Oregon Environmental Public Health Tracking Program

Air Quality Report 2001 – 2010

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Introduction to Oregon Tracking

Environmental Public Health Tracking is the ongoing collection, integration, analysis, interpretation and dissemination of data from environmental hazard monitoring, human exposure and health effects surveillance.

The Centers for Disease Control and Prevention (CDC) funded the Oregon Environmental Public Health Tracking Program (Oregon Tracking) with the following goals:

- Build a sustainable national environmental public health tracking network.
- Enhance environmental public health tracking work force and infrastructure.
- Disseminate information to guide policy and improve public health.
- Foster collaboration among health and environmental programs.

EPHT is a Web-based network of standardized electronic health and environmental data. Oregon is one of 22 grantees funded by the CDC to participate in a collaborative network development process and implement state/city networks that are components of the national network.

Rationale for tracking air quality

Environmental agencies have the primary responsibility of monitoring air quality and population exposure to ozone and $PM_{2.5}$, which are small particles in the air that can only be seen with a microscope. These agencies already track air quality and provide both air quality data and related information to the public. Though air monitoring data are available for monitoring stations across the country, air quality estimates are not widely available in areas between monitoring stations or for the periods when the monitors are not operational.

CDC is collaborating with EPA by providing funding and supporting development and distribution of improved air characterization estimates. These estimates consist of statistical combinations of monitor and modeled data that predict air pollutant concentrations across an entire spatial domain of interest. Such air characterization estimates will be beneficial in not only EPHT surveillance and research of air pollution's effect on health, but also for prevention and pollution control activities.

Putting health and environmental data together in one place via Oregon Tracking complements and enhances the value of the data by emphasizing the importance of the environment-health interaction and by facilitating the linkage and analysis of health and air quality data.

Oregon Tracking air quality surveillance goals estimate the impacts of $PM_{2.5}$ and ozone on health:

- Identify populations that may have higher risk of adverse health effects due to $PM_{2.5}$ and ozone.
- Generate hypotheses for further research.
- Provide information to support health impact assessments and prevention and pollution control strategies.
- Provide the public, environmental health professionals and policymakers with current and easy-to-use information about air pollution and its impact on health.

Oregon Tracking will enhance the ability of public health agencies to estimate the impacts of $PM_{2.5}$ and ozone on health by improving the accessibility of air quality and health outcome data, and by developing practical and systematic methods that can be applied across geographic areas. As part of routine and ongoing surveillance, public health agencies may systematically collect, collate and analyze linked air pollution and health outcome data to estimate the health effect of air pollution. For example, if routine surveillance identifies a population that appears to have elevated health risks from air pollution, the information can be used to develop targeted risk communication/health education campaigns and pollution control strategies, or to generate hypotheses that warrant further research.

Oregon Tracking will also provide information to support prevention and pollution control strategies. Although most jurisdictions are governed by National Ambient Air Quality Standards (NAAQS), important pollution reduction actions affecting transportation, land use and industry are required at the state and regional levels. Policymakers are interested in determining whether actions they take to improve air quality actually result in improved population health. Although air quality and some health data for state and sub-state areas are available nationally, state and local health departments are in a unique position to provide relevant data on air quality impacts in their jurisdictions because of their access to timely, local health data and because of their established role in tracking asthma and other chronic diseases affected by poor air quality.

By communicating both the concentrations of air pollutants and their health effect (i.e., attributable number of health events), Oregon Tracking hopes to produce and disseminate public health-focused air quality information. Ongoing research, largely in the academic sector, continues to refine knowledge of individual and population vulnerabilities and the relationship between air pollution and health effects. Oregon Tracking can augment this work through use of population-based health outcome data, linked with socioeconomic and air pollution data. Thus, health tracking programs can also play a role in disseminating findings related to exposure and health disparities to the public and key stakeholders.

Overview: Air quality indicators and measures

High levels of ozone and PM2.5 are believed to be the main cause of poor air quality in much of the country and have been strongly linked with respiratory and cardiovascular health effects. Air monitoring data for ozone and PM2.5 are available throughout Oregon, but not every county is monitored. The EPA makes available computer-modeled data that cover the entire state, but EPHT does not use these data for tracking purposes.

A few indicators were prioritized to compute and disseminate in a way that would be meaningful to stakeholders. Data used in the calculation of these indicators were obtained from the U.S. Census Bureau and the EPA Air Quality System. The Oregon Department of Environmental Quality (DEQ) collects additional air quality measurements for the PM2.5 air quality index that are not included in this report.

The following Oregon Tracking air quality indicators and measures are discussed in this report:

Indicator	*Measures*
A. Daily ozone level	A1. Annual number of days with maximum 8-hour average ozone concentration over National Ambient Air Quality Standards (NAAQS)
	A2. Person-days with maximum eight-hour average ozone concentration over NAAQS

B. Daily $PM_{2.5}$ level	B1. Percentage of days with $PM_{2.5}$ levels over NAAQS
	B2. Number of person-days with $PM_{2.5}$ levels over NAAQS
C. Annual $PM_{2.5}$ level	C1. Annual average $PM_{2.5}$ concentration
	C2. Percentage of population in counties exceeding the NAAQS compared to percent of population living in counties that meet the standard and percent of population living in counties without $PM_{2.5}$ monitors

A long-term (annual average) indicator for ozone was not included because most studies have focused on short-term effects. A traffic indicator was not selected due to inconsistency in traffic data across and within states. Preliminary investigation suggests that the Oregon Department of Transportation (ODOT) data provide good estimates of highway traffic. However, these estimates may be biased in cities, where there is heavy traffic on unmeasured local roads. Traffic data will continue to be evaluated in the future.

Air quality measures

Scientific studies have linked short-term exposure to ozone and PM2.5 with health effects including coughing, sneezing, runny nose and shortness of breath; and irritation in the eyes, nose and throat. The Oregon Tracking indicator for the percentage and number of days that exceed health standards for both PM2.5 and ozone can be interpreted as the number of days that ozone was unhealthy for sensitive populations, such as people with asthma.

Although number of days over the NAAQS is more easily interpreted than percent of days over the NAAQS, the PM2.5 indicator is expressed as a percent rather than as a count. This is because PM2.5 monitors follow different operating schedules in different locations and seasons of the year, making it impossible to obtain a true count of the number of days with PM2.5 levels exceeding the NAAQS.

Long-term exposure to PM2.5 has been associated with problems such as reduced lung function, the development of chronic bronchitis and premature death. The annual average is a common measure of long-term exposure to PM2.5. Indicators that link population counts to air concentrations estimate the proportion of the population that lives in areas with unhealthy air.

The daily indicators are linked to population as the number of person-days of high ozone and PM2.5. Policymakers may use this information to help determine which areas are most in need of prevention and control strategies. Because the person-days metric may be difficult to interpret, detailed explanations and visuals are provided in those sections of the report.

A. Daily ozone level measures

Ozone occurs naturally in the upper atmosphere, approximately 10 to 30 miles above the earth's surface. This "good" ozone forms a layer that protects life on earth from the sun's harmful rays. Ground-level ozone is formed when pollutants released from cars, power plants and other sources react in the presence of heat and sunlight. It is the prime ingredient of smog and considered to be "bad" ozone because it is located where you can breathe it. Because sunlight and heat cause ozone to form, ozone levels are monitored only during warmer times of the year. The length of the ozone monitoring season varies between different regions in the United States. In Oregon, the ozone monitoring season lasts from May 1 to September 30.

Both nitrogen oxides and volatile organic compounds are emitted by cars, trucks, power plants and factories. Thus high ozone levels are usually observed downwind of densely populated cities, causing ozone monitoring to be focused on urban and industrial areas. Between 2001 and 2010, ozone measurements were available from EPA for nine Oregon counties: Clackamas, Columbia, Deschutes, Jackson, Lane, Marion, Multnomah, Umatilla and Washington. About 73% of Oregon's population resides in these counties.

Figure 1. Oregon counties monitored for ozone

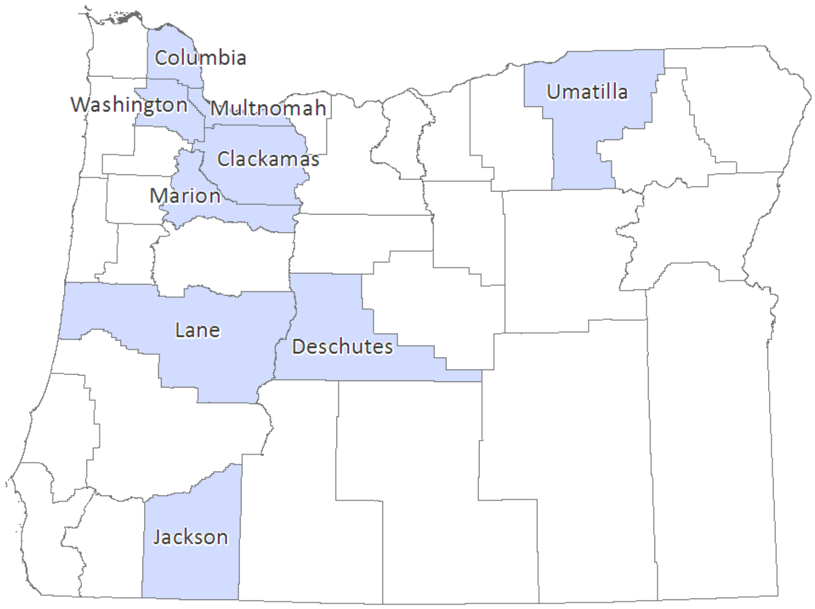

Table 1 presents the number of days per year during which an eight-hour average ozone concentration exceeded the current NAAQS of 75 parts per billion (ppb). Days when ozone levels exceeded the NAAQS were very rare. The highest number of days over the NAAQS in a single county was observed in 2003, with seven days in Lane County. Jackson County is the only county with a statistically significant decrease in ozone days over the NAAQS from 2001 to 2010 (p=0.039 for the trend).

Table 1: Measure A1: Number of days during which ozone concentrations exceeded the NAAQS of 75 parts per billion (ppb), by county

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Clackamas	2	2	2	1	1	1	0	3	2	1
Columbia	0	0	0	0	0	0	0	0	0	0
Deschutes	-	-	-	-	-	-	-	-	0	0
Jackson	1	4	2	1	1	2	0	1	0	0
Lane	0	0	7	1	2	5	1	0	0	0
Marion	0	0	1	0	1	3	0	2	1	1
Multnomah	-	-	-	0	0	1	0	0	1	0
Umatilla	-	-	-	-	-	-	0	0	0	0
Washington	-	-	-	-	-	-	-	-	0	0

Note: No data are available for counties not shown. Empty cells indicate missing data (-). Cells are shaded for ease of interpretation; colors do not reflect statistical comparisons. Cell with highest value is orange; zero values and no data are white. A linear ramp is applied to the other cells. Counties are ordered by number of exceedance days.

Table 2 shows the potential population effect of high ozone days. It contains the number of person-days with ozone levels exceeding the NAAQS, which is the number of days with an exceedance multiplied by the number of people living in the county in which the exceedance occurred.

Table 2: Measure A2: Number of person-days (in thousands) during which ozone concentrations exceeded the NAAQS of 75 parts per billion (ppb), by county

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Clackamas	690	703	711	361	365	371	0	1,144	772	376
Columbia	0	0	0	0	0	0	0	0	0	0
Deschutes	-	-	-	-	-	-	-	-	0	0
Jackson	184	746	379	192	194	392	0	200	0	0
Lane	0	0	2,313	332	670	1,696	345	0	0	0
Marion	0	0	297	0	301	918	0	627	318	315
Multnomah	-	-	-	0	0	683	0	0	727	0
Umatilla	-	-	-	-	-	-	0	0	0	0
Washington	-	-	-	-	-	-	-	-	0	0

Note: No data are available for counties not shown. Empty cells indicate missing data (-). Cells are shaded for ease of interpretation; colors do not reflect statistical comparisons. Cell with highest value is orange; zero values and no data are white. A linear ramp is applied to other cells. Counties are ordered by the number of exceedance person-days.

B. Daily $PM_{2.5}$ measures

Summary statistics of daily $PM_{2.5}$ level data are presented in Table 3 and Table 4. Table 3 shows the percentage of days during which the measured $PM_{2.5}$ concentration was higher than the NAAQS of 35 mcg/m^3 (ranked by the 2001-2010 average), and Table 4 contains the corresponding number of person-days (ranked by the 2011-2010 total). Data are shown for 18 counties, as shown in the map in Figure 2, but after 2002 the number of counties for which data were available decreased.

Figure 2. Oregon counties monitored for PM2.5

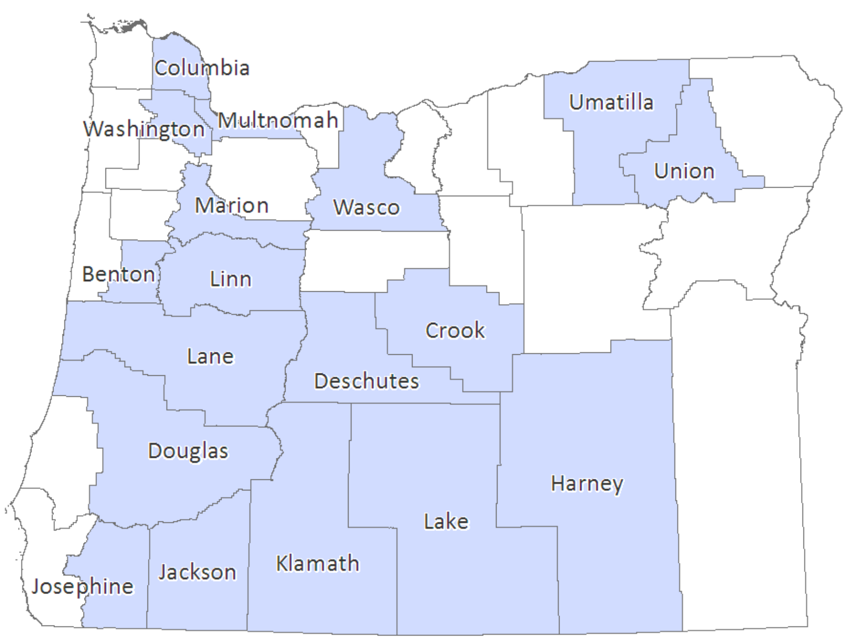

Table 3. Measure B1: Percentage of monitored days during which the measured $PM_{2.5}$ concentration exceeded the NAAQS of 35 micrograms per cubic meter (mcg/m^3)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Benton	0.0	0.0	-	-	-	-	-	-	-	-
Columbia	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-
Crook	-	-	-	-	-	-	-	-	0.0	0.0
Deschutes	0.9	0.0	0.0	0.0	.	.	.	0.0	1.8	0.0
Douglas	-	-	-	-	0.0	2.9	-	-	-	-
Harney	1.7	1.9	0.0	-	-	-	3.4	3.7	0.0	0.0
Jackson	1.4	6.9	2.4	0.8	2.5	1.8	0.4	2.0	2.3	0.0
Josephine	4.2	0.9	1.2	0.0	0.0	0.0	0.0	0.0	1.7	1.8
Klamath	1.9	12.4	1.7	6.7	8.3	2.7	2.6	5.0	5.2	1.7
Lake	0.9	2.9	0.0	-	-	-	2.3	4.2	4.1	0.0
Lane	9.3	6.8	5.2	4.7	10.1	4.8	7.4	2.3	4.2	0.6
Linn	0.8	1.7	0.0	0.0	0.0	-	-	0.0	2.7	0.0
Marion	0.8	0.8	0.0	-	-	-	-	-	-	-
Multnomah	0.3	0.8	0.0	1.6	1.6	1.7	0.8	0.0	0.0	0.0
Umatilla	0.3	2.6	1.8	-	-	0.0	0.0	0.0	0.0	0.0
Union	0.0	0.6	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Wasco	1.6	0.0	0.0	1.9	0.0	-	-	-	-	-
Washington	0.8	3.3	0.9	1.0	1.5	6.7	0.0	0.0	0.0	1.1

Note: No data are available for counties not shown. Empty cells also indicate missing data (-). Cells are shaded for ease of interpretation; colors do not reflect statistical comparisons. The cell with highest value is orange; zero values and no data are white. A linear ramp is applied to the other cells. Counties are ordered by the total percent of exceedance days.

Multiple monitors are in place in some counties, and the monitor with the highest measurement is used for the county number. This can produce results which are not representative of the air quality in the county. For example, Oakridge in Lane County experiences high PM2.5 levels due to the geography of the region. Few people live in Oakridge, but those high levels are assigned to all of Lane County which makes it seem that air in other communities of Lane County is worse than it actually is.

There are strong regional variations in the percent of days with PM2.5 levels exceeding the NAAQS. Lane County had the highest percentage of high $PM_{2.5}$ days; Klamath County showed the highest peak value in 2002 with 12.4 percent of days with PM2.5 levels over the NAAQS. Jackson and Washington Counties also had years with more than 5% of monitored days exceeding the NAAQS.

Medford, the largest city in Jackson County, is located in the Rogue Valley, an area with poor ventilation and frequent temperature inversions that trap air pollutants. Klamath Falls, the largest city in Klamath County, experiences similar effects due to the geography of the Klamath Basin. Canyons in Lane County also trap air pollutants, creating conditions for poor air quality in Oakridge and other communities. Only Lane County had a significant linear trend in decreasing $PM_{2.5}$ exceedances from 2001 through 2010 ($p=0.033$). The Lane Regional Air Protection Agency sponsors a number of programs to address air quality problems. The improved air quality there indicates these efforts are working.

Table 4. Measure B2: Number of person-days (in thousands) during which $PM_{2.5}$ concentrations exceeded the NAAQS of 35 mcg/m^3, by county

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Benton	0	0	-	-	-	-	-	-	-	-
Columbia	0	0	0	0	0	-	-	-	-	-
Crook	-	-	-	-	-	-	-	-	0	0
Deschutes	412	0	0	0	-	-	-	0	1,016	0
Douglas	-	-	-	-	0	1,113	-	-	-	-
Harney	45	49	0	-	-	-	85	91	0	0
Jackson	922	4,703	1,647	564	1,756	1,314	308	1,450	1,689	0
Josephine	1,180	246	336	0	0	0	0	0	510	530
Klamath	435	2,899	410	1,576	1,971	646	628	1,235	1,251	411
Lake	23	77	0	-	-	-	61	111	107	0
Lane	11,044	8,185	6,296	5,673	12,339	5,897	9,361	2,874	5,340	713
Linn	315	642	0	0	0	-	-	0	1,150	0
Marion	857	864	0	-	-	-	-	-	-	-
Multnomah	670	2,029	0	3,801	4,032	4,119	2,138	0	0	0
Umatilla	85	680	479	-	-	0	0	0	0	0
Union	0	53	0	0	83	0	0	0	0	0
Wasco	142	0	0	158	0	-	-	-	-	-
Washington	1,372	5,641	1,504	1,826	2,749	12,411	0	0	0	2,057

Note: No data are available for counties not shown. Empty cells indicate missing data. Cells are shaded for ease of interpretation; colors do not reflect statistical comparisons. Cell with highest value is orange; zero values and no data are white. A linear ramp is applied to the other cells. Counties are ordered by exceedance person-days.

C. Annual PM2.5 level measures

Annual average PM2.5 concentrations are subject to a NAAQS of 15 mcg/m^3, which is significantly lower than the NAAQS of 35 mcg/m^3 for daily PM2.5 concentrations. As shown in Table 5 on the following page, from 2001 to 2010, only Klamath County exceeded the NAAQS for average $PM_{2.5}$ concentration, in 2002, which was due to a large wildfire in Klamath National Forest. Deschutes, Jackson, Josephine, Lane and Umatilla Counties had statistically significant linear trends in decreasing annual average $PM_{2.5}$ concentration ($p<0.05$). There were no significant trends in increasing concentration in any of the monitored counties.

Oregon DEQ collects real-time air quality data in many locations not represented in the NAAQS data. The figures and tables in this report include counties with NAAQS sites that collect data used in Oregon Tracking measures and other counties where $PM_{2.5}$ is monitored in Oregon. When air quality at a particular location is a concern, DEQ sets up additional monitors to gather data.

Figure 3 shows that about 44% of Oregon's population lives in counties where there is no Federal Reference Monitor for $PM_{2.5}$. This limits our ability to draw conclusions about the percent of the population actually exposed to unhealthy levels of $PM_{2.5}$ from these data. However, air monitoring does occur in places with no Federal Reference Monitors, which are positioned in areas where air quality has been a concern.

Figure 3. Measure C2: Percent of population in counties exceeding the NAAQS compared to percent of population in counties that meet the standard and percent of population in counties without Federal Reference Monitors for $PM_{2.5}$, average 2001-2010

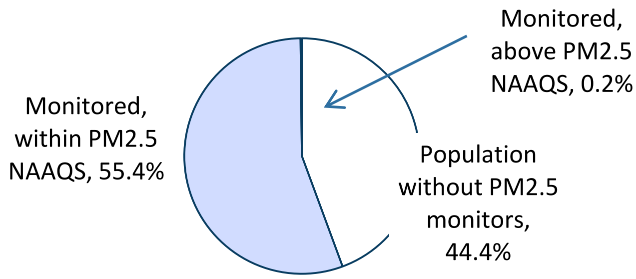

Table 5. Measure C1: Annual mean $PM_{2.5}$ concentrations (mcg/m3), by county

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Benton	7.3	7.6	-	-	-	-	-	-	-	-
Columbia	6.2	6.4	5.6	7.9	-	-	-	-	-	-
Crook	-	-	-	-	-	-	-	-	8.4	7.8
Deschutes	6.9	7.9	7.6	-	-	-	-	-	5.6	4.5
Harney	9.1	9.7	-	-	-	-	9.5	11.2	8.4	7.9
Jackson	10.6	14.0	11.3	10.8	10.1	10.1	9.9	10.0	10.0	7.1
Josephine	10.6	-	9.7	-	-	-	8.2	9.4	8.5	6.4
Klamath	8.9	17.1	10.0	11.3	11.7	11.1	10.8	13.0	11.8	9.8
Lake	7.2	9.0	-	-	-	-	8.1	11.2	10.6	7.5
Lane	13.8	14.1	12.3	12.0	12.8	11.1	10.5	11.5	11.0	8.9
Linn	8.2	8.2	7.9	8.0	-	-	-	-	-	-
Marion	8.2	8.2	-	-	-	-	-	-	-	-
Multnomah	8.8	8.5	8.2	9.3	9.2	9.8	8.1	8.4	7.6	6.3
Umatilla	8.7	9.3	-	-	-	-	7.6	8.3	7.8	6.9
Union	6.7	7.3	6.2	7.4	8.8	9.3	6.4	6.7	7.8	5.9
Wasco	7.5	7.7	6.2	7.7	-	-	-	-	-	-
Washington	9.0	10.5	8.3	9.0	-	-	8.2	8.9	8.7	6.6

Note: No data are available for counties not shown. Empty cells indicate missing data (-). Cells are shaded for ease of interpretation; colors do not reflect statistical comparisons. The cell with highest value is orange; zero values and no data are white. A linear ramp is applied to the other cells. Counties are ordered by the highest overall average.

Major limitations

The representativeness of air quality data vary across the United States. This occurs because the monitoring network differs geographically in purpose, density and placement. The air monitoring data generally represent populated areas, although some rural monitoring occurs. In rural areas there are substantial spatial gaps in data, since the monitoring network is mostly population-based. Because most $PM_{2.5}$ samples used in these measures are collected every third day, temporal limitations include the lack of daily data. Ozone is monitored daily, but only during the ozone monitoring season; year-long data would be useful to confirm that ozone is not a factor in health outcomes during the other times.

These indicators also do not provide information regarding the severity of potential exposures or the magnitude of individual exposure levels. Even when high levels of air pollutants are found, we still can't be certain how much a particular individual is exposed to because exposure and absorption are dependent on a number of factors, including precise location, duration of exposure, exertion level and individual physiology.

The estimated number of person-days will be biased low since the counties that do not contain Federal Reference Monitors are not included in the calculation. Similarly, the percent of the population living in areas above the standard can be difficult to interpret in situations where a large proportion of the population lives in counties without these monitors.

Measures that summarize the number of days that exceed the Air Quality Index are biased higher in areas with more frequent and extensive air pollutant monitoring compared to areas with fewer monitors. However, the Department of Environmental Quality has periodically monitored other areas and has not found concentrations approaching the standard. This provides confirmation that, as the historical data suggests, it is reasonable to assume that locations without monitors do not have high concentrations.

If ozone and $PM_{2.5}$ data are to be used in health assessments, it is critical that adequate consideration is given to the contribution to observed effects by other pollutants, especially those that occur in the presence of ozone and/or $PM_{2.5}$ such as nitrogen dioxide, sulfur dioxide and carbon monoxide. Evaluation of meteorological parameters, such as high temperature and humidity, is also critical. To not consider the potential confounding or modifying effects of other pollutants and meteorological factors would result in invalid estimates.

Summary

Based on analysis of indicators tracked by Oregon Tracking, air quality in Oregon is generally very good. Only a few places in the state regularly have high concentrations of $PM_{2.5}$ in the air; ozone levels are consistently low. Though there are gaps in monitoring, most of the state's population lives in counties where ozone and $PM_{2.5}$ levels are measured. From only 10 years of data is difficult to interpret trends in the number of days with unhealthy levels of $PM_{2.5}$ or ozone. However, the average annual $PM_{2.5}$ level appears to be decreasing in several monitored counties.

Recommendations

Given the good air quality in Oregon, enhancing air quality monitoring by increasing the number of Federal reference monitors is not warranted at this time. Monitoring should continue in those places where air quality issues are more common to allow for evaluation of air quality improvement efforts. However, with the variability in air quality measurements it will be necessary to compile more years of data to appropriately analyze trends. We recommend updating this descriptive analysis every two years and conducting a more thorough statistical analysis in 2018.

With support from CDC, EPA publishes computer-modeled data from the Hierarchical Bayesian Space-time Modeling System (HBM) for the entire contiguous United States. These estimates are produced by extrapolating measured $PM_{2.5}$ and ozone concentrations over areas with no monitors. Daily estimates for a surface divided by a 12 km x 12 km grid are available for the eastern United States for the years 2001-2008. For the entire United States, estimates for a 12 km grid are available for 2007 and 2008, and for a 36 km grid for 2001-2006. In other words, the resolution for western states is not as good for earlier years, which limits analysis. The HBM estimates are considered more reliable than estimates based on other methods, but are still an approximation of the quality of air that an individual may be exposed to. For example, within a 144 (or 1,296) square kilometer grid cell there may be industrial sources of air pollution that expose nearby residents to unhealthy levels of $PM_{2.5}$. The modeled data would not identify that exposure. If exposure to pollution from a specific source is a concern, we recommend targeted air quality monitoring in the surrounding community to gather relevant data.

Reference links

Oregon Department of Environmental Quality (DEQ), Air Quality Division:
www.oregon.gov/DEQ/AQ/index.shtml

Oregon Health Authority (OHA), Oregon Environmental Public Health Tracking (EPHT):
www.healthoregon.org/epht

U.S. Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Environmental Public Health Tracking (NEPHT) Program:
www.cdc.gov/nceh/tracking/default.htm

U.S. Department of Health and Human Services (DHHS), National Institutes of Health (NIH), National Institute of Environmental Health Sciences (NIEHS). Air pollution:
www.niehs.nih.gov/health/topics/exposure/air-pollution/index.cfm

U.S. Environmental Protection Agency (EPA), AirNow, AirCompare:
epa.gov/aircompare

U.S. Environmental Protection Agency (EPA). EPA report on the environment 2008:
cfpub.epa.gov/eroe/index.cfm

U.S. Environmental Protection Agency (EPA). Ground-level ozone:
www.epa.gov/air/ozonepollution/index.html

U.S. Environmental Protection Agency (EPA), National Ambient Air Quality Standards (NAAQS):
www.epa.gov/air/criteria.html

U.S. Environmental Protection Agency (EPA), Office of Air and Radiation (OAR):
www.epa.gov/air

U.S. Environmental Protection Agency (EPA). Particulate matter (PM):
www.epa.gov/oar/particlepollution

U.S. Environmental Protection Agency (EPA). Six common air pollutants:
www.epa.gov/air/urbanair

U.S. Environmental Protection Agency (EPA), Technology Transfer Network (TTN), Ambient Monitoring Technology Information Center (AMTIC): *www.epa.gov/ttn/amtic*

World Health Organization (WHO). Public health and environment, air quality guidelines, global update 2005: *www.who.int/phe/health_topics/outdoorair_aqg/en*

Glossary

Assessment	One of the three core functions of public health (assessment, policy development, assurance). Comprises monitoring health status to identify community health problems; diagnosing and investigating health problems and health hazards in the community; and evaluating the effectiveness, accessibility and quality of population-based health services.
CDC	Centers for Disease Control and Prevention, DHHS
Clean Air Act	The 1970 Clean Air Act directs the EPA to establish limits on how much of a pollutant can be in the air anywhere in the United States.
Contaminant	Anything found in air (including chemicals, particulate matter, infectious organisms, etc.) that may be harmful to human health
Cubic meter	See m^3
DHHS	U.S. Department of Health and Human Services
EPHT	Environmental Public Health Tracking. The national initiative to establish a network to enable the ongoing collection, integration, analysis and interpretation of data about environmental hazards, exposure to environmental hazards and health effects
EPHT Program	Environmental Public Health Tracking Program. This national program is in the Division of Environmental Hazards and Health Effects of CDC's National Center for Environmental Health. The Oregon EPHT Program is housed in the Research and Education Section of the Center for Health Protection in the Public Health Division of the Oregon Health Authority.
Exposure	Proximity to and/or contact with a substance having the potential to cause disease in such a manner that effective transmission of the agent or harmful effects of the agent may occur
Federal Reference Monitor	An air quality monitor that has been approved by EPA to collect data used to determine compliance to the national ambient air quality standards.
Gram	A metric unit of mass equal to one-thousandth of a kilogram. There are 28 grams in 1 ounce.
Hazard	A source that may adversely affect health, from past, current or future exposures
Indicator	A statistic that provides information on trends. Environmental public health indicators supply information about a population's health status with respect to environmental factors that can be used to assess health in a specified population through direct or indirect measures.
Kilogram	A metric unit of mass equal to 1,000 grams (2.2 pounds).
Linear	Pertaining to or represented by lines; long in one dimension and thin in every other dimension. A relationship between two numerical quantities is called linear if any change in one quantity implies a constant proportional change in the other.
Liter	Metric system unit of volume equal to 61.024 cubic inches (1.0567 U.S. quarts wet) 1 liter = 1,000 milliliters. The abbreviation for liter is "L."
m^3	Cubic meter; a measure of volume equal to 1,000 liters, 35.3 cubic feet or 1.3 cubic yards

mcg/m^3	Micrograms per cubic meter; a unit of concentration that equals one millionth of a gram per cubic meter, such as one-millionth of a gram of ozone per cubic meter of air. This is also symbolized as µg/m^3.
Measure	Term that communicates progress on a particular aspect of a program; a basis for comparison or a reference point against which other trends can be evaluated.
NAAQS	National Ambient Air Quality Standards Under the Clean Air Act, the EPA established limits called National Ambient Air Quality Standards (NAAQS) for six air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3) and particulate matter (PM).
Ozone (O^3)	An odorless, colorless gas. Ground-level ozone is formed when pollutants released from cars, power plants and other sources react in the presence of heat and sunlight. It is the prime ingredient of smog and considered to be “bad” ozone because it is located where you can breathe it. "Good" ozone occurs naturally in the stratosphere approximately 10-30 miles above the earth's surface and forms a beneficial layer that protects life on earth from the sun's harmful rays.
Particulate matter ($PM_{2.5}$)	Particles found in the air such as dust, dirt, soot, smoke and liquid droplets. Some particles are large or dark enough to be seen as soot or smoke; others are so small they can only be seen with a microscope. Monitoring stations measure two particle sizes: PM10 and $PM_{2.5}$. The size of the particle determines the potential to cause health effects. Particles larger than 10 micrometers (PM10) do not usually reach the lungs, but can irritate the eyes, nose and throat.
Percentage	A way of expressing a number as a fraction of 100 (percent meaning "per hundred")
Person-days	A measure of exposure; the number of people multiplied by the time they were exposed to a substance
Population-based	Pertaining to the general population as defined by geopolitical boundaries such as nation, state, county and ZIP code
ppb	A measurement: parts per billion
Public health	The art and science dealing with preventing disease, prolonging life and promoting health through organized efforts including preventive medicine, and sanitary and social services
Relationship	A way in which people and things may be associated with each other, either real or suspected, which describes their interaction. Relationship or association does not imply causation.
Spatial	A reference to geographic location; contrasted with temporal, which pertains to time
Temporal	Referring to time, the passage of time or the measurement of time; contrasted with spatial, which pertains to geographic location
Volatile organic compounds (VOC)	Chemical substances containing hydrocarbons (hydrogen and carbon atoms) that evaporate into the atmosphere. EPA has limited the definition to those organic compounds that participate in atmospheric photochemical reactions to produce ozone and ozone precursors.

This report was supported by a National Environmental Public Health Tracking Program cooperative agreement (5U38EH000950-02) from The Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.

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