

## 2014 Comprehensive Emissions Inventory Quick Reference

This quick reference document summarizes the methods used to derive the Washington State 2014 Comprehensive 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 [2014 EPA National Emissions Inventory \(NEI\) v2](#). See the Technical Documentation and Summary Data in the Comprehensive Emissions Inventory section of the [Air Emissions Inventory](#) page for more details.

<b>Source Categories Included in the 2014 County Emissions Inventory</b>	
On-Road Mobile ( <b>ORM</b> )	Industrial Solvents ( <b>SOLV</b> )
Non-Road Mobile ( <b>NRM</b> )	Consumer and Commercial Solvents ( <b>CONS</b> )
Aircraft ( <b>AIR</b> )	Point Sources ( <b>POINT</b> )
Road Dust ( <b>ROADS</b> )	Food and Kindred Products ( <b>FOOD</b> )
Recreational Boats ( <b>BOAT</b> )	Livestock ( <b>LIVE</b> )
Commercial Marine Vessels ( <b>SHIP</b> )	Fertilizer Application ( <b>FERT</b> )
Locomotives ( <b>RR</b> )	Agricultural Tilling and Harvesting ( <b>TILL_HARV</b> )
Gasoline Storage/Transport/Stations ( <b>PETROL</b> )	Agricultural and Silvicultural Burning ( <b>OB_nonRES</b> )
Industrial/Commercial/Institutional Fuel Use ( <b>F_ICI</b> )	Wildfires ( <b>FIRE</b> )
Residential Fuel Use ( <b>F_RES</b> )	Residential Outdoor Burning ( <b>OB_RES</b> )
Woodstoves, Fireplaces, and Inserts ( <b>RWC</b> )	Natural Vegetation/Soils ( <b>NAT</b> )
Construction ( <b>CONST</b> )	Miscellaneous ( <b>MISC</b> )

### 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 2014 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.

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 2014 EPA NEI. EPA used the Federal Aviation Administration [Emissions and Dispersion Modeling System](#) 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.

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.

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 and harbor vessels 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 and represent 2011. Emissions for the Columbia and Snake rivers were taken from the 2014 EPA NEI, discussed in the [2014 NEI Documentation](#).

Locomotives (**RR**) >> Emissions from Burlington Northern Santa Fe Railway, Union Pacific Railroad, and Amtrak are included in this category. Railroads provided 2014 county fuel use for line haul and switch yard locomotives, which was combined with EPA emission factors to calculate total emissions. Class II/III locomotives and additional rail yard emissions were obtained from EPA.

Gasoline Storage/Transport/Stations (**PETROL**) >> VOC emissions from bulk gasoline storage tanks, tank trucks, gasoline station underground tanks, and vehicle refueling are included in this category. EPA estimated this category; activity data and emission factors are discussed in the [2014 NEI Documentation](#).

Industrial/Commercial/Institutional Fuel Use (**F\_ICI**) >> Emissions from industrial/commercial/institutional combustion of wood, natural gas, and other fuels were taken from the 2014 EPA NEI and included in this category. However, some emissions were submitted to EPA by WA ECY. Consumption was estimated from the Energy Information Administration [State Energy Data System](#) and the [County Business Patterns](#) database. Emission factors are from the EPA [Eastern Regional Technical Advisory Committee \(ERTAC\)](#) and [EPA's AP-42 report, Compilation of Air Pollutant Emission Factors](#).

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 2013 Energy Information Administration [State Energy Data System](#), the [2009-2013 American Community Survey 5-Year Estimates](#), 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 2014 EPA NEI and modified to include county-level soil moisture parameters. Non-residential construction activity was based on 2014 [County Business Patterns](#) employment data. Residential construction activity was based on the area disturbed and volume of soil excavated, estimated using the 2014 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 2014 [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: manufacturing, appliances, dry cleaning, metal and electrical coatings, architectural coating, wood finishing, graphic arts, degreasing, maintenance, machinery, motor vehicles and parts, paper, film, railroads, agrochemicals, asphalt paving, etc. This category was estimated by EPA. Emission factors and activity data are discussed in the [2014 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: personal care products, household products, aftermarket auto products, coatings, adhesives & sealants, insecticides, fungicides, rodenticides, etc. This category was estimated by EPA. Emission factors and activity data are discussed in the [2014 NEI Documentation](#).

Point Sources (**POINT**) >> Major industrial, commercial, or institutional stationary facilities are included in this category. This category includes landfills and some minor sources. 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.

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 2014 using the [County Business Patterns](#) database.

Livestock (**LIVE**) >> Dust and ammonia emissions from Concentrated Animal Feeding Operations (CAFOs) were included in this category. Emissions from livestock waste and dust from hooves were estimated by EPA using local cattle population data. Animal waste from livestock results in emissions of both NH<sub>3</sub> and VOCs. In addition, animal activity in the pens and feedlots results in dust emissions. VOC and PM<sub>10</sub> emission factors were derived from the literature. Ammonia emission factors were taken from the [Carnegie Mellon University Ammonia Model](#) v.3.6.

Fertilizer Application (**FERT**) >> Ammonia emissions from croplands due to fertilizer usage are included in this category. Fertilizer usage was estimated using the Fertilizer Emissions Scenario Tool for CMAQ (FEST-C), which was run by EPA. Emission factors and activity data are discussed in the [2014 NEI Documentation](#).

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 based on crop-specific information from the USDA, WSDA, Midwest Research Institute, and WSU College of Agriculture. 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 2014. Additional burns detected by satellites were also included.

Wildfires (**FIRE**) >> Wildfire emissions in this category were initially taken from the [2014 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, the [National Association of State Foresters](#) (NASF) fire database, the [National Fire Plan Operations and Reporting System](#) (NFPORS), and the US Forest Service [Activity Tracking System](#). Fuel moisture was estimated using the [Wildland Fire Assessment System National Fuel Moisture Database](#). Fires that were misclassified by EPA as agricultural or prescribed burns were corrected and included in the wildfire category.

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. The yard waste burning activity method assumes that only rural households burn yard waste and that counties with more than 50% forest cover have households that generate twice the yard waste as other counties. The municipal waste burning activity method assumes that rural households burn 28% of their municipal solid waste. It is assumed that 4.5 lbs of waste are generated per person per day and that 80% of that waste is “burnable”. Emission factors are taken from the EPA.

Natural Vegetation and Soils (**NAT**) >> Biogenic emissions from vegetation and soils in this category were derived from the WSU AIRPACT simulations. Emissions were generated using the [Weather Research and Forecasting](#) (WRF) model and the [Model of Emissions of Gases and Aerosols from Nature \(MEGAN\)](#) v2.1.

Miscellaneous (**MISC**) >> Structure and motor vehicle fires, cremation, dental alloy production, bench scale reagents, fluorescent lamps, waste-water treatment plants, and other relatively minor sources of air 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 hosted on the Comprehensive Emissions Inventory section of the [Air Emissions Inventory](#) page.

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