

2011 Air Quality Ozone Season Summary

Coeur d'Alene Area



**State of Idaho
Department of Environmental Quality
Coeur d'Alene Regional Office**

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1. Introduction

This report presents a summary of monitoring data collected during the 2011 ozone season (May 1–September 30) at the Lancaster Road multipollutant monitoring site (Lancaster site) in Kootenai County, Idaho, and compares the monitoring results to current National Ambient Air Quality Standards (NAAQS). For the purpose of this report, the Coeur d'Alene Airshed is defined as the Rathdrum Prairie, including the cities of Coeur d'Alene, Hayden, Rathdrum and Post Falls. Preliminary modeling suggests the Coeur d'Alene Airshed experiences significant influences from several eastern Washington counties. Although this report focuses on the 2011 season, a comparison between the NAAQS and the entire applicable data set (2005–2011) is presented. The 2011 data used for this report are considered preliminary and have not been completely quality-assured. Data certification will occur by June 30, 2012.

In Idaho, monitoring for the six criteria air pollutants defined in the Clean Air Act of 1970, including ozone, occurs primarily in high population areas where the potential for human exposure is greatest. As a first step to characterize ozone concentrations in the greater Coeur d'Alene area and Kootenai County, the Idaho Department of Environmental Quality (DEQ) installed an ozone monitor, nitrogen dioxide (NO₂) monitor, and a weather tower at the Lancaster site north of Hayden, during summer 2005 (Figure 1).

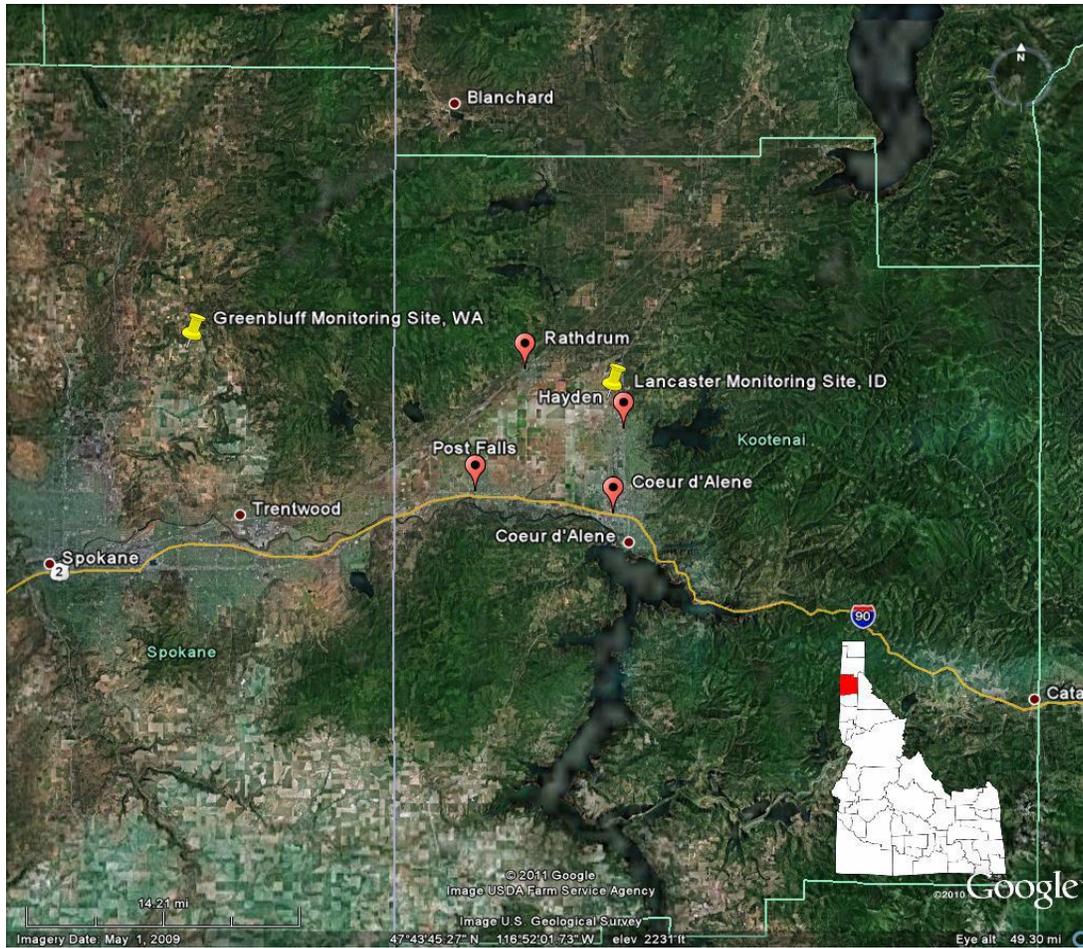


Figure 1. Map of Coeur d’Alene, surrounding areas, and ozone monitoring locations.

Ozone monitoring in Kootenai County takes place for two reasons. The first is to quantify the impacts of ozone precursors (i.e., pollutants that lead to ozone formation in the presence of sunlight) that may be from eastern Washington—particularly Spokane County—and Kootenai County, Idaho. The time it takes for ozone precursors to travel from sources near Spokane, Washington, and other parts of eastern Washington to the Coeur d’Alene area, during average wind conditions and predominant southwesterly wind direction, is roughly the same as the time it takes for the ozone-forming reaction to occur during hot weather. This correlation suggests that precursors released in eastern Washington may contribute to increased ozone in areas of Kootenai County. The second reason for monitoring ozone in the Coeur d’Alene area is that the US Environmental Protection Agency’s (EPA’s) AIRNow national ozone maps previously included Kootenai County with Spokane County because Kootenai County was not monitoring ozone. This inclusion led to Kootenai County being listed in the “moderate” category for ozone on a number of days during each ozone season when it may have actually been measuring concentrations resulting in being listed in the “good” category if a monitor was active in Kootenai County.

1.1 Overview of Ozone

Ozone, a colorless gas molecule with a strong odor, is composed of three atoms of oxygen (O₃). In the upper atmosphere, ozone is considered beneficial because it helps to protect the Earth from the sun's ultraviolet rays. In contrast, ozone formed at ground level is a summertime air pollution problem and is unhealthy for plants and animals. Elevated concentrations of ground-level ozone can cause reduced lung function, respiratory irritation, and can aggravate asthma. Lung damage caused by ozone usually heals within a few days, but repeated or prolonged exposure may cause permanent damage. People with respiratory conditions should limit outdoor activity if ozone levels are high. Even healthy individuals may experience respiratory symptoms on a high-ozone day. Ground-level ozone can also damage agricultural crops and forests by interfering with their ability to grow and produce food.

Ozone can be directly emitted by pollutant sources in certain circumstances, but it is usually formed when photochemical pollutants emitted from gas stations, cars, any combustion sources, industrial sources, and biogenic sources react with sunlight. These pollutants are called ozone precursors and include volatile organic compound (VOCs) and various nitrogen oxides (NO_x). A VOC is an organic compound that often participates in atmospheric photochemical reactions. This excludes all compounds determined by EPA to have negligible photochemical reactivity and listed in 40 CFR 51.100(s), effective July 1, 1998. Ozone formation is enhanced by temperatures near or above 30 °C (86 °F) and intense sunlight.

For additional information on ozone, visit <http://www.epa.gov/air/ozonepollution>. Additional information on ozone in question/answer format is also provided in section 7.

1.2 National Ambient Air Quality Standards

The national Clean Air Act (1970), last amended in 1990, requires EPA to set NAAQS for pollutants considered harmful to public health and the environment. The standards are designed to primarily protect the general public, including sensitive populations such as asthmatics, children, and the elderly. NAAQS are also intended to safeguard public welfare by reducing effects such as decreased visibility and damage to animals, crops and other vegetation, and buildings. The Clean Air Act directed EPA to establish standards for ambient concentrations of the criteria air pollutants, often just called criteria pollutants—ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, and sulfur dioxide.

EPA has periodically revised the original concentration limits and methods of measurement, most recently for ozone in 2008. Table 1 describes the current standard for ozone, which Idaho has adopted. The federal standard (NAAQS) for ozone is based on a 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration. For more information, the EPA air quality standards and supporting rationale are available at <http://epa.gov/air/criteria.html>.

Table 1. National Ambient Air Quality Standard for ozone.

Pollutant	Standard	Level
Ozone	The 3-year average of the fourth-highest daily maximum 8-hour average concentration cannot exceed the level measured at each monitor within an area over each year.	0.075 parts per million

When the EPA designated the new 8-hour ozone standard of 0.075 parts per million (ppm) in 2008, they also tried to eliminate some confusion by directing agencies to treat significant figures differently than in the past when determining compliance. The new calculating convention is to truncate (or cut off a number without rounding) the final concentration calculation after three significant figures. For example, a final concentration of 0.0759 would be 0.075 and not rounded to 0.076. The value of 0.075, shown in Table 1, is used to determine if an area is in compliance and is reflected in the graphs in this report.

Each criteria pollutant typically has different standards for different averaging periods (e.g., annual, daily, hourly, and 8-hour averages). These different standards were developed to address varied health impacts that happen as a result of shorter, higher-level exposures versus longer, lower-level exposures. Additional information is available on the EPA website at <http://epa.gov/air/criteria.html>.

A distinction exists between “exceeding” and “violating” a standard; the two are not equivalent. This distinction is due to the nature of the standards. In most instances, an area can exceed the standard a few times to allow for possible meteorological aberrances. For example, an 8-hour average ozone concentration of 0.090 ppm clearly *exceeds* the standard; however, the standard is not *violated* if the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration (called the design value) does not exceed 0.075 ppm. This distinction is very important when evaluating the compliance status of an area.

2. Idaho’s Monitoring Network

The Idaho ozone monitoring network is a composite of meteorological and pollutant-specific monitoring equipment. Ozone monitoring stations are located in both urban and rural areas, although many of the precursor compounds that react with sunlight to produce ozone are generated primarily in large metropolitan areas. Data from the ozone network are sent directly to engineers and scientists through a wireless telemetry network. These data are used to update both DEQ and EPA websites with current pollution levels and to update Air Quality Index (AQI) information. The data are quality-assured and submitted to EPA and also disseminated to public and private entities that use the data for a variety of projects.

Real-time ozone monitoring data in Idaho is available April through September at <http://airquality.deq.idaho.gov/>. Visit DEQ’s website at <http://www.deq.idaho.gov/> to find more extensive air quality data, educational materials, and discussions of current topics.

2.1 Ozone Monitoring in Kootenai County

Ozone monitoring in the Coeur d'Alene area occurs each summer during the ozone season. The season start date is April 1, and the season end date is September 30. This is the accepted ozone season for the northern latitudes of the contiguous United States and is determined to be the portion of each year when ozone formation has the potential to exceed the NAAQS.

While Idaho generally enjoys good air quality, the state's airsheds are faced with new challenges each year. Over the last decade, criteria air pollutant levels in Idaho have generally decreased to levels well below the federal standards due to better control of air pollution; however, ozone levels in the Coeur d'Alene area, while not violating federal standards, are not far below the current standard (0.075 ppm). Because summers in northern Idaho are normally hot and dry, the Coeur d'Alene area tends to see daily ozone levels that begin to rise in the late morning and then peak in the late afternoon and early evening. This phenomenon follows very closely with the time of day that temperatures are hottest and the sun is highest in the sky.

DEQ chose the Lancaster site for ozone monitoring based on an understanding of basic ozone development processes and the assumption that a majority of the sources of ozone-forming pollutants were located west and, therefore, upwind of Kootenai County. The ozone formation reaction requires ozone-forming pollutants to be subjected to at least 3 hours of heat and intense sunlight to reach peak reactivity. The average wind speeds and predominance of southwesterly winds at the Lancaster site during the ozone season indicated this site would likely measure the maximum ozone concentrations in Kootenai County. As with any monitoring site selection, security, accessibility, and potential interference from nearby activity were also considered. DEQ relied on EPA's *Guideline on Ozone Monitoring Site Selection* to help select this monitoring site.¹ The Lancaster site is currently the only ozone monitoring site located within Kootenai County.

At the Lancaster site, pollutants and meteorological information are measured using EPA-approved reference methods. Table 2 presents the methodology used for measuring ozone and NO_x concentrations at the site.

Table 2. Pollutant monitoring methods used at the Lancaster site in 2010.

Measurement	Pollutant Code	Method	Units
Ozone	O ₃	Ultraviolet absorption	Parts per billion (ppb)
Nitrogen oxides (NO, NO ₂ , and NO _x)	NO _x	Chemiluminescence	Parts per billion (ppb)

The gas monitors used at the Lancaster site are capable of reporting measurements in ppm, which are the units used in the gas NAAQS. Unfortunately, some of DEQ's supporting equipment at the site can only report in parts per billion (ppb). However, DEQ's data acquisition system converts the monitoring outputs into ppm automatically by dividing ppb by 1,000.

1. EPA (US Environmental Protection Agency). 1998. *Guideline on Ozone Monitoring Site Selection*. Research Triangle Park, NC: EPA, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division. EPA-454/R-98-002.

Methods used for collecting the meteorological data are presented in Table 3. These data are collected by a variety of instruments on a 10-meter (m) weather tower.

Table 3. Meteorology monitoring methods used at the Lancaster site in 2010.

Measurement	Parameter Code	Method	Units
Wind speed	WS	Propeller-type anemometer	Meters per second
Wind direction	WD	Tail wind vane	Degrees (0–360)
Solar radiation	SR	Pyranometer	Watts per square meter
2-meter (m) ambient temperature	2-m temp	Platinum resistance thermometer	Degrees Celsius
10-m ambient temperature	10-m temp	Platinum resistance thermometer	Degrees Celsius
Relative humidity	Dew point	Capacitive polymer H chip	Percent
Precipitation as rain	Rain	Tipping rain gauge	Inches (to nearly hundredth)
Barometric pressure	BP	Silicone capacitive pressure sensor	Millibars

When interpreting data from a sampling site, one must consider factors such as temperature, solar radiation, and wind direction, all of which are discussed in this report. Obvious correlations with temperature and solar radiation existed this season, and a less obvious relationship with wind direction was also observed. The wind data suggest that the transport of ozone or its precursors to the site was a factor in the highest readings at the Lancaster site. Additional studies are needed to determine if a definitive link between high ozone concentrations and wind direction exists at this site.

NO_x is also an important component of ozone formation and can be a limiting factor for ozone development. DEQ monitors NO_x at the Lancaster site during the ozone season to help predict O₃ levels. The 2011 season was not a good one for the Lancaster NO_x monitor. Due to technical issues, very little viable NO_x data were collected this season.

3. 2011 Ozone Season Summary

The 2011 ozone season was distinguished by lower than average temperatures for most of the season with temperatures slightly above average for September. These cooler temperatures were not optimal for ozone formation, so ozone levels were relatively low again this year. Ozone concentrations only reached the moderate range on the AQI scale (0.060 ppm and higher) twice during 2011. The highest 8-hour average ozone reading of the year was 0.061 ppm on September 12.

Figure 2 presents a simple overview of the ozone season at the Lancaster site. The relative continuity of daily highs throughout the 2011 season is atypical compared to historic patterns. Normally there are higher than average readings in the hotter months of July and August with lower readings earlier in the season. The pattern for the 2011 season suggests there were conditions during the season that kept ozone formation below average. In this figure, zero values indicate instrument maintenance or breakdowns.

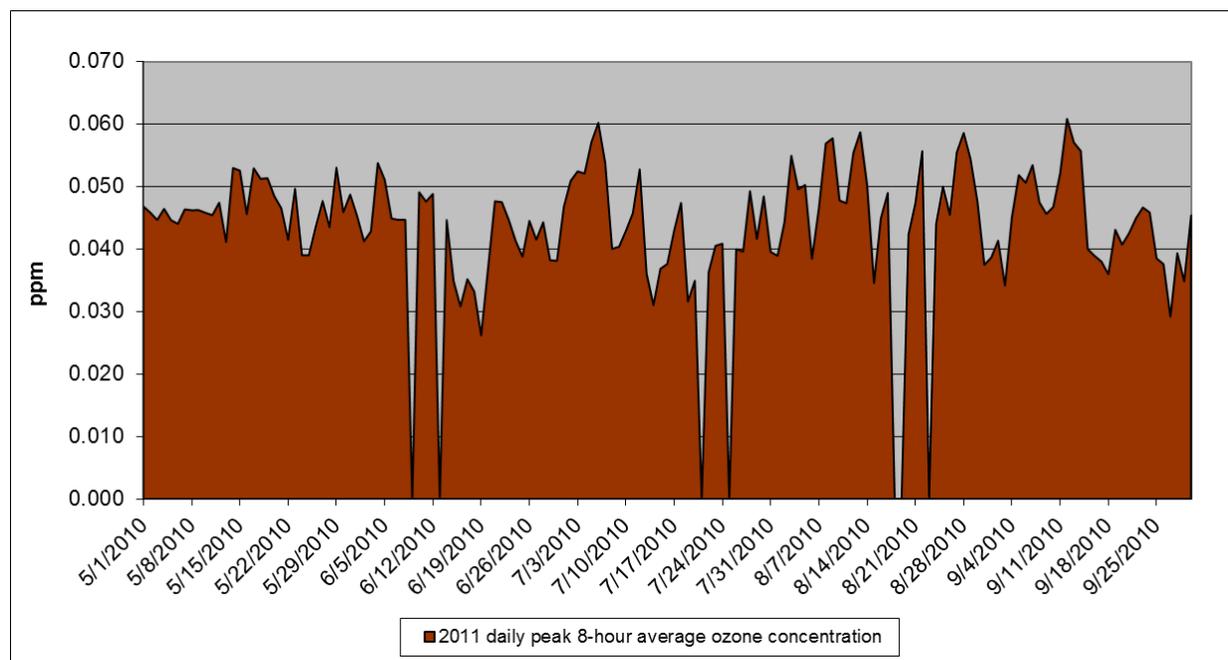


Figure 2. Lancaster site daily peak 8-hour average ozone concentration for the 2011 ozone season.

The Lancaster site's ozone concentrations remained below the NAAQS for 2011. A true comparison to the ozone NAAQS is made by averaging the annual fourth-highest daily maximum 8-hour average ozone concentration over the past 3 years (Figure 3). For the 2011 season, that calculation includes the fourth-highest 8-hour values for 2009–2011. This 3-year average is called the design value. Comparisons to the ozone NAAQS will not be completed until the 2011 ozone data for the Coeur d'Alene area are accepted by EPA in mid-2012. The 2011 ozone data used for this report are considered preliminary until verified by EPA on or before June 30, 2012. Figure 2 and Figure 3 are used only to illustrate how 2011 ozone levels

relate to the ozone standard and do not indicate a determination of whether the NAAQS was violated.

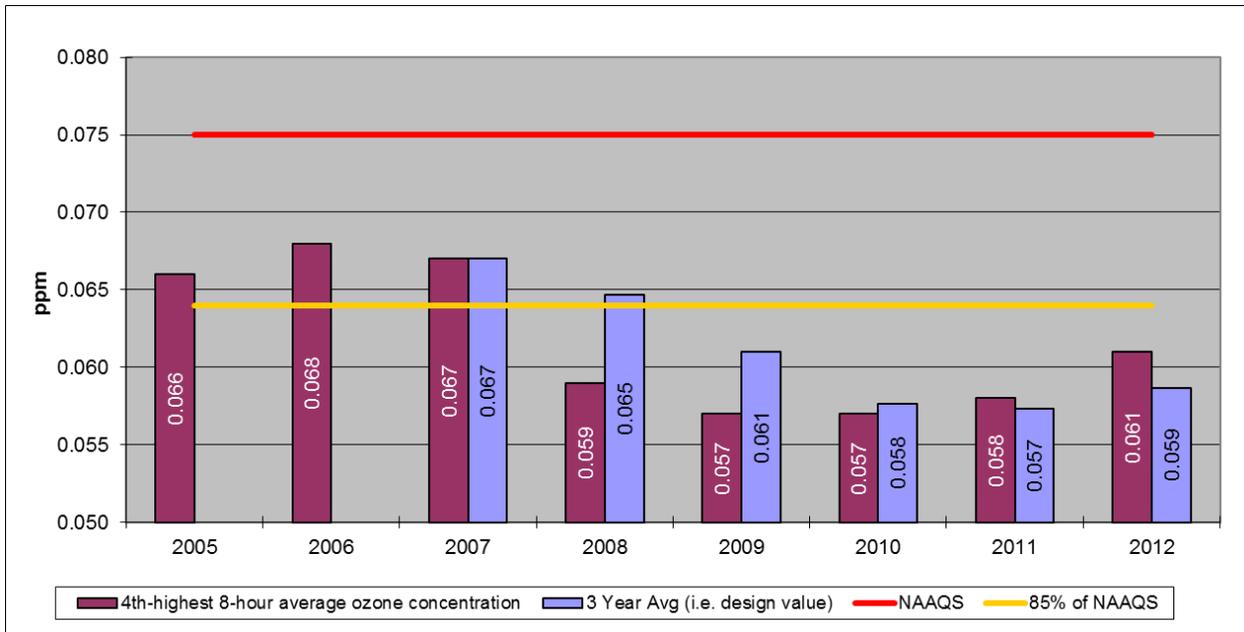


Figure 3. Lancaster site ozone monitoring design values versus ozone National Ambient Air Quality Standard. The 2012 values are projections.

Figure 3 depicts values from the Lancaster site versus the ozone NAAQS. The NAAQS line is set at 0.075 ppm; 85% of the NAAQS line—which represents a trigger level for implementation of increased control of ozone precursors established by Idaho Code 39-116B—is set at 0.064 ppm. The fourth-highest daily 8-hour average ozone concentration is shown for each year since sampling started in 2005. The design value and fourth-highest values for 2012 in Figure 3 were generated using averages of the previous 7 years of design and fourth-highest values.

For the 2011 season, the fourth-highest average was 0.058 ppm, which makes 2011 a lower-than-average year for ozone formation compared to the previous 6 years. The blue bars show the 3-year averages of the fourth-highest daily values (i.e., the design values). The ozone NAAQS determination requires 3 years of data to be evaluated and compared to NAAQS limits. Data from 2009, 2010, and 2011 produce a design value of 0.057 ppm for 2011, which puts Kootenai County at 76% of the current ozone NAAQS.

The design value for 2012 in Figure 3 was generated using an average of the previous 7 years of design values. The design value average for the 7 years of data from the Lancaster site is 0.061 ppm.

Figure 4 shows the 10-day highest 8-hour average ozone concentrations and the hour when the highest average occurred. Time is noted in Pacific standard time. The values ranged from 0.055 to 0.061 ppm for the 10 highest days. These values all fall well below the NAAQS of 0.075 ppm for ozone. The ozone NAAQS is measured in a running 8-hour average format.

The time of day of the daily maximum ozone reading for these days occurs between 5:00 p.m. and 7:00 p.m. on all 10 of these highest days. These spikes late in the day support the fact that ozone formation takes time.

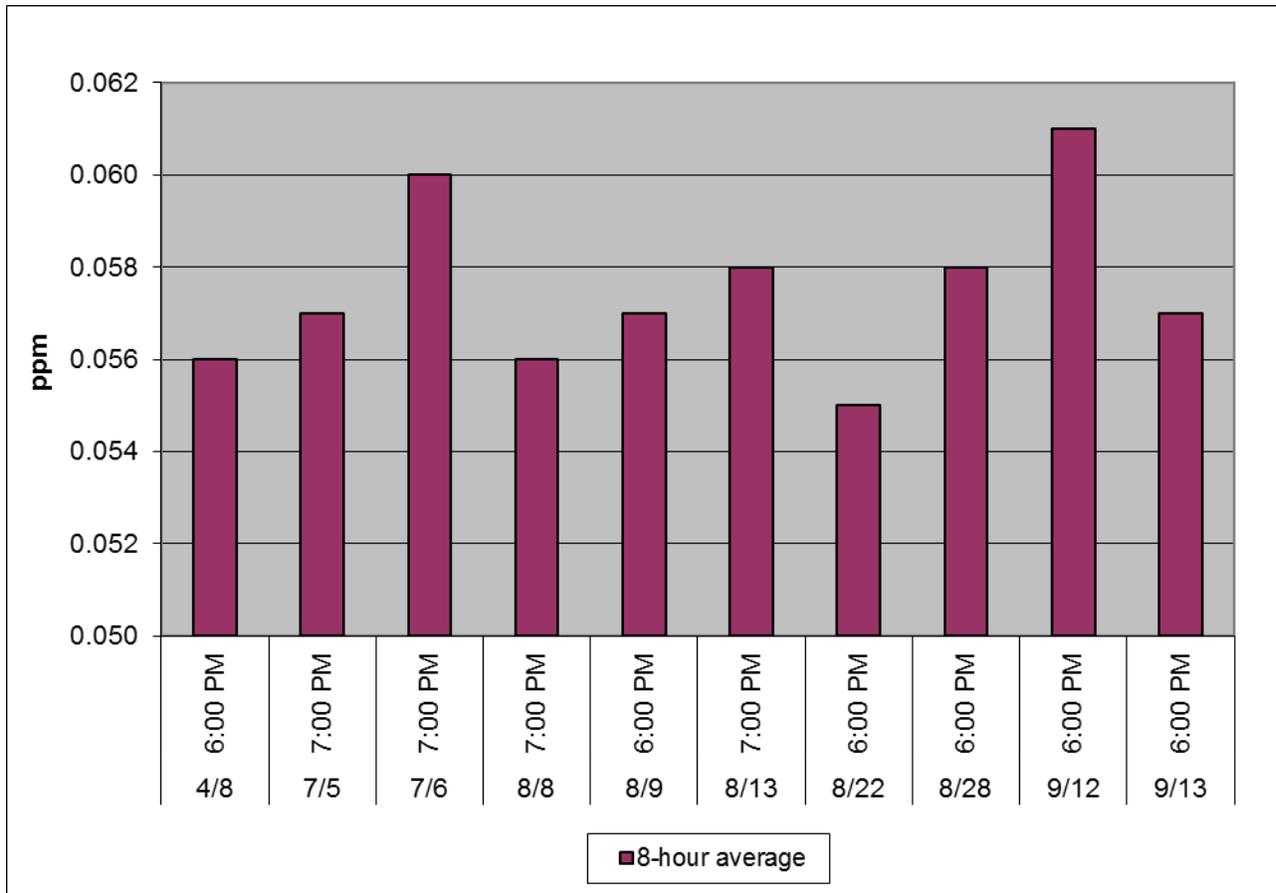


Figure 4. Lancaster site 10-day highest 8-hour average ozone concentrations in 2010 and hour when highest average occurred (in Pacific standard time).

Because temperature is one factor in the formation of ozone, the lower temperatures during summer 2011 most likely had some role in reduced ozone formation. With no days hitting the 100 °F level and only a few days in the 90 °F range, summer 2011 did not have peak ozone production. Nevertheless, ozone in the area was measured at 73%–81% of the NAAQS during the highest concentration days (Figure 5).

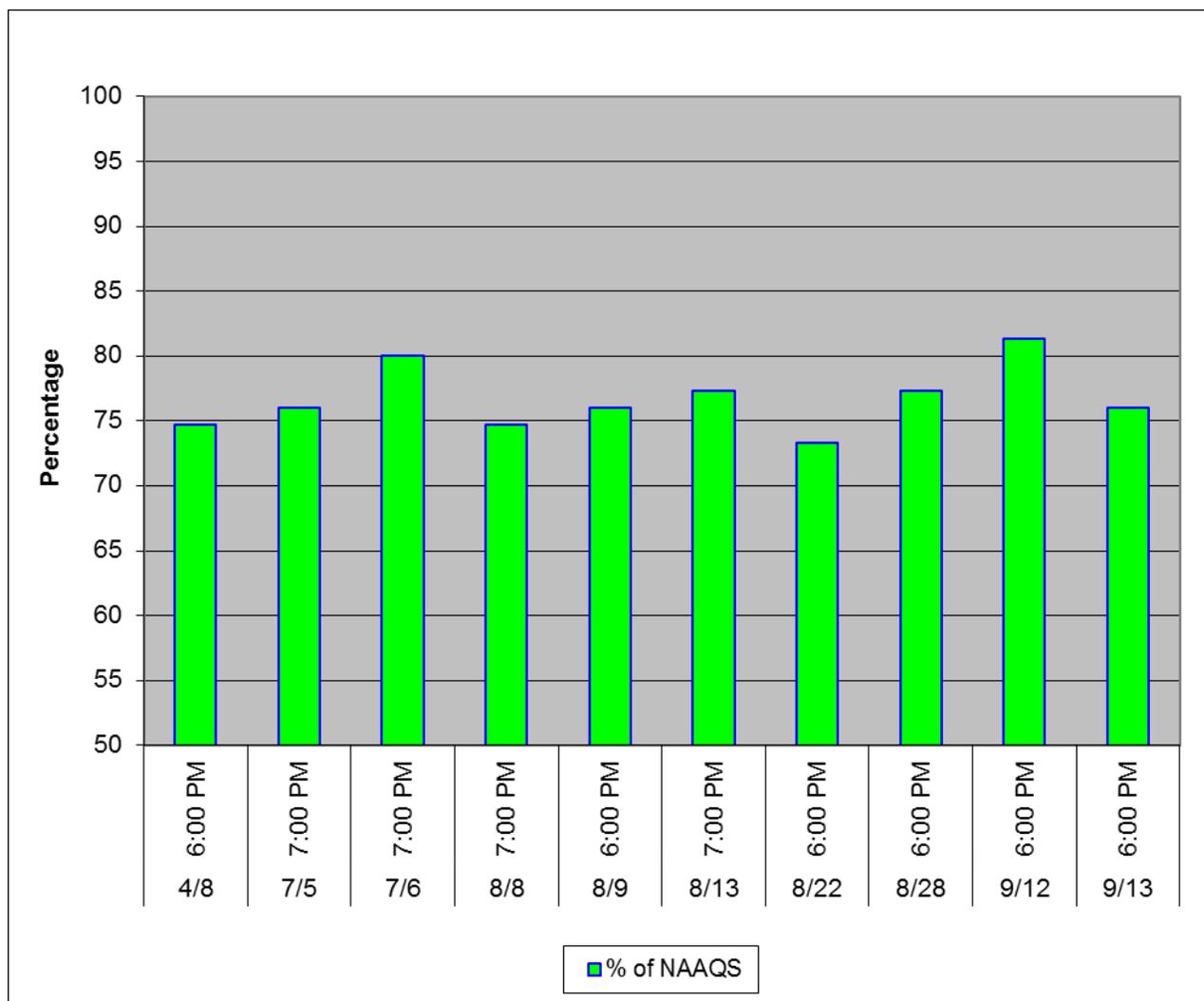


Figure 5. Lancaster site 10-day highest 8-hour average ozone concentrations in 2011 as a percentage of the ozone National Ambient Air Quality Standard. Hour of highest average reading is given in Pacific standard time.

3.1 Ozone, Temperature, and Solar Radiation

Figure 6 shows the average monthly temperatures at the Lancaster site during the 2011 ozone season as well as the historical average temperatures for May–September. The 2011 averages were computed from data measured at the Lancaster site, and the historical averages were from measurements at the Coeur d'Alene Airport. Overall, the 2011 ozone season average temperature was 1.8 °C cooler than in a typical year. Temperatures were markedly below average for April through July but then were above average for September. Again, these cooler temperatures likely contributed to the lower than average ozone levels for 2011.

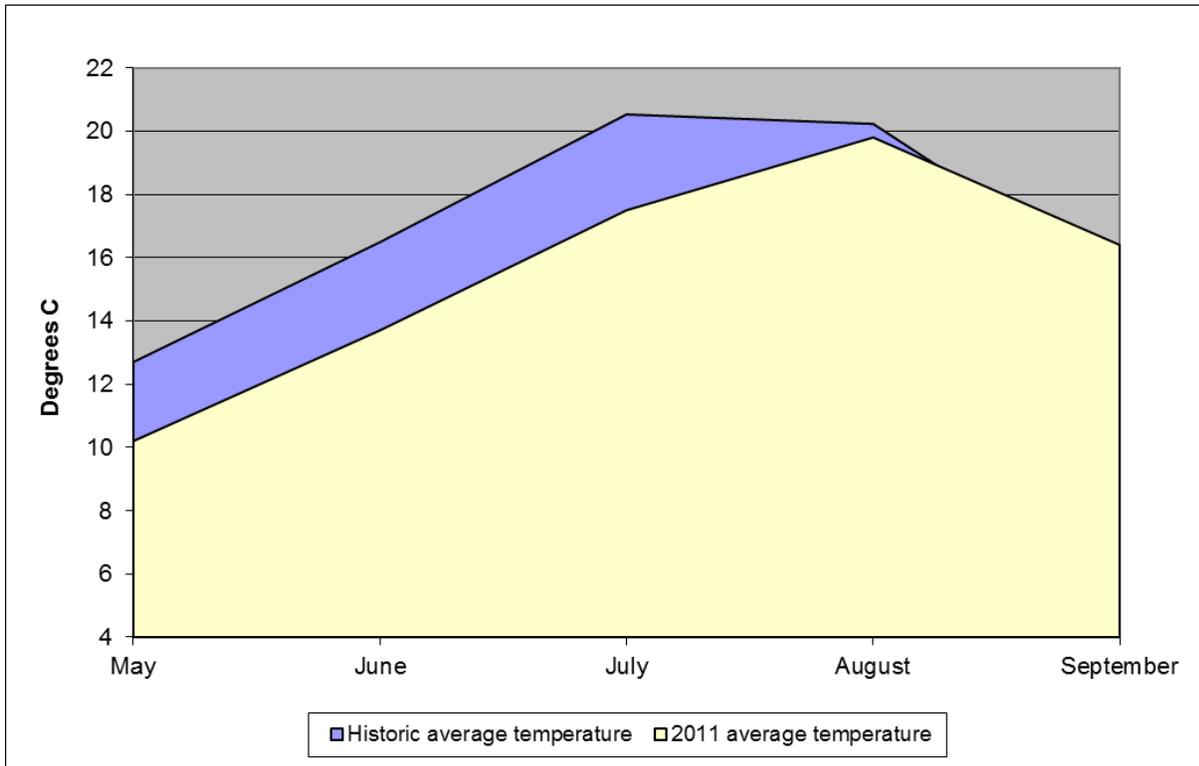


Figure 6. 2010 monthly average temperatures at the Lancaster site versus historical averages.

Precipitation does not directly affect ozone formation, but when it occurs, it generally is accompanied by decreased temperatures and increased cloud cover. The lower temperatures inhibit ozone formation as does the decreased solar radiation due to the cloud cover. Therefore, less precipitation generally correlates with higher levels of ozone. Table 4 compares the historical average precipitation amounts for the May through September ozone season to the actual 2011 precipitation amounts. Current rainfall data are collected at the Lancaster site, but the historical averages are for the National Weather Service site in Spokane, Washington. Precipitation for the season was approximately 1 inch below average. The lower precipitation amounts would suggest conditions were good for higher ozone formation, but there were obviously other factors in play.

Table 4. Historical average precipitation compared with 2011 amounts.

Month	Historical average (inches)	2011 season (inches)
May	2.01	2.36
June	1.80	1.51
July	0.72	0.57
August	0.92	0.11
September	1.27	1.21
Total	6.72	5.76

The relationship between temperature and ozone concentration can be seen in Figure 7, which compares temperature and ozone concentrations over a 4-day period in early July. The temperature values come from the Lancaster site, where temperature is measured at 2 m above the ground in degrees Celsius. The contours of the two lines follow the same general pattern of highs and lows, suggesting that temperature has an influence on the ozone concentration. The figure also clearly shows that ozone formation does not have a perfectly linear relationship with temperature. The availability of precursors, transport of ozone into the area, and cloud cover also has strong effects on the ozone levels on any given day.

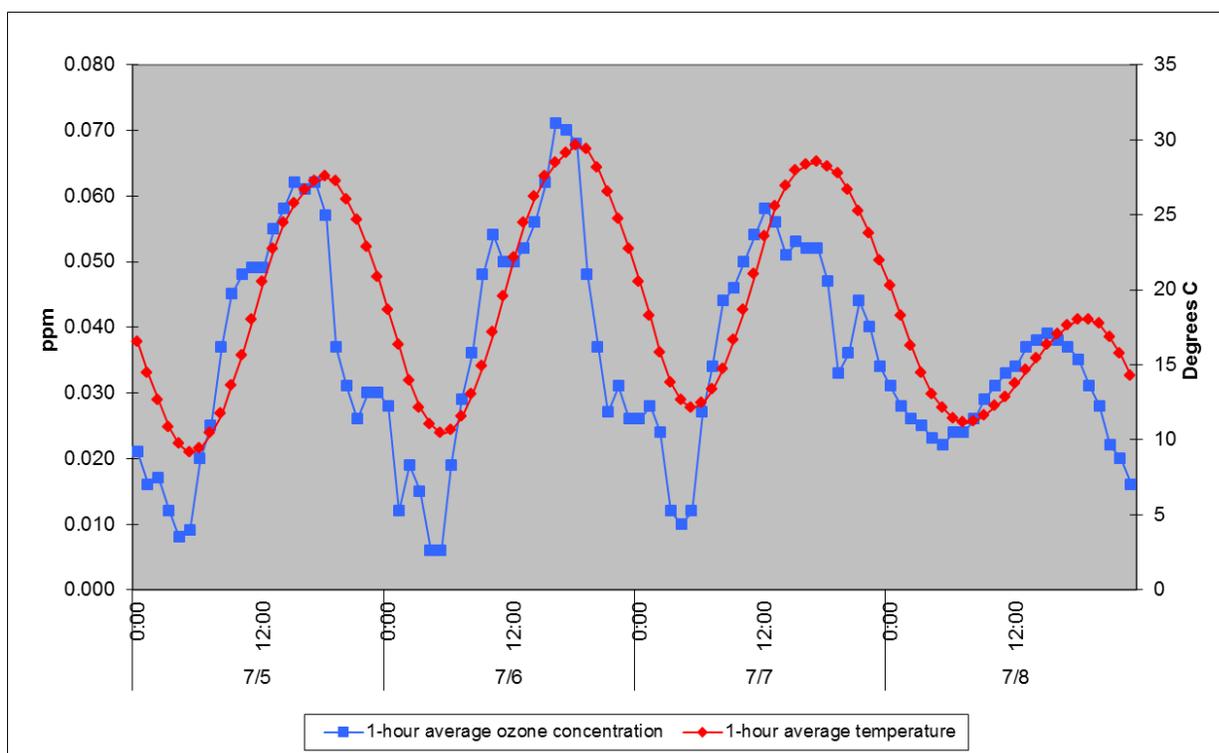


Figure 7. Hourly ozone concentration compared with temperature for July 5–8, 2011.

Unlike temperature, which closely correlates with ozone levels, solar radiation tends to peak before the ozone concentration. This phenomenon occurs partly because of our latitude and the resultant sun angles. Figure 8 shows the correlation between solar radiation and the resulting ozone concentrations for a 4-day period in early July. Solar radiation is measured in watts per square meter (W/m^2) and represents the amount of solar energy available to drive the chemical reactions that form ozone.

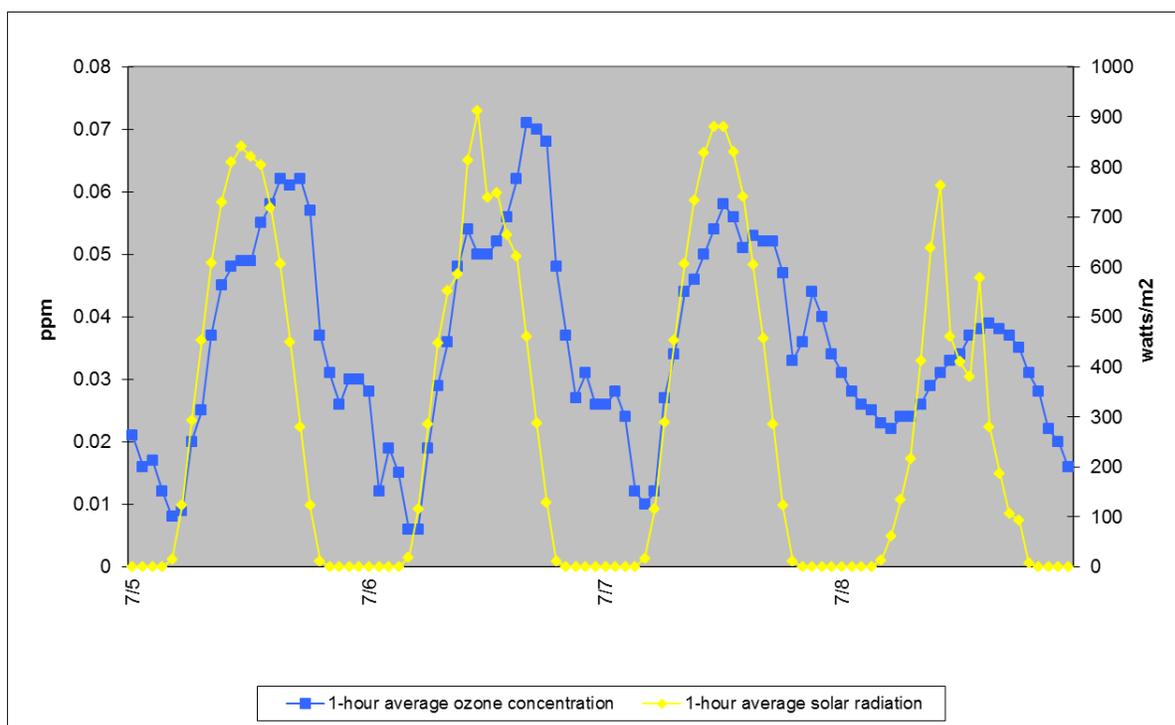


Figure 8. Hourly ozone concentration compared with solar radiation for July 5–8, 2011.

3.2 Ozone and Nitrogen Oxides

While NO_2 (one component of NO_x) is another EPA criteria pollutant, it is not monitored at the Lancaster site expressly for compliance determination. It is mainly monitored to help forecast ozone levels. When ozone is at its peak concentration for the day, NO_x concentrations are at their lowest (Figure 9). When ozone concentrations start to drop late in the day, NO_x concentrations rise and NO_x reaches its peak early in the morning at the lowest ozone levels. This inverse relationship represents the fact that as the day warms up and sunlight is at its strongest, NO_x and other available precursors are converted to ozone. As the sun sets and temperatures cool, NO_x begins to reform as the ozone molecules disassociate, allowing NO_x concentrations to build again. Due to equipment malfunctions, the NO_x data in the chart do not meet DEQ's quality assurance standards and are shown here only for comparison purposes.

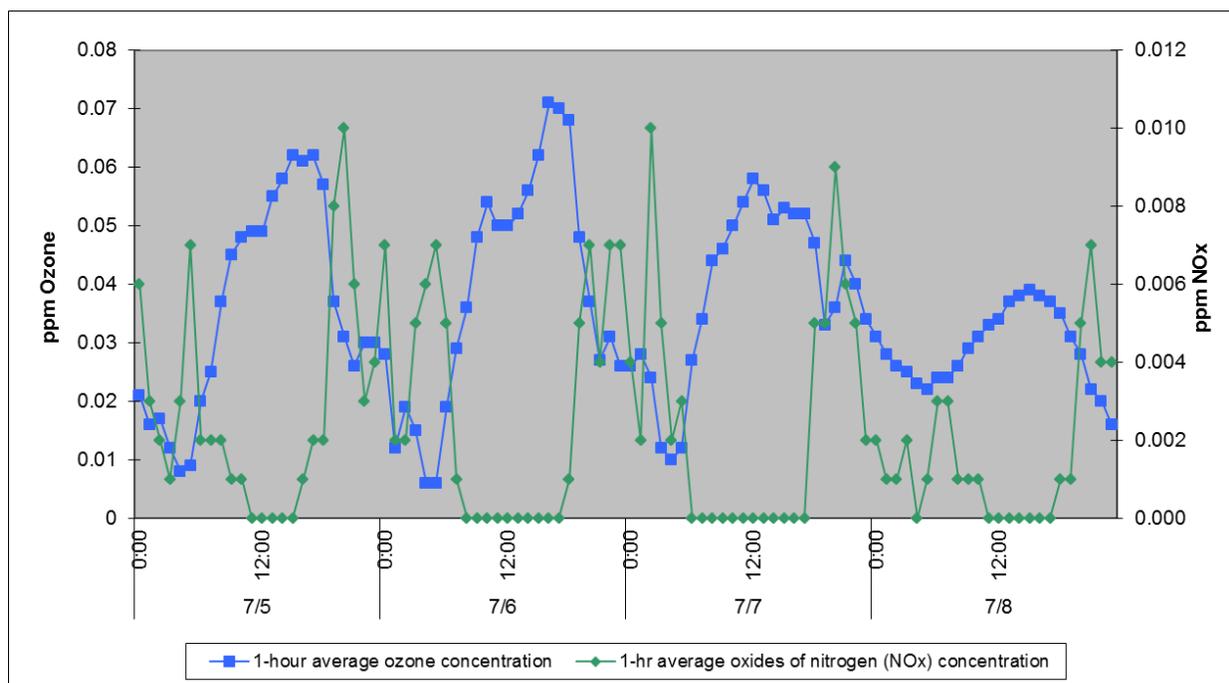


Figure 9. Hourly ozone concentration compared with nitrogen oxides for July 5–8, 2011.

The early morning NO_x peak is related to the morning commute traffic, while the rise in NO_x in the evening coincides with evening commute. The location and amount of traffic relative to a monitoring site can create some issues with NO_x and ozone measurement because NO_x is emitted by combustion engines. Excess NO_x near a monitoring site (fresh NO_x) has been shown to cause a *scouring* effect and will inhibit ozone development in sufficient concentrations to bias ozone results to the low side. This scouring effect is counterintuitive because one would think that increased production of a precursor should lead to more ozone. However, *fresh* NO_x tends to have more NO , which is very reactive and scavenges an oxygen molecule from ozone (O_3) to make NO_2 and oxygen (O_2). This reaction in effect scours some ozone from the air that would normally be present. There is still some debate over the ability to truly isolate monitors from the effects of commuter traffic emissions.

Another factor to take into account when analyzing ozone at the Lancaster site is its proximity to the Coeur d’Alene Airport. An active airport could influence local ozone concentrations. The Coeur d’Alene Airport likely produces some ozone precursor emissions, but these emissions probably do not contribute to increased ozone development measured at the Lancaster site. If the wind is blowing, the emissions at the airport would not likely have time to convert into ozone before reaching the Lancaster site. On days when significant stagnant weather conditions are prevalent, impacts from airport VOC emissions are more likely. On the other hand, fresh NO_x emissions from the airport could be a limiting factor for ozone development, as discussed above, because the scouring effect actually breaks down ozone molecules. DEQ suspects that the influence from the airport is minimal at this site, but additional investigation is needed to confirm this theory.

3.3 Ozone and Wind

A wind rose (Figure 10) depicts the direction wind is coming from, as detected by a fixed point such as a wind sensor. The different spokes around the wheel indicate wind speed, duration, and direction. The length of each spoke is related to the percentage of time the wind is coming from that direction. The different colored sections of the spokes represent the wind speeds, and length of the different colored sections shows the percentage of time the wind was travelling at that speed from that direction. Wind speed is shown in meters per second; Table 5 shows the equivalents for wind speed in miles per hour.

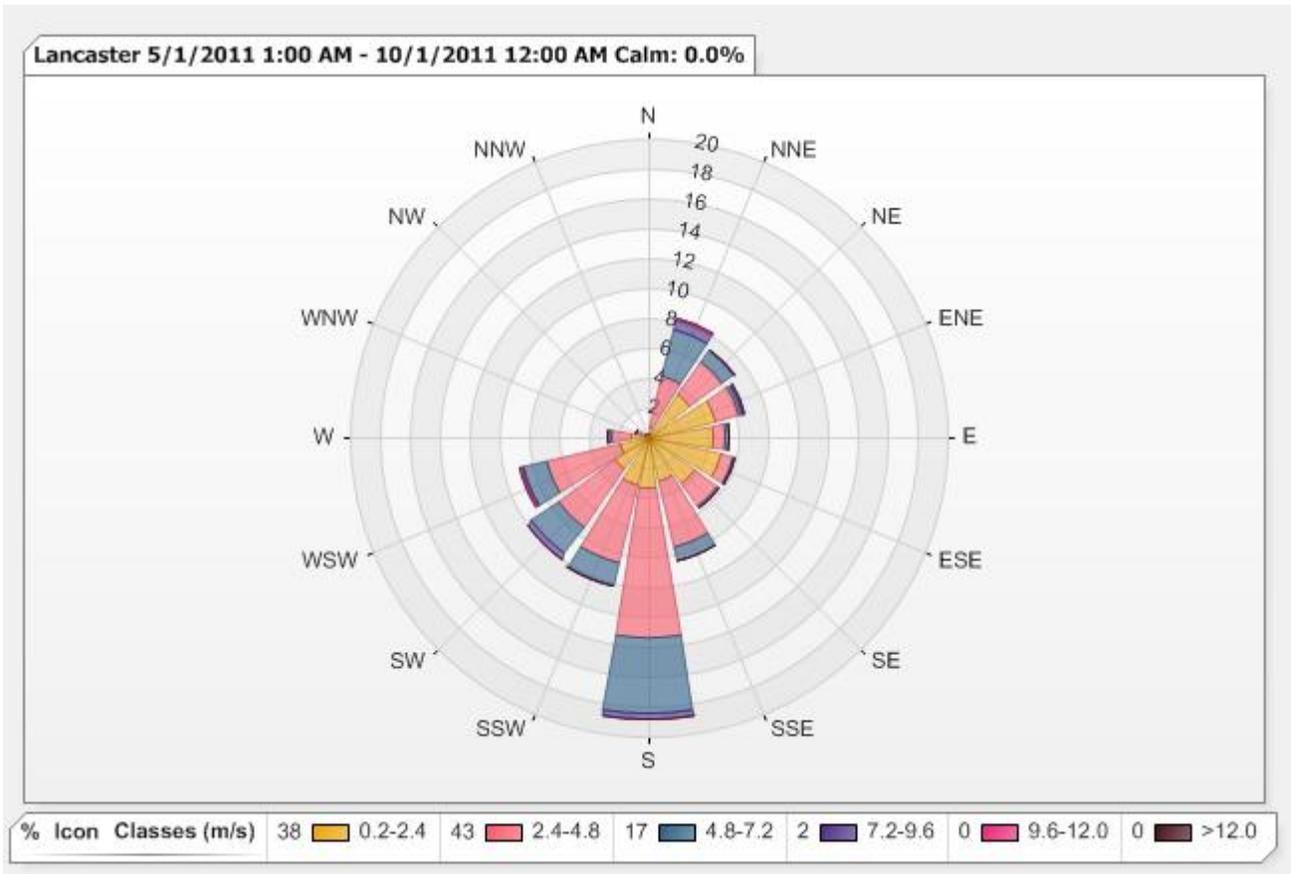


Figure 10. Wind rose for the 2011 ozone season.

The wind rose in Figure 10 includes the entire 2011 ozone season at the Lancaster site. The purpose of the graph is to give an impression of the prevailing wind directions for the season. Wind at the Lancaster site came mainly from the south and between west-southwest and south-southwest. Upwind, when winds are from the southwesterly directions, are large urban and industrial areas. The Lancaster site is located approximately 3 hours downwind at typical wind speeds (roughly 30 miles) from the urban and industrial areas to the west and southwest (i.e., Spokane). This distance is significant because the photochemical reactions necessary to form ozone take approximately 3–4 hours to occur.

Table 5. Meters per second converted to miles per hour.

Meters per second	Miles per hour
0.500–3.000	1.118–6.711
3.000–6.000	6.711–13.422
6.000–9.000	13.42–20.132
9.000–12.000	20.132–26.843

Rather than comparing wind speed to wind direction, a pollution rose (Figure 11) compares hourly ozone concentrations to wind direction. The predominant wind directions with the highest concentrations are between west-southwest and south. Once again, this finding suggests that either ozone or its precursors are being transported to the monitoring site from the urban and industrial areas to the southwest and south.

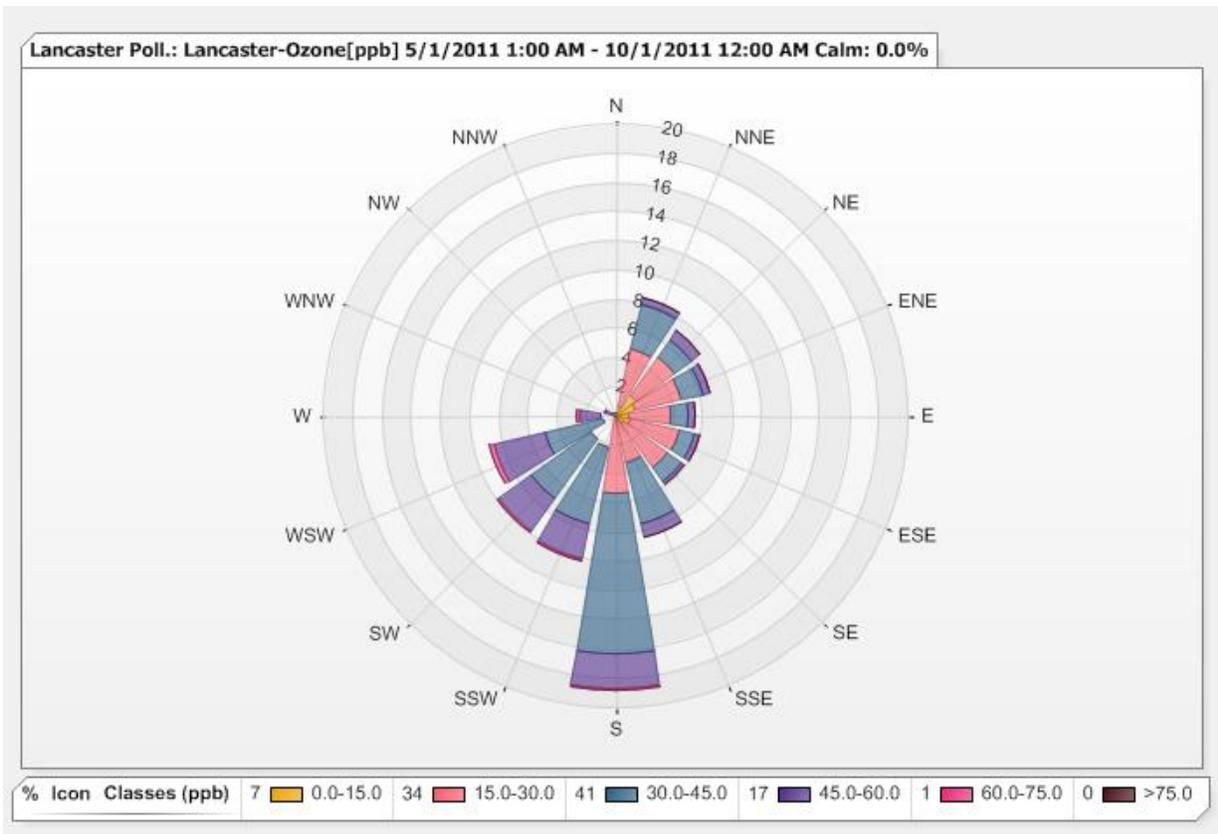


Figure 11. Pollution rose for the 2011 ozone season.

Figure 12 shows the Lancaster site with predominant wind directions during the highest and lowest ozone concentrations. The orange-shaded triangle indicates the dominant wind directions during periods with the most ozone, while the blue-shaded triangle shows the dominant wind directions during periods with the least ozone. This map indicates that transport of ozone from the urban areas located southwest and south of the site played a part in higher ozone concentrations at the site on the highest ozone days. The break in the mountains to the southwest of the Lancaster site likely funnels the winds coming from the west towards the site. This theory warrants further study to determine its validity.

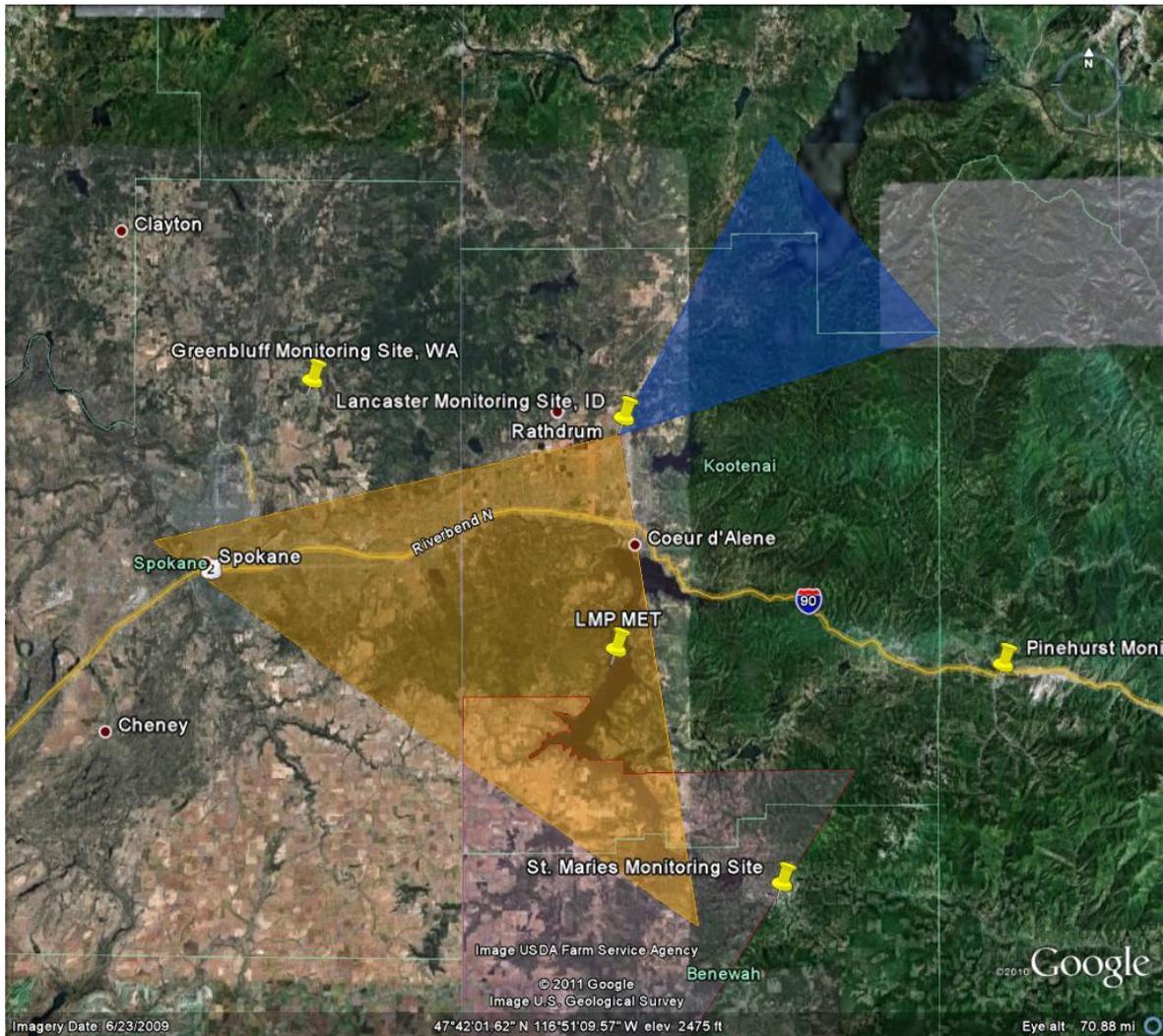


Figure 12. Map of the Coeur d'Alene area showing wind directions during periods of highest (orange) and lowest (blue) ozone concentrations.

4. Potential Standard Changes

In early 2010, EPA proposed a new ozone NAAQS to be set between 0.060 and 0.070 ppm. In mid-2011 the Obama administration asked EPA to wait until 2013, which is the next 5-year assessment of the ozone NAAQS, to determine the need for a change to the NAAQS. The current standard is 0.075 ppm. The proposed ozone NAAQS levels are between 0.060 and 0.070 ppm for the design value, putting the trigger level for the increased precursor control discussed in section 3 between 0.051 and 0.060 ppm design values (85% of the NAAQS).

In Figure 13, a fourth-highest 8-hour average ozone concentration of 0.061 ppm is projected for the 2012 season, resulting in a design value of 0.059 ppm. This projection is based on an average of the fourth-highest 8-hour averages over the past 7 ozone seasons. These results show, when

using the proposed new standards, that the chance of breaking the 85% trigger level is likely, and the potential for exceeding the NAAQS becomes a possibility.

Figure 13 is based on projected numbers for 2012. If the summer is cooler than average again—as in the last 3 years—the projected numbers are high. If the summer is average or warmer-than-average, the actual numbers will likely be closer to the projection.

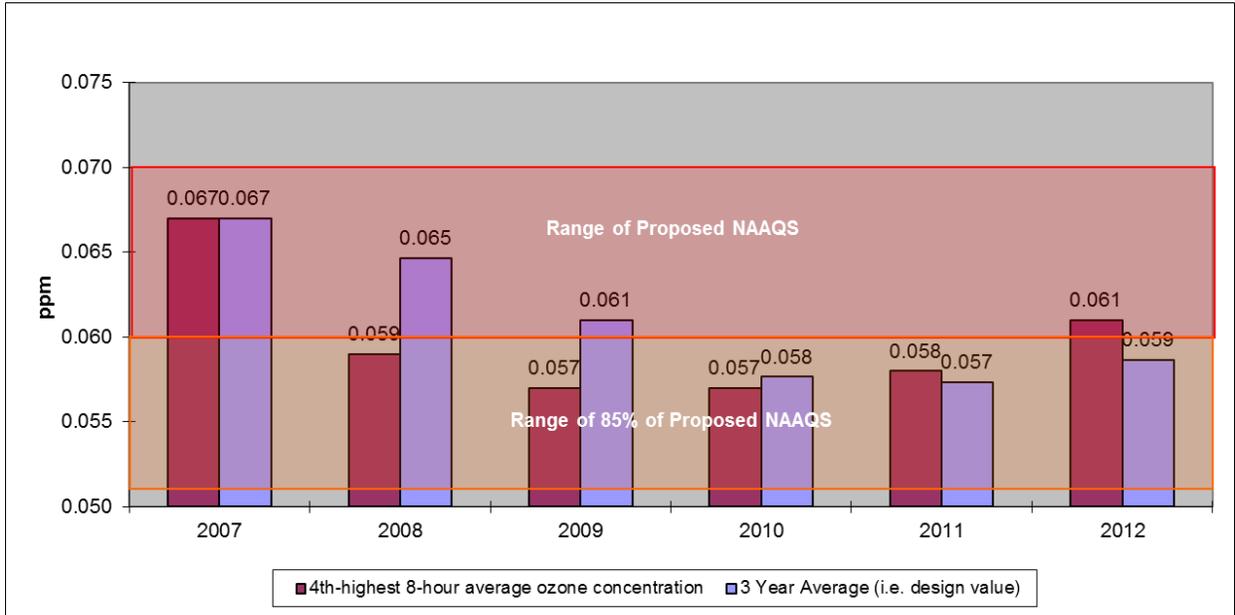


Figure 13. Proposed ozone National Ambient Air Quality Standards, trigger levels (85% of NAAQS), and projected design value for 2012.

The numbers provided in Figure 13 are an educated guess of possible new standards to come from the 2013 ozone NAAQS 5-year assessment. These numbers are solely based on the 2010 proposed new NAAQS.

5. Coeur d’Alene Area Emission Sources

DEQ completed an air emission inventory for NO_x and VOCs in June 2008 to identify the sources of pollutants for Kootenai County and the Spokane area. Identifying pollution sources can help to reduce emissions through improved technologies, education, encouragement to change behaviors, and economic incentives.

5.1 Source Categories

Five general categories characterize air emission sources (with virtually hundreds of subcategories):

1. Point sources—These include large industries that emit pollutants each year from a single location.

2. On-road mobile sources—This category includes both gasoline- and diesel-powered vehicles and accounts for a significant amount of Idaho's air pollution.
3. Nonroad sources—These sources include farm and construction vehicles, aircraft, locomotives, and garden equipment.
4. Stationary area sources—These are smaller but more numerous than point sources and include commercial businesses, such as dry cleaners, printers, and small construction operations, and everyday activities like wood burning.
5. Biogenic sources—Biogenic emissions come from natural sources and include emissions from vegetation, soils, volcanoes, lightning, and sea salt.

The first four categories describe emissions of criteria air pollutants. The fifth category (biogenics) is for emissions that are natural and, therefore, probably unavoidable—but their effects need to be considered.

DEQ's June 2008 emission inventory for the Coeur d'Alene area summarized the quantities of criteria air pollutants from sources in the first four categories described above. The inventory also included anthropogenic (human-generated) and biogenic (naturally-generated) sources of VOCs, which are not criteria air pollutants but are important for understanding and evaluating ozone pollution.

5.2 Sources of Volatile Organic Compounds and Nitrogen Oxides

For the purposes of ozone monitoring, the key findings of the emissions inventory are those related to sources of NO_x and VOCs (ozone precursors). Table 6 presents the amounts of NO_x and VOCs contributed by source category for Kootenai County and the Spokane area. For both areas, on-road mobile sources are the major source of NO_x emissions, while biogenic sources account for the most VOC emissions.

Table 6. Idaho 2005 estimated criteria air pollutant emission inventory—summary for Kootenai County and Spokane area.

Source Category	Nitrogen Oxides (NO _x) (tons/year)		Volatile organic compounds (VOCs) (tons/year)	
	Kootenai County	Spokane Area	Kootenai County	Spokane Area
Point sources	275	783	296	788
On-road mobile sources	3,231	10,244	2,123	6,516
Nonroad mobile sources	810	2,240	1,739	3,280
Stationary area sources	893	2,950	3,842	6,836
Biogenics	0	983	22,528	20,871
Total	5,209	17,200	30,528	38,291

Sources of NO_x and VOCs as pollutants in Kootenai County are presented in Figure 14 and Figure 15, respectively. The combination of all vehicles and equipment (i.e., all on-road and nonroad mobile areas sources) is the greatest source of NO_x emissions in Kootenai County, making up 79% of the total source contribution (Figure 14). The largest subcategories for these

contributors of NO_x are nonroad vehicles and equipment and on-road gasoline vehicles. The small stationary area source facilities make up the bulk of the remaining contribution with 21%.

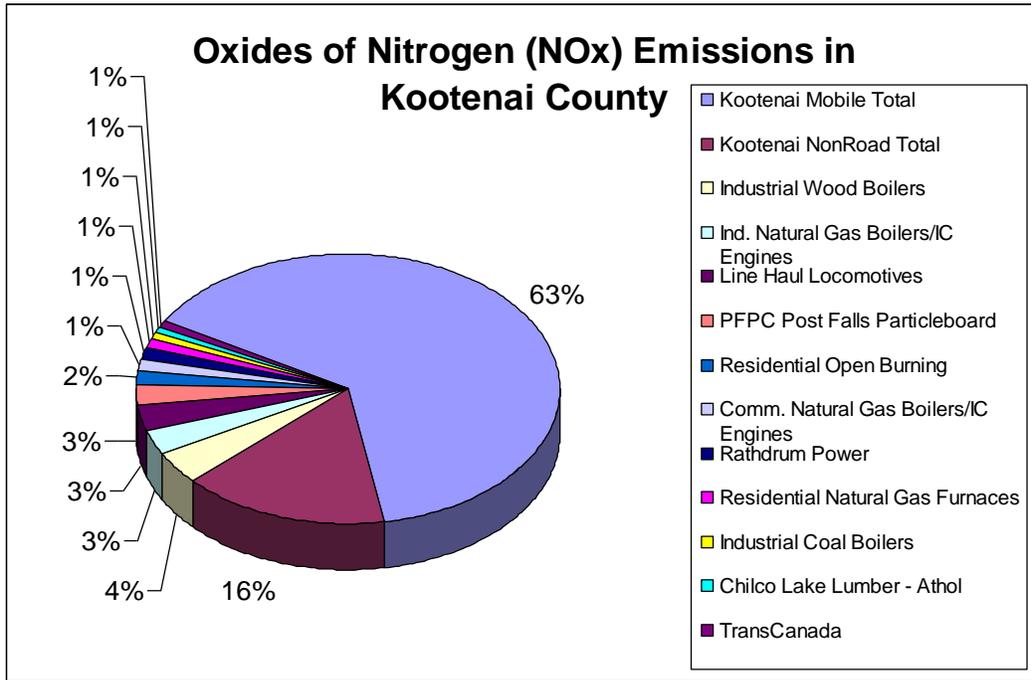


Figure 14. Sources of nitrogen oxides in Kootenai County.

Although VOCs are not criteria air pollutants, they are included in discussion of the criteria air pollutants emission inventory because they are a primary precursor for ozone, which is a criteria pollutant. Aside from biogenics (78%), vehicles and associated equipment (e.g., all on-road and off-road mobile areas sources) contribute the greatest portion of VOCs to the atmosphere in Kootenai County, making up 13% of the total (Figure 15). The largest contributing subcategories for stationary area sources are asphalt applications, cold cleaning (parts degreasing), and indoor wood burning.

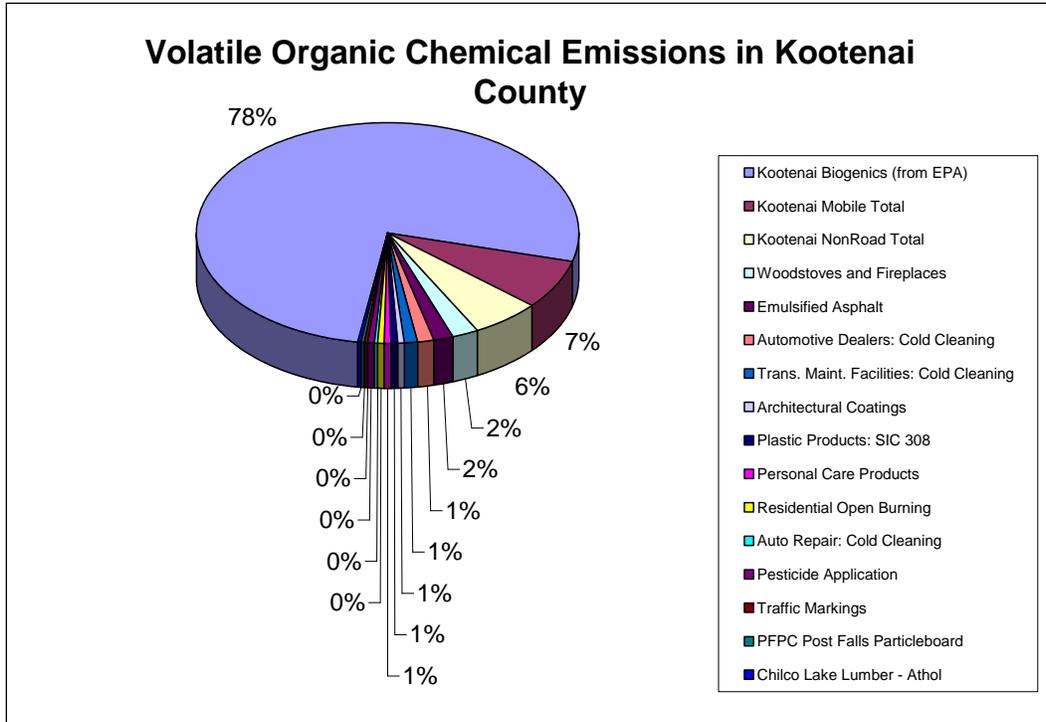


Figure 15. Sources of volatile organic compounds in Kootenai County.

6. Current Public Outreach and Potential Actions

6.1 Current Ozone Air Quality Forecasts

During ozone season, DEQ currently provides forecasts of pollution conditions for ozone in the Coeur d’Alene area. DEQ makes forecasts for each day of the week using pollutant monitoring data and meteorological information. Ozone pollution can rise to very high levels when the area experiences hot days with little-to-no cloud cover. These optimal conditions for ozone formation are also optimal for outdoor activities.

Since ozone tends to be at its worst when the weather is *best* for outdoor activities, ozone forecasts are a helpful tool for those who are easily affected. These forecasts help people who are sensitive to ozone pollution plan their day. Additionally, forecasts allow concerned citizens to plan their activities to lower their impact on ozone precursors during high pollution periods. The ozone forecasts are available on DEQ’s website, www.deq.idaho.gov, as well as EPA’s AIRNow website, www.airnow.gov.

6.2 Potential for Issuing Ozone Alerts

Since we have no control over weather characteristics, controlling ozone means controlling what we put into our air. DEQ and EPA are currently considering the possibility of issuing alerts for the area and conducting associated activities to help curb ozone formation during high-concentration episodes. For current postings relating to these decisions, see DEQ’s website,

www.deq.idaho.gov, and EPA's AIRNow website, www.airnow.gov. Possible future activities could include sending press releases to local media outlets and to others through an e-mail notification list to notify the public of high-ozone conditions. Actions requested of the public when ozone concentrations are high may include limiting driving and open burning, using mass transit, and delaying lawn mowing until after the alert has ended.

6.3 Information Provided by the Air Quality Index

The AQI is an EPA-calculated index for reporting daily air quality. The AQI reports how clean or polluted the air is for a certain area and what associated health effects might be a concern. The AQI focuses on health effects people may experience within a few hours or days after breathing polluted air. It is a broader air quality forecast than the ozone forecast mentioned in section 6.1 because it evaluates air quality based on five criteria air pollutants regulated by the Clean Air Act: (1) ground-level ozone (measured as both a 1-hour and 8-hour average), (2) particle pollution (also known as particulate matter and measured for particles with diameters less than 2.5 micrometers and particles with diameters less than 10 micrometers), (3) carbon monoxide, (4) sulfur dioxide, and (5) nitrogen dioxide (Table 7). For each of these pollutants, EPA has established NAAQS to protect public health. Ground-level ozone and particulate matter are the two pollutants that pose the greatest threat to human health in this country.

An AQI value of 100 generally corresponds to the NAAQS for the pollutant, which is the level EPA has set to protect public health. AQI values below 100 are generally regarded as good to moderate. When AQI values are above 100, air quality is considered to be unhealthy; initially, for certain sensitive groups of people, then for everyone as AQI values increase.

For more detailed information about the AQI and the pollutants it measures, visit EPA's website at www.airnow.gov.

Table 7. Corresponding Air Quality Index category for five criteria pollutants.

Concentration ranges for criteria pollutants							AQI categories	
Ozone (ppm)		Particulate matter ($\mu\text{g}/\text{m}^3$)		Carbon monoxide (ppm)	Sulfur dioxide (ppm)	Nitrogen dioxide (ppm)	AQI value	Category
8-hour average	1-hour average ^a	<2.5 micrometer diameter	2.5–10 micrometer diameter					
0.000–0.059	—	0.0–15.3	0–54	0.0–4.4	0.000–0.034	— ^b	0–50	Good
0.060–0.075	—	15.4–35.4	55–154	4.5–9.4	0.035–0.144	— ^b	51–100	Moderate
0.076–0.095	0.125–0.164	35.5–65.4	155–254	9.5–12.4	0.145–0.224	— ^b	101–150	Unhealthy for sensitive groups
0.096–0.115	0.165–0.204	65.5–150.4	255–354	12.5–15.4	0.225–0.304	— ^b	151–200	Unhealthy
0.116–0.374	0.205–0.404	150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24	201–300	Very unhealthy
— ^c	0.405–0.504	250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64	301–400	Hazardous
— ^c	0.505–0.604	350.4–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04	401–500	

Notes: Air Quality Index (AQI); parts per million (ppm); micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

- Areas are generally required to report the AQI based on 8-hour average ozone values. However, there are a small number of areas where an AQI based on 1-hour average ozone values would be safer. In these cases, in addition to calculating the 8-hour ozone value, the 1-hour ozone value may be calculated, and the greater of the two values reported.
- Nitrogen dioxide has no short-term National Ambient Air Quality Standard and can generate an AQI only above a value of 200.
- Eight-hour ozone values are not used to define AQI values above 300. AQI values above 300 are calculated with 1-hour ozone concentrations.

7. Frequently Asked Questions about Ozone

How is it formed?

Ozone forms when photochemical pollutants, which come mostly from vehicle, biogenic, and industrial sources, react in the presence of heat and sunlight. Ozone-forming pollutants include NO_x and VOCs. Although transportation and industrial sources are the biggest contributors to ozone levels, even gasoline-powered yard equipment, paints, solvents, and off-road vehicle motors contribute.

When does it form?

Ozone pollution is most common in the summer months, when sunlight and stable atmospheric conditions occur. Ozone levels are usually highest in the afternoon, as sunlight photochemically transforms NO_x and VOCs into ozone.

Who is affected?

The groups most affected by ozone levels are children, the elderly, people who are active outdoors, people with respiratory diseases such as asthma, and people with unusual sensitivity to ozone. During physical activity, ozone penetrates deeper into the lungs and can do more damage.

What are the impacts of ozone?

Ozone is a very reactive gas. For this reason, high concentrations of ozone can cause respiratory distress and disease in humans, decreased agricultural and forest yields, and damage to some rubber products, plastics, and paints used outdoors. National crop losses from ozone exposure are estimated at \$3–5 billion annually. Forest losses are harder to estimate.

What are the health effects of ozone?

Ozone can cause coughing and throat irritation, make deep vigorous breathing more difficult, and increase the chance of respiratory infections. It increases sensitivity to allergens and can trigger asthma attacks. Ozone-caused lung damage heals within a few days, but repeated or prolonged exposure may cause permanent damage.

What can I do to minimize the health effects of ozone exposure?

If ozone levels are high and you have a respiratory condition or are normally active outdoors; limit your outdoor exertion.

What can I do to help reduce ozone formation?

You can help reduce ozone formation by limiting vehicle travel and using alternative transportation, avoiding the use of gas-powered yard equipment during the hottest part of the day, and avoiding topping of your gas tank.

What is the government doing about it?

In the United States, management of ozone and other photochemical oxidants has been a major goal of federal and state clean air legislation such as the Clean Air Act. Although many of the pollution control efforts required by the Clean Air Act have been implemented, efforts to

decrease ozone pollution have been only partially successful. In the Coeur d'Alene Airshed, ozone concentrations are elevated but still within the federal standards.

Where is ozone measured?

Unlike other pollutants monitored in Idaho, ozone is formed by precursors that react in the atmosphere. Winds transport ozone and chemical emissions from one area to another. For the Coeur d'Alene area, ozone precursors are emitted into the air in industrial areas of the airshed to the south and southwest and subsequently travel north and northwesterly to more rural areas as they react to form ozone. As a result, DEQ currently has one ozone monitor on the Rathdrum Prairie at the Lancaster site.