The Dirt on Diesels

A serious danger to Oregon's health

A report by the
Oregon Environmental Council

OREGON ENVIRONMENTAL COUNCIL

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Executive Summary

Diesel trucks and buses move goods, services and people, while diesel engines in tractors, bulldozers and forklifts power the construction trades, agriculture and other industries. Diesel engines are popular because they are more powerful, durable and efficient than gasoline engines. Yet they also have a dark side: diesel engine emissions pose serious dangers to human health.

Emissions from diesel-fueled engines are composed of thousands of substances including more than 40 air toxics that are known or suspected carcinogens. Increasing evidence links exposures to these substances with lung cancer, upper respiratory illness, allergies, asthma attacks, and death from heart and respiratory disorders. In fact, recent EPA data indicate that diesel exhaust is likely the main air pollutant contributing to cancer risk in Oregon. Diesel is not just an urban problem — people in every county in Oregon are exposed to ambient concentrations of diesel particulates above safe levels.[1] People with existing heart and lung disease, asthma or other respiratory problems suffer the most.

Diesel trucks pollute when they are traveling down the road and when they idle. For example, the average heavy-duty diesel long distance truck idles on roadsides or at truck stops, emitting tens of pounds of dangerous toxics into the air. Exposures are often greatest for passengers inside diesel vehicles such as school buses, and in the vehicles traveling directly behind.

Few rules and regulations protect Oregonians from diesel pollution. Current federal emission limits for diesel engines are not sufficiently protective. And with more and more diesel engines in use today, they emit more pollution now than in 1970. Oregon never enforces its own standards for highway diesel emissions. In fact, once a heavy-duty diesel vehicle is on the road, its emissions are never tested. This is in contrast to numerous other states, which have successful heavy-duty diesel testing programs, including California, Nevada, Utah, Colorado and Washington. As for diesel-powered engines used in off-road vehicles, such as construction and farm equipment, they are dirtier and the need for improvements is consequently greater.

Eventually, new emissions standards and new technology will help ensure that engines of the future are cleaner. But older diesel engines will remain on the road for many years to come, and we must take steps to reduce their health impact.

The good news is that Oregon can take a few simple steps to reduce diesel engine emissions and exposures.

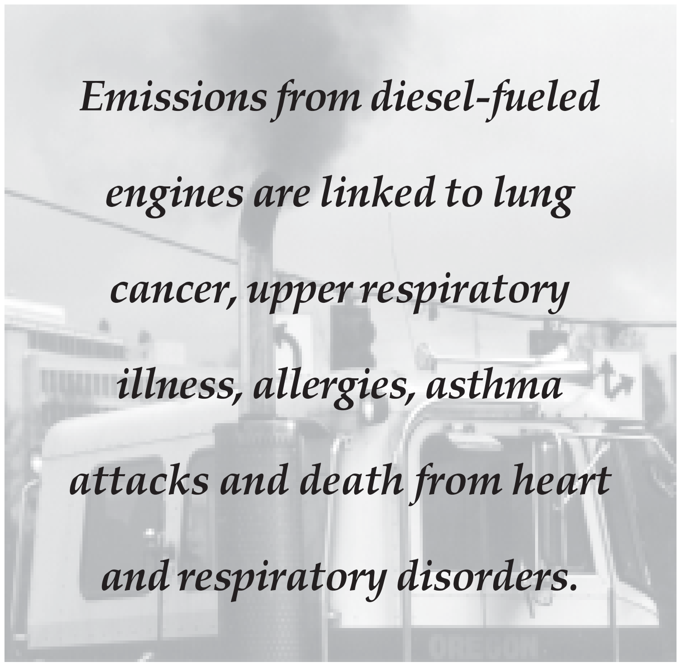
Specifically, Oregon should:

1. Secure ultra-low sulfur diesel for Oregon

Ultra-low sulfur diesel fuel contains no more than 15 parts per million (ppm) of sulfur compared to the current highway fuel with 500 ppm or off-road fuel with up to 5000 ppm. Studies show that the use of this cleaner fuel can reduce emissions of particulate matter by 20-25%. In addition, ultra-low sulfur diesel fuel makes pollution control devices like emissions traps work better. Local fleets should commit to purchasing ultra-low sulfur diesel fuel so that sufficient demand exists to bring it to Oregon.

2. Encourage use of alternative fuel engines

Other fuels are significantly cleaner than diesel. These include compressed natural gas, liquefied natural gas, bio-diesel and alcohol-based fuels. Other options include hybrid diesel-electric engines, fuel cells, and other low or zero emissions technologies. These alternatives exist on the market today, and Oregon should create an economic incentive to encourage their use.



3. Retrofit trucks and buses with pollution control devices

Existing vehicles can be cleaned up now without having to wait for newer, cleaner vehicles. Pollution control devices can reduce emissions by up to 95%. Retrofitting trucks and buses with these devices costs about $6,000 per vehicle. For commercial vehicles, Oregon provides a tax credit to help cover this cost.

Diesel school buses should be the top priority for these retrofits. Retrofitting buses built from 1993–2000 should be the highest priority, with older buses phased out and replaced. To fund school bus retrofits and the replacement of older buses, Oregon should institute a small annual operations fee on diesel-fuel pumps. The fee should sunset once all eligible school buses are retrofit or retired.

4. Ensure that the current diesel fleet meets emission standards on the road

Oregon should establish a diesel-testing program to promote a reasonable level of maintenance. Identifying and cleaning up excess emissions will yield significant pollution reductions. The state could fund this program through fines on excess emitters.

5. Reduce unnecessary idling

Oregon should pass legislation limiting unnecessary idling to five minutes (with certain exceptions). This would reduce exposures to diesel exhaust and lower driver costs, including fuel consumption and engine wear and tear. Numerous other states and jurisdictions have already adoped laws and ordinances to reduce uncessary idling.

6. Establish a contract preference for low-emission fleets and construction equipment

Contractors who use engines that pollute less should qualify for preferences in receiving state government contracts. This will create an incentive for contractors to choose low-emission engines.

7. Encourage the federal government to step up and regulate off-road diesel engines

Given the limited authority that states and localities have to regulate off-road, heavy-duty diesel engines and diesel fuel, new federal standards equivalent to the new rules for on-road engines and fuel are necessary. The Oregon Legislature should let the federal overnment know that Oregonians want strong federal rules.

Diesel Background

Diesel engines are more powerful and efficient than many other types of engines. According to the US Department of Energy (DOE) Office of Transportation Technologies, the fuel efficiency of diesel is 45%, versus 30% for gasoline. With future improvements, diesel's efficiency could climb to 55-63%.

Unfortunately, diesel is a dirty fuel. It is heavier and oilier than gasoline. Diesel exhaust is a complex mixture of carbon, ash, and sulfate particles, and hydrocarbons (see chart below). In addition, the engine produces nitrous oxide (NOx), a precursor of smog. One heavy-duty diesel truck can produce as much air pollution as 150 passenger cars.[2]

Diesel engines are used "on-road" in trucks and buses, and "off-road" in construction, industrial and agricultural equipment.

Sources of Diesel Exhaust in Oregon

In 1996, diesels emitted more than 7,700 tons of diesel particulate matter into Oregon's air, according to the EPA's National Air Toxics Assessment. On-road sources contributed 2,450 tons in 1996, and off-road sources 5,260 tons[4]. DEQ's emissions inventory confirmed these numbers though showing slightly fewer emissions for that year, with on-road sources contributing 2,094 tons and off-road 4,714 tons.

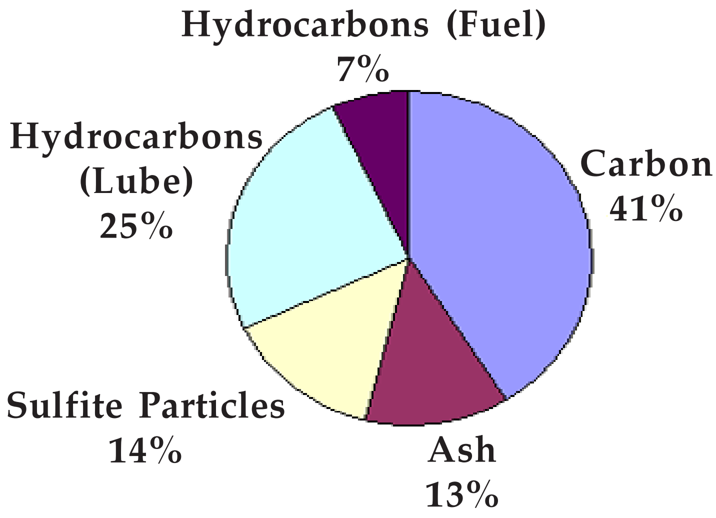
Diesel fuel usage is increasing at a faster raster rate than gasoline. Diesel fuel sales in Oregon have steadily increased, going from 378 million gallons in 1985 to 462 million gallons in 1990 to 504 million gallons in 1999.[5]

On-road sources of diesel exhaust:

On-road sources of diesel exhaust include light, mid- and heavy-duty trucks and buses. Total diesel truck and bus emissions have been getting worse, not better. With an increased reliance on diesel trucks, heavy-duty diesel vehicles emitted 11% more toxic particulates and 37% more smog-forming nitrogen oxides in 1998 than they did in 1970. In contrast, particulate matter from automobile emissions decreased by 75% while NOx emissions decreased 32% over the same period.[6] In addition, the high sulfur content of diesel fuel used in heavy-duty diesel engines leads to even greater particulate pollution.[7]

Overall, we do not know how dirty Oregon's fleet is and have no process to test it once it's on the road.

Chart 1: Composition of Diesel Particulate Matter[3]



Trucks

In Oregon, heavy-duty diesel engines used in large trucks and buses contribute disproportionately to particulate pollution. For example, although heavy-duty diesel trucks and buses comprise only 6% of the total number of

Table 1: DEQ 1996 Emissions inventory data for on-road diesel sources

Type of engine	Tons of particulate matter emitted per year	Percent of total on-road contribution
Light Duty Diesel Vehicles	34.48	1.6%
Light Duty Diesel Trucks	21.75	1.0%
Heavy Duty Diesel Vehicles Class 2B (8500-10000 lbs – parcel delivery, super pickups)	99.26	4.7%
Heavy Duty Diesel Vehicles Class 3,4, &5 (10,001-19,500 lbs – smaller freight trucks, parcel)	53.97	2.6%
Heavy Duty Diesel Vehicles Class 6&7 (19,501-33,000 – large delivery trucks)	284.95	13.6%
Heavy Duty Diesel Vehicles Class 8A&8B (33,001-60,001+ Long haul tractor trailers)	1,481.02	70.6%
Heavy Duty Diesel Buses (School & Transit)	122.07	5.8%
Total On-Road Particulate matter	**2,097.50**	

vehicles on the road, they account for about 70% of the particulate matter from all on-road vehicles (see Table 1). Unlike cars, light trucks and SUVs in metropolitan areas of Oregon, the DEQ never tests heavy-duty trucks for excessive pollution.

Most trucks emit more pollution than allowed by law. In 1998, the U.S. Justice Department caught seven major heavy-duty diesel engine manufacturers rigging their trucks to pass the federal government's pre-sale emissions test. The same vehicles polluted much more once they were actually on the highway. Yet the government ordered no recall of these trucks, allowing them to remain on the road.[9] This highlights the need for some in-use compliance program to ensure that trucks are as clean in use as when they passed the pre-sale emissions test.

According to 1998 registrations, some 355,000 trucks are licensed to operate in Oregon.[10] Approximately 15% are Oregon-licensed, 10% are partially commercial vehicles based in Oregon but operate in interstate commerce, and 75% are based in another state but sometimes operate in Oregon. In 1998, about 75% of the Oregon-licensed fleet was between 1 and 10 years old.

Idling of trucks adds to diesel particulate pollution. Trucks and buses idle their engines to power their heating and cooling systems. For long haul truckers (Class 8A & 8B), idling also powers entertainment systems and other appliances. In addition, past practices such as the need to warm up an engine, which is no longer true, add to the problem. Unfortunately, in just one year, the average idling truck can emit 496 pounds of volatile organic chemicals (VOCs); 1,087 pounds of Carbon Monoxide (CO); 13 pounds of particulate matter; 55,858 pounds of Carbon Dioxide; and 1,290 pounds of nitrogen oxides (NOx).[11]

A typical truck burns approximately one gallon of diesel fuel each hour it idles. If a truck idles for six hours per day and operates 300 days per year, it consumes 1,800 gallons of fuel per year.[12] If diesel costs $1.40 a gallon in Oregon, this cost exceeds $2,500. In addition, running an engine at low speed (idling) causes twice the wear on internal parts compared to driving at regular speeds. According to the American Trucking Association, such wear can increase maintenance costs by almost $2,000 per year and shorten the life of the engine.

Buses

Public transit buses receive some federal grant monies and are required to meet more stringent federal standards than other heavy-duty on-road vehicles. As a result, public buses are a relatively small piece of the diesel problem. Transit fleets are trying to get ahead of the problem. For example, TriMet recently purchased two hybrid diesel electric buses that have lower emissions, and the City of Salem is transitioning to compressed natural gas bus fleet.

However, school buses do not have to meet these more stringent federal standards. Many are aging diesels built to outdated safety and health standards. A recent Yale study cites the particular risk to children from regular exposure to exhaust from these buses.[13] The study found exposures to be at levels far above those predicted by current government monitoring efforts. Several other studies have also documented greater exposures to children on school buses.[14]

Older school buses expose children to even greater levels of pollution, whether waiting at the bus stop or riding on board. Buses built before 1990 and 1991 are allowed by federal standards to emit at least six times more toxic soot and nearly three times more smog forming chemicals than today's models. As of 2001, approximately 24% of Oregon's school buses were built before 1990.

Oregon's school bus fleet totals about 6,046 vehicles. Of these, approximately 5,000 (or 80%) are diesel.[15] These buses transport over 240,000 students to school daily. Oregon children spend approximately 30 million hours riding them each year.[16]

School buses provide access to schools and cut down on congestion. They are still the overall safest way to transport kids to school but they can be readily made to run cleaner. Children should continue to ride the bus, but parents should demand that school buses get cleaned up.

Off-road sources of diesel exhaust

Off-road diesel engines are found in construction, industrial, and agricultural equipment.

According to DEQ's emissions inventory for 1996, construction equipment produces almost half of the off-road diesel particulate matter in

Table 2: DEQ 1996 Emissions inventory data for off-road diesel sources[8]

Type of engine	Tons per year of particulate matter emitted	Percent of total off-road contribution
Construction Equipment	2,158	45.7%
Logging Equipment (excluding trucks)	586	12.4%
Farm Equipment	525	11.1%
Railroad, Line-Haul Locomotives	458	9.7%
Industrial Equipment	407	8.6%
Light Commercial	201	4.3%
Lawn & Garden Equipment	189	4.0%
Marine Vessels	95	2.0%
Railroad, Yard Locomotives	57	1.2%
Recreational Vehicles	15	0.3%
Recreational, Pleasure Craft	12	0.3%
Airport Service Equipment	10	0.2%
Total tons emitted per year	**4,713**	

Oregon (See Table 2). Other large sources include logging and farm equipment, and industrial engines. Off-road diesel fuel has significantly higher sulfur content than on-road, leading to an even larger problem with emissions from these types of engines.

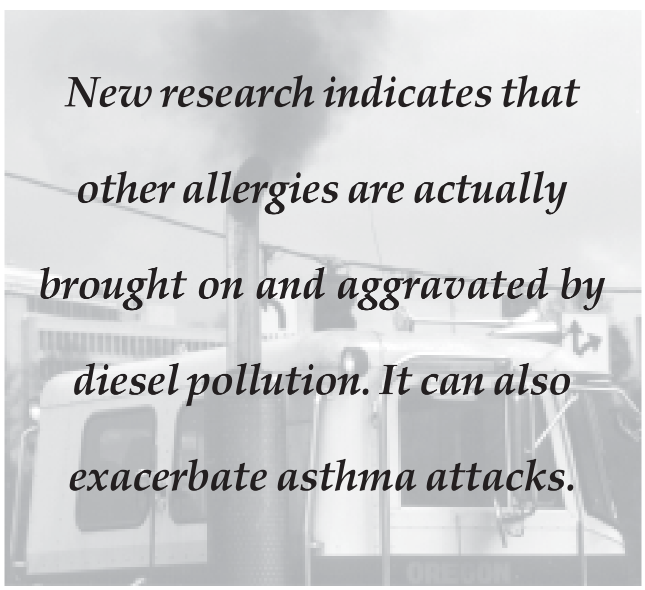
Off-road diesel engine emissions are increasing nationally. For example, 1999 emissions were estimated at 253,000 short tons[17] of particulate matter, a 60% increase from 154,000 short tons in 1970.[18]

Health Effects of Exposure to Diesel Emissions

What's in diesel emissions?

Emissions from diesel-fueled engines are composed of thousands of substances including more than 40 air toxics that are known or suspected carcinogens.[19] These toxics adhere to soot and other particles in diesel exhaust and are breathed deeply into the lungs, leading to a variety of ailments. Health problems linked to diesel exhaust include asthma, upper respiratory illness, cancer, and heart and lung disease.

On-road emissions are particularly dangerous for those who share the road. California scientists discovered that the air inside cars is even dirtier than the air outside because of exhaust from nearby vehicles. When cars follow diesel trucks or buses, the levels of soot inside are six to eight times higher than the ambient air outside the car.[20]



Who's at risk?

Children are at greater risk because they are generally more active outdoors, their lungs are still developing, and they consume more air than adults per pound of body weight. The elderly and people with heart or lung diseases are also more sensitive to particulate air pollution.

People who live in communities that are disproportionately impacted by a variety of environmental hazards are also at greater risk. Often low-income and communities of color receive more pollution and environmental hazards than other communities because they don't have the political power to turn pollution away.

Asthma and respiratory diseases

Asthma is a chronic disease that constricts and inflames the airways, resulting in reduced airflow to the small sacs deep within the lungs where oxygen is transferred to the blood stream and carbon dioxide is removed. Asthma is like breathing through a straw. In an asthma attack, breathing passages tighten, making it difficult to breathe.

Numerous studies show that diesel particulate matter can initiate an asthma attack. For example, children admitted to hospitals with an asthma diagnosis are significantly more likely to live in an area with high truck traffic.[21] New research indicates that other allergies are actually brought on and aggravated by diesel pollution. It can also exacerbate asthma attacks.[22] In other words, diesel pollution can turn a minor asthma attack or allergic response into major problem.

National estimates from the EPA indicate that if new on-road heavy-duty diesel standards are not implemented, continuing high levels of diesel exhaust will cause annually:

- ♦ 8,300 premature deaths
- ♦ 5,500 cases of chronic bronchitis
- ♦ 17,600 cases of acute bronchitis in children
- ♦ Over 360,000 asthma attacks
- ♦ More than 386,000 cases of respiratory symptoms in asthmatic children annually
- ♦ 1.5 million lost work days
- ♦ 7,100 hospital admissions; and
- ♦ 2,400 emergency room visits for asthma every year.[27]

Cancer

The Environmental Protection Agency (EPA) has found that exposure to diesel exhaust, even at low levels, is likely to increase the risk of lung cancer, even though the EPA has yet to specifically quantify that risk.[29] However, in its 2000 rules for heavy-duty diesel highway engines, the EPA concludes that the average lifetime cancer risk might fall into the one in one thousand range, far greater than the one in a million standard that is considered protective of human health.

Drivers face a particularly high risk. For example, a study of truckers with 35 years on the job found that they were 89% more likely than the general public to contract lung cancer.[30] According to the California Air Resources Board, over 30 epidemiological studies found that people who are routinely exposed to diesel exhaust through their work on railroads, docks, trucks or buses have a greater risk of lung cancer.

Costs associated with asthma include hospital bills, medications, doctor fees, missed days of school for children, missed days of work for parents, and diminished academic performance due to school absence. Asthma-related illness is a leading cause for school absenteeism in the US, according to the Children's Environmental Health Network.[23]

The Centers for Disease Control reports that children with asthma incur 88% higher health care costs per year on average than asthma-free children ($1,060 vs. $563). In addition, asthmatic children required 2.7 times as many prescription drugs as asthma-free children. They also experienced twice as many inpatient care days, and 65% more non-urgent medical care visits.[24]

Asthma is prevalent among children in Oregon: of the more than 282,000 Oregonians who have asthma, 63,000 are children.[25] Based on 1994 estimates, asthma accounted for over $125 million in direct and indirect medical costs in Oregon.[26]

A 2002 study estimated that the failure to regulate off-road diesels in Oregon annually leads to:

- ♦ 111 premature deaths in adults 30 and over
- ♦ 74 cases of bronchitis (adults over 26)
- ♦ 63 hospital admissions for pneumonia and chronic pulmonary disease (adults 64 and over)
- ♦ 12 hospital admissions for asthma (adults 65 and over)
- ♦ 2,335 asthma attacks (asthmatics, all ages)
- ♦ 235 cases of acute bronchitis (children 8-12)
- ♦ 2,581 cases of lower respiratory symptoms (children 7-14)
- ♦ 2,588 upper respiratory cases (asthmatic children 9-11)
- ♦ 20,569 work loss days (adults 18-65), and
- ♦ 106,906 minor restricted activity days.

Estimated monetary benefit for avoiding these cases was $879 million.[28]

Table 3: County by county listing of added cancer risk (per million) from exposure to diesel particulate matter over a lifetime of exposure.

Rank	County	Added cancer risk from exposure to diesel (per 1,000,000)
1.	MULTNOMAH	830
2.	WASHINGTON	530
3.	CLACKAMAS	460
4.	MARION	330
5.	YAMHILL	320
6.	COLUMBIA	290
7.	POLK	250
8.	WASCO	250
9.	BENTON	230
10.	LINN	220
11.	HOOD RIVER	220
12	UMATILLA	180
13.	CLATSOP	160
14.	LANE	160
15.	JACKSON	150
16.	TILLAMOOK	140
17.	DESCHUTES	120
18.	JOSEPHINE	110
19.	KLAMATH	110
20.	LINCOLN	110
21.	MORROW	110
22.	JEFFERSON	98
23.	COOS	97
24.	UNION	95
25.	DOUGLAS	95
26.	SHERMAN	89
27.	GILLIAM	88
28.	MALHEUR	86
29.	CROOK	77
30.	BAKER	62
31.	WHEELER	46
32.	WALLOWA	38
33.	CURRY	37
34.	GRANT	30
35.	LAKE	18
36.	HARNEY	17

A 2000 report by the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) estimates that without new federal rules more than 1,105 people in the Portland metropolitan area will get cancer from diesel emissions over a lifetime of exposure.[31]

Information from the Environmental Protection Agency's 1996 National Air Toxics Assessment (NATA) data for Oregon indicates that the entire state has ambient concentrations of diesel particulate matter above human health benchmarks.[32] A benchmark is a concentration of a pollutant expected to harm human health and is based on a cancer risk above a one in a million over a lifetime exposure. This is the most recent data on ambient air concentrations available at a statewide level.

Using the state of California's benchmark, the NATA data predicts that an average of 380 per million people will get cancer over a lifetime of exposure to diesel in Oregon (the state of Oregon does not have a benchmark). Exposure to diesel exhaust is widespread in Oregon, but is particularly severe in urban areas.

Multnomah and Washington Counties are in the worst 5% nationally for exposure to diesel emissions. The risk varies widely by geography as demonstrated by the Table 3 at the top of this page and Map 1 on the next page.[33]

The levels shown are modeled ambient concentrations at the county level. Actual measured concentrations have been found to be higher. In addition, the risk is significantly higher when direct exposures occur.

Heart & lung disease

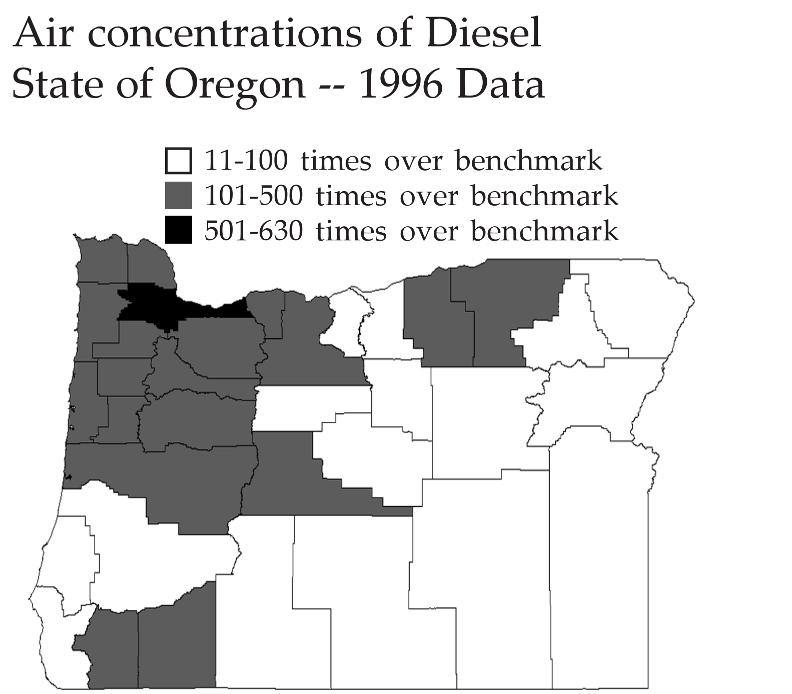
Diesel particulates can contribute to premature death from heart and lung disease. Epidemiologists in about 70 cities around the world have consistently found that more people are hospitalized or die when particulate pollution rises even a moderate amount. A recent report found that fine particulates, such as those produced by diesel engines, are linked to a variety of cardiovascular and reproductive problems, as well as diabetes.[34] [35]

A 1996 Natural Resources Defense Council report estimates that about 300 Portland residents, 100 Eugene/Springfield residents, and 100 Medford residents die prematurely from breathing particulate pollution every year.[36] A 2002 groundbreaking study in the Journal of the American Medical Association concluded that air pollution (of which diesel is a significant contributor) is as potent as second-hand cigarette smoke in its ability to cause heart disease and lung cancer.[37]

Environmental damage from diesel

Diesel exhaust is a substantial source of oxides of nitrogen or NOx, particulate matter and sulfites. NOx is a main ingredient in smog formation and contributes to acid rain and haze. Particulate matter from diesel contributes to visibility impairment. Particulates are known to impair visibility up to 70%. In Western cities, this has reduced visibility to 33-90 miles, compared to natural visibility of 140 miles.[38] In addition, sulfites from diesel exhaust also contribute to acid rain.

Map 1: Ambient air concentrations of diesel.



Exposure to diesel exhaust is widespread in Oregon. These estimates are based on National Air Toxics Assessment data for 1996 and utilize the California benchmark for cancer (Oregon does not have a benchmark). The benchmark is based on a lifetime of exposure. Source: EPA National Air Toxics Assessment Data (www.scorecard.org) utilizing California cancer benchmark. 11/7/2002.

Existing regulations do not protect Oregonians from diesel exhaust

Federal regulations

Under the Clean Air Act, the federal government has the authority to regulate air pollution. It retains the right to regulate fuels and engine specifications. All new diesel fuel and on and off-road motor engines and vehicles in Oregon are required to meet federal emission certification requirements.

Beginning in 2006, the EPA will require ultra-low sulfur fuels for all on-road diesel engines, and new on-road diesel engines will be required to meet lower emission levels beginning in 2007.[39] These lower emissions standards will apply to new engines.[40] However, because diesel engines last over a million miles and are rebuilt multiple times, it will take approximately 30-40 years to realize the full benefits of the new EPA rules. The EPA estimates that not until 2020 will on-road diesel vehicles that meet the new 2007 model standards travel 90% of vehicle miles.[41]

Currently, engines are certified after manufacture and tested prior to installation in vehicles. This emission certification is a federal standard. Once installed, no in-use testing is required. In-use testing can consist of an opacity test of emissions that can be easily done on a roadside or shop environment. An opacity test measures the darkness of the smoke being emitted from a vehicle's exhaust pipe. With the truck in neutral, the opacity of exhaust can be measured with a smoke meter (100% opacity means no light passes through).

Other states, such as California, have discovered that the value of in-use testing is to enforce a reasonable level of maintenance so that vehicles can continue to perform to the levels they were designed for, rather than deteriorating in-use.

EPA guidance suggests that diesel trucks meet a 40% opacity standard (1991 models and newer) or a 55% opacity standard (pre-1991). A well-maintained diesel engine can easily met these standards. An opacity standard is in effect in some counties in Oregon but it is ill-defined and consequently never enforced. The standard was passed in the 1960s and only applies to certain counties west of the Cascades.

The federal particulate standard can also apply to diesel exhaust. Under the Clean Air Act, all states must meet federal standards for fine particulate matter adopted in 1997 (known as the $PM_{2.5}$ standard, the 2.5 refers to the particulate's diameter in microns). In Oregon several communities may have difficulty meeting the new fine particulate matter standard. The Oregon DEQ is currently monitoring pollution levels for compliance.

Off-road equipment is required to meet emissions standards based on their horsepower rating. Some standards for off-road diesel engines and equipment were passed in 1998 in a phased-in emissions reduction rule package.[42] However, there is a delay, similar to that found in on-road reduction attempts, in achieving similar off-road diesel reductions. In addition, while the EPA wants to reduce the sulfur content in off-road fuels, they have yet to determine the level. EPAis expected to propose new rules for this class of engines in 2003. The new rules are expected to require production of ultra-low sulfur diesel fuel (15 ppm down from 3,000ppm currently) for these engines in 2008 and emissions reductions from new engines starting in 2009.

State and federal voluntary actions

Several state and federal agencies have taken actions to reduce diesel exhaust. For example:

- The Oregon Department of Environmental Quality promotes the voluntary retrofit of diesel engines. Users of heavy-duty diesel engines who retrofit with emission controls can qualify for a credit against business taxes of up to 35% of the retrofit costs.

- The Environmental Protection Agency sponsors a national voluntary retrofit program, educational materials and modest technical and financial assistance. They are also promoting an "adopt a bus" program designed to have local businesses help support the cost of school bus retrofits.

- The Oregon Department of Education strongly recommends that school districts adopt guidelines to reduce student exposures to diesel exhaust.[43]

- In September 2002, the EPA's Region 10 administrator urged all Oregon school districts to reduce school bus idling.

Lack of Oregon regulations

Despite existing voluntary actions, Oregonians are being exposed to unacceptable amounts of diesel emissions. In general there is little incentive to clean up diesel without government direction. The state does not regulate diesel or any air toxic beyond federal standards, and the federal standards clearly are not protective. Most of the off-road diesel sources that contribute to the problem have relatively lax standards. In addition, Oregon does not even enforce the statute that does exist. While Oregon cannot regulate the engines themselves or set fuel standards because of federal preemption, it can create incentives for drivers and fleets to use cleaner engines, buy cleaner fuel, and reduce the amount of time engines are idled or used unnecessarily. Oregon can also provide financial assistance for pollution control.

Recommendations

1. Secure ultra-low sulfur diesel for Oregon

Ultra-low sulfur diesel fuel contains no more than 15 parts per million of sulfur. Studies show that the use of this fuel can reduce emissions of particulate matter by 20-25%. In addition, ultra-low diesel fuel enables pollution control devices like emissions traps to work better. A combination of a particulate trap and ultra-low sulfur diesel can result in up to a 90% reduction in emissions of particulate matter. This fuel is refined in the Seattle area. If there is enough of a demand for this fuel (which costs about two cents per gallon more than conventional diesel fuel), it could be made available in Oregon. However, we need a demand of 10 million gallons to make it a viable transaction. Local fleets should commit to purchasing ultra-low sulfur diesel fuel so that sufficient demand exists to bring it to Oregon.

The Oregon Department of Environmental Quality should investigate the feasibility of offering ultra-low sulfur diesel fuel for off-road sources.

2. Encourage use of alternative fuel vehicles

Other fuels are significantly cleaner than diesel. These include compressed natural gas, liquefied natural gas, bio-diesel and alcohol-based fuels. Other options include hybrid diesel-electric engines, fuel cells, and other low or zero emissions technologies. These alternatives exist on the market today, and Oregon should create an economic incentive to encourage their use.

An immediate option is bio-diesel, produced from fat or oil, which can be blended in varying amounts with regular diesel and used in existing diesel engines with little or no engine modification. A 20% bio-diesel blend (B20) costs about $.20 to $.25 more per gallon than conventional diesel, and pure bio-diesel (B100) costs about $1 more per gallon. Bio-diesel is available in Oregon. Encouraging bio-diesel in Oregon has the added benefit of promoting economic development that supports local farmers who grow oil based crops. Another option is Compressed Natural Gas (CNG), which yields significantly fewer emissions.

3. Retrofit trucks and buses with particulate traps

Pollution control devices can reduce emissions by up to 95%. Retrofitting trucks and buses with these devices costs about $6,000 per vehicle. For commercial vehicles, Oregon provides a tax credit to help cover this cost.

Diesel school buses should be the top priority for these retrofits. Retrofitting buses built from 1993–2002 should be the highest priority, with older buses phased out and replaced. To fund school bus retrofits and replacement of older buses, Oregon should institute a small annual operations fee on diesel fuel pumps. The fee should sunset once all eligible school buses are retrofit or retired.

4. Ensure that the current on-road diesel fleet meets emission standards

Oregon should establish a diesel-testing program to enforce emissions standards that are more protective. Identifying and cleaning up excess emissions will yield significant pollution reductions. Numerous other states have heavy-duty diesel testing programs, including California, Nevada, Utah, Colorado and Washington. California has had tremendous success with its heavy-duty diesel-testing program.[44]

The cost to establish a mobile diesel-testing program is approximately $700,000 per biennium. This would cover two roving vans and hiring off-duty state police who have the authority to stop vehicles. The state could fund this program through fines on excess emitters.

An Oregon program should ensure that a large number of vehicles are checked, required repairs are actually made, and the public can report smoking vehicles.

5. Reduce unnecessary idling

Reducing unnecessary idling will reduce pollution and cut the cost of running diesel bus and truck fleets, while strengthening the financial viability of businesses. Reducing idling from even one truck will prevent hundreds of pounds of pollutants from going into the air annually.

Numerous states and cities have idling regulations.[45] Oregon should likewise pass an anti-idling law. Numerous viable alternatives to idling exist and can pay off the initial costs in very short time. For example, thermal storage utilizing battery power can provide heat and cooling for a vehicle anywhere. If a vehicle operates 1,000 hours a year, thermal storage will pay for itself in under 2 years.[46]

In some states, anti-idling efforts and statutes have specifically targeted school buses. For example, Minnesota just launched a Cleaner School Bus outreach campaign. The campaign includes such tools as "no idling" and "clean air zone" signs, and model notices to bus drivers and parents. These tools help implement a new Minnesota law adopted in 2002 to reduce children's exposure to diesel pollution by requiring bus operators to minimize school bus idling.

Some progress can be achieved through education too. A school bus idling education campaign should be launched asking school bus drivers to be part of the solution and pledge not to idle their vehicles.

6. Establish a contract preference for low-emission fleets and construction equipment

Contractors who use engines that pollute less should qualify for preferences in receiving state government contracts. DEQ should define the technical emissions level that must be met.

7. Encourage the federal government to step up and regulate off-road diesel engines

Given the limited authority for states and localities to regulate off-road heavy-duty diesel engines and diesel fuel, new federal standards equivalent to the new rules for on-road engines and fuel are necessary. The state should let the federal government know that these standards are important to Oregonians.

Diesel exhaust represents a real threat to the health of Oregonians. We have ample opportunity to reduce exposures to diesel emissions utilizing means that are effective, affordable and doable.

Endnotes:

1 EPA.1996 National Air Toxics Assessment data. www.epa.gov/ttn.atw.nata/natsal.html.
2 Northeast States for Coordinated Air Use Management. www.nescaum.org/
3 Monahan, Patricia. *Pollution Report Card: Grading America's School Bus Fleets*. Union of Concerned Scientists, February 2002. Represents diesel exhaust from a heavy-duty diesel vehicle manufactured after 1994, using the federal test procedure transient cycle.
4 EPA.1996 National Air Toxics Assessment data. www.epa.gov/ttn/atw/nata/xls/or_emis.xls.
5 Phil Carver, Oregon Office of Energy. Personal communication.
6 EPA. National Air Quality Trends 1999.
7 The current standard for diesel fuel sulfur levels is 500 parts per million (ppm).
8 Oregon DEQ 1996 Emissions Inventory database.
9 EPA factsheet. Diesel emissions 1998.
10 Trucks weighing 8,500 pounds and over. ODOT data.
11 Idleaire website www.idelaire.com.
12 EPA. *Study of Exhaust Emissions from Idling Heavy-duty Diesel Trucks and Commercially Available Idle-Reducing Devices*. EPA-420-R-02-025, October 2002. Exact numbers, hours and days are impossible to know; this number is meant to demonstrate the problem.
13 Wargo, John Ph.D. et. al., *Children's Exposure to Diesel Exhaust on School Buses*, Environment & Human Health Inc. Yale University, February 2002.
14 Solomon, Gina MD, MPH et. al., *No Breathing in the Aisles: Diesel Exhaust Inside School Buses*, Natural Resources Defense Council, January 2001.
15 Monahan, Patricia. *Pollution Report Card: Grading America's School Bus Fleets*. Union of Concerned Scientists, February 2002. Appendix B.
16 Derived from Wargo report estimates of national data (nearly 600,000 school buses transport 24 million students to school daily and, collectively, U.S. children

spend 3 billion hours on school buses each year).
[17] A short ton equals 2,000 pounds.
[18] STAPPA/ALAPCO. *The Dangers of the Dirtiest Diesels: The Health and Welfare Impacts of Off-road Heavy-Duty Diesel Engines and Fuels*. June 2002.
[19] EPA. *Health Assessment Document for Diesel Engine Exhaust*, National Center for Environmental Assessment, May 2002.
[20] Report to the California Environmental Protection Agency Air Resources Board and South Coast Air Quality Management District. *Measuring Concentrations of Selected Air Pollutants Inside California Vehicles*. December 1998.
[21] Edwards, Walters, et. al., *The Association between self-reported asthma and allergic-rhinitis and self-reported traffic density on street of residence in adolescents*. Epidemiology: 7:578-582, 1994.
[22] Presentation to 58th Annual Meeting of the American Academy of Allergy, Asthma & Immunology. *Diesel Exhaust: The exhaust emitted by trucks with diesel engines appears to worsen asthma symptoms in children, as shown in a study conducted in Pasadena, California*. www.chronic-disease.net/cdis-digest/Mar-2002.html.
[23] Children's Environmental Health Network. *The State of Children's Health and the Environment 2002*, Part 2.
[24] Lozano P. et. al. *Health care utilization and cost among children with asthma who were enrolled in a health maintenance organization*. American Academy of Pediatrics 1997 June; 99:757-764.
[25] Oregon Asthma Network.
[26] Ibid.
[27] EPA Press release. *EPA Dramatically reduced pollution from heavy-duty trucks and buses; cuts sulfur levels in diesel fuel*. Dec 21, 2000.
[28] STAPPA/ALAPCO. *The Dangers of the Dirtiest Diesels: The Health and Welfare Impacts of Off-road Heavy-Duty Diesel Engines and Fuels*. June 2002.
[29] EPA
[30] Warren, Jane. *Health Effects of Diesel Exhaust: An HEI Perspective*. Health Effects Institute
[31] STAPPA/ALAPCO. *Cancer Risk from Diesel Particulate* 2000
[32] 1996 NATA data are based on models taking into account population, weather patterns, airshed size, and average amount of agricultural burns, forest fires and point sources. In actual on-site tests, EPA modeling proved to be accurate but somewhat conservative.
[33] The California Environmental Protection Agency (CalEPA) recommends using a cancer risk level for diesel particulate of 300 in a million per microgram per cubic meter (ug/m3) of diesel particulate (3.0 x 10 4 per ug/m3). This represents the risk of developing cancer over a 70-year lifetime. In deriving this figure, CalEPA considered evidence suggesting that diesel risks are from 150 in a million to 1,500 in a million per ug/m3. This 300 in a million represents a conservative estimate.
[34] Health Effects Institute Perspectives. *Understanding the Health Effects of Components of the Particulate Matter Mix: Progress and Next Steps.* April 2002.
[35] Robert D. Brook, MD. et. al., *Inhalation of Fine Particulate Air Pollution and Ozone Causes Acute Arterial Vasoconstriction in Healthy Adults.* American Heart Association, Circulation. 2002; 105:1534.
[36] Shprentz, Deborah. *Breath-Taking – Premature Mortality Due to Particulate Air Pollution in 239 American Cities.* Natural Resources Defense Council. May 1996
[37] C. Arden Pope III, Ph.D., *Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution.* Journal of the American Medical Association 2002; 287:1132-1141.
[38] EPA. Fact sheet: *Final Regional Haze Regulations for Protection of Visibility in National Parks and Wilderness Areas*. 6-2-99.
[39] The current standard for diesel fuel sulfur levels is 500 parts per million (ppm); the current average is 300-350 ppm. The new standard will require 15 ppm beginning June 1, 2006.
[40] The new standard for particulate matter emissions is .01 grams per brake-horsepower-hour (g/bhp-hr), to take full effect in the 2007 model year. The current standard is .1 g/ bhp-hr). The new standard for NOx is .2 g/ g/bhp-hr; the current standard is 4 g/bhp-hr.
[41] EPA 420-R-00-026 Appendix B: VMT Distribution.
[42] This set of rules does not apply to locomotives, large marine engines, underground mining equipment and engines with displacements under 50 cubic centimeters.
[43] Oregon Department of Education Executive Memorandum 66-2002-03.
[44] California Environmental Protection Agency Air Resources Board. Report to commission.
[45] Department of Energy. www.trucks.doe.gov/plain-talk/ idling-regs.html
[46] Argonne National Laboratory.