQ) station and the Lake Park (LP) monitoring site. VOC measurements at Lake Park began reporting in May 2025. A sixth site is still being planned for a location to be determined (TBD) near the southern end of the valley.

Hourly averaged measurements of mixing height, formaldehyde, and hydrogen chloride have been implemented at selected sites (see Table 4) to support O_3 local air quality modeling and O_3 research studies. Hourly averaged mixing layer height data collected at the PAMS site (HW) has been sent to the Unified Ceilometer Network (UCN). In the near future, data from stations operating complementary equipment to meet EMP requirements will also be sent to the UCN (https://ucn-portal.org/)

These additional measurements, conducted year-round as part of the EMP, will be reviewed to ensure that the location remains optimal.

Data summary

This summary provides a brief overview of hourly VOC measurements collected across the monitoring network. It begins with historical trends of the most abundant compounds detected by the GC system at the Utah DAQ PAMS site in Hawthorne. This is followed by a series of 24-hour weekday vs. weekend trends for all the sites. Finally, the VOC data are grouped by chemical classes (alkanes, alkenes, aromatics, acetylene, and isoprene) to better visualize the emission patterns observed across the sites.

Historical trends

Figures 60-63 show the distribution of mean daily VOC concentrations for specific compounds during particular seasons and years. The seasonal analysis of key VOCs reveals consistent patterns across years, with most compounds exhibiting higher mean concentrations in winter and lower levels in summer. These trends reflect the influence of atmospheric conditions and possibly emission sources.
ETHANE consistently recorded the highest mean values among all compounds, especially in winter (ranging from 15.32 to 20.55 ppbc), and declined sharply during summer, reaching as low as 4.48 ppbc

in 2024. This demonstrates a stable year-to-year seasonal pattern. PROPANE followed a similar trend, with winter means up to 11.29 ppbc and summer values ranging between 3.18 and 4.24 ppbc, again showing consistent behavior.

ISO-BUTANE consistently recorded its highest mean concentrations in winter, peaking at 4.93 ppbc in 2021. In contrast, summer months saw a notable decrease, with values dropping to around 1.7 ppbc. Similarly, N-BUTANE exhibited a comparable trend, with its highest mean concentrations in winter (9.13 ppbc in 2021), while summer 2021 concentrations were lower at 3.7 ppbc. ISO-PENTANE also showed elevated concentrations in winter, peaking at 6.42 ppbc in 2021, while summer and spring months consistently exhibited lower levels. N-PENTANE followed the same pattern, with higher concentrations in winter, reaching a peak of 4.06 ppbc in 2021, and a decrease in spring and summer.

BENZENE, TOLUENE, and M&P-XYLENES all exhibited elevated winter concentrations, with notable declines in spring and summer. ETHYLBENZENE remained at relatively low levels <1.5 ppbc, though winter peaks were evident. ETHYLENE also showed a consistent seasonal cycle, with higher concentrations in winter (6.37 ppbc in 2021) and lower levels in the summer near 1 ppbc. This seasonal variation likely reflects photochemical degradation in the warmer months and limited vertical mixing during the winter

ISOPRENE showed higher concentrations in summer, peaking at 33.81 ppbc in 2021, with a mean of 1.45 ppbc that year. In contrast, winter 2021 recorded a much lower mean of 0.2 ppbc. Similar seasonal trends were observed in subsequent years, with summer peaks of 16.8 ppbc in 2022, 9.17 ppbc in 2023, and 21 ppbc in 2024. Winter concentrations remained low across these years, averaging 0.13 ppbc in 2022, 0.14 ppbc in 2023, and 0.13 ppbc in 2024. This seasonal trend aligns with the known behavior of isoprene, which is primarily emitted by plants during warmer temperatures to help them manage heat stress and oxidative damage.

Overall, year-to-year trends were very consistent across all compounds, highlighting persistent seasonal influences and stable emission patterns during the observation period. The plots further reveal recurring wintertime enhancements in VOC concentrations, consistent with increased combustion-related emissions and meteorological factors such as temperature inversions and reduced atmospheric mixing.

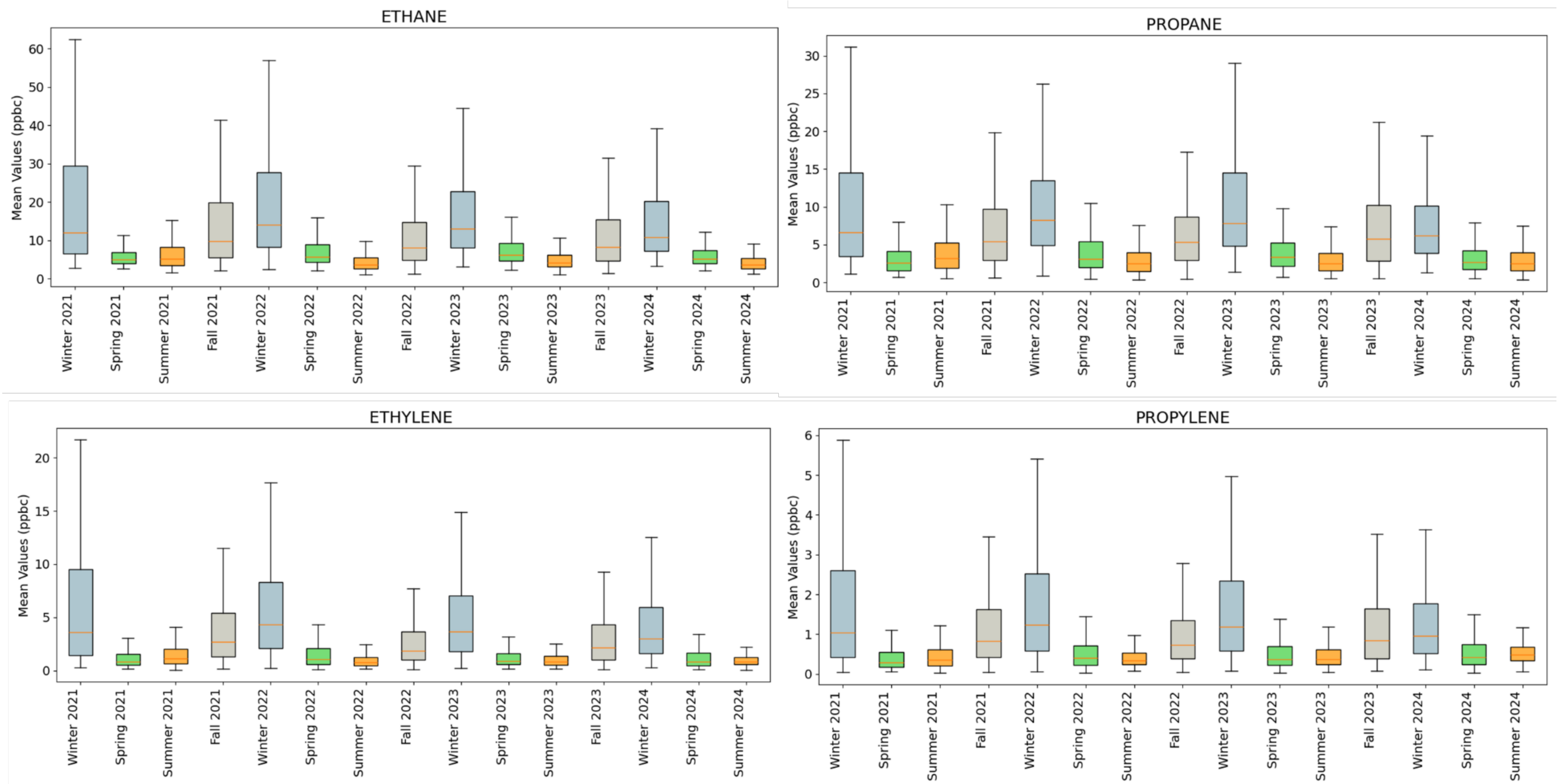

Figure 60. Seasonal box plots for ETHANE, PROPANE, ETHYLENE, and N-BUTANE from 2021 to 2024.

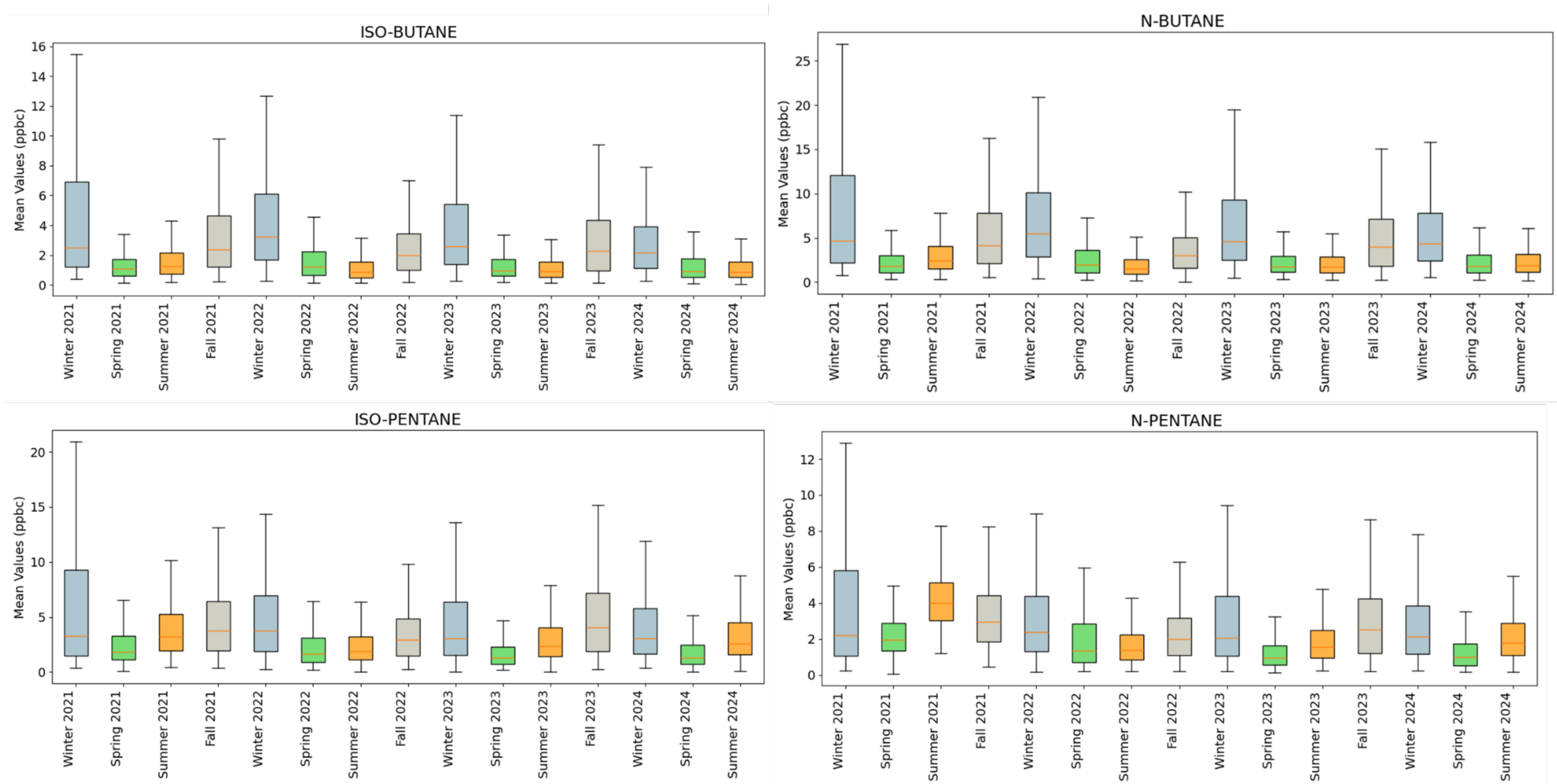

Figure 61. Seasonal box plots for ISOBUTANE, N-BUTANE, ISO-PENTANE and N-PENTANE from 2021 to 2024.

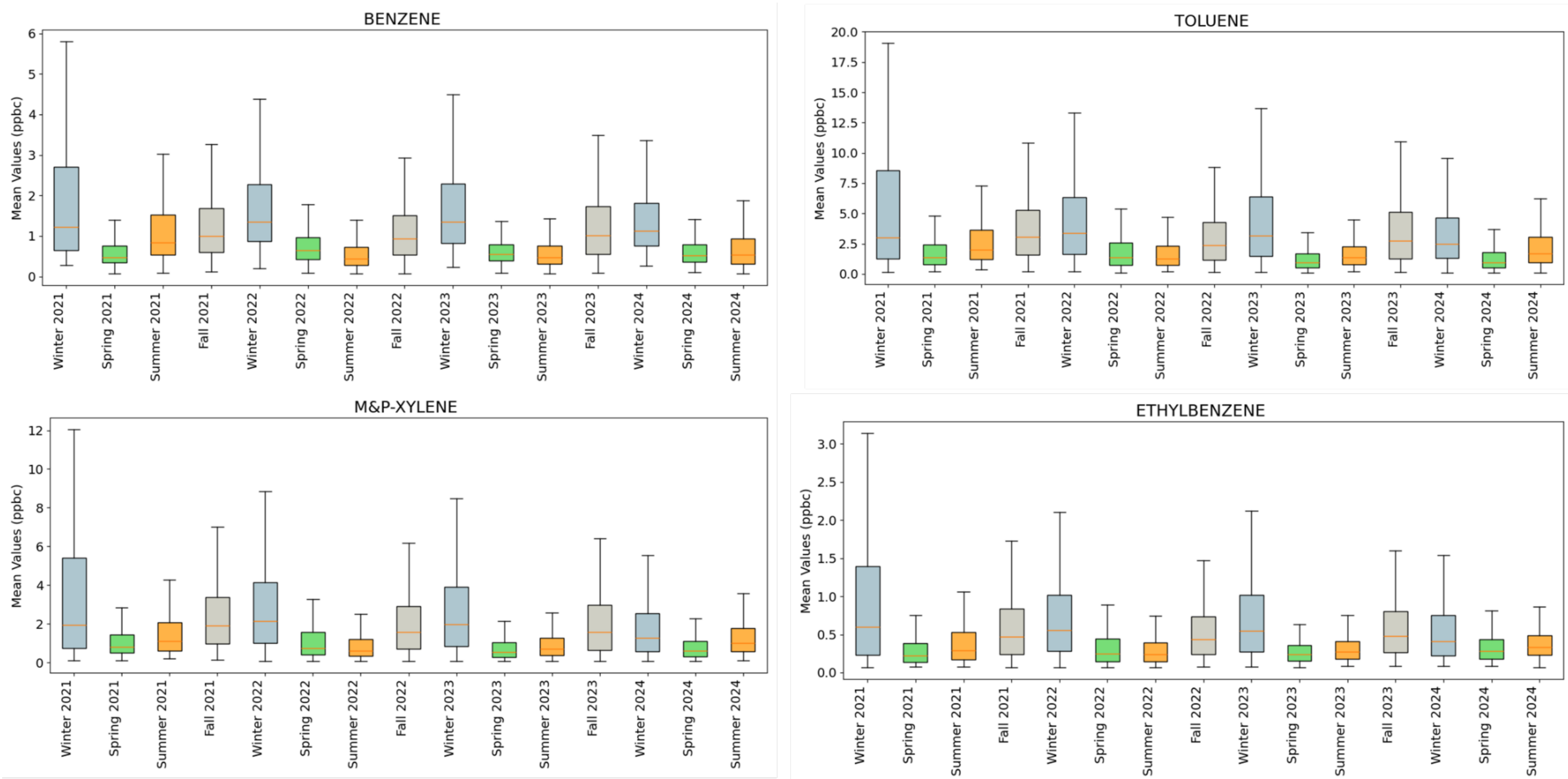

Figure 62. Seasonal box plots for BENZENE, TOLUENE, M&P- XYLENE and ETHYLBENZENE from 2021 to 2024.

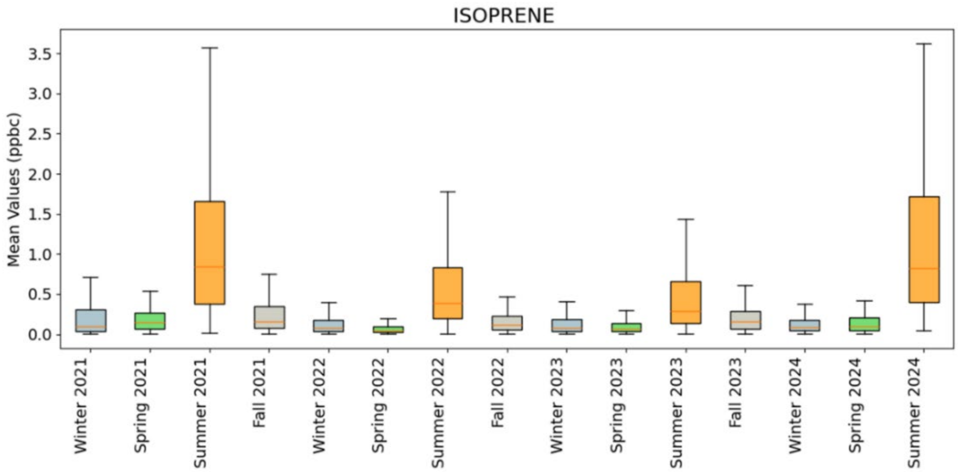

Figure 63. Seasonal box plots for ISOPRENE from 2021 to 2024.

Comparison of VOC Data Between Monitoring Sites (Preliminary Results)

Summer week days vs weekend days

The 24-hour volatile organic compound (VOC) trends for summer weekdays (Figure 64, Figure 66, Figure 68, Figure 70, and Figure 72) and weekends (Figure 65, Figure 67, Figure 69, Figure 71 and Figure 73) at the Hawthorne (HW), Bountiful (BV), Environmental Quality (EQ), Red Butte (RB) and Erda (ED) sites reveal distinct diurnal patterns in both individual compound behavior and total VOC.

The summer VOC trends across the five monitoring sites reveal consistent diurnal patterns, with elevated concentrations during weekday mornings (typically 6–9 AM) driven by vehicular traffic, fuel handling, and industrial activity. Light alkanes such as ethane, propane, and n-butane, along with BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), dominate the VOC profiles and are closely linked to combustion processes, gasoline-related emissions, and petrochemical operations.

On weekends, overall VOC levels generally decrease, and morning peaks become less pronounced, reflecting reduced anthropogenic activity. However, persistent emissions, particularly of light alkanes, suggest continuous contributions from industrial or domestic sources.

Site-specific patterns highlight unique influences:

- **BV** shows strong and sustained industrial signatures.
- **RB** exhibits sharp morning increases tied to traffic, along with elevated isoprene levels, indicating a significant biogenic contribution.
- **EQ** reflects impacts from freeway, airport, and industrial activity.
- **ED** may be influenced by episodic wildfire smoke events.
- **HW** displays weekend propane spikes likely linked to domestic use.

Across all sites, iso-pentane, n-pentane, and BTEX compounds consistently serve as reliable tracers of gasoline-related emissions. Biogenic VOCs like isoprene peak in the afternoon due to sunlight and temperature, maintaining stable patterns throughout the week. Overall, the data emphasize the combined influence of traffic-related and industrial sources in shaping ambient VOC concentrations during Summer 2024 at the monitored locations.

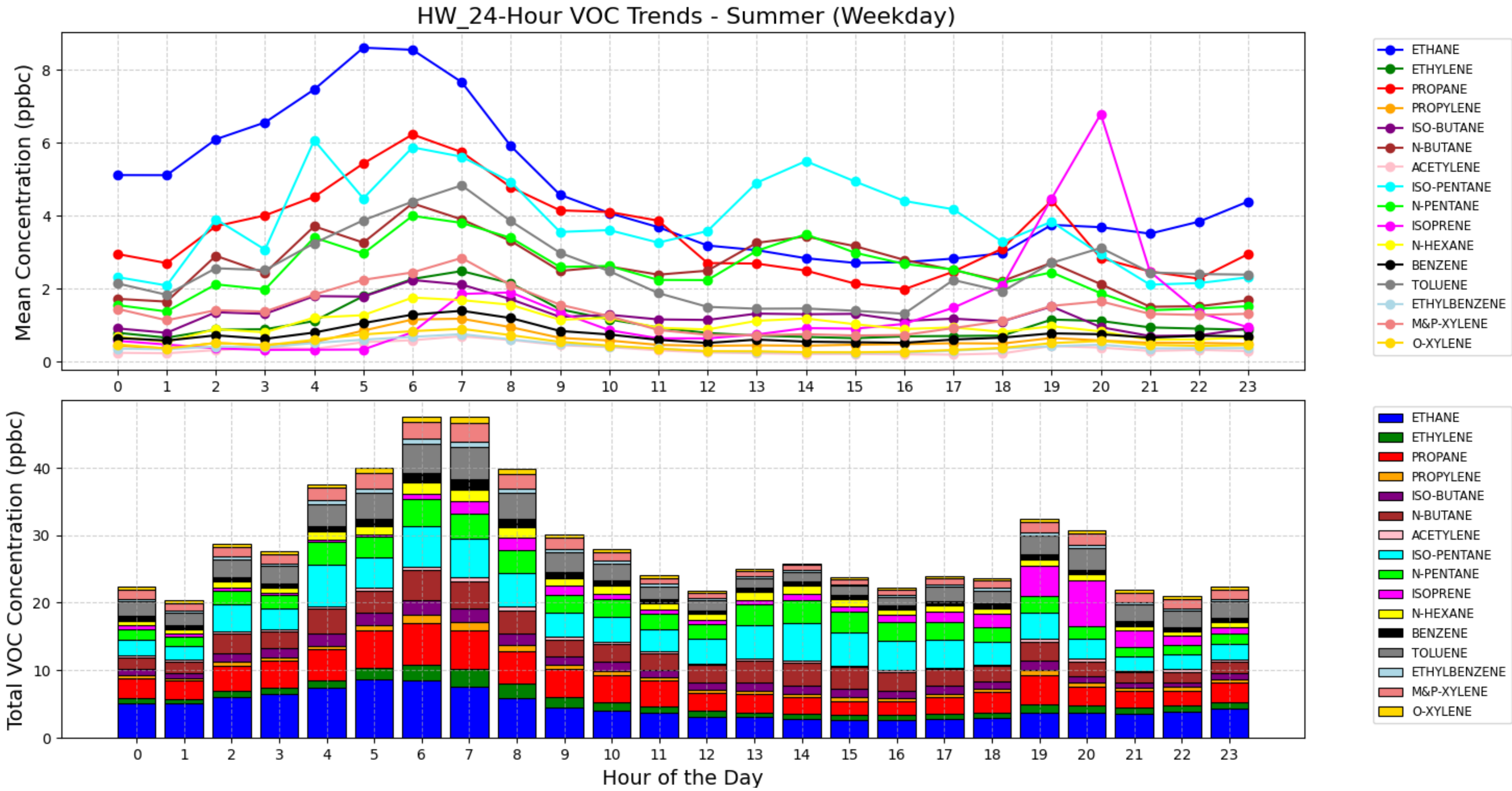

Figure 64. Average diurnal patterns observed on summer 2024 weekdays at Hawthorne site.

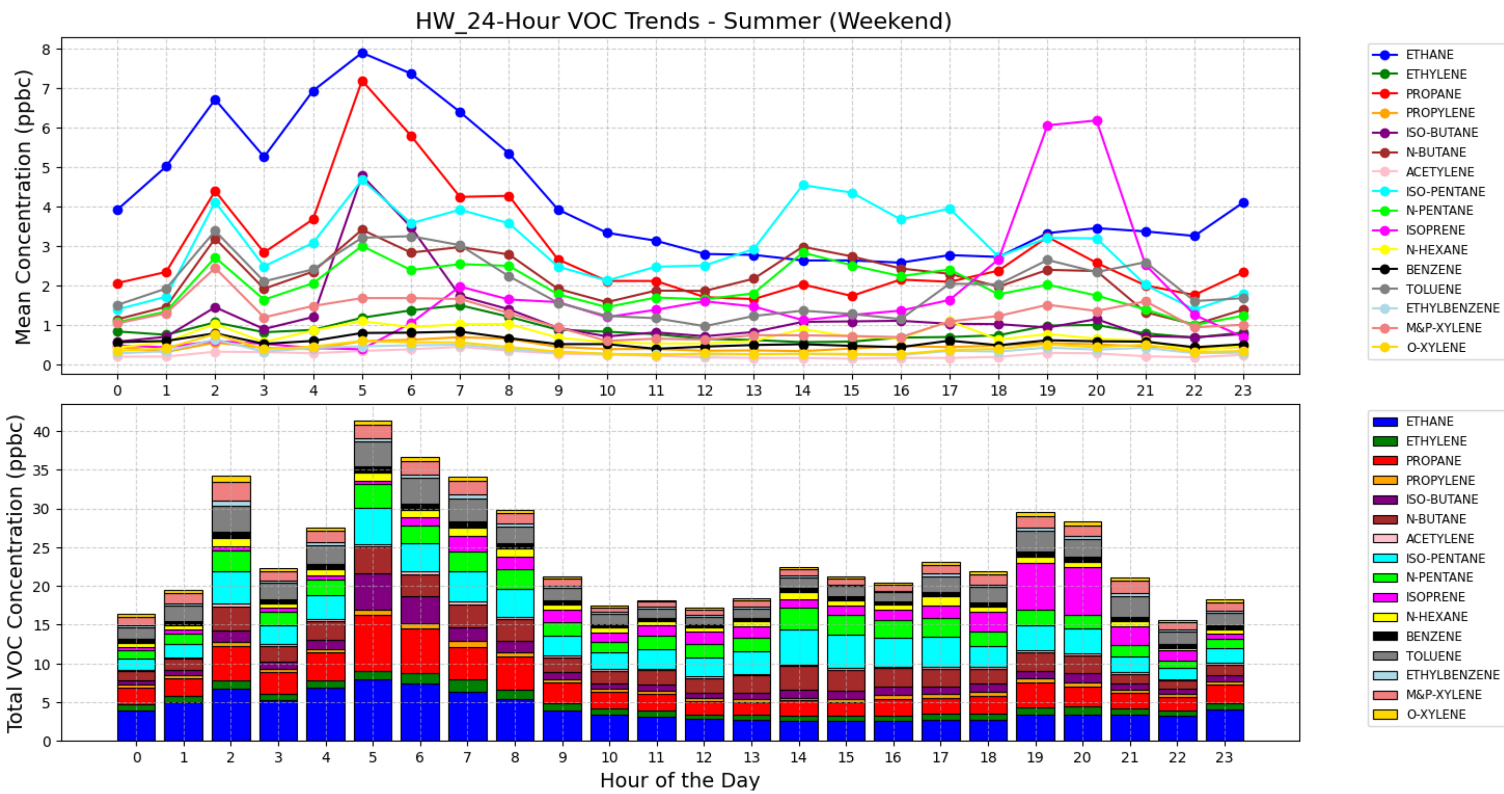

Figure 65. Average diurnal patterns observed on summer 2024 weekend at Hawthorne site.

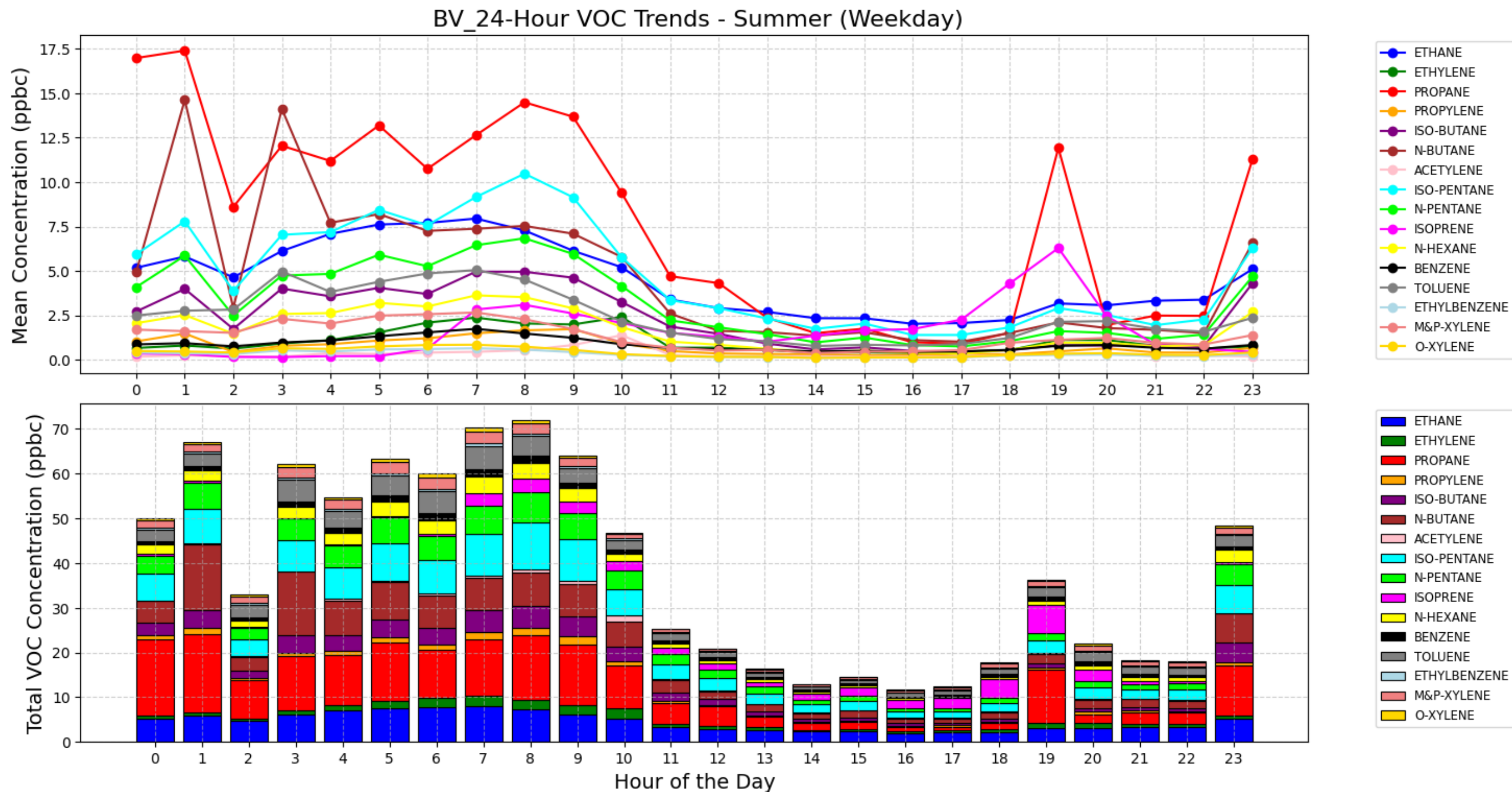

Figure 66. Average diurnal patterns observed on summer 2024 weekdays at Bountiful site.

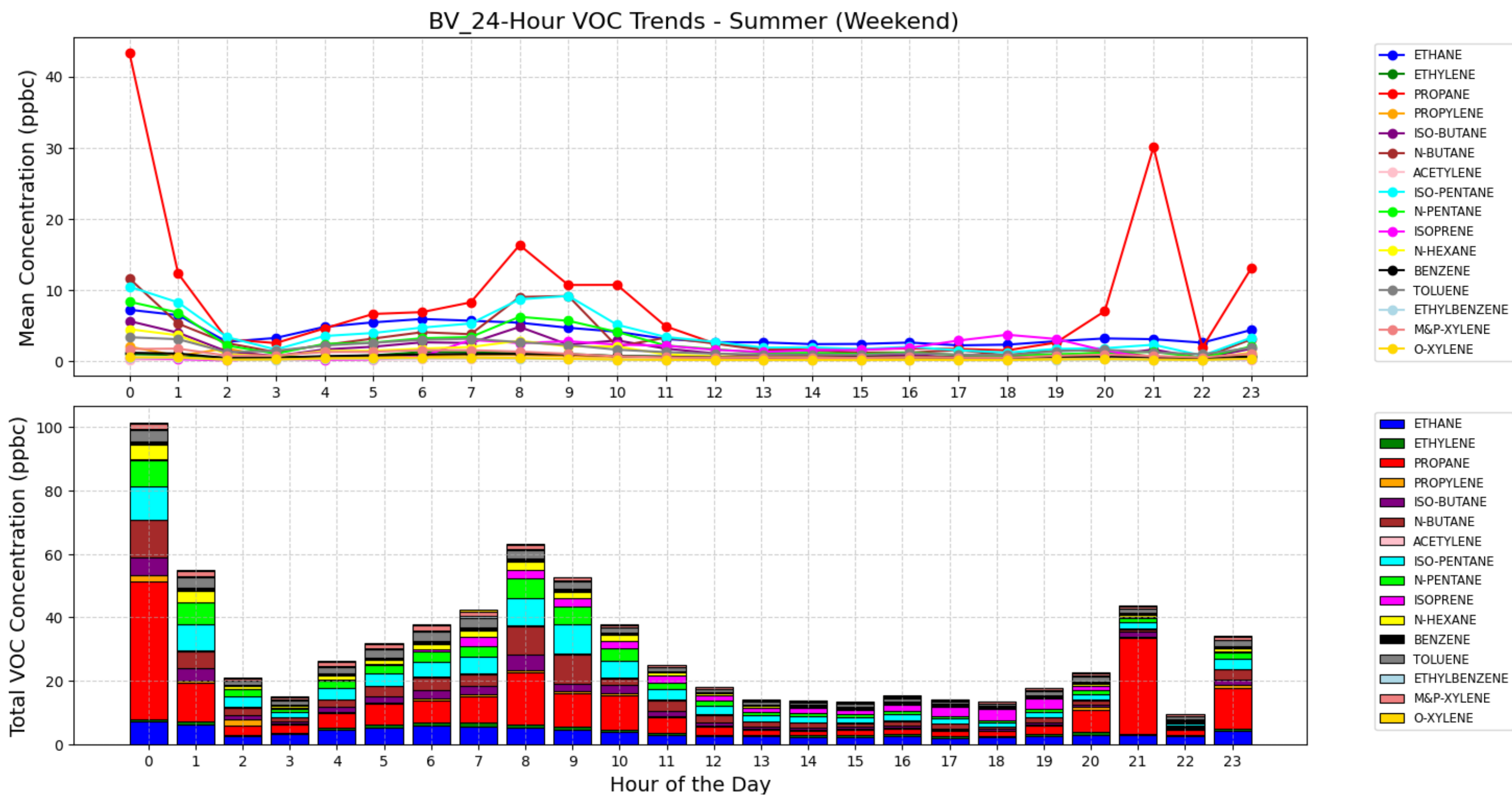

Figure 67. Average diurnal patterns observed on summer 2024 weekends at the Bountiful site. Note that the data for the BV GC site was not validated due to a series of events, including AC unit issues, which resulted in limited data availability. However, a comparison of VOC concentrations reported by the GC with those reported by the Air Toxics Trends Program for the days with available data was conducted as a means of validating the BV GC data.

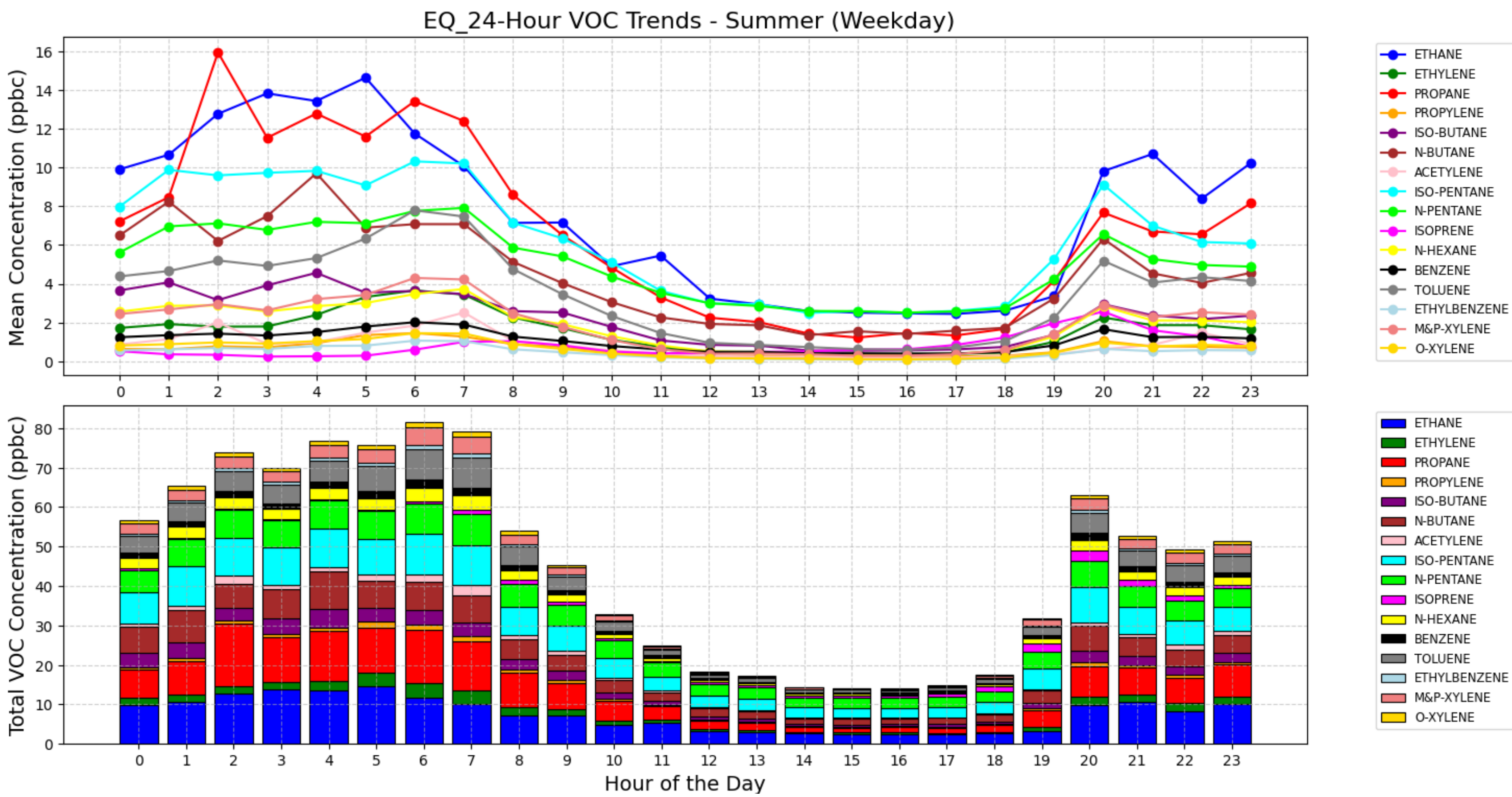

Figure 68. Average diurnal patterns observed on summer 2024 weekdays at Environmental Quality site.

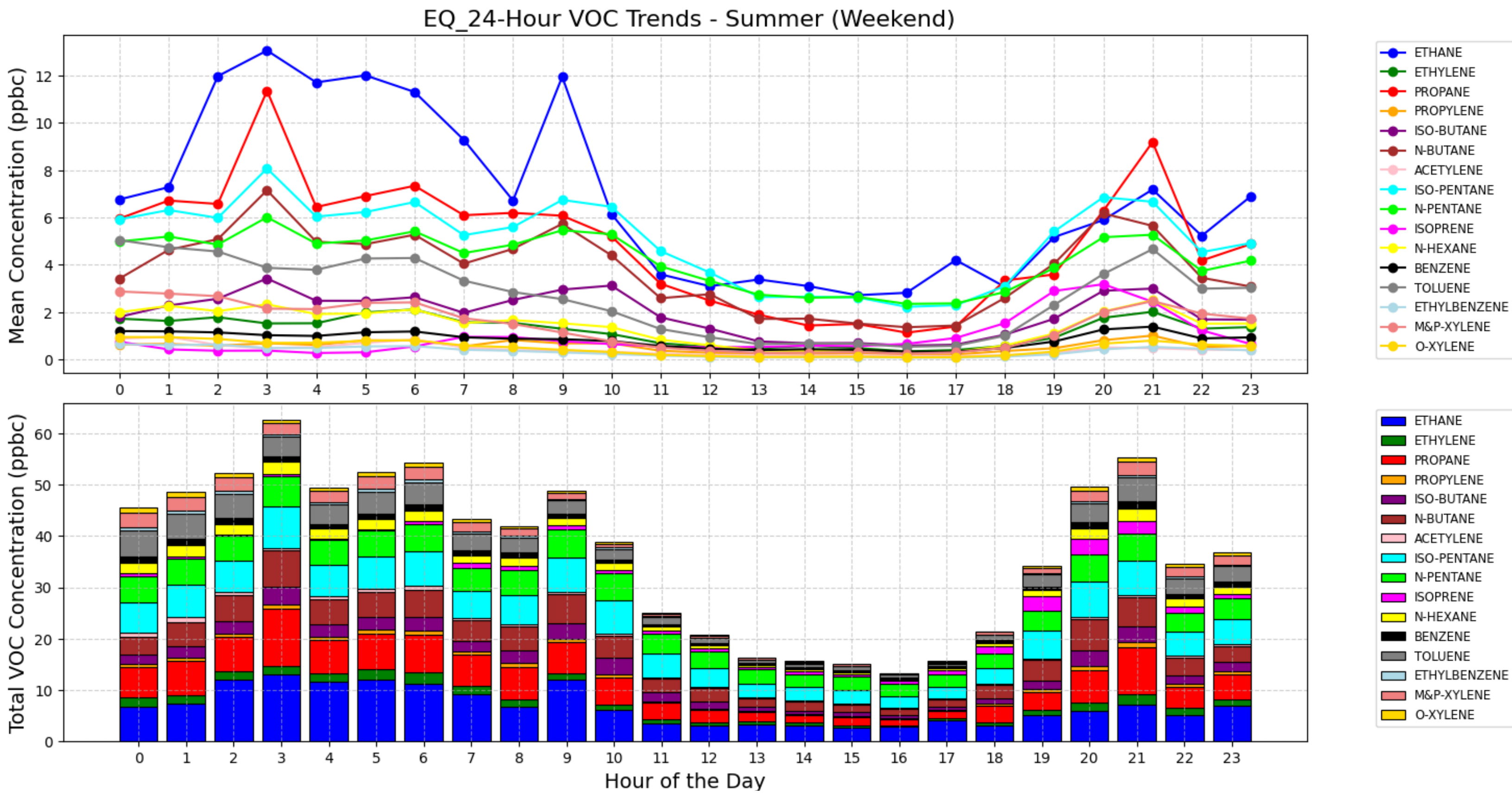

Figure 69. Average diurnal patterns observed on summer 2024 weekends at the Environmental Quality site.

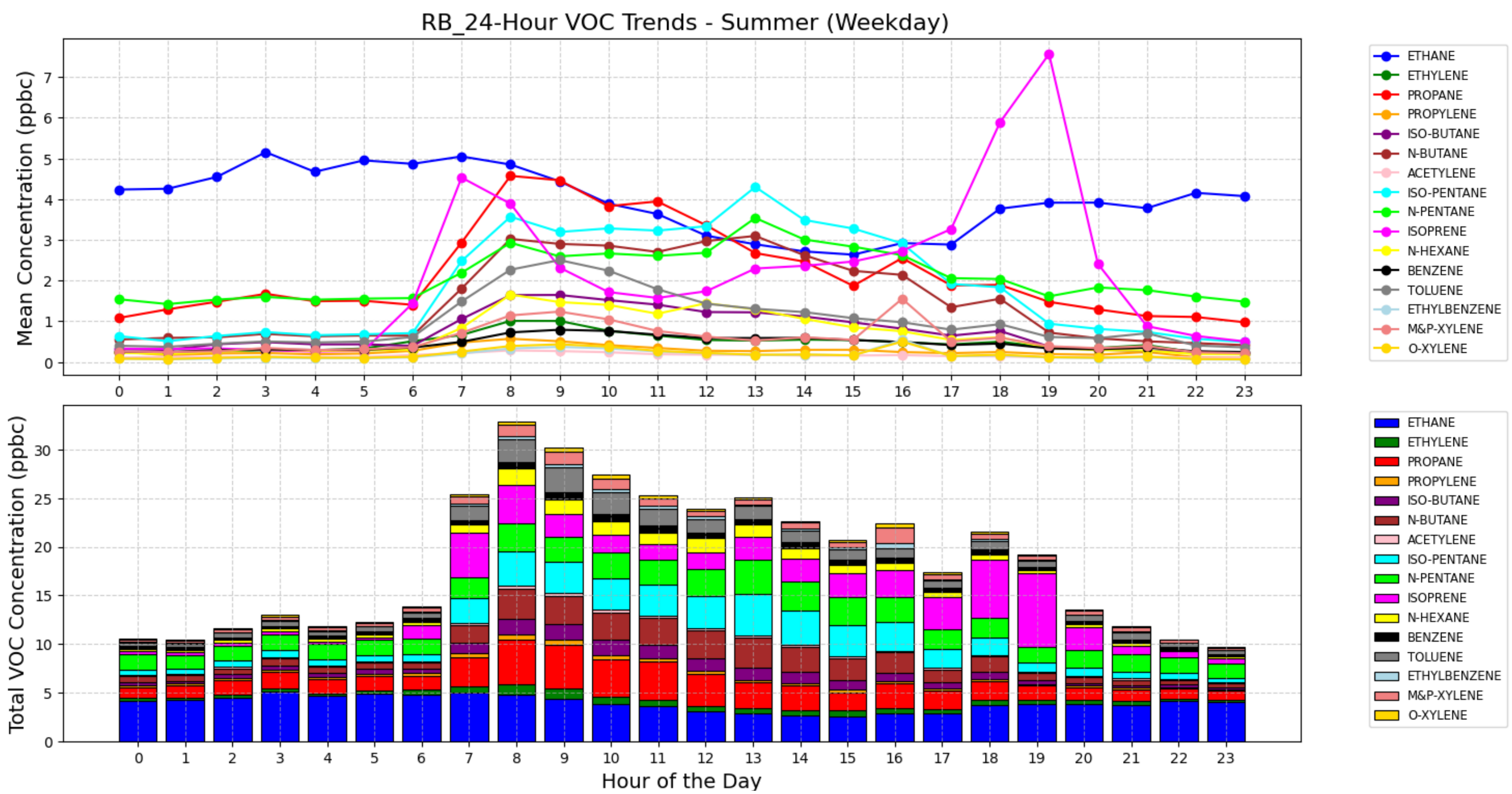

Figure 70. Average diurnal patterns observed on summer 2024 weekdays at Red Butte site.

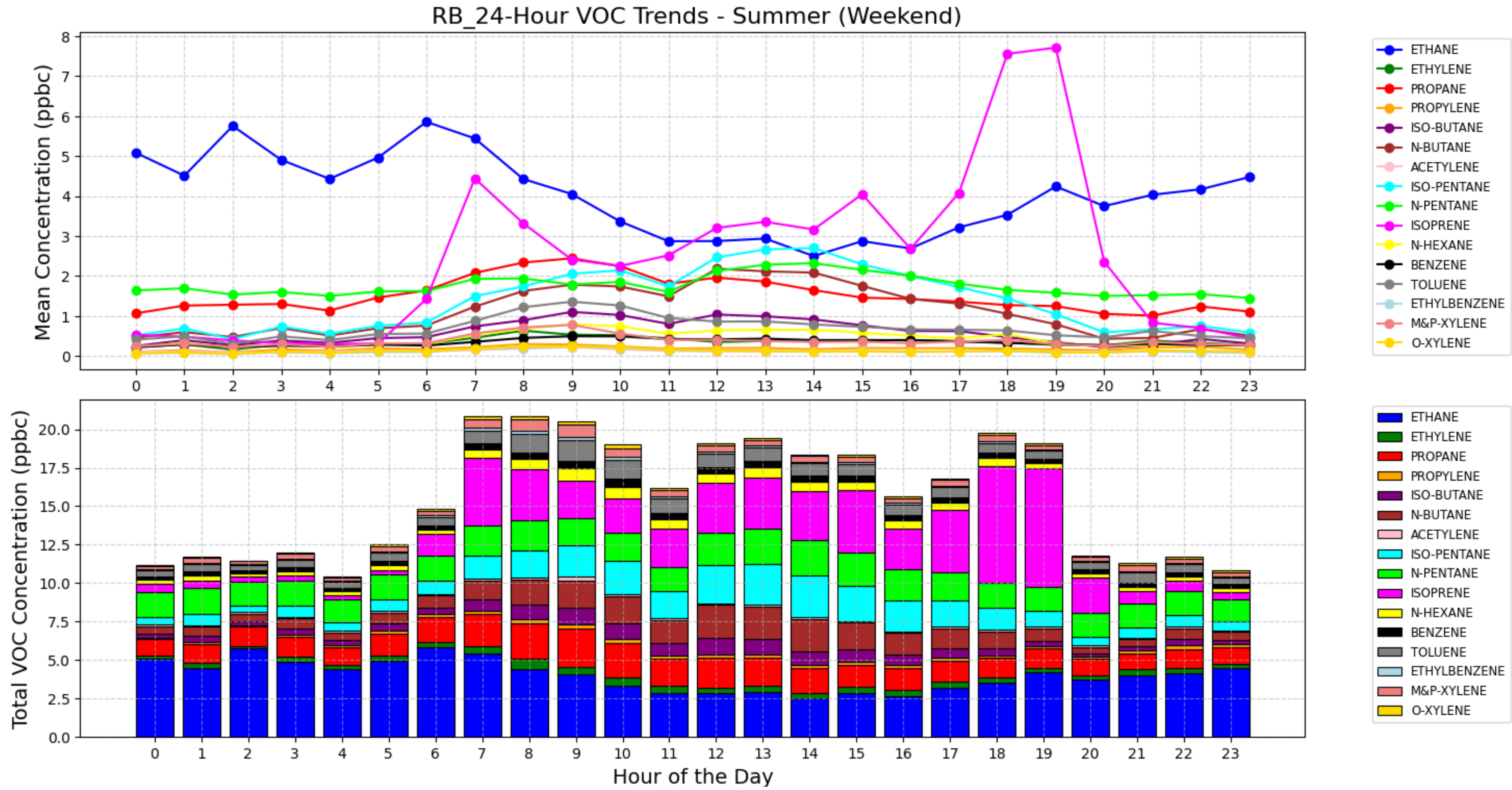

Figure 71. Average diurnal patterns observed on summer 2024 weekends at the Red Butte site.

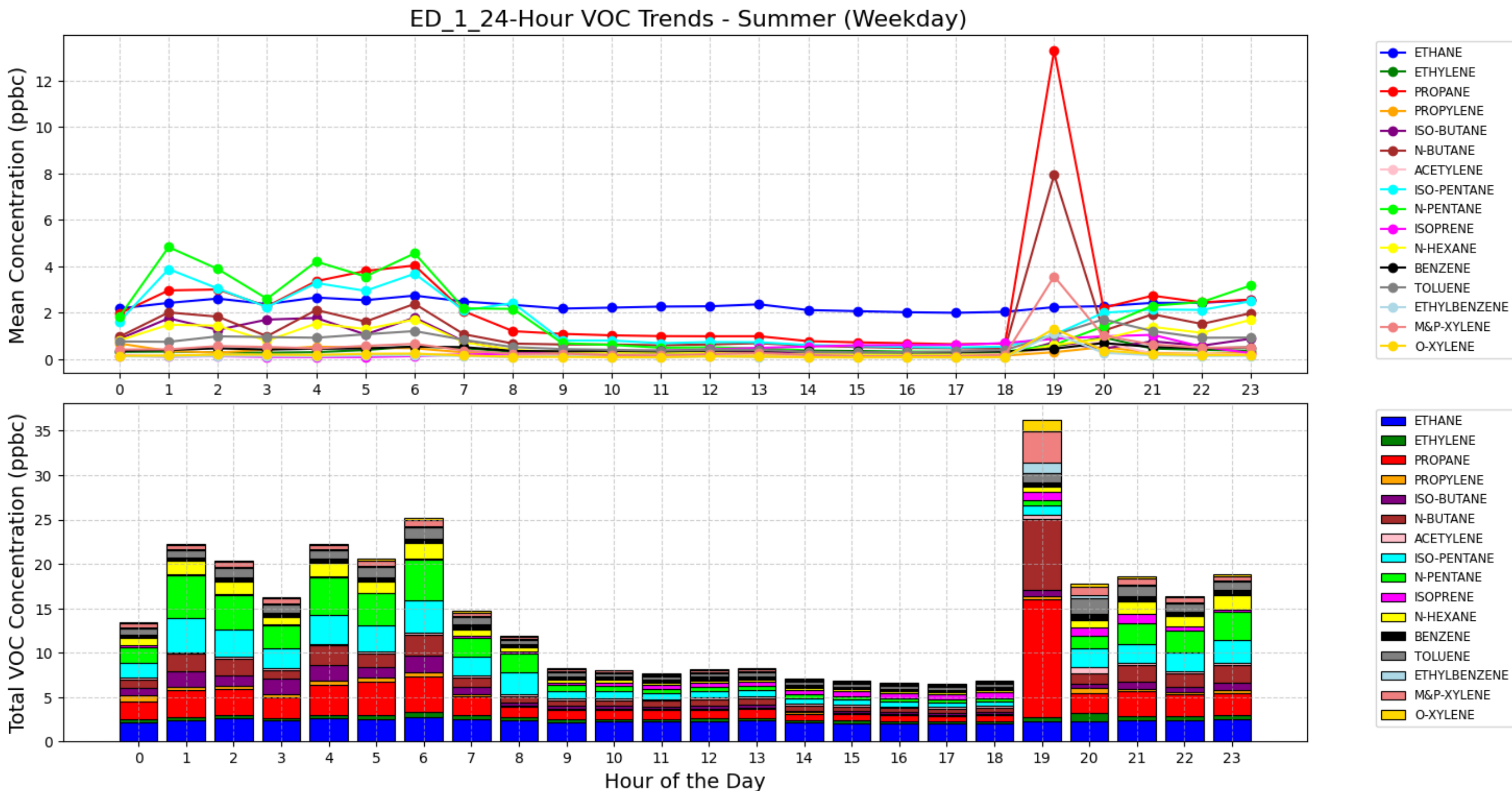

Figure 72. Average diurnal patterns observed on summer 2024 weekdays at Erda site.

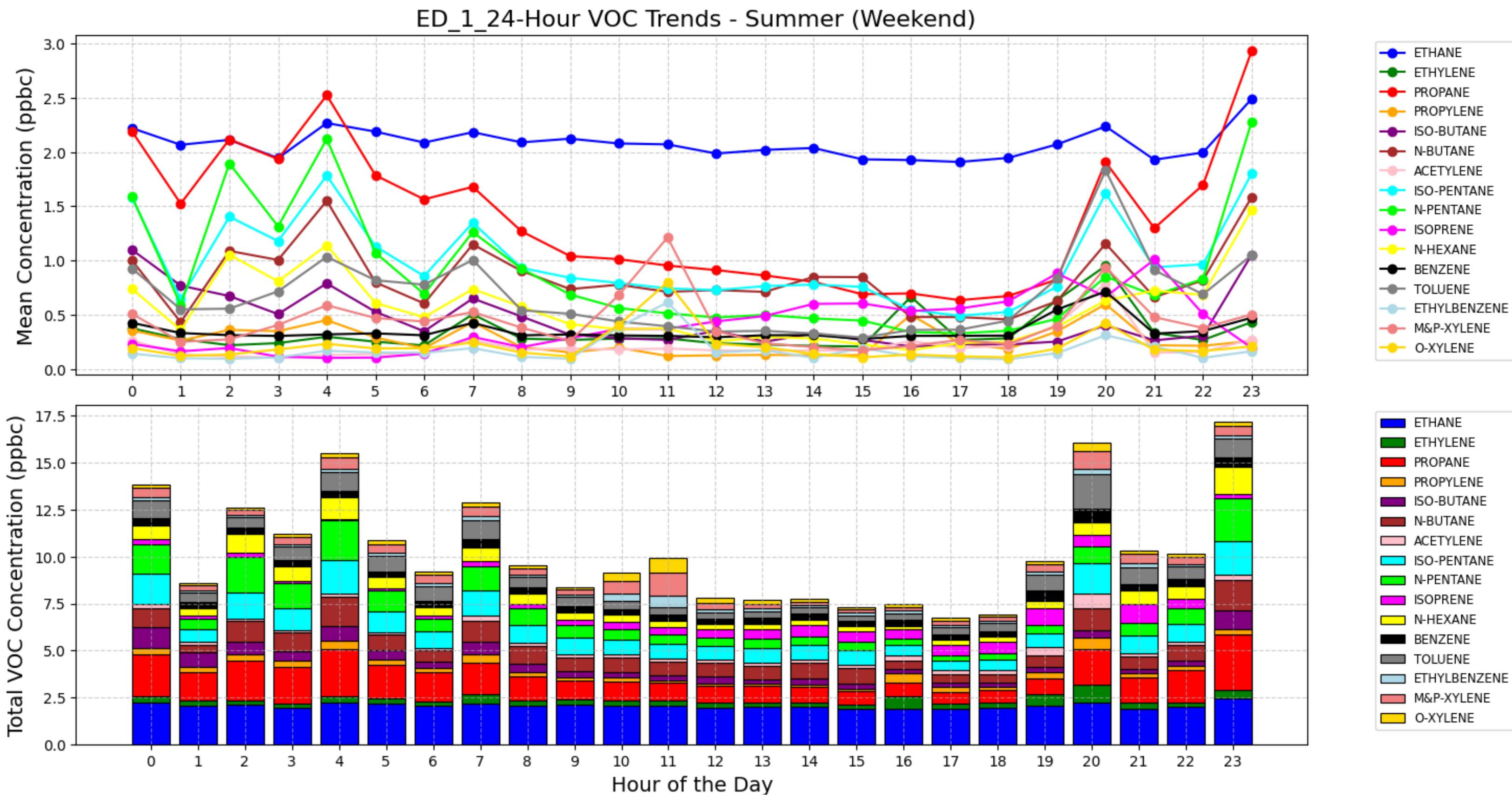

Figure 73. Average diurnal patterns observed on summer 2024 weekends at the Erda site.

Grouping chemical visualization

Volatile Organic Compounds (VOCs) measured by the gas chromatograph (GC) instrument (Table 33) can be grouped into chemical families to aid visualization and interpretation. These families include Alkanes, Alkenes, Alkynes, Aromatics, and Terpenes. The Utah DAQ currently identifies three terpene compounds, alpha-pinene, beta-pinene, and isoprene, within the dataset. However, alpha-pinene and beta-pinene are not reported to the Air Quality System (AQS) due to stability issues observed in the quality control (QC) canisters. These compounds were previously included in the Quality control Standards but were removed due to stability issues. Isoprene will be plotted separated from the other pinene compounds. The only Alkyne compound is Acetylene.

A map showing the locations of the GC sites in the network is presented in Figure 66. The pie charts in the figure represent the percentage contributions of each grouped chemical species measured at each site to the total VOC measurements and a summarized time series stacked bar trends are shown in Figures 67- 72

Among the five sites, EQ had the highest total non-methane total carbon (TNMTC) concentration at 54 ppbC, mainly due to high ALKANES and AROMATICS. BV followed with 48 ppbC, also driven by ALKANES. HW and RB had moderate levels (40 and 24 ppbC, respectively), with HW notable for its higher AROMATICS. ED had the lowest TNMTC at 17 ppbC, with low levels across all compounds. Notably, RB had the highest ISOPRENE, suggesting a stronger biogenic source.

When compared to the average of all sites:

- EQ showed the highest values, with ALKANES 54.5% above average, AROMATICS up 49.4%, and ACETYLENE nearly double the average. However, ISOPRENE was 37.7% below average.
- BV also showed elevated values: ALKANES (37.0%), ALKENES (38.0%), and TNMTC (31.9%) above average.
- HW was close to average overall, but had much higher AROMATICS (40.9%).
- ED had the lowest levels, with TNMTC 54.0% below average and most compounds 50–65% lower.
- RB was low in most compounds, but ISOPRENE was 73.4% above average.

These patterns highlight different emission sources and environmental factors affecting VOC levels at each site.

Please note that the GC at BV experienced issues during the summer. Due to the limited number of days the system reported data or passed quality control checks, the data was not submitted to AQS. To validate the GC data from BV site included in this summary, a comparison was conducted with overlapping VOCs reported by the Toxics program.

Volatile Organic Compounds (VOCs) measured by the gas chromatograph (GC) instrument (Table 34) can be grouped into chemical families to aid visualization and interpretation. These families include Alkanes, Alkenes, Aromatics, and Terpenes. The Utah DAQ currently identifies three terpene compounds in the dataset: alpha-pinene, beta-pinene, and isoprene. However, alpha-pinene and beta-pinene are not reported to the Air Quality System (AQS) due to stability issues observed in the quality control (QC) canisters. These compounds were previously included in the QC standards but were removed for this reason.

A map showing the locations of the GC sites in the network is presented in Figure 66. The pie charts in this figure illustrate the percentage contributions of each grouped chemical species to the total VOC measurements at each site.

Summarized time series stacked bar trends are shown in Figures 75–81.

When compared to the average across all sites:

- **EQ** showed the highest values, with Alkanes 55% above average, Aromatics 49 % above average, and Acetylene nearly double the average. However, isoprene was 38% below average.
- **BV** also showed elevated values: Alkanes (37%), Alkenes (38 %), and TNMTC (32%) above average.
- **HW** was close to the overall average but had significantly higher Aromatics (41%).
- **ED** had the lowest levels, with TNMTC 54.0% below average and most compounds 50–65% lower than average.
- **RB** was low in most compounds, but isoprene was 73 % above average.

These patterns highlight the influence of different emission sources and environmental factors on VOC levels at each site.

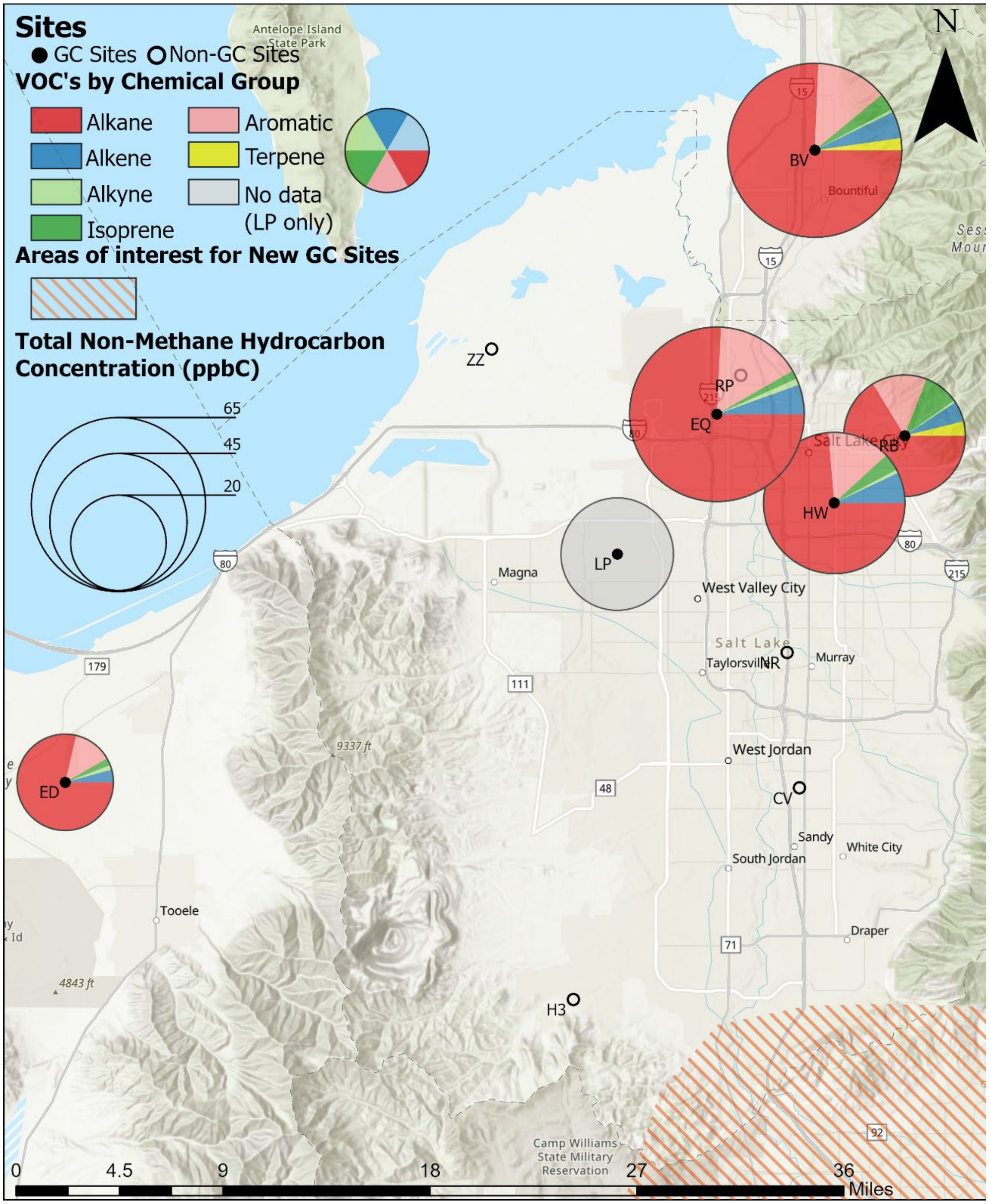

Figure 74. Map of GC site locations across the monitoring network. At each site, pie charts indicate the relative contributions of grouped chemical species (alkanes, alkenes, alkyne, aromatics) to the total VOC concentrations measured.

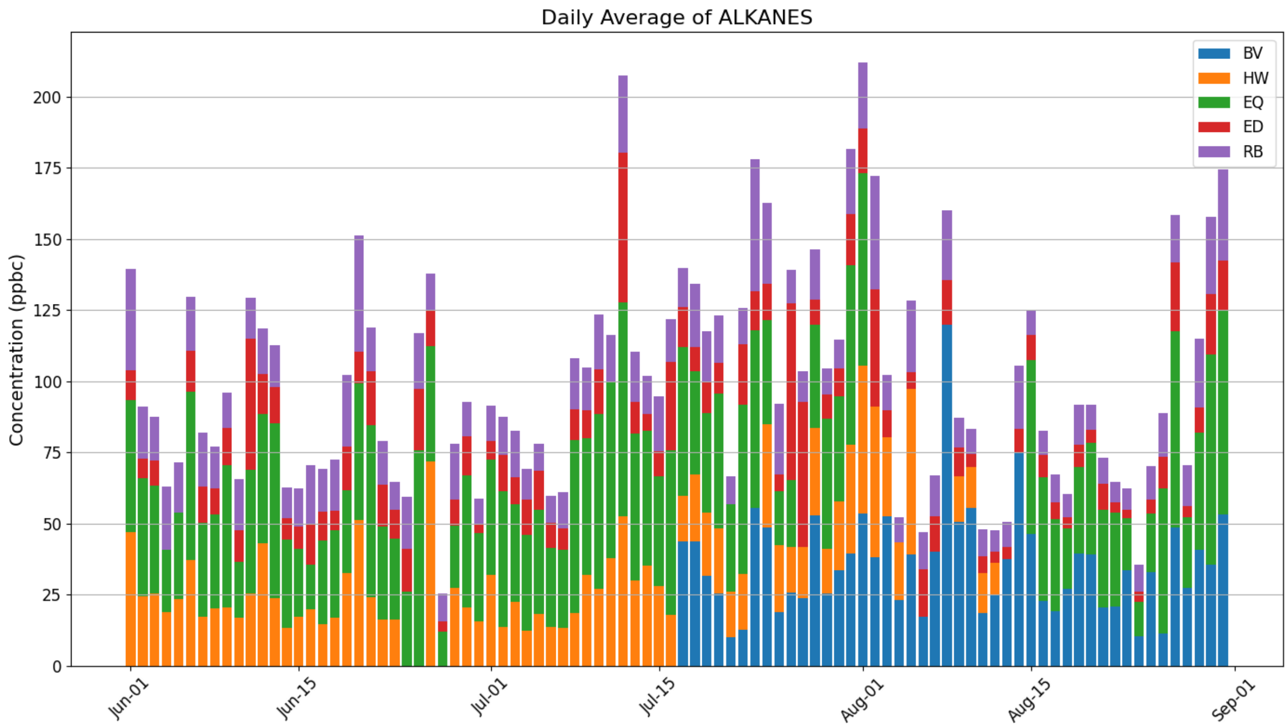

Figure 75. Time series trends showing Alkane compound concentrations measured across multiple monitoring sites in the network during summer 2024.

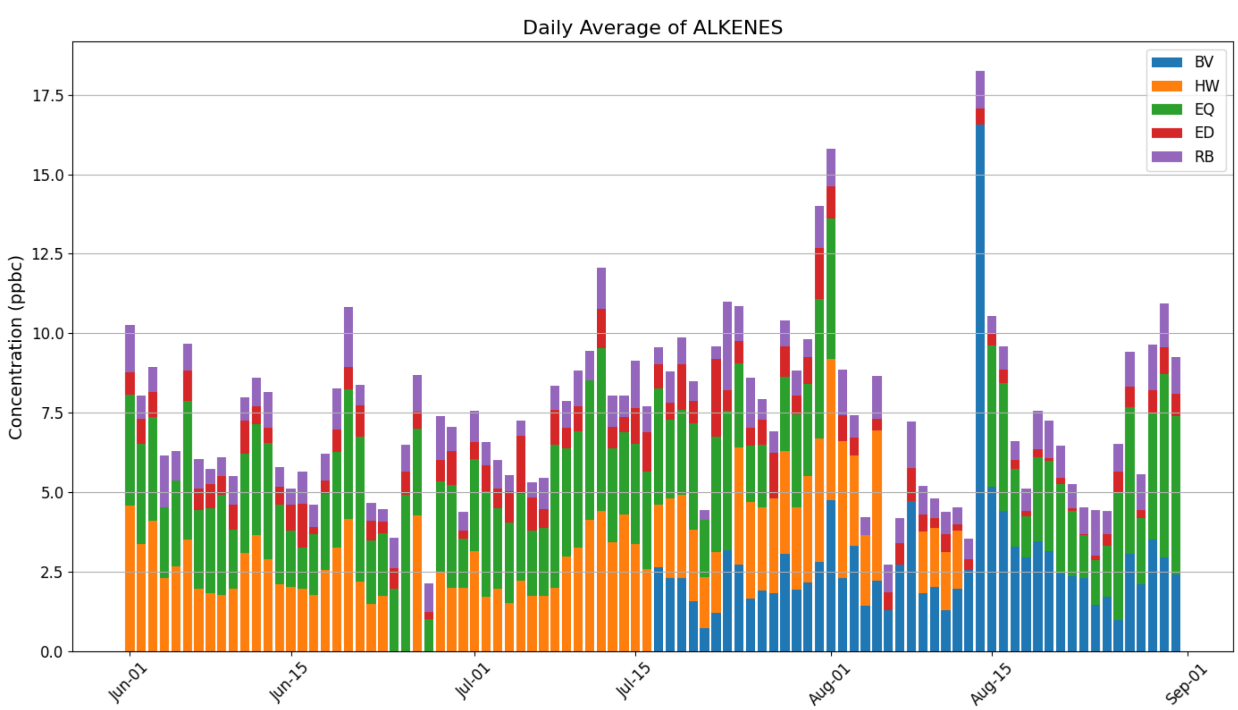

Figure 76. Time series trends showing Alkenes compound concentrations measured across multiple monitoring sites in the network during summer 2024.

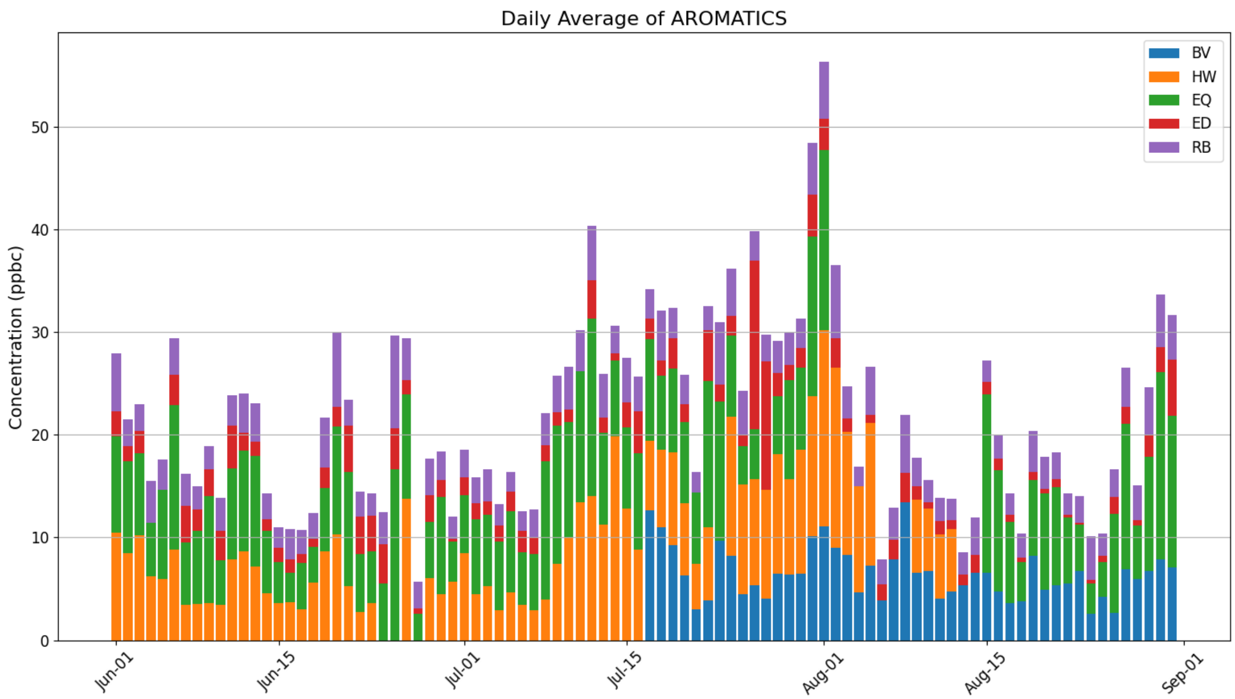

Figure 77. Time series trends showing Aromatics compound concentrations measured across multiple monitoring sites in the network during summer 2024.

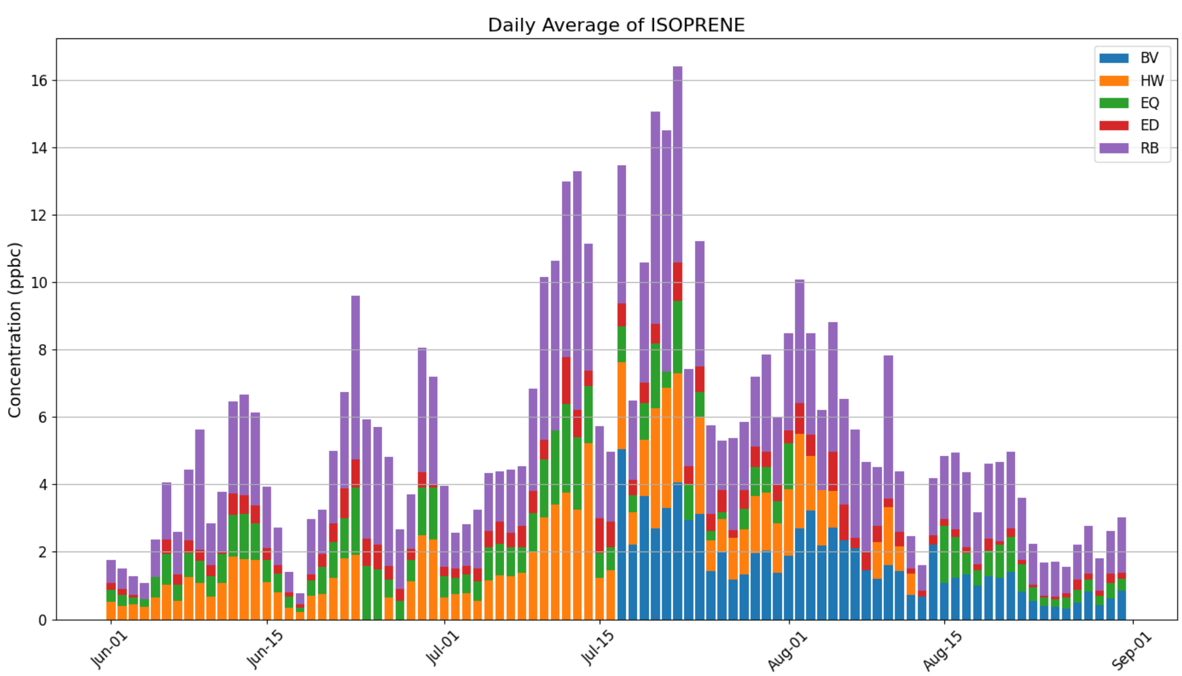

Figure 78. Time series trends showing Isoprene compound concentrations measured across multiple monitoring sites in the network during summer 2024.

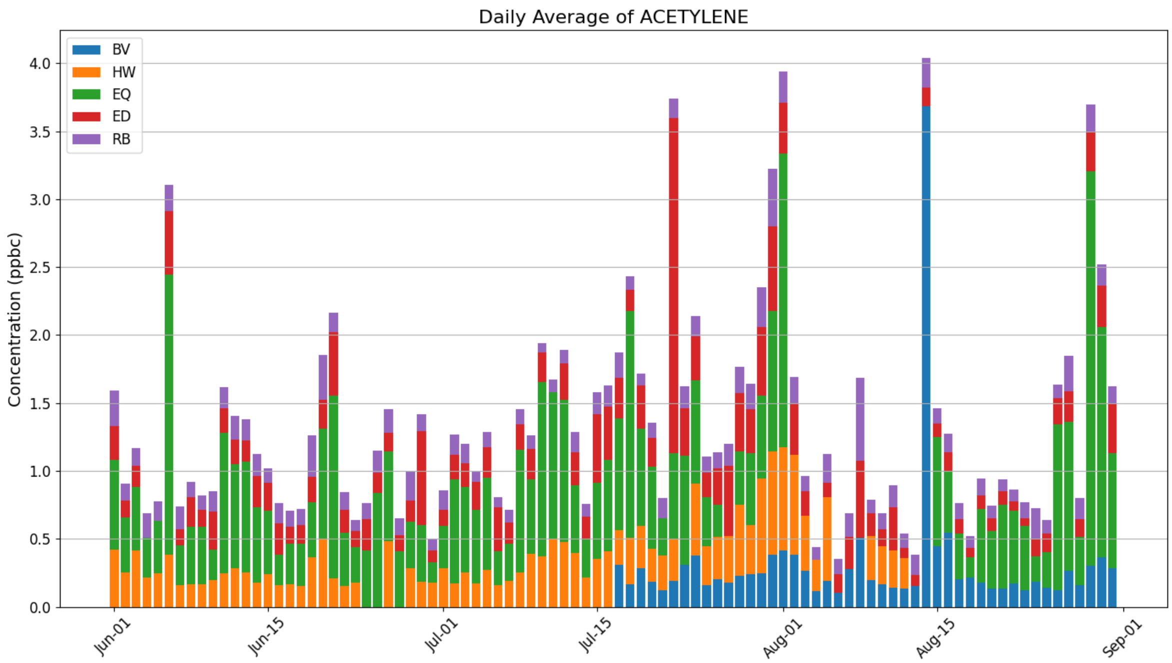

Figure 79. Time series trends showing Alkynes (Acetylene) compound concentrations measured across multiple monitoring sites in the network during summer 2024.

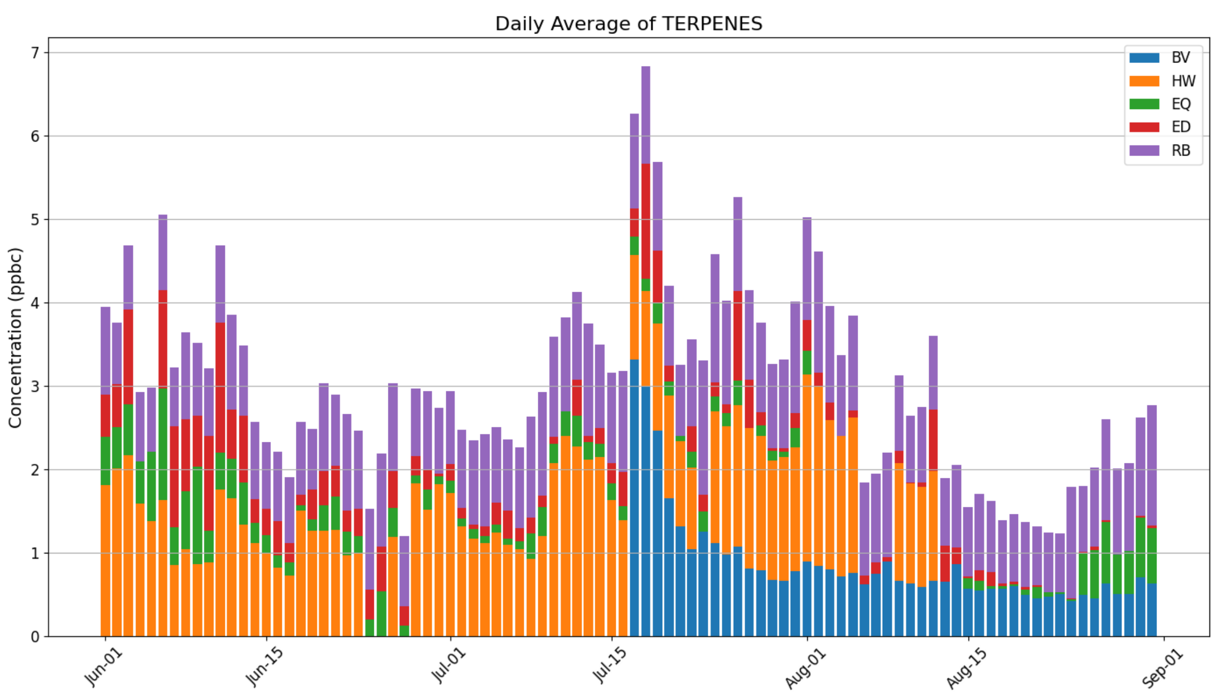

Figure 80. Time series trends showing Terpenes Compounds concentrations measured across multiple monitoring sites in the network during summer 2024.

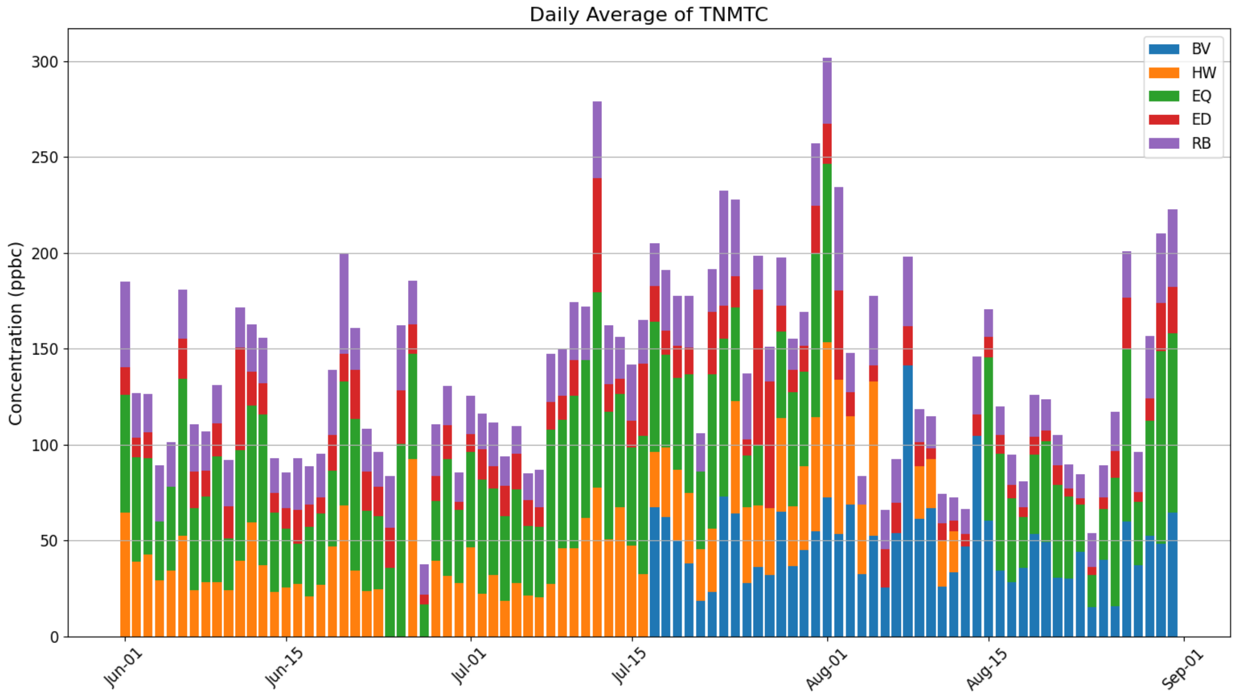

Figure 81. Time series trends showing Total Non-Methane Target Compounds (TNMTC) concentrations measured across multiple monitoring sites in the network during summer 2024.

The reactivity of VOCs plays a crucial role in ozone formation. The Maximum Incremental Reactivity (MIR) scale ranks VOCs based on their potential to form ozone[18,19]. Figures 82-86 display MIR-weighted summer 2024 VOC concentrations for the five sites where VOCs are measured. Each figure contains two plots: the top plot shows time-weighted VOC trends, while the bottom plot shows the same data normalized by the total daily VOC concentration.

Alkanes such as ethane, propane, and n-butane, along with acetylene, are relatively less reactive and typically originate from sources like natural gas use, fuel combustion, and vehicular emissions. These compounds often show higher concentrations particularly during early morning hours, due to commuter traffic and stable atmospheric conditions that limit vertical mixing. In contrast, aromatics like benzene, toluene, and xylenes are more reactive and photochemically active. They also tend to peak on mornings but exhibit greater variability, suggesting a stronger influence from mobile sources and solvent use. Isoprene, a highly reactive biogenic VOC emitted by vegetation, typically peaks during warm afternoon hours. Overall, more reactive VOCs, such as isoprene and aromatics, play a larger role in ozone formation, with elevated levels during afternoons indicating periods of enhanced photochemical activity. Isoprene and xylenes are among the most reactive and potent ozone precursors. Aromatics like

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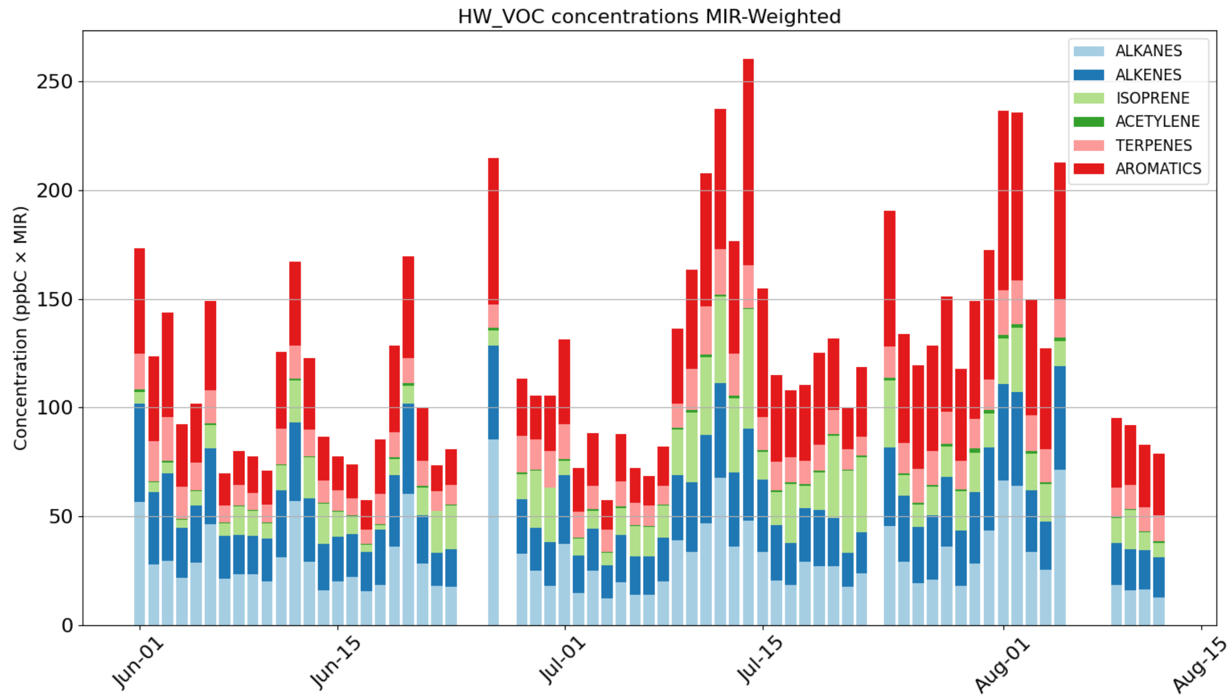
[18] https://ww2.arb.ca.gov/sites/default/files/2020-12/cp_reg_mir-tables.pdf

[19] https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2009/mir2009/mir10.pdf

toluene and xylenes have higher MIR values than alkanes, meaning they contribute more to ozone formation. In contrast, alkanes such as ethane and propane are less reactive and contribute less to ozone, though they tend to persist longer in the atmosphere.

Figures 87 and 88 show examples of VOC concentrations on days with low and high ozone levels, presented both with and without MIR weighting, to illustrate differences in reactivity contribution.



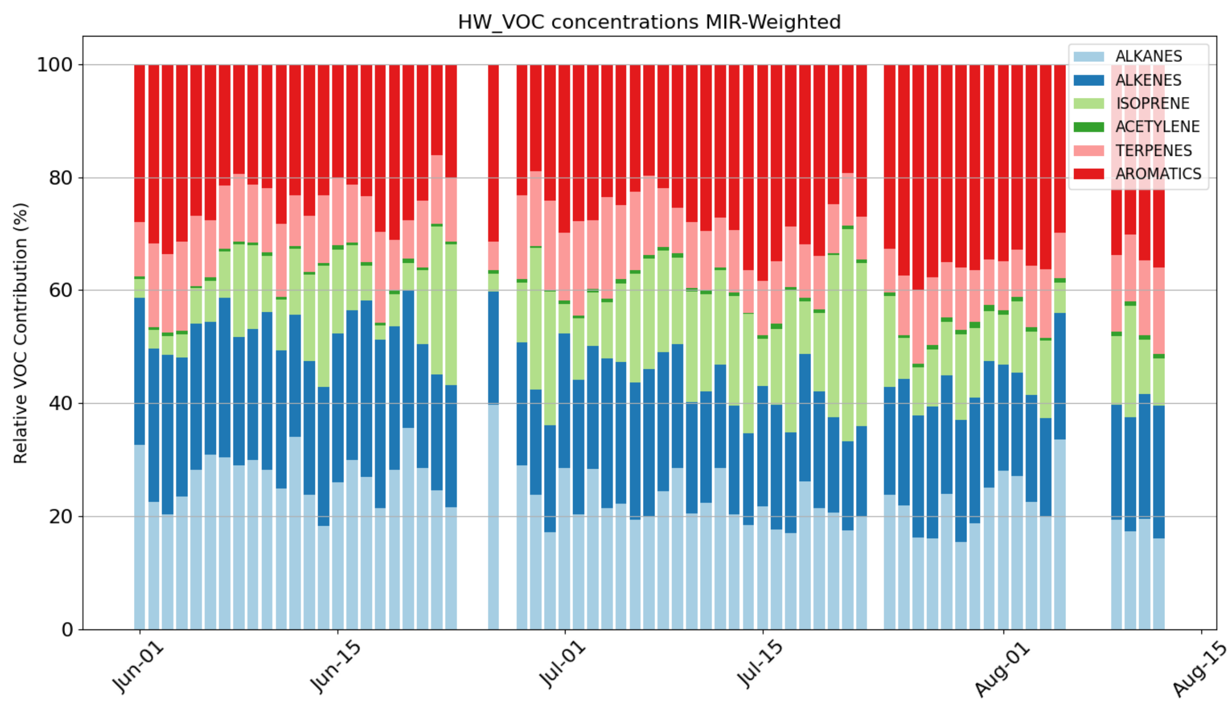
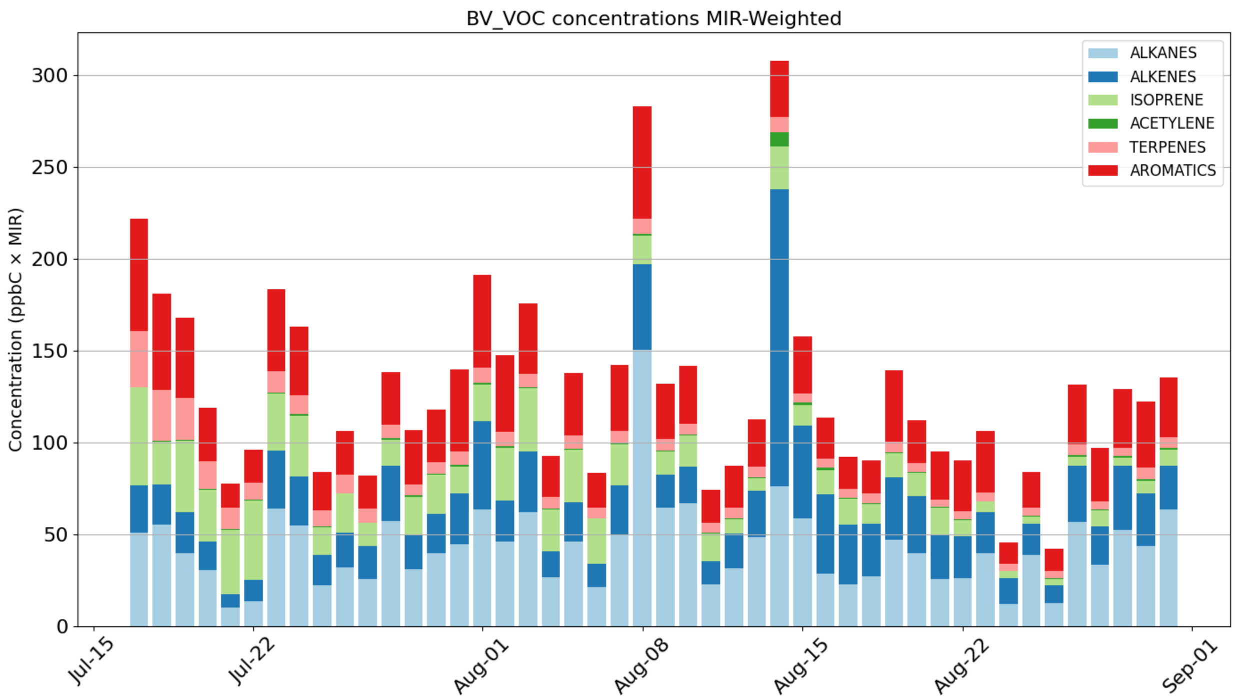


Figure 82. Time series of VOC contributions weighted by reactivity for summer 2024 at the Hawthorne site (top); bottom plot shows the same trends expressed as a percentage of the total



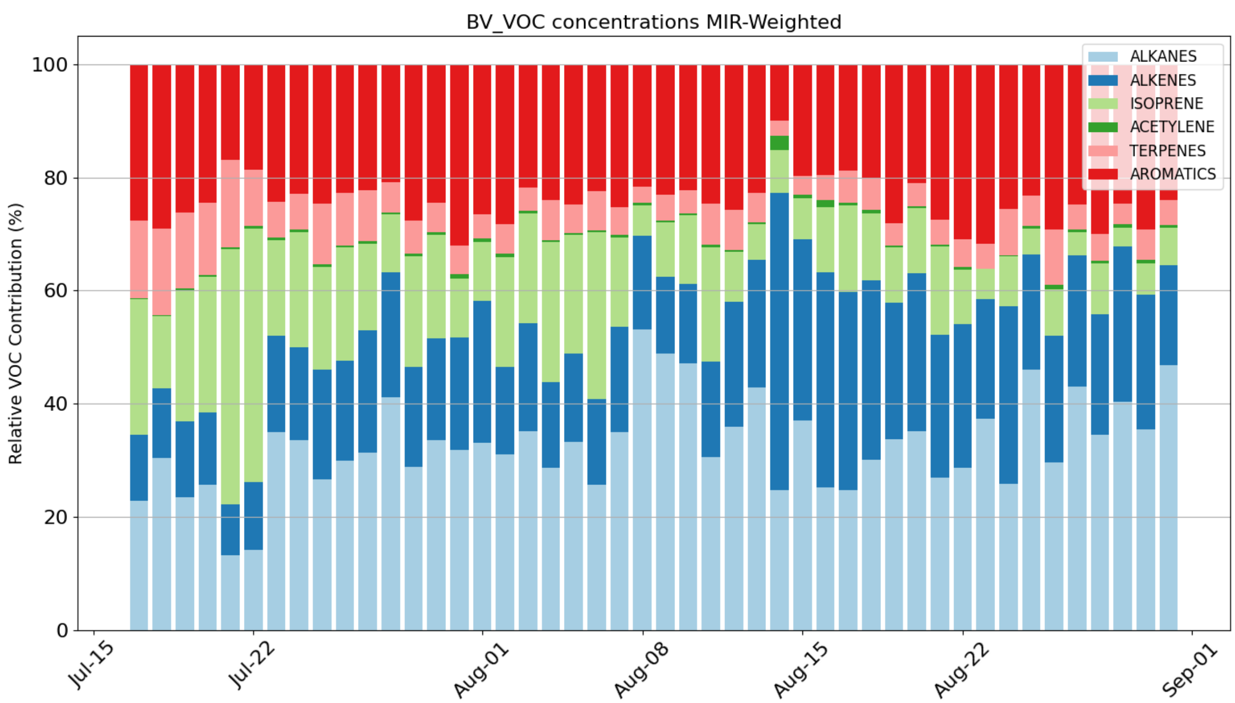
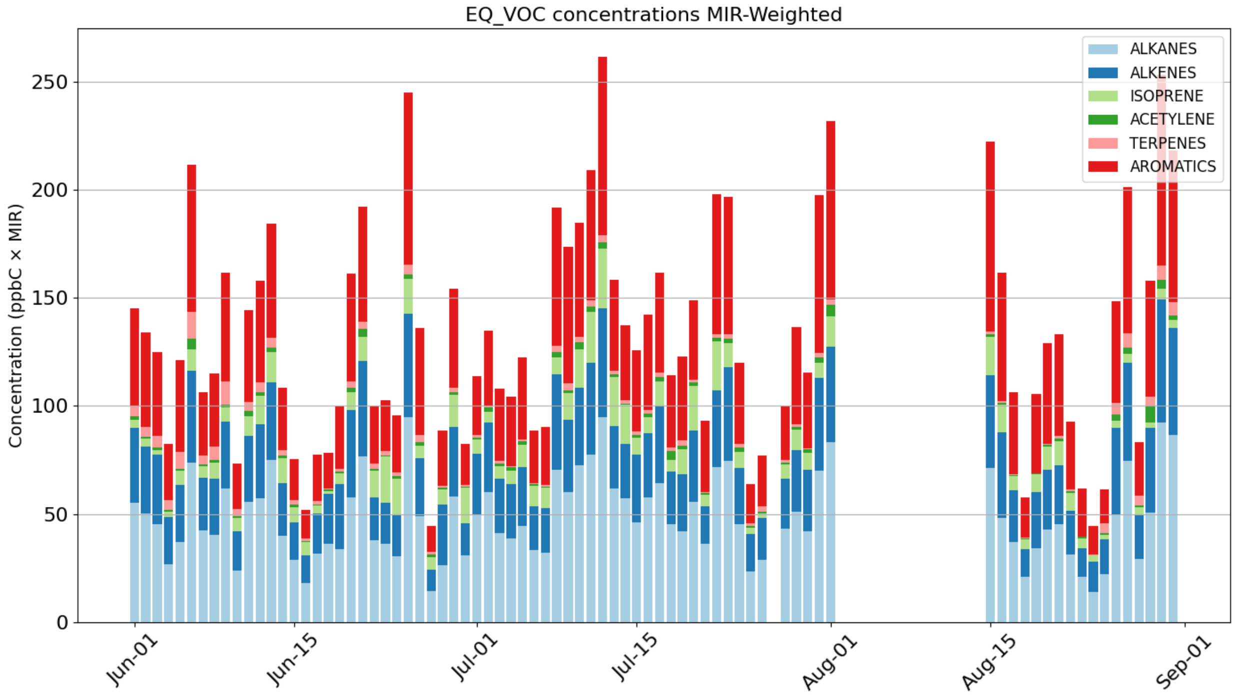


Figure 83. Time series of VOC contributions weighted by reactivity for summer 2024 at the Bountiful site (top); bottom plot shows the same trends expressed as a percentage of the total



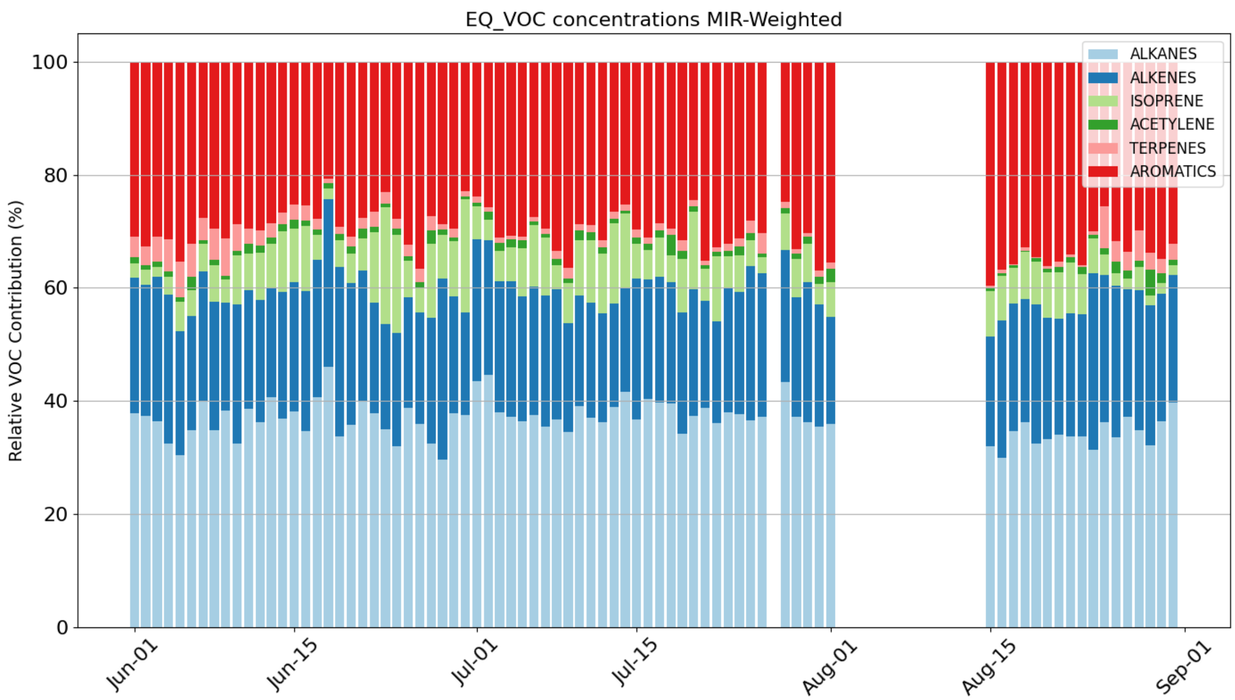
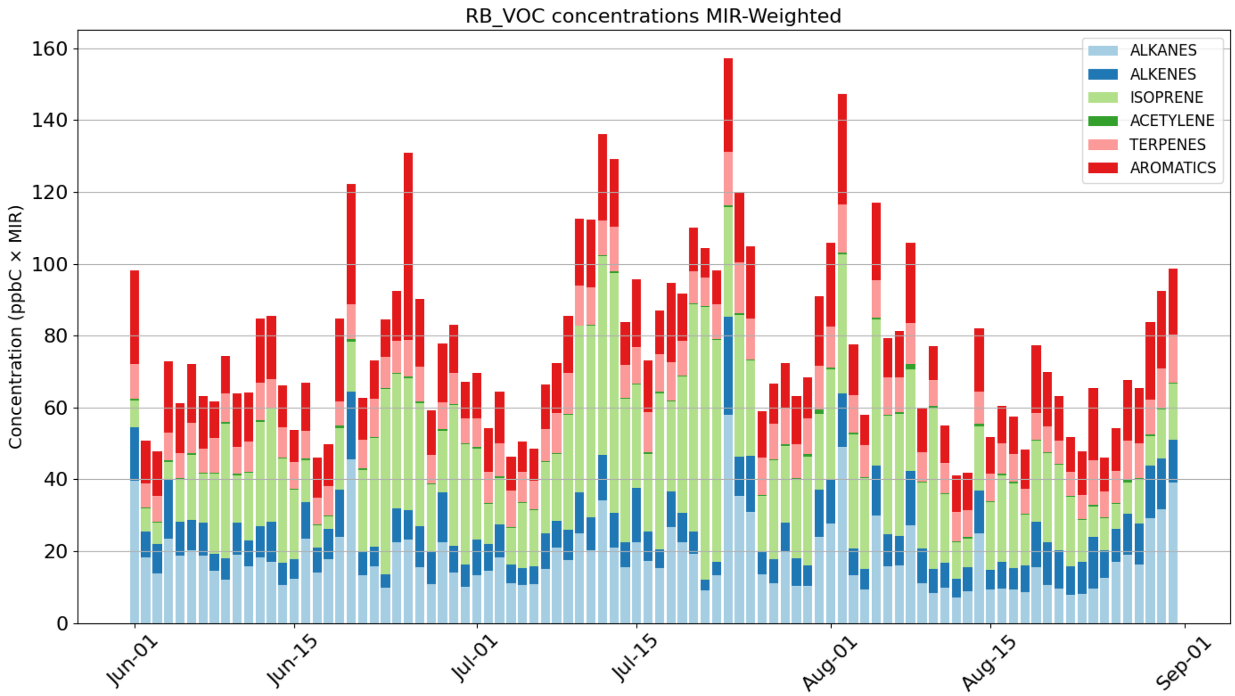


Figure 84. Time series of VOC contributions weighted by reactivity for summer 2024 at the Environmental Quality site (top); bottom plot shows the same trends expressed as a percentage of the total



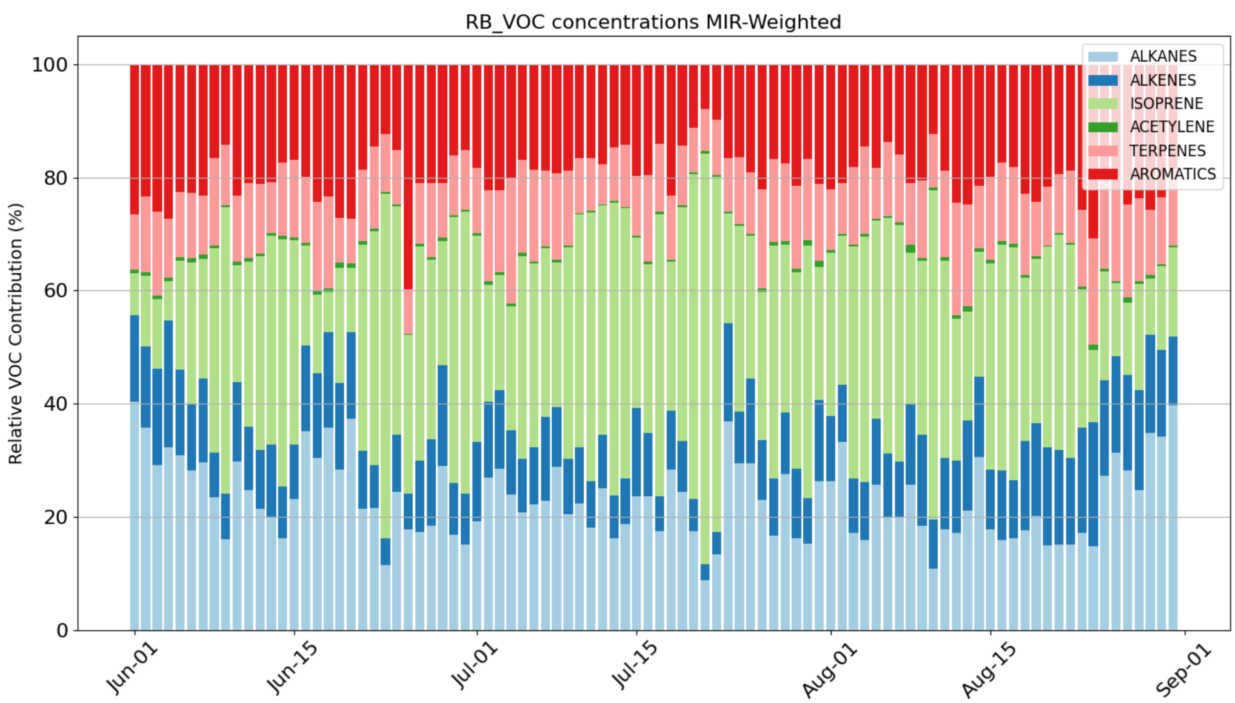
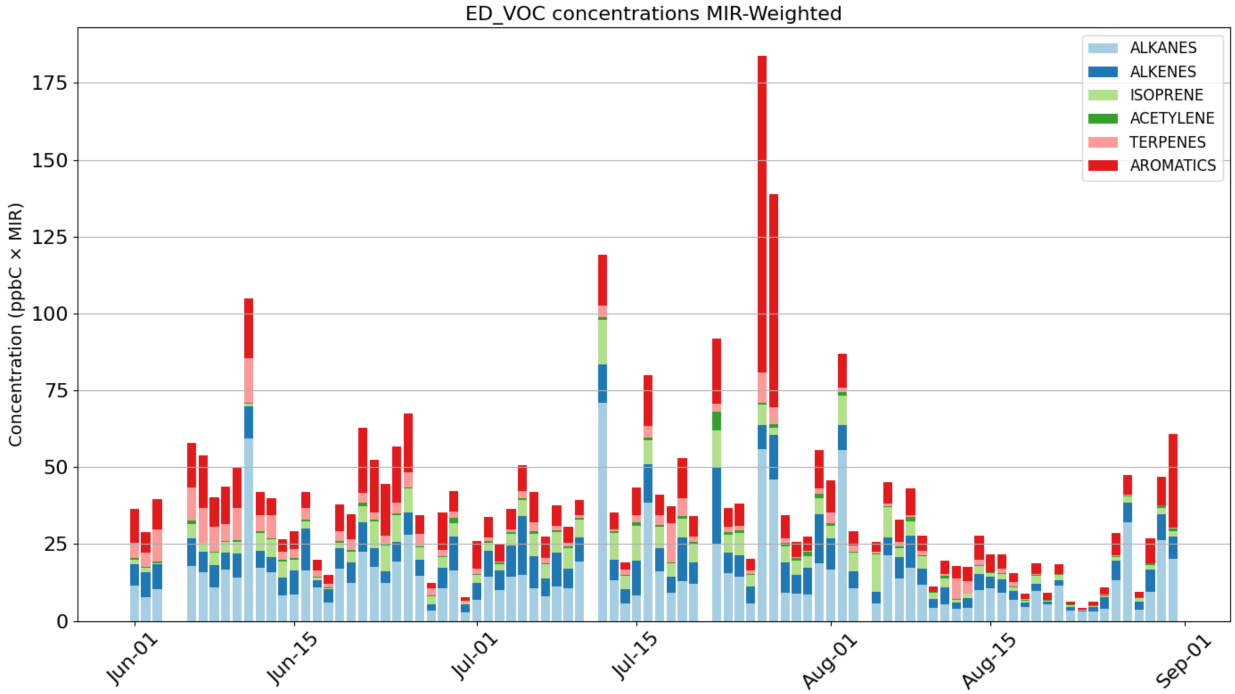


Figure 85. Time series of VOC contributions weighted by reactivity for summer 2024 at the Red Butte site (top); bottom plot shows the same trends expressed as a percentage of the total



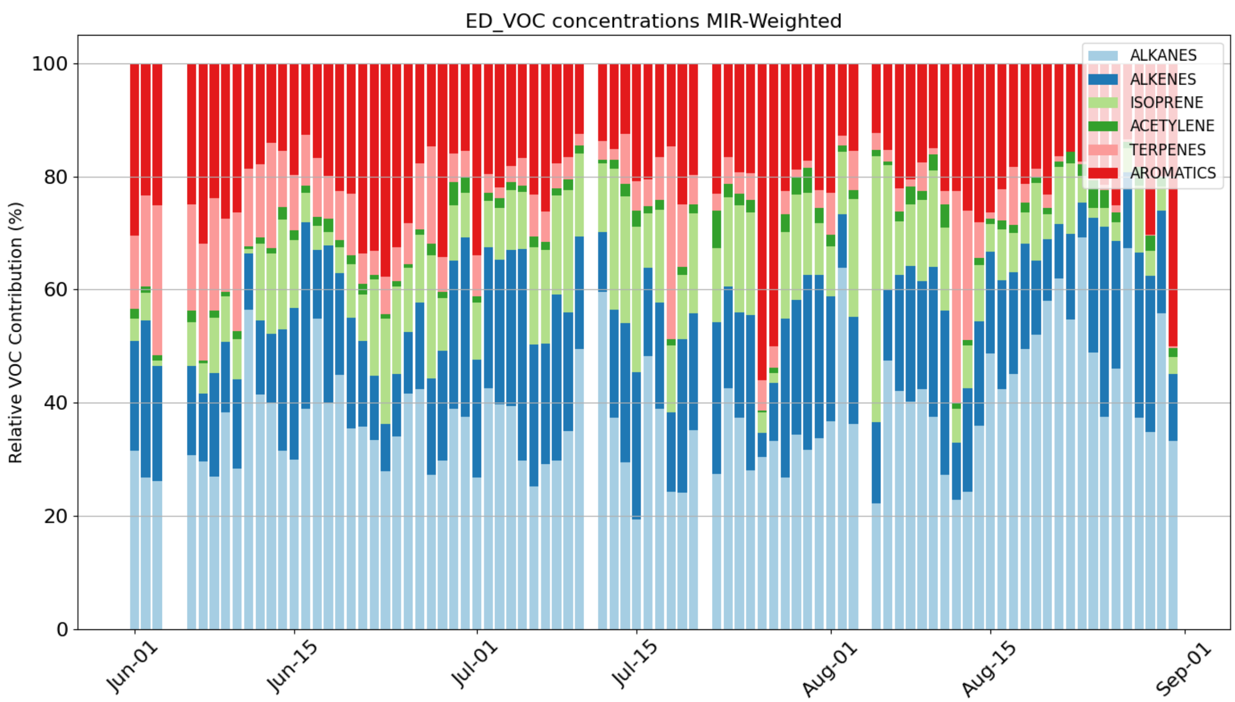


Figure 86. Time series of VOC contributions weighted by reactivity for summer 2024 at the Erdal site (top); bottom plot shows the same trends expressed as a percentage of the total

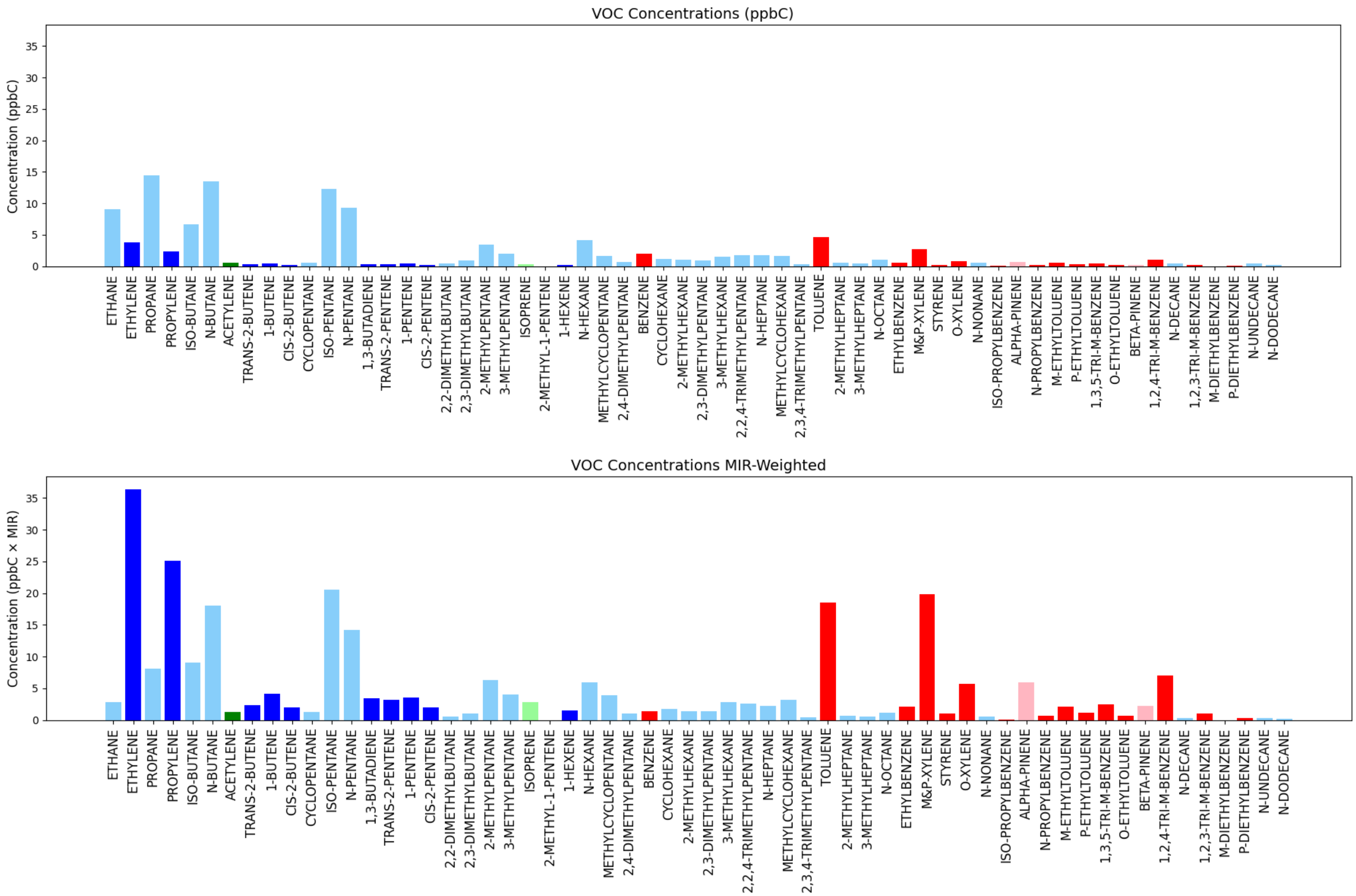


Figure 87. VOC concentrations (top) and MIR-weighted VOC concentrations (bottom) for a day with low O_3 concentrations at the EQ site

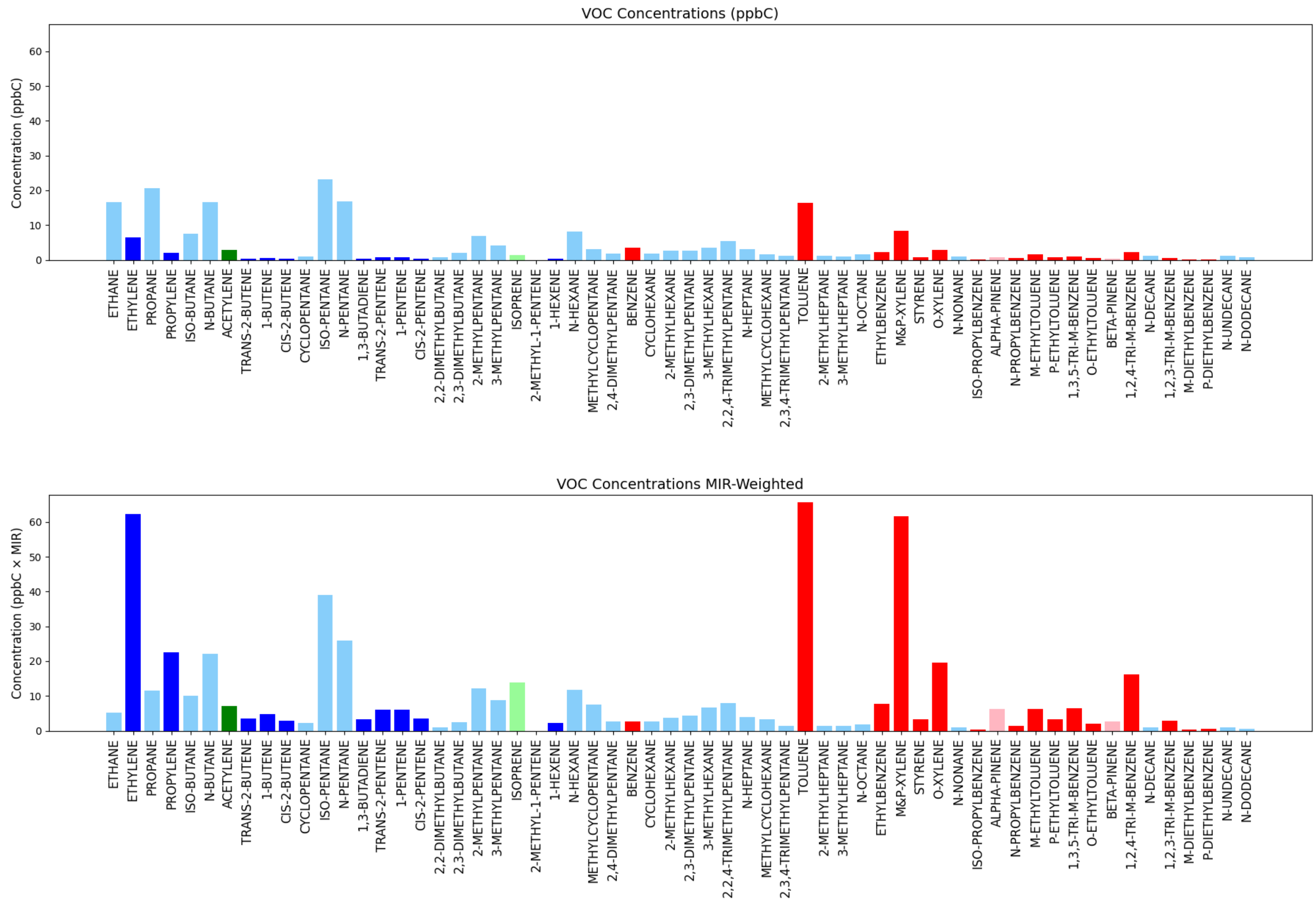


Figure 88. VOC concentrations (top) and MIR-weighted VOC concentrations (bottom) for a day with high O_3 concentrations at the EQ site

3.7 Air Toxics Trends

The Utah UDAQ has been participating in the EPA-funded Urban Air Toxics Monitoring Program since 1999. In January 2003, the air toxics monitoring equipment was re-located from West Valley to Bountiful Viewmont (BV) in order to co-locate the air toxics monitors with $PM_{2.5}$ speciation samplers, which would provide a more complete characterization of monitored air pollutants.

Currently, more than 90-VOCs, 10-carbonyls, 19-PAHs, and 11-metals are measured as part of the air toxics trends program. The samples are collected on a 1-in-6-day sampling schedule over a 24-hour period. The list of the air toxics measured at the site are listed in Table 35.

The Utah DAQ does not intend to propose any modifications to the Air Toxics Trend Site.

Table 35. List of toxics measured at the DAQ NATTS site.

Parameter	Compounds
VOCs	Carbon disulfide, Propylene, Acetylene, Freon 114, 1,3-Butadiene, n-Octane, Methyl tert-butyl ether, Tert-amyl methyl ether, tert-Butyl ethyl ether, Ethyl acrylate, Methyl methacrylate, Acrolein, Methyl isobutyl ketone, Ethylene oxide, Acetonitrile, Acrylonitrile, Chloromethane, Dichloromethane, Chloroform, Carbon tetrachloride, Bromoform, Trichlorofluoromethane, Chloroethane, 1,1-Dichloroethane, Methyl chloroform, Ethylene dichloride, Tetrachloroethylene, Tetrachloroethylene, 1,1,2,2-Tetrachloroethane, Bromomethane, 1,1,2-Trichloroethane, 1,1,2-Trichloro-1,2,2-trifluoroethane, Dichlorodifluoromethane, Trichloroethylene, 1,1-Dichloroethylene, Bromodichloromethane, 1,2-Dichloropropane, trans-1,3-Dichloropropene, trans-1,3-Dichloropropene, cis-1,3-Dichloropropene, Dibromochloromethane, Chloroprene, Bromochloromethane, trans-1,2-Dichloroethylene, cis-1,2-Dichloroethene, Ethylene dibromide, Hexachlorobutadiene, Vinyl chloride, m/p Xylene, Benzene, Toluene, Ethylbenzene, o-Xylene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, Styrene, Chlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 1,2,4-Trichlorobenzene. Total NMOC (non-methane organic compound), Ethane, n-dodecane, Ethylene, Propane, n-Butane, Iso-Butane, Trans-2-Butene,Cis-2-Butene,n-Pentane, Isopentane, 1-Pentene, trans-2-Pentene, trans-2-Pentene, cis-2-Pentene, 3-Methylpentane, n-Hexane, n-Heptane, n-Nonane, n-Decane, Cyclopentane, Isoprene, 2,2-Dimethylbutane, 1-Hexene, 2-Methyl-1-pentene, 2,4-Dimethylpentane, Cyclohexane, 3-Methylhexane, 2,2,4-Trimethylpentane, 2,3,4-Trimethylpentane, 3-Methylheptane, alpha-Pinene, beta-Pinene, Methylcyclopentane, Methylcyclohexane, 2-Methylhexane, 1-Butene, 2,3-Dimethylbutane, 2-Methylpentane, 2,3-Dimethylpentane, n-Undecane, 2-Methylheptane, n-Propylbenzene, Isopropylbenzene, o-Ethyltoluene, m-Ethyltoluene, p-Ethyltoluene, m-Diethylbenzene, p-Diethylbenzene, 1,2,3-Trimethylbenzene
Carbonyls	Formaldehyde, Acetaldehyde, Propionaldehyde, Butyraldehyde, Hexanaldehyde, Valeraldehyde, Crotonaldehyde, Acetone, Methyl ethyl ketone, Benzaldehyde
PAHs	Naphthalene, Acenaphthene, Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Chrysene, Coronene, Perylene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[e]pyrene, Dibenzo[a,h]anthracene, Benzo[g,h,i]perylene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene
Metals (PM_{10})	Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Nickel, Mercury, Selenium

3.8 Mercury Deposition Network

Mercury was of significant health and environmental concern in Utah. Advisories limiting the consumption of fish were issued for certain lakes and watersheds due to their elevated mercury levels in 2008. The Utah DAQ was part of the National Mercury Deposition Network, measuring mercury dry deposition from 2009 to summer 2017, and measurements were discontinued after consultation with the EPA.

3.9 Meteorological Monitoring Network

Meteorological parameters, including ambient temperature, relative humidity, ambient pressure, solar radiation as well as wind speed and direction are currently measured at multiple sites throughout the state of Utah in order to properly represent the complex wind patterns and micrometeorology in Utah's airshed and to support air quality models and trends in co-located air pollutants. In 2021, DAQ updated the technology used to measure the meteorological variables. Previously, the system used cup anemometers and vane systems to measure wind direction and speed, but it was replaced by sonic anemometer systems (2D sonic sensors, RM Young Ultrasonic 86004). The modifications will reduce the time spent maintaining the meteorological systems and lower the detection threshold, which will allow DAQ to capture and better understand the small eddies and transports during our cold pool seasons, where the typical analog sensor will read no wind flow. The new system is smaller and more cost effective than the previous set up, which is favorable for the limited space in the monitoring shelters.

A second crucial update was to get a combination of temperature and relative humidity sensors (Campbell Scientific HMP60) at every site, which is beneficial for air quality modeling application. In addition, pyranometers (Campbell Scientific CS301) to measure incoming solar radiation were also installed.

3.10 Data Loggers

The data loggers at the network sites are being replaced with a digital data logging system. This new system is based on the Campbell Scientific CR6 platform and collects data using the Modbus protocol. Main advantages of the digital system include increased flexibility in scheduling PZS sequences and the elimination of issues common to analog data collection, such as overrange events, calibration imprecisions, and voltage irregularities caused by power disruptions. Additionally, the digital platform enables the collection of diagnostic data from gaseous and particulate monitoring instruments. This diagnostic information helps operators identify and resolve instrument malfunctions more quickly, reducing downtime and minimizing data loss or invalidation. Digital loggers are now in use at 14 of the 23 stations. These stations are: Brigham City (BG), Bountiful (BV), Copperview (CV), Herriman (H3), Heber (HB), Lake Park (LP), Moab (M7), Near Road (NR), Price (P2), Red Butte (RB), Rose Park (RP), Spanish Fork (SF), Smithfield (SM), and Prison (ZZ).

4. Summary of UDAQ Monitoring Updates (2021-2024) and Suggested Future Modifications

The operational changes, instrumentation upgrades, and network expansions across air quality monitoring stations in Utah from 2021 through 2024 are summarized below:

- **Network Expansion and Station Installations**:
  - ➢ Completed the installation of two monitoring stations, Lake Park (LP) and Prison (ZZ), established to assess the environmental impact of the Utah Inland Port; both stations are now fully operational.
  - ➢ New stations have been established in Brigham City (Box Elder), Moab (Grand County), Red Butte (Salt Lake County), and Heber Station (Wasatch County).

- **Enhanced Monitoring Plan (EMP) Implementation**:
  - ➢ As part of the EMP, hourly averaged measurements of speciated volatile organic compounds (VOCs) (PAMS target list compounds), Cavity Attenuated Phase Shift (CAPS) Spectroscopy True NO_2, total reactive nitrogen (NOY), and Hourly averaged Formaldehyde and Hydrogen chloride measurements. All the EMP sites are reporting hourly averaged measurements of speciated volatile organic compounds but the rest of the measurements vary between stations.

- **Instrument Upgrades and Additions**:
  - ➢ Replacement of filter-based PM_{10} instruments with continuous samplers at Harrisville, Lindon and Herriman.
  - ➢ Installation of Pandora Spectrometer at Hawthorne (HW) and additional ceilometers at selected sites to enhance atmospheric data collection.
  - ➢ Upgrades to meteorological sensors statewide, including the adoption of 2D sonic anemometers and new temperature, humidity, and radiation sensors.
  - ➢ The data loggers at the network sites are being replaced with a digital data logging system. Digital loggers are now in use at 14 of the 23 stations. These stations are: Brigham City (BG), Bountiful (BV), Copperview (CV), Herriman (H3), Heber (HB), Lake Park (LP), Moab (M7), Near Road (NR), Price (P2), Red Butte (RB), Rose Park (RP), Spanish Fork (SF), Smithfield (SM), and Prison (ZZ).

- **Station Closures and Relocations**:
  - ➢ The Escalante site in Garfield County was discontinued due to a non-renewed contract.
  - ➢ The Spanish Fork (SF) station was relocated within a few hundred feet of its original location in 2021.

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To ensure efficient and representative pollution monitoring across the state of Utah, DAQ proposes the following network modifications. These recommendations are primarily intended to improve UDAQ's ability to evaluate regulatory air quality modeling results.

- **Network Expansion and Station Installations**

  - **Data Gaps and Future Monitoring Stations**

Modelers identified additional air monitoring stations that could be useful, listed below in order of priority:

- Summit County:
  - O_3, NOx, and $PM_{2.5}$
  - Next county projected to reach the MSA population threshold that requires an air monitoring station.

- West Davis County: (Layton/Syracuse area):
  - O_3, NOx, $PM_{2.5}$, PM_{10}
  - PM_{10} monitoring and composition, particularly from dust off of the Farmington Bay GSL dust hotspot.

- The desert west of the GSL:
  - O_3, NOx, and PM_{10}
  - This site would serve as a background location to evaluate how air quality changes before and after easterly air transport across the Great Salt Lake and into the Salt Lake Valley. It could also help identify background concentrations of other pollutants.

- Beck Street
  - $PM_{2.5}$, PM_{10}, O_3 and NOx
  - This site would assess dust ($PM_{2.5}$ and PM_{10}) near the Staker Parson mine in North Salt Lake and could also help evaluate $PM_{2.5}$ and ozone (O_3) pollution from the refineries along the I-15 corridor.

- Utah County
  - $PM_{2.5}$, O_3 and NOx
  - Consider identifying another urban site in northern Utah County, east of I-15.

- Logan/Cache Valley site
  - $PM_{2.5}$, O_3 and NOx
  - Locate a second monitor closer to the Southeast part of Logan City to complement the existing Smithfield (SM) site. Modeling suggests ozone pollution near the

boundaries of Cache County along US-89 and US-91, is relatively low compared to levels within Logan city.

- Ogden, Weber County
  - $PM_{2.5}$, PM_{10}, O_3 and NOx
  - Identify a second monitoring site in Ogden, Weber County, to complement the existing Harrisville (HV) site. Air quality modeling indicates that the Harrisville site may not adequately represent pollution levels across Weber County.

- Delta, Millard County
  - $PM_{2.5}$, PM_{10}, O_3 and NOx
  - This site could serve as a background location for all non-PM_{10} compounds. It would also help track PM_{10} (dust) transported from the south into the Salt Lake Valley, particularly during high-wind events, which most often originate south of the valley.

- **Data Redundancy**

The Environmental Quality (EQ) site was installed in 2018 and includes a variety of instruments, including co-located monitors and newer technologies. It is located on the roof of the Technical Center building and is situated just one mile from the Rose Park (RP) station. The initial objective for Environmental Quality (EQ) was to eventually replace the Rose Park station.

A site-to-site analysis reported Pearson correlation coefficients between the two stations of 0.98 for $PM_{2.5}$, 0.96 for O_3, 0.89 for NO_2, 0.55 for SO_2, and 0.79 for CO. Although the stations are close in proximity, they may be impacted differently by sources. For example, the average daily traffic count near EQ is approximately 100,000 vehicles, compared to about 1,000 near Rose Park site.
Utah DAQ will continue evaluating these two sites.

Lastly, UDAQ will continue reviewing all stations to ensure that they constantly meet acceptance criteria and monitoring objectives. Any sites that do not meet the requirements will be evaluated for future actions.

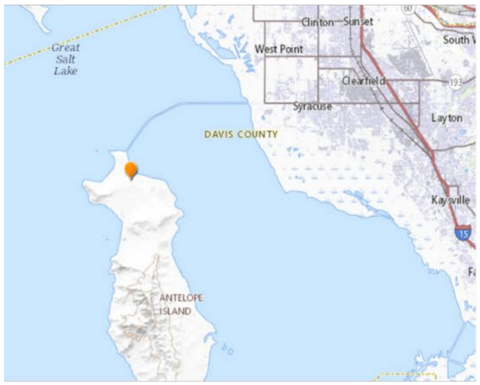
Appendix A List of equipment used at the DAQ monitoring sites.

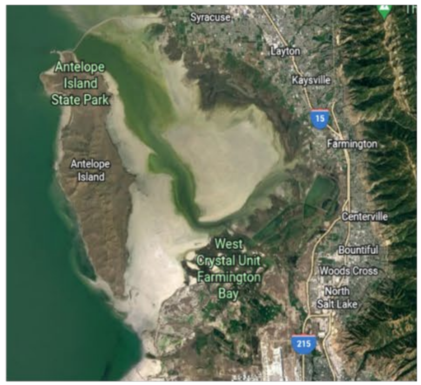
Parameter	Units	Mfg	Model #	Details
$PM_{2.5}$ FRM	Micrograms/cubic meter (25 C)	Thermo	2025i	Low volume sampler (filter) with very sharp cut cyclone (VSCC) - Gravimetric
$PM_{2.5}$ FEM	Micrograms/cubic meter (25 C)	Thermo	5030i Sharp	Beta Attenuation
	Micrograms/cubic meter (25 C)	Teledyne API	T640/T640X	Broadband Spectroscopy
PM_{10} FRM	Micrograms/cubic meter (25 C)	Thermo	2025i	Low volume sampler (filter) - Gravimetric
PM_{10} FEM	Micrograms/cubic meter (25 C)	MetOne	E-BAM PLUS	Beta Attenuation Mass Monitor
$PM_{2.5}$ Speciation	Micrograms/cubic meter (LC)	Met One SASS	Met One SASS/SuperSASS	Met One SASS/SuperSASS: Teflon/Energy dispersive XRF; Nylon/Ion Chromatography
	Micrograms/cubic meter (LC)	URG	3000N	URG 3000N w/Pall Quartz Filter-Organic/Inorganic Carbon
Carbon Monoxide	Parts per million	Teledyne API	T300U	Gas Filter Correlation
Carbon Monoxide (trace level)	Parts per million	Teledyne API	T300	Gas Filter Correlation
Nitrogen Dioxide (trace)	Parts per billion	Teledyne API	T200U	Gas Phase Chemiluminescence
Nitrogen Dioxide (CAPS true)	Parts per billion	Teledyne API	N500	Cavity Attenuated Phase Shift (CAPS) Spectroscopy
Reactive Oxides of Nitrogen (NO_Y)	Parts per billion	Teledyne API	T200U	Chemiluminescence Thermo Electron
Sulfur Dioxide	Parts per billion	Teledyne API	T100	Pulsed Fluorescent
Sulfur Dioxide (trace)	Parts per billion	Teledyne API	T100U	Pulsed Fluorescent
Ozone	Parts per million	Teledyne API	T400	Ultraviolet Absorption
Ozone	Parts per million	Teledyne API	T265	Gas Phase Chemiluminescence
Black Carbon	Micrograms/cubic meter (LC)	Magee	AE33	Aethalometer - Optical Absorption
Air Toxics (carbonyls)	Parts per billion Carbon	ATEC	8000	SILICA-DNPH-CARTRIDGE-KI O3 SCRUB - HPLC
Air Toxics (VOCs)	Parts per billion Carbon	ATEC	2200	6L SUBATM SS CANISTER or SS-CANISTER-PRESSURIZED
Air Toxics (PM_{10} Metals)	Nanograms/cubic meter (25 C)	TISCH	TE-Wilbur10	Tisch Model TE-Wilbur10 Low-Volume Sampler

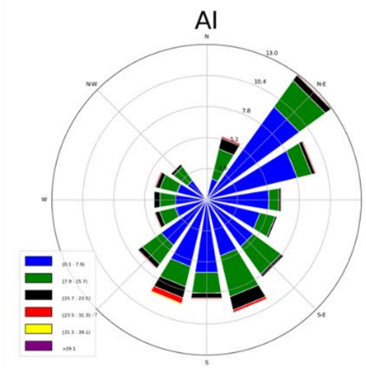
Appendix A List of equipment used at the DAQ monitoring sites (cont.).

Parameter	Units	Mfg	Model #	Details
Air Toxics (PAHs)	Nanograms/cubic meter (25 C)	TISCH	TE-Wilbur-BL	High Volume Sampler (PUF) GC/MS TO-13
Air Toxics (hourly VOCs)	Parts per billion Carbon	Agilent/Markes CIA	T890B	Preconcentrator trap/thermal desorber - electronic drier - Markes CIA TD/Agilent GC dual FID - carbon response
Hydrogen Chloride (HCL)	Parts per billion	Picarro	G2108	Cavity Ring Down Spectroscopy (CRDS)
Formaldehyde (HCHO)	Parts per billion	Picarro	G2307	Cavity Ring Down Spectroscopy (CRDS)
Mixing Height	Meters	Vaisala	CL-51	Optical Scattering Ceilometer
Mixing Height	Meters	Vaisala	CL-61	Optical Scattering Ceilometer
Wind Direction/Speed	Meter per second or mile per hour	RM Young	Ultrasonic Anemometer-86004	Sonic Anemometer
Relative Humidity	Percent relative humidity			Electronic RH Sensor
Solar Radiation	Watts per square meter			Electronic Sensors
UV radiation	Watts per square meter	Apogee	Apogee SU-200-SS	
Ambient Temperature	Degrees Fahrenheit			Electronic Temperature Sensor
Barometric Pressure	Millibars			Electronic Sensors

Appendix B Site Information





Site:	**Antelope Island (AI)**	**Longitude:**	**-112.231541**	**Station Type:**	**SPM**
AQS#:	49-011-6001	Latitude:	41.039404	MSA:	Ogden-Clearfield
Address:	Antelope Island	Elevation (m):	1355		
City:	N/A				
County:	Davis				

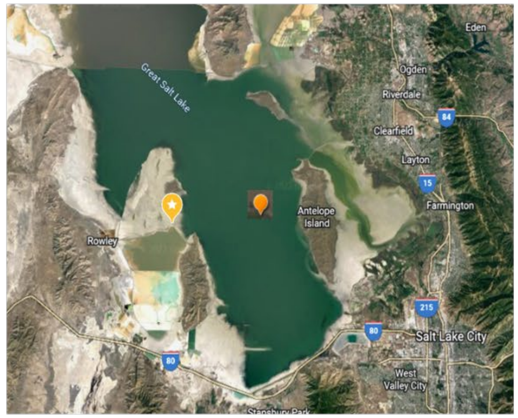
Site Objective:
This site is established to collect meteorological information for air quality modeling inputs.
Does the site meet the objective? Yes, all objectives are met.

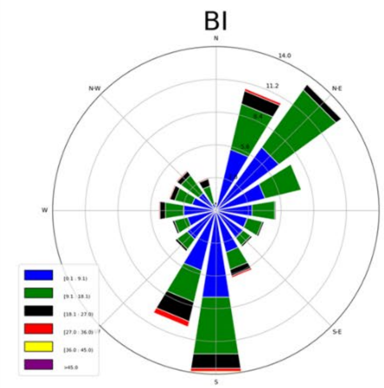
Site Description:
The site is on Antelope Island State Park, near the ranger residences, in Davis County.
Can data from this site be used to evaluate NAAQS? No

Meteorological Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale

Relative Humidity	Elec. Thin Film	Continuous	6 meters	Urban
Ambient Temperature	Elec. Resistance	Continuous	6 meters	Urban
Wind Direction	Elec. Resistance Level 1	Continuous	6 meters	Urban
WD Sigma	Elec. EPA Method	Continuous	6 meters	Urban
Wind Speed	Elec. Chopped Signal Level 1	Continuous	6 meters	Urban





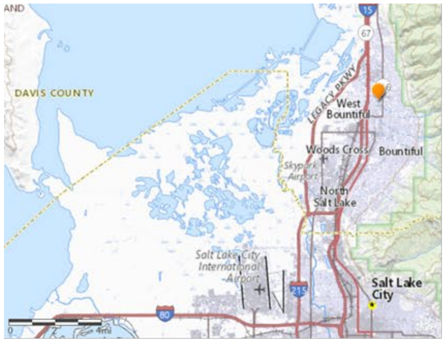
Site:	Badger Island (BI)	Longitude:	-112.231541	Station Type:	SPM
AQS#:	49-011-6001	Latitude:	40.94212	MSA:	Salt Lake City
Address:	No street address, on an Island	Elevation (m):	1285		
City:	N/A				
County:	Davis				

Site Objective:
This site is established to collect meteorological information for air quality modeling inputs.
Does the site meet the objective? Yes, all objectives are met.

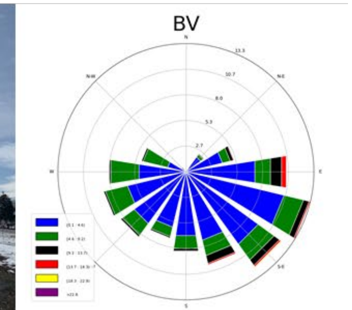
Site Description: The site is on Badger Island
Can data from this site be used to evaluate NAAQS? No

Meteorological Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Relative Humidity	Elec. Thin Film	Continuous	6 meters	Urban
Ambient Temperature	Elec. Resistance	Continuous	6 meters	Urban
Wind Direction	Elec. Resistance Level 1	Continuous	6 meters	Urban
WD Sigma	Elec. EPA Method	Continuous	6 meters	Urban
Wind Speed	Elec. Chopped Signal Level 1	Continuous	6 meters	Urban







Site:	Bountiful Viewmont (BV)	Longitude:	-111.884505	Station Type:	SLAMS
AQS#:	49-011-0004	**Latitude:**	40.902945	**MSA:**	Ogden-Clearfield
Address:	1370 North 171 West	**Elevation (m):**	1309		
City:	Bountiful				
County:	Davis				

Site Objective:
The Bountiful Viewmont site is established to determine public exposure to air pollution. The site also monitors emissions from nearby oil refineries and local sand and gravel operations. Previous monitoring and saturation studies have recorded high ozone concentrations. This site is chosen for intensive speciation of $PM_{2.5}$ under the EPA Chemical Speciation Network (CSN), gaseous volatile organic compounds under the EPA National Air Toxics Trends Network (NTTN) including hexavalent chromium and carbonyl compounds and hourly VOC_PAMS measurements, Nitrogen dioxide, true Nitrogen dioxide and Reactive Oxides of Nitrogen are monitored under the Enhanced Monitoring Plan (EMP) to in support of the ozone monitoring.

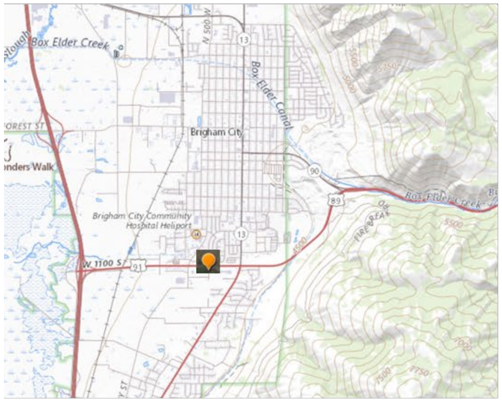
Does the site meet the objective? Yes, all objectives are met.

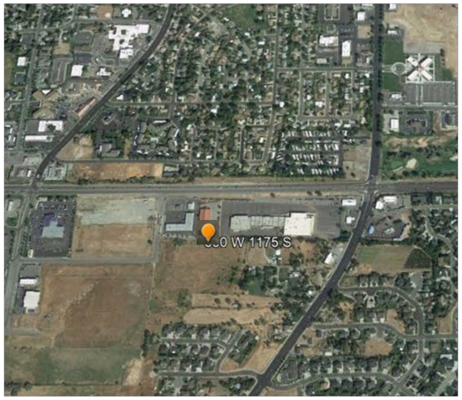
Site Description:
The site is located near Viewmont High School at the north end of the city of Bountiful, Davis County.
Can data from this site be used to evaluate NAAQS? Yes

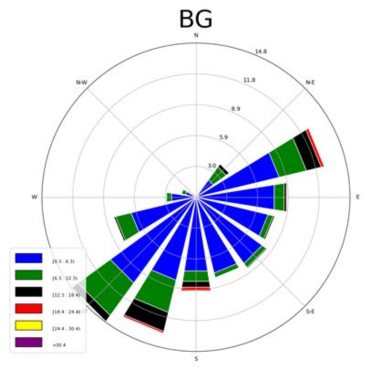
Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Nitrogen Dioxide (CAPS true)	Cavity Attenuated Phase Shift (CAPS)	Continuous	Population Exposure	SLAMS- Population Neighborhood
NOy	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood

Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
PM_{10}	Manual Gravimetric	Daily (Feb 1-Sep 30)	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
PM_{10} Metals	Manual Gravimetric	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
PM_{10} Metals Co-located	Manual Gravimetric	6 samples/year	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Speciation	Manual EPA CSN	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
VOC	Manual EPA NATTS	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
Air Toxics (hourly VOCs-PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	Population Neighborhood
Semi-volatile	Manual EPA NATTS	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
Carbonyl compounds	Manual EPA NATTS	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
Formaldehyde and Hydrogen Chloride	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	Population Neighborhood
Black Carbon	Aethalometer (light absorption)	Continuous	Population Exposure	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban
Precipitation	Tipping Bucket Rain Gauge	Continuous		Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban







Site:	Brigham City #3 (BG)	Longitude:	-112.021484	Station Type:	SLAMS
AQS#:	49-003-0005	Latitude:	41.485039	MSA:	Ogden-Clearfield
Address:	350 West 1175 South	Elevation (m):	1316		
City:	Brigham City				
County:	Box Elder				

Site Objective:
Site established to contain to assess population exposure and to help the forecasters with ozone and $PM_{2.5}$ predictions.

Does the site meet the objective? Yes, all objectives are met.

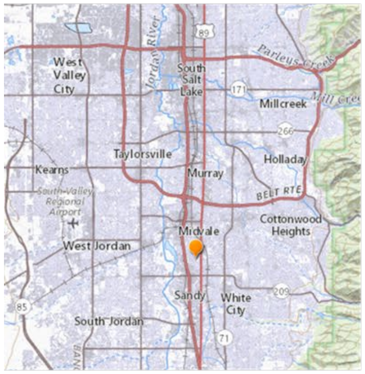
Site Description:
The site is located in near a neighborhood area of Brigham City in Box Elder County

Can data from this site be used to evaluate NAAQS? Yes

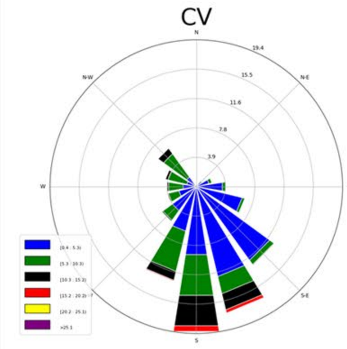
Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
PM10	Manual Gravimetric	Daily (Feb 1-Sep 30)	Population Exposure	SLAMS- Population Neighborhood

$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban







Site:	Copperview (CV)	Longitude:	-111.894162	Station Type:	SLAMS
AQS#:	49-035-2005	Latitude:	40.597911	MSA:	Salt Lake City
Address:	8449 South Monroe St.	Elevation (m):	1343		
City:	Midvale				
County:	Salt Lake				

Site Objective:
Site established to assess population exposure in southeast Salt Lake County and to help the forecasters with ozone and PM2.5 predictions.

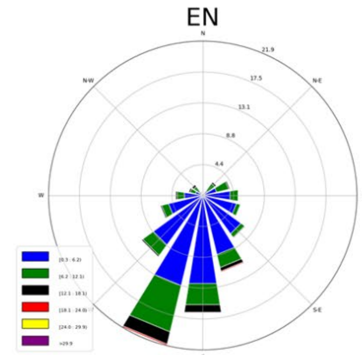
Does the site meet the objective? Yes, all objectives are met.

Site Description:
The site is located in a neighborhood area of Midvale in Salt Lake County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
Carbon Monoxide, Trace	Gas Phase Correlation	Continuous	Population Exposure	SLAMS- Population Neighborhood
Sulfur Dioxide, Trace	Pulsed Fluorescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban

Site:	Enoch (EN)	Longitude:	-113.055482	Station Type:	SLAMS
AQS#:	49-021-0005	**Latitude:**	37.747409	**MSA:**	Not in MSA
Address:	3840 North 325 East	**Elevation (m):**	1693		
City:	Enoch				
County:	Iron				

Site Objective:
Site established to contain to assess population exposure and to help the forecasters with ozone and PM2.5 predictions.

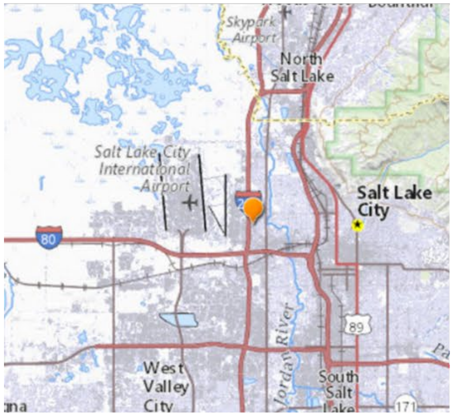
Does the site meet the objective? Yes, all objectives are met.

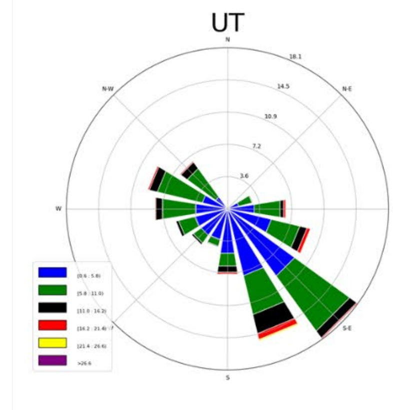
Site Description:
This site is located in a county area near Enoch.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban





Site:	Environmental Quality (EQ)	Longitude:	-111.94585	Station Type:	SLAMS
AQS#:	49-035-3015	**Latitude:**	40.777028	**MSA:**	Salt Lake City
Address:	1950 West 240 North	**Elevation (m):**	1284		
City:	Salt Lake City				
County:	Salt Lake				

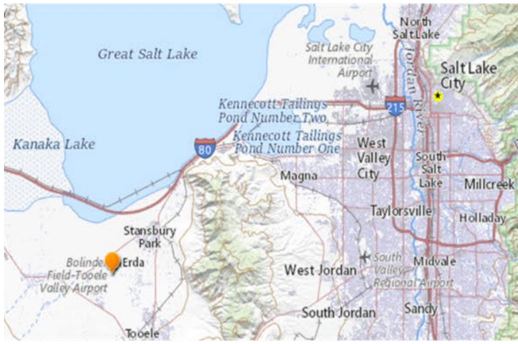
Site Objective:
The Air Monitoring Center site is established to replace the Rose Park station as an area of further investigation of $PM_{2.5}$ in Salt Lake County.
Does the site meet the objective? Yes, all objectives are met.

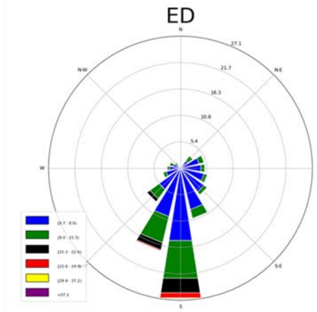
Site Description:
The site is located at the roof of the Technical Support Center in the city of Salt Lake, Salt Lake County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Ammonia	Manual NADP AMoN	Integrated 14 days	Population Exposure	SPM-Transport Regional
Trace Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- High Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- High Neighborhood

Carbon Monoxide	Gas Phase Correlation	Continuous	Population Exposure	SLAMS- High Neighborhood
Sulfur Dioxide, Trace	Pulsed Fluorescence	Continuous	Population Exposure	SLAMS- High Neighborhood
AirToxics (hourly VOCs- PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	Population Neighborhood
Formaldehyde	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- High Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
PM_{10}	Manual Gravimetric	Daily	Population Exposure	SLAMS-Population Neighborhood
PM_{10}	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS-Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	15 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	15 meters	Urban
Wind Direction	2D-ultrasonic-anemometer transducers	Continuous	15 meters	Urban
Wind Speed	2D-ultrasonic-anemometer transducers	Continuous	15 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	15 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	15 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	15 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban





Site:	Erda (ED)	Longitude:	-112.355782	Station Type:	SLAMS
AQS#:	49-045-0004	**Latitude:**	40.600565	**MSA:**	Salt Lake City
Address:	2163 West Erda Way	**Elevation (m):**	1321		
City	Erda				
County:	Tooele				

Site Objective:
This site is established to determine population exposure to air pollutants.

Does the site meet the objective? Yes, all objectives are met.

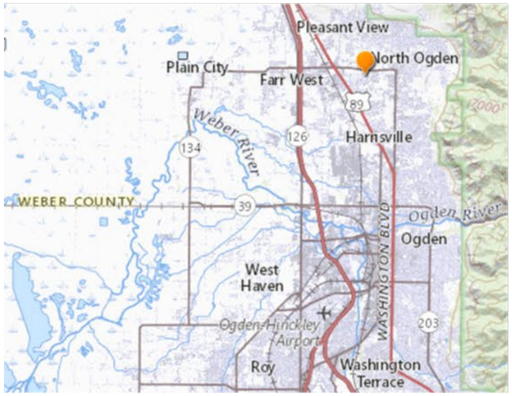
Site Description:
The site is located in the city of Erda, Tooele County.

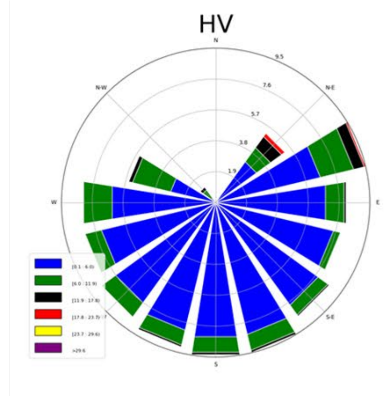
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Nitrogen Dioxide (CAPS true)	Cavity Attenuated Phase Shift (CAPS)	Continuous	Population Exposure	SLAMS- Population Neighborhood
NOy	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood

AirToxics (hourly VOCs- PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	Population Neighborhood
Formaldehyde & Hydrogen Chloride	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	3 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban





Site:	Harrisville (HV)	Longitude:	-111.986476	Station Type:	SLAMS
AQS#:	49-057-1003	Latitude:	41.302685	MSA:	Ogden-Clearfield
Address:	425 West 2550 North	Elevation (m):	1320		
City:	Harrisville				
County:	Weber				

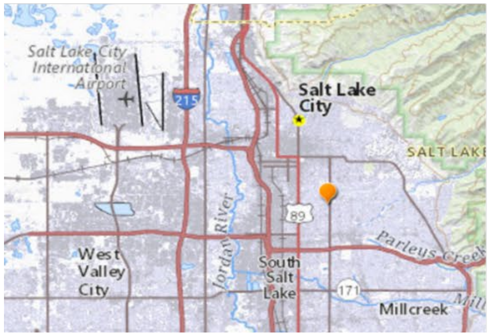
Site Objective:
This site is established in response to an ozone saturation study indicating this as a potentially high ozone concentration area. It is monitoring particulate matter
Does the site meet the objective? Yes, all objectives are met.

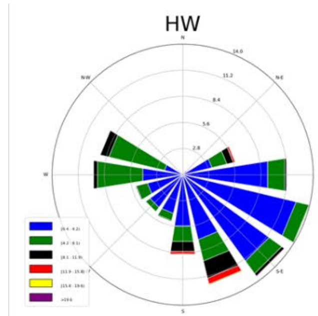
Site Description:
The site is located on the grounds of Majestic Elementary School in the city of Harrisville, Weber County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
Carbon Monoxide	Gas Phase Correlation	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
PM_{10} Real Time	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban





Site:	Hawthorne (HW)	Longitude:	-111.872221	Station Type:	SLAMS
AQS#:	49-035-3006	**Latitude:**	40.734367	**MSA:**	Salt Lake City
Address:	1675 South 600 East	**Elevation (m):**	1308		
City:	Salt Lake City				
County:	Salt Lake				

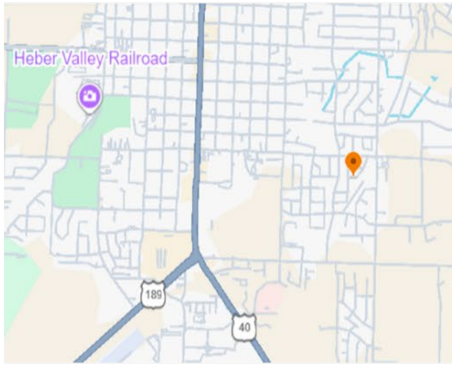
Site Objective:
This site is established to represent population exposure in the Salt Lake City area. This site is also designated as the EPA NCORE site for Utah.
Does the site meet the objective? Yes, all objectives are met.

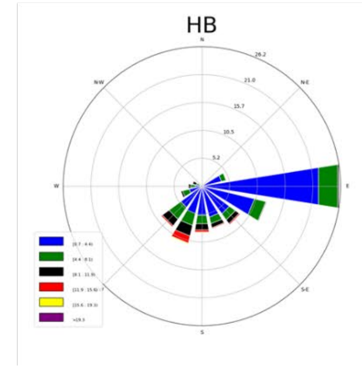
Site Description:
The site is located at Hawthorne Elementary School in the southeast section of Salt Lake City, Salt Lake County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Nitrogen Dioxide (CAPS true)	Cavity Attenuated Phase Shift (CAPS)	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
Carbon Monoxide Trace Level	Gas Phase Correlation	Continuous	Population Exposure	SLAMS-High Neighborhood
NOy Trace Level	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood

SO2 Trace Level	Pulsed Fluorescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Speciation	Manual EPA CSN	1 in 3 days	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
PM_{10}	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
PM_{10} Real Time	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
PM_{coarse}	Manual Gravimetric Subtraction	Daily	Population Exposure	SLAMS- Population Neighborhood
Air Toxics (hourly VOCs-PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	Population Neighborhood
Formaldehyde	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	3 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Relative Humidity	Air Temperature and Relative Humidity	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	4 meters	Urban
UV Radiation	UV Radiation sensor	Continuous	4 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban
Precipitation	Tipping Bucket Rain Gauge	Continuous		Urban



Site:	Heber (HB)	Longitude:	-112.036329	Station Type:	SLAMS
AQS#:	49-051-0001	Latitude:	40.497962	MSA:	Heber
Address:	Heber City Site #1 Water Conservation District lot, 626 E 1200 S Heber City	Elevation (m):	1524.11		
City:	Heber				
County:	Heber				

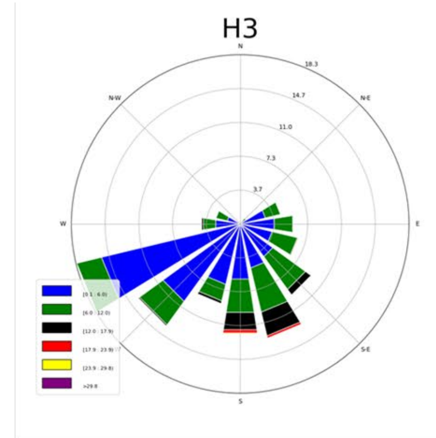
Site Objective:
This site is established to represent population exposure in Heber county.
Does the site meet the objective? Yes, all objectives are met.

Site Description:
The site is located at Public Power Utility Facility
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood

$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban

Site:	Herriman #3 (H3)	Longitude:	-112.036329	Station Type:	SLAMS
AQS#:	49-035-3012	**Latitude:**	40.496412	**MSA:**	Salt Lake City
Address:	14058 Mirabella Drive	**Elevation (m):**	1534		
City:	Herriman				
County:	Salt Lake				

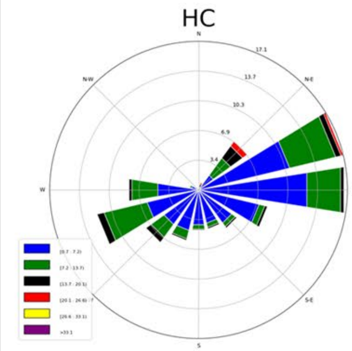
Site Objective:
This site is established to represent population exposure in southwest the Salt Lake County.
Does the site meet the objective? Yes, all objectives are met.

Site Description:
The site is located at Fort Herriman Middle School in southwest Salt Lake County
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor Co-located	Continuous	Precision and Accuracy	SLAMS- Population Neighborhood
PM_{10} Real Time	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban



Site:	Hurricane (HC)	Longitude:	-113.305105	Station Type:	SLAMS
AQS#:	49-053-0007	Latitude:	37.179138	MSA:	St George
Address:	147 North 870 West	Elevation (m):	992		
City:	Hurricane				
County:	Washington				

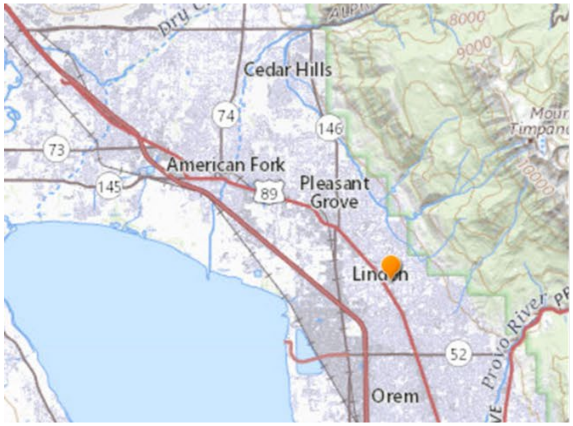
Site Objective: This site is established to determine population exposure to ozone in Washington County
Does the site meet the objective? Yes, all objectives are met.

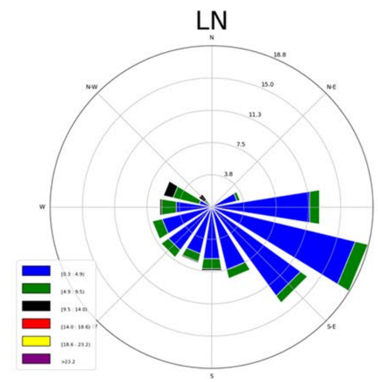
Site Description: This site is located behind the Hurricane City offices
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood

Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	2 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban



Site:	Lindon (LN)	Longitude:	-111.713486	Station Type:	SLAMS
AQS#:	49-049-4001	**Latitude:**	40.339505	**MSA:**	Provo - Orem
Address:	50 North Main	**Elevation (m):**	1444		
City:	Lindon				
County:	Utah				

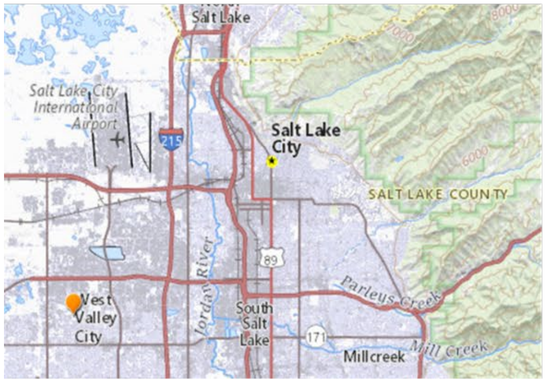
Site Objective: This site is established to determine PM emissions from commercial and industrial sources. Historically, this site has reported the highest PM values in Utah County
Does the site meet the objective? Yes, all objectives are met.

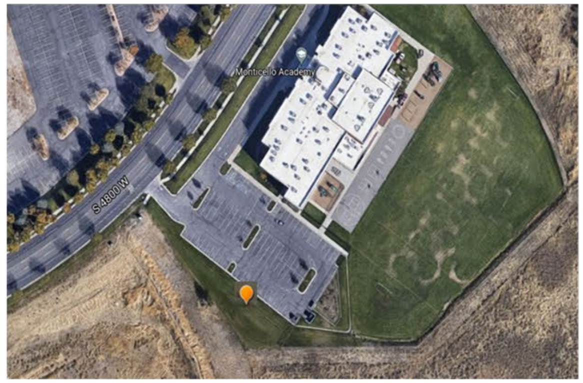
Site Description: The site is located at the Lindon Elementary School in the City of Lindon, Utah County
Can data from this site be used to evaluate NAAQS? Yes

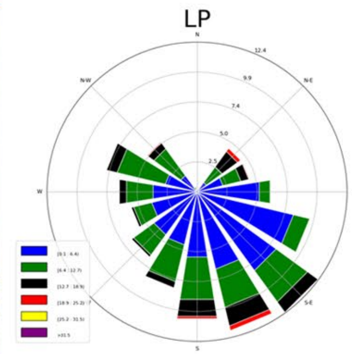
Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
Carbon Monoxide	Gas Phase Correlation	Continuous	Population Exposure	SLAMS-High Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population
$PM_{2.5}$	Manual Gravimetric Co-located	1 in 6 days	Precision and Accuracy Assessment	SLAMS- Population
$PM_{2.5}$ Speciation	Manual EPA CSN	1 in 6 days	Population Exposure	SLAMS- Population
PM_{10} Real Time	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Black Carbon	Aethalometer (light absorption)	Continuous	Population Exposure	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban







Site:	Lake Park (LP)	Longitude:	-112.008684	Station Type:	SLAMS
AQS#:	49-035-3014	**Latitude:**	40.709905	**MSA:**	Salt Lake City
Address:	2782 South Corporate Park Dr.	**Elevation (m):**	1295		
City:	West Valley City				
County:	Salt Lake				

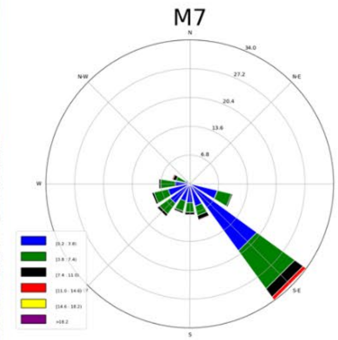
Site Objective: This site recently established to determine the potential impact of the Inland Port on the Salt Lake Valley Airshed.
Does the site meet the objective? Yes, all objectives are met.

Site Description: This site is located near the parking lot of Monticello Academy in West Valley City, Salt Lake County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Black Carbon	Aethalometer (light absorption)	Continuous	Population Exposure	SLAMS- Population Neighborhood

Air Toxics (hourly VOCs-PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban



Site:	Moab (M7)	Longitude:	-109.537167	Station Type:	SPM
AQS#:	49-019-0007	**Latitude:**	38.566055	**MSA:**	NA
Address:	691 S Mill Creek Dr.	**Elevation (m):**	1259		
City	Moab				
County:	Grand				

Site Objective:
Site established to assess population exposure and support air quality forecasting

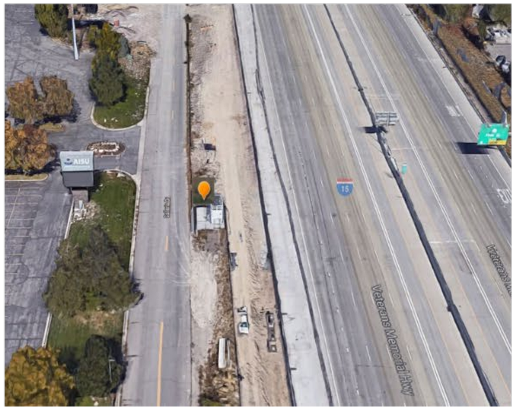
Does the site meet the objective? Yes, all objectives are met.

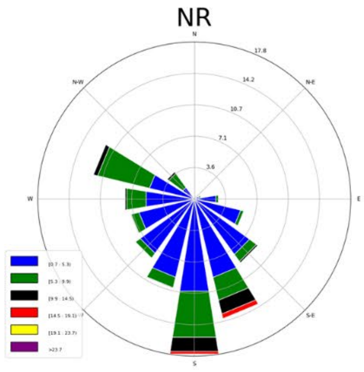
Site Description:
in Moab, Grand County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SPM
Ozone	Ultraviolet	Continuous	Population Exposure	SPM
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SPM

Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Regional
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Regional
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Regional
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Regional
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Regional
WD Sigma	Electronic EPA Method	Continuous	10 meters	Regional
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Regional





Site:	Near Road (NR)	Longitude:	-111.901874	Station Type:	SLAMS
AQS#:	49-035-4002	**Latitude:**	40.662868	**MSA:**	Salt Lake City
Address:	5001 South Galleria Dr.	**Elevation (m):**	1305		
City:	Murray				
County:	Salt Lake				

Site Objective: This site established to assess population exposure to and to monitor vehicular contribution to air pollution as part of the EPA NO_2 monitoring
Does the site meet the objective? Yes, all objectives are met.

Site Description: A site was found for the Near Road monitor on I-15 at the address 4951 South Galleria Dr, Murray. The site is located at 14 meters from the inlet probe to the center of the nearest lane (the nearest lane is an exit lane) or It is 19 meters to center of the nearest lane that supports normal traffic flow.
Can data from this site be used to evaluate NAAQS? NO*

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	Micro
Ozone	Ultraviolet	Continuous	Population Exposure	Micro
Carbon Monoxide	Gas Phase Correlation	Continuous	Population Exposure	Micro
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	Micro
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	Micro

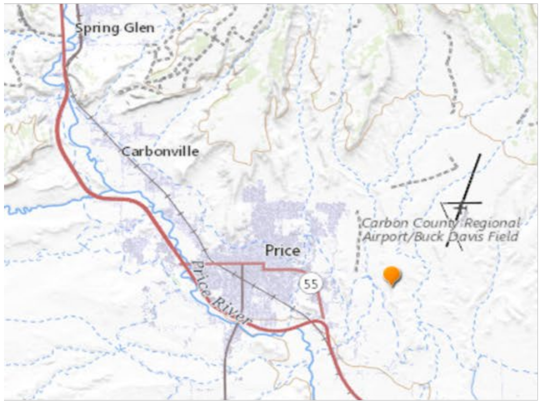
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	3 meters	Micro
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	3 meters	Micro
Wind Direction	2D-ultrasonic anemometer	Continuous	3 meters	Micro
Wind Speed	2D-ultrasonic anemometer	Continuous	3 meters	Micro
Ambient Pressure	Barometric Pressure Transducer	Continuous	3 meters	Micro
Solar Radiation	Solar Radiation sensor	Continuous	3 meters	Micro

[*] State and Local Air Monitoring Stations (SLAMS) are strategically placed to represent general air quality across urban, suburban, and rural areas. These sites follow specific siting criteria designed to avoid direct influence from nearby pollution sources like industrial areas or highways. The goal is to reflect typical population exposure and provide broad spatial coverage.
In contrast, near-road monitoring sites are located within 50 to 100 meters of major roadways, specifically to capture the impact of traffic emissions. These sites are placed in areas with heavy vehicle activity and are more likely to record higher levels of pollutants such as NO_2 and $PM_{2.5}$. Due to their proximity to major traffic, near-road sites are more likely to exceed the NAAQS compared to more widely distributed SLAMS stations.

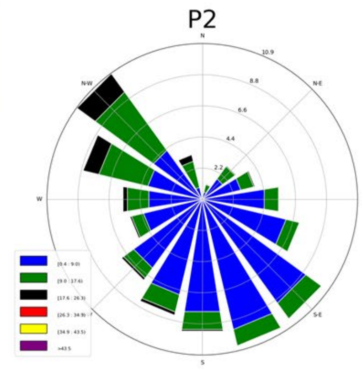
A few key points to consider:

- *Near-road sites are designed to assess the impact of traffic emissions, which can elevate pollutants like $PM_{2.5}$. Including these sites in the broader NAAQS calculation could distort the results, as they represent areas with high vehicle emissions that may not be indicative of the general population's exposure to $PM_{2.5}$.*
- *The primary aim of the $PM_{2.5}$ NAAQS is to protect public health across a broader region. Near-road monitoring, on the other hand, focuses on localized hotspots with high traffic volumes. These hotspots may have elevated $PM_{2.5}$ concentrations that exceed the NAAQS, but they don't reflect the typical exposure experienced by the general population, which is usually lower, especially in areas farther from traffic.*

Because near-road sites do not fully represent the exposure of the majority of the population, excluding their data from NAAQS calculations helps provide a more accurate picture of air quality and exposure levels that affect the general public.







Site:	Price #2 (P2)	Longitude:	-110.770097	Station Type:	SPM
AQS#:	49-007-1003	**Latitude:**	39.595749	**MSA:**	Price
Address:	351 South 2500 East	**Elevation (m):**	1737		
City:	Price				
County:	Carbon				

Site Objective: This site is established in response to a three-state ozone study.
Does the site meet the objective? Yes, all objectives are met.

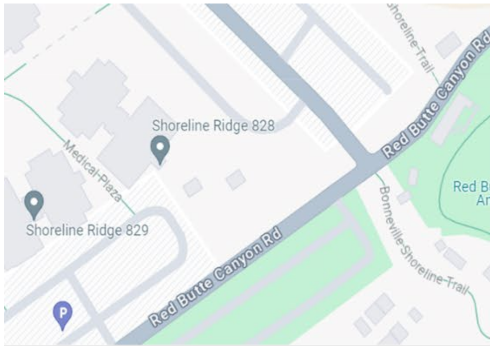
Site Description: This site is located in a farm field 3.6 Km east of Price
Can data from this site be used to evaluate NAAQS? Yes

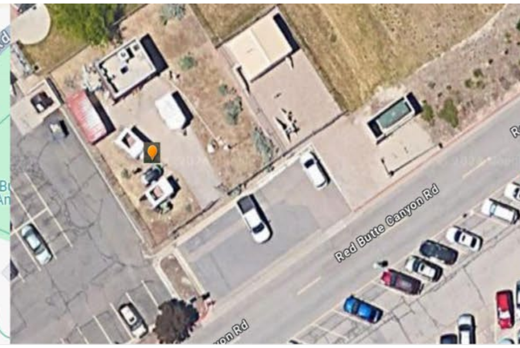
Gaseous/Particulate Parameters

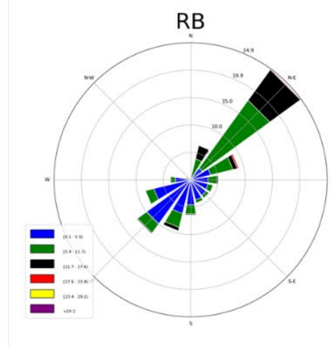
Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS-High Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SPM

Meteorological Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Regional
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Regional
Wind Direction	2D-ultrasonic anemometer	Continuous	10 meters	Regional
Wind Speed	2D-ultrasonic anemometer	Continuous	10 meters	Regional
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Regional
WD Sigma	Electronic EPA Method	Continuous	10 meters	Regional
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Regional





Site:	Red Butte (RB)	Longitude:	-111.8285	Station Type:	SPM
AQS#:	49-035-3018	**Latitude:**	40.7667	**MSA:**	Salt Lake City
Address:	2195 Red Butte canyon Rd	**Elevation (m):**	1517		
City:	Salt Lake City				
County:	Salt Lake				

Site Objective:
This site is established to support air quality models and research studies
Does the site meet the objective? Yes, all objectives are met.

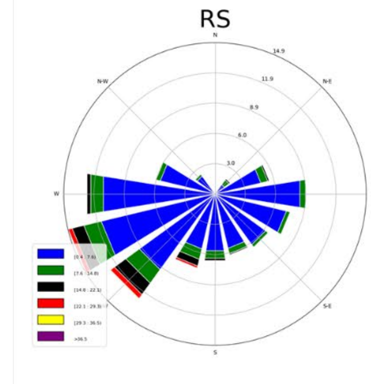
Site Description:
The site is located at the University of Utah Research Met in the southeast section of Salt Lake City, Salt Lake County.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide (CAPS true)	Cavity Attenuated Phase Shift (CAPS)	Continuous	Population Exposure	SPM
Ozone	Ultraviolet	Continuous	Population Exposure	SPM
NOy Trace Level	Gas Phase Chemiluminescence	Continuous	Population Exposure	SPM
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SPM

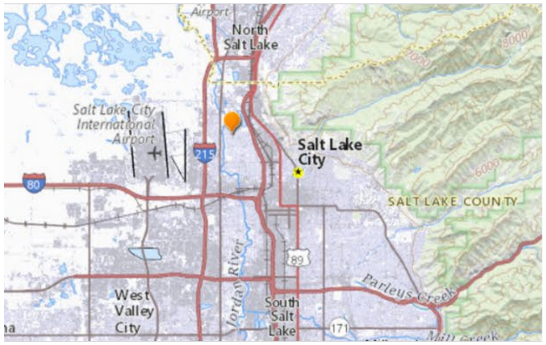
Air Toxics (hourly VOCs-PAMS)	Instrumental Gas Chromatography	Continuous	Ozone modeling input	SPM
Formaldehyde	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	SPM
Meteorological Parameters				
Parameter	**Sampling &**	**Operating**	**Tower**	**Spatial**
	Analysis Method	**Schedule**	**Height**	**Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	2 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Relative Humidity	Air Temperature and Relative	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban



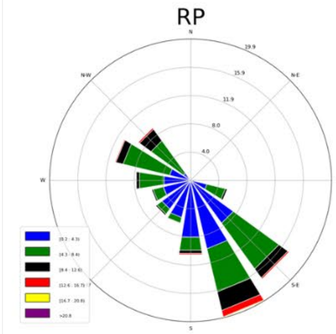


Site:	Roosevelt (RS)	Longitude:	-110.008961	Station Type:	SLAMS
AQS#:	49-013-0002	**Latitude:**	40.294175	**MSA:**	NA
Address:	290 South 1000 West	**Elevation (m):**	1585		
City:	Roosevelt				
County:	Duchesne				
Site Objective: This site is established to determine maximum ozone and $PM_{2.5}$ concentrations in Duchesne County **Does the site meet the objective?** Yes, all objectives are met.					
Site Description: The site is located in the city park North West section of Roosevelt. **Can data from this site be used to evaluate NAAQS?** Yes					
Gaseous/Particulate Parameters					
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Monitoring Objective**	**Spatial Scale**	
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood	
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- Population Neighborhood	
Ozone	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood	

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor Co-located	Continuous	Precision and Accuracy	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population
PM_{10}	Manual Gravimetric	Daily	Population Exposure	SLAMS-Impact Neighborhood
PM_{10}	Manual Gravimetric Co-located	1 in 6 days	Precision and Accuracy Assessment	SLAMS- Population
PM_{10} Real Time	Beta Attenuation Mass Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban
Ambient Temperature	Elec. Resistance	Continuous	2 meters	Urban
Temperature Difference	Math Channel	Continuous	2 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban







Site:	Rose Park (RP)	Longitude:	-111.930996	Station Type:	SLAMS
AQS#:	49-035-3010	Latitude:	40.795514	MSA:	Salt Lake City
Address:	1250 North 1400 West	Elevation (m):	1283		
City:	Salt Lake City				
County:	Salt Lake				

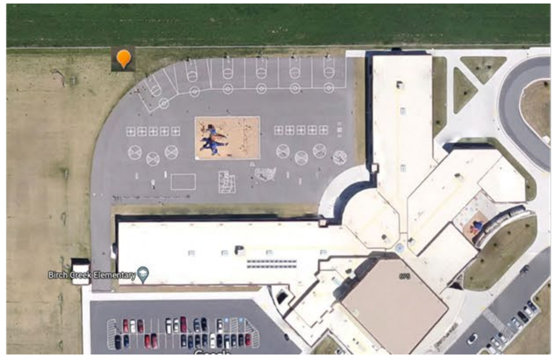
Site Objective: This site is established to better represent PM2.5 exposure in this area of Salt Lake City
Does the site meet the objective? Yes, all objectives are met.

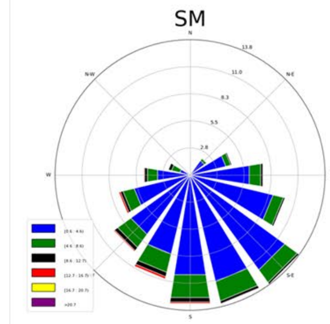
Site Description: The site is located in the community of Rose Park at the north end of Salt Lake City, Salt Lake County
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- Population Neighborhood
Carbon Monoxide	Gas Phase Correlation	Continuous	Population Exposure	SLAMS- Population Neighborhood
Sulfur Dioxide	Pulsed Fluorescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population

$PM_{2.5}$	Manual Gravimetric Co-located	Daily	Precision and Accuracy Assessment	SLAMS- Population
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban





Site:	Smithfield (SM)	Longitude:	-111.852064	Station Type:	SLAMS
AQS#:	49-005-0007	**Latitude:**	41.84267	**MSA:**	Logan
Address:	675 West 220 North	**Elevation (m):**	1379		
City:	Smithfield				
County:	Cache				

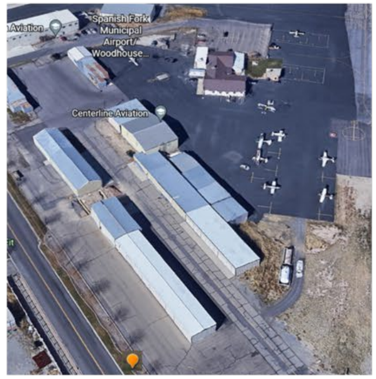
Site Objective: Site established to replace Logan site and determine general population exposure.
Does the site meet the objective? Yes, all objectives are met.

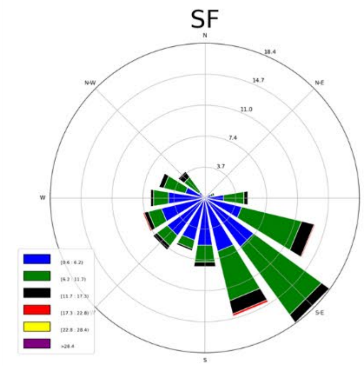
Site Description: This site is located at Birch Creek Elementary School in Cache County. It is approximately 7 miles north of Logan
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Speciation	Manual EPA CSN	1 in 6 days	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Precision and Accuracy	SLAMS- Population Neighborhood

$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor Co-located	Continuous	Precision and Accuracy	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$	Manual Gravimetric Co-located	Daily	Precision and Accuracy Assessment	SLAMS- Population Neighborhood
Black Carbon	Aethalometer (light absorption)	Continuous	Population Exposure	SLAMS- Population Neighborhood
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban



Site:	Spanish Fork (SF)	Longitude:	-111.658011	Station Type:	SLAMS
AQS#:	49-049-5010	Latitude:	40.136369	MSA:	Provo - Orem
Address:	300 West 2050 North	Elevation (m):	1380		
City:	Spanish Fork				
County:	Utah				

Site Objective: This site is established to determine the boundary of the high ozone and $PM_{2.5}$ concentrations in Utah County.
Does the site meet the objective? Yes, all objectives are met.

Site Description: The site is located at the Spanish Fork airport in the city of Spanish Fork, Utah County.
Can data from this site be used to evaluate NAAQS? Yes

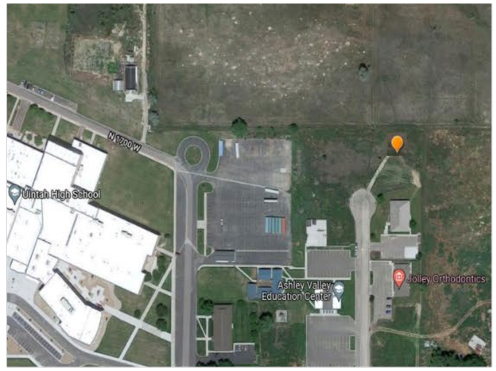
Gaseous/Particulate Parameters

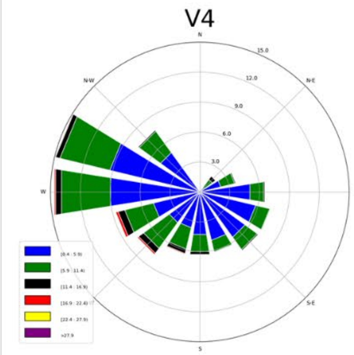
Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SLAMS- Population Neighborhood
Ozone	Ultraviolet	Continuous	Population Exposure	SLAMS- Population Neighborhood
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS- Population Neighborhood

$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood

Meteorological Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban





Site:	Vernal (V4)	Longitude:	-109.560731	Station Type:	SLAMS
AQS#:	49-047-1004	Latitude:	40.464812	MSA:	NA
Address:	628 North 1700 West	Elevation (m):	1667		
City:	Vernal				
County:	Uintah				

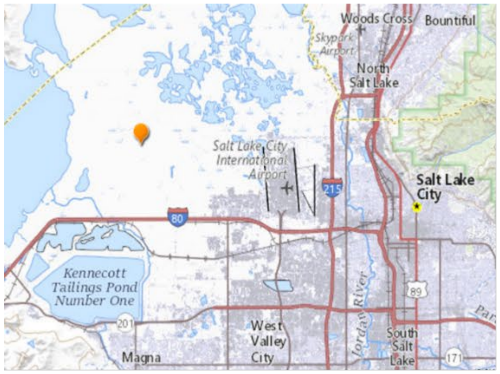
Site Objective: This site is established was set up in response to an ozone study.
Does the site meet the objective? Yes, all objectives are met.

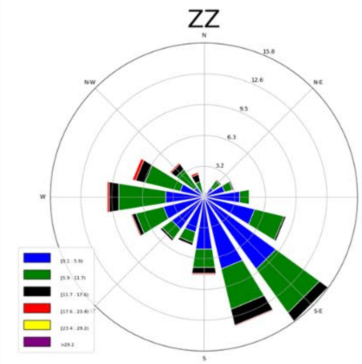
Site Description: The site is located at the northwest of the city of Vernal.
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	Regional
Ozone	Ultraviolet	Continuous	Population Exposure	Regional
Ozone	Gas Phase Chemiluminescence	Continuous	Population Exposure	Regional
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SLAMS-Population
$PM_{2.5}$	Manual Gravimetric	Daily	Population Exposure	SLAMS- Population Neighborhood

Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Regional
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Regional
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Regional
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Regional
Ambient Pressure	Barometric Pressure Transducer	Continuous	2 meters	Regional
WD Sigma	Electronic EPA Method	Continuous	10 meters	Regional
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Regional





Site:	Prison (ZZ)	Longitude:	-112.087772	Station Type:	SPM
AQS#:	49-035-3016	Latitude:	40.80793	MSA:	Salt Lake City
Address:	8000 W 1480 N	Elevation (m):	1287		
City:	Salt Lake City				
County:	Salt Lake				

Site Objective: This site recently established to determine the potential impact of the Inland Port on the Salt Lake Valley Airshed.
Does the site meet the objective? Yes, all objectives are met.

Site Description: This site is located at the new State Prison north of I-80 on the southern border of the Great Salt Lake in Salt Lake County
Can data from this site be used to evaluate NAAQS? Yes

Gaseous/Particulate Parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Nitrogen Dioxide	Gas Phase Chemiluminescence	Continuous	Population Exposure	SPM
Ozone	Ultraviolet	Continuous	Population Exposure	SPM
$PM_{2.5}$ Real Time	Synchronized Hybrid Ambient Real Time Particulate Monitor	Continuous	Air Quality Index	SPM
PM_{10}	Manual Gravimetric	Daily (Feb 1-Sep 30)	Population Exposure	SPM

Black Carbon	Aethalometer (light absorption)	Continuous	Population Exposure	SPM
Formaldehyde and Hydrogen Chloride	Cavity Ring Down Spectroscopy (CRDS)	Continuous	Ozone modeling input	SPM
Meteorological Parameters				
Parameter	**Sampling & Analysis Method**	**Operating Schedule**	**Tower Height**	**Spatial Scale**
Relative Humidity	Air Temperature and Relative Humidity Sensor- Electronic Thin Film	Continuous	10 meters	Urban
Ambient Temperature	Air Temperature and Relative Humidity Sensor- Electronic Resistance	Continuous	10 meters	Urban
Wind Direction	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Wind Speed	2D-ultrasonic anemometer transducers	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	10 meters	Urban
WD Sigma	Electronic EPA Method	Continuous	10 meters	Urban
Solar Radiation	Solar Radiation sensor	Continuous	10 meters	Urban
Mixing Height	Optical Scattering Ceilometer	Continuous		Urban