Diesel Work Group Follow-up to May 5, 2016 meeting

Non-road New Diesel Engine Federal Emission Certification Tiers
Highway Heavy Duty Diesel Engine Federal Emission Standards
Attachment A

Emission Inventory and Modeling

A description of the process DEQ uses to identify, calculate and model sources of emissions is under development and will be available at the next meeting.

EPA Pollutant Standards vs. Oregon Toxic Benchmarks

Attachment B

Under the Clean Air Act the EPA establishes standards for exposure to six "criteria" pollutants. A number of exceedance of those standards constitutes a violation that triggers requirements for planning and implementation of strategies to reduce concentrations below the standards and to show continued maintenance for at least ten years.

Under the Oregon Air Toxics program benchmarks are established for 52 air toxics identified as representing a protective level of exposure to reduce additional cancer risk to one-in-a-million over a lifetime of exposure or, for non-carcinogens, to result in no non-cancer health effects over a lifetime of exposure. After comparing modeling or monitoring data a determination that concentrations are higher than a benchmark, either at the geographic or source level, leads to a planning process to identify strategies to reduce concentrations below standards.

Risk from Diesel PM exposure outside the Portland area

Attachment C

EPA recently posted their latest analysis of concentration and exposure for the 2011 basis year of 180 air toxics, including diesel PM, across the country. The results from the diesel PM analysis for the state of Oregon are shown in the Table and graphically in the map.

Cost for retrofit

The cost to retrofit depends upon the size of the engine and the volume of exhaust flow, the level of emission reduction desired and, in the case of particle filters, whether an active or passive filter regeneration technology is deployed. Generally for a heavy duty truck engine, a passive diesel particle filter can cost approximately $16,000, an active system approximately $22,000. A diesel oxidation catalyst can cost approximately $5,000 but reduces particulate emissions by 20-25% as compared to the particulate filter that reduce PM by upwards of 90%.

Necessary vs. Unnecessary Idling

Certain circumstances may justify the idling of an engine otherwise used for propulsion or the intended work of the equipment. A summary of commonly identified circumstances under which idling is deemed necessary is outlined in Attachment D.

Impacts of congestion on air quality

Vehicle engines do not emit uniformly over their operational cycle. There are higher and lower emission levels depending upon, for instance, the speed of the vehicle. Characterizing this in a meaningful way has been demonstrated in some studies that we have been able to identify but we would prefer to research this area more thoroughly to provide a more comprehensive assessment of the state of research on this topic.

Attachment A

Nonroad Compression Ignition Engines: Exhaust Emission Standards

Rated Power kW (hp)	Tier	Model Year	NMHC + NOx (g/kW-hr)	NOx (g/kW-hr)	PM (g/kW-hr)
kW < 8 (hp<11)	1	2000-2004	10.5	-	1.0
	2	2005-2007	7.5	-	0.80
	4	2008+	7.5	-	0.40
8 ≤ kW < 19 (11≤hp<25)	1	2000-2004	9.5	-	0.80
	2	2005-2007	7.5	-	0.80
	4	2008+	7.5	-	0.40
19 ≤ kW < 37 (25≤hp<50)	1	1999-2003	9.5	-	0.80
	2	2004-2007	7.5	-	0.60
	4	2008-2012	7.5	-	0.30
		2013+	4.7	-	0.03
37 ≤ kW < 56 (50≤hp<75)	1	1998-2003	-	9.2	-
	2	2004-2007	7.5	-	0.40
	3	2008-2011	4.7	-	0.40
	4 (Option 1)[1]	2008-2012	4.7	-	0.30
	4 (Option 2)[1]	2012	4.7	-	0.03
	4	2013+	4.7	-	0.03
56 ≤ kW < 75 (75≤hp<100)	1	1998-2003	-	9.2	-
	2	2004-2007	7.5	-	0.40
	3	2008-2011	4.7	-	0.40
	4	2012-2013	4.7	-	0.02
		2014+	-	0.40	0.02
75 ≤ kW < 130 (100≤hp<175)	1	1997-2002	-	9.2	-
	2	2003-2006	6.6	-	0.30
	3	2007-2011	4.0	-	0.30
	4	2012-2013	4.0	-	0.02
		2014+	-	0.40	0.02

[1] A manufacturer may certify all their engines to either Option 1 or Option 2 sets of standards starting in the indicated model year. Manufacturers selecting Option 2 must meet Tier 3 standards in the 2008-2011 model years.

Attachment A

Rated Power kW (hp)	Tier	Model Year	NMHC + NOx (g/kW-hr)	NOx (g/kW-hr)	PM (g/kW-hr)
130 ≤ kW < 225 (175≤hp<300)	1	1996-2002	-	9.2	0.54
	2	2003-2005	6.6	-	0.20
	3	2006-2010	4.0	-	0.20
	4	2011-2013	4.0	-	0.02
		2014+[i]	-	0.40	0.02
225 ≤ kW < 450 (300≤hp<600)	1	1996-2000	-	9.2	0.54
	2	2001-2005	6.4	-	0.20
	3	2006-2010	4.0	-	0.20
	4	2011-2013	4.0	-	0.02
		2014+	-	0.40	0.02
450 ≤ kW < 560 (600≤hp<750)	1	1996-2001	-	9.2	0.54
	2	2002-2005	6.4	-	0.20
	3	2006-2010	4.0	-	0.20
	4	2011-2013	4.0	-	0.02
		2014+	-	0.40	0.02
kW ≥ 560 (hp≥750)	1	2000-2005	-	9.2	0.54
	2	2006-2010	6.4	-	0.20
	4	2011-2014	-	3.5	0.10
		2015+	-	3.5	0.04

Attachment A

Non Road Diesel Emission Standards										
Engine Tiers by Horsepower and Year										
			Minimum Horsepower in Group							
	1	11	25	50	75	100	175	300	600	751
			Horsepower Groups							
Year	1 - 10	11-24	25-49	50-74	75-99	100-174	175-299	300-599	600-750	750+
1995	T0	T0	T0	T0	T0	T0	T0	T0	T0	T0
1996	T0	T0	T0	T0	T0	T0	T1	T1	T1	T0
1997	T0	T0	T0	T0	T0	T1	T1	T1	T1	T0
1998	T0	T0	T0	T1	T1	T1	T1	T1	T1	T0
1999	T0	T0	T1	T1	T1	T1	T1	T1	T1	T0
2000	T1	T1	T1	T1	T1	T1	T1	T1	T1	T1
2001	T1	T1	T1	T1	T1	T1	T1	T2	T1	T1
2002	T1	T1	T1	T1	T1	T1	T1	T2	T2	T1
2003	T1	T1	T1	T1	T1	T2	T2	T2	T2	T1
2004	T1	T1	T2	T2	T2	T2	T2	T2	T2	T1
2005	T2	T2	T2	T2	T2	T2	T2	T2	T2	T1
2006	T2	T2	T2	T2	T2	T2	T3	T3	T3	T2
2007	T2	T2	T2	T2	T2	T3	T3	T3	T3	T2
2008	T4	T4	T4i	T4i	T3	T3	T3	T3	T3	T2
2009	T4	T4	T4i	T4i	T3	T3	T3	T3	T3	T2
2010	T4	T4	T4i	T4i	T3	T3	T3	T3	T3	T2
2011	T4	T4	T4i	T4i	T3	T3	T4i	T4i	T4i	T4i
2012	T4	T4	T4i	T4i	T4i	T4i	T4i	T4i	T4i	T4i
2013	T4	T4	T4	T4	T4i	T4i	T4i	T4i	T4i	T4i
2014	T4	T4	T4	T4	T4i	T4i	T4	T4	T4	T4i
2015	T4	T4	T4	T4	T4	T4	T4	T4	T4	T4
2016	T4	T4	T4	T4	T4	T4	T4	T4	T4	T4
2017	T4	T4	T4	T4	T4	T4	T4	T4	T4	T4

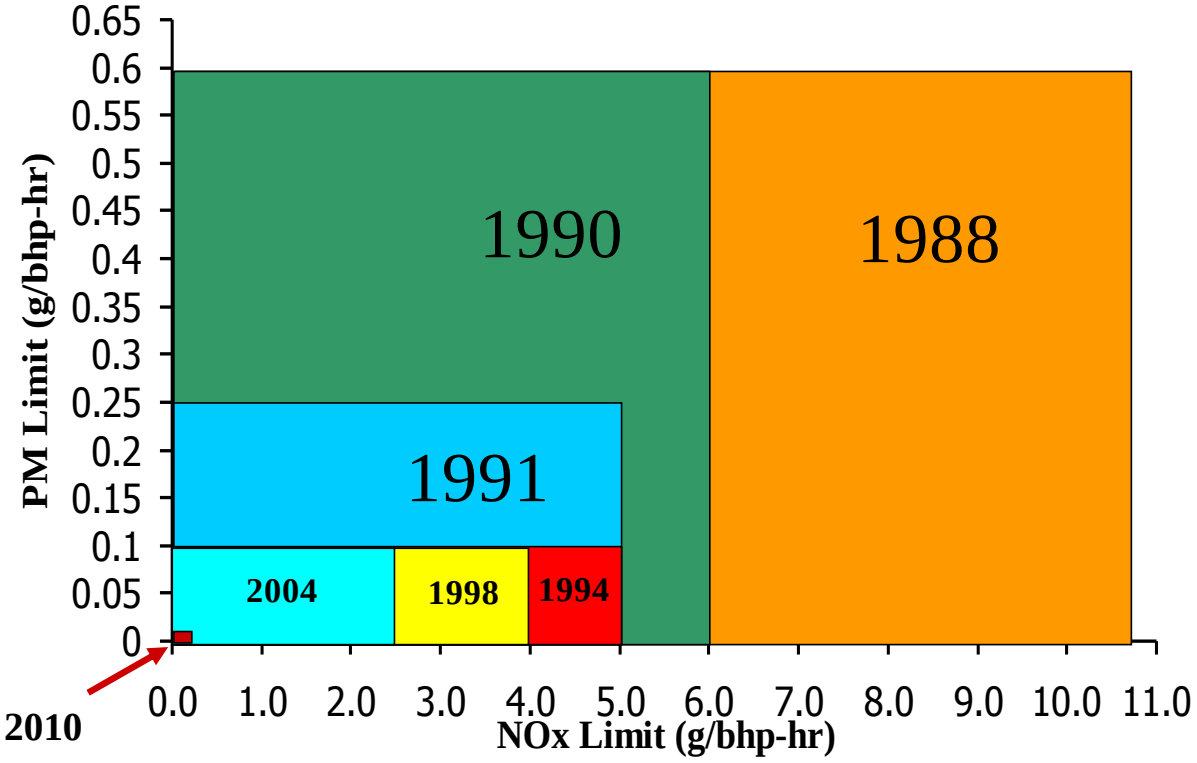
Attachment A

Onroad Compression Ignition Engines: Exhaust Emission Standards

Engine Model Year	NMHC + NOx (g/bhp-hr)	NOx (g/bhp-hr)	PM (g/bhp-hr)
1974-1978	16	-	-
1979-1984	10	-	-
1985-1987	-	10.7	-
1988-89	10.7	-	0.60
1990	6.0	-	0.60
1991-1993	-	5.0	0.25 0.10 (buses)
1994-1997	-	5.0	0.1 0.7 (buses) 0.05 (buses 1996+)
1998-2003	-	4.0	0.1 0.05 (buses)
2004-2006	2.4	-	0.1 0.05 (buses) 0.30
2007-2010+	3.4	0.2 (2010)	0.01

Attachment A

Onroad Compression Ignition Engines: Exhaust Emission Standards



ATTACHMENT B

EPA United States Environmental Protection Agency

NAAQS Table

The Clean Air Act, which was last amended in 1990, requires EPA to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of national ambient air quality standards. ***Primary standards*** provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. ***Secondary standards*** provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA has set National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" air pollutants. Periodically, the standards are reviewed and may be revised. The current standards are listed below. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ($\mu g/m^3$).

Pollutant [links to historical tables of NAAQS reviews]		**Primary/ Secondary**	**Averaging Time**	**Level**	**Form**
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 $\mu g/m^3$ (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 $\mu g/m^3$	annual mean, averaged over 3 years
		secondary	1 year	15.0 $\mu g/m^3$	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years
					Not to be exceeded

	PM_{10}	primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 μg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

Menu of Control Measures for NAAQS Implementation

The Menu of Control Measures (MCM) provides state, local and tribal air agencies with the existing emission reduction measures as well as relevant information concerning the efficiency and cost effectiveness of the measures. State, local and tribal agencies will be able to use this information in developing emission reduction strategies, plans and programs to assure they attain and maintain the National Ambient Air Quality Standards (NAAQS). The MCM is a living document that can be updated with newly available or more current data as it becomes available.

- Menu of Control Measures

Last updated on March 29, 2016

ATTACHMENT B

Air Quality

Air Toxics

DEQ Home > Air Quality > Air Toxics > Benchmarks

Sign up for email updates on Air Toxics

- Air Quality Home
- Air Quality Index
- Air Toxics
- Burning
- Maintenance and Nonattainment Areas
- Portland Air Quality
- Regional Haze
- Vehicle Inspection Program
- Transportation
- Woodstoves

Oregon Air Toxics Benchmarks

Oregon's air toxics benchmarks help DEQ identify, evaluate and address air toxics problems. Oregon air toxics benchmarks are based on concentration levels that would result in a cancer risk of one-in-a-million additional cancers based on a lifetime of exposure. For non-carcinogens, the benchmarks are levels you could breathe for a lifetime without any non-cancer health effects.

The ambient benchmark concentrations for 52 air toxics of concern in Oregon are based on consensus recommendations from the Air Toxics Scientific Advisory Committee, a panel of experts that provides advice on the state air toxics program that is scientifically and technically sound, independent and balanced.

The benchmarks are based on concentration levels that protect the health of our most sensitive individuals. These benchmarks provide consistent health-based goals, as DEQ develops strategies to reduce air toxics.

- Air Toxics Benchmarks Rules Division 246 of OR Admin Rules
- Air toxics benchmarks for industrial facilities' nickel use Chapter 340

[print version]

For more information about **Air Quality** call 503-229-5359 or email.

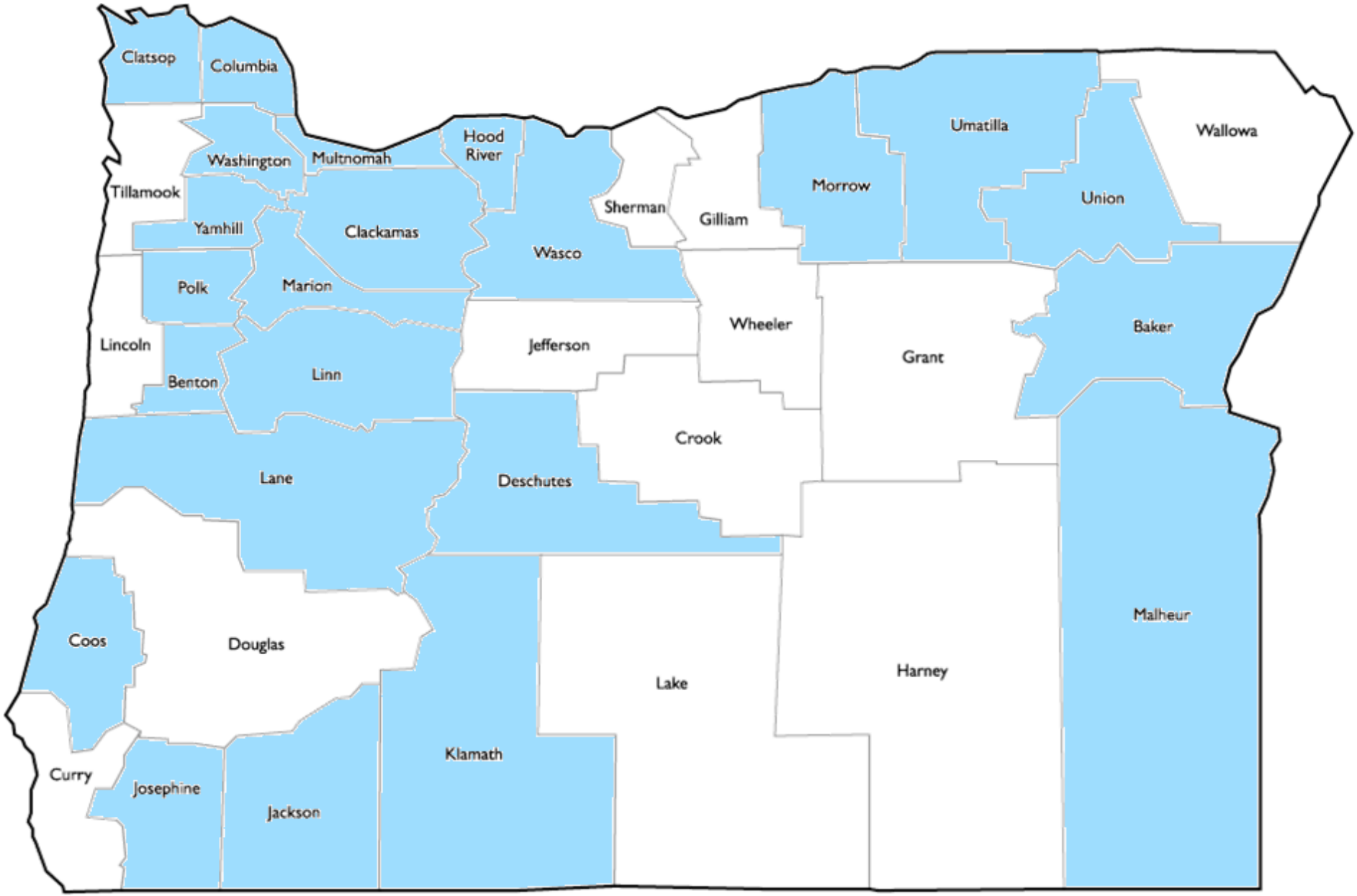
Oregon Department of Environmental Quality
Headquarters: 811 SW Sixth Ave., Portland, OR 97204-1390
Phone: 503-229-5696 or toll free in Oregon 1-800-452-4011
Oregon Telecommunications Relay Service: 1-800-735-2900 FAX: 503-229-6124

The Oregon Department of Environmental Quality is a regulatory agency authorized to protect Oregon's environment by the State of Oregon and the Environmental Protection Agency.

DEQ Web site privacy notice

Attachment C

Counties Where Lifetime Excess Risk for Cancer from Exposure to Diesel PM is Greater than One in a Million.



ATTACHMENT C

The National Air Toxics Assessment

OVERVIEW OF EPA'S 2011 NATIONAL AIR TOXICS ASSESSMENT

- On December 17, 2015, the U.S. Environmental Protection Agency (EPA) released the fifth version of the National Air Toxics Assessment (NATA) – a state-of-the-science screening tool that provides information on the potential risks from breathing air toxics. This tool can inform efforts to identify and prioritize air toxic pollutants, source types, and locations of potential concern.
- EPA suggests that the results of this assessment be used cautiously, as the overall quality and uncertainties of the assessment will vary from location to location as well as from pollutant to pollutant.
- The 2011 NATA is based on emissions for the 2011 calendar year – the most complete and up-to-date emissions data available at the time of the assessment.
- The 2011 NATA assessed 180 air toxics such as benzene, formaldehyde and acrolein, plus diesel particulate matter (PM) (181 total), from the following types of emissions sources:
    - **Stationary sources**, e.g., industrial facilities such as coke ovens for the steel industry, refineries and smaller sources like gas stations
    - **Mobile sources**, e.g., cars, trucks and off-road vehicles like construction equipment and trains
    - **Events**, e.g., wildfires, prescribed burning
    - **Biogenics**, e.g., naturally-occurring emissions
- In addition, NATA includes:
    - **Secondary formation**, e.g., pollutants that form from chemical reactions from other pollutants emitted into the air such as formaldehyde
    - **Background**, e.g., long-range transport from distant sources
- The emissions data were then modeled to make broad estimates of health risks (both cancer and non-cancer risks) over geographic areas of the country to provide a snapshot of air quality in 2011. Estimated health risks are provided for about 140 air toxics for which we have health benchmarks.

HIGHLIGHTS

The 2011 NATA uses improved emissions and modeling methods that help better characterize risks across the country.

- Monitoring data and emissions inventories show overall reductions in air toxics across the country as a result of Clean Air Act programs. Results from the 2011 NATA support this downward trend.

ATTACHMENT C

- Emissions from fires and biogenic sources are included in this version of NATA and more detailed location information was available for some sources, such as oil and gas wells and airports.
- Two air quality models - a long range transport and chemistry model and a near-field model - were combined to estimate ambient air concentrations of air toxics across the country.
- By combining the two models, EPA is able to provide an improved air quality prediction that accounts for air pollution transport across regions, secondary pollution formation in the atmosphere, and local conditions near specific sources.

Pollutants

- Nationwide, the key pollutants that contribute most to overall cancer risks are formaldehyde, benzene, and acetaldehyde.
- The key pollutants that contribute most to overall nationwide non-cancer risk are acrolein, diesel PM, and chlorine.
- Key pollutants in some local areas vary depending on local industrial emissions and the amount and type of emissions from transportation.
- The 2011 NATA includes diesel PM for non-cancer health effects only.

Sources

- Secondary formation is the largest contributor to cancer risks nationwide, accounting for 47 percent of the risk. On-road mobile sources contribute the most risk from directly emitted pollutants (about 18 percent).
- Nationally, on-road mobile sources contribute the largest amount to non-cancer risks (34 percent). Nonroad mobile sources and nonpoint sources also contributed to the non-cancer risks in nearly equal amounts (15 percent).
- Contributing sources in some areas may be local industry sources.

Geographic Areas

- According to the 2010 U.S. census, there are approximately 78,000 census tracts in the country. Based on the 2011 NATA, EPA estimates there are approximately 130 tracts (or less than one percent) with cancer risks greater than 100-in-1 million.
- For census tracts with risk greater than 100-in-1 million, the risks are due to large and small industry, as well as mobile sources and secondary formation.
- Urban areas tend to have higher overall estimates of cancer and non-cancer risks than rural areas because there are more air toxics emissions from varied sources, in addition to higher population densities. Secondary formation also tends to occur more in urban areas because of the complex mixture of emitted pollutants.

ATTACHMENT C

BACKGROUND

- EPA developed NATA because there is not a large, nationwide monitoring network in place for the 187 pollutants identified as air toxics. To understand potential health risks from breathing air toxics, the agency developed the model-based NATA.
- NATA is useful in informing national and localized efforts to collect air toxics information, characterize emissions and prioritize pollutants and geographic areas for more refined data collection and analyses, and other activities designed to reduce pollution and risks to public health. However, it should not be used to single out or rank areas of the country as having the highest risk.
- EPA collaborates extensively with industry, state, local and Tribal air agencies to develop and quality assure the information contained in the assessment.
- For more information on NATA, visit the website at: www.epa.gov/national-air-toxics-assessment
- To view the interactive mapping tool, visit: www.epa.gov/national-air-toxics-assessment/2011-nata-map
- For additional questions and answers regarding NATA, go to: www.epa.gov/national-air-toxics-assessment/nata-frequent-questions

ATTACHMENT C

State	County	Population	Pollutant Name	Total Conc
OR	Entire state	3831069	DIESEL PM	0.349973232
OR	Multnomah	735334	DIESEL PM	1.553735672
OR	Washington	529710	DIESEL PM	1.283784028
OR	Clackamas	375992	DIESEL PM	1.144538544
OR	Marion	315335	DIESEL PM	1.053281348
OR	Jackson	203206	DIESEL PM	0.741316268
OR	Wasco	25213	DIESEL PM	0.711621132
OR	Linn	116672	DIESEL PM	0.561596143
OR	Benton	85579	DIESEL PM	0.429033954
OR	Clatsop	37039	DIESEL PM	0.410983158
OR	Yamhill	99191	DIESEL PM	0.367045276
OR	Columbia	49351	DIESEL PM	0.344348409
OR	Malheur	31313	DIESEL PM	0.334620647
OR	Hood River	22346	DIESEL PM	0.27954312
OR	Polk	75403	DIESEL PM	0.196342162
OR	Umatilla	75889	DIESEL PM	0.176532644
OR	Lane	351715	DIESEL PM	0.157391605
OR	Deschutes	157733	DIESEL PM	0.148573824
OR	Morrow	11173	DIESEL PM	0.145705259
OR	Coos	63043	DIESEL PM	0.143473997
OR	Baker	16134	DIESEL PM	0.133459001
OR	Klamath	66380	DIESEL PM	0.111534136
OR	Union	25748	DIESEL PM	0.111052912
OR	Josephine	82713	DIESEL PM	0.110556032
OR	Sherman	1765	DIESEL PM	0.098793654
OR	Douglas	107664	DIESEL PM	0.089741992
OR	Lincoln	46034	DIESEL PM	0.087357373
OR	Gilliam	1871	DIESEL PM	0.078047601
OR	Jefferson	21720	DIESEL PM	0.062013303
OR	Tillamook	25250	DIESEL PM	0.058370111
OR	Crook	20978	DIESEL PM	0.053466354
OR	Curry	22364	DIESEL PM	0.039146399
OR	Wheeler	1441	DIESEL PM	0.033655638
OR	Wallowa	7008	DIESEL PM	0.03076759
OR	Lake	7895	DIESEL PM	0.029052076
OR	Grant	7445	DIESEL PM	0.027517673
OR	Harney	7422	DIESEL PM	0.026946546

from: EPA 2011 National Air Toxics Assessment
https://www.epa.gov/national-air-toxics-assessment/2011-nata-assessment-results#pollutant

Attachment D

Vehicle Idling

Idling is generally understood to be the condition where the engine responsible for vehicle propulsion or to conduct the intended work of the equipment is operating but the vehicle is not moving or the equipment is not undertaking the work for which it is designed.

Idling, in some situations, may be considered necessary, for instance while waiting for a traffic light to change. What may be considered unnecessary is a policy choice reflecting considerations among the 59 cities, counties and states that have adopted an idling control restriction.

EPA developed a model idling law in which they suggested the following as exemptions from idling restrictions, i.e., "necessary idling":

(1) a vehicle idles while forced to remain motionless because of on-highway traffic, an official traffic control device or signal, or at the direction of a law enforcement official.
(2) a vehicle idles when operating defrosters, heaters, air conditioners, or installing equipment solely to prevent a safety or health emergency, and not as part of a rest period.
(3) a police, fire, ambulance, public safety, military, other emergency or law enforcement vehicle, or any vehicle being used in an emergency capacity, idles while in an emergency or training mode and not for the convenience of the vehicle operator.
(4) the primary propulsion engine idles for maintenance, servicing, repairing, or diagnostic purposes if idling is required for such activity.
(5) a vehicle idles as part of a state or federal inspection to verify that all equipment is in good working order, provided idling is required as part of the inspection.
(6) idling of the primary propulsion engine is necessary to power work-related mechanical or electrical operations other than propulsion (e.g., mixing or processing cargo or straight truck refrigeration). This exemption does not apply when idling for cabin comfort or to operate non-essential on-board equipment.
(7) an armored vehicle idles when a person remains inside the vehicle to guard the contents, or while the vehicle is being loaded or unloaded.

Idling may also be allowed during mandated rest periods for truck drivers when the ambient temperature is outside specified temperature limits to provide housekeeping services and temperature control for the driver.