

2011 Comprehensive Emissions Inventory Categories Reference

This reference document summarizes the methods used to derive the Washington State 2011 County Emissions Inventory, an [Air Emissions Inventory](#) product created by the Washington State [Department of Ecology Air Quality Program](#). The main pollutants included in this Emissions Inventory (EI) are carbon monoxide, particulate matter, nitrogen oxides, sulfur dioxide, volatile organic compounds (VOCs), and ammonia. The EI data is *not* based on ambient air quality monitor observations used by the Environmental Protection Agency (EPA) to enforce the [National Ambient Air Quality Standards](#), nor is it meant to account for greenhouse gases (e.g. carbon dioxide, methane, and CFCs are not part of the EI). Instead, the EI is a collection of annual emissions estimates that are calculated using publicly available information (e.g. population, permitted facilities, road activity, registered vehicles, etc.) and EPA models or emission factors usually documented in the [Compilation of Air Pollutant Emission Factors](#) (AP-42; e.g. from source test data, material balance studies, and engineering estimates). The EI is used for air quality State Implementation Plan (SIP) attainment/maintenance work, air quality forecasting, other air quality planning and rule efforts, public information, point source fee generation, and federal air quality reporting. Although Washington State developed most of the EI, some source category data was taken directly from the [2011 EPA National Emissions Inventory \(NEI\)](#). See the [Technical Documentation](#) and [Summary Data](#) for more details.

Source Categories Included in the 2011 County Emissions Inventory	
On-Road Mobile (ORM)	Industrial Solvents (SOLV)
Non-Road Mobile (NRM)	Consumer and Commercial Solvents (CONS)
Road Dust (ROADS)	Point Sources (PT)
Aircraft (AIR)	Public Water Treatment (POTW)
Recreational Boats (BOAT)	Food and Kindred Products (FOOD)
Commercial Marine Vessels (SHIP)	Livestock Waste (LIVE)
Locomotives (RR)	Fertilizer Application (FERT)
Gasoline Storage/Transport (GAS_TRANS)	Agricultural Tilling and Harvesting (TILL_HARV)
Gasoline Stations (GASSTN)	Agricultural and Silvicultural Burning (OB_nonRES)
Commercial Fuel Use (F_COMM)	Wildfires (FIRE)
Residential Fuel Use (F_RES)	Residential Outdoor Burning (OB_RES)
Woodstoves, Fireplaces, and Inserts (RWC)	Natural Vegetation/Soils (NAT)
Construction (CONST)	Miscellaneous (MISC)

Emissions Source Category Descriptions:

On-Road Mobile (ORM) >> Emissions due to fuel combustion, fuel evaporation, brake wear, and tire wear from vehicles on public roadways are included in this category. EPA's [Motor Vehicle Emission Simulator \(MOVES\)](#) model version 2010b was used to calculate these emissions. Vehicle miles traveled, vehicle population, vehicle types, fuel types, emissions control programs, meteorological information, and other parameters were used as input to the MOVES model.

Non-Road Mobile (NRM) >> This category includes emissions from gasoline, diesel, compressed natural gas, and liquefied petroleum gas fueled equipment used in agriculture, lawn and garden, airports, logging, oil fields, construction and mining, recreation, commerce, railroad maintenance, and industry. Emissions were estimated using EPA's [NONROAD](#) model version 2008a.

Road Dust (**ROADS**) >> Emissions generated as vehicles pass along roadways and disturb the layer of loose material on or near the road surface are included in this category. Brake and tire wear are not included here but are included in the On-Road Mobile source category. Emissions were estimated using vehicle miles traveled data, vehicle population, road types, precipitation, and EPA emission factors.

Aircraft (**AIR**) >> Emissions from aircraft landing and takeoff cycles are included in this category, but in-flight emissions are not included. Emissions were taken from the 2011 EPA NEI. EPA used the Federal Aviation Administration [Emissions and Dispersion Modeling System](#) version 5.1 for airports where detailed aircraft-specific activity data were available. Emissions from smaller airports were estimated using aircraft operations data and activity survey responses provided by the Federal Aviation Administration.

Recreational Boats (**BOAT**) >> Emissions from recreational marine vessels are included in this category. County boat registration and the average meteorological conditions by season were used as input to EPA's [NONROAD](#) model version 2008a. Recreational Boats are separated from Non-Road Mobile for this EI.

Commercial Marine Vessels (**SHIP**) >> Emissions from ocean-going vessels, harbor vessels, and cargo handling equipment are included in this category. Estimates for coastal waterways, Puget Sound, and the Strait of Juan de Fuca were prepared by Starcrest Consulting Group, LLC. Emissions for the Columbia and Snake rivers were taken from the 2011 EPA NEI, which used 2002 activity data and regional growth factors.

Locomotives (**RR**) >> Emissions from Burlington Northern Santa Fe Railway, Union Pacific Railroad, and Amtrak are included in this category. Railroads provided 2011 county fuel use for line haul and switch yard locomotives, which was combined with EPA emission factors to calculate total emissions.

Gasoline Storage/Transport (**GAS_TRANS**) >> VOC emissions from bulk gasoline storage tanks and tank trucks are included in this category. EPA estimated 2008 national VOC emissions at storage tanks by adjusting 1998 national [Gasoline Distribution Maximum Achievable Control Technology](#) standards with the volume of gasoline supplied in 2008 (from the U.S. Department of Energy) and employment data reported in the 2007 [County Business Patterns](#) database. Emissions from tank trucks were estimated using the [Emission Inventory Improvement Program](#) guidance for gasoline-filled trucks, EPA's [National Mobile Inventory Model](#), information from the US Energy Information Administration, and emission factors from the [2011 EPA NEI documentation](#).

Gasoline Stations (**GASSTN**) >> VOC emissions from gasoline station underground tanks and vehicle refueling are included in this category. Emissions were based on the amount of gasoline distributed, the number of vehicles per county, and the [2011 NEI EPA documentation](#).

Commercial Fuel Use (**F_COMM**) >> Emissions from commercial combustion of wood were taken from the 2011 EPA NEI and included in this category. Consumption was estimated from the Energy Information Administration [State Energy Data System](#) and the 2009 [County Business Patterns](#) database. Emission factors were taken from the [Central States Air Resource Agencies 2011 EI Enhancement Project](#).

Residential Fuel Use (**F_RES**) >> Emissions from heating homes with distillate oil, natural gas, and liquefied petroleum are included in this category. Each county's fuel use was estimated using the 2010 Energy Information Administration [State Energy Data System](#), the 2006-2010 US Census Bureau [American Community Survey](#), and EPA emission factors.

Woodstoves, Fireplaces, and Inserts (**RWC**) >> Emissions from woodstoves, fireplaces, fireplace inserts, and pellet stoves are included in this source category. Residential wood combustion activity for each county was estimated using data from surveys conducted by Washington State University (2001) and the National Research Center (2007). Further details on typical wood types and weight were acquired from the Puget Sound Clean Air Agency, the Department of Ecology, the Department of Natural Resources, and the US Forest Service. Emission factors were taken from EPA.

Construction (**CONST**) >> Dust generated during construction of non-residential, residential, and road developments were taken from the 2011 EPA NEI and included in this category. Non-residential construction activity was based on [County Business Patterns](#) employment data. Residential construction activity was based on the area disturbed and volume of soil excavated, estimated using the 2010 US Census Bureau's [Building Permits Survey](#) and [Characteristics of New Housing](#) reports. Road construction activity was based on the area disturbed, estimated using the 2008 [Federal Highway Administration statistics](#). Moisture was estimated using regional soil moisture derived from Thornthwaite's Precipitation-Evaporation Index and methodology from the California Air Resources Board.

Industrial Solvents (**SOLV**) >> VOC and toxic gas emissions from solvents used in industry are included in this category. The 2011 [Quarterly Census of Employment and Wages](#) report was combined with population data to estimate emissions from solvents in many industrial sectors: manufacturing, appliances, dry cleaning, metal and electrical coatings, architectural coating, wood finishing, graphic arts, degreasing, maintenance, machinery, motor vehicles and parts, paper, film, railroads, etc. Emission factors were taken from the [2011 EPA NEI documentation](#).

Consumer and Commercial Solvents (**CONS**) >> Non-industrial activities utilizing solvents that release VOCs and toxic gases are included in the Consumer and Commercial Solvents source category. The solvents may serve as propellants, aid in product drying through evaporation, or act as co-solvents and cleaning agents. Solvent use activity was estimated using national per capita emission rates from the EPA and local population data. Emission factors were taken from the [2011 EPA NEI documentation](#).

Point Sources (**PT**) >> Major industrial, commercial, or institutional stationary facilities are included in this category. Methods for estimating emissions across facilities may have included continuous emissions monitors, stack test data, mass balance, professional judgment, manufacturer specifications, scientific research, and emission factors from government, manufacturers, or research groups.

Public Water Treatment (**POTW**) >> Waste water treatment plant emissions are included in this category. Emissions were based on nationally reported flow rates through treatment plants and allocated to the county-level based on 2011 Washington population data. Emission factors were taken from [VOC Emissions from Wastewater Treatment Plants: Characterization, Control, and Compliance](#) and [Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources](#).

Food and Kindred Products (**FOOD**) >> Emissions from commercial cooking are included in this category and were taken from EPA. Restaurant data was derived from the 2002 [Dun & Bradstreet Marketplace](#) database and projected to 2011 using the [County Business Patterns](#) database.

Livestock Waste (**LIVE**) >> Ammonia emissions from dairy and beef cattle manure were included in this category. The number of dairy cattle and total cattle for 2012 was obtained by county from the Washington State Department of Agriculture and US Department of Agriculture (USDA). Emission factors were taken from the [Carnegie Mellon University Ammonia Model](#) v.3.6.

Fertilizer Application (**FERT**) >> Ammonia emissions from croplands are included in this category. Fertilizer usage was obtained from WSDA and allocated to counties based on the [2011 EPA NEI documentation](#). Emission factors came from the [Carnegie Mellon University Ammonia Model](#) v.3.6.

Agricultural Tilling and Harvesting (**TILL_HARV**) >> Emissions of agricultural dust from tilling, preparation for planting, harvest machines, and loading/transport of crops in the field are all included in this category. Emissions of fugitive dust from agricultural tilling were taken from EPA, based on crop-specific information from the USDA and the 2008 [National Crop Residue Management Survey](#). Harvesting emissions were based on the [Western Regional Air Partnership Fugitive Dust Handbook](#) plus crop-specific statistics produced by the USDA [National Agricultural Statistics Service](#) and the Washington State Department of Agriculture.

Agricultural and Silvicultural Burning (**OB_nonRES**) >> This category includes emissions from silvicultural burning of logging debris and forested areas (a.k.a prescribed fires) and agricultural burns of vegetative debris (e.g. for pest control or crop management). Silvicultural burns in Washington are managed by the Department of Natural Resources, the US Forest Service, the Bureau of Indian Affairs, and private industry. Agricultural burns are archived in the Department of Ecology agricultural burn permit database. Emissions estimates were based on silvicultural and agricultural permits issued in 2011.

Wildfires (**FIRE**) >> Wildfire emissions in this category were taken from the [2011 EPA Fire NEI effort](#), generated by Sonoma Technology, Inc. (STI) in collaboration with the US Forest Service. STI generated emissions with the [BlueSky](#) model, which included the [Landscape Fire and Resource Management Planning Tools Fuel Characteristic Classification System](#), the [Consume](#) model, and the [Fire Emission Production Simulator](#). Wildfire locations were determined using [Incident Command Summary Reports](#), the [Hazard Mapping System](#), the [Geospatial Multi-Agency Coordination](#) group, and the [Activity Tracking System](#). Fuel moisture was estimated using the [Wildland Fire Assessment System National Fuel Moisture Database](#).

Residential Outdoor Burning (**OB_RES**) >> Emissions from the burning of yard waste (e.g. vegetative material such as branches, grass, or leaves) and residential waste (e.g. trash and other solid waste) are included in this category. Residential yard waste and trash burning activity was estimated from a 2001 Washington State University survey. Emission factors were taken from the [2011 EPA NEI documentation](#).

Natural Vegetation and Soils (**NAT**) >> Biogenic emissions from vegetation and soils included in this category were taken directly from the 2011 EPA NEI. Emissions were generated using the [Weather Research and Forecasting](#) model and the [Biogenic Emission Inventory System](#) v3.14.

Miscellaneous (**MISC**) >> Structure and motor vehicle fires, cremation, dental alloy production, bench scale reagents, fluorescent lamps, and other relatively minor sources of emissions are included in the Miscellaneous source category. Details on the methods used to estimate emissions from these sources are available in the [Technical Documentation](#).

For more information please contact the Air Quality Program by phone at (360) 407-6800 or by [email](#).