DAPL: Health and Social Perspectives

Dakota Access Pipeline

Drs. Lori and Robert Byron

Objectives

1. Discuss the risks of gas/oil pipelines.
2. Increase awareness of health issues related to fracking.
3. Discuss the beliefs and reasons behind the civil protest at Standing Rock.
This is DAPL.
This is DAPL.
This is DAPL.

Photo: http://portside.org/2017-02-21/construction-near-standing-rock-restarts-pipeline-fights-flare-across-us
Pipeline Oil Spills, U.S. 1986-2016

8700 spills/year (almost 1/day)
4.2 million barrels, 176 million gallons, spilled
Over 10% of spills have seeped into water bodies

Yellowstone River 1/2015: 50,000 barrel spill under the ice
How do you clean that up?

Crude oil contains:
hexane, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene

Climate Impact Per Unit of Energy
Natural Gas vs. Coal Emissions

20-Year Time Horizon Comparing Greenhouse Gas Emissions from Shale Gas and Coal

- Methane
- Indirect CO2
- Direct CO2

<table>
<thead>
<tr>
<th></th>
<th>Low Estimate</th>
<th>High Estimate</th>
<th>Conventional Gas</th>
<th>Low Estimate</th>
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<th>Surface-mined</th>
<th>Deep-Mined</th>
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</table>
Fracking infrastructure. Illustration from article in Nature, Sept. 15, 2011, Natural Gas: Should fracking stop?, by Robert W. Howarth, Anthony Ingraffea, & Terry Engelder. [http://www.nature.com/nature/journal/v477/n7364/fig_tab/477271a_F1.html](http://www.nature.com/nature/journal/v477/n7364/fig_tab/477271a_F1.html)
20-40% of water returns to surface as wastewater with high levels of salts and toxic levels of Ba, As and Ra

Airborne emissions: VOC, NOx, BTEX

~ 12 % of methane produced by fracking is lost by leaking into the atmosphere across the production chain
Fracking Concerns

- 2300-7000 single truck trips/well\(^1\)
- PM from vehicles
- Increased traffic related injuries & deaths (Eagle Ford Shale play in southern Texas, traffic fatalities increased by 48 percent from 2008 to 2013, compared with a statewide decrease of 3 percent)\(^2\)
- Silica/Silicosis related to fracking sand transport
- As of 2013, more than 15 million people in the U.S. lived within 1 mile of a natural gas well drilled since 2000.\(^3\)
- Total US Oil & Gas wells: 1.7 million, fracking-137,000

# Cumulative Impacts of Fracking: 2005-2014

<table>
<thead>
<tr>
<th>State</th>
<th>Wells Fracked</th>
<th>Hydrochloric Acid Used (10^3 pounds)</th>
<th>Methanol Used (10^3 pounds)</th>
<th>Methanol Released from Well Completed in 2014 (10^6 pounds)</th>
<th>Wastewater Produced in 2014 (10^6 gallons)</th>
<th>Water Consumed (10^6 gallons)</th>
<th>Land Disturbed (acres)</th>
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<tbody>
<tr>
<td>Arkansas</td>
<td>6,496</td>
<td>142,406</td>
<td>2,025</td>
<td>unavailable</td>
<td>unavailable</td>
<td>11,290</td>
<td>144</td>
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<td>California</td>
<td>3,405</td>
<td>1,034</td>
<td>489</td>
<td>unavailable</td>
<td>1,057</td>
<td>237</td>
<td>140</td>
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<tr>
<td>Colorado</td>
<td>22,615</td>
<td>68,663</td>
<td>10,042</td>
<td>3,139</td>
<td>19,142</td>
<td>395</td>
<td>105,866</td>
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<td>Louisiana</td>
<td>2,883</td>
<td>15,136</td>
<td>2,045</td>
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<td>4,880</td>
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<td>New Mexico</td>
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<td>70,798</td>
<td>4,403</td>
<td>8,592</td>
<td>3,132</td>
<td>125</td>
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<td>North Dakota</td>
<td>8,224</td>
<td>82,198</td>
<td>88,168</td>
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<td>14,891</td>
<td>517</td>
<td>33,718</td>
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<td>Ohio</td>
<td>1,594</td>
<td>105,447</td>
<td>1,942</td>
<td>313</td>
<td>7,771</td>
<td>136</td>
<td>9,118</td>
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<td>Oklahoma</td>
<td>7,421</td>
<td>455,225</td>
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<td>19,582</td>
<td>546</td>
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<td>Pennsylvania</td>
<td>9,233</td>
<td>1,806,032</td>
<td>5,396</td>
<td>1,821</td>
<td>24,732</td>
<td>295</td>
<td>52,813</td>
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<td>Texas</td>
<td>54,958</td>
<td>2,148,789</td>
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<td>120,215</td>
<td>2,521</td>
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<td>Utah</td>
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<td>35,926</td>
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<td>West Virginia</td>
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<td>64,134</td>
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<td>7,851</td>
<td>88</td>
<td>15,272</td>
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<td>Wyoming</td>
<td>7,277</td>
<td>18,074</td>
<td>5,870</td>
<td>70</td>
<td>2,528</td>
<td>116</td>
<td>29,836</td>
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<td><strong>TOTAL</strong></td>
<td><strong>137,743</strong></td>
<td><strong>5,038,953</strong></td>
<td><strong>444,786</strong></td>
<td><strong>14,993</strong></td>
<td><strong>239,166</strong></td>
<td><strong>5,340</strong></td>
<td><strong>679,148</strong></td>
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</table>

Elizabeth Ridlington, Kim Norman (Frontier Group), Rachel Richardson (Environment America Research & Policy Center), Fracking by the Numbers: The Damage to Our Water, Land and Climate from a Decade of Dirty Drilling, Appendix A, April 2016; http://www.environmentamerica.org/sites/environment/files/reports/Fracking%20by%20the%20Numbers%20vUS.pdf
Difficulties with research on UOG (Unconventional Oil and Gas)

- Vast expansion this century
- Emissions (VOCs, PM2.5) are variable in their intensity, frequency, and duration
- Over a thousand different chemicals used in the extraction process, study design difficult
- Exposure varies with proximity to wells w/drilling and hydraulic fracturing, wellpads, compression stations, processors, storage facilities, waste sites, and the transport between these stations
- Chemicals are "trade secrets"
- Oilfield wastes largely unregulated, also radioactive
- Contamination of air, soil, and water possible
Fracking is currently largely exempt from:

- Safe Drinking Water Act
- Resource Conservation and Recovery Act
- Clean Water Act
- Clean Air Act
- CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
- TSCA (no rulemaking yet)

Expectant mothers who live near active natural gas wells in Pennsylvania are at an increased risk of giving birth prematurely (40% more likely) and for having high-risk pregnancies. (In a posthoc analysis, there was an association with physician-recorded high-risk pregnancy identified from the problem list.

“Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA”

Epidemiology: March 2016 - Volume 27 - Issue 2 - p 163–172

Casey, Joan A.; Savitz, David A.; Rasmussen, Sara G.; Ogburn, Elizabeth L.; Pollak, Jonathan; Mercer, Dione G.; Schwartz, Brian S.

Johns Hopkins School of Public Health
National Institute of Environmental Health Sciences Grant

2009-2013
9,384 mothers and 10,946 neonates

Suggests a positive association between greater density and proximity of natural gas wells within a 10-mile radius of maternal residence and greater prevalence of CHDs and possibly NTDs, but not oral clefts, preterm birth, or reduced fetal growth.

https://ehp.niehs.nih.gov/1306722/
“Unconventional oil and gas development and risk of childhood leukemia: Assessing the evidence”
(“Yale Public Health Analysis”)

Science of The Total Environment
Volume 576, 15 January 2017, Pages 138–147

E. Elliott, P. Trinh, X. Ma, B. Leaderer, M. Ward, N. Deziel

The researchers reviewed the evidence of cancer risk for 1117 water contaminants and 143 air pollutants related to fracking.

Found 55 chemicals released into air or water that may cause cancer, 20 of which increase leukemia and lymphoma.

More than 80% lacked enough data to classify whether or not they had the potential to cause cancer.
Adult Complications

Unconventional gas and oil drilling is associated with increased hospital utilization rates.


University of Pennsylvania School of Medicine

2007-2011
67 zip codes/3 counties

Fracking in Pennsylvania significantly associated with increased rates of hospitalization for cardiac and neurological issues, and also associated with urological, cancer-related, skin-related problems.

-for communities with the most wells, the rate of cardiac hospitalizations was 27 % higher than in the control county.
In 2010, 28 cows in Pennsylvania were quarantined after a leaking waste container left a puddle of hydraulic fracking fluid in their field. A year later, the released cows appeared healthy, but gave birth to 11 offspring described as “dead or extremely weak,” an outcome that the farm owner called “abominable.” Only 3 calves survived.

“Mni Waconi”: ”Water is Life” in Lakota

Photo: https://trofire.com/2017/03/02/fbi-thinks-standing-rock-protesters-might-terrorists/
“We (indigenous peoples) view earth as a living system. We thank the plant before we pick it. We give thanks for water before we drink it. We bless the air we breathe with burning sweet grass.”
“You can live without money. You can live without oil. But you can’t live without water.”

Rezpect Our Water

#NoDAPL

DAPL Timeline

- 9/14 Standing Rock Sioux Chair “not in favor”
- 10/14 Protests begin, petitions for a state E.O. to halt construction
- 3/16 EPA/DOI/etc asks for an formal EIS (not just the EA) from the ACE [ACE then looked at ½ mile radius of the river crossing and not 88 yards beyond (reservation)]
- 7/16 Standing Rock Sioux filed suit against ACE
- 9/16 construction begun
- 12/16 ACE denied easement under river, EIS was to be completed.
- 1/17 E.O. to continue construction/end env. assessment
- 5/17 oil flowing in the DAPL
- 6/17 Court says EA is inadequate – lacking NA issues (fishing and hunting rights, env justice). ACE must reconsider these issues.
Standing Rock was vaster than what [you see on the surface.] At its height it was almost certainly the biggest political gathering of Native North Americans ever seen, said to be the first time all seven bands of the Lakota had come together since they defeated Custer at Little Bighorn in 1876, one that made an often-invisible tribe visible around the world. What unfolded there seemed as though it might not undo one pipeline but write a radical new chapter to a history of more than 500 years of colonial brutality, centuries of loss, dehumanization and dispossession. --- Rebecca Solnik


Lori Byron, MD, FAAP: lori.byron@gmail.com

Robert Byron, MD, MPH, FACP: rgbryon@gmail.com
Thanks to
- The hundreds of thousands who stood in support of the Standing Rock Sioux
- Over 300 tribes who stood together
- Those who were injured by water cannons, rubber bullets, tear gas and concussion grenades, and attack dogs, and arrests
- Those who provided assistance, finances and supplies
- Those who gave their time and prayers

Thanks to
- The scientists and researchers who continue to expose the hazards of fossil fuels, both present and future
- The AAP for its aggressive advocacy for children.
Webinars
Series of scientific webinars that provide a forum for discourse on scientific issues.
- Live and On-Demand
- Case Conferences
- Journal Clubs
- Grand Rounds

Online Courses
Evidence-based online courses on a variety of children's environmental health topics.
- Interactive and Self-Paced
- CE Available

Resource Catalog
Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals
- Topics included:
  - Air Quality
  - Pesticides
  - Natural Disasters
  - BPA
  - Mold
  - Lead
  - Mercury
1) Identify links between climate change and increased risk for wildfires

2) Describe health impacts of wildfires

3) Outline resources available to address health and safety concerns

4) Discuss risk communication strategies to address health and safety concerns from wildfires
Disclaimers

- This material was supported by the American Academy of Pediatrics (AAP) and funded (in part) by the cooperative agreement FAIN: 1U61TS000237-03 from the Agency for Toxic Substances and Disease Registry (ATSDR).

- Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing partial funding to ATSDR under Inter-Agency Agreement number DW-75-95877701. Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.
INCREASING MAGNITUDES OF WARMING INCREASE THE LIKELIHOOD OF SEVERE AND PERVERSIVE IMPACTS
As the world warms, we can expect more wildfires.
Impacts

- Longer fire seasons
- More intense wildfires
- More fuel for forest fires
- Drier conditions
- Wildfires increase carbon dioxide, increasing global warming
Extreme Weather in the US (2011):
Record Breaking Weather Events*

* In addition there were 7 record-breaking tornado events. Additional research is needed to understand the impact of climate change on tornado events.

Information on data sources and map methods available at:
http://www.nrdc.org/health/climate/extreme-weather.asp
Extreme Weather Map
2012: Thousands of Weather Records Broken in the U.S., Costs Climbing
PM$_{2.5}$ Monitoring Station Completeness Criteria

Monitors were included if 50% of all days in a quarter were available, all four quarters in 2011 were available and the overall average completeness was 85% or higher. Only monitors operating on an every-day schedule were included.
Air Quality Impacts
Health effects of smoke

**Daily Counts of Asthma ED Visits; Pocosin Lakes NC 2008**

First day of flaming

3 days of high exposure

Rappold AG et al. Environ. Health Perspectives 2011
Health Effects of Wildland Fire Smoke

Percent change in cumulative RR by discharge diagnosis category for exposed and referent counties in NC during 3-day period of high exposure compared with the entire 6-week study period.

Rappold AG et al. Environ. Health Perspectives 2011
Wildfire Smoke Resources

Key Resources for Health Professionals
What is Particle Pollution?

On this page:

- What is particle pollution and what types of particles are a health concern?
- Where does particle pollution come from?
- Where and when is particle pollution a problem?

What is particle pollution and what types of particles are a health concern?

Particle pollution, also known as particulate matter (PM), includes solid particles and liquid droplets suspended in the air. PM can be made up of a number of different substances, including chemical compounds (such as ammonium sulfate, sulfuric acid, and nitrates) and biological substances (such as soot, metals, soil or dust, and plant spores).

The air we breathe indoors and outdoors is made up of gases, dust, dirt, soot, or smoke, are large enough to be seen, but most of the time they can only be detected using an electron microscope. The fine particles, however, are too small to be seen by the naked eye.

Your patients who are at risk for the health effects of particle pollution exposure should be aware of the effects of particle pollution exposure. Those who are concerned about particles that are 10 micrometers (µm) in diameter or smaller should be particularly concerned, because these are the particles that can pass through the nose and throat and enter the lungs and might even translocate into the bloodstream, causing inflammation and damage to the circulatory system and the central nervous system. Once inhaled, these particles can affect the respiratory system.
EPA Air Pollution Factsheets

ASThma AND OUTDOOR AIR POLLUTION

1. Air pollution can make asthma symptoms worse and trigger attacks.

   If you or your child has asthma, have you ever noticed symptoms get worse when the air is polluted? Air pollution can make it harder to breathe. It can also cause other symptoms, like coughing, wheezing, chest discomfort, and a burning feeling in the lungs.

   Two key air pollutants can affect asthma. One is ozone (found in smog). The other is particle pollution (found in haze, smoke, and dust). When ozone and particle pollution are in the air, adults and children with asthma are more likely to have symptoms.

2. You can take steps to help protect your health from air pollution.

   - Get to know how sensitive you are to air pollution.
   - Notice your asthma symptoms when you are physically active. Do they happen more often when the air is more polluted? If so, you may be sensitive to air pollution.

   - Are you at higher risk?

   Older adults and people with risk factors for heart disease or stroke may be at greater risk. You are at greater risk if you:
   - Have had a heart attack, angina, bypass surgery, angioplasty with or without a stent, a stroke, blockages in the neck or leg arteries, heart failure, heart rhythm problems, diabetes, or chronic obstructive lung disease.
   - May be at greater risk of heart disease or stroke (and therefore at greater risk from particle pollution) if any of these apply:
     - You are a man 45 years or older, or a woman 55 years or older.
     - You have a family history of stroke or early heart disease (father or brother diagnosed before age 55; mother or sister diagnosed before age 65).
     - You have high blood pressure or high blood cholesterol.

   - How can you protect your health?

   Regular exercise is important for staying healthy, especially if you have heart disease. By adjusting when and where you exercise, you can lead a healthier lifestyle and help reduce your risk of heart problems or stroke triggered by air pollution. In addition:
   - If you have heart disease or have experienced a stroke, check with your health care provider about the best ways to protect your health when the air quality is unhealthy.
   - If you’re at risk of heart disease or stroke and plan to exercise more than usual, discuss this with your health care provider.

   - Know when and where particle pollution levels may be unhealthy.

   Particle pollution levels can be high any time of year. Particle levels can also be high:
   - Near busy roads, in urban areas (especially during rush hour), and in industrial areas.
   - When there is smoke in the air from wood stoves, fireplaces, burning vegetation, or

www3.epa.gov/airnow/asthma-flyer.pdf (English)
www3.epa.gov/airnow/health-prof/EPA-poster-Spanish-2008.pdf (Spanish)
www3.epa.gov/airnow/heartflyer.pdf (English)
www3.epa.gov/airnow/heartflyer-sp.pdf (Spanish)

Wildfire Guide 2016

- Primarily a federal/California document; housed on AirNow website
- Updated air quality and health information
- Evidenced-based exposure reduction measures
- Entirely new section on communicating air quality
  - Uses “Current PM” levels from AirNow
  - Uses satellite information on Fires: Current Conditions page
  - Visual range information updated
- PEHSU fact sheets about children’s health, 2011
- Information about new interagency Wildland Fire Air Quality Response Program

https://www3.epa.gov/airnow/wildfire_may2016.pdf
Wildfire Guide 2017 – Example Draft Fact Sheets

WILDFIRE SMOKE FACTSHEET

Prepare for Fire Season

If you live in an area that is regularly affected by smoke or where the wildfire risk is high, it is important to prepare for fire season. Know how to get ready before a wildfire. Know how to protect yourself and your property from smoke exposure during a wildfire.

Being prepared for fire season is especially important for the health of children, older adults, people with heart or lung disease.

Prepare Before a Wildfire

- Stock up so you don’t have to go out when it’s smoky. Have several days worth of medications on hand. Buy groceries that do not need to be refrigerated or cooked, because cooking can add to indoor particulate levels.
- Choose a “clean room” in your home. Choose a room with as few windows and doors as possible, such as a bedroom. Use a portable air cleaner and avoid indoor sources of pollution.
- Buy a portable air cleaner before there is a smoke event. High efficiency particulate air (HEPA) filters are more effective at capturing small particles and electronstatic precipitators that do not produce ozone, can help reduce indoor particulate levels.
- Understand how you will receive alerts and health warnings, including air quality reports and public service announcements, from local officials.

WILDFIRE SMOKE FACTSHEET: Indoor Air Filtration

Exposure to Particle Pollutants

Indoor sources of particulate matter (PM) come from combustion events such as smoking, candle burning, cooking and wood burning. During a wildfire event, outdoor PM can increase indoor PM levels well above the levels normally found. As outlined in the Guide, reducing indoor sources of pollution is a major step to lower the concentrations of PM indoors. Further reductions in indoor PM can be achieved using one of the filtration options discussed below.

Filtration Options

There are two effective options for improving air filtration in the home: upgrading the central system filter or using high efficiency portable air cleaning appliances. Before discussing filtration options, it is important to understand the basics of filter efficiency.

Filter Efficiency

The most widely used industry standard for filter efficiency is known as the Minimum Efficiency Reporting Value, or MERV rating. The MERV scale for residential filters ranges from 1-12. The higher the MERV, the greater the percentage of particles captured as the air passes through the filter media. Higher MERV (higher efficiency) filters are especially effective at capturing very small particles that can most affect health.

Central Air System Filter

The filter used in the central heating and cooling system of the home can effectively reduce indoor PM. A home typically will have a low MERV (1-4) filterless efficiency that is below that of a medical face mask. Consider replacing the filter with one that meets the higher standards of an HEPA (High Efficiency Particulate Air) filter.

Portable Air Cleaner

Portable air cleaners are appliances that can be placed anywhere in a room and are effective at capturing micro- and sub-micron particles. These units are especially effective in reducing pollen and mold spores, which can cause outdoor air quality.

WILDFIRE SMOKE FACTSHEET

Children

Background

- Wildfire smoke affects children to a greater extent than adults because their lungs are still developing and their noses are more sensitive.
- Smoke can irritate the respiratory system, leading to coughing, wheezing, and difficulty breathing.
- Smoke can affect infants and children’s development, intelligence, and long-term health.

Recommendations

Planning Ahead

- Stock up so you don’t have to go out when it’s smoky. Have several days worth of medications on hand.
- Buy groceries that do not need to be refrigerated or cooked, because cooking can add to indoor particulate levels.
- Choose a “clean room” in your home. Select a room with as few windows and doors as possible, such as a bedroom. Use a portable air cleaner and avoid indoor sources of pollution.
- Buy a portable air cleaner before there is a smoke event.
- Have a portable air cleaner on hand at all times.

Health Effects from Smoke

- Smoke can cause eye irritation, coughing, and difficulty breathing.
- Smoke can irritate the nasal passages, leading to nasal congestion and sinusitis.
- Smoke can affect infants and children’s development, intelligence, and long-term health.

Recommendations

- Keep children indoors with the windows closed.
- Use portable air cleaners to reduce indoor air pollution.
- Use fans to increase air circulation.
- Use air conditioning to reduce indoor air pollution.

Original PEHSU Wildfire Factsheet available at: http://www.pehsu.net/cgi/page.cgi/resources.html
Risk Communication Strategies

Regional and National Examples
National
## AQI and Air Quality Flag Program

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<thead>
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<th>Air Quality Index (AQI) Values</th>
<th>Levels of Health Concern</th>
<th>Colors</th>
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<tbody>
<tr>
<td>When the AQI is in this range:</td>
<td>...air quality conditions are:</td>
<td>...as symbolized by this color:</td>
</tr>
<tr>
<td>0 - 50</td>
<td>Good</td>
<td>Green</td>
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<tr>
<td>51 - 100</td>
<td>Moderate</td>
<td>Yellow</td>
</tr>
<tr>
<td>101 - 150</td>
<td>Unhealthy for Sensitive Groups</td>
<td>Orange</td>
</tr>
<tr>
<td>51 - 200</td>
<td>Unhealthy</td>
<td>Red</td>
</tr>
<tr>
<td>201 - 300</td>
<td>Very Unhealthy</td>
<td>Purple</td>
</tr>
<tr>
<td>301 - 500</td>
<td>Hazardous</td>
<td>Maroon</td>
</tr>
</tbody>
</table>

### Colors:
- **Green**
  - It's a great day to be active outside.
- **Yellow**
  - It's a good day to be active outside. Take it easier if you are unusually sensitive to air pollution.
- **Orange**
  - Older adults, children and teens, people with certain health conditions, and people who are active outdoors should take it easier.
- **Red**
  - Everyone should take it easier.
- **Purple**
  - Sensitive groups, avoid outdoor exertion. Everyone else, avoid long or intense outdoor exertion.
Check the Air Quality Forecast

Get Your Air Quality By:
- Email
- Widget
- Apps

- Subscribe to **ENVIROFLASH**: The air quality forecast will be sent to your email.
  - Free and easy to subscribe
  - [www.airnow.gov/enviroflash](http://www.airnow.gov/enviroflash)

- Download the free AirNow APP available at [www.airnow.gov](http://www.airnow.gov)

- You can install a **WIDGET** to show local air quality on your website.

- **EPA SmokeReady App** (undergoing beta testing!)
Key Resources

- AirNow
- Air Quality Flag Program
- Current Conditions
- Health Providers Page
- Wildfire Smoke and Health
- Wildfire Smoke: Guide for Public Health Officials
- Wildfire Trends
- California Air Resources Board Resources
- CDC Wildfire Factsheets
- PEHSU Wildfire Fact Sheet
- Wildland Fire Air Quality Response Program
Thank you!