Final Report

WRAP MOBILE SOURCE EMISSION INVENTORIES UPDATE

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May 2006

ACKNOWLEDGEMENTS

The authors acknowledge the contributions of many people who provided input and advice on the work described in this report:

- Mr. Tom Moore, WRAP technical liaison for this project, served as the primary contact for this work, and assisted in aspects of the work too numerous to mention.
- The WRAP Emissions Forum actively participated in the work, advising and guiding.
- State and local air quality planning agency staff reviewed and provided updated modeling inputs and activity data.
- Jim Lyons and Phil Heirigs of Sierra Research performed the fuel survey data analyses described in Section 2

To all these individuals the authors express their sincere appreciation.

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ACRONYMS

ADTV	Average daily traffic volume
ATADS	Air Traffic Activity Data System (of the FAA)
ATP	Anti-Tampering Program
BEA	Bureau of Economic Affairs
BTS	Bureau of Transportation Statistics
CARB	California Air Resources Board
CEFS	California Emissions Forecasting System
CERR	Consolidate Emissions Reporting Rule
CI	Compression ignition
CMV	Commercial marine vessel
CNG	Compressed natural gas
CO	Carbon monoxide
CODAS	Consolidated Operations and Delay Analysis System (of the FAA)
COG	Council of Governments
DOE	Department of Energy
EC	Elemental carbon
EDMS	Emissions and Dispersion Modeling System (of the FAA)
EDMS	WRAP's Emissions Data Management System
EIA	Energy Information Administration
EIIP	Emission Inventory Improvement Program
EPA	Environmental Protection Agency
EPS2	Emissions Processing System version 2
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTP	Federal Test Procedure
GCVTC	Grand Canyon Visibility Transport Commission
GSE	Ground support equipment
GSP	Gross State Product
GVW	Gross vehicle weight
HC	Hydrocarbon
HDDV	Heavy-duty diesel vehicle
HDGT	Heavy-duty gasoline truck
HDV	Heavy-duty vehicle
HHDDV	Heavy heavy-duty diesel vehicle
HP	Horsepower
HPMS	Highway Performance Monitoring System
I/M	Inspection and Maintenance
LDDT	Light-duty diesel truck
LDDV	Light-duty diesel vehicle
LDGT	Light-duty gasoline truck
LDGV	Light-duty gasoline vehicle
LDT	Light-duty truck
LDV	Light-duty vehicle
LEV	Low Emission Vehicle
LHDDV	Light heavy-duty diesel vehicle
LPG	Liquid Propane Gas

LTO	Landing and take-off
MARPOL	International Convention for the Prevention of Pollution from Ships
MHDDV	Medium heavy-duty diesel vehicle
MPO	Metropolitan Planning Organization
MSF	Mobile Sources Forum
MY	Model year
NAPAP	National Acid Precipitation Assessment Program
NCDC	National Climatic Data Center
NEI	National Emissions Inventory
NET	National Emissions Trends
NFS	National Forest Service
NH_3	Ammonia
NIPER	National Institute for Petroleum and Energy Research
NPIAS	National Plan of Integrated Airport System
NOx	Nitrogen oxides
NO_2	Nitrogen dioxide
NREL	National Renewable Energy Laboratory
OC	Organic carbon
PM	Particulate matter
PM_{10}	Particulate matter less than or equal to 10 micrometers
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometers
QA	Quality assurance
RIA	Regulatory Impact Analysis
RMC	Regional Modeling Center
RPO	Regional Planning Organization
RSD	Regulatory Support Document
SCC	Source Classification Code
SI	Spark ignition
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions
SO_2	Sulfur dioxide
SO_4	Sulfate
SO_X	Sulfur oxides
TAF	Terminal Area Forecast (of the FAA)
THC	Total hydrocarbons
TIM	Time in mode
TPD	Tons per day
TPY	Tons per year
TSD	Technical Support Document
TWC	Three-way catalyst
VMT	Vehicle miles traveled
VOC	Volatile organic compound
WGA	Western Governor’s Association
WRAP	Western Regional Air Partnership

PREFACE
Regulatory Framework for Tribal Visibility Implementation Plans

The Regional Haze Rule explicitly recognizes the authority of tribes to implement the provisions of the Rule, in accordance with principles of Federal Indian law, and as provided by the Clean Air Act §301(d) and the Tribal Authority Rule (TAR) (40 CFR §§49.1– .11). Those provisions create the following framework:

1. Absent special circumstances, reservation lands are not subject to state jurisdiction.

2. Federally recognized tribes may apply for and receive delegation of federal authority to implement CAA programs, including visibility regulation, or "reasonably severable" elements of such programs (40 CFR §§49.3, 49.7). The mechanism for this delegation is a Tribal Implementation Plan (TIP). A reasonably severable element is one that is not integrally related to program elements that are not included in the plan submittal, and is consistent with applicable statutory and regulatory requirements.

3. The Regional Haze Rule expressly provides that tribal visibility programs are “not dependent on the strategies selected by the state or states in which the tribe is located” (64. Fed. Reg. 35756), and that the authority to implement §309 TIPs extends to all tribes within the GCVTC region (40 CFR §51.309(d)(12).

4. The EPA has indicated that under the TAR tribes are not required to submit §309 TIPs by the end of 2003; rather they may choose to opt-in to §309 programs at a later date (67 Fed. Reg. 30439).

5. Where a tribe does not seek delegation through a TIP, EPA, as necessary and appropriate, will promulgate a Federal Implementation Plan (FIP) within reasonable timeframes to protect air quality in Indian country (40 CFR §49.11). EPA is committed to consulting with tribes on a government to government basis in developing tribe-specific or generally applicable TIPs where necessary (See, e.g., 63 Fed. Reg.7263-64).

It is our hope that the methods for estimating mobile source emissions described in this report will prove useful to tribes, whether they choose to submit full or partial 308 or 309 TIPs, or work with EPA to develop FIPs. The amount of modification necessary will vary considerably from tribe to tribe. The authors have striven to ensure that all references to tribes in the document are consistent with principles of tribal sovereignty and autonomy as reflected in the above framework. Any inconsistency with this framework is strictly inadvertent and not an attempt to impose requirements on tribes which are not present under existing law.

Tribes, along with states and federal agencies, are full partners in the WRAP, having equal representation on the WRAP Board as states. Whether Board members or not, it must be remembered that all tribes are governments, as distinguished from the “stakeholders” (private interest) which participate on Forums and Committees but are not eligible for the Board. Despite this equality of representation on the Board, tribes are very differently situated than states. There are over four hundred federally recognized tribes in the WRAP region, including Alaska. The sheer number of tribes makes full participation impossible. Moreover, many tribes are faced with pressing environmental, economic, and social issues, and do not have the resources to participate in an effort such as the WRAP, however important its goals may be. These factors necessarily limit the level of tribal input into and endorsement of WRAP products.

The tribal participants in the WRAP, including Board members Forum and Committee members and co-chairs, make their best effort to ensure that WRAP products are in the best interest of the tribes, the environment, and the public. One interest is to ensure that WRAP policies, as implemented by states and tribes, will not constrain the future options of tribes who are not involved in the WRAP. With these considerations and limitations in mind, the tribal participants have joined the state, federal, and private stakeholder interests in approving this report as a consensus document.

1.0 INTRODUCTION

1.1 BACKGROUND

Visibility impairment is a concern in many areas of the United States, especially in scenic national parks and wilderness areas. Visibility is impaired as a result of haze, a condition in which sunlight is absorbed and/or scattered when it encounters airborne particles from both natural and anthropogenic pollution. In 1999 the U.S. Environmental Protection Agency announced the Regional Haze Rule, which calls for state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas (referred to as Class I areas). The rule requires the states, in coordination with the Environmental Protection Agency, the National Park Service, U.S. Fish and Wildlife Service, the U.S. Forest Service, and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment. Five multi-state regional planning organizations (RPOs) are working to develop the technical basis for these plans. The largest of these RPOs is the Western Regional Air Partnership (WRAP), which is made up of Western states, tribes, and federal agencies. The WRAP was formed in 1997 as the successor to the Grand Canyon Visibility Transport Commission (GCVTC), which made over 70 recommendations in June 1996 for improving visibility in 16 national parks and wilderness areas on the Colorado Plateau.

The WRAP is implementing regional planning processes to improve visibility in all Western Class I areas by providing the technical and policy tools needed by states and tribes to implement the federal regional haze rule. The rule requires the development of mobile source emissions inventories. WRAP contracted with ENVIRON to develop approaches for and to estimate mobile source emissions for the Western states. The first set of mobile source emissions use in WRAP air quality modeling were developed several years ago (Pollack et al., 2004).

The purpose of this project was to update the previously developed WRAP mobile source emission inventories. Specifically, the goals of this effort were to survey state and local air quality planning agencies to obtain the most up-to-date activity data and modeling inputs, to account for all of the “on the books” mobile source control measures, and to use the latest modeling tools available. This report describes in detail the methods used to estimate these revised mobile source emissions, and provides the resulting emissions estimates.

1.2 EMISSIONS INVENTORIED UNDER MOBILE SOURCES

Mobile sources include on-road and off-road vehicles and engines. On-road mobile sources include vehicles certified for highway use – cars, trucks, and motorcycles. For reporting on-road mobile source emissions, vehicles are divided into two major classes – light-duty and heavy-duty. Light-duty vehicles include passenger cars, light-duty trucks (up to 8500 lbs gross vehicle weight [GVW]), and motorcycles. Heavy-duty vehicles are trucks of more than 8500 lbs GVW.

Off-road mobile equipment encompasses a wide variety of equipment types that either move under their own power or are capable of being moved from site to site. Off-road mobile equipment sources are defined as those that move or are moved within a 12-month period and are covered under the EPA’s emissions regulations for nonroad mobile sources. Off-road mobile sources are vehicles and engines in the following categories:

- Agricultural equipment, such as tractors, combines, and balers;
- Aircraft, jet and piston engines;
- Airport ground support equipment, such as terminal tractors;
- Commercial marine vessels, such as ocean-going deep draft vessels;
- Commercial and industrial equipment, such as fork lifts and sweepers;
- Construction and mining equipment, such as graders and back hoes;
- Lawn and garden equipment, such as leaf and snow blowers;
- Locomotives, switching and line-haul trains;
- Logging equipment, such as shredders and large chain saws;
- Pleasure craft, such as power boats and personal watercraft;
- Railway maintenance equipment, such as rail straighteners;
- Recreational equipment, such as all-terrain vehicles and off-road motorcycles; and
- Underground mining and oil field equipment, such as mechanical drilling engines.

Road dust emissions estimates were also updated in this work are described in this report.

1.3 SCOPE OF THE MOBILE SOURCES INVENTORY

The scope of the WRAP mobile sources emission inventories is as follows:

> Geographic domain: Emissions were estimated by county for all counties in 14 states: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.
>
> Temporal resolution: Emissions were estimated for an average day in each of the four seasons, and for an average annual weekday. Seasons are defined as three-month periods: spring is March through May; summer is June through August; fall is September through November; and winter is December through February. Emissions were estimated for the 2002 base year and for three future years – 2008, 2013, and 2018.
>
> Pollutants: Emissions were estimated for primary particulate matter (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), carbon monoxide (CO), ammonia (NH_3), elemental and organic carbon (EC/OC), and sulfate (SO4).
>
> Sources: For all pollutants, emissions were estimated separately by vehicle class for on-road sources and by equipment type/engine type for off-road sources. Emissions were summarized for gasoline and diesel-fueled engines.

1.4 OVERVIEW OF APPROACH FOR ESTIMATING ON-ROAD AND OFF-ROAD MOBILE SOURCE EMISSIONS

As with most emissions sources, on-road and off-road mobile source emissions are estimated as the products of emission factors and activity estimates. Except for California, the on-road mobile sources emission factors were derived from EPA's MOBILE6 model, available at http://www.epa.gov/OMSWWW/m6.htm. Activity for on-road mobile sources is vehicle miles traveled (VMT). State and local agencies were provided default modeling inputs and VMT levels for base and future years for review and update; all states and several agencies provided updated. The California Air Resources Board (CARB) provided on-road emissions estimates by county and vehicle class directly; these were based on CARB's in-house version of their EMFAC model.

For all states except California, EPA's draft NONROAD2004 model was used to estimate so-called traditional off-road sources[1], all sources listed above except aircraft, commercial marine, and locomotives. The NONROAD model includes estimates of emission factors, activity levels, and growth factors for all traditional off-road sources. The default activity levels were provided to state agencies for input and update; however, no state provided updated off-road activity data. Emissions estimation methods for aircraft, commercial marine, and locomotives were similar to approaches EPA has recently used in developing national emission inventories. For California, CARB provided off-road emissions estimates by source category and county directly.

1.5 MOBILE SOURCE EMISSION INVENTORY WORK PRODUCTS

The following types emission of emission inventory data files were prepared for the on-road emissions, off-road emissions, and road dust emissions:

- SMOKE files for processing the emissions for use in air quality modeling. SMOKE takes the county-level emissions results and performs three primary operations: temporal allocation to days of the week and hours of the day, spatial allocation to the 36km grid cells used in the modeling, and application of speciation profiles to generate the model species needed for CMAQ modeling.
- NIF files for input to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp).
- Summary tables and graphs, available on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

Section 8 of this report provides summary tables and graphs of the estimated on-road and off-road emissions by state for the base and future years.

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[1] The final version of NONROAD (NONROAD2005, available at http://www.epa.gov/otaq/nonrdmdl.htm) was released after the work in this project was completed.

2.0 EMISSIONS MODELS USED AND ADDITIONAL CALCULATIONS FOR AIR QUALITY MODELING

On-road and off-road mobile source emissions are estimated as the products of emission factors and activity estimates. Except for California, the on-road mobile sources emission factors were derived from the EPA MOBILE6 model. Activity for on-road mobile sources is vehicle miles traveled (VMT). EPA's NONROAD2004 model was used to estimate emissions from off-road mobile sources except for aircraft, commercial marine, and locomotives. This section provides information on the versions of each model that were used in estimating emissions.

This section also provides the assumptions and data used to calculate additional pollutants that are not calculated in these models but are required for air quality modeling. Lastly, this section discusses the development of the temporal profiles used for allocation of the average day emissions to day of week and hour of day for use in air quality modeling.

2.1 EPA MOBILE6 MODEL

The MOBILE model is EPA's regulatory model for estimating on-road mobile source gram per mile emission factors for VOC (exhaust and evaporative), NO_X, CO, PM, NH_3, and SO_2. The current regulatory version of the model is MOBILE6, released in 2002. The model and supporting documentation may be found on EPA's web site at http://www.epa.gov/OMSWWW/m6.htm.

The MOBILE6 model includes the effects of all of the following "on the books" Federal regulations for on-road motor vehicles:

- Tier 1 light-duty vehicle standards, beginning with, beginning MY 1996;
- National Low Emission Vehicle (NLEV) standards, beginning MY 2001;
- Tier 2 light-duty vehicle standards beginning MY 2005, with low sulfur gasoline beginning summer 2004;
- Heavy-duty vehicle standards beginning MY 2004; and
- Heavy-duty vehicle standards beginning MY 2007, with low sulfur diesel beginning summer 2006.

MOBILE6 estimates emissions by vehicle class, for 28 vehicle classes. For the WRAP modeling, the emissions were estimated for eight vehicle classes, which are combined from these 28. The eight vehicle classes are those that were modeled in the prior generation of the mode, MOBILE5, as shown in Table 2-1.

Table 2-1. MOBILE5 vehicle classes for which emissions were estimated.

Vehicle Class	MOBILE Code	Weight Description
Light-duty gasoline vehicles (passenger cars)	LDGV	Up to 6000 lb gross vehicle weight (GVW)
Light-duty gasoline trucks[1] (pick-ups, minivans, passenger vans, and sport-utility vehicles)	LDGT1	Up to 6000 lb GVW
	LDGT2	6001-8500 lb GVW
Heavy-duty gasoline vehicles	HDGV	8501 lb and higher GVW equipped with heavy-duty gasoline engines
Light-duty diesel vehicles (passenger cars)	LDDV	Up to 6000 lb GVW
Light-duty diesel trucks	LDDT	Up to 8500 lb GVW
Heavy-duty diesel vehicles	HDDV	8501 lb and higher GVW
Motorcycles[2]	MC	

[1] Emissions for light-duty trucks are modeled separately for two weight classes with different emissions standards in the Clean Air Act

[2] Highway-certified motorcycles only are included in the model. Off-road motorcycles, such as dirt bikes, are modeled as a no-road mobile source in EPA's NONROAD model.

The particulate matter emission factors in MOBILE6 are from an earlier EPA particulates emission factor model called PART5. The tire and brake wear estimates from PART5 used in MOBILE6 are dated, and newer brake wear estimates were available (Garg et al,) and were used to develop revised brake wear emission factors, the same as used in the previous WRAP mobile sources emission inventory (Pollack et al., 2004).

2.2 EPA NONROAD MODEL

Off-road mobile equipment encompasses a wide variety of equipment types that either move under their own power or are capable of being moved from site to site. Off-road mobile equipment sources are defined as those that move or are moved within a 12-month period and are covered under the EPA's emissions regulations for nonroad mobile sources. Emissions for so-called traditional nonroad sources are estimated by EPA in their NONROAD emissions model, available on the NONROAD web page at http://www.epa.gov/otaq/nonrdmdl.htm.

At the time that the off-road emissions were estimated for this project, the latest version of the model was draft NONROAD2004. In December of 2005 final NONROAD2005 was released. The web page above provides now only the NONROAD2005 final model.

The NONROAD model includes both emission factors and default county-level population and activity data. The model therefore estimates not just emission factors but also emissions. Technical documentation of all aspects of the model can be found on the EPA NONROAD web page.

The NONROAD model includes more than 80 basic and 260 specific types of nonroad equipment, and further stratifies equipment types by horsepower rating and fuel type, in the following categories:

- airport ground support, such as terminal tractors;
- agricultural equipment, such as tractors, combines, and balers;
- construction equipment, such as graders and back hoes;
- industrial and commercial equipment, such as fork lifts and sweepers;
- recreational vehicles, such as all-terrain vehicles and off-road motorcycles;
- residential and commercial lawn and garden equipment, such as leaf and snowblowers;
- logging equipment, such as shredders and large chain saws;
- recreational marine vessels, such as power boats;
- underground mining equipment; and
- oil field equipment.

The NONROAD model does not include commercial marine, locomotive, and aircraft emissions. Emissions for these three source categories are estimated using other EPA methods and guidance documents (described in Sections 5-7). However, support equipment for aircraft, locomotive, and commercial marine operations and facilities are included in the NONROAD model.

The NONROAD model estimates emissions for six exhaust pollutants: hydrocarbons (HC), NO_X, carbon monoxide (CO), carbon dioxide (CO_2), sulfur oxides (SO_X), and PM. The model also estimates emissions of non-exhaust HC for six modes — hot soak, diurnal, refueling, resting loss, running loss, and crankcase emissions.

The NONROAD model used in this study incorporates the effects of all of the following “on the books” Federal nonroad equipment regulations:

- Emission standards for new nonroad spark-ignition engines below 25 hp;
- Phase 2 emission standards for new spark-ignition hand-held engines below 25 hp;
- Phase 2 emission standards for new spark-ignition nonhandheld engines below 25 hp;
- Emission standards for new gasoline spark-ignition marine engines;
- Tier 1 emission standards for new nonroad compression-ignition engines above 50 hp;
- Tier 1 and Tier 2 emission standards for new nonroad compression-ignition engines below 50 hp including recreational marine engines;
- Tier 2 and Tier 3 standards for new nonroad compression-ignition engines of 50 hp and greater not including recreational marine engines greater than 50 hp; and
- Tier 4 emissions standards for new nonroad compression-ignition engines above 50 hp, and reduced nonroad diesel fuel sulfur levels.

The NONROAD model provides emission estimates at the national, state, and county level. The basic equation for estimating emissions in the NONROAD model is as follows:

$$Emissions = (Pop)(Power)(LF)(A)(EF)$$

where

Pop = Engine Population
Power = Average Power (hp)
LF = Load Factor (fraction of available power)
A = Activity (hrs/yr)
EF = Emission Factor (g/hp-hr)

The national or state engine population is estimated and multiplied by the average power, activity, and emission factors. Equipment population by county is estimated in the model by geographically allocating national engine population through the use of econometric indicators, such as construction valuation. The manner in which the geographic allocation is performed is as follows:

$(County\ Population)_i\ /(National\ Population)_I = (County\ Indicator)_i\ /(National\ Indicator)_i$

where

i is an equipment application like construction or agriculture.

Activity is temporally allocated through the use of monthly, and day of week fractions of yearly activity.

The NONROAD model has default estimates for all variables and factors used in the calculations. All of these estimates are in model input files, and can be changed by the user if data more appropriate to the local area are available.

2.3 CALIFORNIA MODELS

The California Air Resources Board (CARB) provided on-road and off-road emissions data for base and future years for use in this project. CARB has developed their own models for on-road and off-road emissions estimation. CARB's on-road model is referred to as EMFAC. The version of the model that was used to generate the CARB on-road emissions was EMFAC2002 (available at http://www.arb.ca.gov/msei/on-road/latest_version.htm), with internal updates for some of the activity data that were not publicly available.

For many years, CARB has been developing its own off-road emissions model, called OFFROAD. Although CARB has developed most of the model inputs as part of their analyses in support of their off-road equipment regulations, the model has never been publicly released.

For all California emissions, CARB provided their emissions estimates for the base and future years. Emissions data only were proved, not activity data and emission factors. Details on the data that CARB provided for each source category are provided in Sections 3 through 7.

2.4 POLLUTANTS ADDED FOR AIR QUALITY MODELING

For CMAQ modeling, additional model species are required beyond what is estimated in MOBILE, NONROAD, EMFAC, and OFFROAD. Specifically, particulate matter needed to be split into elemental carbon (EC), organic carbon (OC), and sulfate (SO_4); and NO_X needed to be split into NO and NO_2.

EC and OC were estimated by applying EC/OC fractions to the PM_{10} and $PM_{2.5}$ emissions estimates. The EC/OC splits used for these calculations are summarized in Table 2-2. These are the same EC/OC fractions used in the previous WRAP mobile sources emissions estimates; their derivation is described in Pollack et al., 2004. Sulfate was then estimated as PM – EC – OC, for both PM10 and PM2.5. Coarse PM is calculated as PM10 – PM2.5

Table 2-2. Elemental carbon/organic carbon fractions.

Process/Pollutant	EC	OC	Source
Gasoline Exhaust	23.9%	51.8%	Gillies and Gertler, 2000
Light-Duty Diesel Exhaust	61.3%	30.3%	Gillies and Gertler, 2000
Heavy-Duty Diesel Exhaust	75.0%	18.9%	Gillies and Gertler, 2000
Tire Wear	60.9%	21.75%	Radian, 1988
Brake Wear	2.8%	97.2%	Garg et al, 2000

While there have been several studies and reviews of particulate composition (e.g. EPA, 2001 and Turpin and Lim, 2000) since the time of the work referenced in Table 2-2, there has not been a comparable comprehensive evaluation of particulate composition. Many particulate source/receptor statistical modeling efforts have been attempted, but all used source profiles that predate those listed in Table 2-2. A comprehensive evaluation of source profiles needs to include the effect of the proper age distribution and maintenance history of in-use vehicles. No recent studies have investigated the source profiles using such an evaluation, and so could not be used for this work. In addition, the default EPA resource for compositional estimates of emissions, SPECIATE, has not provided any revised profiles since October 1999.

The ratio of NO to NO2 for NOx emissions from mobile sources is a result of the chemical equilibrium formed during internal combustion with NO the primary constituent of NOx. Aftertreatment devices may begin to perturb the ratio of NO and NO2 as NOx and particulate control are applied to diesel engines (Tonkyn, 2001, Herndon, 2002, and Chatterjee, 2004). However, these systems have not yet been widely employed, so it is not possible to judge what the proportion of NOx that NO and NO2 will be in the future. For this work the EPA default proportions of NO and NO2 (90/10) were used to apportion the NOx emission estimates.

2.5 TEMPORAL PROFILES

The on-road and off-road emissions are estimated as average day, per season. For use in air quality modeling, these average day emissions must be temporally allocated to the 24 hours of the day for each day of the week. This temporal allocation is done in the SMOKE emissions processing system. The EPA temporal profiles for on-road and off-road emissions were reviewed and found to be deficient for on-road sources. The EPA defaults for on-road temporal profiles vary only by weekday vs. weekend; for both weekdays and weekends the 24-hour profiles do not vary by vehicle class. And there are only two day of week profiles – one for light-duty gasoline vehicles and one for all vehicle classes.

ENVIRON has analyzed an extremely large database of detailed traffic counter data by vehicle class, roadway type, and state under contract to EPA (Lindhjem, 2004). From this work using national databases of vehicle activity maintained by the Federal Highway Administration (FHWA), revised temporal profiles for on-road sources were developed. The databases used were the FHWA Traffic Volume Trends (http://www.fhwa.dot.gov/policy/ohpi/travel/index.htm) for temporal activity of vehicles, and the FHWA Vehicle Travel Information System (VTRIS) (http://www.fhwa.dot.gov/ohim/ohimvtis.htm) that identifies individual vehicle classes to estimate temporal variation in the vehicle mix. Three sets of profiles were developed: day of week profiles by vehicle class (Figure 2-1); hour of day profiles for weekdays, by vehicle class (Figure 2-2); and hour of day profiles for weekends, by vehicle class (Figure 2-3). These temporal profiles show important differences in vehicle activity by vehicle class across the days of the week and the hours of the day.

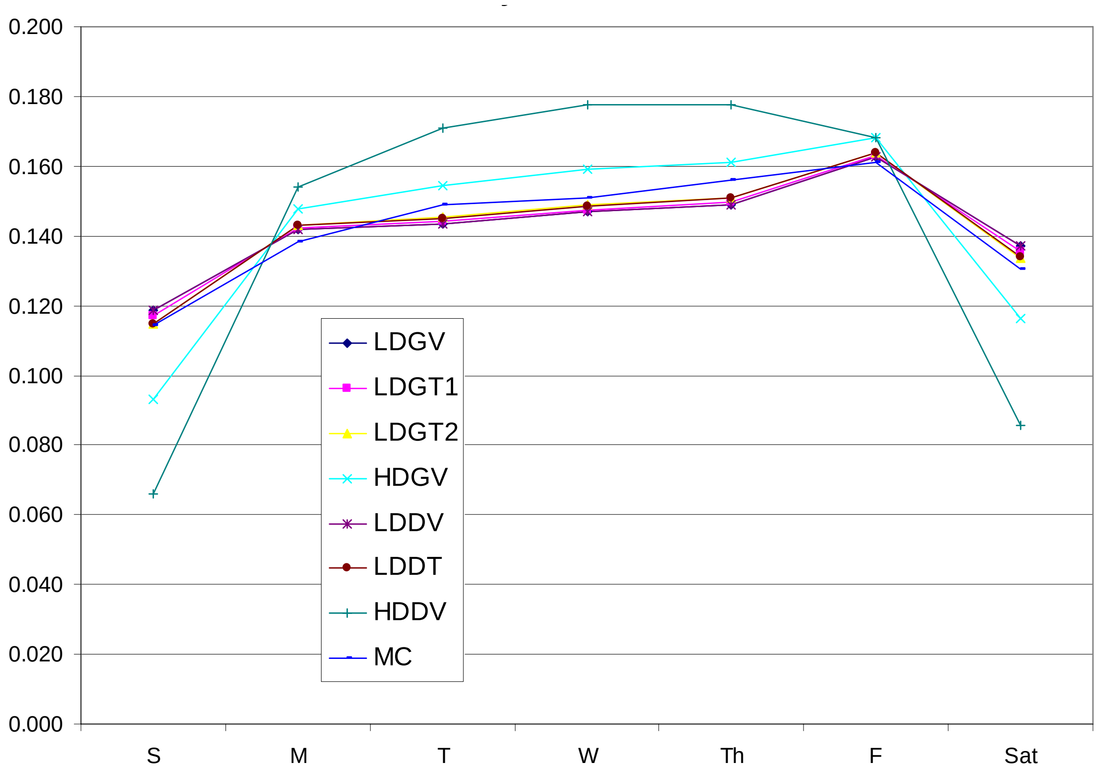


Figure 2-1. Day of week profiles by vehicle class.

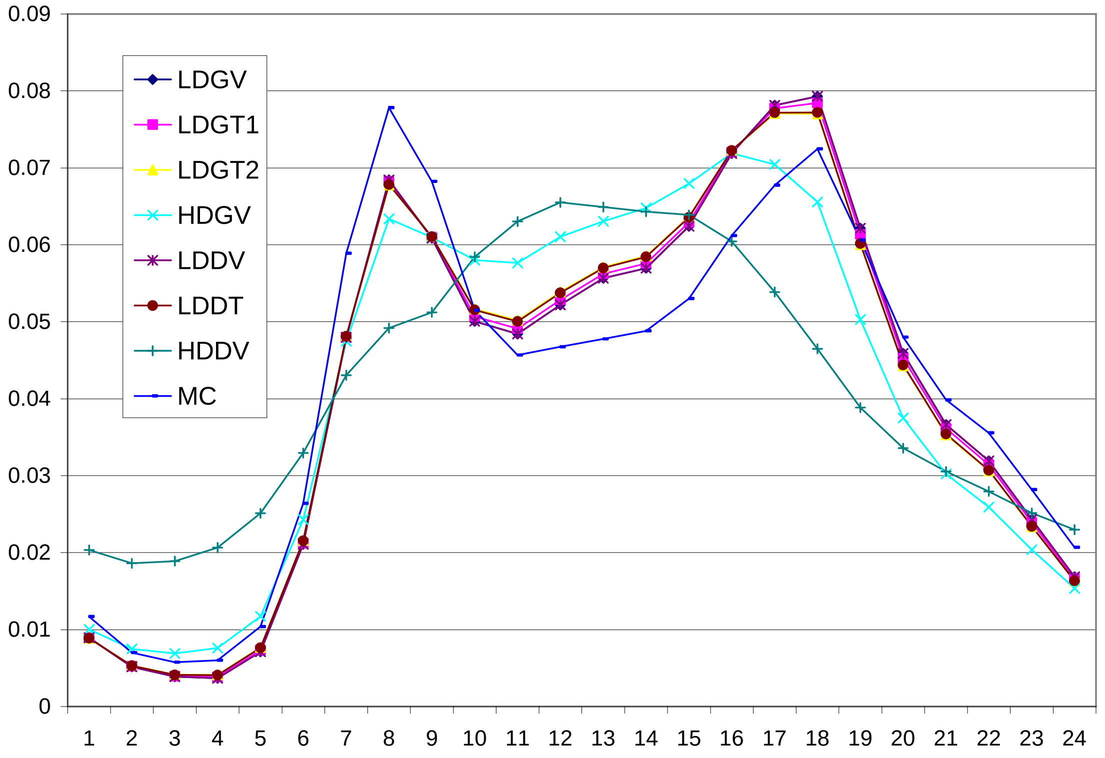


Figure 2-2. Weekday hour of day profiles by vehicle class.

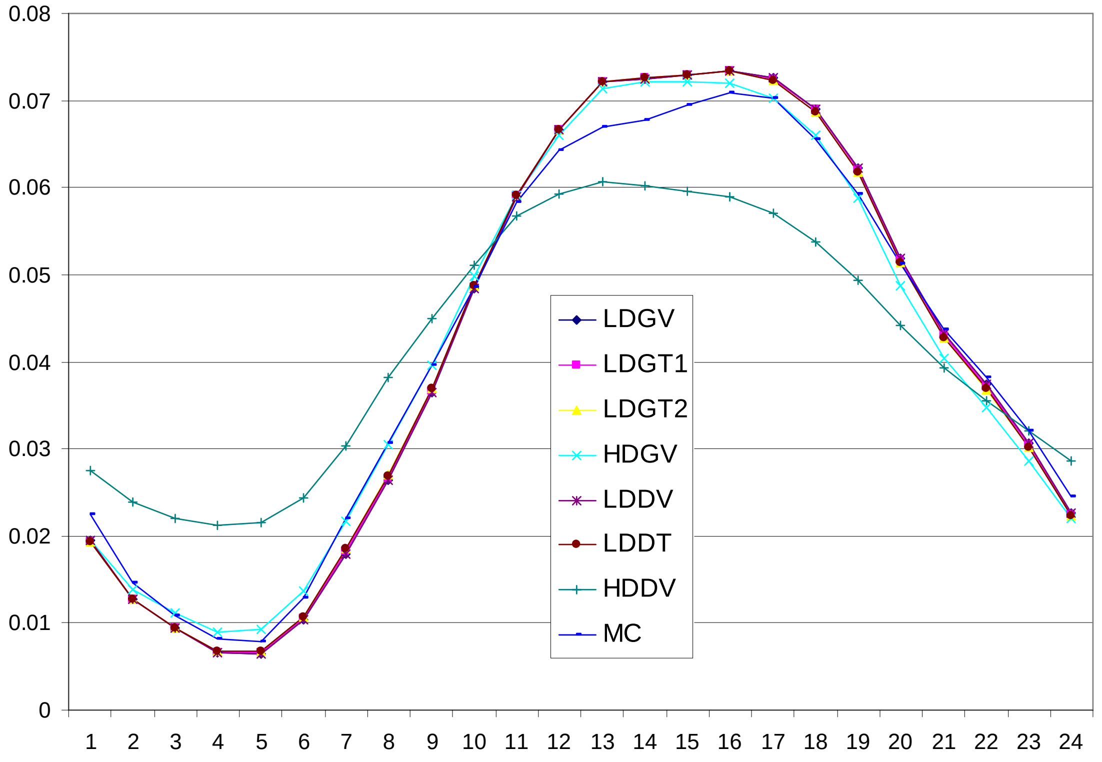


Figure 2-3. Day of week profiles by vehicle class.

3.0 ON-ROAD VEHICLE EMISSIONS METHODOLOGY

This section describes the emissions model inputs and calculations performed for estimating 2002 base year and 2008/2013/2018 future year on-road emissions, using EPA's MOBILE6 model. The generation of SMOKE files for input into the air quality model is also described. To estimate on-road emissions, defaults were established for all mobile source model input parameters, and also for vehicle miles traveled (VMT) estimates. These default inputs were sent to state and local air quality planning agencies in the WRAP states (except for California), and they were requested to provide the most up-to-date modeling and VMT inputs.

Updated data and model inputs provided by state and local contacts are described below. All state agencies responded to the survey requests for base and future year modeling inputs. In addition, survey responses were received from the local agencies for the following counties:

- Arizona – Pima and Maricopa
- Colorado – Denver nonattainment area counties
- Nevada – Clark and Washoe
- New Mexico – Bernalillo

For California, the Air Resources Board provided emissions estimates directly for all years, estimated using an internal version of the EMFAC2002 model, with updated activity data for some areas.

3.1 VMT ESTIMATES

The default VMT data used as the starting point in this analysis were the annual VMT estimates that EPA had compiled for the 2002 National Emission Inventory (NEI2002), in the county database for the National Mobile Inventory Model (NMIM, available at http://www.epa.gov/OMSWWW/nmim.htm). EPA had derived the VMT estimates from Highway Performance Monitoring System (HPMS) data from the Federal Highway Administration (FHWA). State and local data provided to EPA as part of the June 2004 Consolidated Emissions Reporting Rule (CERR) submittal were incorporated into the default VMT estimates. These default VMT estimates, by county, vehicle type, and roadway type, were posted to the WRAP Mobile Sources Update Project web page, and a survey form was sent to state and local air quality planners asking them to review the estimates and provide updates where available. By default the annual VMT were assumed to be allocated evenly to each season; two states (WA and UT) had provided seasonal VMT allocation data that was included in the default modeling inputs files posted.

Most of the state and local agencies that responded to the survey provided updated VMT estimates. The areas for which updates were not provided and the state or local agency accepted the NMIM defaults were: Arizona - all counties except Maricopa; Denver area; North Dakota; South Dakota; and Washington. In most of these cases, the VMT estimates had been previously provided to EPA under the CERR and had already been incorporated into the NMIM database.

3.2 MOBILE6 INPUTS

EPA's MOBILE6 model was used to estimate on-road VOC, CO, NOx, PM, SO2, and NH3 emission factors. Default MOBILE6 inputs were sent to the state and local agencies for review and updating. The default inputs were primarily derived from the NMIM database as discussed above. For fuel inputs, however, fuel survey data were analyzed to develop default modeling inputs. The subsections below discuss these inputs and updates made by the state and local agencies for use in the WRAP MOBILE6 modeling.

3.2.1 Speed

Speed is an important input to the MOBILE6 model emission factor calculations, as MOBILE6 has significant non-linear speed correction factors by roadway type. The default speeds were those used by EPA in the NEI2002 (EPA/Pechan, 2005), as shown in Table 3-1. Local speed data were provided by Utah, Wyoming, Idaho, and Maricopa Co (AZ). Except for Utah, the AVERAGE SPEED command was used to provide average speeds by roadway type for each vehicle class. Utah provided more detailed speed distribution information, and the SPEED VMT command was used for MOBIL6 runs for all Utah counties.

Table 3-1. Default speeds by road type and vehicle type (mph), from NEI2002.

Urban						
	Interstate	**Other Freeways & Expressways**	**Principal Arterial**	**Minor Arterial**	**Collector**	**Local**
Light-duty vehicles	45	45	20	20	20	20
Light-duty trucks	45	45	20	20	20	20
Heavy-duty vehicles	35	35	15	15	15	15
Rural						
	Interstate	**Principal Arterial**	**Minor Arterial**	**Major Collector**	**Minor Collector**	**Local**
Light-duty vehicles	60	45	40	35	30	30
Light-duty trucks	55	45	40	35	30	30
Heavy-duty vehicles	40	35	30	25	25	25

The twelve HPMS roadway types shown in Table 3-1 were assigned to the MOBILE6 roadway types. MOBILE6 freeway roadway type was assigned to rural interstates, urban interstates, and urban other freeways and expressways. The MOBILE6 arterial roadway type was assigned to rural arterials, rural minor arterials, rural major collectors, rural minor collectors, rural locals, urban principal arterials, urban minor arterials, and urban collectors. The MOBILE6 local roadway type was assigned to urban locals.

3.2.2 Meteorological and Altitude Inputs

The default temperature and humidity inputs were actual 2002 seasonal temperatures, derived from the NMIM database for the NEI2002 (EPA/Pechan, 2005). These data were determined from 2002 observations from the National Climatic Data Center (NCDC).

Default altitudes were also extracted from the NMIM database for the NEI2002, as determined by EPA. In the NMIM database, all counties in the States of Colorado, Nevada, New Mexico, and Utah (except Washington County) are modeled as high altitude areas; all counties in all other States are treated as low altitude.

For the WRAP modeling, updated meteorological and/or altitude inputs were provided for all counties in Arizona, Idaho, Utah, and Wyoming.

3.2.3 Control Programs

Vehicle emission factors are affected by federal and local control programs. MOBILE6 includes the effects of all "on-the-books" federal control programs, as described in Section 2. Local control programs are implemented in CO or ozone nonattainment areas, and include vehicle Inspection and Maintenance (I/M) programs, Anti-Tampering Programs (ATP), oxygenated fuel programs, and local fuel regulations. Some areas also have Stage II (at-the-pump) vehicle refueling controls; however, refueling emissions are not included in this analysis (they are included in the WRAP area source emissions). Table 3-2 lists the counties modeled with I/M programs. The latest control program inputs were provided for all of these counties.

Table 3-2. Counties modeled with an inspection and maintenance program.

State	County
AK	Anchorage
AK	Fairbanks
AZ	Maricopa
AZ	Pima
CO	Adams
CO	Arapahoe
CO	Boulder
CO	Broomfield
CO	Douglas
CO	Jefferson
CO	Denver
CO	El Paso
CO	Larimer
CO	Weld
ID	Ada
NM	Bernalillo
NV	Clark
NV	Washoe
OR	Clackamas
OR	Jackson
OR	Multnomah
OR	Washington
UT	Davis
UT	Salt Lake
UT	Weber
UT	Utah
WA	Clark
WA	King

State	County
WA	Snohomish
WA	Spokane
WA	Pierce

Oxygenated fuel programs are in place in some areas as a provision for maintaining air quality standards. In other areas, there is oxygen in the fuels although not required as part of State Implementation Plan. Fuel inputs were developed from the 2002 fuel survey as described below.

3.2.4 External Files

MOBILE6 allows the user to supply a number of external files to override model defaults. Of these, the registration distribution is perhaps the most key for this effort. The registration distribution defines the age mix of each vehicle type – the fraction of registered vehicles from each of 25 model years for each vehicle type. For areas that did not provide their own registration distributions, the MOBILE6 national defaults were used. Local registration distributions were provided for counties in Arizona, Colorado, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Other external files were provided by a few areas: Clark County provided VMT fractions, VMT by hour, and hourly starts distributions; Utah provided speed bin distributions; and Idaho DEQ provided VMT fractions for Ada and Canyon Counties.

3.2.5 On-Road Fuel Properties

Seasonal fuel properties were specified for all counties for MOBILE6 runs. The fuel properties include RVP, oxygenated fuel specifications (oxygen type, volume or weight percent, and market share), and gasoline and diesel sulfur levels.

For most states, fuel specifications were determined by Sierra Research from an analysis of 2002 city-specific fuel survey data from the Alliance of Automobile Manufacturers and regional survey data published by TRW/Northrop-Grumman (formerly the National Institute for Petroleum and Energy Research, NIPER). A more complete discussion of Sierra Research's methods for compiling the data, and a listing of the resulting default fuel properties, are in Appendix A.

Although many state and local agencies had provided EPA MOBILE6 input files for use in NEI2002, EPA did not incorporate the fuel inputs from these files unless *all* fuel parameters required for estimating both criteria air pollutants (CAPs) and hazardous air pollutants (HAPs) were provided, and of the WRAP states only CO and WA had done so. Almost all areas provided updated fuel inputs for use in the modeling.

The WRAP modeling was done on a seasonal basis, with three-month seasons: spring is March through May; summer is June through August; fall is September through November; and winter is December through February. In several areas, oxygenated fuels programs changed mid-season (i.e., in the midst of the WRAP three-month seasons). In those cases, average values were used for each fuel parameter for the three months in the season. Sensitivity analyses were performed to evaluate the effect of averaging fuel oxygenate and/or RVP content to represent a seasonal run relative to averaging the emissions from individual monthly runs, and the effects were found to be very small, less than 1%.

3.3 SEASONAL EMISSIONS CALCULATIONS

After creating MOBILE6 input files using the inputs discussed above, MOBILE6 was run for each county in each season, by roadway type. The MOBILE6 seasonal emission factors were then multiplied by the seasonal VMT. These seasonal emission calculations were performed at the SCC level; i.e., for each seasonal VMT value representing a given county, vehicle type, and roadway type, the corresponding emission factor was multiplied by the VMT value. The speed and MOBILE6 roadway type were used to determine the appropriate roadway type of the emission factors. For summary files, emissions were then aggregated by light- and heavy-duty vehicles and by diesel and gasoline fuel types for each county and season. These summary files of the seasonal emissions by county were posted to the project web page (http://wrapair.org/forums/ef/UMSI/index.html). Annual emissions were also calculated and are available by county and by state in the spreadsheets posted to the project web page.

3.4 FUTURE YEAR EMISSIONS

Once the 2002 base year emissions survey responses were all received and processed, another survey was sent to state and local agencies to request VMT and modeling inputs for estimating on-road emissions for the three future years – 2008, 2013, and 2018. Default VMT and modeling inputs for all three future years were provided with the survey, and recipients were asked to provide updated VMT and modeling inputs where available. The surveys were sent to the same state and local contacts who replied to the 2002 base year survey; all responded with updates for the future year modeling.

3.4.1 VMT Growth Factors

The default VMT levels were generated using the same growth factors as used in the previous WRAP mobile sources modeling (Pollack et al., 2004). The spreadsheets provided with the survey included VMT estimates for each year and also the growth factors used to grow the VMT from 2002 to each of the three future years (except for Alaska, which was not included in the earlier WRAP mobile sources modeling). VMT updates were provided by many states, and Alaska provided new VMT growth factors.

Figure 3-1 shows the overall VMT growth rates by state. For several states, growth rates were provided by county, but for this figure the growth rates are for the aggregate VMT across all counties in each state.

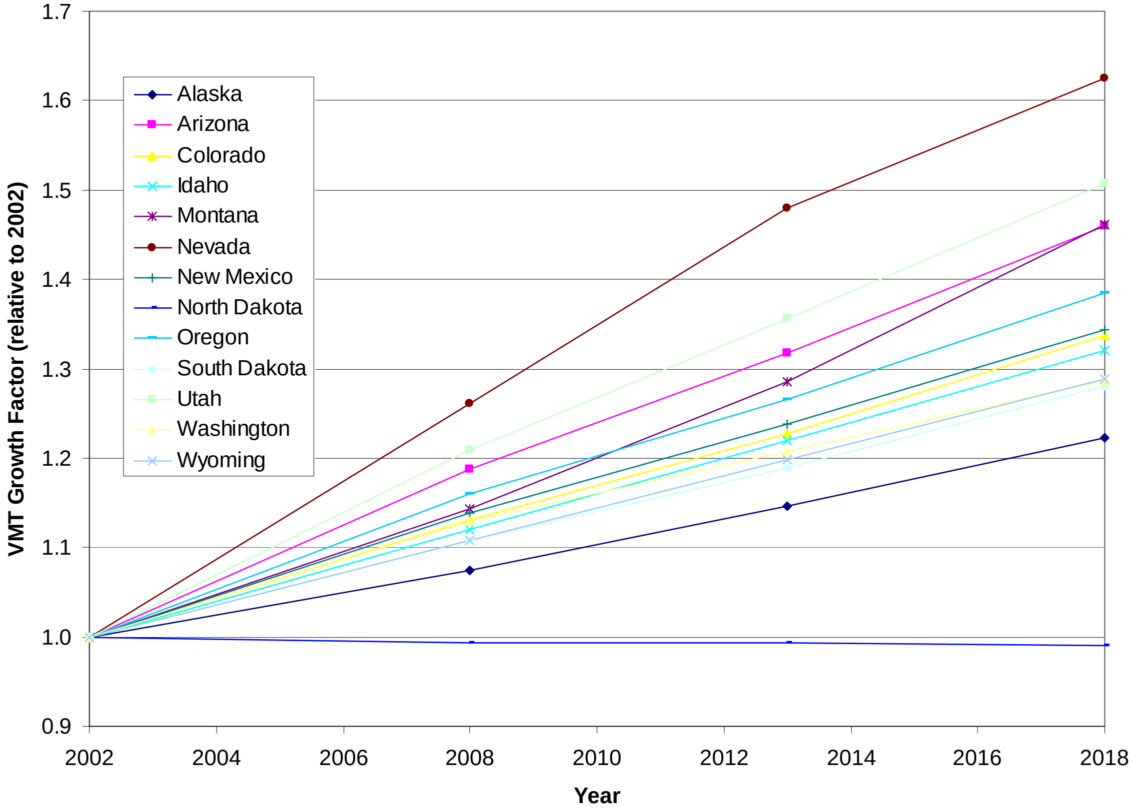


Figure 3-1. Statewide VMT growth rates, 2002 to 2018.

3.4.2 MOBILE6 Inputs

Default MOBILE6 inputs for all three future years were provided in spreadsheets and sent to the state and local contacts. These defaults were the same input data and files as the 2002 base year modeling that had been compiled from the base year survey as described above, except for fuel specifications. Default fuel sulfur levels were set to the levels mandated by federal regulation: 30 ppm for gasoline sulfur (required by the federal Tier 2 regulations), and 15 ppm for on-road diesel sulfur (required by the federal HDDV 2007 regulations).

Before the future year modeling was done, the State of Washington passed a bill that gradually phases out I/M by 2020. In its place, Washington was adopting the California Low Emission Vehicle (LEV) II program. The Washington Department of Ecology survey contact said that because it was difficult to account for the CA LEV II program in their MOBILE6 modeling, they kept the I/M program parameters in place (Otterson, 2005).

Oregon has also adopted temporary rules for an Oregon LEV program, and the Oregon DEQ is scheduled to propose permanent adoption of the Oregon LEV standards in the summer of 2006. The program requires that new motor vehicles sold in Oregon meet California's vehicle emission standards beginning with model year 2009. Because this rule was not a permanent rulemaking, its effects are not included in the MOBILE6 modeling.

The emissions benefits of adoption of the CA LEV program are controversial. With the many differences between the federal Tier 2 and California LEV program, it is very difficult to accurately estimate the differences, and MOBILE6 is not set up to model adoption of the CA LEV program. There have been studies in which the effects were estimated for some areas (NESCAUM/CSI, 2003; ERG/CSI, 2004), and other states considering adoption rely on these studies. Oregon's Fact Sheet about their proposed rule refers to Washington's analysis, which in turn relied on NESCAUM's analysis: "The state of Washington has estimated that by 2020, California standards will reduce smog-forming emissions and air toxics by approximately 5% to 8% more than would be achieved by the federal standards and 11% to 16% beyond federal standards by 2030. Washington also estimates a 17% reduction of green house gas emissions by 2020 and 27% by 2030 as a result of the California standards. DEQ expects that similar benefits would be achieved in Oregon."

3.5 PROCESSING OF CALIFORNIA EMISSIONS

CARB provided on-road emissions that were generated using their EMFAC2002 model, with updated activity data that is not yet available in the publicly accessible version of the model. CARB provided average (ton per day, TPD) weekday county-level annual, summer, and winter emissions for on-road vehicles for calendar years 2002, 2008, 2010, 2015, and 2020. These emissions were provided by vehicle type but not by roadway type, as EMFAC does not have emission factors by roadway type.

A number of processing steps were required to generate on-road emissions for California that are similar in content and format to the emissions for the remaining WRAP states:

- Calendar year 2013 emissions were interpolated from CARB's emissions for years 2010 and 2015.
- The weekday emissions were converted to average day using the day-of-week temporal profiles described in Section 2.
- The vehicle types in CARB's EMFAC model are different from those in MOBILE. The vehicle types were mapped to the eight MOBILE5 vehicle types. CARB provided a cross-reference file for this purpose.
- Per discussion with CARB, spring and fall emissions were estimated as
  (4 * annual TPD – summer TPD – winter TPD)/2
- The CARB files did not include ammonia emissions. Ammonia emissions were estimated using scaling factor based on SO2 emissions. The scaling factors were derived using the CARB 2002 fuel sulfur content and statewide average gasoline and diesel fuel economy (obtained from a statewide EMFAC2002 run).

When these steps were run, the estimation of additional pollutants and generation of SMOKE and NIF files proceeded as for the rest of the WRAP states, as described below.

3.6 GENERATION OF SMOKE AND NIF FILES

Emissions files were generated in the format needed for SMOKE emissions processing. For these files, and for use in air quality modeling, the additional pollutants described in Section 2 were calculated. Seasonal emissions SMOKE files were generated only for years 2002 and 2018, the years for which the WRAP air quality modeling is performed. The pollutants included in the SMOKE files are VOC (exhaust, evaporative, and total), NO_X, CO, NH3, SO_2, PM10, EC10, OC10, SO4(10), PM2.5, EC2.5, OC2.5, SO4(2.5), coarse PM (PMC), NO, and NO2.

Separate files were prepared for California and all other WRAP states, by year and by season. The SMOKE files for the thirteen non-California states include emissions by county, roadway type, and vehicle type. Table 3-3 shows the source classification codes (SCC) for the on-road emissions categorized by vehicle type and HPMS roadway classification. As CARB's EMFAC model does not differentiate by roadway type, the SMOKE files generated for California are categorized by county and vehicle type only. The SCCs in the SMOKE files for the California on-road emissions are shown in Table 3-4.

Annual emissions files in EPA's National Inventory Format (NIF) were also prepared and submitted to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp). These NIF files contain a smaller set of pollutants; the additional pollutants needed for air quality modeling are not included. Annual emissions NIF files were prepared for each of the four years modeled, separately for California and non-California states, using the SCCs in Tables 3-3 and 3-4.

Summary spreadsheets, tables, and graphs were also prepared, and were posted on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

Table 3-3. SCC codes for on-road emissions in SMOKE files (non-California states).

SCC	Vehicle Class	Facility Type
2201001110	LDGV	Rural Interstate
2201001130	LDGV	Rural Other Principal Arterial
2201001150	LDGV	Rural Minor Arterial
2201001170	LDGV	Rural Major Collector
2201001190	LDGV	Rural Minor Collector
2201001210	LDGV	Rural Local
2201001230	LDGV	Urban Interstate
2201001250	LDGV	Urban Other Freeways and Expressways
2201001270	LDGV	Urban Other Principal Arterial
2201001290	LDGV	Urban Minor Arterial
2201001310	LDGV	Urban Collector
2201001330	LDGV	Urban Local
2201020110	LDGT1	Rural Interstate
2201020130	LDGT1	Rural Other Principal Arterial
2201020150	LDGT1	Rural Minor Arterial
2201020170	LDGT1	Rural Major Collector
2201020190	LDGT1	Rural Minor Collector
2201020210	LDGT1	Rural Local
2201020230	LDGT1	Urban Interstate
2201020250	LDGT1	Urban Other Freeways and Expressways
2201020270	LDGT1	Urban Other Principal Arterial
2201020290	LDGT1	Urban Minor Arterial
2201020310	LDGT1	Urban Collector
2201020330	LDGT1	Urban Local
2201040110	LDGT2	Rural Interstate
2201040130	LDGT2	Rural Other Principal Arterial

SCC	Vehicle Class	Facility Type
2201040150	LDGT2	Rural Minor Arterial
2201040170	LDGT2	Rural Major Collector
2201040190	LDGT2	Rural Minor Collector
2201040210	LDGT2	Rural Local
2201040230	LDGT2	Urban Interstate
2201040250	LDGT2	Urban Other Freeways and Expressways
2201040270	LDGT2	Urban Other Principal Arterial
2201040290	LDGT2	Urban Minor Arterial
2201040310	LDGT2	Urban Collector
2201040330	LDGT2	Urban Local
2201070110	HDGV	Rural Interstate
2201070130	HDGV	Rural Other Principal Arterial
2201070150	HDGV	Rural Minor Arterial
2201070170	HDGV	Rural Major Collector
2201070190	HDGV	Rural Minor Collector
2201070210	HDGV	Rural Local
2201070230	HDGV	Urban Interstate
2201070250	HDGV	Urban Other Freeways and Expressways
2201070270	HDGV	Urban Other Principal Arterial
2201070290	HDGV	Urban Minor Arterial
2201070310	HDGV	Urban Collector
2201070330	HDGV	Urban Local
2201080110	MC	Rural Interstate
2201080130	MC	Rural Other Principal Arterial
2201080150	MC	Rural Minor Arterial
2201080170	MC	Rural Major Collector
2201080190	MC	Rural Minor Collector
2201080210	MC	Rural Local
2201080230	MC	Urban Interstate
2201080250	MC	Urban Other Freeways and Expressways
2201080270	MC	Urban Other Principal Arterial
2201080290	MC	Urban Minor Arterial
2201080310	MC	Urban Collector
2201080330	MC	Urban Local
2230001110	LDDV	Rural Interstate
2230001130	LDDV	Rural Other Principal Arterial
2230001150	LDDV	Rural Minor Arterial
2230001170	LDDV	Rural Major Collector
2230001190	LDDV	Rural Minor Collector
2230001210	LDDV	Rural Local
2230001230	LDDV	Urban Interstate
2230001250	LDDV	Urban Other Freeways and Expressways
2230001270	LDDV	Urban Other Principal Arterial
2230001290	LDDV	Urban Minor Arterial
2230001310	LDDV	Urban Collector
2230001330	LDDV	Urban Local
2230060110	LDDT	Rural Interstate
2230060130	LDDT	Rural Other Principal Arterial
2230060150	LDDT	Rural Minor Arterial
2230060170	LDDT	Rural Major Collector

SCC	Vehicle Class	Facility Type
2230060190	LDDT	Rural Minor Collector
2230060210	LDDT	Rural Local
2230060230	LDDT	Urban Interstate
2230060250	LDDT	Urban Other Freeways and Expressways
2230060270	LDDT	Urban Other Principal Arterial
2230060290	LDDT	Urban Minor Arterial
2230060310	LDDT	Urban Collector
2230060330	LDDT	Urban Local
2230070110	HDDV	Rural Interstate
2230070130	HDDV	Rural Other Principal Arterial
2230070150	HDDV	Rural Minor Arterial
2230070170	HDDV	Rural Major Collector
2230070190	HDDV	Rural Minor Collector
2230070210	HDDV	Rural Local
2230070230	HDDV	Urban Interstate
2230070250	HDDV	Urban Other Freeways and Expressways
2230070270	HDDV	Urban Other Principal Arterial
2230070290	HDDV	Urban Minor Arterial
2230070310	HDDV	Urban Collector
2230070330	HDDV	Urban Local

Table 3-4. SCC codes for California on-road emissions in SMOKE files.

SCC	Vehicle Class
2230070000	HDDV
2230060000	LDDV
2230000000	LDDV
2201070000	HDGV
2201020000	LDGT1
2201040000	LDGT2
2201000000	LDGV
2201080000	MC

4.0 OFF-ROAD EQUIPMENT EMISSIONS METHODOLOGY

This section describes the methods for estimating 2002 base year and 2008/2013/2018 future year emissions for so-called traditional off-road equipment. Equipment types included here are in the following categories:

- airport ground support, such as terminal tractors;
- agricultural equipment, such as tractors, combines, and balers;
- construction equipment, such as graders and back hoes;
- industrial and commercial equipment, such as fork lifts and sweepers;
- recreational vehicles, such as all-terrain vehicles and off-road motorcycles;
- residential and commercial lawn and garden equipment, such as leaf and snowblowers;
- logging equipment, such as shredders and large chain saws;
- recreational marine vessels, such as power boats;
- underground mining equipment; and
- oil field equipment.

Seasonal average daily emissions were estimated for the thirteen non-California western states using EPA's NONROAD model. To estimate emissions from these sources, defaults were established for all NONROAD model input parameters. These default inputs were sent to state and local air quality planning agencies in the WRAP states (except for California), and they were requested to provide the most up-to-date modeling. For California, the Air Resources Board (CARB) provided all off-road emissions estimates from their own modeling system, which has similar equipment types.

The methodology for estimating emissions for the other off-road sources – locomotive, aircraft, and commercial marine – are covered in the following three sections.

4.1. NONROAD MODELING

As discussed in Section 2, the NONROAD2004 model was used to estimate off-road emissions for the non-California WRAP states. The model was run for each county for each season in the base and future years.

The NONROAD model estimates emissions, and includes defaults for all inputs affecting the emissions. The modeling inputs include fuel composition, ambient temperatures, equipment population and activity data, and equipment population growth factors.

For nonroad diesel fuel sulfur levels, 2002 defaults were derived by Sierra Research from analysis of 2002 city-specific fuel survey data from the Alliance of Automobile Manufacturers and regional survey data published by TRW/Northrop-Grumman (formerly the National Institute for Petroleum and Energy Research, NIPER). A more complete discussion of Sierra Research's methods for compiling the data, and a listing of the resulting default fuel properties, are in Appendix B. Future year nonroad diesel default sulfur levels were set to those required by the federal Tier 4 nonroad diesel rule – 500 ppm in 2008, and 15 ppm in 2013 and 2018.

A survey letter and accompanying spreadsheets were sent to state and local air quality agency contacts, to request review of the default modeling inputs and any updates that the agencies could provide. Apart from temperatures, which many agencies provided, few updated modeling inputs were provided. The Alaska DEC and a few other agencies provided updated gasoline sulfur levels (the same as used in the MOBILE6 modeling as discussed in Section 2) and nonroad diesel fuel sulfur levels (note that Alaska has some exemptions from the federal rule).

Key inputs for determining NONROAD equipment emissions and the equipment population and activity data, and allocation factors. As described in Section 2, NONROAD equipment population by county is estimated in the model by geographically allocating national engine population through the use of econometric indicators, such as construction valuation. EPA encourages state and local agencies to develop local data from surveys, but such work is expensive and difficult to carry out, and only a few agencies in the country have done so. However, some information is available at state agencies for population allocations, e.g., recreational boat registration data. Updated allocation files were used for some categories in Arizona and Wyoming, based on previous work done by ENVIRON for AZ DEQ (Pollack et al., 2004) and WY DEQ (Pollack et al., 2005). In addition, updated allocation files were provided for some categories for Colorado and Washington.

Updated agricultural equipment populations were developed based on the US Department of Agriculture's 2002 Census of Agriculture, available at http://www.nass.usda.gov/Census_of_Agriculture/index.asp. This survey provides estimates of the in-use equipment populations used for agriculture in each county of the US, and was used to develop equipment population files to replace the defaults in EPA's NONROAD2004 model. State total populations for agricultural equipment (by equipment type) were extracted from the Census of Agriculture, and were used to revise the NONROAD2004 model state populations.

For estimating future year emissions, the NONROAD model incorporates the effects of all "on the books" regulations, as described in Section 2. The model contains growth factors for all equipment types, which have been derived by EPA from a proprietary database of equipment sales for several years. No state or local agency provided alternative growth factors, so the model defaults were used in all cases.

The NONROAD model estimates county-level emissions of VOC, NOx, CO, PM10, PM2.5, and SO2; other pollutants were estimated as described below. For reporting, emissions were summed across equipment types by source category and by either gasoline or diesel fuel groupings. CNG and LPG-powered equipment, which account for only a small fraction of emissions, were lumped into the gasoline category.

The NONROAD model outputs weekday emissions. Weekday-to-average-day adjustment factors were applied to all emissions, based on temporal adjustment factors developed by EPA that are internal to the model. In addition, EPA's NONROAD Reporting Utility THC-to-VOC conversion factors were also applied, as the NONROAD core model outputs total hydrocarbons only.

4.2 PROCESSING OF CALIFORNIA EMISSIONS

CARB provided emissions estimates for traditional off-road equipment types that were generated using internal models and spreadsheets. CARB provided county-level average day emissions for some sources and average weekday emissions for others; and annual totals for some sources, summer/winter seasonal for others. For most source categories, emissions were provided for years 2002, 2008, 2010, 2015, and 2018.

A number of processing steps were required to generate off-road emissions for California that are similar in content and format to the emissions for the remaining WRAP states:

- CARB's emissions estimates did not include the effects of EPA's Tier 4 nonroad diesel equipment standards. Adjustment factors by equipment type were developed from a NONROAD run with and without Tier 4 controls. (This is not an option when running the NONROAD model. Rather, modified NONROAD tech.dat file was developed for this purpose.)
- For those sources where weekday emissions were provided, the weekday emissions were converted to average day using the EPA NONROAD model day-of-week temporal profiles.
- Emissions for year 2013 were linearly interpolated from CARB's 2010 and 2015, if 2013 emissions were not provided.
- The CARB equipment type codes were matched to EPA NONROAD equipment codes (SCCs) using a CARB cross-reference file.
- For those sources where annual, summer, and winter emissions were provided, spring and fall emissions were estimated as
  (4 * annual TPD – summer TPD – winter TPD)/2
- For those sources for which only annual emissions were provided, seasonal emissions were estimated using the seasonal allocation factors for California in the NONROAD model.
- The CARB files did not include ammonia emissions. Ammonia emissions were estimated using scaling factor based on SO2 emissions, derived using gasoline and nonroad diesel fuel sulfur values provided by CARB.

When these steps were run, the estimation of additional pollutants and generation of SMOKE and NIF files proceeded as for the rest of the WRAP states, as described below.

4.3 GENERATION OF SMOKE AND NIF FILES

Emissions files were generated in the format needed for SMOKE emissions processing. For these files, and for use in air quality modeling, the additional pollutants described in Section 2 were calculated. Seasonal emissions SMOKE files were generated only for years 2002 and 2018, the years for which the WRAP air quality modeling is performed. The pollutants included in the SMOKE files are VOC, NO_X, CO, NH3, SO_2, PM10, EC10, OC10, SO4(10), PM2.5, EC2.5, OC2.5, SO4(2.5), coarse PM (PMC), NO, and NO2.

Separate files were prepared for California and all other WRAP states, by year and by season. The SMOKE files for the thirteen non-California states include emissions by county and nonroad equipment SCC, which indicates equipment type and fuel type.

Annual emissions files in EPA's National Inventory Format (NIF) were also prepared and submitted to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp). These NIF files contain a smaller set of pollutants; the additional pollutants needed for air quality modeling are not included. Annual emissions NIF files were prepared for each of the four years modeled, separately for California and non-California states, using the fully detailed nonroad SCCs.

Summary spreadsheets, tables, and graphs were also prepared, and were posted on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

5.0 LOCOMOTIVE EMISSIONS METHODOLOGY

County level locomotive emissions estimates were estimated as the product of locomotive fuel consumption and average locomotive emission factors. Previous WRAP locomotive emissions estimates (Pollack et al., 2004) allocated national fuel consumption estimates to counties using emissions data offered by the National Emissions Inventory. For this project a detailed revision to that allocation method was developed for allocating 2002 national fuel consumption estimates. Emission factors were also revised to combine line-haul and switching engines because only national total fuel consumption was available. Additional emission factors for ammonia and fuel sulfur provided by EPA were also incorporated and form the basis from which sulfur dioxide was estimated.

5.1 2002 LOCOMOTIVE EMISSIONS

This work spatially allocated 2002 national locomotive activity, in the form of fuel consumption, using historic data of freight movements. The 2002 Class I railroad activity data were derived from national fuel consumption data reported by the Association of American Railroads (AAR, 2003), and the activity data for Class II/III railroads from data reported by the American Short Line & Regional Railroad Association (ASLRRA, 1999 and Benson, 2004). To allocate this national fuel consumption to the county level, ENVIRON used the most recent county level rail activity estimates available. These activity estimates were ton-miles of freight movement estimated by the Bureau of Transportation Statistics (2002), using data from 1995. The 2002 national activity data were allocated to each county in the WRAP states using the fraction of the 1995 national rail activity that occurred in each county and then multiplying that fraction by the 2002 national rail activity, as demonstrated in equation (1).

$$CA02 = NA02 * (CA95/NA95) \qquad (1)$$

where

CA02 = 2002 county locomotive fuel consumption
NA02 = 2002 national locomotive fuel consumption
CA95 = 1995 county million gross ton miles (MGTM)
NA95 = 1995 national total MGTM

The spatial allocation of the national emissions in this work followed the methods of the EPA National Emission Inventory (NEI, 1999 and unchanged for 2002) of allocating locomotive activity. The 1995 activity data were obtained as GIS shapefiles containing track segments and an associated database of rail density per mile (MGTM/mi) corresponding to those segments. The segment-specific rail density estimates were provided as ranges. For each segment, the midpoint of the density range was assumed to represent the average track loading on that segment. Table 5-1 shows a list of the ranges and the midpoint values used in this study. The top end density was reported as an open-ended range, greater than 100 MGTM/mi, which was estimated as 120 MGTM/mi. This differs from the allocation method used in the NEI 2002, which represented the top end traffic density as 100 MGTM/mi. The use of 120 MGTM/mi is expected to more accurately reflect the relative importance of those main line track segments than using the minimum value of 100 MGTM/mi.

Table 5-1. Track segment density ranges used for allocation to counties (MGTM/mi).

Density ID	Segment Density Range	Assumed Segment Density
0	unknown, abandoned, or dummy	0
1	0.1 to 4.9	2.5
2	5.0 to 9.9	7.45
3	10.0 to 19.9	14.95
4	20.0 to 39.9	29.95
5	40.0 to 59.9	49.95
6	60.0 to 99.9	79.95
7	100.0 and greater	120

To obtain county level rail density from track segment density, a shapefile was first created that contained all US counties. Next, the two shapefiles were projected to the same map projection so that the counties were overlaid by the BTS track segments. Then, track segments were intersected by the county borders so that county-specific track segments were created. For each county it was then possible to sum the products of segment densities and county-specific segment lengths to obtain the total county activity as 1995 ton-miles. The county fraction of 1995 national rail activity was then the sum of activity in that county over the sum of activity in all counties. The relative county locomotive activity for the western States is shown in Figure 5-1.

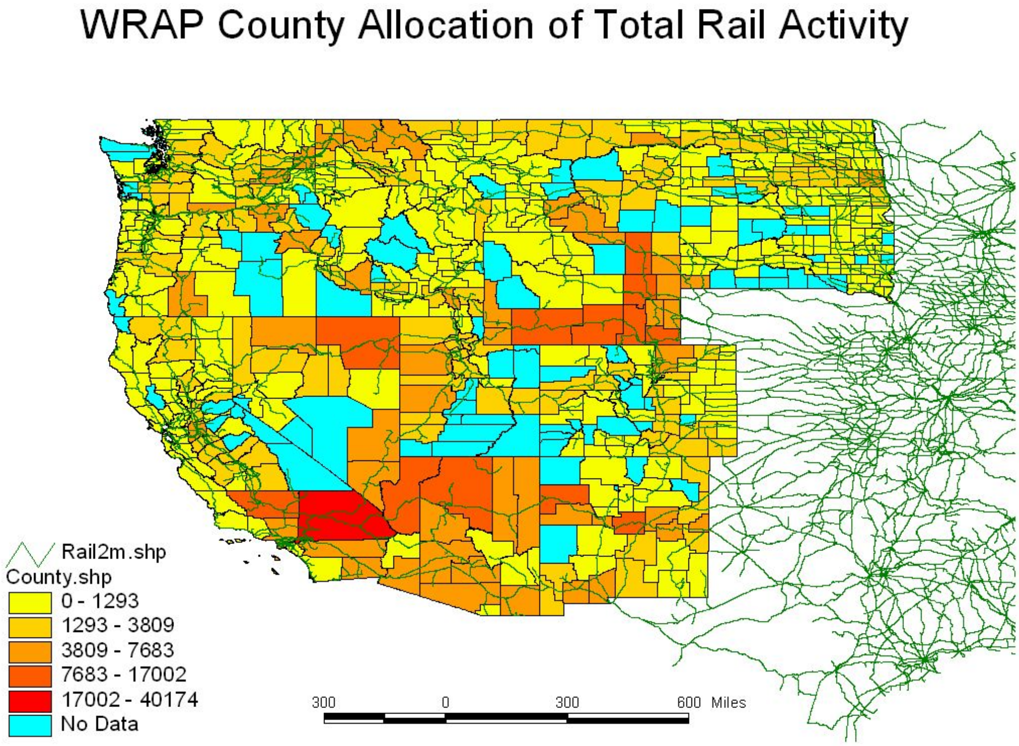


Figure 5-1. County level rail activity in the WRAP states.

Year 2002 county rail fuel consumption was estimated using the 1995 county fraction of national rail activity as demonstrated in equation (1). National locomotive fleet average emissions factors with units of grams per gallon of fuel were obtained from the EPA (1997). The emission factors for 2002 are summarized in Table 5-2. County level emissions of hydrocarbons (HC), NOx and particulate matter (PM10) were calculated by multiplying 2002 county level fuel consumption by these emission factors.

Table 5-2. National fleet average emission factors (gram per gallon) from EPA (1997).

Engine Type	HC	CO	NOx	PM	SO2[1]	NH3[2]
2002 Fleet Average	10.7	27.4	248.8	6.8	16.4	0.116

[1] Reported as SO_2 and derived from an average sulfur level of 2600 ppm. (EPA, 2004b)
[2] EPA (2004a)

One issue was to determine the fraction of the total PM emissions that is sulfate. Equation (2) was derived from test data from an EPA study that measured the PM weight change that resulted from a change in the fuel sulfur level. The percentage of sulfate PM was estimated to be 19.4%. The remaining PM was split between EC and OC using the historic National Emission Trends report estimate of 80% as elemental carbon and 20% as organic carbon.

$$\text{Sulfate PM (BSFC units)} = \text{BSFC} * 7.0 * 0.02247 * 0.01 * (SOx_{fuel} - SOx_{bas}) \qquad (2)$$

where

SOx_{bas} = 0% sulfur for entirely elemental and organic carbon PM
SOx_{fuel} = % sulfur in fuel used (0.26%)

Sulfate PM = 0.0004 (g/gram fuel) or 1.32 (g/gallon) or 19.4% of the PM rate in Table 5-2.

Equation (2) was derived by estimating that the fuel sulfur partially (2.247%) converts to SO_3 (with the remainder emitted as SO_2), which rapidly hydrolyzes in the humid exhaust to hydrated sulfuric acid [H_2SO_4*(7)H_2O] and condenses on other PM. From this assumption arises the molecular weight adjustment of 7.0 (ratio of hydrated sulfuric acid to elemental sulfur). The figure 0.01 in the equation is to adjust values in percent (%) to fractional values.

County level locomotive emissions were estimated for all WRAP counties based on the procedure described above, except for those areas for which emissions data were supplied by local or state agencies. Four states - Alaska, Arizona, Wyoming, and Idaho - and one county - Clark County, NV - supplied more detailed locomotive emissions estimates from local surveys and other information derived from specific activity in those states. In the case of Arizona and Wyoming, ENVIRON performed surveys of all railroad activity (Pollack et al, 2004a; Pollack et al, 2004b). The Alaska Department of Environmental Conservation (Edwards, 2005) and the Idaho Department of Environmental Quality (Reinbold, 2005) supplied their own estimates, as did the Clark County Department of Air Quality Management (Li, 2005).

The spatial allocation of annual locomotive NOx emissions is shown in Figure 5-2. Seasonal emissions were estimated based on an assumption of uniform year-round activity. Figure 5-2 shows the effect of the major east-west corridors from Los Angeles through Arizona and New Mexico, Northern California through Nevada, Utah and Wyoming, and Washington, Northern

Montana and North Dakota; the north-south corridor through California, Oregon, and Washington; and the coal mining region of eastern Wyoming. Other major and minor routes are also evident though the size of the county affects the emission totals estimated, so a major line that runs through a small or narrow county may not appear significant, and, likewise, a large county may appear over-weighted compared with a neighboring county with less through mileage.

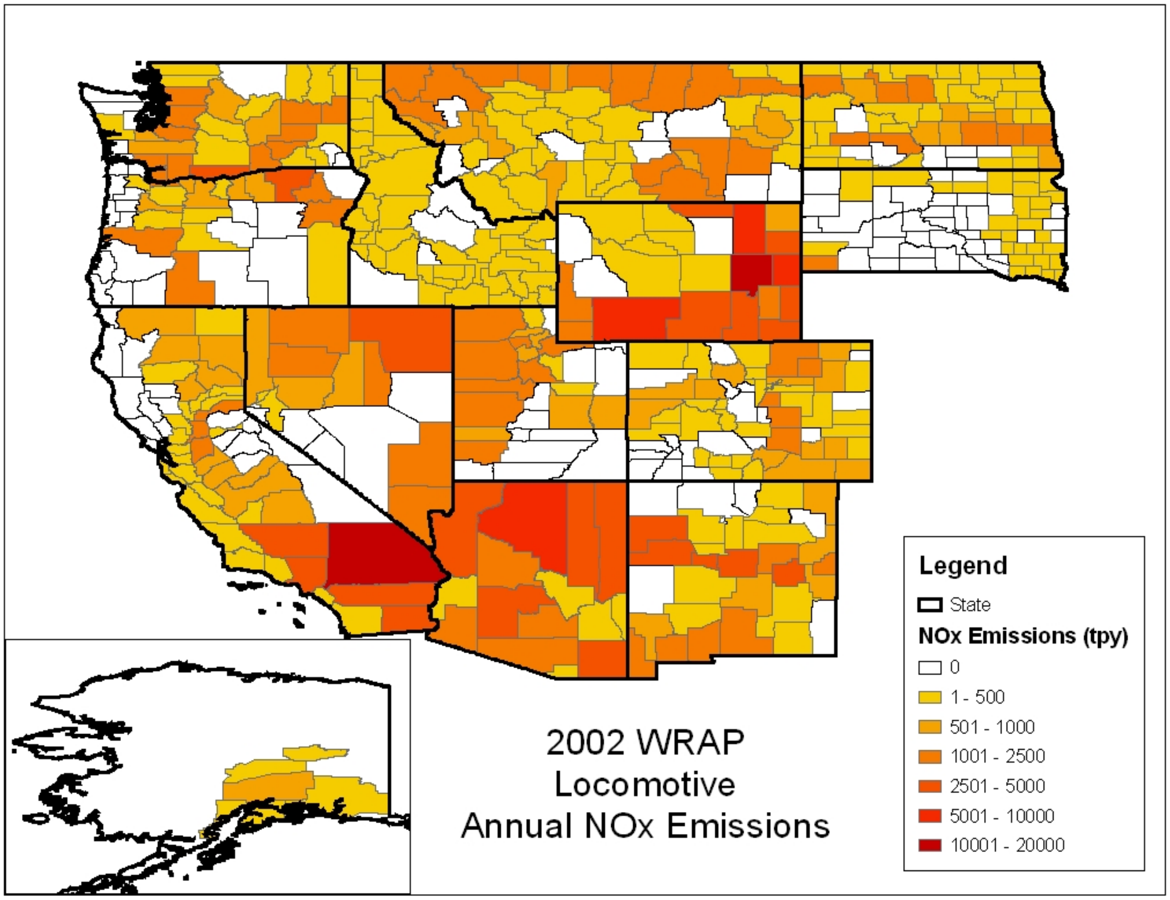


Figure 5-2. County level rail NOx emissions (tons per year) in the WRAP states.

5.2 PROJECTED FUTURE YEAR LOCOMOTIVE EMISSIONS

To estimate future year activity, a trend analysis was performed on the historical fuel consumption of the activity of the two predominant (in the West, Union Pacific and BNSF) railroads' activity. Figure 5-3 shows the company-wide fuel consumption calculated from historic revenue ton-mile and fuel consumption per revenue ton-mile. National freight transfers and the regression of fuel efficiency were used to determine the fuel consumption trend over as long a period as possible. Freight transfers (ton-mile) are not a sufficient activity indicator alone because the efficiency (ton-miles per gallon of fuel consumed) of railroads has been improving over time. AAR (2005) provided historical efficiency (gallons per ton-mile) for Burlington Northern (predating the merger with the Atchison Topeka and Santa Fe [ATSF] railroad) and Union Pacific (predating the merger with Southern Pacific and others). The historic trend in fuel efficiency for each company (Union Pacific and Burlington Northern) was combined with the revenue ton-mile for Union Pacific and Southern Pacific, and BN and ATSF. A trend in fuel consumption for the combined companies was thus estimated from 1990 through 2002 as shown in Figure 5-3 despite the merger activity that occurred during this period. The future year projected activity was then determined from a linear regression of the fuel consumption for the combined company operations of the predominant railroads in their current configuration as Union Pacific and BNSF.

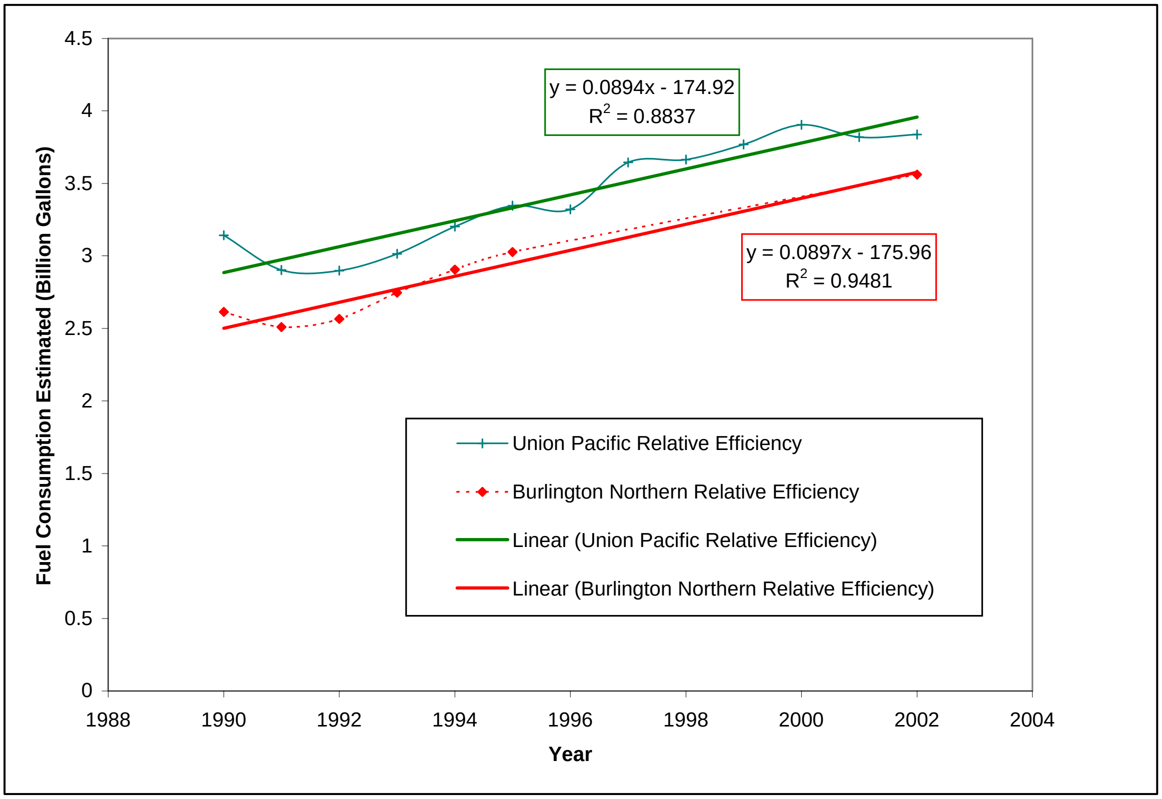


Figure 5-3. Trends in historical rail fuel consumption by railroad.

The resulting future year projection factors are listed in Table 5-3 for the two major railroads and the combined projection. The trends for the two railroads are very similar.

Table 5-3. Locomotive activity growth projection for this work.

Comparison Years	Union Pacific	BNSF	Combined
2008 / 2002	1.13	1.15	1.14
2013 / 2002	1.24	1.27	1.26
2018 / 2002	1.35	1.40	1.37

In addition to projected railroad activity, the emission rates were projected using EPA future year emission rates (1997, Regulatory Support Document), as shown in Table 5-4.

Table 5-4. Locomotive emission rate projections.

Comparison Years	HC	CO	NOx	PM	SO2*	NH3
2008/2002	0.892	1.000	0.693	0.882	0.192	1
2013/2002	0.819	1.000	0.627	0.802	0.006	1
2018/2002	0.763	1.000	0.580	0.740	0.006	1

* Fuel sulfur averaged 2600 ppm in 2002, assumed to average 500 ppm in 2008 and 15 ppm in 2013 and 2018. (EPA, Clean Air Nonroad Diesel Rule Fact Sheet, May, 2004) PM emission rates were not adjusted for fuel sulfur level though a reduction should be realized with low sulfur fuel.

The overall emissions from locomotives for future years were then determined by combining the activity growth in Table 5-3 and the emission rate projections in Table 5-4.

5.3 CALIFORNIA LOCOMOTIVE EMISSIONS

CARB provided locomotive emissions for the base and three future years from their internal emissions data bases. CARB's emission estimates assumed 2500 ppm sulfur in the fuel for all years, and so adjustments were made to the SO2 and PM emissions to reflect the lower mandated levels in future years. Federal requirements are for sulfur levels to be 500 ppm in 2008 and 15 ppm in 2013 and 2018. However, ARB expects fuel sulfur levels to be 129 in 2008. SO2 emissions were adjusted using a direct scalar of the fuel sulfur levels assumed in the emissions estimated by ARB and the regulated levels. The PM emissions were adjusted to reflect the lower sulfur levels using a PM adjustment derived by ARB staff, as provided to ENVIRON.

The CARB emissions did not include NH3; NH3 was estimated by developing a scaling factor based on SO_X emissions. Yearly fuel consumption estimates were derived based on SO_X emissions and the CARB assumed 2500ppm fuel sulfur content. A per-volume NH3 emission factor was applied to the estimated fuel consumption to estimate NH3 emissions for each year at the county level. Lastly, PM was split among sulfate, EC, and OC using the same methods as for the other states described above.

5.4 GENERATION OF SMOKE AND NIF FILES

Emissions files were generated in the format needed for SMOKE emissions processing. Annual average day county-level locomotive emissions SMOKE files were generated, for all WRAP states combined, only for years 2002 and 2018, the years for which the WRAP air quality modeling is performed. The pollutants included in the SMOKE files are VOC, NO_X, CO, NH3, SO_2, PM10, EC10, OC10, SO4(10), PM2.5, EC2.5, OC2.5, SO4(2.5), coarse PM (PMC), NO, and NO2. Separate files were prepared for each year.

Annual emissions files in EPA's National Inventory Format (NIF) were also prepared and submitted to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp). These NIF files contain a smaller set of pollutants; the additional pollutants needed for air quality modeling are not included. Annual emissions NIF files were prepared for each of the four years modeled, for all states combined.

Summary spreadsheets and tables were also prepared, and were posted on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

6.0 AIRCRAFT EMISSIONS METHODOLOGY

County-level aircraft emissions for 2002 for the WRAP states were obtained from work performed for EPA's 2002 National Emissions Inventory (NEI2002). Activity data for aircraft emissions are takeoff cycles (LTOs), and emission factors are primarily from the Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS). The 2002 emissions were projected to future years using forecast LTOs available from the FAA. More detailed estimates were provided for some states.

The FAA EDMS model combines specified aircraft and activity levels with default emissions factors in order to estimate annual inventories for a specific airport. Aircraft activity levels in EDMS are expressed in terms of LTOs, which consist of the four aircraft operating modes: taxi and queue, take-off, climb-out, and landing. Default values for the amount of time a specific aircraft spends in each mode, or the time-in-modes (TIMs), are coded into EDMS.

Aircraft emissions are estimated for four aircraft categories:

- Air carriers, which are larger turbine-powered commercial aircraft with at least 60 seats or 18,000 lbs payload capacity;
- Air taxis, which are commercial turbine or piston-powered aircraft with less than 60 seats or 18,000 lbs payload capacity;
- General aviation aircraft, which are small piston-powered, non-commercial aircraft; and
- Military aircraft.

6.1 2002 AIRCRAFT EMISSIONS

6.1.1 NEI2002 Aircraft Emissions Estimates and Additional Pollutants

For the 2002 aircraft emissions, annual emissions files prepared for the NEI2002 formed the basis of the work. These files were sent to ENVIRON by EPA's contractor, Eastern Research Group (Billings, 2005). For this work, ERG ran the EDMS model for about 1100 towered airports across the U.S. using detailed 2002 aircraft/LTO activity data. Additional calculations were performed to estimate the additional pollutants needed for WRAP modeling. Key elements of those calculations are described by aircraft type below.

<u>Air Carriers</u> – The NEI2002 inventory data for VOC, CO, NOx, and SO_2 for Air Carriers were used directly. Additional calculations were made to estimate the emissions of the additional pollutants in the WRAP inventory:

- The NOx inventory speciation values for NO and NO_2 were assumed to be 90% and 10%, respectively, which are the default EPA speciations.
- It was assumed that no NH_3 is emitted from air carrier turbine engines, which normally run lean.
- All of the fuel-bound sulfur was assumed to form SO_2 in the engine exhaust.
- Due to the lack of other, more recent sources for aircraft particulate emission factors, the total suspended particulate (TSP) emissions from the air carriers were estimated using a commercial fleet-average emission factor from EPA's 1985 National Acid Precipitation

Assessment Program (NAPAP). To calculate PM2.5, according to the NEI2002, 97.6% of the particulate matter emitted from Commercial Aircraft was assumed to be $PM_{2.5}$, as is assumed in the NEI2002.

Air Taxi, General Aviation and Military Aircraft – The NEI2002 inventory data for VOC, CO, NOx, SO_2, PM10, and PM2.5 for these Aircraft types were used directly. Additional calculations were made to estimate the emissions of the additional pollutants in the inventory:

- As for the air carriers, 90% of the NOx emissions were assumed to be NO and 10% were assumed to be NO_2.
- For ammonia, air taxi and military aircraft were assumed to be dominated by turbine-powered aircraft running lean, thus producing a negligible amount of ammonia. For general aviation, ammonia was estimated using a fleet-average fuel consumption rate from the EDMS data for piston engines, operational mode-specific fuel flow rates weighted by the typical time spent in each mode, average hours of operation estimated from FAA data, and a g/gallon emission factor for non-catalyst light-duty gasoline engines.
- As for air carriers, all of the fuel-bound sulfur was assumed to form SO_2 in the engine exhaust.

6.1.2 State Updates

The NEI2002-based inventory estimates were updated with additional information provided for six areas:

For Alaska, Sierra Research, under contract to the WRAP Emissions Forum, developed seasonal aircraft emissions estimates for all aircraft types for Alaska in 2002. These data were used instead of the NEI2002 data described above. A number of minor modifications needed to be made to the data to make them consistent with the rest of the aircraft data. The most significant difference was that air carriers and air taxis were lumped into one category. These were then coded as the air carriers SCC, and WRAP Alaska air taxi emissions were set to zero.

For Arizona, the NEI2002-based inventory was updated with emissions estimates from the Arizona 2002 inventory work previously done by ENVIRON (Pollack et al., 2004). This work included detailed EDMS modeling based on activity data obtained from both the FAA and local sources. Further updates were made for specific airports with emissions data provided by Pima and Maricopa Counties.

The Idaho DEQ provided 2002 aircraft emissions for all counties for general aviation and military aircraft.

Clark County (Nevada) provided 2002 emissions estimates for three airports in the county, based on a recent airport emissions study (Ricondo, 2004).

For Wyoming, the NEI2002-based inventory was updated emissions estimates from Wyoming 2002 inventory work previously done by ENVIRON (Pollack et al., 2004a). This work included detailed EDMS modeling based on activity data obtained from both the FAA and local sources.

The California Air Resources Board (CARB) provided both base and future year aircraft emissions estimates, discussed below.

6.1.3 Seasonal Emissions Estimates

The NEI2002 aircraft emissions are annual estimates, as were most of the updates provided by state and local agencies. To estimate seasonal county-level emission inventories, the monthly distribution of activity for airports in the WRAP region was obtained from the FAA's Air Traffic Activity Data System (ATADS) (http://www.apo.data.faa.gov/main/atads.asp). The ATADS is the official source for historical monthly or annual air traffic statistics for airports with FAA-operated or FAA-contracted traffic control towers. The average seasonal distribution was calculated by state and aircraft type from the ATADS dataset. These state-level seasonal distributions were then applied to the annual county-level emissions in each state to derive the seasonal county-level emissions for each state.

6.2 FUTURE YEAR AIRCRAFT EMISSIONS

For all states except California, aircraft emissions were projected to the three future years from the 2002 emissions, by county and aircraft type, using FAA LTO forecasts as the activity data. Emission factors were assumed to be unchanged over time. The International Civil Aviation Organization (ICAO) has promulgated NO_x and CO emission standards for commercial aircraft, exempting general aviation and military engines from the rule (ICAO, 1998), and the majority of engines are already meeting this standard. EPA officially promulgated the ICAO standards for air carriers in a final rule in November 0f 2005.

The historic and projected LTO data by airport are available online from the Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) database (http://www.apo.data.faa.gov/main/taf.asp) for all aircraft categories for which emissions were estimated. Projected LTO data for years 2008, 2013 and 2018, and historic data for 2002 were used to develop future year growth factors for all aircraft types. Growth factors were calculated as the ratio of the sum of LTOs by county and aircraft type in each future year to the sum of LTOs by county and aircraft type in 2002. These future year growth factors were then applied to 2002 emission estimates by county and aircraft to develop future year emission inventories.

A small number of counties had no aircraft LTOs in 2002 and a significant number of LTOs in future years. For these counties, emissions were calculated using projected future year LTOs and Emission Factors by aircraft type.

6.3 CALIFORNIA AIRCRAFT EMISSIONS

CARB provided annual, winter, and summer aircraft emissions estimates by county and aircraft type for the 2002 base year and the three future years. A number of processing steps were required to generate off-road emissions for California that are similar in content and format to the emissions for the remaining WRAP states:

- The CARB aircraft emissions for commercial aircraft and air taxis were combined. The SCC for commercial aircraft was assigned to the combined emissions, and zero emissions were assigned to the SCC for air taxis.
- Spring and call emissions were calculated at the county and SCC level as
  Spring or fall emissions = (4 * annual emissions – winter emissions – summer emissions) / 2
- Ammonia emissions were calculated using NH3/SOX scaling factors at the county and SCC level.
- The additional pollutants needed for WRAP modeling were calculated using speciation factors and appropriate formulas.

6.4 GENERATION OF SMOKE AND NIF FILES

Emissions files were generated in the format needed for SMOKE emissions processing. Seasonal county-level aircraft emissions SMOKE files were generated, for all WRAP states combined, only for years 2002 and 2018, the years for which the WRAP air quality modeling is performed. The pollutants included in the SMOKE files are VOC, NO_X, CO, NH3, SO_2, PM10, EC10, OC10, SO4(10), PM2.5, EC2.5, OC2.5, SO4(2.5), coarse PM (PMC), NO, and NO2. Separate files were prepared for each year.

Annual emissions files in EPA's National Inventory Format (NIF) were also prepared and submitted to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp). These NIF files contain a smaller set of pollutants; the additional pollutants needed for air quality modeling are not included. Annual emissions NIF files were prepared for each of the four years modeled, for all states combined.

Summary spreadsheets and tables were also prepared, and were posted on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

7.0 COMMERCIAL MARINE EMISSIONS METHODOLOGY

Commercial marine emissions comprise a wide variety of vessel types and uses. Table 7-1 describes the different types of commercial marine vessel activity. In the previous WRAP mobile sources emission inventory work, emissions were estimated for most types of vessels (Pollack et al., 2004). Military emissions were not estimated because the activity data are not publicly available, and offshore emissions were not considered at that time.

Table 7-1. Commercial vessel types.

Source Definition	Purpose	Geographic Area
Deep draft	Ocean-going large vessels	Ocean Traffic
		Near port
Tow or Push Boats	Barge Freight	River Traffic
		Ocean Traffic
Tugs	Vessel assist and support functions	Near port
Ferries	River or lake ferrying	Regular routes
Other Commercial Vessels	Smaller support or excursion boats	Near dock
Dredges	Dredging projects	Varies
Commercial Fishing	Market fishing	Ocean
Military	Coast Guard and Navy	Ocean & Port

In this work, emissions were estimated for deep draft vessels within shore and near port using port call data, and offshore emissions generated from ship location data. The most important revision for commercial marine emissions leading to regional haze (PM, SOx, and NOx) was the estimation of emissions for the offshore activity, primarily of ocean-going vessels. This activity was not previously estimated for the WRAP emission inventory, and has been a subject of concern as vessel traffic passes out from and along and upwind of the western coast of the US. The other revision conducted here was to update in-shore deep-draft vessel emissions to reflect changing fleet mix, especially the retirement of steamship powered vessels.

One issue for modelers was which vertical grid layer to introduce the deep draft emissions. The stack height of 34 to 58 meters (Starcrest, 2004) and plume rise for ocean-going (deep draft) vessels indicated that the emissions should be placed in the second vertical layer (above 36 and below 73 meters). The plume rise was estimated at 2 meters using standard plume rise models with the vessel speed of 17 to 25 knots as the wind speed, exhaust exit rate of 35 to 40 meters per second with an average stack diameter of about 1.3 meters (Anderson, 2000).

7.1 OFF-SHORE EMISSIONS ESTIMATES

The method used to estimate the offshore marine emissions uses location identification data from a sample of vessels within the region of interest, and scaling factors by vessel type to estimate all ships. The ship proximity data and methods used to develop the ship population and emissions offshore are described in Appendix B. In short, this method uses positioning data generated by a subset of the world's ships, assumes the sample is a random sample, and scales that sample to the entire world fleet.

Emissions estimates using this method were compared with the emissions generated using the Puget Sound port activity estimates described below. The grid cell emission totals at the entrance/exit of the Strait of Juan de Fuca using the scaled proximity method were approximately half of what were predicted using just the US port traffic, ignoring the traffic to and from Vancouver, Canada. Using the proximity method it would be expected that the emissions would be underestimated as ships near land, because positioning systems would be turned off or, if manually operated, would not be actively engaged during this period of time. This would reduce the number of ship indicators in areas near land and underestimate the ship traffic. Therefore, emissions in the first whole grid cell and any partial grid cells near the coast were zeroed out and replaced with emission estimates derived from the in-port activity for Oregon and Washington ports (Puget Sound, Columbia River, Coos Bay, and Grays Harbor) with remaining near coast estimates unchanged, as shown in Figure 7-1. The most apparent difference can be observed in Figure 7-1 for the grid cells near the mouth of the Columbia River where the nearest four grid cells now have higher emissions. There are also higher emissions at the entrance to the Strait of Juan de Fuca, but that result is less clear in Figure 7-1.

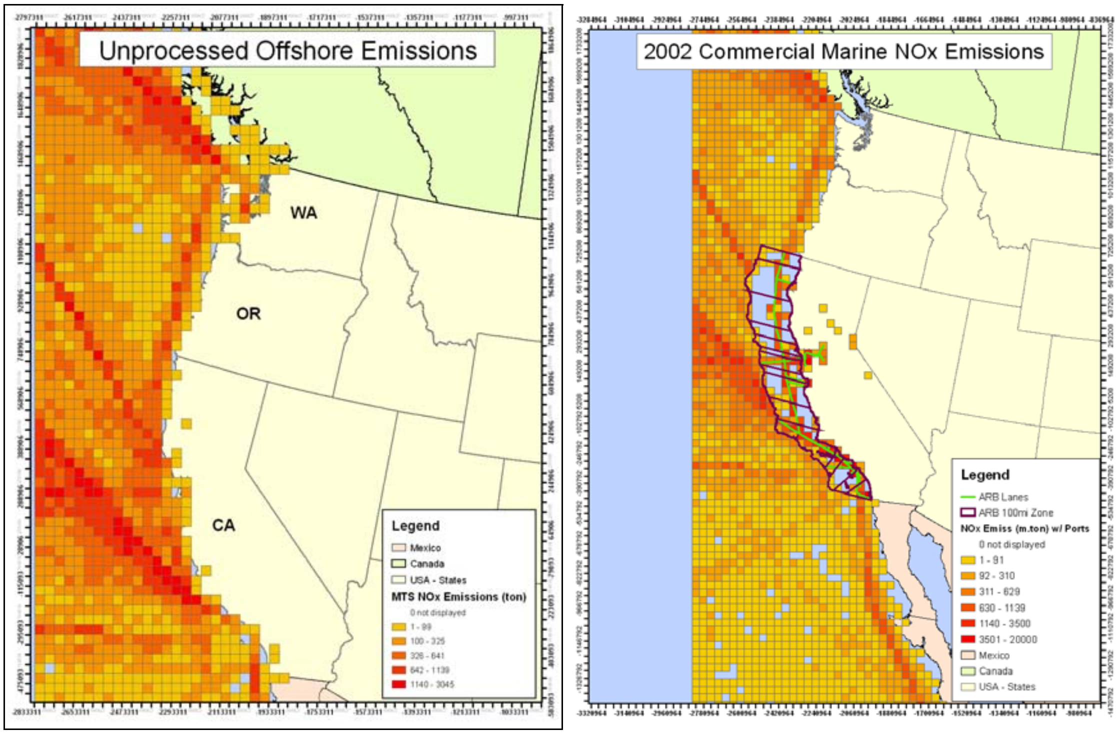


Figure 7-1. Raw offshore emission estimates and with near port emissions substituted (Blue grids indicate no emissions over water).

The commercial marine vessel emission inventory estimates provided by the California Air Resources Board (CARB) includes estimates for ships in transit within 100 miles of the coast (CARB, 2005). The transit emissions predicted using the proximity method in this work were zeroed out for the zone where CARB estimates were applicable. They were replaced by the CARB transit emissions estimates that were spatially assigned to the coastal shipping lanes defined by CARB. The result of this replacement along the California coast is apparent in the right side of Figure 7-1. The CARB data also included large vessel activity in ports. Therefore, in addition to using the CARB transit emissions for the California coastal zone, the CARB in port emissions were used for the California ports.

Because the emissions offshore represent entirely new estimates of emissions in the WRAP modeling domain, a summary of emissions is shown in Table 7-2 by state compared with the emissions near the ports and for California within the coastal zone. For purposes of preparing state emissions totals for offshore activity, the states were defined using the latitudes where the state borders meet the shore, as shown in Figure 7-2. For the near port totals in Table 7-2, it should be noted that the Columbia River vessel traffic (especially the transit up and down the river) was primarily allocated to the State of Washington counties.

Table 7-2. 2002 Large ocean-going ship emissions by location (tons/year).

State	VOC	CO	NOx	PM10	SO2
Washington (offshore)	1,451	2,941	44,692	3,247	25,130
Washington (near port)	103	209	3,467	335	2,483
Washington (within shore)	277	1,206	10,764	763	5,352
Oregon (offshore)	1,331	2,706	41,113	2,986	23,119
Oregon (near port)	22	44	736	72	532
Oregon (within shore)	23	271	1,415	42	212
California (offshore)	4,269	8,681	131,930	9,587	74,181
California (coastal zone)	5,387	14,345	111,550	6,042	46,059
Total	**12,863**	**30,403**	**345,667**	**23,074**	**177,068**

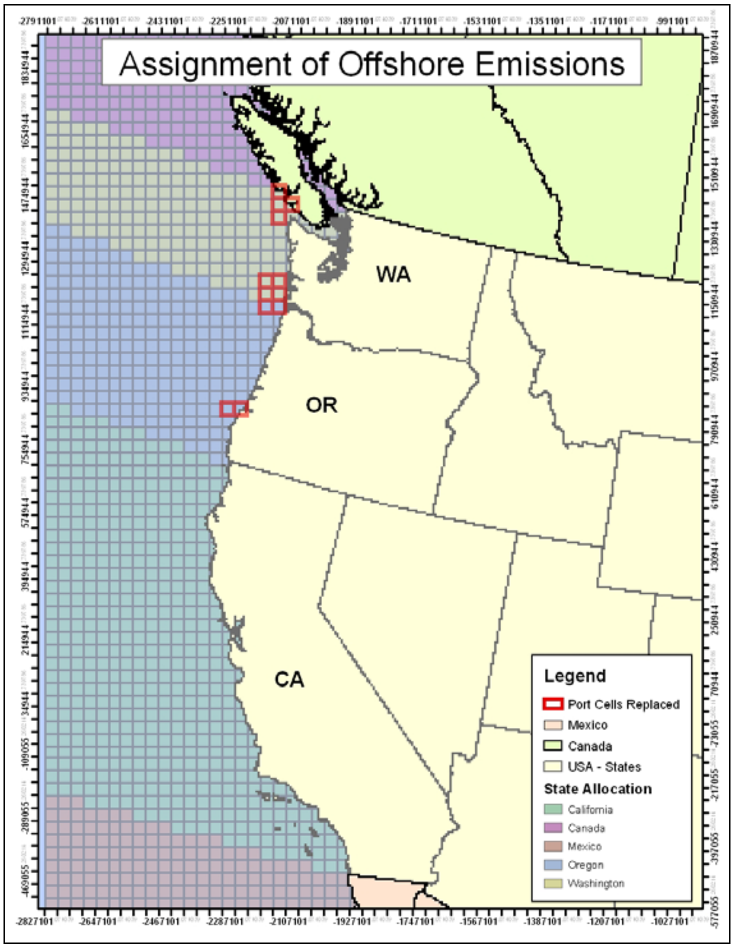


Figure 7-2. Offshore emissions by state and grid cells replaced with near port data.

7.2 IN-SHORE PORT REVISIONS TO EMISSIONS (INCLUDING LARGER ALASKAN FREIGHT PORTS)

Ocean-going vessel emissions near ports were revised from the previous WRAP estimates (Pollack et al., 2004) to account for fleet turnover and more recent emission rate estimates. The fleet turnover aspect of the work considered the entire replacement of steamships with motorships, especially for projecting future year estimates.

However, the work scope did not consider ocean-going vessels heading to and from Vancouver, B.C. and other Canadian traffic that may pass into or near US waters. The emissions from these vessels were estimated out 25 miles from the Pacific Ocean coast and used to compare with the estimates from the method used to estimate emissions off the coast and in the open ocean.

7.2.1 Emission Factors Revision

Table 7-3 shows the emission factors estimated by the U.S. EPA for Category 2 and 3 engines (EPA, 1999a, 2003) used in previous WRAP emission inventory estimates. For the Category 2 engines, the average values shown in Table 7-3 were the average values used to estimate the emission reductions from the new emission standards (Samulski, 1999), and are quite similar to the emission factors for the highest power Category 1 engines. For Category 3 engines, EPA relied on a review of the base emission factors by ENVIRON (2002), based on the available data to date when the study was conducted.

Table 7-3. US EPA (1999a, 2003) baseline emission factors for marine engines.

Engine Category	HC [g/kW-hr]	CO [g/kW-hr]	NO_X [g/kW-hr]	PM [g/kW-hr]
Category 2 (5-30 l/cylinder)	0.134	2.48	13.36	0.32 low sulfur
Category 3 Medium Speed (> 300 rpm, > 30 l/cylinder)	0.5*	0.7	16.6	Fuel sulfur dependence
Category 3 Slow speed	0.5*	1.1	23.6	Fuel sulfur dependence

* Converted from kg/tonne units in Lloyds (1995) using 210 (g/kW-hr) for “medium speed” engines.

The term “medium speed” refers to Category 3 engines with rated speeds of typically 300 to 750 rpm (though most Category 3 medium speed engines are found in 400 –550 rpm range) that are typically 4-stroke engines either geared or used with diesel-electric drives that turn the propeller or power the generators for electrical power for the ship. Category 2 engines have been either 2-stroke (GM-EMD or Fairbanks-Morse engines) or 4-stroke engine designs with rated speeds typically, but not always, above 750 rpm, used either for propulsion of smaller vessels or auxiliary power on larger ones. Emission factors for these marine engine types had been derived from previous reviews and emission measurement studies [EPA (2000), Environment Canada (1997), Lloyds (1995), ETC (1997), BAH (1991), Environment Canada (1999), and TRC (1989)].

Since the previous WRAP work, additional studies related to marine engine emissions have been published, including Cooper (2001 and 2003) and ENTEC (2002). Emission estimates from these studies were cited in the Port of Los Angeles (PoLA) emission inventory report (Starcrest, 2004). Table 7-4 summarizes emission factors from these studies.

Table 7-4. Emission factors for marine engines in the Port of Los Angeles emission inventory report.

Engine Category	HC [g/kW-hr]	CO [g/kW-hr]	NO_X [g/kW-hr]	PM [g/kW-hr]
Main Engine (Medium Speed – Residual Oil)	0.5	1.1	14.0	0.72
Main Engine (Slow Speed – Residual Oil)	0.6	1.4	18.1	1.92
Auxiliary Engine (Medium Speed – Residual Oil)	0.4	1.1	14.7	0.30
Auxiliary Engine (Medium Speed – Gas Oil)	0.4	1.1	13.9	0.30

The author of the 2002 ENTEC study later published a report to supplement the emission data compiled in the ENTEC study for marine engines (IVL, 2004). The emission data used in the IVL 2004 study are summarized in Table 7-5 for engines built prior to the MARPOL NOx emission reduction requirement. Note the dramatic difference in the slow speed particulate emission rate estimates of 1.92 or 1.3 g/kW-hr.

Table 7-5. Emission factors found in the IVL 2004 report for average 1999 conditions.

Engine Category	BSFC [g/kW-hr]	HC [g/kW-hr]	CO [g/kW-hr]	NO_X [g/kW-hr]	PM [g/kW-hr]
Medium Speed – Residual Oil (2.4% sulfur)	215	0.2	1.1	14.0	0.5
Medium Speed – Gas Oil (0.4% sulfur)	205	0.2	1.1	13.2	0.2
Slow Speed – Residual Oil (2.4% sulfur)	195	0.3	0.5	18.1	1.3
Slow Speed – Gas Oil (0.4% sulfur)	185	0.3	0.5	17.0	0.2

A distinction between Category 2 and 3 medium-speed engines was not made in the earlier ENTEC report, and the average ENTEC medium-speed engine NOx emission rate estimate is found directly between the Category 2 and 3 medium-speed NOx emission rates from the EPA-sponsored work. The PM emission rate for medium speed engines was well under that for slow speed engines using the same high sulfur heavy (residual) oil, without an explanation. The PM measured from engines using high sulfur fuels will be largely comprised of sulfate aerosols, so it will likely be sensitive to temperature of particulate collection device and in turn the exhaust temperature. Still there is no technical reason to think that medium speed engines produce significantly lower particulate emissions than slow speed engines when burning the same fuel. In fact, the particulate emission factors in the ENTEC report are identical for medium and slow speed engine during maneuvering (a lower power and less efficient mode with higher specific emissions rates) at the same level of 2.4 (g/kW-hr).

For this study, the IVL emission factors were used except for particulate emissions where the slow and medium speed engine particulate emission rate when burning residual oil was adjusted to 1.73 and 1.76 g/kW-hr respectively. This is consistent with what was used in the previous WRAP commercial marine emission inventory and reflects the assumption that the average sulfur level in the heavy fuels was 3% compared to the average of 2.4% sulfur for residual fuel in the IVL report. Particulate emission rates during the hotelling (at berth) mode were 0.3 g/kW-hr, assuming a lower fuel sulfur level was used for this mode, which may not be the situation.

There remains considerable uncertainty about the particulate emissions rates, especially for engines using high sulfur fuels. The IVL (2004) and ENTEC (2002) estimates indicate that the authors consider the uncertainty in the PM10 emission rates to be in excess of 50%. This may stem from the method of collection, filter handling, or other factors associated with the hygroscopic nature of the particulate formed from diesel engines burning high sulfur fuels. The particulate emissions rates and sulfur relationship used for this work were not intended to be the final word on the subject, but provide a reasonable range of estimates consistent with the best understanding at this time.

7.2.2 Revised Estimates for Ocean-Going Vessels

EPA (1999b) reviewed estimates of the ocean-going vessel activity for Coos Bay and Puget Sound ports. In this document, a method is also described to extrapolate ocean-going vessel activity for other ports and to allocate activity to individual Puget Sound ports. Two data sources existed for the EPA (1999b) report, one of which gathered general information about the total number of trips by vessel type for the top 95 US ports, and the other gathered more specific information for several ports including the Puget Sound ports totals and Coos Bay. The more general information was used to allocate the more specific activity information to each of the Puget Sound ports and to extrapolate an estimate of the activity of the Columbia River ports. This method was identical to previous WRAP emission inventories with the replacement of steamships with motorships of the same gross tonnage. The revised emission estimates are shown in Table 7-6 for Puget Sound ports to be used to cross reference to the Columbia River ports. Emission rates for motorships are higher for NOx but lower for PM and SOx than for steamships.

Table 7-6. Emission estimates for Puget Sound (excluding Grays Harbor) ocean-going vessels in 2002.

Estimate	HC (tons/year)	CO (tons/year)	NOx (tons/year)	PM (tons/year)	SO2 (tons/year)
Cruise (25 miles to entrance of the Strait)	52	106	1,759	170	1,400
Reduced Speed Zone	135	275	4,554	440	3,255
Maneuvering	23	67	203	24	164
Hotelling	28	523	2,814	68	302
Total	**238**	**971**	**9,329**	**701**	**5,121**

The emissions estimated in Table 7-6 do not include Canadian vessel traffic, and so may underestimate the emissions within and just outside the Strait of Juan de Fuca. A Canadian study (Levelton, 2002) added in Canadian traffic, which significantly increased (by 1.5 to 4 times) the reduced speed zone and cruise mode emissions for Washington State emissions exclusively in the transit modes through the Strait of Juan de Fuca. The scope of this project did not include the Canadian traffic emissions, but it should be understood that this emission source affects Washington marine emissions.

For geographic allocation, the emissions for each port were separated into three segments: cruise, reduced speed zone (RSZ), maneuvering and hotelling/dwelling. For emissions associated with Grays Harbor vessel calls, all emissions were considered to occur in Grays Harbor County. For all Puget Sound vessel calls, the cruise condition emissions were assumed to occur in Clallum County. For all Puget Sound vessel calls, the maneuvering and hotelling emissions were allocated to the county of the port of interest. The emissions for the reduced speed zone were allocated to the counties along the primary shipping channel according to estimates of the fraction of time spent in each county. For example, port calls to Olympia included RSZ emissions in Clallum, Jefferson, Kitsap, Pierce, and Thurston counties; and Port calls to Bellingham included transit through Clallum, San Juan, and Whatcom counties. Because shipping lanes often straddle county boundaries, these county designations were made for expedience and could be improved by plotting emissions along the actual shipping lanes rather than the county in general.

The basic data for the vessel calls and emission estimates were for 1996, the same as the previous emission inventory, but the scaling (growth) estimates from 1996 to 2002 were updated with freight movement information for 2002 compared to 1996. These scaling factors are shown in Table 7-7 for each port.

Table 7-7. Freight tonnage from 1996 to 2002 by port.

Port	1996	2002	2002/1996
Seattle Harbor, WA	23,547,000	19,591,009	0.83
Tacoma Harbor, WA	21,491,000	20,587,109	0.96
Anacortes Harbor, WA	13,844,000	15,362,650	1.11
Everett Harbor, WA	4,007,000	3,009,175	0.75
Port Angeles Harbor, WA	2,780,000	1,673,985	0.60
Grays Harbor, WA	1,990,000	1,485,991	0.75
Bellingham Harbor, WA	1,419,000	250,000	0.18
Olympia Harbor, WA	1,893,000	1,440,439	0.76
Puget Sound Totals	**68,981,000**	**61,914,367**	**0.90**
Port of Astoria, OR	324,000	95,000	0.29
Port of Kalama, WA	8,223,000	6,386,161	0.78
Port of Longview, WA	5,163,000	4,705,771	0.91
Port of Portland, OR	29,734,000	26,635,044	0.90
Port of Vancouver, WA	7,704,000	6,610,345	0.86
Columbia River Totals	**51,148,000**	**44,432,321**	**0.87**
Coos Bay	3,322,000	1,706,821	0.51
Valdez, AK	77,116,000	50,513,074	0.66
Ketchikan, AK	1,341,000	753,000	0.56
Nikiski, AK	6,608,630	7,235,098	1.09
Anchorage, AK	3,401,000	2,983,137	0.88

7.2.3 Columbia River Ports

The Columbia River ports were estimated according to the procedure described in EPA (1999b), where a scaling factor was determined with a similar port, in this case, the Puget Sound totals. Adjustments were made to the actual vessel activity such as reduced speed zone load and time in mode based on discussions with the River Pilots for the Columbia River ports. Other factors, such as cruise, maneuvering, and hotelling time and load, were kept the same with the adjusted number of vessel calls.

Vessels arriving near the mouth of the Columbia River are guided by Bar pilots across the Columbia Bar to Astoria (approximately 14 nautical miles), where River pilots begin piloting ships to their destination. The River pilots estimate that 12 knots is a typical average speed for ships once the pilots take command.

There were five major ports in the Columbia River for which EPA (1999b) identified and estimated total vessel visits. These total vessel visits were compared with the total activity for Puget Sound ports (including Grays Harbor) for which a more detailed estimate has already been produced, as shown in the Table 7-8. The port call information provided here does not necessarily match the actual deep draft vessel calls because often smaller ships are included in the Army Corps estimates than would be included in a port specific data of deep draft vessels. The individual vessel visits by type of vessel for each Columbia River port were divided by the Puget Sound totals and multiplied by the more detailed estimate of the Puget Sound ports totals to produce an estimate of vessel activity for each of the Columbia River ports.

Table 7-8. Port activity totals as presented by EPA (1999b) for 1995.

Activity Data	**Puget Sound Ports**	**Port of Portland, OR**	**Port of Kalama, WA**	**Port of Vancouver, WA**	**Port of Longview, WA**	**Port of Astoria, OR**
RSZ Mileage (Nautical)	--	93	69	94	59	14
Bulk Carrier	**1378**	**694**	**378**	**446**	**543**	**397**
Container Ship	**2667**	**540**	**0**	**7**	**0**	**0**
General Cargo	**428**	**69**	**1**	**111**	**44**	**5**
Other	**82**	**0**	**0**	**0**	**0**	**1**
Passenger	101	792	0	20	5	9
Reefer	108	10	0	0	13	0
Roll on/Roll off	795	126	0	7	15	4
Tanker	1000	299	20	28	9	0
Vehicle Carrier	1069	247	0	13	0	0

By using the ratio of total visits, the emissions for the Columbia River ports were directly calculated from the Puget Sound totals for cruise, maneuvering, and hotelling emissions. The resulting emissions adjusted to eliminate steamships for 1996 activity are shown in Table 7-9; Table 7-10 shows the emissions projected to 2002. Cruise conditions are assumed here to begin 14 miles out from Astoria where the reduce speed zone ends. Reduced speed zone emissions used the ratio of total visits and the ratios of load and time in mode for each Columbia River port. For instance, the reduced speed zone in the Puget Sound ranges from the entrance of the Strait of Juan de Fuca to near each port while the reduced speed zone for the Columbia River ports ranges from 14 miles out and in the Columbia River. Both the vessel speed (which affects the engine load) and the time in mode are different between the Puget Sound and Columbia River.

Table 7-9. Emission estimates for Columbia River ocean-going vessels in 1996.

Estimate	HC (tons/year)	CO (tons/year)	NOx (tons/year)	PM (tons/year)	SO2 (tons/year)
Port of Astoria, OR	6	69	395	14	76
Port of Kalama, WA	11	78	555	30	198
Port of Longview, WA	15	114	789	41	264
Port of Portland, OR	62	330	2662	174	1196
Port of Vancouver, WA	20	118	914	56	377

Table 7-10. Emission estimates for Columbia River ocean-going vessels in 2002.

Estimate	HC (tons/year)	CO (tons/year)	NOx (tons/year)	PM (tons/year)	SO2 (tons/year)
Port of Astoria, OR	3	22	146	7	44
Port of Kalama, WA	11	65	512	31	212
Port of Longview, WA	18	113	862	51	344
Port of Portland, OR	72	328	2935	209	1470
Port of Vancouver, WA	21	109	920	61	423

Overall emissions for vessels visiting each port are shown in Table 7-10 for 2002. However, transit emissions occur in the Columbia River downstream of each port rather than in the port area. The geographic allocation for the transit (cruise and RSZ) emissions were to the Washington counties (Pacific for cruise and some RSZ, Wahkiakum, Cowlitz, or Clark) below each port according to the fraction of time spent in each county. Maneuvering and hotelling emissions were allocated to the county of the port, whether Washington or Oregon.

The port of Coos Bay was determined differently in that no steamships called at this port in 1996. Therefore, no adjustment to the vessel fleet was made for this work other than using the revised NOx emission factors described here.

7.2.4 Alaskan Ports

Some Alaskan ports were covered by the EPA (1999b) report on deep draft vessel activity. The port calls at these ports were associated with the port calls of either the Puget Sound or Coos Bay whichever was most like the ports under consideration. The vessel characteristics at the Alaskan ports were assumed to be identical to the ports where such detailed data was available. The activity estimates shown in Table 7-11 using the same methodology to estimate the Columbia River port activity.

Table 7-11. Port activity totals as presented by EPA (1999b) compared with Puget Sound Ports or Coos Bay.

Activity Data	Puget Sound Ports	Valdez, AK	Ketchikan, AK	Coos Bay, OR	Port of Nikiska, AK	Port of Anchorage, AK
RSZ Mileage (Nautical)	Various	27	14	14	84	144
Bulk Carrier	**1378**	**0**	**77**	**185**	**2**	**13**
Container Ship	**2667**	**0**	**274**	**--**	**--**	**--**
General Cargo	**428**	**0**	**290**	**78**	**4**	**5**

Activity Data	Puget Sound Ports	Valdez, AK	Ketchikan, AK	Coos Bay, OR	Port of Nikiska, AK	Port of Anchorage, AK
Other	**82**	**0**	**36**	**470**	**208**	**498**
Passenger	101	29	976	--	--	--
Reefer	108	0	0	--	--	--
Roll on/Roll off	795	0	0	--	--	--
Tanker	1000	1270	25	--	--	--
Vehicle Carrier	1069	0	0	--	--	--

The emission estimates based on the relative apportionment of activity and emissions for these ports are shown in Table 7-12 for 1996 and projected to 2002 in Table 7-13. Because ship calls for smaller ports vary widely from one year to the next depending upon freight demands, it may not be possible to project long-term activity growth. Also, at the time this work was conducted, data were not available for other ports, such as cruise or other vessels in Juneau, in the format necessary to estimate emissions.

Table 7-12. Emission estimates for Alaskan port ocean-going vessels in 1996.

Estimate	HC (tons/year)	CO (tons/year)	NOx (tons/year)	PM (tons/year)	SO2 (tons/year)
Valdez, AK	43	224	1,581	101	688
Ketchikan, AK	23	146	1,080	64	432
Port of Nikiska, AK	0.3	1.3	12	0.9	6.4
Port of Anchorage, AK	1.3	4.7	52	4.2	30

Table 7-13. Emission estimates for Alaskan port ocean-going vessels in 2002.

Estimate	HC (tons/year)	CO (tons/year)	NOx (tons/year)	PM (tons/year)	SO2 (tons/year)
Valdez, AK	28	147	1035	66	451
Ketchikan, AK	13	82	606	36	243
Port of Nikiska, AK	0.3	1.4	13	1.0	7.1
Port of Anchorage, AK	1.2	4.1	46	3.7	27

7.2.5 California Coastal Transit and Ports

Emissions for commercial marine vessels operating near and within the State of California were provided by CARB (CARB, 2005). Emissions were provided for several major categories, labeled by ARB as SHIPS IN-TRANSIT, SHIPS MANEUVERING and SHIPS BERTHING. The IN-TRANSIT category was defined as corresponding to operations on shipping lanes within 100 miles of the California coast. The MANUEVERING and BERTHING categories correspond to operations at ports. Emissions were also provided for a category labeled COMMERCIAL BOATS that accounts for the activity of smaller vessels near ports and on interior waterways. To incorporate the data provided by CARB into the WRAP commercial marine inventory, the CARB county level emissions estimates were spatially allocated to the 36 kilometer grid.

One of two methods was used to spatially allocate the California marine vessel emissions, depending on the emission category. For the IN-TRANSIT emissions, CARB provided a shapefile that defined the 100 mile coastal zone and a shapefile that defined the shipping lanes within that zone. By overlaying the 100 mile zone for each county with the shipping lanes and the WRAP grid, it was possible to assign a fraction of the county total emissions to each grid cell. For the remaining emissions categories, the emissions were assigned to the grid cells that encompassed the major port in the county. The exception to such port assignments were inland counties where emissions were assigned to major lakes or rivers. Figure 7-3 shows the grid cells to which IN-TRANSIT and the port/inshore emissions were assigned by these procedures.

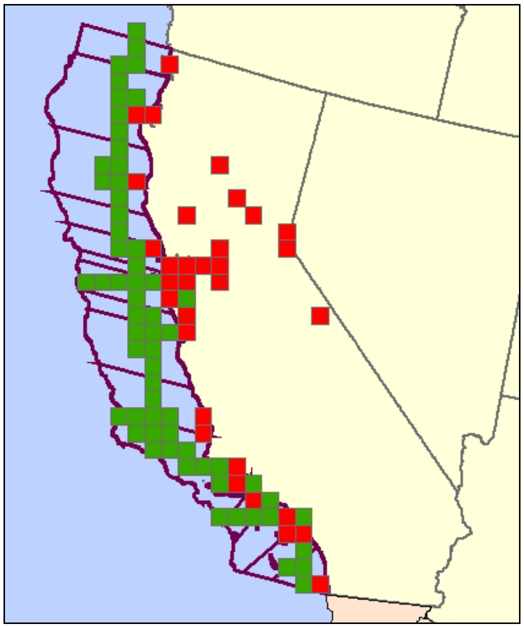


Figure 7-3. Grid assignment of California in-transit (green) and port/inshore (red) emissions.

The grid cell assigned emissions were then added to the other WRAP offshore and near port gridded emissions. Any overlap of the two inventories was eliminated. This yielded a comprehensive emission inventory for commercial marine operations on the west coast that encompasses all the zones shown in Figure 7-4.

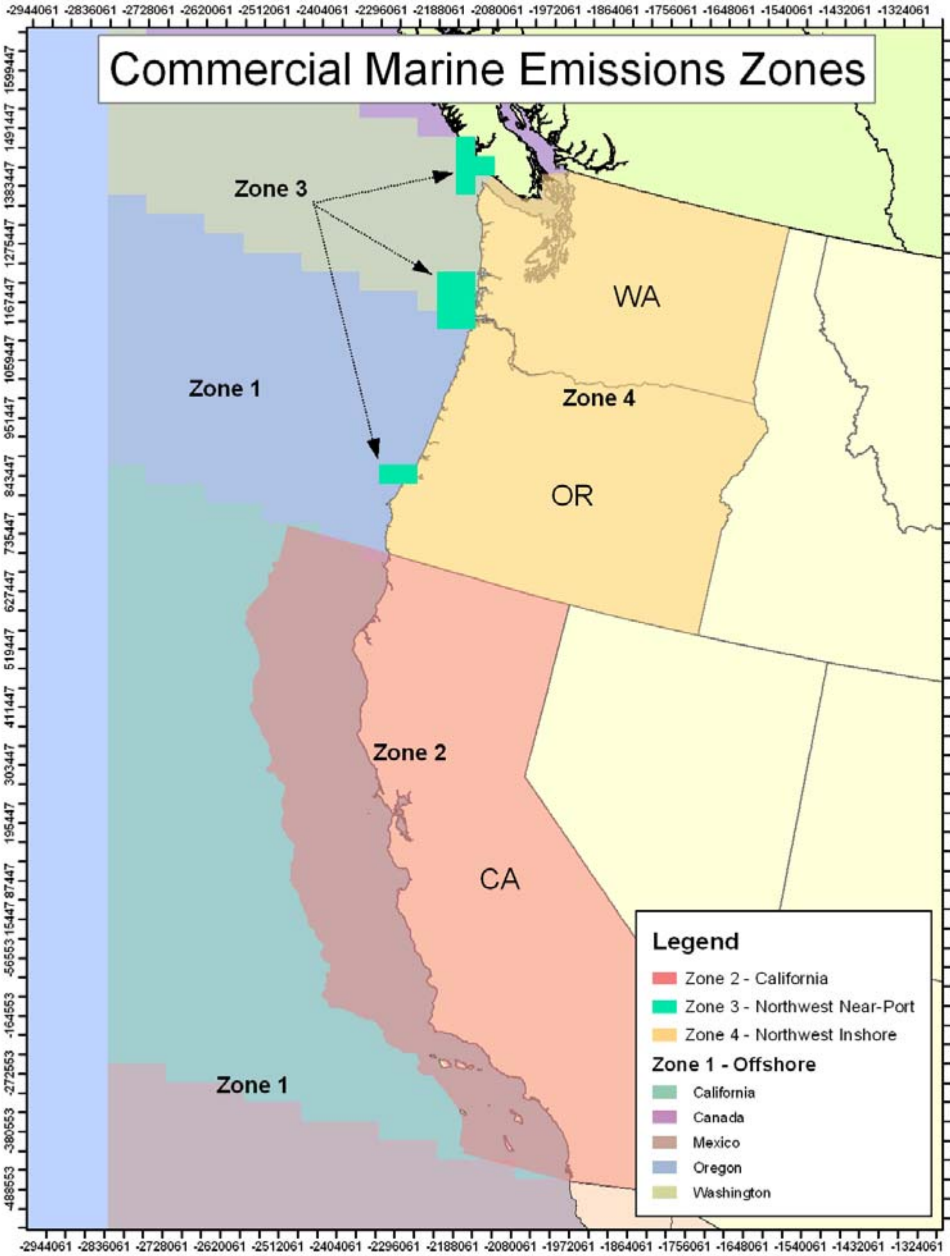


Figure 7-4. Distinct zones included in the WRAP commercial marine emissions inventory.

7.3 FUTURE YEAR COMMERCIAL MARINE PROJECTIONS

Projection factors for future year commercial marine emissions were derived from a study performed by Corbett and Wang (2005). This projection was based on an investigation of the historic trend in the larger vessels' installed power. The installed power combines the propulsion power of individual vessels and number of calls of each vessel to the WRAP coastal ports. The historic trend shown in Figure 7-3 does not provide a sufficient number of years to determine the form of the equation to use to project future year activity. The fit of the historic data was equivalent whether an exponential fit (equivalent to compound annual growth rate (CAGR)) or a linear regression was used. For this work, therefore, an average of the exponential and linear regression was used to project future year commercial marine activity, per agreement and discussion with CARB staff, and thereby matching CARB projections (CARB, 2005). These average projection factors are shown in Table 7-14; they were applied to all three west coast states, to all in-shore and offshore emissions. No emission rate decrease was projected because international standards are not expected to affect emissions.

Table 7-14. Projection factors for ocean-going vessels.

Future Year	Relative to 2002
2008	1.39
2013	1.79
2018	2.30

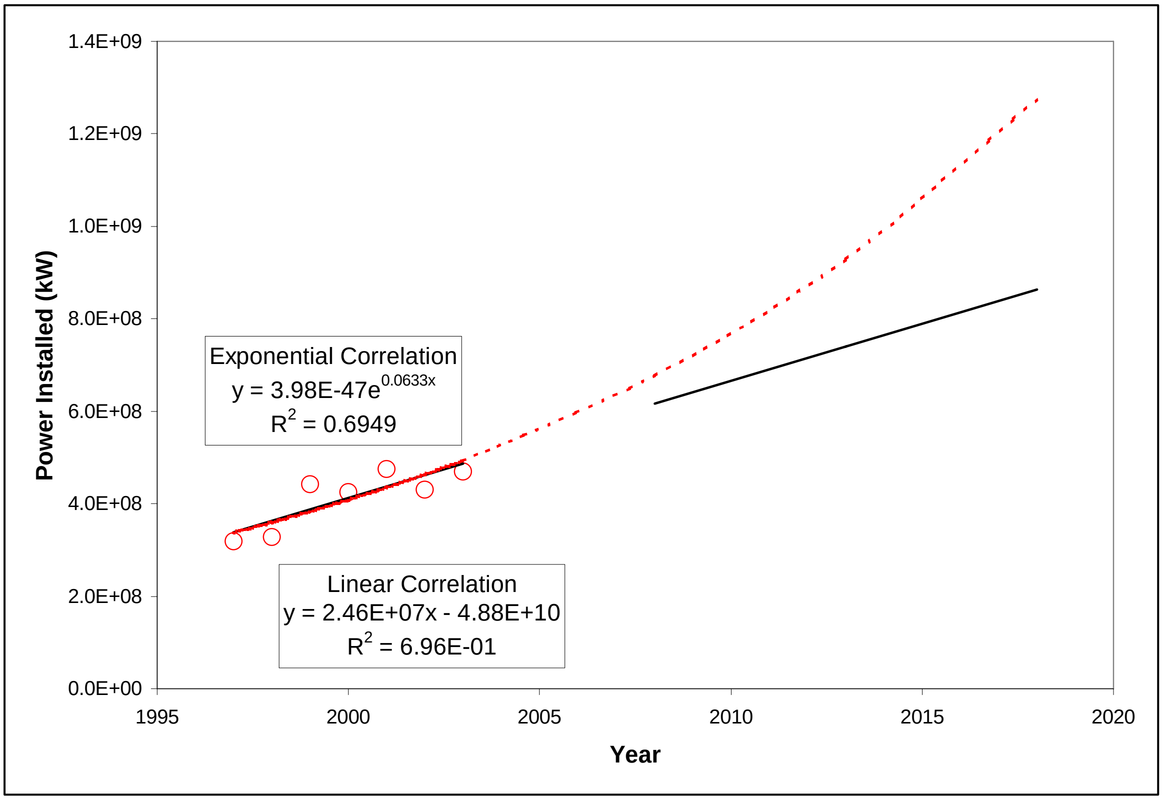


Figure 7-5. Commercial marine installed power trend and analysis.

7.4 RECENT GOODS MOVEMENT REGULATORY ACTIVITY

In the WRAP region, there have been several initiatives to better evaluate and regulate emission sources related to goods movement including marine vessels, locomotive, cargo handling equipment, other off-road equipment, and trucks.

The regulatory emissions control strategies have largely focused on California through the Air Resources Board's Goods Movement Plan (http://www.arb.ca.gov/planning/gmerp/gmerp.htm). Nonregulatory voluntary emission reduction plans are summarized by the West Coast Collaborative (http://www.westcoastcollaborative.org/index.htm). These regulatory and nonregulatory approaches will likely significantly affect future year emission projections but because they were not "on the books" at the time this work was done they have largely not been included in the WRAP emissions inventory projections. The California regulations primarily affect the particulate and sulfur emissions from some of the larger off-road emissions sources; these include lower fuel sulfur for auxiliary engines of large vessels, shoreside power for large vessels at berth, fleet turnover/retrofit for cargo handling equipment, locomotive fleet turnover, truck initiatives, and other measures. To the extent that the rules were final, ARB likely included the effects of these in their projected emissions, but many rules were not approved by the Board until after such inventories were provide to WRAP, and many rules are still under proposal.

In addition, as described above, the basic approach for estimating large vessel emissions in the mid-Pacific shipping lanes was developed by Professor James Corbett. Since the time of the WRAP commercial marine emissions inventory evaluation in 2005, Professor Corbett, under contract to CARB, has developed a revision to his approach, described at http://www.ocean.udel.edu/cms/jcorbett/sea/NorthAmericanSTEEM/. This modified approach is to be used for the evaluation of the Sulfur Emission Control Area (SECA, described at http://www.westcoastcollaborative.org/wkgrp-marine.htm) for the United States submittal.

8.0 ROAD DUST EMISSIONS METHODOLOGY

In the previous WRAP mobile source emissions inventory work, fugitive road dust emissions for unpaved roads were revised from the traditional EPA estimates with updated silt loading values, updated and revised activity estimates, and the application of transport fractions (Pollack et al., 2004). The aim of that work was to resolve large differences in road dust emissions in adjacent counties, and to use a consistent methodology across the WRAP region. The revised road dust emissions were estimated for 1996, the base year for the original WRAP modeling work, and 2018.

For this project, paved and unpaved road dust emissions were updated using the updated VMT for the base and future years provided by state and local contacts as part of the base and future year survey work. Any updated road dust controls provided were also incorporated into the estimates. It is important to note that since the previous WRAP road dust emissions estimates were prepared, EPA's guidance on estimating paved and unpaved road dust emissions was updated; see http://www.epa.gov/ttn/chief/ap42/ch13/index.html. For this project, the Emissions Forum opted to update the road dust emissions only to reflect updated VMT and controls, and not to reflect the updated EPA guidance methodology. Resources required to do a more complete update with the latest methodology would be large, and since road dust is not an important contributor to regional haze the decision was made to do the simpler updates only.

Road dust emissions estimates in the earlier WRAP work did not include Alaska, as Alaska was not a WRAP member at the time. Road dust emissions were therefore not estimated for Alaska in this effort. For California, road dust emissions provided by CARB were used.

Road dust emissions in the previous work included application of a factor to account for deposition and other removal mechanisms that tend to lower the amount of dust that is transported on a regional basis (i.e., across the 36 km grid cells in the WRAP modeling domain). The county-specific transport fractions that were applied depend on the vegetative characteristics of each county, and were calculated as the weighted average of vegetation-specific transport fractions in each county. For the current work, updated transport fractions were available, but were applied to the road dust emissions (and other dust sources) in the SMOKE emissions processing rather than in the development of the county-level emissions.

8.1 ROAD DUST SURVEY

As part of the survey form for future year VMT and modeling inputs for on-road and off-road emissions calculations, state and local agencies were asked to provide updated information to revise the earlier paved and unpaved road dust emissions. Along with the survey form, ENVIRON provided spreadsheets that showed the fractions of total VMT on paved and unpaved roads from the previous road dust emissions estimates, and state and local agencies were asked to review and update these fractions if they had appropriate available data. The survey also asked for a review and update of the road dust controls assumptions used in the prior work.

8.1.1 Updates to Paved and Unpaved Road VMT

An issue that arose is that in several regions the VMT that had been provided for the 2002 base year was for paved roads only, and did not include VMT from unpaved roads. This was the case for Pima County (AZ), Idaho, Nevada (all but Clark County), Utah, Wyoming. This meant that on-road vehicle emissions estimates, which use VMT as the activity data, were slightly underestimated in those areas. However, unpaved road VMT is a very small fraction of total VMT, and the Emissions Forum decided to not revise the existing on-road vehicle emissions estimates.

Unpaved VMT estimates were provided for all counties in Colorado, Montana, Nevada, Utah, and Washington, and for Maricopa County (AZ). The revisions for Montana were significant. Montana's approach for estimating unpaved road VMT was follows:

> "Because traffic on many of the unpaved roads is not systematically monitored, or in MDOT lingo called "Off_System", the following approach was used to determine the effective average annual daily traffic (AADT) on unpaved roads in each of the 56 counties in Montana. With the effective AADT for each county and the miles of unpaved roads that was Off-System in each county, the VMT for the unpaved off-system roads was calculated in each county. The AADT of these off system unpaved roads was determined based on state-wide data from traffic counters at several sites across the state that yielded an average daily traffic on unpaved roads. For this example the state-wide average AADT used on unpaved roads is 360 vehicle per day.
>
> For example, if the average AADT on unpaved roads is 360 vehicles per day the "effective" AADT would be calculated for a county with a low population density as follows:
>
> Effective AADT = 360 x 0.044/6.8 = 2.23,
>
> where 0.044 is the population density for county "A" and 6.8 is the average population density for the 56 counties in Montana. So for the low population density county A, the VMT would simply become the effective AADT multiplied by the total length of unpaved off-system roads in county A. Or VMT = 2.23 X 100 miles = 223 VMT for county A with 100 miles of unpaved road. For county "B" which has a high population density of 17.0 with 50 miles of unpaved off-system road. The effective AADT would be 360 x 17.0/6.8 = 900 and the VMT would be 900 X 50 miles or 45,000 VMT." (Carlin, 2005.)

The result of this approach is that Montana's unpaved road VMT is several times higher than in the previous inventory.

For future year road dust emissions estimates, the default VMT growth factors were assumed to be the same for unpaved VMT as for paved VMT. In the survey, state and local agencies were asked to provide updates if available. Three regions responded with updates to 2018 information: Maricopa County and Utah provided updated 2018 unpaved road VMT, and the Washington DEQ said to assume no growth in unpaved VMT between 2002 and 2018.

8.1.2 Updates to Road Dust Controls

The default assumptions for dust controls updates were those set by EPA in their calculation of road dust for the 1996 National Emissions Inventory, which was the basis of the previous WRAP road dust emissions estimates. The control assumed for paved roads was vacuum sweeping twice per month to achieve a control level of 79 percent, applied to urban and rural roads in serious PM nonattainment areas and to urban roads in moderate PM nonattainment areas. The penetration factor used varied by road type and nonattainment area classification (serious or moderate). For unpaved roads, the control measure and level of control assumed by EPA varied by PM nonattainment area classification and by rural and urban areas. On urban unpaved roads in moderate PM nonattainment areas, the assumed control was paving the unpaved roads. This control was applied with a control efficiency of 96 percent and a penetration rate of 50 percent. On rural roads in serious PM nonattainment areas, chemical stabilization was the assumed control; this control was applied with an assumed control efficiency of 75 percent and penetration rate of 50 percent. On urban unpaved roads in serious PM nonattainment areas, paving and chemical stabilization were the assumed control measures, with an assumed overall control efficiency of 90 percent and penetration rate of 75 percent. Updates to these control assumptions were provided by Maricopa County (AZ) and Yakima County (WA).

8.2 ROAD DUST EMISSIONS CALCULATIONS

The 2002 road dust emissions estimates were derived by modifying the previous WRAP road dust emissions estimates for updates to paved and unpaved road VMT and dust controls. The previous inventory covered the years 1996, 2003, 2008, 2013, and 2018. For this effort, the default 2002 paved and unpaved road dust VMT and emissions were calculated by county and roadway type by linearly interpolating from the previous 1996 and 2003 estimates. Transport fractions were backed out of these estimates.

The 2002 paved and unpaved VMT were then updated. A scaling factor of (updated 2002 VMT/default 2002 VMT) was then calculated by county and roadway type, and applied to the default 2002 road dust emissions to derive the updated emissions estimates. This calculation was done separately for paved and unpaved roads, for both PM10 and PM2.5. The same seasonal allocation factors for VMT used to estimate on-road vehicle emissions were then used to derive seasonal paved and unpaved road dust emissions.

Figure 8-1 compares coarse PM (PM10 – PM2.5) 2002 total unpaved road dust emissions between the previous WRAP inventory and this revision, with transport fractions applied. The differences in the emissions from the previous to the current effort seen in this plot are due to changes in unpaved road VMT, changes in control measures, and changes in the transport fractions. Overall the unpaved road dust emissions are lower, but the most striking change is for Montana, which has reported significantly increased unpaved road VMT in the current effort.

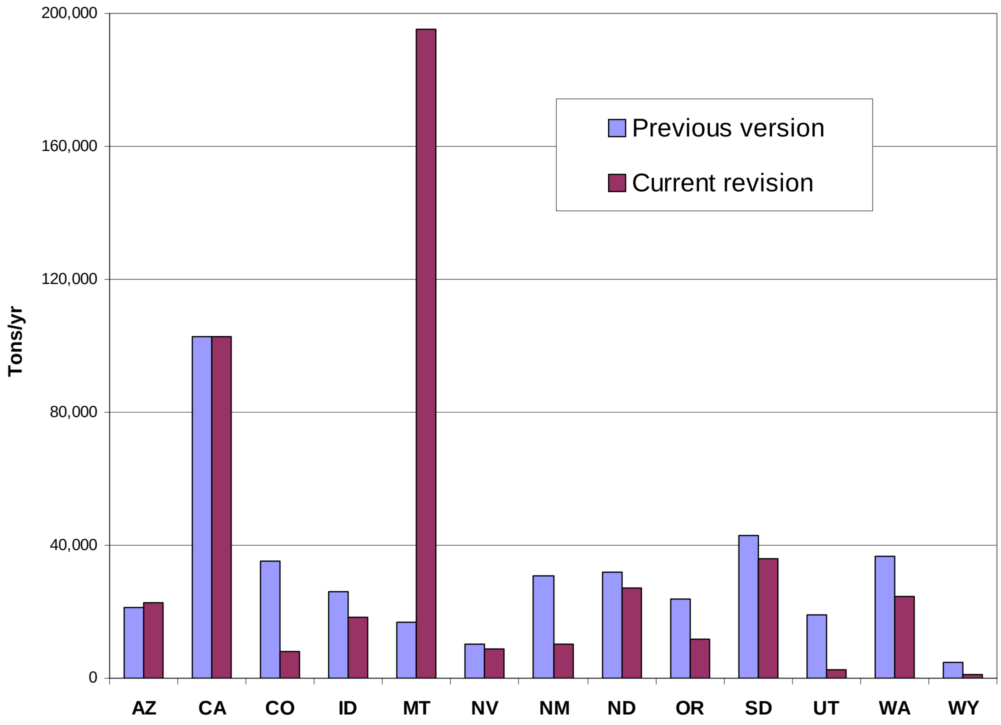


Figure 8-1. Unpaved road dust coarse PM emissions, with transport fractions applied, from previous and current WRAP inventories.

Paved and unpaved road dust emissions for 2018 were calculated in an analogous manner as the 2002 emissions: A scaling factor of (updated 2018 VMT/previous 2018 VMT) was calculated by county and roadway type, and applied to the previous 2018 road dust emissions to derive the updated emissions estimates. This calculation was done separately for paved and unpaved roads, for both PM10 and PM2.5. The seasonal allocation factors were then applied to determine seasonal emissions. The same controls were assumed for 2018 as used in 2002; no state or local agency indicated any changes should be made.

8.3 GENERATION OF SMOKE AND NIF FILES

Emissions files were generated in the format needed for SMOKE emissions processing. Seasonal county-level road dust emissions SMOKE files were generated, for all WRAP states combined (Alaska and California not included), only for years 2002 and 2018, the years for which the WRAP air quality modeling is performed. Separate files were prepared for each year.

Annual emissions files in EPA’s National Inventory Format (NIF) were also prepared and submitted to the WRAP Emissions Data Management System (EDMS), the on-line repository of all WRAP emissions data (http://www.wrapedms.org/default_login.asp). Annual emissions NIF files were prepared for each of the four years modeled, for all states combined (not Alaska or California).

Summary spreadsheets and tables were also prepared, and were posted on the WRAP Mobile Sources Emission Inventory Update project web page at http://wrapair.org/forums/ef/UMSI/index.html.

9.0 RESULTS

This section provides the emissions estimates for on-road and off-road mobile source emissions, and for road dust emissions, developed using the methodologies described in the previous sections of this report. The results are presented here in a series of tables and graphs; more detailed emissions by state, county, and source category are available in spreadsheets posted on the project web page at http://wrapair.org/forums/ef/UMSI/index.html.

9.1 OVERVIEW OF WRAP EMISSION INVENTORIES

To put the results of this work into context, Figures 9-1 and 9-2 show the contributions by source category for all emissions estimated for the WRAP region for 2002 and 2018, respectively. Figure 9-1 shows that on-road and off-road mobile source emissions comprise more than half of all CO and NOx emissions in 2002, and much lesser fractions for all other pollutants. Shipping emissions, though, are a significant contributor to overall SO2 emissions – about 20% in 2002.

In 2018, mobile source emissions are a much smaller fraction of overall NOx emissions. The contribution of NOx emissions from on-road vehicles has dropped significantly, from 34 percent to 16 percent, as older vehicles have been scrapped and replaced by newer vehicles that meet more stringent standards (for both light- and heavy-duty vehicles). The off-road equipment emissions contribution is similar in both years. There are newer standards for off-road equipment in future years, but they start later than for on-road vehicles, and have a longer phase-in period. Shipping emissions in 2018 contribute to 14 percent of the total NOx and about 22 percent of the total SO2 emissions.

9.2 ON-ROAD EMISSIONS

Figure 9-3 shows the contributions by vehicle class and fuel type to 2002 on-road emissions for the pollutants estimated. Light-duty vehicles dominate VOC, CO, and NH3 emissions; while heavy-duty vehicles dominate PM emissions. NOx emissions are about evenly split between light- and heavy-duty vehicles.

Figures 9-4 through 9-8 show the annual average ton per day (TPD) emissions by vehicle class, fuel type, and state, for the different pollutants. The emissions are listed by state and fuel type in Table 9-1. The graphs allow a visual comparison of emissions by state, as well as showing the relative contributions by vehicle class and fuel type. For all pollutants except SO2, California has the highest emissions of all of the states; California on-road SO2 emissions are lower because of state regulations requiring low sulfur fuels.

Figure 9-9 shows the spatial distribution of on-road NO emissions for on-road vehicles on a July weekday for 2002. This plot was prepared by the WRAP Regional Modeling Center (RMC) for quality assurance (QA) purposes. The plot shows the emissions for the contiguous 48 states, as prepared by the WRAP and the other four Regional Planning Organizations (RPOs), as well as Canada and Mexico. What is evident in the plot are the higher on-road NOx emissions in the major population centers and also major freeways in rural areas.

Tables 9-2 to 9-4 list the annual emissions for the three future years, by state and fuel type. Figures 9-10 through 9-15 show the changes in on-road mobile source emissions over time from 2002 to 2018. There are significant reductions in all pollutants as the fleet is turned over and newer vehicles are introduced that meet more stringent standards, most importantly the Tier 2 light-duty vehicle standards beginning with the 2005 model year and the 2007 heavy-duty standards. Despite an increase of about 40 percent in VMT, on-road NOx emissions are reduced by almost 70 percent from 2002 to 2018, VOC emissions by about 60 percent, and CO emissions by about 50 percent. On-road PM2.5 emissions are also decreasing, though at a lesser rate, about 25 percent from 2002 to 2018. On-road SO2 emissions are reduced dramatically from 2002 to 2008, as federal regulations require the introduction of low-sulfur gasoline and diesel fuels during that period.

9.3 OFF-ROAD EMISSIONS

Figure 9-16 shows the contributions to 2002 off-road emissions by source category, excluding commercial marine emissions. NOx emissions are dominated by locomotives and construction equipment. Lawn and garden equipment and recreational marine are the largest contributors to off-road VOC emissions, and lawn and garden equipment also dominate CO emissions. Agricultural and construction equipment are the largest contributors to both PM10 and PM2.5 emissions.

Figures 9-17 through 9-21 show the annual average TPD emissions by source category and state for the different pollutants. The emissions are listed by state and fuel type in Table 9-5. As for on-road emissions, California has the highest emissions of all of the states for all pollutants except SO2; California off-road SO2 emissions are lower because of state regulations requiring low sulfur nonroad diesel fuel in 2002. Figure 9-22 shows the QA plot of the spatial distribution of NO emissions for off-road equipment on a July weekday for 2002.

Tables 9-6 to 9-8 list the annual off-road emissions for the three future years, by state and fuel type. Figures 9-23 through 9-28 show the changes in off-road mobile source emissions over time from 2002 to 2018, excluding commercial marine emissions. There are significant reductions in all pollutants except CO as the off-road equipment fleet is turned over and newer engines are introduced that meet more stringent standards. Off-road NOx emissions are reduced by almost 40 percent from 2002 to 2018, VOC emissions by about 37 percent, and PM emissions by about 43 percent. CO emissions for off-road equipment are increasing slightly, and SO2 emissions are reduced dramatically as the low sulfur nonroad diesel fuel regulations are phased in.

9.4 TOTAL MOBILE SOURCE EMISSIONS

Figures 9-29 through 9-34 show the changes in total on-road and off-road mobile source emissions over time from 2002 to 2018, excluding commercial marine emissions. For all mobile sources combined (except commercial marine), there are significant reductions in all pollutants over time – about 55 percent for NOx emissions, about 50 percent for VOC emissions, about 50 percent for PM10 and 40 percent for PM2.5 emissions, about 37 percent in CO emissions, and nearly 90 percent in SO2 emissions.

Offshore commercial marine emissions were not included in the previous WRAP mobile sources emission inventory, and are a significant source of NOx and SO2 emissions. Table 9-9 shows the west coast 2002 NOx and SO2 emissions for all mobile sources, including commercial marine. The table shows that total commercial marine emissions, offshore plus inshore, are about 25 percent of the sum of all other on-road and off-road NOx emissions, and about five times the sum of all other mobile SO2 emissions. Table 9-10 shows the west coast 2018 NOx and SO2 emissions for all mobile sources, including commercial marine. In the future years, NOx and SO2 emissions have been reduced from all other mobile sources (except aircraft), but commercial marine emissions NOx and SO2 emissions are increasing with increased ship traffic. In 2018, total commercial marine emissions are about 25 percent higher than all other mobile NOx emissions, and about five times the sum of all other mobile SO2 emissions.

9.5 ROAD DUST EMISSIONS

Tables 9-11 and 9-12 show the estimated PM10 and PM2.5 emissions by state for paved and unpaved roads, respectively. Tables 9-13 and 9-14 show the road dust emissions by state in 2018. (California road dust emissions are not included in these tables; they are reported in the area sources and were not revised in this effort.) Road dust emissions increase significantly from 2002 to 2018, in proportion to the increase in vehicle miles travelled.

Figure 9-35 shows the QA plot of the spatial distribution of road dust coarse PM emissions for on a July weekday for 2002. The plot shows that the clear methodological differences in estimating road dust emissions in Montana vs. the rest of the WRAP states, and also differences among the calculations by RPO.

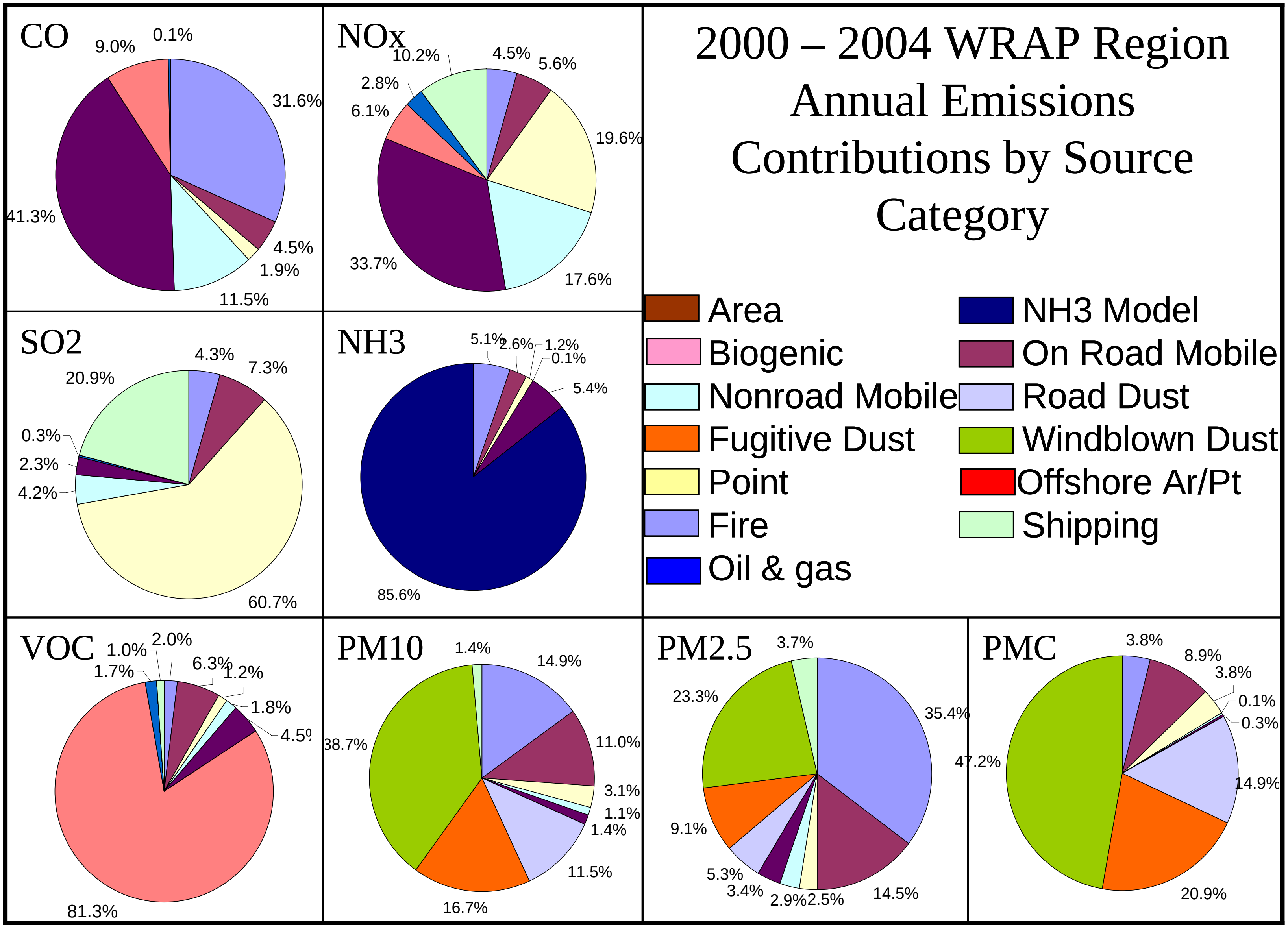


Figure 9-1. 2000 – 2004 WRAP region annual emissions contributions by source category. Source: Adelman et al., 2006.

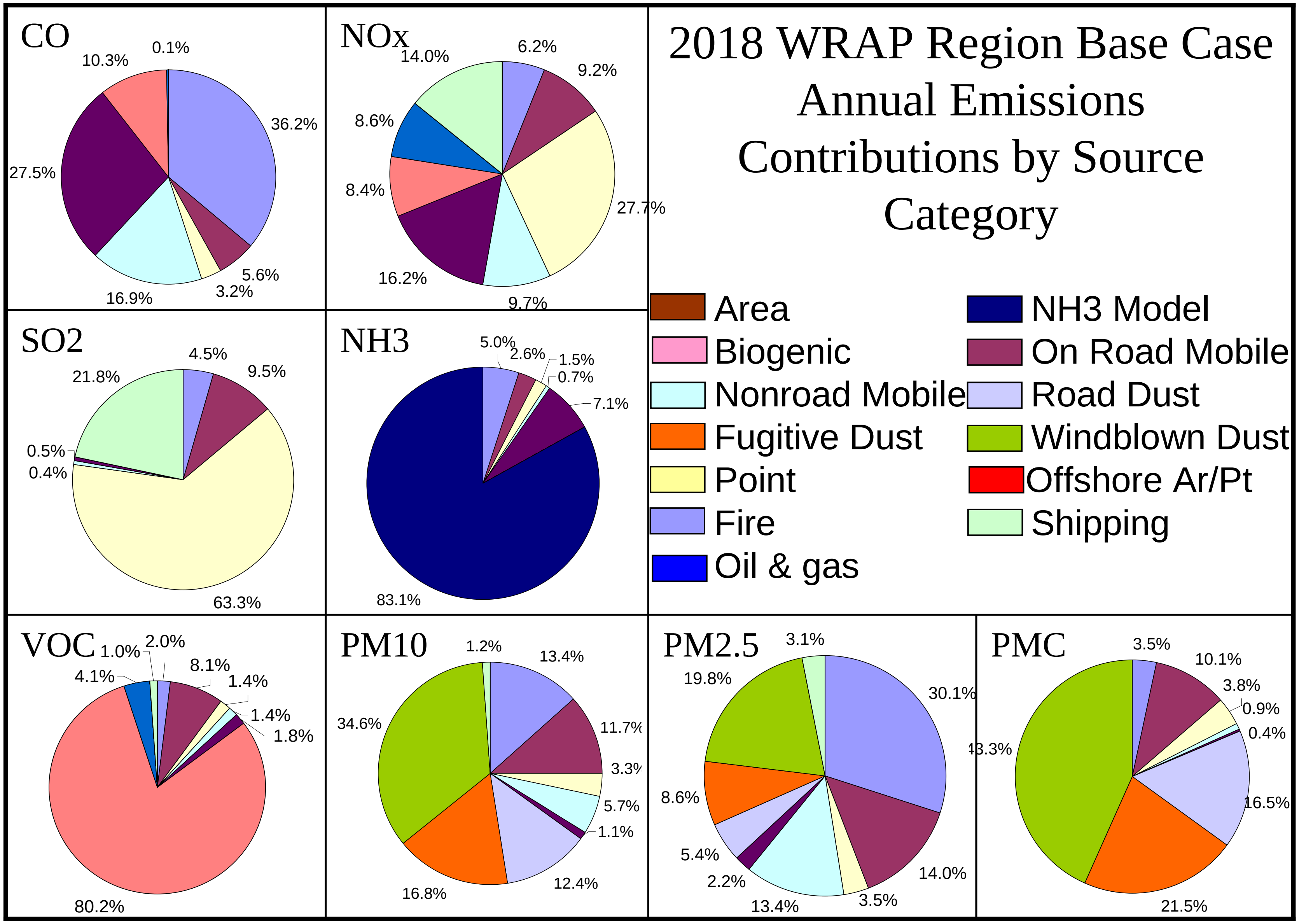


Figure 9-2. 2018 WRAP region Base Case annual emissions contributions by source category. Source: Adelman et al., 2006.

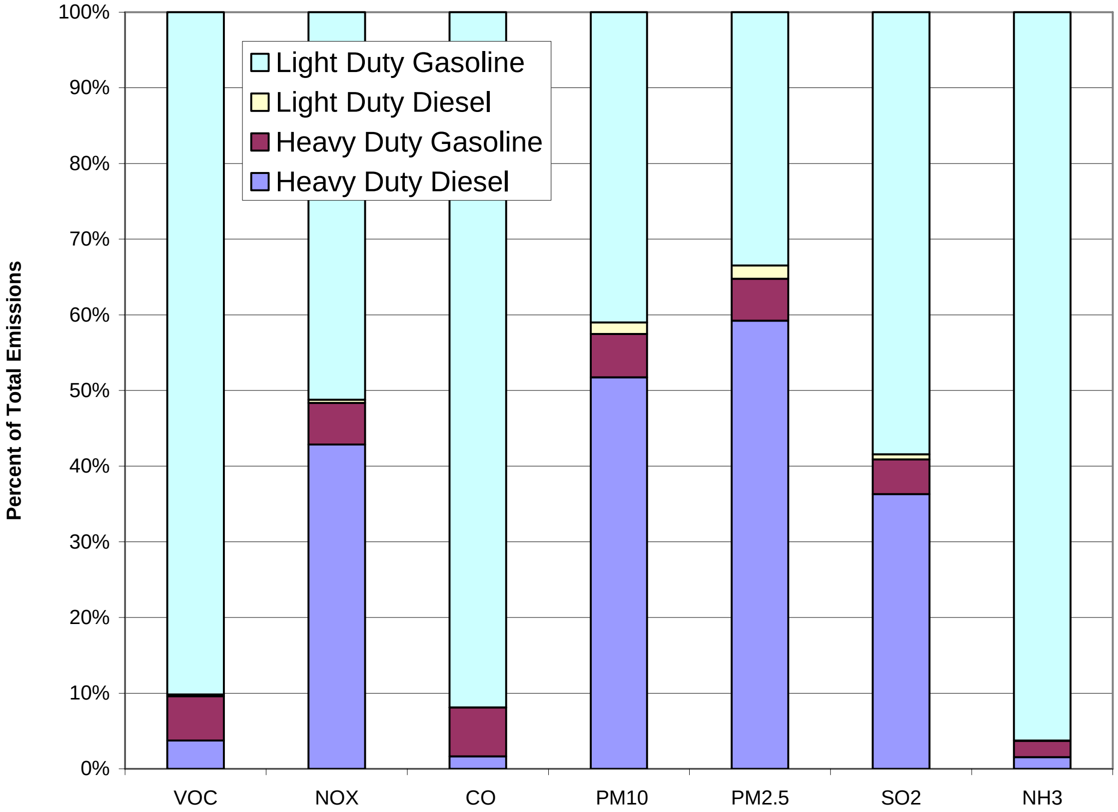


Figure 9-3. 2002 Western states average annual on-road emissions (% by vehicle class and fuel type).

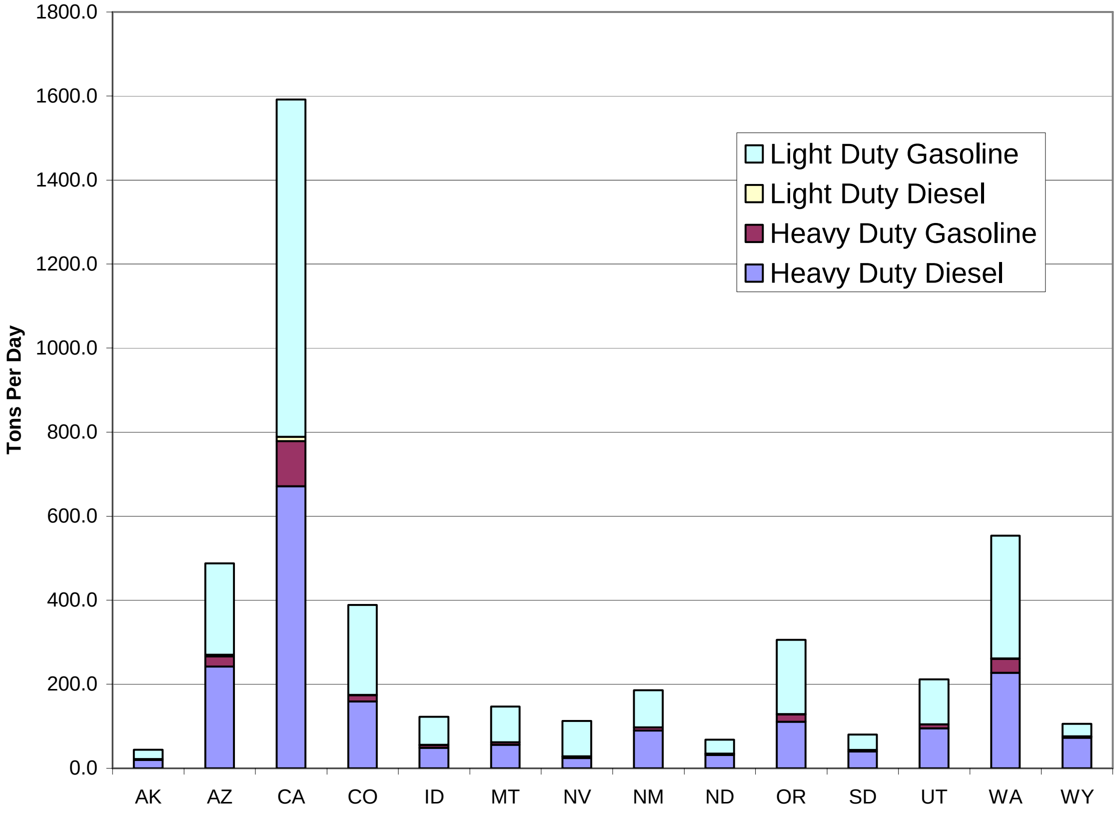


Figure 9-4. 2002 Western states average annual on-road NOx emissions by vehicle class and fuel type.

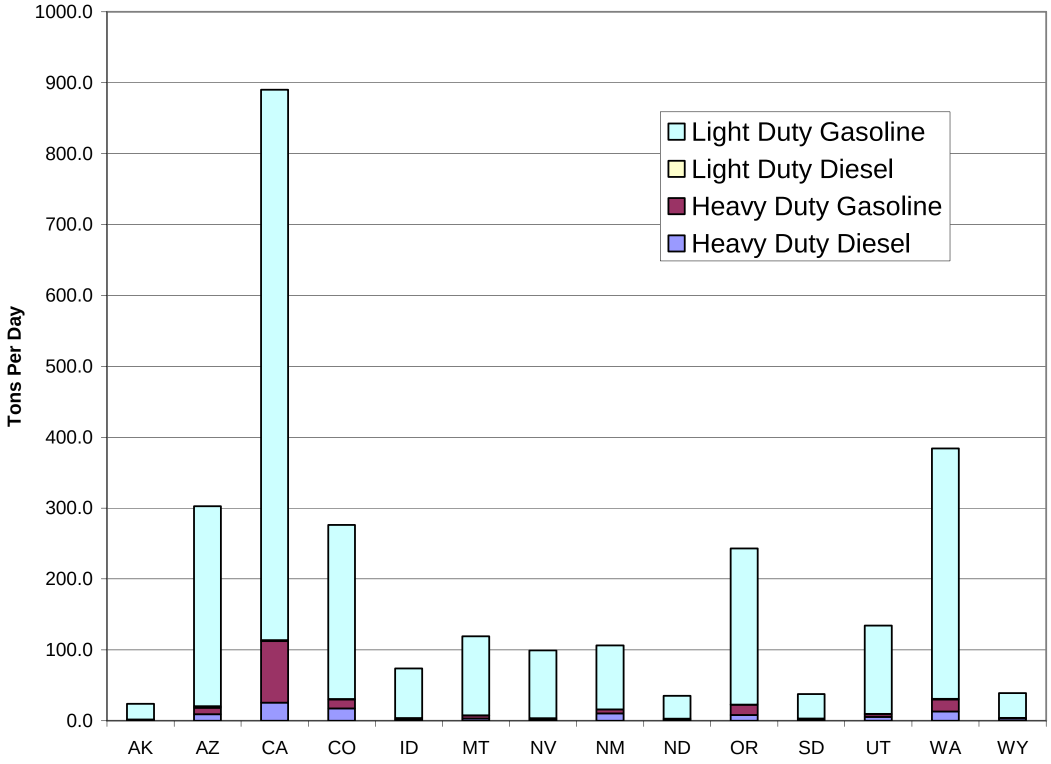


Figure 9-5. 2002 Western states average annual on-road VOC emissions by vehicle class and fuel type.

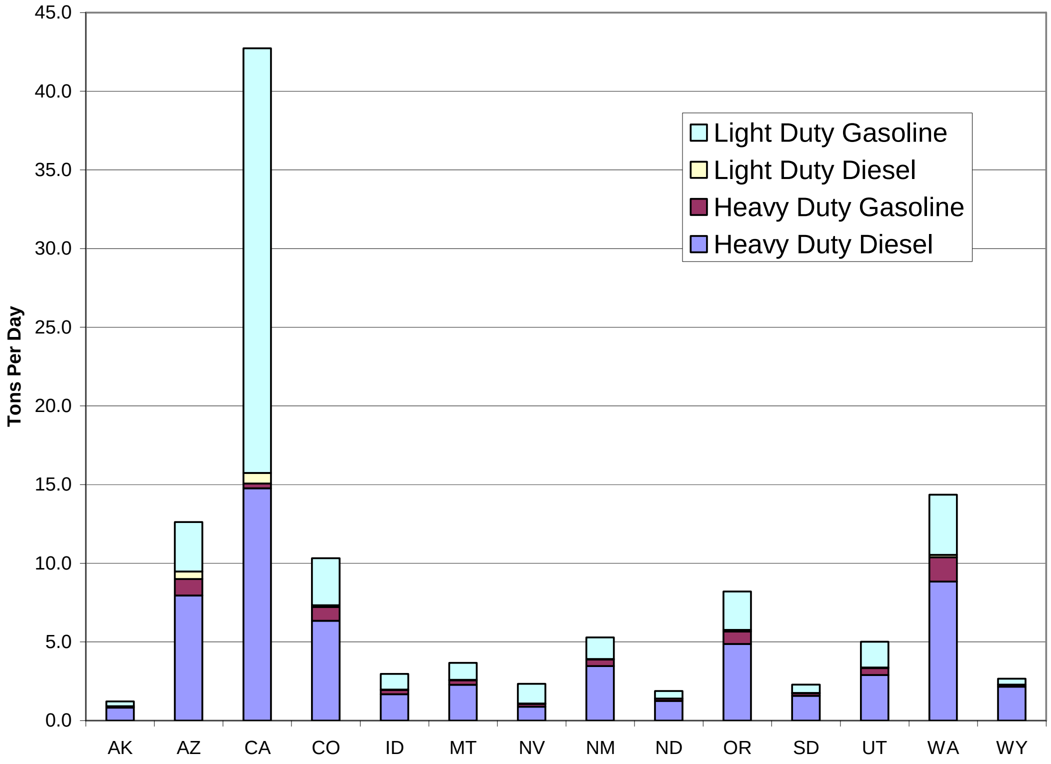


Figure 9-6. 2002 Western states average annual on-road PM10 emissions by vehicle class and fuel type.

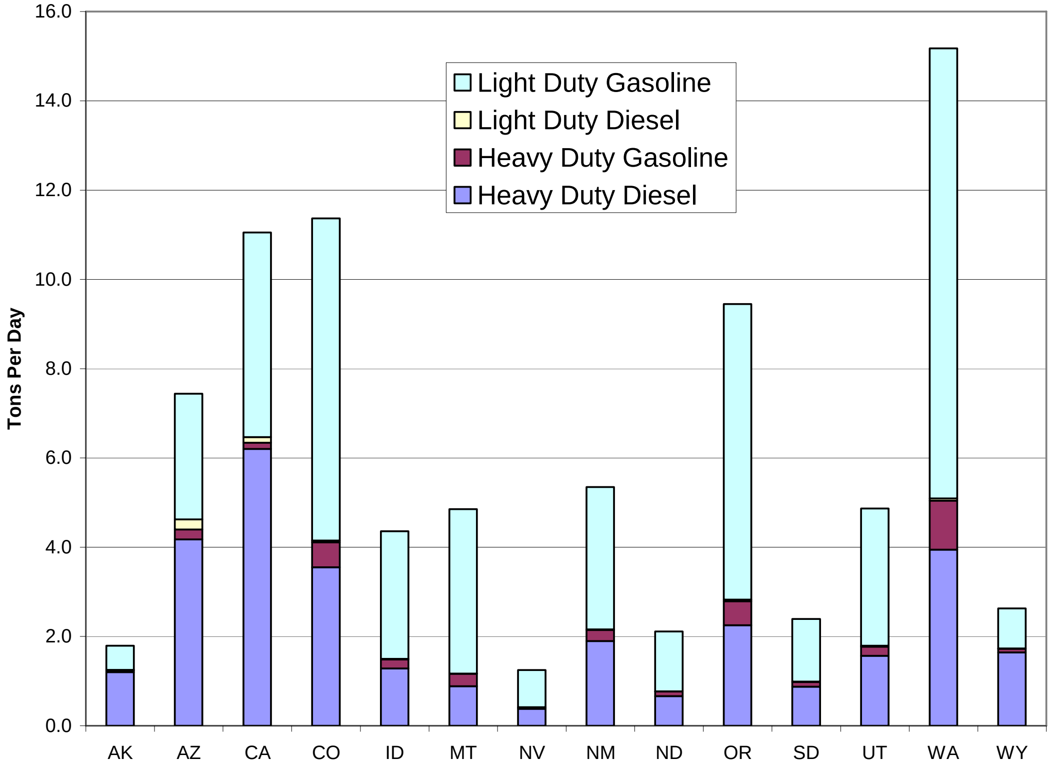


Figure 9-7. 2002 Western states average annual on-road SO2 emissions by vehicle class and fuel type.

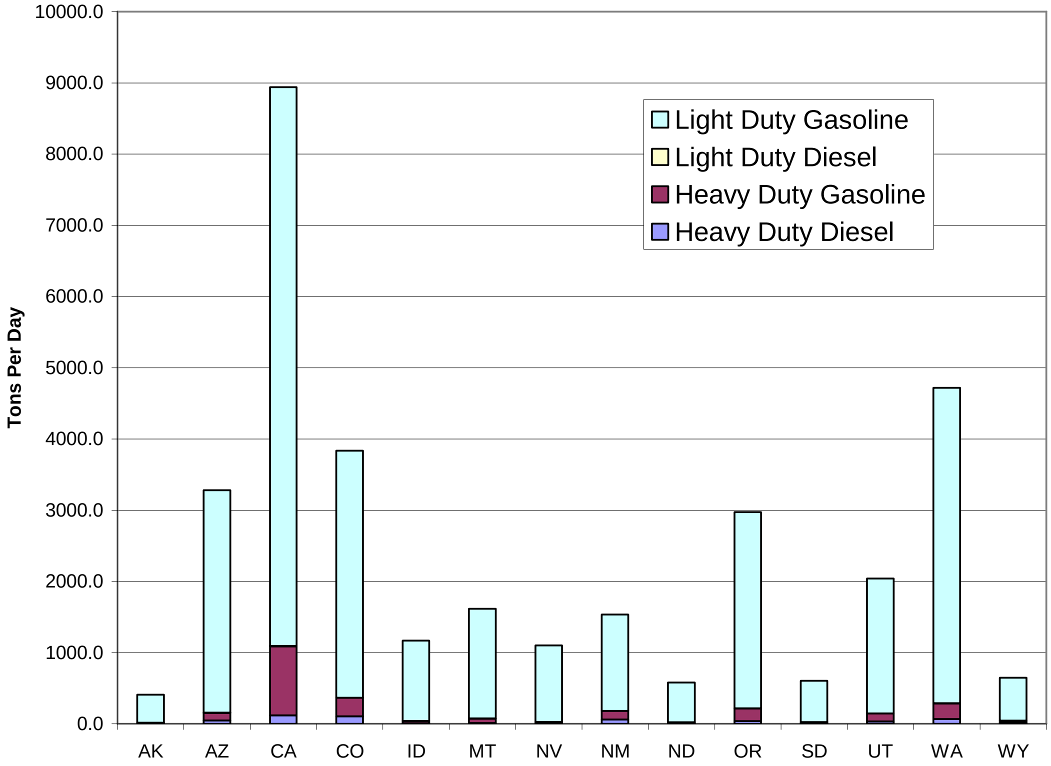


Figure 9-8. 2002 Western states average annual on-road CO emissions by vehicle class and fuel type.

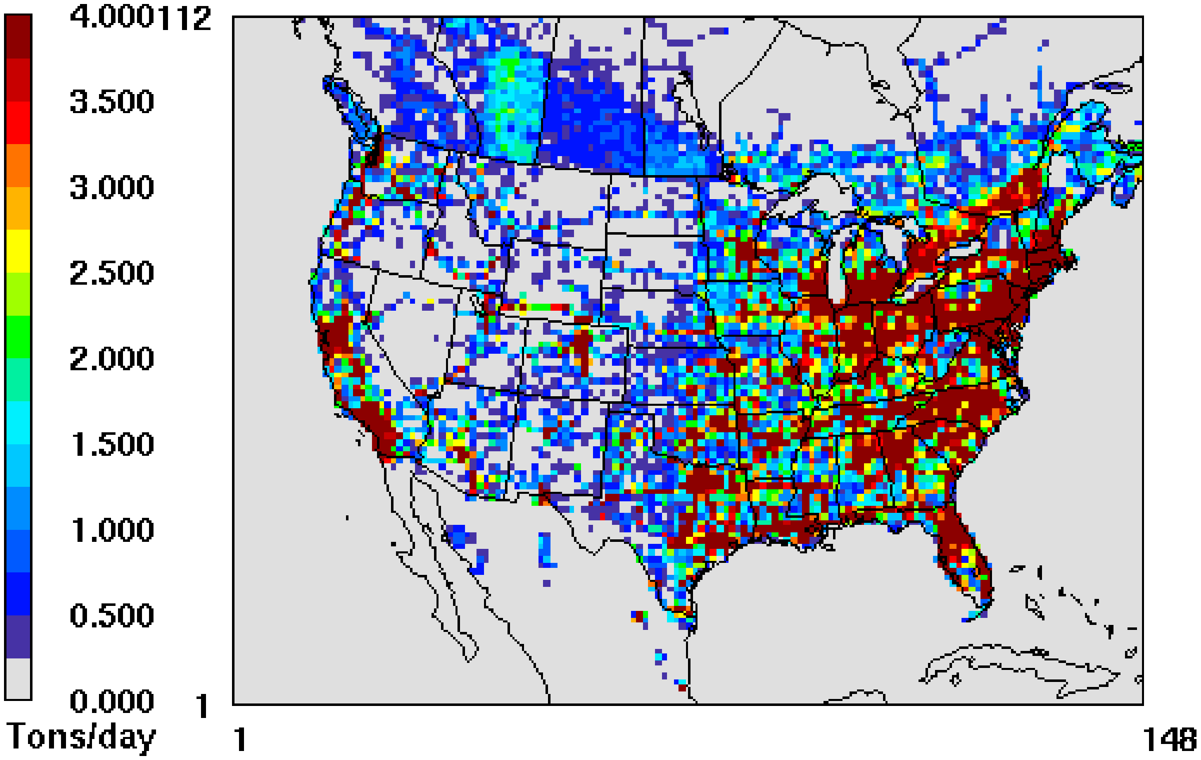
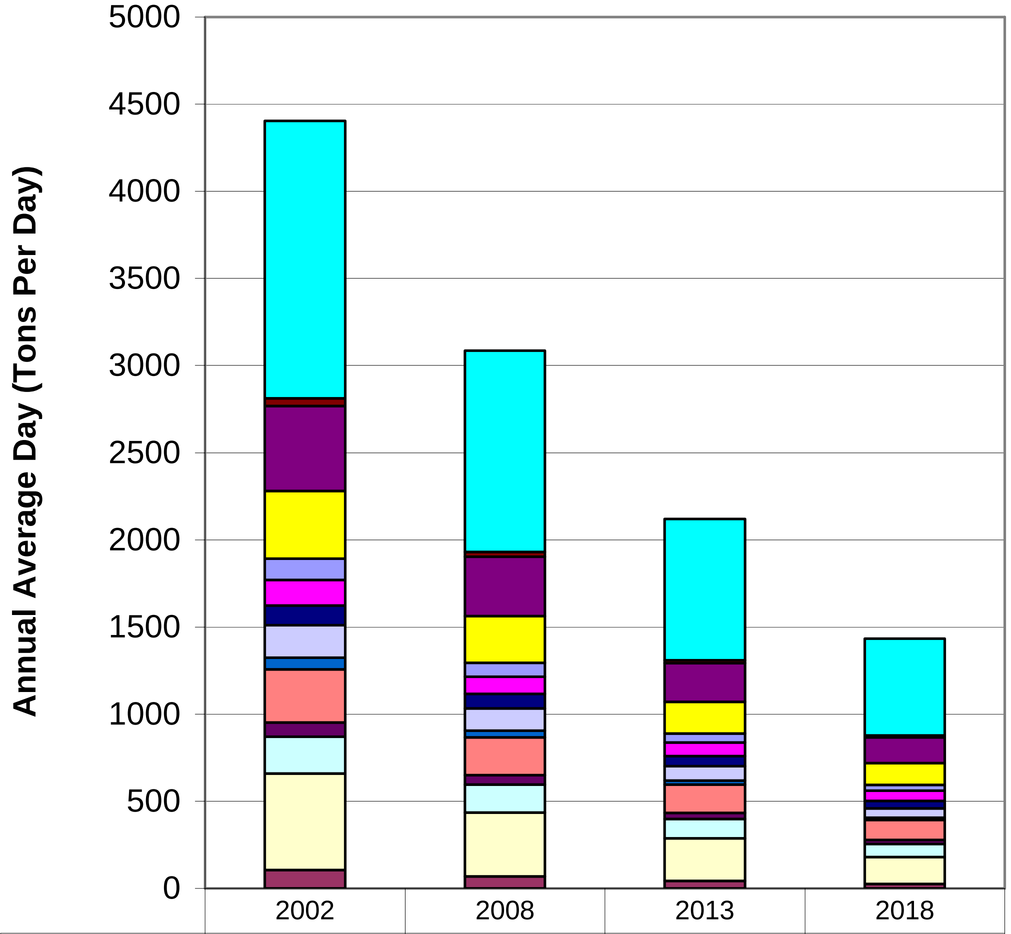
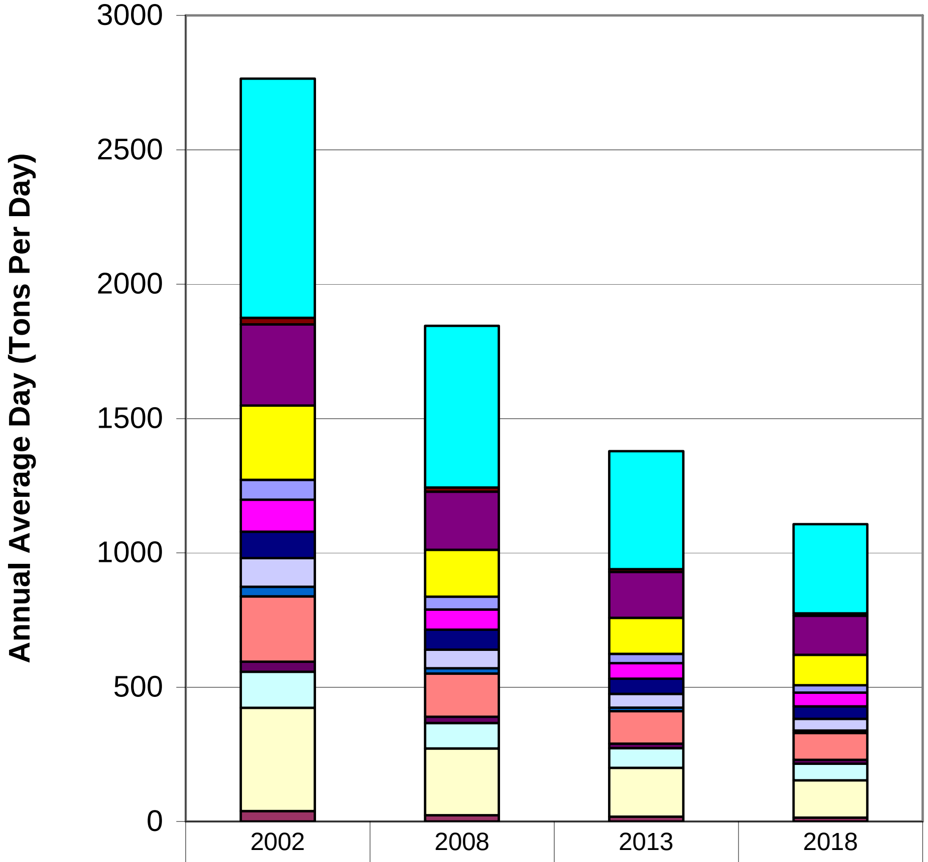


Figure 9-9. Spatial distribution of all RPO on-road NO emissions, 2002 July weekday. Source: WRAP Regional Modeling Center (*http://pah.cert.ucr.edu/aqm/308/QA_plan02a36.plots/)*



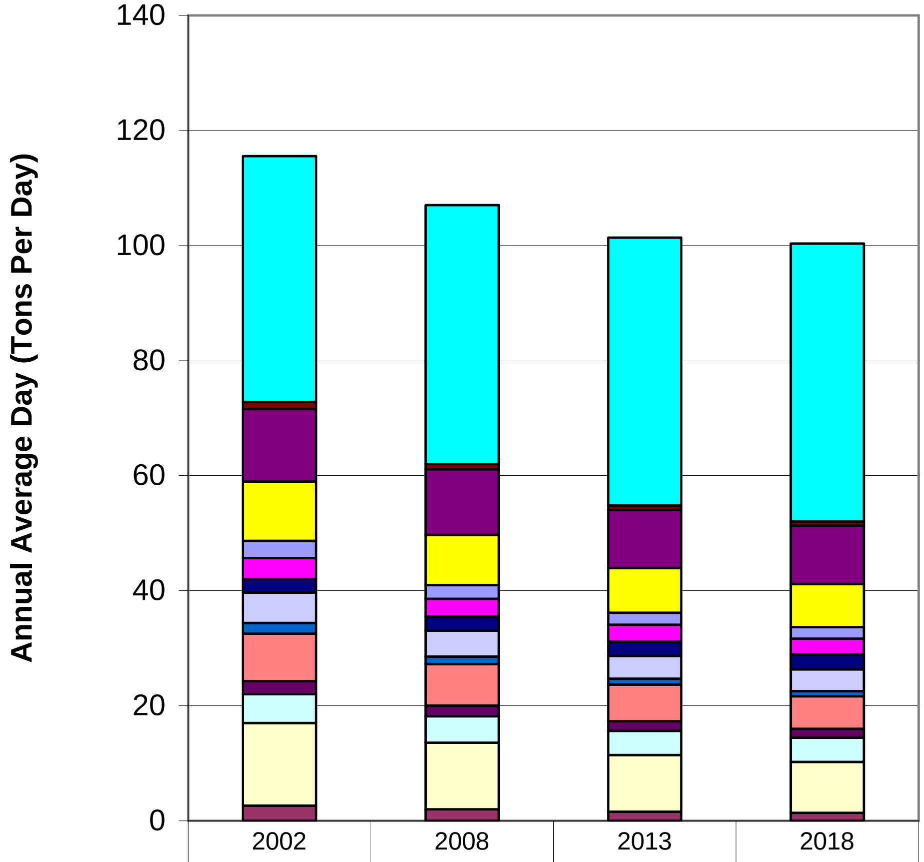
	2002	2008	2013	2018
■ California	1592	1156	809	556
■ Alaska	44	28	17	11
■ Arizona	488	340	222	147
■ Colorado	389	269	181	124
■ Idaho	122	79	51	34
■ Montana	147	97	78	60
■ Nevada	113	83	59	41
■ New Mexico	186	128	83	54
■ North Dakota	68	38	22	13
■ Oregon	306	217	163	115
■ South Dakota	80	53	34	22
■ Utah	212	161	112	75
■ Washington	553	367	244	153
■ Wyoming	106	68	43	27

Figure 9-10. Western states on-road annual average daily NOx emissions, 2002 – 2018.



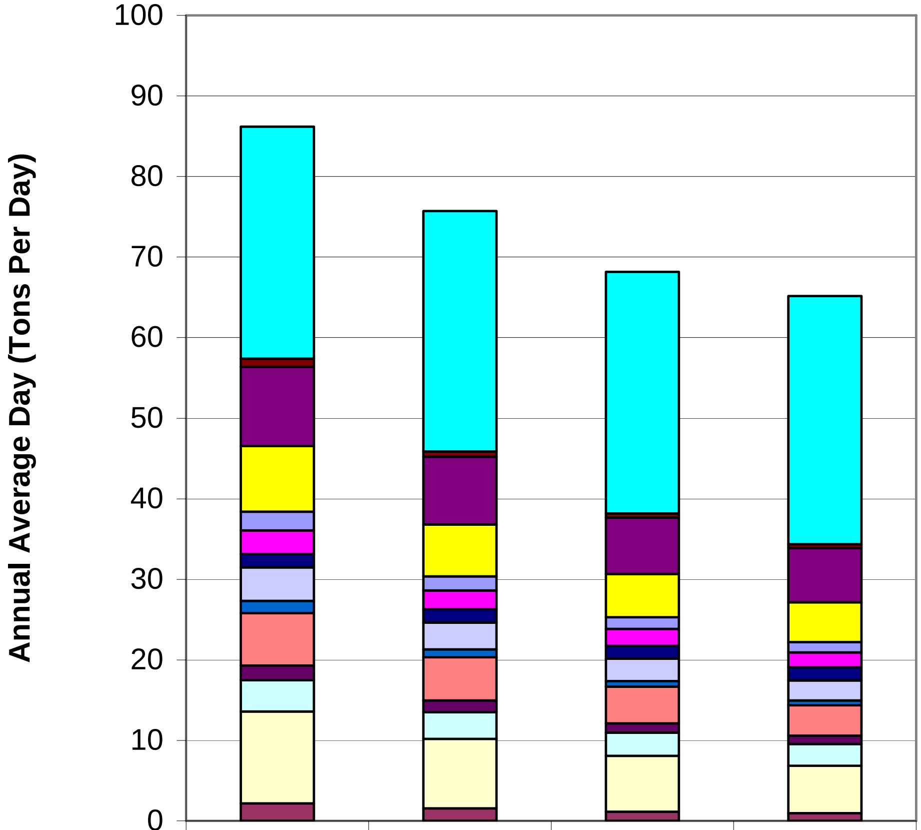
	2002	2008	2013	2018
■ California	890	602	439	332
■ Alaska	24	15	10	8
■ Arizona	303	216	171	145
■ Colorado	276	175	134	114
■ Idaho	74	47	34	28
■ Montana	119	75	58	51
■ Nevada	99	75	57	47
■ New Mexico	106	69	51	43
■ North Dakota	35	19	13	10
■ Oregon	243	161	121	100
■ South Dakota	38	24	17	14
■ Utah	134	95	74	62
■ Washington	384	248	181	139
■ Wyoming	39	24	18	14

Figure 9-11. Western states on-road annual average daily VOC emissions, 2002 – 2018.



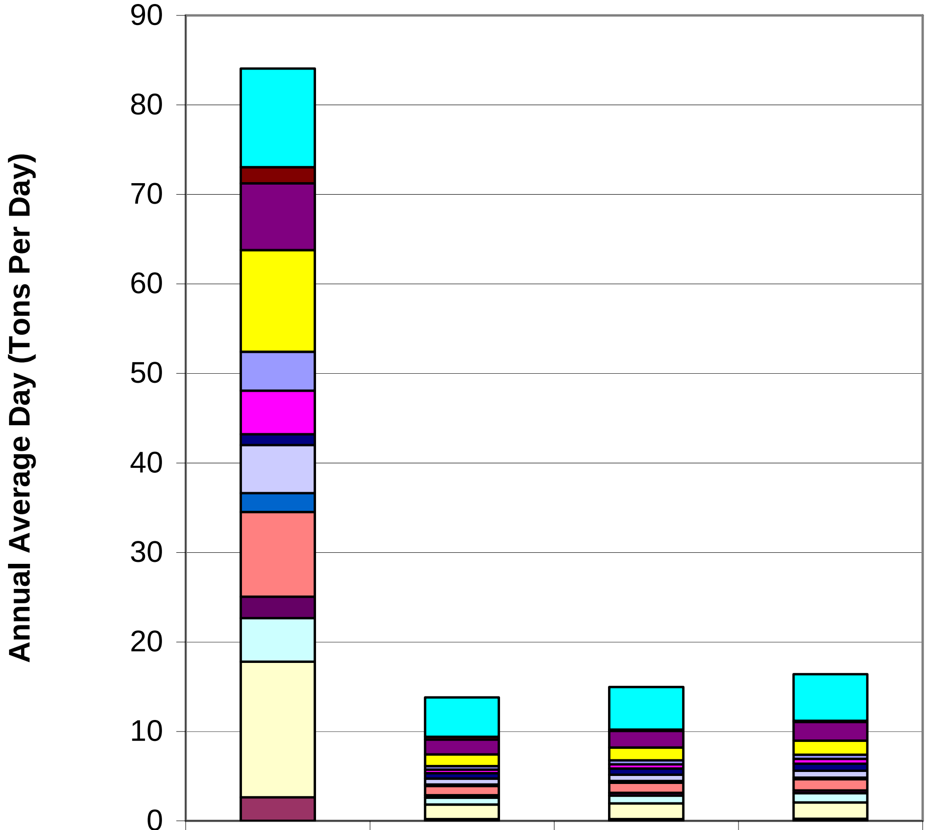
	2002	2008	2013	2018
■ California	42.7	45.0	46.6	48.3
■ Alaska	1.2	0.9	0.8	0.7
■ Arizona	12.6	11.4	10.1	10.2
■ Colorado	10.3	8.7	7.7	7.5
■ Idaho	3.0	2.4	2.1	2.0
■ Montana	3.7	3.1	2.9	2.7
■ Nevada	2.3	2.4	2.5	2.6
■ New Mexico	5.3	4.5	4.0	3.8
■ North Dakota	1.9	1.3	1.0	0.9
■ Oregon	8.2	7.2	6.3	5.7
■ South Dakota	2.3	1.9	1.6	1.5
■ Utah	5.0	4.6	4.2	4.2
■ Washington	14.4	11.6	9.9	8.9
■ Wyoming	2.7	2.0	1.6	1.4

Figure 9-12. Western states on-road annual average daily PM10 emissions, 2002 – 2018.



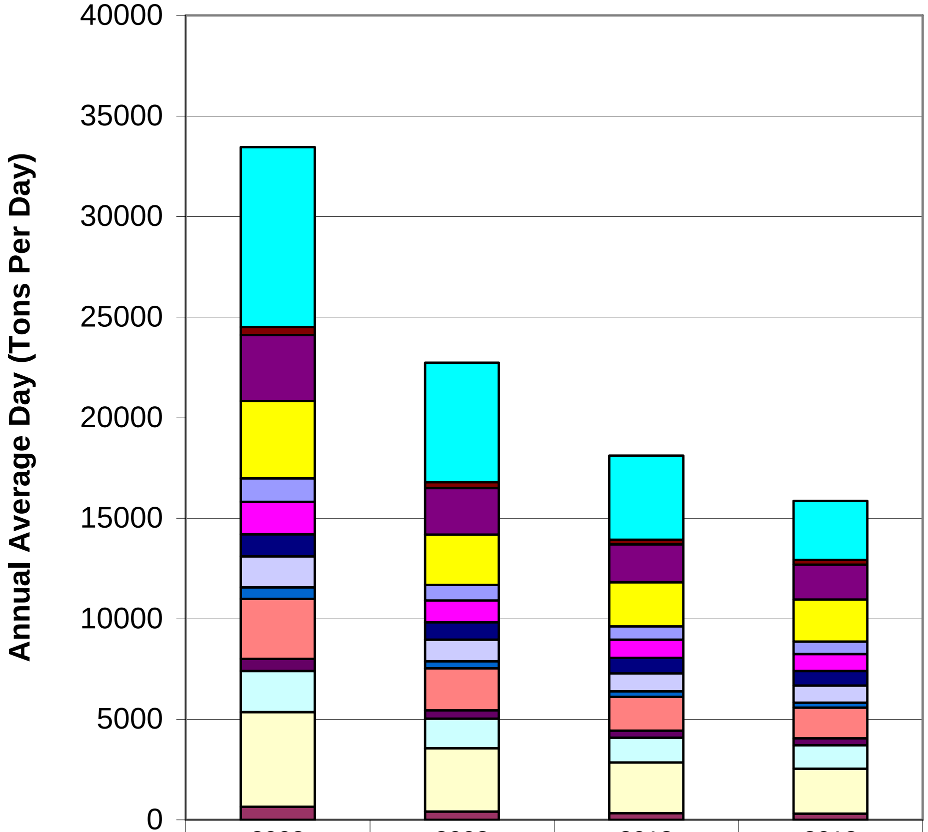
	2002	2008	2013	2018
■ California	28.8	29.8	30.0	30.8
■ Alaska	1.0	0.7	0.5	0.5
■ Arizona	9.9	8.4	7.0	6.7
■ Colorado	8.1	6.5	5.4	4.9
■ Idaho	2.3	1.7	1.4	1.3
■ Montana	2.9	2.4	2.1	1.8
■ Nevada	1.7	1.6	1.6	1.6
■ New Mexico	4.2	3.3	2.8	2.5
■ North Dakota	1.5	1.0	0.7	0.6
■ Oregon	6.5	5.4	4.5	3.8
■ South Dakota	1.8	1.4	1.2	1.0
■ Utah	3.9	3.3	2.9	2.7
■ Washington	11.4	8.6	6.9	5.9
■ Wyoming	2.2	1.5	1.2	1.0

Figure 9-13. Western states on-road annual average daily PM2.5 emissions, 2002 – 2018.



	2002	2008	2013	2018
California	11.1	4.4	4.8	5.2
Alaska	1.8	0.3	0.1	0.2
Arizona	7.4	1.7	1.9	2.1
Colorado	11.4	1.3	1.4	1.6
Idaho	4.4	0.4	0.4	0.5
Montana	4.9	0.4	0.5	0.5
Nevada	1.2	0.6	0.7	0.8
New Mexico	5.3	0.6	0.7	0.8
North Dakota	2.1	0.2	0.2	0.2
Oregon	9.4	1.0	1.1	1.3
South Dakota	2.4	0.3	0.3	0.3
Utah	4.9	0.8	0.9	1.0
Washington	15.2	1.6	1.7	1.9
Wyoming	2.6	0.2	0.2	0.2

Figure 9-14. Western states on-road annual average daily SO2 emissions, 2002 – 2018.



	2002	2008	2013	2018
■ California	8939	5937	4179	2933
■ Alaska	409	293	249	235
■ Arizona	3282	2312	1867	1727
■ Colorado	3835	2502	2206	2086
■ Idaho	1170	777	657	621
■ Montana	1616	1076	898	851
■ Nevada	1100	876	771	727
■ New Mexico	1537	1062	891	843
■ North Dakota	579	353	280	246
■ Oregon	2973	2088	1678	1535
■ South Dakota	606	417	350	328
■ Utah	2042	1462	1238	1171
■ Washington	4718	3160	2515	2243
■ Wyoming	646	416	340	308

Figure 9-15. Western states on-road annual average daily CO emissions, 2002 – 2018.

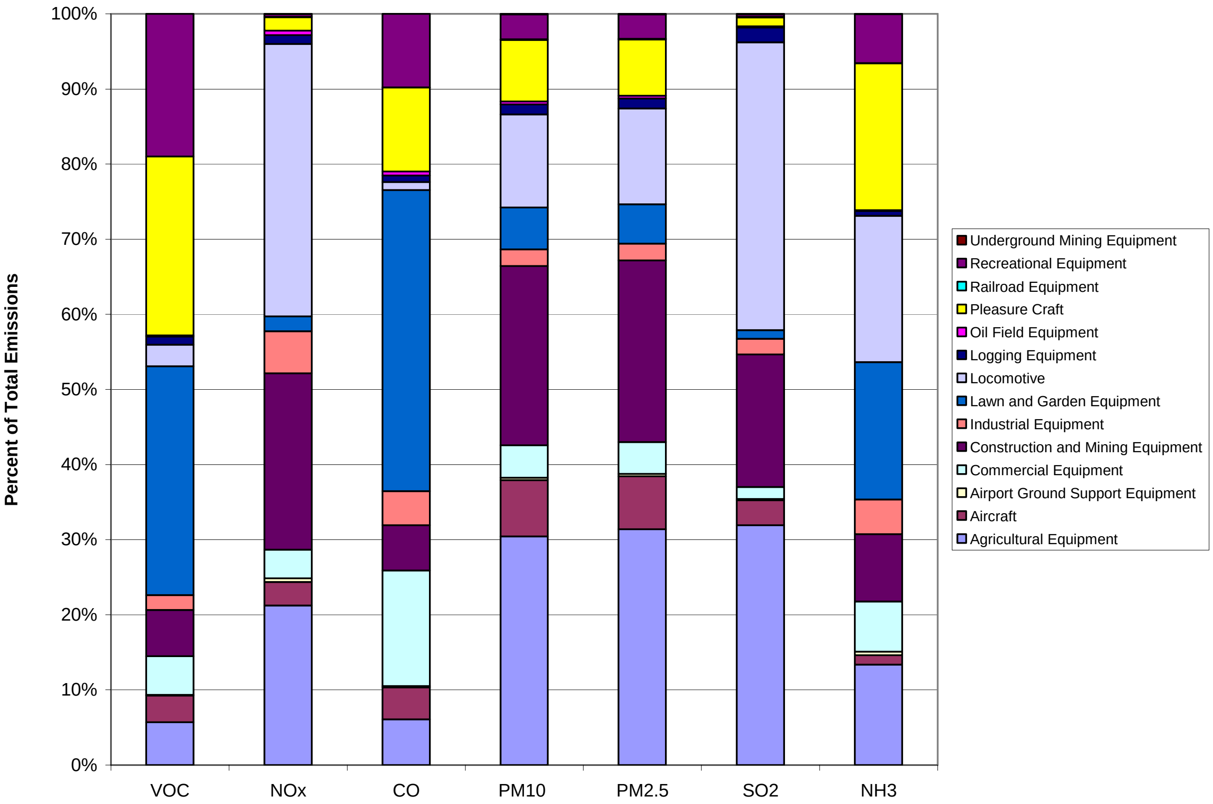


Figure 9-16. Western states 2002 off-road emissions (% by source category, does not include commercial marine).

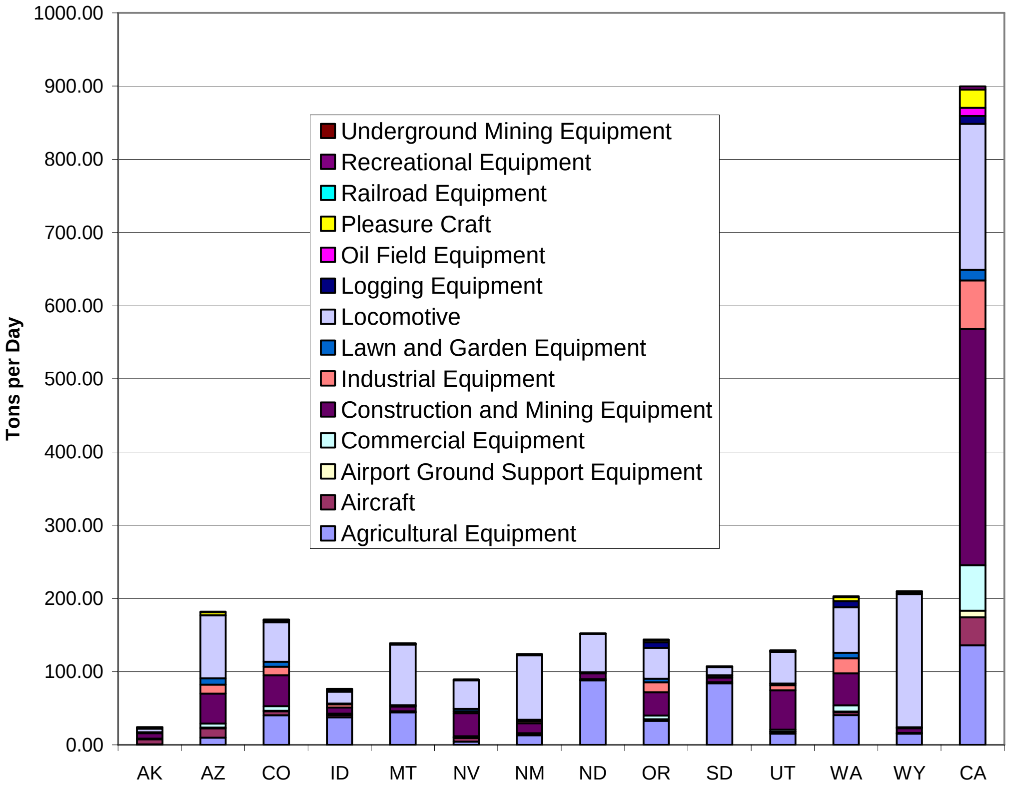


Figure 9-17. 2002 Western states average annual off-road NOx emissions by source category (does not include commercial marine).

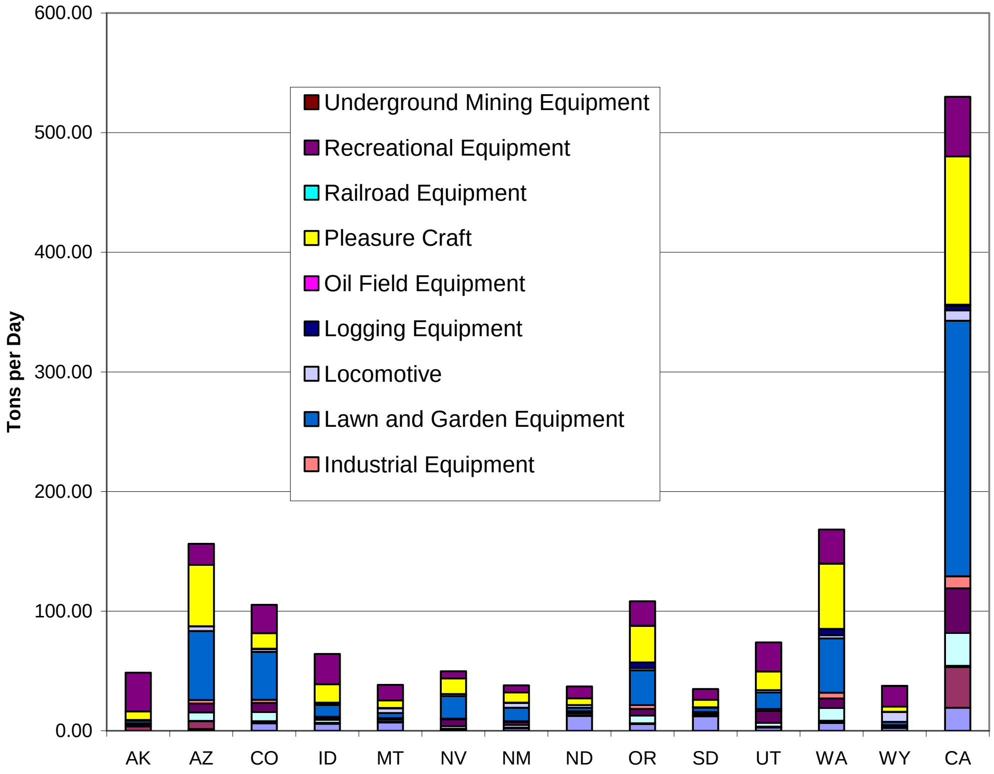


Figure 9-18. 2002 Western states average annual off-road VOC emissions by source category (does not include commercial marine).

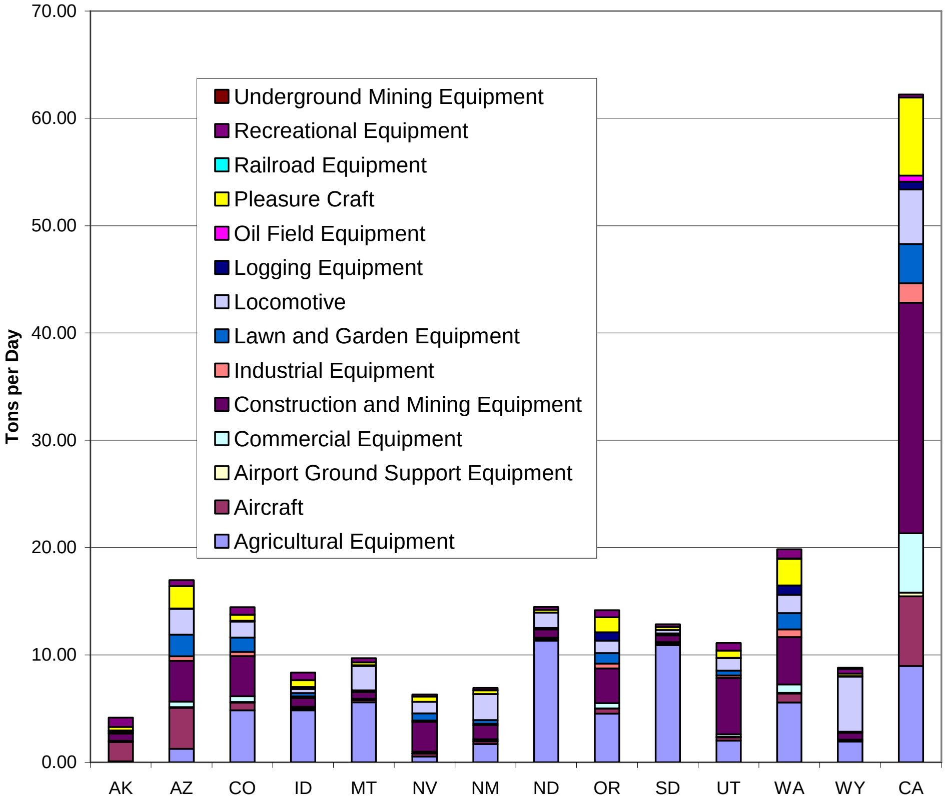


Figure 9-19. 2002 Western states average annual off-road PM10 emissions by source category (does not include commercial marine).

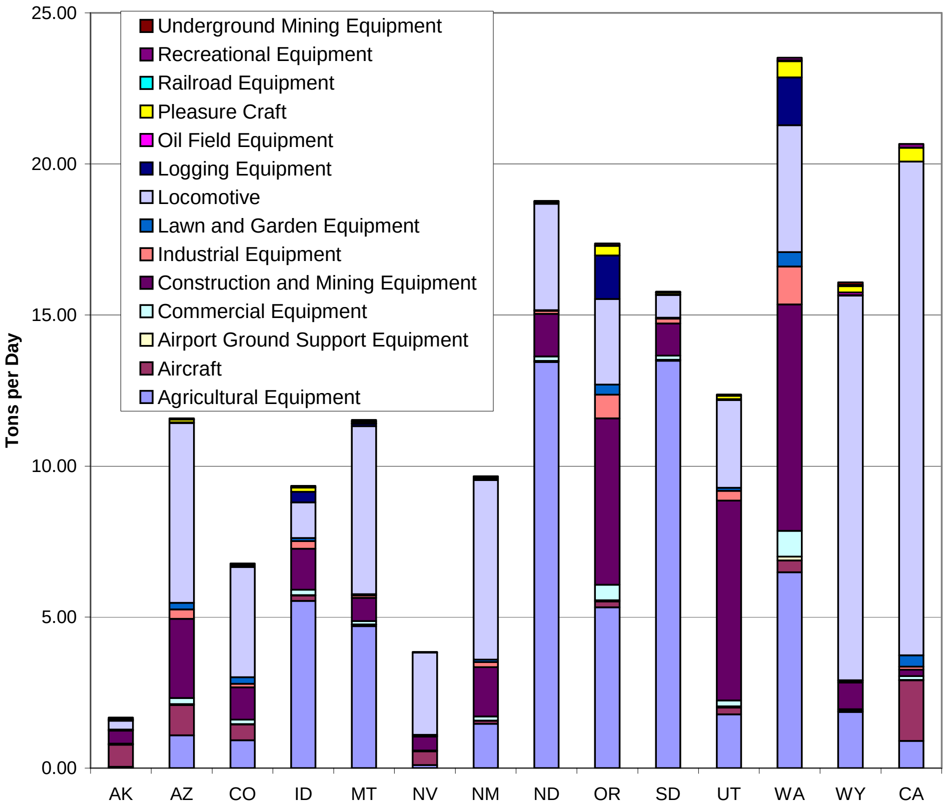


Figure 9-20. 2002 Western states average annual off-road SO2 emissions by source category (does not include commercial marine).

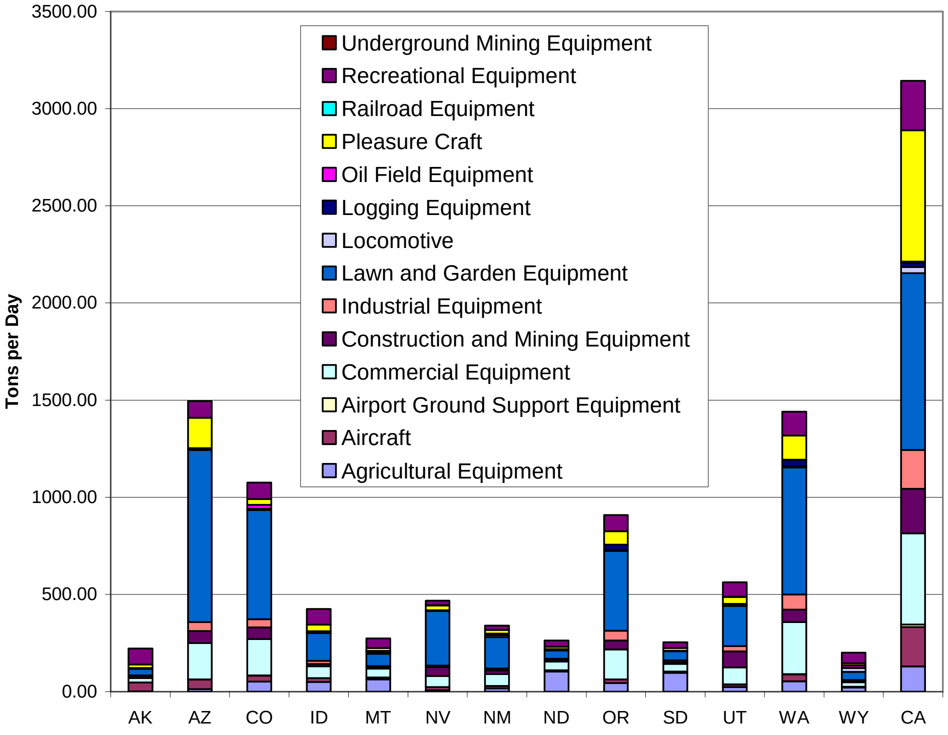


Figure 9-21. 2002 Western states average annual off-road CO emissions by source category (does not include commercial marine).

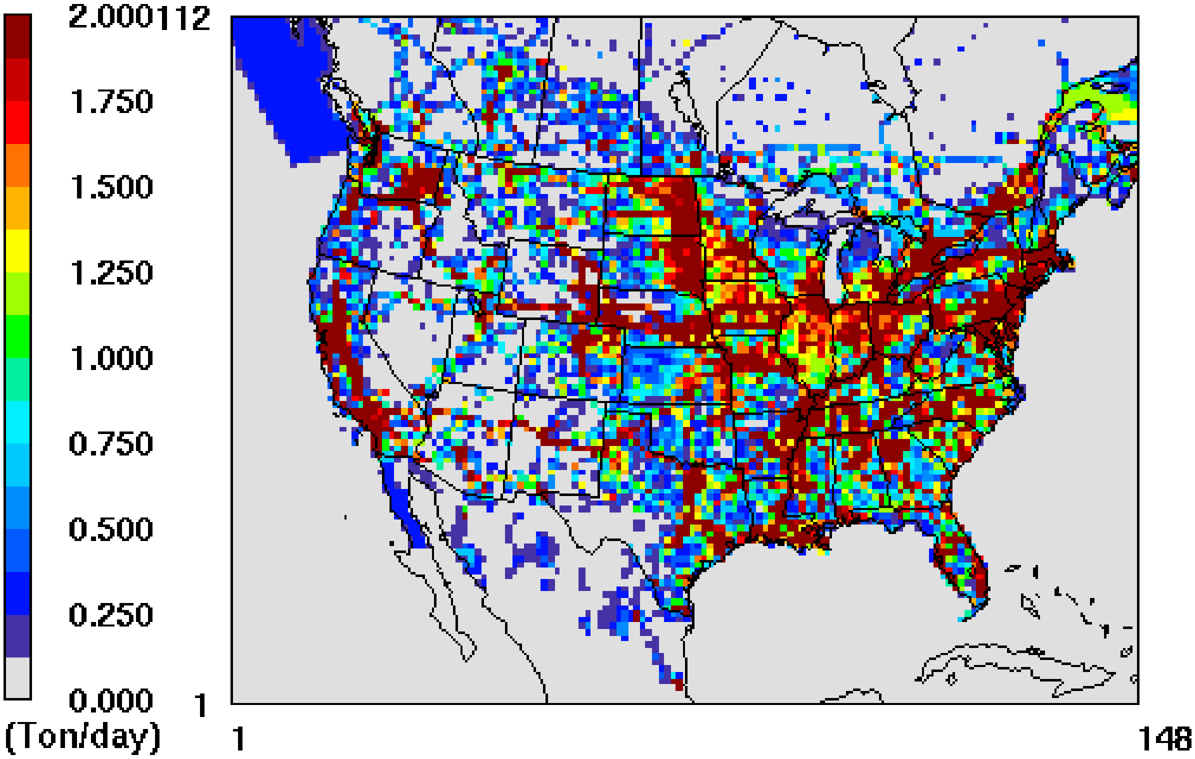
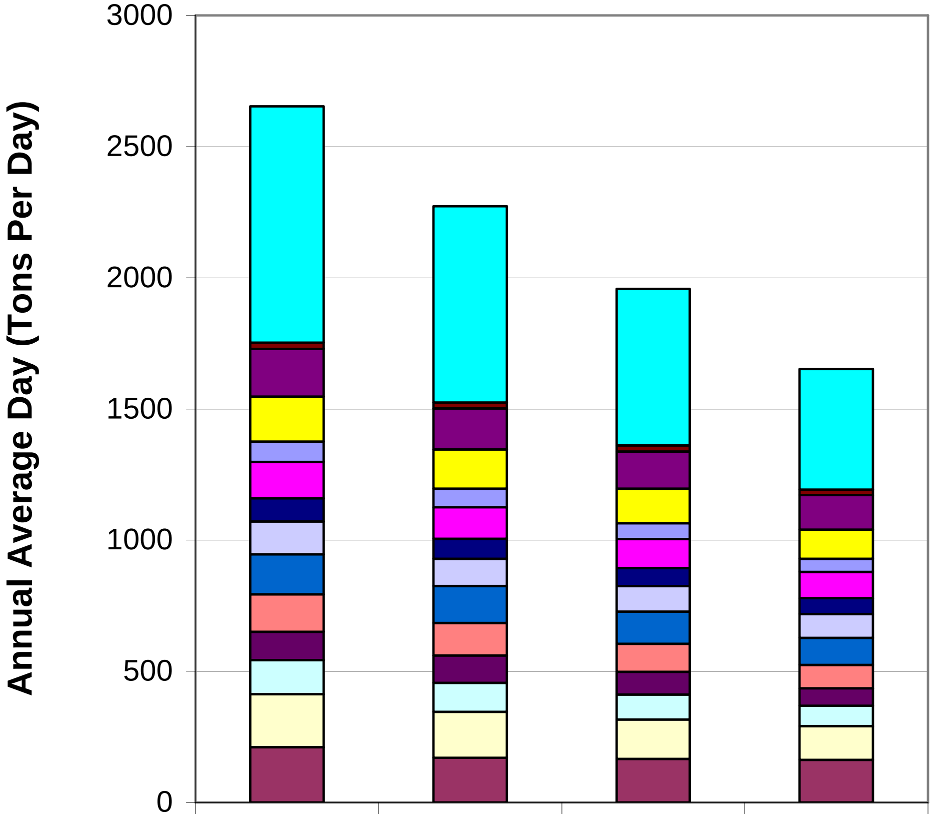
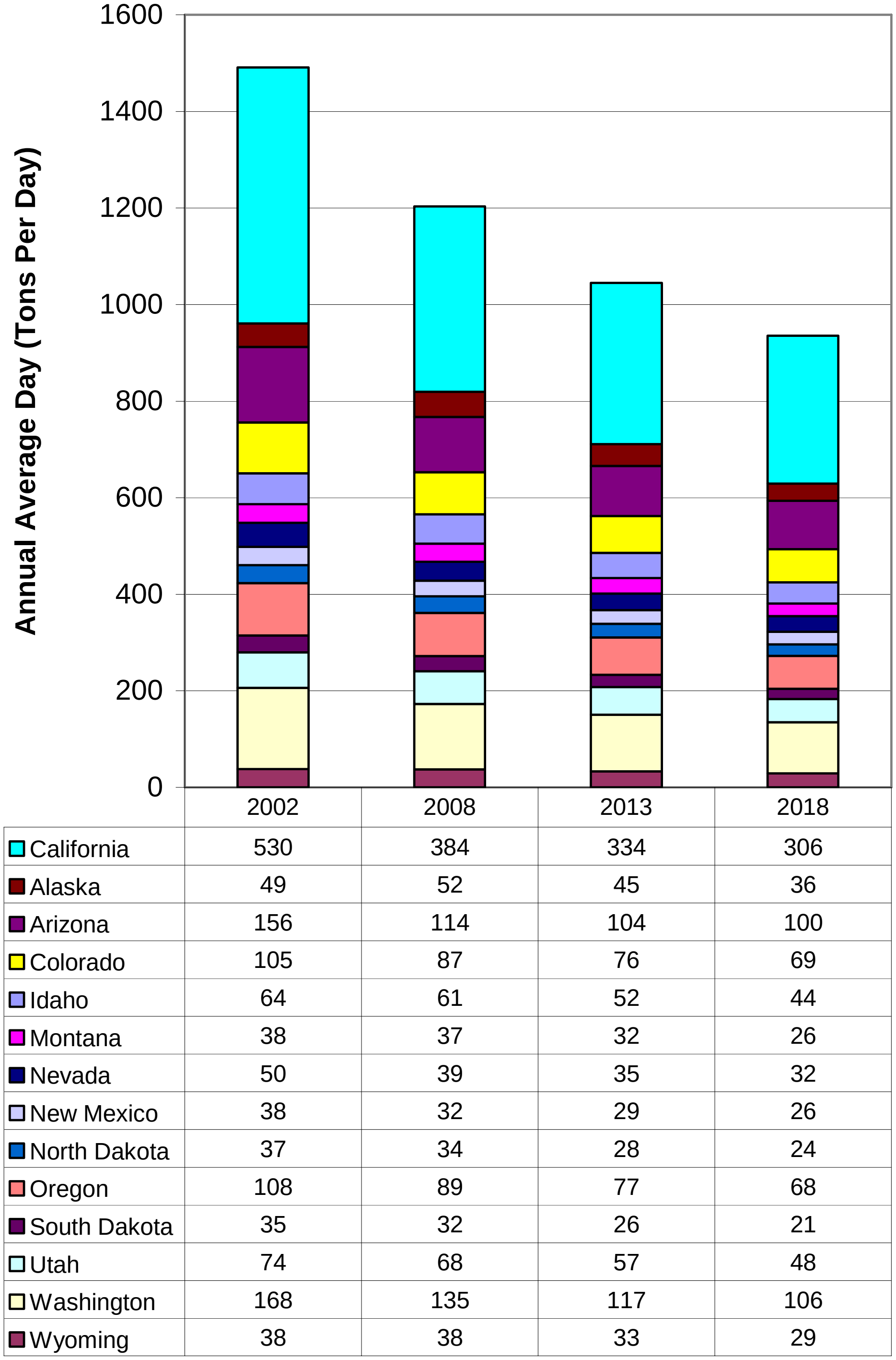


Figure 9-22. Spatial distribution of all RPO off-road NO emissions, 2002 July weekday. Source: WRAP Regional Modeling Center (http://pah.cert.ucr.edu/aqm/308/QA_plan02a36.plots/)



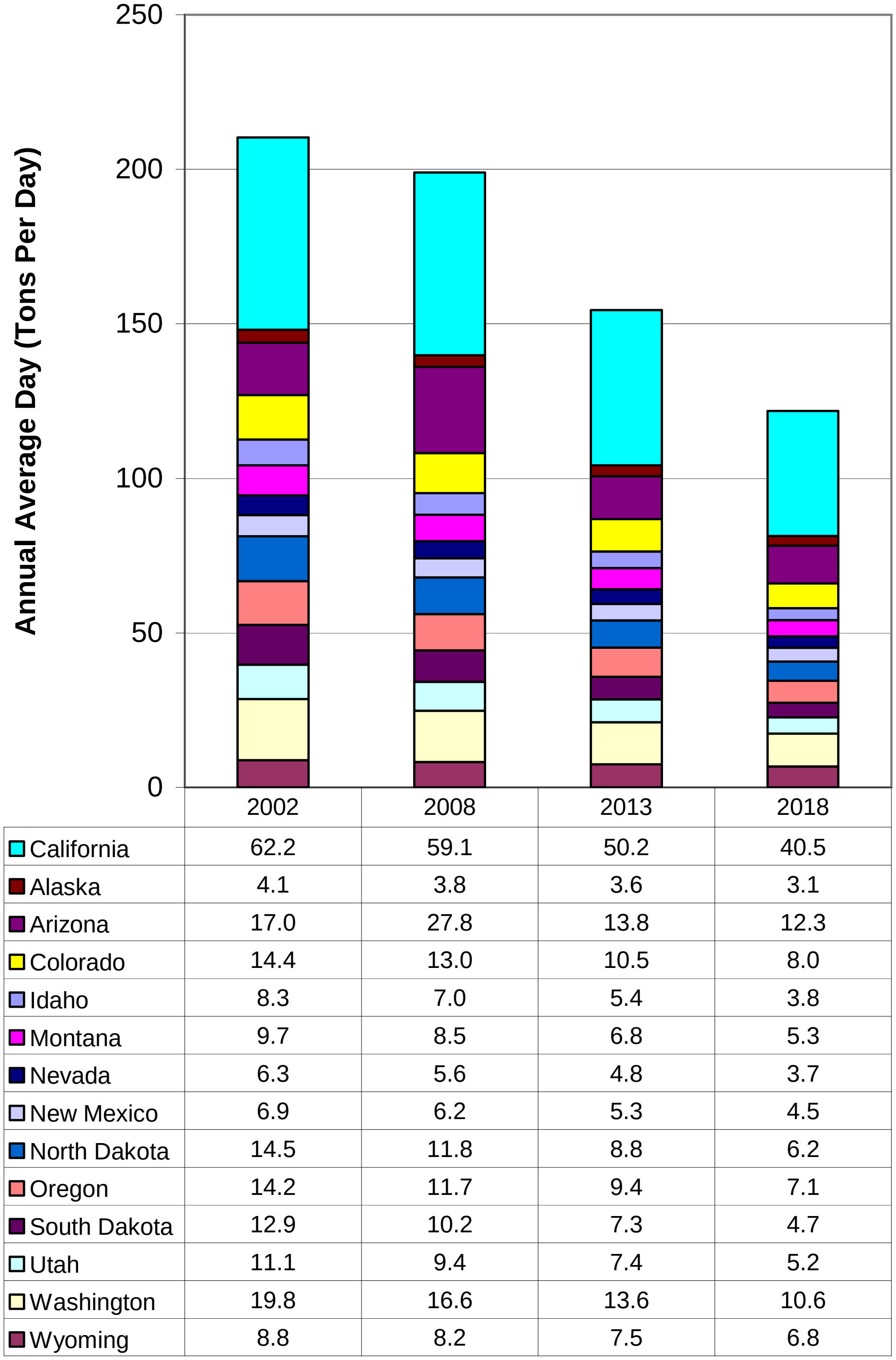
	2002	2008	2013	2018
■ California	900	748	597	458
■ Alaska	24	23	22	21
■ Arizona	182	155	143	131
■ Colorado	171	151	132	112
■ Idaho	77	70	60	50
■ Montana	139	121	111	100
■ Nevada	89	76	69	61
■ New Mexico	124	103	97	91
■ North Dakota	152	142	123	103
■ Oregon	144	124	106	89
■ South Dakota	107	105	87	67
■ Utah	129	110	95	78
■ Washington	203	174	150	128
■ Wyoming	210	171	166	163

Figure 9-23. Western states off-road annual average daily NOx emissions, 2002 – 2018 (does not include commercial marine).



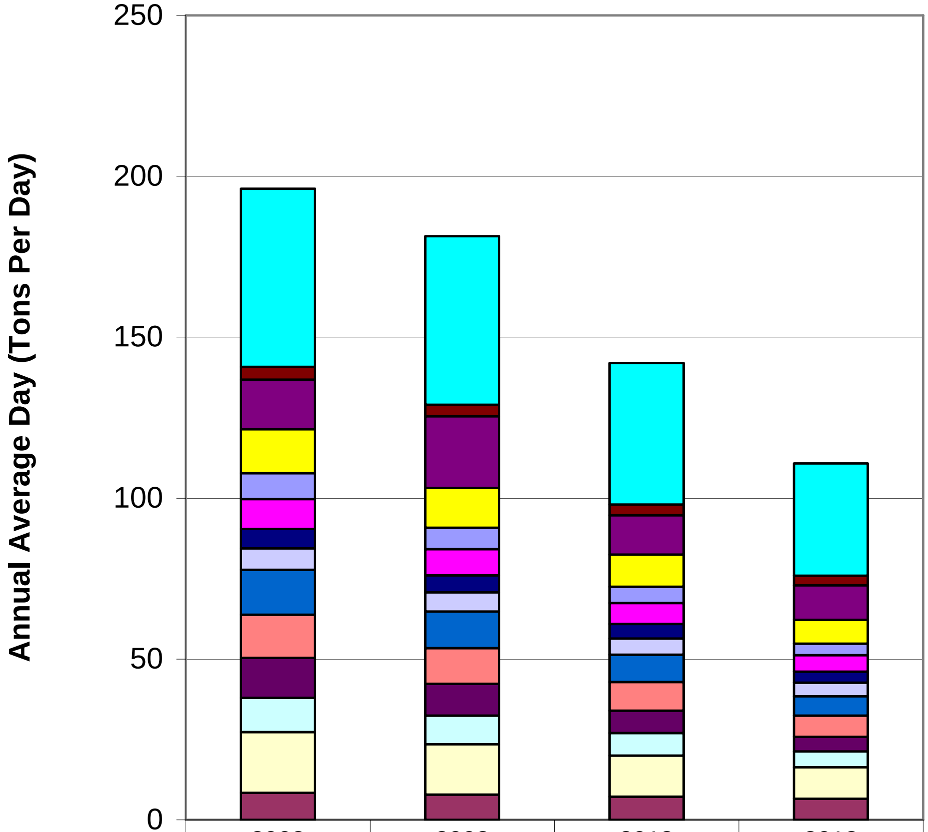
	2002	2008	2013	2018
California	530	384	334	306
Alaska	49	52	45	36
Arizona	156	114	104	100
Colorado	105	87	76	69
Idaho	64	61	52	44
Montana	38	37	32	26
Nevada	50	39	35	32
New Mexico	38	32	29	26
North Dakota	37	34	28	24
Oregon	108	89	77	68
South Dakota	35	32	26	21
Utah	74	68	57	48
Washington	168	135	117	106
Wyoming	38	38	33	29

Figure 9-24. Western states off-road annual average daily VOC emissions, 2002 – 2018 (does not include commercial marine).



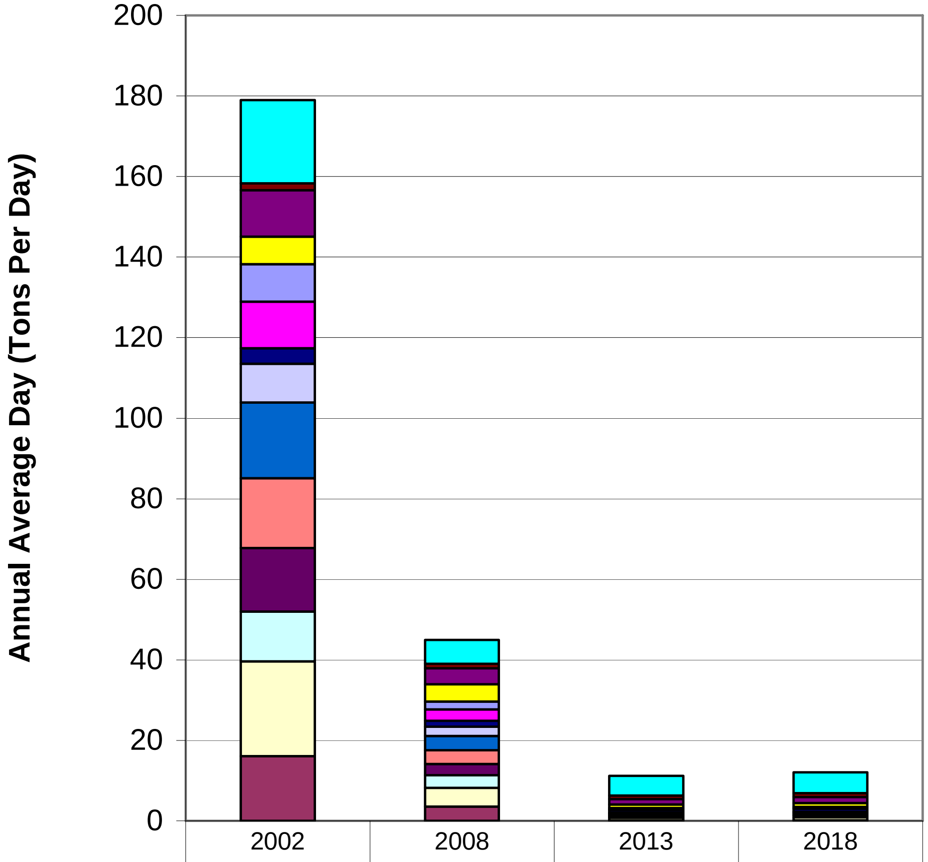
	2002	2008	2013	2018
California	62.2	59.1	50.2	40.5
Alaska	4.1	3.8	3.6	3.1
Arizona	17.0	27.8	13.8	12.3
Colorado	14.4	13.0	10.5	8.0
Idaho	8.3	7.0	5.4	3.8
Montana	9.7	8.5	6.8	5.3
Nevada	6.3	5.6	4.8	3.7
New Mexico	6.9	6.2	5.3	4.5
North Dakota	14.5	11.8	8.8	6.2
Oregon	14.2	11.7	9.4	7.1
South Dakota	12.9	10.2	7.3	4.7
Utah	11.1	9.4	7.4	5.2
Washington	19.8	16.6	13.6	10.6
Wyoming	8.8	8.2	7.5	6.8

Figure 9-25. Western states off-road annual average daily PM10 emissions, 2002 – 2018 (does not include commercial marine).



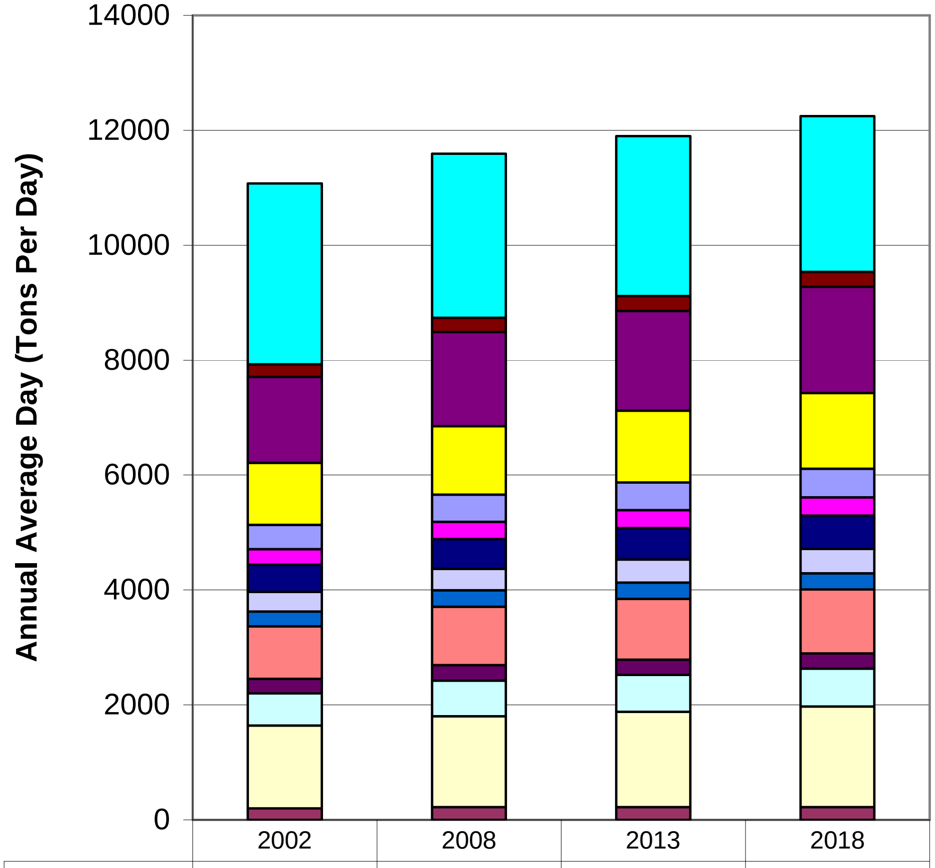
	2002	2008	2013	2018
California	55.4	52.4	44.0	34.9
Alaska	4.0	3.6	3.4	3.0
Arizona	15.3	22.2	12.3	10.7
Colorado	13.8	12.3	9.9	7.4
Idaho	8.0	6.7	5.1	3.6
Montana	9.3	8.2	6.5	5.0
Nevada	6.0	5.3	4.5	3.5
New Mexico	6.6	5.9	5.1	4.2
North Dakota	14.0	11.4	8.5	5.9
Oregon	13.5	11.1	8.9	6.6
South Dakota	12.4	9.9	7.0	4.5
Utah	10.6	8.9	7.0	4.9
Washington	18.8	15.6	12.8	9.9
Wyoming	8.5	7.9	7.2	6.5

Figure 9-26. Western states off-road annual average daily PM2.5 emissions, 2002 – 2018 (does not include commercial marine).



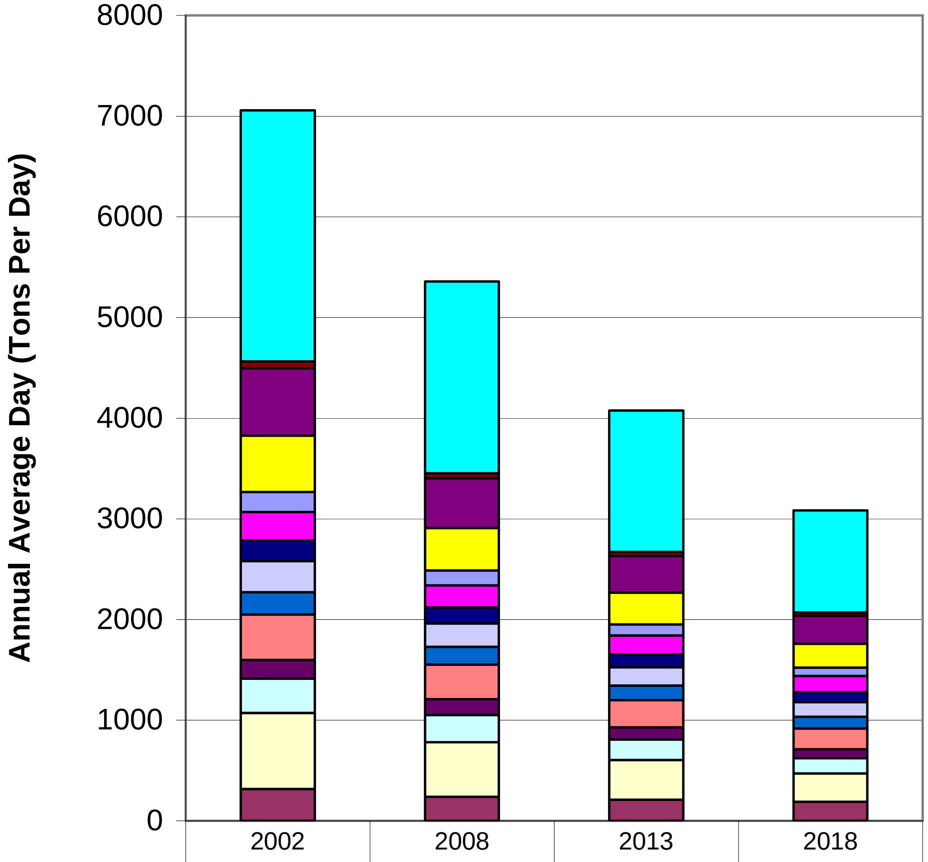
	2002	2008	2013	2018
■ California	20.7	5.9	4.9	5.2
■ Alaska	1.7	1.2	0.9	0.9
■ Arizona	11.6	4.0	1.4	1.5
■ Colorado	6.8	4.3	0.9	1.0
■ Idaho	9.3	1.9	0.3	0.3
■ Montana	11.5	2.8	0.2	0.2
■ Nevada	3.8	1.5	0.7	0.7
■ New Mexico	9.7	2.3	0.2	0.2
■ North Dakota	18.8	3.6	0.2	0.2
■ Oregon	17.4	3.3	0.4	0.4
■ South Dakota	15.8	2.9	0.1	0.1
■ Utah	12.4	3.1	0.4	0.4
■ Washington	23.5	4.6	0.7	0.7
■ Wyoming	16.1	3.6	0.2	0.2

Figure 9-27. Western states off-road annual average daily SO2 emissions, 2002 – 2018 (does not include commercial marine).



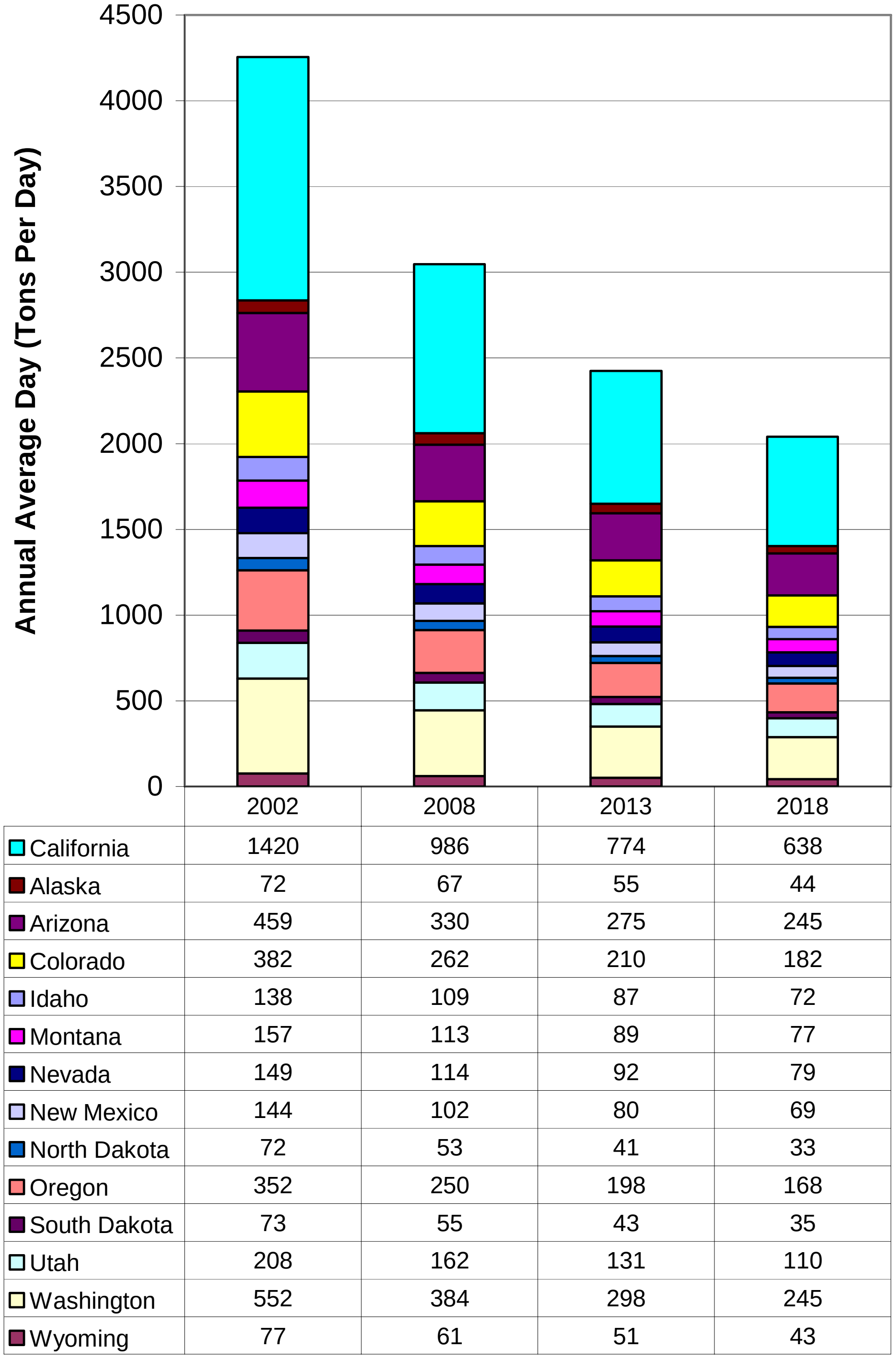
	2002	2008	2013	2018
■ California	3143	2857	2783	2711
■ Alaska	222	251	258	256
■ Arizona	1495	1638	1735	1850
■ Colorado	1077	1188	1250	1319
■ Idaho	426	472	485	498
■ Montana	274	303	309	315
■ Nevada	468	516	549	583
■ New Mexico	341	377	400	423
■ North Dakota	263	286	282	281
■ Oregon	909	1011	1059	1115
■ South Dakota	254	272	265	262
■ Utah	563	621	641	660
■ Washington	1441	1584	1659	1749
■ Wyoming	201	221	224	225

Figure 9-28. Western states off-road annual average daily CO emissions, 2002 – 2018 (does not include commercial marine).



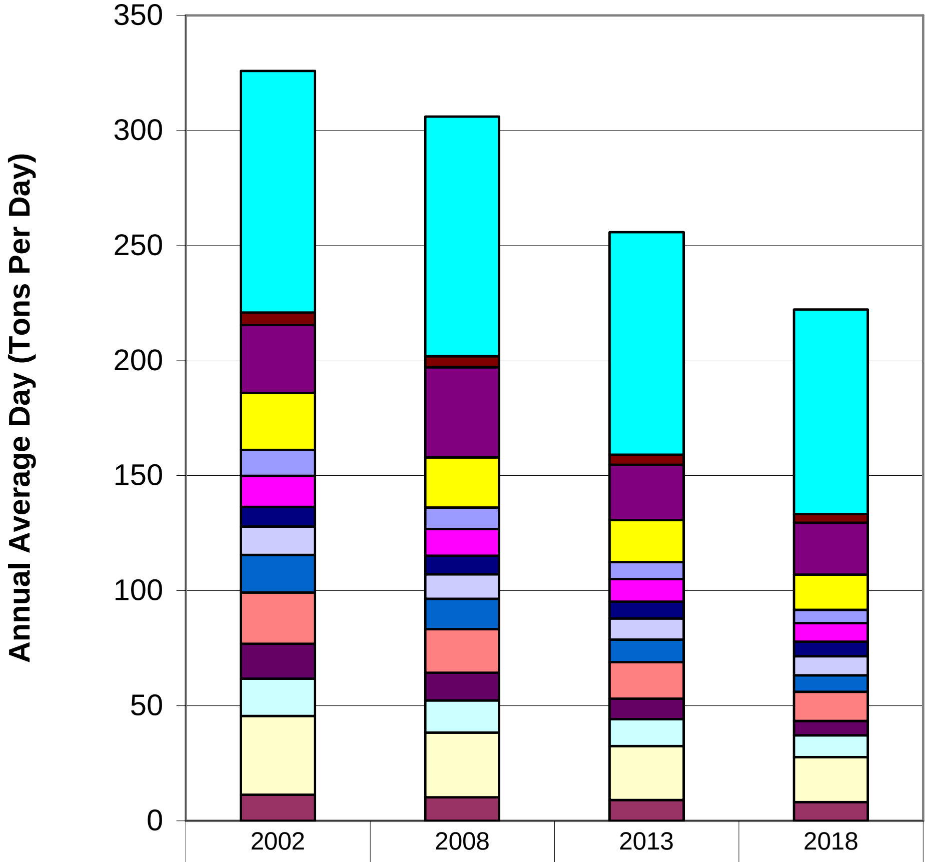
	2002	2008	2013	2018
■ California	2492	1904	1406	1015
■ Alaska	69	51	40	32
■ Arizona	670	496	365	278
■ Colorado	560	419	313	236
■ Idaho	199	150	111	83
■ Montana	286	218	188	161
■ Nevada	202	159	128	102
■ New Mexico	310	231	179	145
■ North Dakota	220	180	146	116
■ Oregon	450	341	269	204
■ South Dakota	187	158	121	89
■ Utah	341	271	207	153
■ Washington	756	542	394	281
■ Wyoming	316	239	209	189

Figure 9-29. Western states total mobile annual average daily NOx emissions, 2002 – 2018(does not include commercial marine).



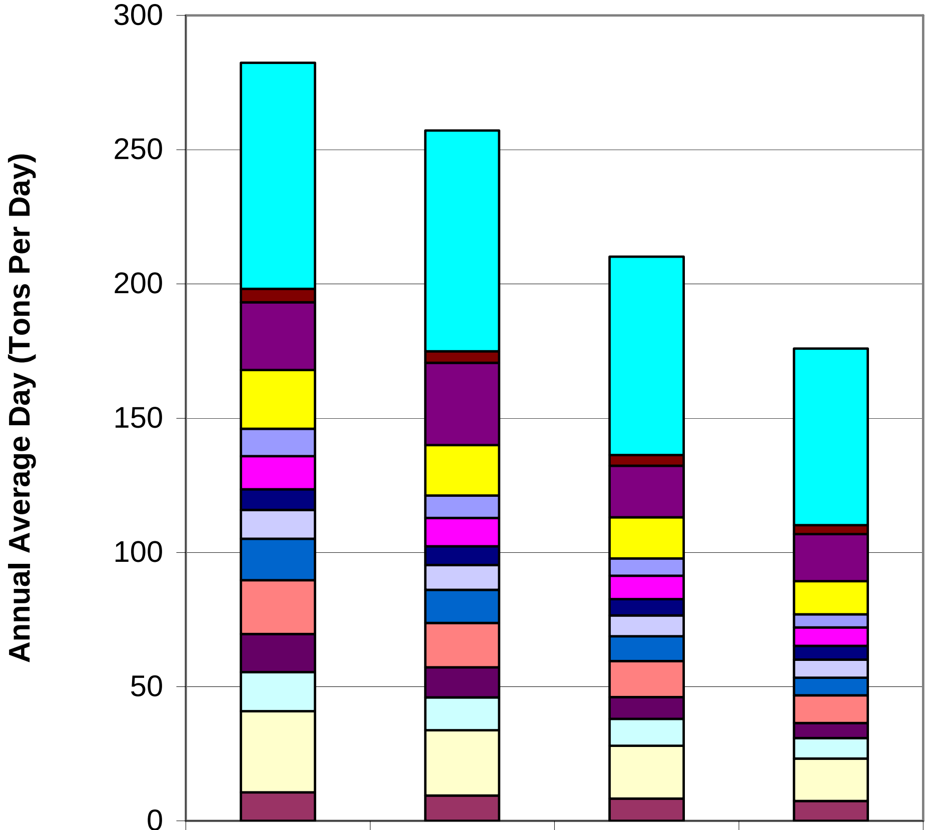
	2002	2008	2013	2018
California	1420	986	774	638
Alaska	72	67	55	44
Arizona	459	330	275	245
Colorado	382	262	210	182
Idaho	138	109	87	72
Montana	157	113	89	77
Nevada	149	114	92	79
New Mexico	144	102	80	69
North Dakota	72	53	41	33
Oregon	352	250	198	168
South Dakota	73	55	43	35
Utah	208	162	131	110
Washington	552	384	298	245
Wyoming	77	61	51	43

Figure 9-30. Western states total mobile annual average daily VOC emissions, 2002 – 2018(does not include commercial marine).



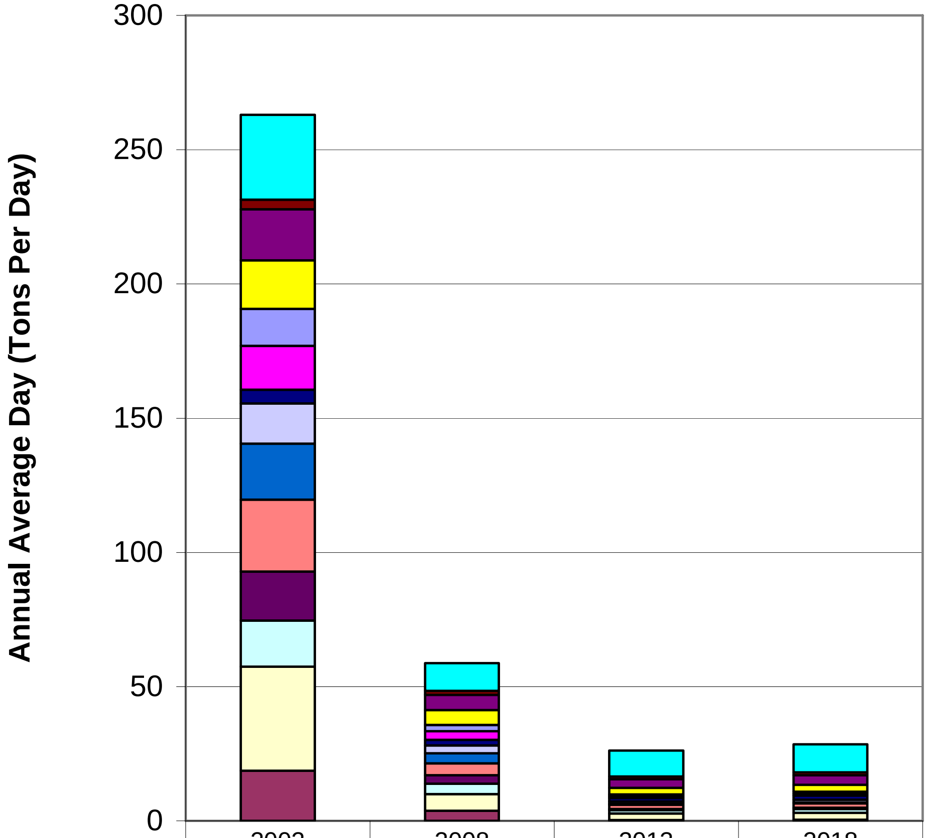
	2002	2008	2013	2018
■ California	104.9	104.2	96.8	88.8
■ Alaska	5.4	4.8	4.3	3.8
■ Arizona	29.6	39.2	24.0	22.5
■ Colorado	24.8	21.7	18.2	15.4
■ Idaho	11.3	9.4	7.5	5.8
■ Montana	13.4	11.6	9.7	8.0
■ Nevada	8.7	8.0	7.3	6.3
■ New Mexico	12.2	10.7	9.3	8.3
■ North Dakota	16.3	13.1	9.8	7.1
■ Oregon	22.4	18.9	15.8	12.8
■ South Dakota	15.1	12.1	8.9	6.3
□ Utah	16.1	13.9	11.7	9.4
□ Washington	34.2	28.2	23.5	19.5
■ Wyoming	11.4	10.2	9.1	8.2

Figure 9-31. Western states total mobile annual average daily PM10 emissions, 2002 – 2018(does not include commercial marine).



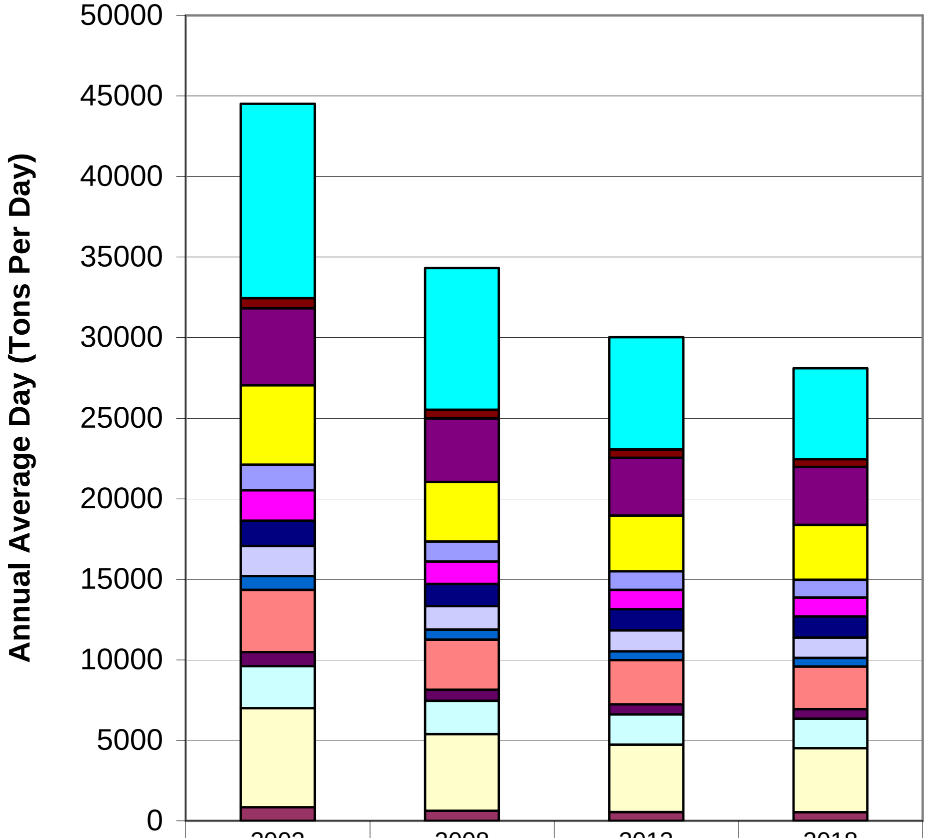
	2002	2008	2013	2018
California	84.2	82.2	73.9	65.7
Alaska	4.9	4.3	3.9	3.4
Arizona	25.2	30.6	19.2	17.5
Colorado	21.9	18.8	15.3	12.4
Idaho	10.3	8.4	6.5	4.9
Montana	12.2	10.5	8.6	6.9
Nevada	7.7	7.0	6.1	5.1
New Mexico	10.8	9.2	7.8	6.7
North Dakota	15.5	12.4	9.2	6.5
Oregon	20.0	16.5	13.4	10.4
South Dakota	14.2	11.3	8.1	5.5
Utah	14.5	12.2	9.9	7.6
Washington	30.2	24.3	19.7	15.7
Wyoming	10.7	9.5	8.4	7.5

Figure 9-32. Western states total mobile annual average daily PM2.5 emissions, 2002 – 2018(does not include commercial marine).



	2002	2008	2013	2018
California	31.7	10.3	9.7	10.4
Alaska	3.5	1.5	1.0	1.1
Arizona	19.0	5.6	3.2	3.6
Colorado	18.1	5.6	2.3	2.6
Idaho	13.7	2.4	0.7	0.8
Montana	16.4	3.2	0.6	0.7
Nevada	5.1	2.1	1.4	1.5
New Mexico	15.0	3.0	0.9	1.0
North Dakota	20.9	3.8	0.3	0.4
Oregon	26.8	4.4	1.5	1.7
South Dakota	18.2	3.1	0.4	0.4
Utah	17.2	3.9	1.3	1.4
Washington	38.7	6.3	2.4	2.6
Wyoming	18.7	3.8	0.4	0.4

Figure 9-33. Western states total mobile annual average daily SO2 emissions, 2002 – 2018(does not include commercial marine).



	2002	2008	2013	2018
■ California	12082	8794	6962	5645
■ Alaska	631	544	507	491
■ Arizona	4777	3950	3602	3576
■ Colorado	4912	3690	3456	3405
■ Idaho	1596	1249	1143	1118
■ Montana	1890	1379	1207	1167
■ Nevada	1569	1391	1321	1310
■ New Mexico	1878	1440	1290	1265
■ North Dakota	842	639	562	528
■ Oregon	3882	3099	2737	2650
■ South Dakota	860	689	615	590
■ Utah	2605	2083	1879	1831
■ Washington	6159	4744	4174	3993
■ Wyoming	847	637	564	533

Figure 9-34. Western states total mobile annual average daily CO emissions, 2002 – 2018(does not include commercial marine).

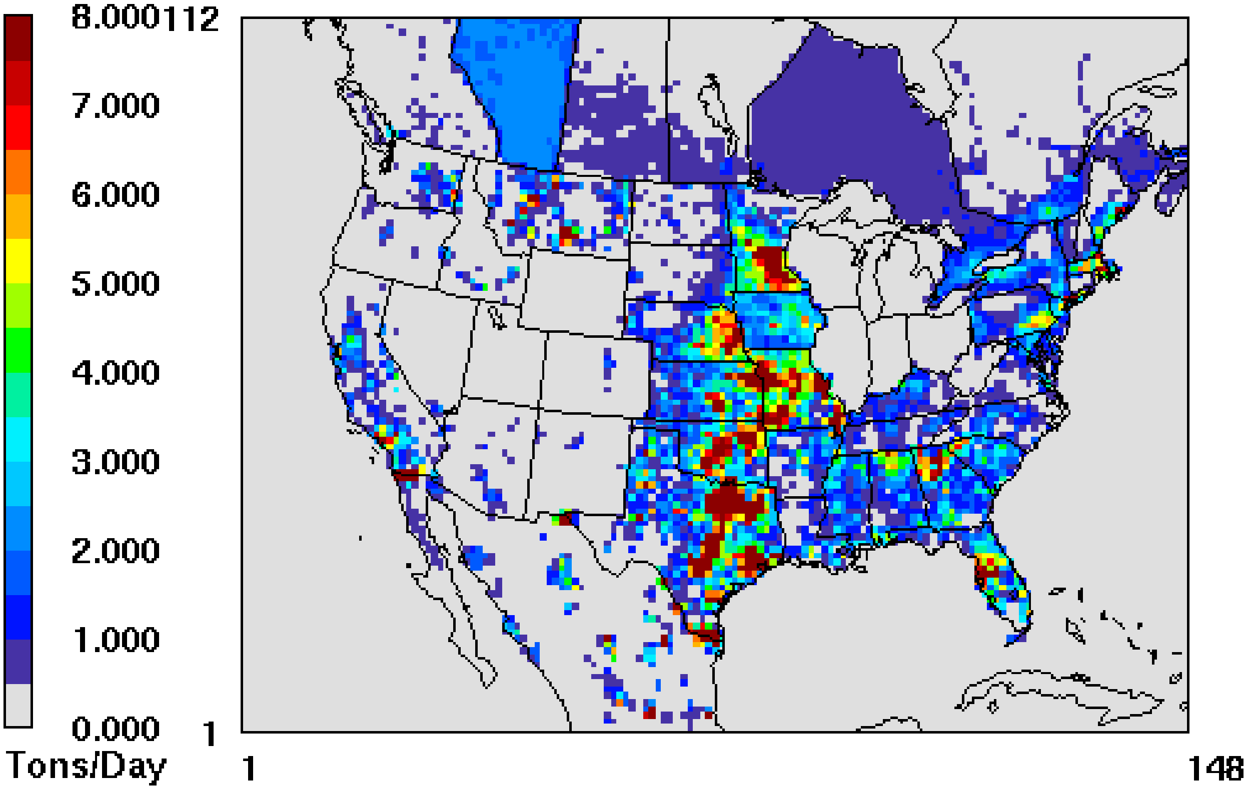


Figure 9-35. Spatial distribution of all RPO road dust coarse PM emissions, 2002 July weekday. Source: WRAP Regional Modeling Center (http://pah.cert.ucr.edu/aqm/308/QA_plan02a36.plots/)

Table 9-1. 2002 Western states total on-road emissions by fuel type.

2002 Western States Total On-road Emissions by Fuel Type (tons)

State	VOC		NOx		CO		PM10 *		PM2.5 *	
	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline
ALASKA	370	8,296	7,276	8,921	1,764	147,640	302	143	261	94
ARIZONA	4,179	106,235	89,803	88,171	18,452	1,179,480	3,079	1,529	2,615	990
CALIFORNIA	9,764	315,178	248,866	332,215	44,984	3,217,797	5,634	9,960	4,781	5,738
COLORADO	6,561	94,271	58,228	83,597	39,564	1,360,285	2,358	1,407	2,023	948
IDAHO	703	26,278	17,811	26,779	3,575	423,498	623	460	534	312
MONTANA	1,252	42,212	20,362	33,236	5,304	584,575	842	497	720	348
NEVADA	563	35,704	8,997	32,084	2,640	398,956	336	513	285	319
NEW MEXICO	3,780	34,978	32,897	34,924	22,446	538,555	1,278	651	1,091	434
NORTH DAKOTA	572	12,226	11,430	13,299	2,671	208,662	460	225	393	152
OREGON	3,115	85,635	40,671	70,928	14,236	1,071,042	1,816	1,179	1,573	805
SOUTH DAKOTA	692	13,037	14,562	14,644	3,209	218,051	581	255	496	171
UTAH	2,079	46,982	34,783	42,570	13,140	732,333	1,074	756	918	498
WASHINGTON	5,070	135,115	83,391	118,596	24,923	1,697,021	3,288	1,954	2,814	1,349
WYOMING	1,233	13,022	26,616	11,938	8,043	227,843	793	178	679	121
Total	**39,936**	**969,167**	**695,691**	**911,901**	**204,950**	**12,005,736**	**22,465**	**19,707**	**19,182**	**12,278**

* PM emissions include exhaust, brake wear, and tire wear emissions.

2002 Western States Total On-road Emissions All Fuel Types (tons)

	VOC	NOx	CO	PM10 *	PM2.5 *	SO2	NH3	VMT
	Total	Total	Total	Total	Total	Total	Total	Total
ALASKA	8,666	16,197	149,404	445	355	655	492	4,896,832,612
ARIZONA	110,415	177,974	1,197,931	4,609	3,605	2,715	5,034	52,505,231,448
CALIFORNIA	324,942	581,081	3,262,781	15,594	10,519	4,034	22,118	
COLORADO	100,832	141,825	1,399,848	3,765	2,971	4,149	4,317	43,538,870,500
IDAHO	26,981	44,590	427,072	1,084	845	1,590	1,430	14,166,793,207
MONTANA	43,464	53,598	589,879	1,339	1,068	1,770	1,294	13,572,665,487
NEVADA	36,267	41,081	401,596	849	604	455	2,030	19,371,235,904
NEW MEXICO	38,759	67,820	561,001	1,928	1,525	1,951	2,132	21,332,076,809
NORTH DAKOTA	12,798	24,728	211,333	685	544	771	732	7,335,902,003
OREGON	88,750	111,599	1,085,278	2,996	2,378	3,448	3,263	33,246,265,505
SOUTH DAKOTA	13,729	29,206	221,260	836	666	873	842	8,498,126,602
UTAH	49,061	77,352	745,472	1,830	1,416	1,777	2,453	24,421,066,630
WASHINGTON	140,185	201,987	1,721,944	5,242	4,162	5,539	5,213	54,461,603,359
WYOMING	14,255	38,554	235,886	971	800	960	538	6,093,734,942
Total	**1,009,103**	**1,607,593**	**12,210,686**	**42,172**	**31,460**	**30,688**	**51,889**	**303,440,405,008**

* PM emissions include exhaust, brake wear, and tire wear emissions.

Table 9-2. 2008 Western states total on-road emissions by fuel type.

2008 Western States Total On-road Emissions by Fuel Type (tons)

State	VOC		NOx		CO		PM10 *		PM2
	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
ALASKA	257	5,166	4,232	5,943	1,250	105,605	203	133	166
ARIZONA	3,268	75,689	59,720	64,533	15,312	828,703	2,491	1,663	2,009
CALIFORNIA	8,745	210,877	206,245	215,687	40,782	2,126,227	4,682	11,754	3,824
COLORADO	5,170	58,548	42,164	55,900	32,755	880,320	1,860	1,320	1,523
IDAHO	503	16,719	11,099	17,889	2,629	281,114	447	419	364
MONTANA	886	26,645	13,013	22,509	4,376	388,377	726	416	598
NEVADA	472	26,806	6,302	24,040	2,327	317,321	294	598	239
NEW MEXICO	2,857	22,495	22,034	24,833	17,865	369,890	1,008	636	820
NORTH DAKOTA	365	6,663	6,151	7,876	1,747	127,184	297	184	242
OREGON	2,177	56,445	28,654	50,701	12,387	749,639	1,508	1,105	1,263
SOUTH DAKOTA	532	8,058	9,415	9,970	2,527	149,743	453	242	369
UTAH	1,641	32,933	25,094	33,641	11,045	522,705	885	787	721
WASHINGTON	3,858	86,753	55,919	78,210	19,398	1,134,060	2,469	1,765	2,026
WYOMING	860	7,748	16,468	8,395	5,907	145,777	568	161	463
Total	**31,592**	**641,547**	**506,512**	**620,128**	**170,306**	**8,126,665**	**17,891**	**21,182**	**14,626**

* PM emissions include exhaust, brake wear, and tire wear emissions.

2008 Western States Total On-road Emissions All Fuel Types (tons)

State	VOC	NOx	CO	PM10 *	PM2.5 *	SO2	NH3	VMT
	Total	Total	Total	Total	Total	Total	Total	Total
ALASKA	5,423	10,175	106,855	336	249	114	537	5,263,761,063
ARIZONA	78,957	124,253	844,015	4,154	3,062	608	6,177	62,360,885,147
CALIFORNIA	219,622	421,933	2,167,009	16,435	10,895	1,606	24,831	
COLORADO	63,718	98,065	913,074	3,181	2,355	469	5,003	49,235,781,423
IDAHO	17,223	28,989	283,743	866	625	150	1,630	15,866,808,392
MONTANA	27,531	35,522	392,753	1,142	860	149	1,538	15,456,431,874
NEVADA	27,278	30,342	319,648	892	601	220	2,617	24,413,396,217
NEW MEXICO	25,353	46,867	387,755	1,644	1,219	234	2,449	24,281,452,671
NORTH DAKOTA	7,029	14,027	128,931	481	356	68	738	7,287,475,377
OREGON	58,622	79,355	762,026	2,613	1,962	379	3,948	38,574,459,271
SOUTH DAKOTA	8,590	19,385	152,270	695	520	91	938	9,409,925,235
UTAH	34,575	58,735	533,749	1,672	1,214	285	3,037	29,539,802,645
WASHINGTON	90,611	134,129	1,153,458	4,234	3,154	596	6,181	61,535,911,146
WYOMING	8,608	24,863	151,683	730	565	69	619	6,751,816,264
Total	**673,139**	**1,126,640**	**8,296,971**	**39,074**	**27,638**	**5,039**	**60,242**	**349,977,906,724**

* PM emissions include exhaust, brake wear, and tire wear emissions.

Table 9-3. 2013 Western states total on-road emissions by fuel type.

2013 Western States Total On-road Emissions by Fuel Type (tons)

State	VOC		NOx		CO		PM10 *		PM2.5 *	
	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline
ALASKA	201	3,600	2,334	4,037	591	90,382	145	135	111	83
ARIZONA	2,682	59,634	32,596	48,485	7,557	673,758	1,946	1,755	1,462	1,091
CALIFORNIA	7,058	153,343	143,638	151,732	35,236	1,489,946	3,809	13,187	2,971	7,967
COLORADO	4,267	44,518	25,155	41,079	17,538	787,674	1,448	1,372	1,115	850
IDAHO	399	12,180	6,241	12,439	1,271	238,713	331	436	253	268
MONTANA	760	20,323	9,056	19,279	2,072	325,638	631	439	497	272
NEVADA	416	20,501	3,601	17,930	1,154	280,400	239	680	181	407
NEW MEXICO	2,354	16,292	12,915	17,318	8,919	316,151	779	664	595	411
NORTH DAKOTA	267	4,350	3,166	5,028	773	101,383	202	175	154	107
OREGON	1,686	42,457	19,881	39,643	5,603	606,931	1,183	1,135	947	708
SOUTH DAKOTA	441	5,725	5,488	6,894	1,262	126,497	349	249	267	154
UTAH	1,357	25,514	15,001	25,829	5,628	446,411	690	850	528	524
WASHINGTON	2,964	63,243	32,678	56,248	9,817	908,188	1,834	1,762	1,425	1,101
WYOMING	679	5,867	9,221	6,436	2,836	121,170	421	164	322	102
Total	**25,530**	**477,548**	**320,970**	**452,378**	**100,257**	**6,513,242**	**14,007**	**23,005**	**10,829**	**14,045**

* PM emissions include exhaust, brake wear, and tire wear emissions.

2013 Western States Total On-road Emissions All Fuel Types (tons)

State	VOC	NOx	CO	PM10 *	PM2.5 *	SO2	NH3	VMT
	Total	Total	Total	Total	Total	Total	Total	Total
ALASKA	3,801	6,372	90,973	280	193	52	574	5,612,631,896
ARIZONA	62,316	81,082	681,315	3,701	2,553	681	6,893	69,196,740,935
CALIFORNIA	160,400	295,370	1,525,183	16,996	10,938	1,743	26,879	
COLORADO	48,785	66,234	805,213	2,820	1,965	515	5,437	53,470,363,618
IDAHO	12,579	18,680	239,984	767	521	163	1,783	17,283,487,713
MONTANA	21,083	28,336	327,709	1,070	769	170	1,748	17,388,826,117
NEVADA	20,917	21,530	281,554	919	589	259	3,084	28,652,313,876
NEW MEXICO	18,646	30,233	325,070	1,443	1,006	257	2,662	26,409,377,126
NORTH DAKOTA	4,617	8,194	102,155	377	261	68	740	7,284,197,119
OREGON	44,143	59,523	612,534	2,318	1,655	417	4,331	42,084,271,224
SOUTH DAKOTA	6,167	12,382	127,759	599	421	99	1,004	10,101,861,956
UTAH	26,870	40,830	452,040	1,540	1,053	327	3,433	33,127,162,995
WASHINGTON	66,208	88,926	918,005	3,595	2,526	637	6,651	65,788,792,672
WYOMING	6,546	15,657	124,007	586	424	75	675	7,300,217,365
Total	**503,078**	**773,348**	**6,613,499**	**37,012**	**24,874**	**5,466**	**65,897**	**383,700,244,613**

* PM emissions include exhaust, brake wear, and tire wear emissions.

Table 9-4. 2018 Western states total on-road emissions by fuel type.

2018 Western States Total On-road Emissions by Fuel Type (tons)

State	VOC		NOx		CO		PM10 *		PM2.5 *	
	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline
ALASKA	178	2,891	1,198	2,890	346	85,496	117	142	84	86
ARIZONA	2,590	50,281	16,668	36,821	4,843	625,333	1,791	1,926	1,268	1,192
CALIFORNIA	5,768	115,406	96,453	106,607	31,804	1,038,918	3,182	14,455	2,407	8,841
COLORADO	4,066	37,432	13,540	31,686	10,551	751,021	1,235	1,486	886	918
IDAHO	361	9,980	3,247	9,073	761	225,768	270	465	193	284
MONTANA	744	17,801	5,984	16,051	1,529	309,209	502	494	362	305
NEVADA	400	16,691	1,942	13,102	752	264,664	209	743	149	444
NEW MEXICO	2,235	13,317	7,016	12,722	5,471	302,048	665	713	475	439
NORTH DAKOTA	221	3,264	1,511	3,390	422	89,481	152	172	108	105
OREGON	1,508	34,883	12,588	29,534	3,682	556,632	840	1,228	612	764
SOUTH DAKOTA	415	4,683	2,975	5,078	778	118,965	299	266	213	164
UTAH	1,293	21,400	8,239	19,111	3,489	424,100	587	936	419	575
WASHINGTON	2,512	48,145	16,499	39,408	5,563	813,247	1,396	1,838	1,005	1,140
WYOMING	618	4,673	4,797	4,934	1,673	110,847	344	173	246	107
Total	22,910	380,848	192,659	330,408	71,666	5,715,729	11,590	25,038	8,425	15,364

* PM emissions include exhaust, brake wear, and tire wear emissions.

2018 Western States Total On-road Emissions All Fuel Types (tons)

State	VOC	NOx	CO	PM10 *	PM2.5 *	SO2	NH3	VMT
	Total	Total	Total	Total	Total	Total	Total	Total
ALASKA	3,069	4,088	85,842	259	170	56	612	5,984,083,743
ARIZONA	52,871	53,489	630,176	3,717	2,460	762	7,604	76,683,204,547
CALIFORNIA	121,175	203,060	1,070,723	17,637	11,248	1,897	29,562	
COLORADO	41,498	45,226	761,572	2,721	1,804	568	5,894	58,265,177,164
IDAHO	10,340	12,320	226,529	735	476	177	1,930	18,700,167,033
MONTANA	18,545	22,035	310,738	996	667	195	1,976	19,775,017,157
NEVADA	17,091	15,044	265,416	953	593	286	3,384	31,477,060,492
NEW MEXICO	15,553	19,739	307,520	1,379	914	281	2,877	28,668,617,848
NORTH DAKOTA	3,485	4,902	89,902	324	213	68	739	7,265,376,615
OREGON	36,391	42,122	560,314	2,068	1,376	461	4,725	46,054,049,449
SOUTH DAKOTA	5,098	8,053	119,742	565	377	108	1,075	10,879,625,452
UTAH	22,693	27,350	427,589	1,523	994	368	3,811	36,801,812,054
WASHINGTON	50,657	55,908	818,811	3,234	2,144	679	7,088	70,092,205,086
WYOMING	5,290	9,731	112,520	517	352	81	725	7,848,618,467
Total	403,757	523,067	5,787,395	36,628	23,789	5,988	72,001	418,495,015,107

* PM emissions include exhaust, brake wear, and tire wear emissions.

Table 9-5. 2002 Western states total nonroad annual emissions by fuel type.

2002 Western States Total Nonroad Annual Emissions by Fuel Type (tons)

	VOC		NOX		CO		PM10		PM2.5		SO2		NH3	
State	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**
ALASKA	1,574	16,161	7,991	885	11,363	69,530	935	578	918	525	561	50	4	9
ARIZONA	6,310	50,719	58,602	7,865	25,522	520,067	4,354	1,840	3,945	1,655	4,158	68	30	17
CALIFORNIA	168,437	25,014	123,578	204,742	1,011,861	135,241	8,824	13,887	7,458	12,763	7,056	484	502	44
COLORADO	5,471	32,968	55,448	7,134	26,819	366,178	4,184	1,089	4,043	977	2,344	128	31	12
IDAHO	2,691	20,790	25,254	2,697	14,391	141,046	2,421	625	2,340	574	3,347	64	11	6
MONTANA	3,842	10,171	49,136	1,559	15,848	84,008	3,203	335	3,100	300	4,151	56	26	3
NEVADA	2,642	15,506	30,462	2,144	14,503	156,422	1,775	533	1,715	485	1,389	15	17	5
NEW MEXICO	2,942	10,931	43,394	1,944	11,878	112,408	2,139	390	2,066	347	3,493	35	22	4
NORTH DAKOTA	5,122	8,400	54,195	1,465	22,661	73,408	5,006	273	4,853	243	6,814	38	30	3
OREGON	4,543	35,008	45,470	7,112	21,519	310,228	3,894	1,277	3,767	1,156	6,201	137	27	11
SOUTH DAKOTA	4,318	8,461	37,218	1,969	20,584	72,127	4,409	285	4,273	254	5,722	35	22	3
UTAH	4,133	22,811	43,498	3,699	19,535	185,898	3,294	763	3,187	693	4,463	51	25	7
WASHINGTON	6,181	55,235	63,364	10,740	29,738	496,225	5,218	2,025	5,043	1,828	8,394	190	37	18
WYOMING	4,091	9,661	75,752	923	13,125	60,150	2,931	276	2,839	250	5,843	27	38	3
TOTAL	**222,297**	**321,836**	**713,362**	**254,879**	**1,259,348**	**2,782,936**	**52,588**	**24,176**	**49,548**	**22,050**	**63,936**	**1,378**	**823**	**145**

*Does not include Commercial Marine

2002 Western States Total Nonroad Emissions All Fuel Types (tons)

	VOC	NOx	CO	PM10	PM2.5	SO2	NH3
State	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
ALASKA	17,736	8,876	80,893	1,513	1,443	611	12
ARIZONA	57,030	66,467	545,589	6,194	5,600	4,226	48
CALIFORNIA	193,451	328,320	1,147,102	22,710	20,222	7,540	546
COLORADO	38,438	62,581	392,997	5,274	5,021	2,472	43
IDAHO	23,480	27,951	155,437	3,047	2,914	3,411	17
MONTANA	14,013	50,696	99,856	3,538	3,400	4,206	29
NEVADA	18,147	32,606	170,925	2,309	2,199	1,403	22
NEW MEXICO	13,873	45,338	124,286	2,529	2,413	3,528	26
NORTH DAKOTA	13,521	55,659	96,069	5,279	5,096	6,852	33
OREGON	39,552	52,583	331,747	5,171	4,923	6,338	38
SOUTH DAKOTA	12,779	39,187	92,711	4,693	4,527	5,756	25
UTAH	26,944	47,197	205,433	4,057	3,880	4,514	32
WASHINGTON	61,415	74,103	525,963	7,243	6,871	8,584	55
WYOMING	13,752	76,675	73,275	3,207	3,089	5,871	41
TOTAL	**544,132**	**968,241**	**4,042,284**	**76,763**	**71,598**	**65,314**	**967**

*Does not include Commercial Marine

Table 9-6. 2008 Western states total nonroad annual emissions by fuel type.

2008 Western States Total Nonroad Annual Emissions by Fuel Type (tons)

	VOC		NOX		CO		PM10		PM2.5		SO2		NH3	
State	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**
ALASKA	1,401	17,658	7,470	851	8,230	83,558	742	659	729	600	392	30	4	10
ARIZONA	5,927	35,599	50,270	6,436	25,088	572,187	3,905	1,634	3,492	1,465	1,417	34	35	18
CALIFORNIA	120,357	19,872	106,636	166,355	904,004	138,889	10,241	11,345	8,669	10,445	1,824	317	726	188
COLORADO	4,812	27,041	49,947	5,008	26,051	407,694	3,596	1,152	3,468	1,036	1,539	25	37	13
IDAHO	2,270	20,117	23,637	2,016	13,376	158,923	1,881	681	1,815	625	695	13	14	7
MONTANA	3,455	10,110	42,810	1,194	15,322	95,186	2,736	370	2,646	332	1,017	7	31	4
NEVADA	2,331	11,974	26,193	1,658	14,054	174,131	1,505	540	1,452	491	529	8	19	5
NEW MEXICO	2,684	9,175	36,051	1,426	11,533	126,146	1,849	403	1,785	359	841	8	26	4
NORTH DAKOTA	4,473	7,953	50,456	1,246	20,920	83,358	4,028	290	3,903	259	1,298	6	37	3
OREGON	3,759	28,850	40,072	5,138	19,646	349,531	2,961	1,320	2,861	1,194	1,194	23	32	12
SOUTH DAKOTA	3,641	7,895	36,650	1,557	18,771	80,477	3,438	296	3,330	265	1,034	7	28	3
UTAH	3,485	21,237	37,574	2,652	17,923	208,561	2,584	834	2,495	756	1,118	14	30	8
WASHINGTON	5,242	44,147	55,782	7,852	27,841	550,263	4,025	2,016	3,882	1,820	1,658	37	44	19
WYOMING	3,936	9,762	61,651	717	13,596	67,122	2,697	303	2,612	275	1,303	5	44	3
TOTAL	**167,774**	**271,392**	**625,197**	**204,104**	**1,136,356**	**3,096,025**	**46,189**	**21,846**	**43,140**	**19,922**	**15,860**	**533**	**1,107**	**296**

*Does not include Commercial Marine

2008 Western States Total Nonroad Emissions All Fuel Types (tons)

	VOC	NOx	CO	PM10	PM2.5	SO2	NH3
State	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
ALASKA	19,059	8,321	91,788	1,401	1,329	422	14
ARIZONA	41,527	56,705	597,275	5,539	4,957	1,451	53
CALIFORNIA	140,229	272,992	1,042,893	21,586	19,114	2,141	914
COLORADO	31,854	54,955	433,744	4,748	4,503	1,564	50
IDAHO	22,387	25,653	172,300	2,562	2,440	709	21
MONTANA	13,565	44,005	110,509	3,107	2,978	1,024	35
NEVADA	14,305	27,850	188,185	2,045	1,943	537	25
NEW MEXICO	11,859	37,476	137,679	2,252	2,145	849	30
NORTH DAKOTA	12,426	51,702	104,278	4,318	4,162	1,304	40
OREGON	32,610	45,209	369,177	4,282	4,055	1,217	44
SOUTH DAKOTA	11,537	38,206	99,248	3,734	3,595	1,040	31
UTAH	24,722	40,226	226,484	3,418	3,252	1,132	37
WASHINGTON	49,390	63,635	578,104	6,042	5,702	1,695	62
WYOMING	13,698	62,367	80,718	3,000	2,887	1,308	47
TOTAL	**439,166**	**829,301**	**4,232,382**	**68,035**	**63,062**	**16,394**	**1,404**

*Does not include Commercial Marine

Table 9-7. 2013 Western states total nonroad annual emissions by fuel type.

2013 Western States Total Nonroad Annual Emissions by Fuel Type (tons)

	VOC		NOX		CO		PM10		PM2.5		SO2		NH3	
State	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**
ALASKA	1,405	15,005	7,176	907	8,454	85,651	681	615	670	559	286	32	4	10
ARIZONA	5,684	32,218	46,834	5,325	24,087	609,196	3,408	1,641	3,005	1,468	459	37	39	19
CALIFORNIA	107,045	15,001	100,839	117,095	891,596	124,223	10,597	7,728	8,950	7,101	1,578	204	692	85
COLORADO	4,029	23,750	44,179	3,835	23,182	432,956	2,703	1,135	2,600	1,019	310	27	41	14
IDAHO	1,776	17,372	20,360	1,628	11,281	165,832	1,327	636	1,277	584	83	15	15	7
MONTANA	2,952	8,576	39,325	1,018	13,386	99,541	2,147	342	2,073	306	50	7	33	4
NEVADA	2,059	10,639	23,794	1,417	13,474	186,992	1,211	527	1,166	479	228	9	21	6
NEW MEXICO	2,436	7,973	34,110	1,144	10,886	134,972	1,556	387	1,501	344	71	9	28	4
NORTH DAKOTA	3,535	6,810	43,830	1,086	16,666	86,443	2,937	276	2,845	246	51	7	40	4
OREGON	3,035	24,985	34,956	3,843	16,823	369,721	2,158	1,286	2,081	1,161	115	25	35	13
SOUTH DAKOTA	2,708	6,700	30,476	1,232	14,458	82,287	2,374	279	2,298	249	40	7	30	4
UTAH	2,894	18,058	32,691	1,952	15,694	218,232	1,938	778	1,867	705	122	15	33	8
WASHINGTON	4,317	38,333	49,008	5,905	24,375	581,200	2,995	1,973	2,882	1,778	202	39	48	20
WYOMING	3,733	8,482	59,895	691	13,401	68,396	2,441	290	2,363	262	54	6	48	4
TOTAL	**147,608**	**233,904**	**567,474**	**147,080**	**1,097,763**	**3,245,643**	**38,474**	**17,895**	**35,579**	**16,262**	**3,648**	**437**	**1,108**	**201**

***Does not include Commerical Marine.**

2013 Western States Total Nonroad Emissions All Fuel Types (tons)

	VOC	NOx	CO	PM10	PM2.5	SO2	NH3
State	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
ALASKA	16,410	8,083	94,105	1,296	1,229	318	15
ARIZONA	37,901	52,159	633,282	5,049	4,473	495	58
CALIFORNIA	122,046	217,934	1,015,819	18,326	16,051	1,782	776
COLORADO	27,779	48,014	456,139	3,838	3,620	337	55
IDAHO	19,148	21,988	177,113	1,963	1,861	97	23
MONTANA	11,528	40,344	112,927	2,488	2,379	57	38
NEVADA	12,698	25,211	200,466	1,738	1,645	237	27
NEW MEXICO	10,410	35,255	145,858	1,944	1,845	80	33
NORTH DAKOTA	10,345	44,917	103,108	3,213	3,091	58	43
OREGON	28,020	38,799	386,543	3,445	3,242	140	48
SOUTH DAKOTA	9,409	31,708	96,745	2,653	2,547	47	33
UTAH	20,952	34,643	233,926	2,716	2,572	137	41
WASHINGTON	42,650	54,912	605,575	4,969	4,660	241	67
WYOMING	12,215	60,586	81,797	2,730	2,626	60	52
TOTAL	**381,512**	**714,554**	**4,343,405**	**56,369**	**51,840**	**4,085**	**1,309**

***Does not include Commerical Marine.**

Table 9-8. 2018 Western states total nonroad annual emissions by fuel type.

2018 Western States Total Nonroad Annual Emissions by Fuel Type (tons)

	VOC		NOX		CO		PM10		PM2.5		SO2		NH3	
State	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**	**Diesel**	**Gasoline**
ALASKA	1,431	11,551	6,713	1,051	8,502	84,994	604	537	596	487	314	33	5	11
ARIZONA	5,593	31,010	42,509	5,349	22,072	653,150	2,831	1,647	2,440	1,471	507	39	43	20
CALIFORNIA	100,935	10,713	101,379	65,933	887,988	101,551	11,086	3,692	9,340	3,407	1,682	207	749	83
COLORADO	3,526	21,481	37,048	3,828	19,532	461,760	1,798	1,104	1,721	990	342	29	45	15
IDAHO	1,472	14,533	16,485	1,659	9,166	172,469	823	572	788	525	86	16	17	8
MONTANA	2,655	6,986	35,549	1,003	11,573	103,474	1,629	302	1,571	269	53	8	36	4
NEVADA	1,873	9,943	20,766	1,438	12,265	200,527	839	517	805	470	252	10	24	6
NEW MEXICO	2,288	7,188	32,055	1,136	9,983	144,249	1,266	371	1,219	329	79	9	31	5
NORTH DAKOTA	2,975	5,687	36,357	1,075	13,009	89,692	2,008	256	1,945	226	55	7	43	4
OREGON	2,575	22,411	28,690	3,795	13,220	393,671	1,340	1,255	1,285	1,130	125	27	38	14
SOUTH DAKOTA	2,145	5,610	23,299	1,175	10,633	84,888	1,461	257	1,413	229	43	7	32	4
UTAH	2,485	15,039	26,544	1,918	12,430	228,368	1,212	704	1,162	636	136	16	36	9
WASHINGTON	3,725	34,929	40,747	5,872	19,796	618,715	1,934	1,947	1,851	1,753	220	42	52	21
WYOMING	3,631	6,924	58,642	758	13,174	68,923	2,217	261	2,146	236	58	6	53	4
TOTAL	**137,308**	**204,005**	**506,781**	**95,992**	**1,063,345**	**3,406,430**	**31,050**	**13,424**	**28,282**	**12,158**	**3,953**	**457**	**1,204**	**207**

***Does not include Commerical Marine.**

2018 Western States Total Nonroad Emissions All Fuel Types (tons)

	VOC	NOx	CO	PM10	PM2.5	SO2	NH3
State	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
ALASKA	12,982	7,765	93,496	1,141	1,084	347	16
ARIZONA	36,603	47,858	675,222	4,478	3,911	546	64
CALIFORNIA	111,648	167,312	989,539	14,778	12,747	1,889	832
COLORADO	25,007	40,877	481,292	2,902	2,711	371	60
IDAHO	16,006	18,144	181,634	1,395	1,313	102	24
MONTANA	9,641	36,552	115,047	1,931	1,840	61	41
NEVADA	11,816	22,203	212,792	1,356	1,274	261	30
NEW MEXICO	9,475	33,191	154,232	1,637	1,548	89	36
NORTH DAKOTA	8,662	37,432	102,700	2,264	2,171	62	47
OREGON	24,986	32,485	406,891	2,594	2,416	152	51
SOUTH DAKOTA	7,755	24,474	95,522	1,718	1,641	50	36
UTAH	17,524	28,461	240,798	1,916	1,798	153	45
WASHINGTON	38,654	46,619	638,511	3,882	3,604	263	73
WYOMING	10,555	59,400	82,097	2,479	2,383	65	57
TOTAL	**341,313**	**602,773**	**4,469,775**	**44,474**	**40,440**	**4,411**	**1,410**

***Does not include Commerical Marine.**

Table 9-9. West coast 2002 NOx and SO2 emissions.

Summary of 2002 West Coast NOx Emissions (tons per year)

	Commercial Marine								
			Coastal/In-Shore - Zones 2,3,4						
State	**Total**	**Offshore - Zone 1**	*Total*	*Near-Port - Zone 3*	*Inshore - Zone 4*	**ONROAD**	**NONROAD**	**Aircraft**	**Locomotive**
California	243,480	131,930	111,550	NA	NA	581,081	240,006	13,917	72,818
Oregon	43,265	41,113	2,152	736	1,415	111,599	36,491	706	15,386
Washington	58,922	44,692	14,231	3,467	10,764	201,987	49,870	1,465	22,768
Total	345,667	217,734	127,933	4,204	12,179	894,667	326,367	16,089	110,971

Summary of 2002 West Coast SO2 Emissions (tons per year)

	Commercial Marine								
			Coastal/In-Shore - Zones 2,3,4						
State	**Total**	**Offshore - Zone 1**	*Total*	*Near-Port - Zone 3*	*Inshore - Zone 4*	**ONROAD**	**NONROAD**	**Aircraft**	**Locomotive**
California	120,240	74,181	46,059	NA	NA	4,034	799	733	5,964
Oregon	23,863	23,119	744	532	212	3,448	5,232	71	1,035
Washington	32,964	25,130	7,835	2,483	5,352	5,539	6,909	142	1,532
Total	177,068	122,430	54,637	3,015	5,564	13,022	12,941	947	8,532

Table 9-10. West coast 2002 NOx and SO2 emissions.

Summary of 2018 West Coast NOx Emissions (tons per year)

	Commercial Marine								
			Coastal/In-Shore - Zones 2,3,4						
State	**Total**	**Offshore - Zone 1**	*Total*	*Near-Port - Zone 3*	*Inshore - Zone 4*	**ONROAD**	**NONROAD**	**Aircraft**	**Locomotive**
California	478,468	282,351	196,117	NA	NA	203,060	90,952	28,460	47,900
Oregon	92,565	87,961	4,604	1,576	3,028	42,122	19,315	896	12,274
Washington	126,090	95,641	30,449	7,419	23,030	55,908	26,683	1,774	18,163
Total	697,123	465,953	231,170	8,995	26,058	301,090	136,950	31,130	78,336

Summary of 2018 West Coast SO2 Emissions (tons per year)

	Commercial Marine								
			Coastal/In-Shore - Zones 2,3,4						
State	**Total**	**Offshore - Zone 1**	*Total*	*Near-Port - Zone 3*	*Inshore - Zone 4*	**ONROAD**	**NONROAD**	**Aircraft**	**Locomotive**
California	272,278	178,200	94,079	NA	NA	1,897	601	1,243	45
Oregon	57,304	55,517	1,787	1,277	510	461	54	90	8
Washington	79,178	60,363	18,815	5,963	12,852	679	77	174	12
Total	408,760	294,080	114,681	7,240	13,362	3,037	732	1,506	66

Table 9-11. 2002 Paved road dust PM emissions.

2002 Paved Road Dust Emissions - PM10

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	9,557	28.36	28.29	23.42	24.17
COLORADO	9,858	29.65	28.31	23.67	26.37
IDAHO	5,511	17.03	17.88	12.64	13.06
MONTANA	3,860	12.01	11.59	8.87	9.91
NEVADA	3,459	10.39	10.65	8.30	8.54
NEW MEXICO	6,232	18.89	18.29	15.02	15.90
NORTH DAKOTA	2,875	8.83	8.58	6.80	7.30
OREGON	10,343	31.42	34.97	23.76	24.04
SOUTH DAKOTA	2,624	8.07	7.69	6.17	6.71
UTAH	5,109	15.55	15.64	12.00	12.69
WASHINGTON	14,026	41.97	43.77	34.23	33.76
WYOMING	1,692	5.18	5.13	3.92	4.39
Total	**75,146**	**227**	**231**	**179**	**187**

2002 Paved Road Dust Emissions - PM2.5

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	2,389	7.09	7.08	5.86	6.05
COLORADO	2,465	7.42	7.09	5.93	6.60
IDAHO	1,378	4.27	4.48	3.17	3.28
MONTANA	965	3.01	2.91	2.23	2.49
NEVADA	865	2.60	2.66	2.08	2.14
NEW MEXICO	1,558	4.73	4.58	3.76	3.98
NORTH DAKOTA	719	2.22	2.15	1.71	1.83
OREGON	2,586	7.87	8.75	5.95	6.02
SOUTH DAKOTA	656	2.03	1.93	1.55	1.69
UTAH	1,277	3.89	3.91	3.00	3.18
WASHINGTON	3,507	10.53	10.98	8.59	8.47
WYOMING	423	1.30	1.29	0.98	1.10
Total	**18,787**	**57**	**58**	**45**	**47**

Table 9-12. 2002 Unpaved road dust PM emissions.

2002 Unpaved Road Dust Emissions - PM10

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	33,824	91.98	94.02	90.49	94.17
COLORADO	13,542	39.53	35.60	36.03	37.31
IDAHO	45,922	127.26	114.44	132.49	129.05
MONTANA	604,746	1,710.81	1,564.91	1,619.02	1,730.42
NEVADA	10,476	28.37	26.96	30.25	29.23
NEW MEXICO	14,823	42.68	40.48	37.40	41.88
NORTH DAKOTA	40,447	116.56	106.80	102.82	117.30
OREGON	95,013	233.50	235.25	305.92	266.21
SOUTH DAKOTA	57,021	168.24	155.54	137.71	163.70
UTAH	2,162	5.72	5.51	6.34	6.13
WASHINGTON	57,718	128.97	147.05	199.00	160.10
WYOMING	400	0.98	0.99	1.31	1.09
Total	**976,094**	**2,695**	**2,528**	**2,699**	**2,777**

2002 Unpaved Road Dust Emissions - PM2.5

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	5,079	13.81	14.12	13.59	14.14
COLORADO	2,031	5.93	5.34	5.40	5.60
IDAHO	6,888	19.09	17.17	19.87	19.36
MONTANA	90,712	256.62	234.74	242.85	259.56
NEVADA	1,695	4.59	4.36	4.89	4.73
NEW MEXICO	2,223	6.40	6.07	5.61	6.28
NORTH DAKOTA	6,067	17.48	16.02	15.42	17.59
OREGON	14,252	35.02	35.29	45.89	39.93
SOUTH DAKOTA	8,553	25.24	23.33	20.66	24.55
UTAH	324	0.86	0.83	0.95	0.92
WASHINGTON	8,658	19.35	22.06	29.85	24.02
WYOMING	60	0.15	0.15	0.20	0.16
Total	**146,543**	**405**	**379**	**405**	**417**

Table 9-13. 2018 Paved road dust PM emissions.

2018 Paved Road Dust Emissions - PM10

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	13,779	40.83	40.74	33.81	34.90
COLORADO	13,225	39.79	38.00	31.74	35.37
IDAHO	7,274	22.48	23.60	16.68	17.24
MONTANA	5,788	18.06	17.44	13.25	14.82
NEVADA	5,200	15.56	15.91	12.57	12.90
NEW MEXICO	8,367	25.35	24.54	20.17	21.35
NORTH DAKOTA	2,842	8.71	8.46	6.74	7.23
OREGON	14,325	43.52	48.43	32.91	33.30
SOUTH DAKOTA	3,362	10.34	9.86	7.90	8.60
UTAH	7,788	23.74	23.87	18.25	19.32
WASHINGTON	18,059	54.04	56.36	44.08	43.46
WYOMING	2,180	6.67	6.61	5.05	5.65
Total	**102,190**	**309**	**314**	**243**	**254**

2018 Paved Road Dust Emissions - PM2.5

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	3,445	10.21	10.19	8.46	8.73
COLORADO	3,306	9.96	9.51	7.95	8.85
IDAHO	1,819	5.64	5.91	4.18	4.33
MONTANA	1,447	4.53	4.37	3.33	3.72
NEVADA	1,300	3.89	3.98	3.14	3.23
NEW MEXICO	2,092	6.35	6.15	5.05	5.35
NORTH DAKOTA	711	2.18	2.12	1.69	1.82
OREGON	3,581	10.89	12.12	8.24	8.34
SOUTH DAKOTA	841	2.61	2.48	1.99	2.16
UTAH	1,947	5.94	5.97	4.57	4.84
WASHINGTON	4,515	13.55	14.14	11.06	10.91
WYOMING	545	1.67	1.66	1.27	1.42
Total	**25,548**	**77**	**79**	**61**	**64**

Table 9-14. 2018 Unpaved road dust PM emissions.

2018 Unpaved Road Dust Emissions - PM10

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	47,891	130.26	133.20	128.06	133.29
COLORADO	17,865	52.15	46.96	47.53	49.22
IDAHO	60,617	165.68	152.30	176.33	169.88
MONTANA	740,137	2,085.07	1,913.79	1,991.98	2,116.51
NEVADA	15,795	42.77	40.65	45.61	44.07
NEW MEXICO	19,911	58.07	53.97	49.85	56.40
NORTH DAKOTA	38,643	111.36	102.04	98.23	112.07
OREGON	131,662	323.56	326.00	423.92	368.90
SOUTH DAKOTA	72,851	214.94	198.72	175.94	209.14
UTAH	2,089	5.52	5.33	6.12	5.92
WASHINGTON	57,718	128.96	147.03	198.98	160.09
WYOMING	513	1.27	1.26	1.67	1.41
Total	**1,205,692**	**3,320**	**3,121**	**3,344**	**3,427**

2018 Unpaved Road Dust Emissions - PM2.5

State	Annual (tpy)	Winter (tpd)	Spring (tpd)	Summer (tpd)	Autumn (tpd)
ARIZONA	7,189	19.55	19.99	19.22	20.01
COLORADO	2,680	7.82	7.04	7.13	7.38
IDAHO	9,093	24.85	22.84	26.45	25.48
MONTANA	111,020	312.76	287.07	298.80	317.48
NEVADA	2,593	7.02	6.67	7.49	7.23
NEW MEXICO	2,987	8.71	8.10	7.48	8.46
NORTH DAKOTA	5,796	16.70	15.31	14.73	16.81
OREGON	19,749	48.53	48.90	63.59	55.34
SOUTH DAKOTA	10,928	32.24	29.81	26.39	31.37
UTAH	313	0.83	0.80	0.92	0.89
WASHINGTON	8,658	19.34	22.06	29.85	24.01
WYOMING	77	0.19	0.19	0.25	0.21
Total	**181,083**	**499**	**469**	**502**	**515**

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Appendix A

Development of Calendar Year 2002 County-Level Fuel Specification Data

December 14, 2004

Memo To: Alison Pollack
ENVIRON International Corporation

From: Philip Heirigs and Joe Roeschen, Sierra Research

Subject: Development of Calendar Year 2002 County-Level Fuel Specification Data for the WRAP Modeling Domain

At your request, Sierra has developed calendar year 2002 gasoline and Diesel fuel specification data for each county in the 14-state WRAP modeling domain (i.e., AK, AZ, CA, CO, ID, MT, NV, NM, ND, OR, SD, UT, WA, WY). This effort built upon a previous analysis prepared by Sierra for the 1996 base year. The data and methodologies used for the 2002 analysis are summarized below, and the results are contained in the attached Excel spreadsheet (WRAP_Fuel_2002_toENVIRON.xls). If you have any questions or need anything else, please call one of us or Jim Lyons at 916-444-6666.

Gasoline Specifications

For gasoline, the following parameters were recorded:

- RVP (in psi);
- Sulfur (in ppm);
- Volume percent of MTBE and ethanol; and
- Weight percent of oxygen.

Because of differences in fuel properties (and control programs, e.g., RVP and oxygenates) across seasons, data were developed for winter, spring, summer, and fall. The fuel specification data used to construct the attached file were extracted from data published by the Alliance of Automobile Manufacturers (the Alliance)[1] and data published by TRW/Northrop-Grumman (formerly the National Institute for Petroleum and Energy Research, NIPER).[2,3] The Alliance

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[1] "Alliance of Automobile Manufacturers North American Fuel Survey - Gasoline & Diesel Fuel," published by the Alliance of Automobile Manufacturers. The winter 2002 and summer 2002 data were used for this analysis.

[2] Dickson, C.L. "Motor Gasolines, Winter 2001-2002," TRW Petroleum Technologies, July 2002.

[3] Dickson, C.L. "Motor Gasolines, Summer 2002," Northrop Grumman, March 2003.

publications contain fuel survey results for the following cities within the WRAP modeling domain:

- Albuquerque, NM (gasoline and Diesel);
- Billings, MT (gasoline and Diesel);
- Denver, CO (gasoline and Diesel);
- Fairbanks, AK (gasoline only)
- Las Vegas, NV (gasoline only);
- Los Angeles, CA (gasoline and Diesel);
- Phoenix, AZ (gasoline only);
- San Francisco, CA (gasoline only); and
- Seattle, WA (gasoline and Diesel).

The TRW gasoline surveys encompass broader geographical regions. The following TRW gasoline "Districts" are included within the WRAP modeling domain:

- District 7 - Central and Upper Plains (used for Eastern ND and SD);
- District 9 - North Mountain States (MT, WY, ID, Eastern WA, and Eastern OR);
- District 10 - Central Mountain States (CO and UT);
- District 11 - New Mexico and West Texas;
- District 12 - West Southwest (AZ, Southern NV, and Southeastern CA);
- District 13 - Pacific Northwest (Western WA and Western OR);
- District 14 - Northern California and Northern Nevada; and
- District 15 - Southern California.

Each county was "mapped" to one of the areas where fuel specification data were available. Although this was at times a subjective process, the following guidelines were generally followed. Alliance data were used for counties that contained the cities for which the fuel survey data were collected. In addition, surrounding counties were mapped to the Alliance city if it was felt that the fuels would be similar. For example, the Alliance data for Denver were used to reflect those counties in Colorado that are subject to a wintertime oxygenates program (i.e., Denver, Adams, Boulder, etc.), while the TRW data (District 10) were used to reflect gasoline in the rest of the state. The county-level assignments were also based on a review of a petroleum products pipeline map (published by the National Petroleum Council) as well as the District boundary maps contained in the TRW reports.

The sources summarized above contain gasoline data for summer and winter, and they report gasoline specifications separately for regular, mid-grade, and premium. A composite gasoline specification for each county and season (winter and summer) was estimated by volume-weighting the three grades of gasoline based on annual statewide sales data published by the Energy Information Administration.[4]

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[4] "Petroleum Marketing Annual 2002," Energy Information Administration, DOE/EIA-0487(2002), August 2003.

Fuel specifications for spring and fall are not reported in the Alliance and TRW surveys. As a result, the following approach was used to generate gasoline specifications for spring (assumed to be April) and fall (assumed to be October):

- *RVP* - The approach used in the National Emissions Inventory (NEI)[5] to develop monthly estimates of gasoline RVP from January (winter) and July (summer) data was generally followed in this study. That approach uses an interpolation routine in which the winter and summer RVP data are used in conjunction with the ASTM volatility class of an area for the month being analyzed. However, for all states except Alaska, the ASTM class for April (i.e., ASTM class A[6]) is the same as that for July, implying that the July volatility should be assigned to April. For areas that have summertime RVP controls that go beyond the 9.0 psi RVP limit imposed in ASTM class A areas, this results in unreasonably low RVP levels being assigned to the spring fuel specifications. For those areas, we assumed an RVP of 8.7 psi, which reflects the ASTM specification with a 0.3 psi compliance cushion. For some counties in California, the summertime RVP levels were assigned to April, as April 1 is the compliance date for low-volatility fuel in a number of California counties. In addition, summertime RVP was assigned to the fall for a number of California counties, as the RVP controls extend through October 31 for some areas of California.

- *Oxygenate* - Because a number of areas in the Western U.S. have wintertime oxygenate requirements that do not extend into the spring or fall, the oxygenate levels observed in the summer were assigned to the spring and fall.

- *Sulfur* - Sulfur levels for spring and fall were assumed to be an arithmetic average of the summer and winter sulfur levels.

Diesel Fuel Specifications

For this project, Diesel fuel sulfur level was needed (by season) for on-highway and off-highway fuel for each county in the WRAP modeling domain. The data and methods used to generate these estimates are summarized below.

On-Highway Diesel Sulfur - Estimates for on-highway Diesel sulfur level were based on the Alliance fuel survey data outlined above for Albuquerque, Billings, Denver, Los Angeles, and Seattle. In addition, TRW publishes data on Diesel fuel specifications for the following regions:[7]

- Rocky Mountain Region (MT, ID, WY, UT, CO, NM, Eastern AZ, Western ND, and Western SD);

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[5] "Documentation for the Onroad National Emissions Inventory (NEI) for Base Years 1970-2002," Prepared by E.H. Pechan & Associates for the U.S. Environmental Protection Agency, January 2004.

[6] Note that April reflects a transition month in ASTM volatility class for most states, with two classes being assigned (e.g., A and C for Southern California). Based on EPA guidance contained in the MOBILE4 User's Guide, the lower volatility level is to be used for cases in which more than one class is listed; thus, class A was used for April in most of the areas in the WRAP modeling domain.

[7] Dickson, C.L. "Diesel Fuel Oils, 2002," TRW Petroleum Technologies, December 2002.

- Western Region (WA, OR, NV, CA, Western AZ); and
- Central Region (used for Eastern ND and SD).

In addition to reporting data by Region, the TRW report also contains data for Districts within each Region. For cases in which it was possible to segregate data for specific Districts, those data were used in the analysis.

Similar to the methodology used to generate gasoline specifications by county, each county in the modeling domain was mapped to one of the areas where fuel survey data were available. While the Alliance surveys are conducted in the winter and the summer, the TRW data do not distinguish between winter and summer. Thus, counties that were mapped to the TRW data set have the same sulfur level assigned year-round, whereas areas mapped to Alliance data have different summer and winter sulfur levels (although they generally are very close to one another). Spring and fall estimates from the Alliance data were based on an arithmetic average of the winter and summer results.

Note that neither the Alliance nor the TRW reports contain data on Alaska Diesel fuel. For this analysis, estimates for Diesel fuel sulfur level were obtained through discussions with the Alaska Department of Environmental Conservation. Average values of those data were used for the northern portion of Alaska. For Southeast Alaska (i.e., Juneau and surrounding boroughs), fuel is generally barged in from Northern Washington. Thus, fuel specifications from Seattle were mapped to the boroughs in the southeast area of the state.

Off-Highway Diesel Sulfur - The data available on off-highway Diesel fuel specifications are extremely limited. For this analysis, we used TRW data for the following regions and calendar years:

- Rocky Mountain Region - 2002;
- Western Region - 1996; and
- Central Region - 2001.

Data from prior to 2002 had to be used in some cases for this study because the 2002 Diesel survey only contained a single off-road Diesel fuel sample from the Central Region (which was taken from the WI/IL/IN District) and no samples at all from the Western Region.

For California and Maricopa County, AZ, regulations are in place that require the use of on-highway fuels in off-road equipment. Thus, the sulfur levels in these areas were based on the on-road data. Finally, for Alaska it was assumed that off-road Diesel fuel outside of Southeast Alaska had the same sulfur content as on-road Diesel fuel.

Winter and summer gasoline properties by county.

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
02013	02	013	AK	Aleutians East B	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02016	02	016	AK	Aleutians West C	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02020	02	020	AK	Anchorage Ed	ANCH	14.5	146	0.0	9.5	3.3		12.6	133	0.0	0.0	0.0
02050	02	050	AK	Bethel Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02060	02	060	AK	Bristol Bay Borough	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02068	02	068	AK	Denali Borough	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02070	02	070	AK	Dillingham Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02090	02	090	AK	Fairbanks Ed	AAM-FB	14.5	162	0.0	0.0	0.0		12.6	133	0.0	0.0	0.0
02100	02	100	AK	Haines Ed	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02110	02	110	AK	Juneau Ed	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02122	02	122	AK	Kenai Penninsula	AAM-FB	14.5	162	0.0	0.0	0.0		12.6	133	0.0	0.0	0.0
02130	02	130	AK	Ketchikan Ed	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02150	02	150	AK	Kodiak Island Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02164	02	164	AK	Lake and Peninsula	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02170	02	170	AK	Matanuska-Susitna	AAM-FB	14.5	162	0.0	0.0	0.0		12.6	133	0.0	0.0	0.0
02180	02	180	AK	Nome Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02185	02	185	AK	North Slope Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02188	02	188	AK	Northwest Arctic	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02201	02	201	AK	Prince Of Wales	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02220	02	220	AK	Sitka Ed	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02232	02	232	AK	Skagway-Yakutat	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02240	02	240	AK	Southeast Fairbanks	AAM-FB	14.5	162	0.0	0.0	0.0		12.6	133	0.0	0.0	0.0
02261	02	261	AK	Valdez-Cordova E	AAM-FB	14.5	162	0.0	0.0	0.0		12.6	133	0.0	0.0	0.0
02270	02	270	AK	Wade Hampton Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02280	02	280	AK	Wrangell-Petersburg	NIPER-13	13.7	324	0.0	0.0	0.0		7.5	342	0.0	0.0	0.0
02282	02	282	AK	Yakutat Borough	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
02290	02	290	AK	Yukon-Koyukuk Ed	AAM-FB	14.5	160	0.0	0.0	0.0		12.6	130	0.0	0.0	0.0
04001	04	001	AZ	Apache	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04003	04	003	AZ	Cochise	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04005	04	005	AZ	Coconino	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04007	04	007	AZ	Gila	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04009	04	009	AZ	Graham	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04011	04	011	AZ	Greenlee	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04012	04	012	AZ	La Paz	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04013	04	013	AZ	Maricopa	AAM-PX	9.0	10	0.1	9.4	3.3		6.8	94	9.1	0.0	1.6
04015	04	015	AZ	Mohave	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04017	04	017	AZ	Navajo	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04019	04	019	AZ	Pima	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04021	04	021	AZ	Pinal	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04023	04	023	AZ	Santa Cruz	NIPER-11	11.5	235	0.2	0.0	0.0		7.7	268	0.0	0.0	0.0
04025	04	025	AZ	Yavapai	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
04027	04	027	AZ	Yuma	NIPER-12	11.9	0	10.3	0.0	1.8		7.0	66	8.1	0.0	1.4
06001	06	001	CA	Alameda	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06003	06	003	CA	Alpine	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06005	06	005	CA	Amador	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
FIPS	State No.	County No.	State	County	Data Source	RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)		RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)
06007	06	007	CA	Butte	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06009	06	009	CA	Calaveras	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06011	06	011	CA	Colusa	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06013	06	013	CA	Contra Costa	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06015	06	015	CA	Del Norte	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06017	06	017	CA	El Dorado	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06019	06	019	CA	Fresno	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06021	06	021	CA	Glenn	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06023	06	023	CA	Humboldt	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06025	06	025	CA	Imperial	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06027	06	027	CA	Inyo	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06029	06	029	CA	Kern	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06031	06	031	CA	Kings	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06033	06	033	CA	Lake	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06035	06	035	CA	Lassen	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06037	06	037	CA	Los Angeles	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06039	06	039	CA	Madera	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06041	06	041	CA	Marin	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06043	06	043	CA	Mariposa	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06045	06	045	CA	Mendocino	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06047	06	047	CA	Merced	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06049	06	049	CA	Modoc	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06051	06	051	CA	Mono	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06053	06	053	CA	Monterey	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06055	06	055	CA	Napa	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06057	06	057	CA	Nevada	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06059	06	059	CA	Orange	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06061	06	061	CA	Placer	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06063	06	063	CA	Plumas	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06065	06	065	CA	Riverside	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06067	06	067	CA	Sacramento	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06069	06	069	CA	San Benito	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06071	06	071	CA	San Bernardino	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06073	06	073	CA	San Diego	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06075	06	075	CA	San Francisco	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06077	06	077	CA	San Joaquin	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06079	06	079	CA	San Luis Obispo	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06081	06	081	CA	San Mateo	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06083	06	083	CA	Santa Barbara	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06085	06	085	CA	Santa Clara	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06087	06	087	CA	Santa Cruz	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06089	06	089	CA	Shasta	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06091	06	091	CA	Sierra	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06093	06	093	CA	Siskiyou	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06095	06	095	CA	Solano	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06097	06	097	CA	Sonoma	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
06099	06	099	CA	Stanislaus	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06101	06	101	CA	Sutter	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06103	06	103	CA	Tehama	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06105	06	105	CA	Trinity	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06107	06	107	CA	Tulare	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06109	06	109	CA	Tuolumne	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06111	06	111	CA	Ventura	AAM-LA	11.6	20	10.2	0.9	2.1		7.0	10	10.4	0.6	2.1
06113	06	113	CA	Yolo	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
06115	06	115	CA	Yuba	AAM-SF	12.4	10	3.2	1.1	0.9		7.1	10	5.0	1.2	1.3
08001	08	001	CO	Adams	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08003	08	003	CO	Alamosa	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08005	08	005	CO	Arapahoe	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08007	08	007	CO	Archuleta	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08009	08	009	CO	Baca	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08011	08	011	CO	Bent	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08013	08	013	CO	Boulder	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08015	08	015	CO	Chaffee	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08017	08	017	CO	Cheyenne	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08019	08	019	CO	Clear Creek	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08021	08	021	CO	Conejos	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08023	08	023	CO	Costilla	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08025	08	025	CO	Crowley	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08027	08	027	CO	Custer	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08029	08	029	CO	Delta	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08031	08	031	CO	Denver	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08033	08	033	CO	Dolores	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08035	08	035	CO	Douglas	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08037	08	037	CO	Eagle	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08039	08	039	CO	Elbert	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08041	08	041	CO	El Paso	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08043	08	043	CO	Fremont	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08045	08	045	CO	Garfield	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08047	08	047	CO	Gilpin	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08049	08	049	CO	Grand	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08051	08	051	CO	Gunnison	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08053	08	053	CO	Hinsdale	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08055	08	055	CO	Huerfano	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08057	08	057	CO	Jackson	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08059	08	059	CO	Jefferson	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08061	08	061	CO	Kiowa	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08063	08	063	CO	Kit Carson	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08065	08	065	CO	Lake	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08067	08	067	CO	La Plata	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08069	08	069	CO	Larimer	AAM-DN	14.2	149	0.0	9.7	3.4		9.0	167	0.0	4.2	1.4
08071	08	071	CO	Las Animas	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08073	08	073	CO	Lincoln	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
FIPS	State No.	County No.	State	County	Data Source	RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)		RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)
08075	08	075	CO	Logan	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08077	08	077	CO	Mesa	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08079	08	079	CO	Mineral	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08081	08	081	CO	Moffat	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08083	08	083	CO	Montezuma	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08085	08	085	CO	Montrose	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08087	08	087	CO	Morgan	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08089	08	089	CO	Otero	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08091	08	091	CO	Ouray	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08093	08	093	CO	Park	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08095	08	095	CO	Phillips	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08097	08	097	CO	Pitkin	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08099	08	099	CO	Prowers	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08101	08	101	CO	Pueblo	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08103	08	103	CO	Rio Blanco	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08105	08	105	CO	Rio Grande	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08107	08	107	CO	Routt	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08109	08	109	CO	Saguache	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08111	08	111	CO	San Juan	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08113	08	113	CO	San Miguel	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08115	08	115	CO	Sedgwick	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08117	08	117	CO	Summit	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08119	08	119	CO	Teller	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08121	08	121	CO	Washington	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08123	08	123	CO	Weld	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
08125	08	125	CO	Yuma	NIPER-10	12.8	176	0.0	0.0	0.0		7.8	175	0.0	0.0	0.0
16001	16	001	ID	Ada	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16003	16	003	ID	Adams	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16005	16	005	ID	Bannock	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16007	16	007	ID	Bear Lake	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16009	16	009	ID	Benewah	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16011	16	011	ID	Bingham	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16013	16	013	ID	Blaine	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16015	16	015	ID	Boise	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16017	16	017	ID	Bonner	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16019	16	019	ID	Bonneville	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16021	16	021	ID	Boundary	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16023	16	023	ID	Butte	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16025	16	025	ID	Camas	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16027	16	027	ID	Canyon	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16029	16	029	ID	Caribou	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16031	16	031	ID	Cassia	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16033	16	033	ID	Clark	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16035	16	035	ID	Clearwater	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16037	16	037	ID	Custer	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16039	16	039	ID	Elmore	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						**Summer 2002 Gasoline Properties**				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
16041	16	041	ID	Franklin	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16043	16	043	ID	Fremont	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16045	16	045	ID	Gem	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16047	16	047	ID	Gooding	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16049	16	049	ID	Idaho	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16051	16	051	ID	Jefferson	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16053	16	053	ID	Jerome	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16055	16	055	ID	Kootenai	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16057	16	057	ID	Latah	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16059	16	059	ID	Lemhi	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16061	16	061	ID	Lewis	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16063	16	063	ID	Lincoln	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16065	16	065	ID	Madison	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16067	16	067	ID	Minidoka	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16069	16	069	ID	Nez Perce	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16071	16	071	ID	Oneida	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16073	16	073	ID	Owyhee	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16075	16	075	ID	Payette	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16077	16	077	ID	Power	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16079	16	079	ID	Shoshone	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16081	16	081	ID	Teton	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16083	16	083	ID	Twin Falls	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16085	16	085	ID	Valley	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
16087	16	087	ID	Washington	NIPER-9	12.7	195	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
30001	30	001	MT	Beaverhead	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30003	30	003	MT	Big Horn	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30005	30	005	MT	Blaine	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30007	30	007	MT	Broadwater	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30009	30	009	MT	Carbon	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30011	30	011	MT	Carter	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30013	30	013	MT	Cascade	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30015	30	015	MT	Chouteau	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30017	30	017	MT	Custer	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30019	30	019	MT	Daniels	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30021	30	021	MT	Dawson	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30023	30	023	MT	Deer Lodge	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30025	30	025	MT	Fallon	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30027	30	027	MT	Fergus	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30029	30	029	MT	Flat Head	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30031	30	031	MT	Gallatin	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30033	30	033	MT	Garfield	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30035	30	035	MT	Glacier	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30037	30	037	MT	Golden Valley	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30039	30	039	MT	Granite	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30041	30	041	MT	Hill	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30043	30	043	MT	Jefferson	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
30045	30	045	MT	Judith Basin	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30047	30	047	MT	Lake	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30049	30	049	MT	Lewis and Clark	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30051	30	051	MT	Liberty	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30053	30	053	MT	Lincoln	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30055	30	055	MT	Mc Cone	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30057	30	057	MT	Madison	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30059	30	059	MT	Meagher	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30061	30	061	MT	Mineral	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30063	30	063	MT	Missoula	AAM-BL	13.9	365	0.0	10.0	3.4		8.7	389	0.0	0.0	0.0
30065	30	065	MT	Musselshell	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30067	30	067	MT	Park	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30069	30	069	MT	Petroleum	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30071	30	071	MT	Phillips	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30073	30	073	MT	Pondera	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30075	30	075	MT	Powder River	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30077	30	077	MT	Powell	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30079	30	079	MT	Prairie	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30081	30	081	MT	Ravalli	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30083	30	083	MT	Richland	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30085	30	085	MT	Roosevelt	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30087	30	087	MT	Rosebud	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30089	30	089	MT	Sanders	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30091	30	091	MT	Sheridan	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30093	30	093	MT	Silver Bow	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30095	30	095	MT	Stillwater	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30097	30	097	MT	Sweet Grass	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30099	30	099	MT	Teton	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30101	30	101	MT	Toole	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30103	30	103	MT	Treasure	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30105	30	105	MT	Valley	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30107	30	107	MT	Wheatland	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30109	30	109	MT	Wibaux	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30111	30	111	MT	Yellowstone	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
30113	30	113	MT	Yellowstone Park	AAM-BL	13.9	405	0.0	0.0	0.0		8.7	389	0.0	0.0	0.0
32001	32	001	NV	Churchill	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32003	32	003	NV	Clark	AAM-LV	8.9	20	0.2	9.2	3.2		8.3	27	0.2	0.0	0.0
32005	32	005	NV	Douglas	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32007	32	007	NV	Elko	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32009	32	009	NV	Esmeralda	AAM-LV	8.9	20	0.2	9.2	3.2		8.3	27	0.2	0.0	0.0
32011	32	011	NV	Eureka	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32013	32	013	NV	Humboldt	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32015	32	015	NV	Lander	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32017	32	017	NV	Lincoln	AAM-LV	8.9	20	0.2	9.2	3.2		8.3	27	0.2	0.0	0.0
32019	32	019	NV	Lyon	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32021	32	021	NV	Mineral	AAM-LV	8.9	20	0.2	9.2	3.2		8.3	27	0.2	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
32023	32	023	NV	Nye	AAM-LV	8.9	20	0.2	9.2	3.2		8.3	27	0.2	0.0	0.0
32027	32	027	NV	Pershing	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32029	32	029	NV	Storey	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32031	32	031	NV	Washoe	NIPER-14	12.6	9	0.0	7.8	2.7		7.2	37	2.9	0.0	0.5
32033	32	033	NV	White Pine	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
32510	32	510	NV	Carson City	NIPER-14	11.6	10	2.2	0.0	0.4		7.2	37	2.9	0.0	0.5
35001	35	001	NM	Bernalillo	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
35003	35	003	NM	Catron	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35005	35	005	NM	Chaves	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35006	35	006	NM	Cibola	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35007	35	007	NM	Colfax	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35009	35	009	NM	Curry	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35011	35	011	NM	De Baca	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35013	35	013	NM	Dona Ana	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35015	35	015	NM	Eddy	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35017	35	017	NM	Grant	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35019	35	019	NM	Guadalupe	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35021	35	021	NM	Harding	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35023	35	023	NM	Hidalgo	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35025	35	025	NM	Lea	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35027	35	027	NM	Lincoln	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35028	35	028	NM	Los Alamos	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
35029	35	029	NM	Luna	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35031	35	031	NM	Mc Kinley	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35033	35	033	NM	Mora	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35035	35	035	NM	Otero	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35037	35	037	NM	Quay	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35039	35	039	NM	Rio Arriba	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35041	35	041	NM	Roosevelt	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35043	35	043	NM	Sandoval	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
35045	35	045	NM	San Juan	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35047	35	047	NM	San Miguel	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35049	35	049	NM	Santa Fe	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
35051	35	051	NM	Sierra	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35053	35	053	NM	Socorro	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35055	35	055	NM	Taos	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35057	35	057	NM	Torrance	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
35059	35	059	NM	Union	NIPER-11	11.5	237	0.2	0.0	0.0		7.7	270	0.0	0.0	0.0
35061	35	061	NM	Valencia	AAM-ALB	12.7	170	0.0	8.6	3.0		8.8	240	2.0	2.0	1.0
38001	38	001	ND	Adams	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38003	38	003	ND	Barnes	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38005	38	005	ND	Benson	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38007	38	007	ND	Billings	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38009	38	009	ND	Bottineau	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38011	38	011	ND	Bowman	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38013	38	013	ND	Burke	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
38015	38	015	ND	Burleigh	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38017	38	017	ND	Cass	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38019	38	019	ND	Cavalier	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38021	38	021	ND	Dickey	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38023	38	023	ND	Divide	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38025	38	025	ND	Dunn	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38027	38	027	ND	Eddy	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38029	38	029	ND	Emmons	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38031	38	031	ND	Foster	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38033	38	033	ND	Golden Valley	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38035	38	035	ND	Grand Forks	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38037	38	037	ND	Grant	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38039	38	039	ND	Griggs	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38041	38	041	ND	Hettinger	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38043	38	043	ND	Kidder	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38045	38	045	ND	La Moure	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38047	38	047	ND	Logan	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38049	38	049	ND	Mc Henry	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38051	38	051	ND	Mc Intosh	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38053	38	053	ND	Mc Kenzie	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38055	38	055	ND	Mc Lean	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38057	38	057	ND	Mercer	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38059	38	059	ND	Morton	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38061	38	061	ND	Mountrail	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38063	38	063	ND	Nelson	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38065	38	065	ND	Oliver	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38067	38	067	ND	Pembina	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38069	38	069	ND	Pierce	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38071	38	071	ND	Ramsey	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38073	38	073	ND	Ransom	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38075	38	075	ND	Renville	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38077	38	077	ND	Richland	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38079	38	079	ND	Rolette	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38081	38	081	ND	Sargent	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38083	38	083	ND	Sheridan	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38085	38	085	ND	Sioux	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38087	38	087	ND	Slope	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38089	38	089	ND	Stark	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0
38091	38	091	ND	Steele	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38093	38	093	ND	Stutsman	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38095	38	095	ND	Towner	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38097	38	097	ND	Traill	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38099	38	099	ND	Walsh	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38101	38	101	ND	Ward	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38103	38	103	ND	Wells	NIPER-7	13.3	212	0.0	0.0	0.0		8.1	278	0.0	0.0	0.0
38105	38	105	ND	Williams	AAM-BL	14.0	413	0.0	0.0	0.0		8.6	421	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
41001	41	001	OR	Baker	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41003	41	003	OR	Benton	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41005	41	005	OR	Clackamas	NIPER-13	14.1	150	0.0	8.8	3.0		7.5	326	0.0	0.0	0.0
41007	41	007	OR	Clatsop	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41009	41	009	OR	Columbia	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41011	41	011	OR	Coos	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41013	41	013	OR	Crook	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41015	41	015	OR	Curry	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41017	41	017	OR	Deschutes	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41019	41	019	OR	Douglas	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41021	41	021	OR	Gilliam	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41023	41	023	OR	Grant	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41025	41	025	OR	Harney	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41027	41	027	OR	Hood River	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41029	41	029	OR	Jackson	NIPER-13	14.1	150	0.0	8.8	3.0		7.5	326	0.0	0.0	0.0
41031	41	031	OR	Jefferson	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41033	41	033	OR	Josephine	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41035	41	035	OR	Klamath	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41037	41	037	OR	Lake	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41039	41	039	OR	Lane	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41041	41	041	OR	Lincoln	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41043	41	043	OR	Linn	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41045	41	045	OR	Malheur	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41047	41	047	OR	Marion	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41049	41	049	OR	Morrow	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41051	41	051	OR	Multnomah	NIPER-13	14.1	150	0.0	8.8	3.0		7.5	326	0.0	0.0	0.0
41053	41	053	OR	Polk	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41055	41	055	OR	Sherman	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41057	41	057	OR	Tillamook	NIPER-13	13.7	310	0.0	0.0	0.0		7.5	326	0.0	0.0	0.0
41059	41	059	OR	Umatilla	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41061	41	061	OR	Union	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41063	41	063	OR	Wallowa	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41065	41	065	OR	Wasco	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41067	41	067	OR	Washington	NIPER-13	14.1	150	0.0	8.8	3.0		7.5	326	0.0	0.0	0.0
41069	41	069	OR	Wheeler	NIPER-9	12.7	198	0.0	0.0	0.0		8.3	309	0.0	0.0	0.0
41071	41	071	OR	Yamhill	NIPER-13	14.1	150	0.0	8.8	3.0		7.5	326	0.0	0.0	0.0
46003	46	003	SD	Aurora	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46005	46	005	SD	Beadle	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46007	46	007	SD	Bennett	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46009	46	009	SD	Bon Homme	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46011	46	011	SD	Brookings	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46013	46	013	SD	Brown	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46015	46	015	SD	Brule	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46017	46	017	SD	Buffalo	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46019	46	019	SD	Butte	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46021	46	021	SD	Campbell	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
46023	46	023	SD	Charles Mix	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46025	46	025	SD	Clark	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46027	46	027	SD	Clay	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46029	46	029	SD	Codington	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46031	46	031	SD	Corson	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46033	46	033	SD	Custer	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46035	46	035	SD	Davison	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46037	46	037	SD	Day	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46039	46	039	SD	Deuel	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46041	46	041	SD	Dewey	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46043	46	043	SD	Douglas	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46045	46	045	SD	Edmunds	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46047	46	047	SD	Fall River	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46049	46	049	SD	Faulk	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46051	46	051	SD	Grant	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46053	46	053	SD	Gregory	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46055	46	055	SD	Haakon	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46057	46	057	SD	Hamlin	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46059	46	059	SD	Hand	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46061	46	061	SD	Hanson	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46063	46	063	SD	Harding	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46065	46	065	SD	Hughes	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46067	46	067	SD	Hutchinson	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46069	46	069	SD	Hyde	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46071	46	071	SD	Jackson	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46073	46	073	SD	Jerauld	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46075	46	075	SD	Jones	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46077	46	077	SD	Kingsbury	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46079	46	079	SD	Lake	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46081	46	081	SD	Lawrence	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46083	46	083	SD	Lincoln	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46085	46	085	SD	Lyman	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46087	46	087	SD	Mc Cook	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46089	46	089	SD	Mc Pherson	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46091	46	091	SD	Marshall	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46093	46	093	SD	Meade	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46095	46	095	SD	Mellette	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46097	46	097	SD	Miner	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46099	46	099	SD	Minnehaha	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46101	46	101	SD	Moody	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46103	46	103	SD	Pennington	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46105	46	105	SD	Perkins	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0
46107	46	107	SD	Potter	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46109	46	109	SD	Roberts	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46111	46	111	SD	Sanborn	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46113	46	113	SD	Shannon	NIPER-9	12.8	203	0.0	0.0	0.0		8.3	316	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
46115	46	115	SD	Spink	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46117	46	117	SD	Stanley	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46119	46	119	SD	Sully	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46121	46	121	SD	Todd	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46123	46	123	SD	Tripp	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46125	46	125	SD	Turner	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46127	46	127	SD	Union	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46129	46	129	SD	Walworth	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46135	46	135	SD	Yankton	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
46137	46	137	SD	Ziebach	NIPER-7	13.3	210	0.0	0.0	0.0		8.1	275	0.0	0.0	0.0
49001	49	001	UT	Beaver	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49003	49	003	UT	Box Elder	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49005	49	005	UT	Cache	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49007	49	007	UT	Carbon	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49009	49	009	UT	Daggett	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49011	49	011	UT	Davis	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49013	49	013	UT	Duchesne	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49015	49	015	UT	Emery	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49017	49	017	UT	Garfield	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49019	49	019	UT	Grand	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49021	49	021	UT	Iron	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49023	49	023	UT	Juab	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49025	49	025	UT	Kane	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49027	49	027	UT	Millard	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49029	49	029	UT	Morgan	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49031	49	031	UT	Piute	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49033	49	033	UT	Rich	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49035	49	035	UT	Salt Lake	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49037	49	037	UT	San Juan	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49039	49	039	UT	Sanpete	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49041	49	041	UT	Sevier	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49043	49	043	UT	Summit	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49045	49	045	UT	Tooele	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49047	49	047	UT	Uintah	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49049	49	049	UT	Utah	NIPER-10	14.4	195	0.0	7.0	2.4		7.8	173	0.0	0.0	0.0
49051	49	051	UT	Wasatch	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49053	49	053	UT	Washington	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49055	49	055	UT	Wayne	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
49057	49	057	UT	Weber	NIPER-10	12.8	173	0.0	0.0	0.0		7.8	173	0.0	0.0	0.0
53001	53	001	WA	Adams	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53003	53	003	WA	Asotin	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53005	53	005	WA	Benton	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53007	53	007	WA	Chelan	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53009	53	009	WA	Clallam	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53011	53	011	WA	Clark	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53013	53	013	WA	Columbia	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
53015	53	015	WA	Cowlitz	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53017	53	017	WA	Douglas	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53019	53	019	WA	Ferry	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53021	53	021	WA	Franklin	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53023	53	023	WA	Garfield	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53025	53	025	WA	Grant	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53027	53	027	WA	Grays Harbor	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53029	53	029	WA	Island	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53031	53	031	WA	Jefferson	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53033	53	033	WA	King	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53035	53	035	WA	Kitsap	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53037	53	037	WA	Kittitas	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53039	53	039	WA	Klickitat	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53041	53	041	WA	Lewis	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53043	53	043	WA	Lincoln	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53045	53	045	WA	Mason	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53047	53	047	WA	Okanogan	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53049	53	049	WA	Pacific	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53051	53	051	WA	Pend Oreille	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53053	53	053	WA	Pierce	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53055	53	055	WA	San Juan	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53057	53	057	WA	Skagit	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53059	53	059	WA	Skamania	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53061	53	061	WA	Snohomish	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53063	53	063	WA	Spokane	NIPER-9	13.4	258	0.0	9.7	3.3		8.3	304	0.0	0.0	0.0
53065	53	065	WA	Stevens	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53067	53	067	WA	Thurston	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53069	53	069	WA	Wahkiakum	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53071	53	071	WA	Walla Walla	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53073	53	073	WA	Whatcom	AAM-SE	14.3	270	0.0	2.5	0.9		7.8	329	0.0	2.7	0.9
53075	53	075	WA	Whitman	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
53077	53	077	WA	Yakima	NIPER-9	12.7	196	0.0	0.0	0.0		8.3	304	0.0	0.0	0.0
56001	56	001	WY	Albany	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56003	56	003	WY	Big Horn	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56005	56	005	WY	Campbell	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56007	56	007	WY	Carbon	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56009	56	009	WY	Converse	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56011	56	011	WY	Crook	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56013	56	013	WY	Fremont	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56015	56	015	WY	Goshen	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56017	56	017	WY	Hot Springs	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56019	56	019	WY	Johnson	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56021	56	021	WY	Laramie	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56023	56	023	WY	Lincoln	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56025	56	025	WY	Natrona	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56027	56	027	WY	Niobrara	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0

						Winter 2002 Gasoline Properties						Summer 2002 Gasoline Properties				
	State	County			Data	RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County	Source	(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
56029	56	029	WY	Park	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56031	56	031	WY	Platte	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56033	56	033	WY	Sheridan	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56035	56	035	WY	Sublette	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56037	56	037	WY	Sweetwater	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56039	56	039	WY	Teton	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56041	56	041	WY	Uinta	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56043	56	043	WY	Washakie	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0
56045	56	045	WY	Weston	NIPER-9	12.7	192	0.0	0.0	0.0		8.3	297	0.0	0.0	0.0

Spring and fall gasoline properties by county.

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
02013	02	013	AK	Aleutians East B		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02016	02	016	AK	Aleutians West C		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02020	02	020	AK	Anchorage Ed		14.5	140	0.0	0.0	0.0		14.5	140	0.0	0.0	0.0
02050	02	050	AK	Bethel Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02060	02	060	AK	Bristol Bay Borough		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02068	02	068	AK	Denali Borough		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02070	02	070	AK	Dillingham Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02090	02	090	AK	Fairbanks Ed		14.5	148	0.0	0.0	0.0		14.5	148	0.0	0.0	0.0
02100	02	100	AK	Haines Ed		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02110	02	110	AK	Juneau Ed		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02122	02	122	AK	Kenai Penninsula		14.5	148	0.0	0.0	0.0		14.5	148	0.0	0.0	0.0
02130	02	130	AK	Ketchikan Ed		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02150	02	150	AK	Kodiak Island Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02164	02	164	AK	Lake and Peninsu		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02170	02	170	AK	Matanuska-Susitna		14.5	148	0.0	0.0	0.0		14.5	148	0.0	0.0	0.0
02180	02	180	AK	Nome Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02185	02	185	AK	North Slope Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02188	02	188	AK	Northwest Arctic		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02201	02	201	AK	Prince Of Wales		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02220	02	220	AK	Sitka Ed		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02232	02	232	AK	Skagway-Yakutat		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02240	02	240	AK	Southeast Fairbanks		14.5	148	0.0	0.0	0.0		14.5	148	0.0	0.0	0.0
02261	02	261	AK	Valdez-Cordova E		14.5	148	0.0	0.0	0.0		14.5	148	0.0	0.0	0.0
02270	02	270	AK	Wade Hampton Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02280	02	280	AK	Wrangell-Petersburg		13.7	333	0.0	0.0	0.0		13.7	333	0.0	0.0	0.0
02282	02	282	AK	Yakutat Borough		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
02290	02	290	AK	Yukon-Koyukuk Ed		14.5	145	0.0	0.0	0.0		14.5	145	0.0	0.0	0.0
04001	04	001	AZ	Apache		8.7	251	0.0	0.0	0.0		9.3	251	0.0	0.0	0.0
04003	04	003	AZ	Cochise		8.7	251	0.0	0.0	0.0		8.7	251	0.0	0.0	0.0
04005	04	005	AZ	Coconino		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04007	04	007	AZ	Gila		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04009	04	009	AZ	Graham		8.7	251	0.0	0.0	0.0		8.7	251	0.0	0.0	0.0
04011	04	011	AZ	Greenlee		8.7	251	0.0	0.0	0.0		8.7	251	0.0	0.0	0.0
04012	04	012	AZ	La Paz		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04013	04	013	AZ	Maricopa		8.7	52	9.1	0.0	1.6		8.7	52	9.1	0.0	1.6
04015	04	015	AZ	Mohave		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04017	04	017	AZ	Navajo		8.7	251	0.0	0.0	0.0		9.3	251	0.0	0.0	0.0
04019	04	019	AZ	Pima		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04021	04	021	AZ	Pinal		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04023	04	023	AZ	Santa Cruz		8.7	251	0.0	0.0	0.0		8.7	251	0.0	0.0	0.0
04025	04	025	AZ	Yavapai		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
04027	04	027	AZ	Yuma		8.7	33	8.1	0.0	1.4		8.7	33	8.1	0.0	1.4
06001	06	001	CA	Alameda		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06003	06	003	CA	Alpine		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06005	06	005	CA	Amador		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
06007	06	007	CA	Butte		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06009	06	009	CA	Calaveras		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06011	06	011	CA	Colusa		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06013	06	013	CA	Contra Costa		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06015	06	015	CA	Del Norte		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06017	06	017	CA	El Dorado		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06019	06	019	CA	Fresno		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06021	06	021	CA	Glenn		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06023	06	023	CA	Humboldt		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06025	06	025	CA	Imperial		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06027	06	027	CA	Inyo		8.7	15	10.4	0.6	2.1		8.7	15	10.4	0.6	2.1
06029	06	029	CA	Kern		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06031	06	031	CA	Kings		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06033	06	033	CA	Lake		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06035	06	035	CA	Lassen		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06037	06	037	CA	Los Angeles		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06039	06	039	CA	Madera		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06041	06	041	CA	Marin		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06043	06	043	CA	Mariposa		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06045	06	045	CA	Mendocino		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06047	06	047	CA	Merced		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06049	06	049	CA	Modoc		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06051	06	051	CA	Mono		8.7	10	5.0	1.2	1.3		8.7	10	5.0	1.2	1.3
06053	06	053	CA	Monterey		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06055	06	055	CA	Napa		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06057	06	057	CA	Nevada		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06059	06	059	CA	Orange		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06061	06	061	CA	Placer		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06063	06	063	CA	Plumas		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06065	06	065	CA	Riverside		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06067	06	067	CA	Sacramento		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06069	06	069	CA	San Benito		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06071	06	071	CA	San Bernardino		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06073	06	073	CA	San Diego		7.0	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06075	06	075	CA	San Francisco		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06077	06	077	CA	San Joaquin		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06079	06	079	CA	San Luis Obispo		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06081	06	081	CA	San Mateo		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06083	06	083	CA	Santa Barbara		8.7	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06085	06	085	CA	Santa Clara		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06087	06	087	CA	Santa Cruz		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06089	06	089	CA	Shasta		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06091	06	091	CA	Sierra		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06093	06	093	CA	Siskiyou		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06095	06	095	CA	Solano		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06097	06	097	CA	Sonoma		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
06099	06	099	CA	Stanislaus		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06101	06	101	CA	Sutter		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06103	06	103	CA	Tehama		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06105	06	105	CA	Trinity		8.7	10	5.0	1.2	1.3		9.5	10	5.0	1.2	1.3
06107	06	107	CA	Tulare		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06109	06	109	CA	Tuolumne		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06111	06	111	CA	Ventura		8.7	15	10.4	0.6	2.1		7.0	15	10.4	0.6	2.1
06113	06	113	CA	Yolo		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
06115	06	115	CA	Yuba		8.7	10	5.0	1.2	1.3		7.1	10	5.0	1.2	1.3
08001	08	001	CO	Adams		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08003	08	003	CO	Alamosa		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08005	08	005	CO	Arapahoe		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08007	08	007	CO	Archuleta		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08009	08	009	CO	Baca		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08011	08	011	CO	Bent		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08013	08	013	CO	Boulder		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08015	08	015	CO	Chaffee		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08017	08	017	CO	Cheyenne		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08019	08	019	CO	Clear Creek		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08021	08	021	CO	Conejos		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08023	08	023	CO	Costilla		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08025	08	025	CO	Crowley		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08027	08	027	CO	Custer		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08029	08	029	CO	Delta		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08031	08	031	CO	Denver		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08033	08	033	CO	Dolores		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08035	08	035	CO	Douglas		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08037	08	037	CO	Eagle		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08039	08	039	CO	Elbert		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08041	08	041	CO	El Paso		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08043	08	043	CO	Fremont		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08045	08	045	CO	Garfield		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08047	08	047	CO	Gilpin		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08049	08	049	CO	Grand		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08051	08	051	CO	Gunnison		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08053	08	053	CO	Hinsdale		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08055	08	055	CO	Huerfano		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08057	08	057	CO	Jackson		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08059	08	059	CO	Jefferson		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08061	08	061	CO	Kiowa		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08063	08	063	CO	Kit Carson		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08065	08	065	CO	Lake		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08067	08	067	CO	La Plata		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08069	08	069	CO	Larimer		9.0	158	0.0	4.2	1.4		9.9	158	0.0	4.2	1.4
08071	08	071	CO	Las Animas		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08073	08	073	CO	Lincoln		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
08075	08	075	CO	Logan		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08077	08	077	CO	Mesa		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08079	08	079	CO	Mineral		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08081	08	081	CO	Moffat		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08083	08	083	CO	Montezuma		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08085	08	085	CO	Montrose		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08087	08	087	CO	Morgan		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08089	08	089	CO	Otero		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08091	08	091	CO	Ouray		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08093	08	093	CO	Park		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08095	08	095	CO	Phillips		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08097	08	097	CO	Pitkin		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08099	08	099	CO	Prowers		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08101	08	101	CO	Pueblo		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08103	08	103	CO	Rio Blanco		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08105	08	105	CO	Rio Grande		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08107	08	107	CO	Routt		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08109	08	109	CO	Saguache		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08111	08	111	CO	San Juan		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08113	08	113	CO	San Miguel		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08115	08	115	CO	Sedgwick		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08117	08	117	CO	Summit		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08119	08	119	CO	Teller		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08121	08	121	CO	Washington		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08123	08	123	CO	Weld		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
08125	08	125	CO	Yuma		8.7	175	0.0	0.0	0.0		9.4	175	0.0	0.0	0.0
16001	16	001	ID	Ada		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16003	16	003	ID	Adams		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16005	16	005	ID	Bannock		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16007	16	007	ID	Bear Lake		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16009	16	009	ID	Benewah		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16011	16	011	ID	Bingham		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16013	16	013	ID	Blaine		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16015	16	015	ID	Boise		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16017	16	017	ID	Bonner		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16019	16	019	ID	Bonneville		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16021	16	021	ID	Boundary		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16023	16	023	ID	Butte		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16025	16	025	ID	Camas		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16027	16	027	ID	Canyon		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16029	16	029	ID	Caribou		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16031	16	031	ID	Cassia		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16033	16	033	ID	Clark		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16035	16	035	ID	Clearwater		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16037	16	037	ID	Custer		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16039	16	039	ID	Elmore		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
16041	16	041	ID	Franklin		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16043	16	043	ID	Fremont		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16045	16	045	ID	Gem		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16047	16	047	ID	Gooding		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16049	16	049	ID	Idaho		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16051	16	051	ID	Jefferson		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16053	16	053	ID	Jerome		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16055	16	055	ID	Kootenai		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16057	16	057	ID	Latah		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16059	16	059	ID	Lemhi		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16061	16	061	ID	Lewis		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16063	16	063	ID	Lincoln		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16065	16	065	ID	Madison		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16067	16	067	ID	Minidoka		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16069	16	069	ID	Nez Perce		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16071	16	071	ID	Oneida		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16073	16	073	ID	Owyhee		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16075	16	075	ID	Payette		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16077	16	077	ID	Power		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16079	16	079	ID	Shoshone		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
16081	16	081	ID	Teton		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16083	16	083	ID	Twin Falls		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16085	16	085	ID	Valley		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
16087	16	087	ID	Washington		8.7	250	0.0	0.0	0.0		9.4	250	0.0	0.0	0.0
30001	30	001	MT	Beaverhead		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30003	30	003	MT	Big Horn		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30005	30	005	MT	Blaine		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30007	30	007	MT	Broadwater		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30009	30	009	MT	Carbon		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30011	30	011	MT	Carter		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30013	30	013	MT	Cascade		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30015	30	015	MT	Chouteau		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30017	30	017	MT	Custer		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30019	30	019	MT	Daniels		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30021	30	021	MT	Dawson		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30023	30	023	MT	Deer Lodge		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30025	30	025	MT	Fallon		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30027	30	027	MT	Fergus		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30029	30	029	MT	Flat Head		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30031	30	031	MT	Gallatin		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30033	30	033	MT	Garfield		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30035	30	035	MT	Glacier		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30037	30	037	MT	Golden Valley		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30039	30	039	MT	Granite		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30041	30	041	MT	Hill		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30043	30	043	MT	Jefferson		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
30045	30	045	MT	Judith Basin		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30047	30	047	MT	Lake		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30049	30	049	MT	Lewis and Clark		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30051	30	051	MT	Liberty		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30053	30	053	MT	Lincoln		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30055	30	055	MT	Mc Cone		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30057	30	057	MT	Madison		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30059	30	059	MT	Meagher		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30061	30	061	MT	Mineral		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30063	30	063	MT	Missoula		8.7	377	0.0	0.0	0.0		10.9	377	0.0	0.0	0.0
30065	30	065	MT	Musselshell		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30067	30	067	MT	Park		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30069	30	069	MT	Petroleum		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30071	30	071	MT	Phillips		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30073	30	073	MT	Pondera		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30075	30	075	MT	Powder River		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30077	30	077	MT	Powell		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30079	30	079	MT	Prairie		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30081	30	081	MT	Ravalli		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30083	30	083	MT	Richland		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30085	30	085	MT	Roosevelt		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30087	30	087	MT	Rosebud		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30089	30	089	MT	Sanders		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30091	30	091	MT	Sheridan		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30093	30	093	MT	Silver Bow		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30095	30	095	MT	Stillwater		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30097	30	097	MT	Sweet Grass		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30099	30	099	MT	Teton		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30101	30	101	MT	Toole		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30103	30	103	MT	Treasure		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30105	30	105	MT	Valley		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30107	30	107	MT	Wheatland		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30109	30	109	MT	Wibaux		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30111	30	111	MT	Yellowstone		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
30113	30	113	MT	Yellowstone Park		8.7	397	0.0	0.0	0.0		10.9	397	0.0	0.0	0.0
32001	32	001	NV	Churchill		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32003	32	003	NV	Clark		8.7	23	0.2	0.0	0.0		8.7	23	0.2	0.0	0.0
32005	32	005	NV	Douglas		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32007	32	007	NV	Elko		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32009	32	009	NV	Esmeralda		8.7	23	0.2	0.0	0.0		8.7	23	0.2	0.0	0.0
32011	32	011	NV	Eureka		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32013	32	013	NV	Humboldt		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32015	32	015	NV	Lander		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32017	32	017	NV	Lincoln		8.7	23	0.2	0.0	0.0		8.7	23	0.2	0.0	0.0
32019	32	019	NV	Lyon		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32021	32	021	NV	Mineral		8.7	23	0.2	0.0	0.0		8.7	23	0.2	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
32023	32	023	NV	Nye		8.7	23	0.2	0.0	0.0		8.7	23	0.2	0.0	0.0
32027	32	027	NV	Pershing		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32029	32	029	NV	Storey		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32031	32	031	NV	Washoe		8.7	23	2.9	0.0	0.5		9.6	23	2.9	0.0	0.5
32033	32	033	NV	White Pine		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
32510	32	510	NV	Carson City		8.7	23	2.9	0.0	0.5		9.3	23	2.9	0.0	0.5
35001	35	001	NM	Bernalillo		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
35003	35	003	NM	Catron		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35005	35	005	NM	Chaves		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35006	35	006	NM	Cibola		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35007	35	007	NM	Colfax		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35009	35	009	NM	Curry		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35011	35	011	NM	De Baca		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35013	35	013	NM	Dona Ana		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35015	35	015	NM	Eddy		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35017	35	017	NM	Grant		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35019	35	019	NM	Guadalupe		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35021	35	021	NM	Harding		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35023	35	023	NM	Hidalgo		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35025	35	025	NM	Lea		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35027	35	027	NM	Lincoln		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35028	35	028	NM	Los Alamos		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
35029	35	029	NM	Luna		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35031	35	031	NM	Mc Kinley		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35033	35	033	NM	Mora		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35035	35	035	NM	Otero		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35037	35	037	NM	Quay		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35039	35	039	NM	Rio Arriba		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35041	35	041	NM	Roosevelt		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35043	35	043	NM	Sandoval		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
35045	35	045	NM	San Juan		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35047	35	047	NM	San Miguel		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35049	35	049	NM	Santa Fe		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
35051	35	051	NM	Sierra		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35053	35	053	NM	Socorro		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35055	35	055	NM	Taos		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35057	35	057	NM	Torrance		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
35059	35	059	NM	Union		8.7	253	0.0	0.0	0.0		9.3	253	0.0	0.0	0.0
35061	35	061	NM	Valencia		8.8	205	2.0	2.0	1.0		9.7	205	2.0	2.0	1.0
38001	38	001	ND	Adams		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38003	38	003	ND	Barnes		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38005	38	005	ND	Benson		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38007	38	007	ND	Billings		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38009	38	009	ND	Bottineau		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38011	38	011	ND	Bowman		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38013	38	013	ND	Burke		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
FIPS	State No.	County No.	State	County		RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)		RVP (psi)	Sulfur (ppm)	MTBE (vol%)	EtOH (vol%)	Oxygen (wt%)
38015	38	015	ND	Burleigh		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38017	38	017	ND	Cass		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38019	38	019	ND	Cavalier		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38021	38	021	ND	Dickey		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38023	38	023	ND	Divide		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38025	38	025	ND	Dunn		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38027	38	027	ND	Eddy		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38029	38	029	ND	Emmons		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38031	38	031	ND	Foster		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38033	38	033	ND	Golden Valley		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38035	38	035	ND	Grand Forks		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38037	38	037	ND	Grant		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38039	38	039	ND	Griggs		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38041	38	041	ND	Hettinger		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38043	38	043	ND	Kidder		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38045	38	045	ND	La Moure		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38047	38	047	ND	Logan		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38049	38	049	ND	Mc Henry		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38051	38	051	ND	Mc Intosh		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38053	38	053	ND	Mc Kenzie		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38055	38	055	ND	Mc Lean		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38057	38	057	ND	Mercer		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38059	38	059	ND	Morton		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38061	38	061	ND	Mountrail		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38063	38	063	ND	Nelson		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38065	38	065	ND	Oliver		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38067	38	067	ND	Pembina		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38069	38	069	ND	Pierce		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38071	38	071	ND	Ramsey		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38073	38	073	ND	Ransom		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38075	38	075	ND	Renville		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38077	38	077	ND	Richland		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38079	38	079	ND	Rolette		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38081	38	081	ND	Sargent		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38083	38	083	ND	Sheridan		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38085	38	085	ND	Sioux		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38087	38	087	ND	Slope		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38089	38	089	ND	Stark		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0
38091	38	091	ND	Steele		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38093	38	093	ND	Stutsman		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38095	38	095	ND	Towner		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38097	38	097	ND	Traill		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38099	38	099	ND	Walsh		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38101	38	101	ND	Ward		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38103	38	103	ND	Wells		8.7	245	0.0	0.0	0.0		10.6	245	0.0	0.0	0.0
38105	38	105	ND	Williams		8.7	417	0.0	0.0	0.0		10.9	417	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
41001	41	001	OR	Baker		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41003	41	003	OR	Benton		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41005	41	005	OR	Clackamas		8.7	238	0.0	0.0	0.0		11.0	238	0.0	0.0	0.0
41007	41	007	OR	Clatsop		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41009	41	009	OR	Columbia		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41011	41	011	OR	Coos		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41013	41	013	OR	Crook		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41015	41	015	OR	Curry		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41017	41	017	OR	Deschutes		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41019	41	019	OR	Douglas		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41021	41	021	OR	Gilliam		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41023	41	023	OR	Grant		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41025	41	025	OR	Harney		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41027	41	027	OR	Hood River		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41029	41	029	OR	Jackson		8.7	238	0.0	0.0	0.0		11.0	238	0.0	0.0	0.0
41031	41	031	OR	Jefferson		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41033	41	033	OR	Josephine		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41035	41	035	OR	Klamath		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41037	41	037	OR	Lake		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41039	41	039	OR	Lane		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41041	41	041	OR	Lincoln		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41043	41	043	OR	Linn		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41045	41	045	OR	Malheur		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41047	41	047	OR	Marion		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41049	41	049	OR	Morrow		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41051	41	051	OR	Multnomah		8.7	238	0.0	0.0	0.0		11.0	238	0.0	0.0	0.0
41053	41	053	OR	Polk		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41055	41	055	OR	Sherman		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41057	41	057	OR	Tillamook		8.7	318	0.0	0.0	0.0		10.8	318	0.0	0.0	0.0
41059	41	059	OR	Umatilla		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41061	41	061	OR	Union		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41063	41	063	OR	Wallowa		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41065	41	065	OR	Wasco		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41067	41	067	OR	Washington		8.7	238	0.0	0.0	0.0		11.0	238	0.0	0.0	0.0
41069	41	069	OR	Wheeler		8.7	254	0.0	0.0	0.0		10.4	254	0.0	0.0	0.0
41071	41	071	OR	Yamhill		8.7	238	0.0	0.0	0.0		11.0	238	0.0	0.0	0.0
46003	46	003	SD	Aurora		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46005	46	005	SD	Beadle		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46007	46	007	SD	Bennett		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46009	46	009	SD	Bon Homme		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46011	46	011	SD	Brookings		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46013	46	013	SD	Brown		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46015	46	015	SD	Brule		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46017	46	017	SD	Buffalo		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46019	46	019	SD	Butte		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46021	46	021	SD	Campbell		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						Fall 2002 Gasoline Properties				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
46023	46	023	SD	Charles Mix		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46025	46	025	SD	Clark		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46027	46	027	SD	Clay		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46029	46	029	SD	Codington		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46031	46	031	SD	Corson		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46033	46	033	SD	Custer		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46035	46	035	SD	Davison		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46037	46	037	SD	Day		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46039	46	039	SD	Deuel		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46041	46	041	SD	Dewey		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46043	46	043	SD	Douglas		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46045	46	045	SD	Edmunds		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46047	46	047	SD	Fall River		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46049	46	049	SD	Faulk		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46051	46	051	SD	Grant		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46053	46	053	SD	Gregory		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46055	46	055	SD	Haakon		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46057	46	057	SD	Hamlin		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46059	46	059	SD	Hand		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46061	46	061	SD	Hanson		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46063	46	063	SD	Harding		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46065	46	065	SD	Hughes		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46067	46	067	SD	Hutchinson		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46069	46	069	SD	Hyde		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46071	46	071	SD	Jackson		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46073	46	073	SD	Jerauld		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46075	46	075	SD	Jones		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46077	46	077	SD	Kingsbury		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46079	46	079	SD	Lake		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46081	46	081	SD	Lawrence		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46083	46	083	SD	Lincoln		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46085	46	085	SD	Lyman		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46087	46	087	SD	Mc Cook		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46089	46	089	SD	Mc Pherson		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46091	46	091	SD	Marshall		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46093	46	093	SD	Meade		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46095	46	095	SD	Mellette		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46097	46	097	SD	Miner		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46099	46	099	SD	Minnehaha		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46101	46	101	SD	Moody		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46103	46	103	SD	Pennington		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46105	46	105	SD	Perkins		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0
46107	46	107	SD	Potter		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46109	46	109	SD	Roberts		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46111	46	111	SD	Sanborn		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46113	46	113	SD	Shannon		8.7	259	0.0	0.0	0.0		9.4	259	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
46115	46	115	SD	Spink		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46117	46	117	SD	Stanley		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46119	46	119	SD	Sully		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46121	46	121	SD	Todd		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46123	46	123	SD	Tripp		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46125	46	125	SD	Turner		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46127	46	127	SD	Union		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46129	46	129	SD	Walworth		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46135	46	135	SD	Yankton		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
46137	46	137	SD	Ziebach		8.7	243	0.0	0.0	0.0		9.5	243	0.0	0.0	0.0
49001	49	001	UT	Beaver		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49003	49	003	UT	Box Elder		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49005	49	005	UT	Cache		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49007	49	007	UT	Carbon		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49009	49	009	UT	Daggett		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49011	49	011	UT	Davis		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49013	49	013	UT	Duchesne		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49015	49	015	UT	Emery		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49017	49	017	UT	Garfield		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49019	49	019	UT	Grand		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49021	49	021	UT	Iron		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49023	49	023	UT	Juab		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49025	49	025	UT	Kane		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49027	49	027	UT	Millard		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49029	49	029	UT	Morgan		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49031	49	031	UT	Piute		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49033	49	033	UT	Rich		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49035	49	035	UT	Salt Lake		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49037	49	037	UT	San Juan		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49039	49	039	UT	Sanpete		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49041	49	041	UT	Sevier		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49043	49	043	UT	Summit		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49045	49	045	UT	Tooele		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49047	49	047	UT	Uintah		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49049	49	049	UT	Utah		8.7	184	0.0	0.0	0.0		9.6	184	0.0	0.0	0.0
49051	49	051	UT	Wasatch		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49053	49	053	UT	Washington		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49055	49	055	UT	Wayne		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
49057	49	057	UT	Weber		8.7	173	0.0	0.0	0.0		9.4	173	0.0	0.0	0.0
53001	53	001	WA	Adams		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53003	53	003	WA	Asotin		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53005	53	005	WA	Benton		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53007	53	007	WA	Chelan		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53009	53	009	WA	Clallam		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53011	53	011	WA	Clark		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53013	53	013	WA	Columbia		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
53015	53	015	WA	Cowlitz		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53017	53	017	WA	Douglas		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53019	53	019	WA	Ferry		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53021	53	021	WA	Franklin		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53023	53	023	WA	Garfield		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53025	53	025	WA	Grant		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53027	53	027	WA	Grays Harbor		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53029	53	029	WA	Island		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53031	53	031	WA	Jefferson		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53033	53	033	WA	King		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53035	53	035	WA	Kitsap		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53037	53	037	WA	Kittitas		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53039	53	039	WA	Klickitat		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53041	53	041	WA	Lewis		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53043	53	043	WA	Lincoln		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53045	53	045	WA	Mason		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53047	53	047	WA	Okanogan		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53049	53	049	WA	Pacific		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53051	53	051	WA	Pend Oreille		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53053	53	053	WA	Pierce		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53055	53	055	WA	San Juan		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53057	53	057	WA	Skagit		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53059	53	059	WA	Skamania		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53061	53	061	WA	Snohomish		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53063	53	063	WA	Spokane		8.7	281	0.0	0.0	0.0		10.7	281	0.0	0.0	0.0
53065	53	065	WA	Stevens		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53067	53	067	WA	Thurston		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53069	53	069	WA	Wahkiakum		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53071	53	071	WA	Walla Walla		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53073	53	073	WA	Whatcom		8.7	299	0.0	2.7	0.9		11.0	299	0.0	2.7	0.9
53075	53	075	WA	Whitman		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
53077	53	077	WA	Yakima		8.7	250	0.0	0.0	0.0		10.4	250	0.0	0.0	0.0
56001	56	001	WY	Albany		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56003	56	003	WY	Big Horn		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56005	56	005	WY	Campbell		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56007	56	007	WY	Carbon		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56009	56	009	WY	Converse		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56011	56	011	WY	Crook		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56013	56	013	WY	Fremont		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56015	56	015	WY	Goshen		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56017	56	017	WY	Hot Springs		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56019	56	019	WY	Johnson		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56021	56	021	WY	Laramie		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56023	56	023	WY	Lincoln		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56025	56	025	WY	Natrona		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56027	56	027	WY	Niobrara		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0

						Spring 2002 Gasoline Properties						**Fall 2002 Gasoline Properties**				
	State	County				RVP	Sulfur	MTBE	EtOH	Oxygen		RVP	Sulfur	MTBE	EtOH	Oxygen
FIPS	No.	No.	State	County		(psi)	(ppm)	(vol%)	(vol%)	(wt%)		(psi)	(ppm)	(vol%)	(vol%)	(wt%)
56029	56	029	WY	Park		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56031	56	031	WY	Platte		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56033	56	033	WY	Sheridan		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56035	56	035	WY	Sublette		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56037	56	037	WY	Sweetwater		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56039	56	039	WY	Teton		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56041	56	041	WY	Uinta		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56043	56	043	WY	Washakie		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0
56045	56	045	WY	Weston		8.7	244	0.0	0.0	0.0		9.4	244	0.0	0.0	0.0

On-road and off-road diesel fuel properties by county and season.

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
							On-Highway						Off-Highway			
FIPS	State No.	County No.	State	County		Data Source	Winter	Summer	Spring	Fall		Data Source	Winter	Summer	Spring	Fall
02013	02	013	AK	Aleutians East B		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02016	02	016	AK	Aleutians West C		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02020	02	020	AK	Anchorage Ed		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02050	02	050	AK	Bethel Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02060	02	060	AK	Bristol Bay Borough		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02068	02	068	AK	Denali Borough		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02070	02	070	AK	Dillingham Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02090	02	090	AK	Fairbanks Ed		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02100	02	100	AK	Haines Ed		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02110	02	110	AK	Juneau Ed		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02122	02	122	AK	Kenai Penninsula		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02130	02	130	AK	Ketchikan Ed		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02150	02	150	AK	Kodiak Island Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02164	02	164	AK	Lake and Peninsu		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02170	02	170	AK	Matanuska-Susitna		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02180	02	180	AK	Nome Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02185	02	185	AK	North Slope Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02188	02	188	AK	Northwest Arctic		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02201	02	201	AK	Prince Of Wales		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02220	02	220	AK	Sitka Ed		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02232	02	232	AK	Skagway-Yakutat		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02240	02	240	AK	Southeast Fairbanks		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02261	02	261	AK	Valdez-Cordova E		ADEC-URB	750	2500	750	750		ADEC-URB	750	2500	750	750
02270	02	270	AK	Wade Hampton Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02280	02	280	AK	Wrangell-Petersburg		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
02282	02	282	AK	Yakutat Borough		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
02290	02	290	AK	Yukon-Koyukuk Ed		ADEC-RRL	750	750	750	750		ADEC-RRL	750	750	750	750
04001	04	001	AZ	Apache		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04003	04	003	AZ	Cochise		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04005	04	005	AZ	Coconino		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04007	04	007	AZ	Gila		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04009	04	009	AZ	Graham		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04011	04	011	AZ	Greenlee		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04012	04	012	AZ	La Paz		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04013	04	013	AZ	Maricopa		NIPER-N	360	360	360	360		NIPER-N	360	360	360	360
04015	04	015	AZ	Mohave		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04017	04	017	AZ	Navajo		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04019	04	019	AZ	Pima		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04021	04	021	AZ	Pinal		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04023	04	023	AZ	Santa Cruz		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
04025	04	025	AZ	Yavapai		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
04027	04	027	AZ	Yuma		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
06001	06	001	CA	Alameda		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06003	06	003	CA	Alpine		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06005	06	005	CA	Amador		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
06007	06	007	CA	Butte		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06009	06	009	CA	Calaveras		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06011	06	011	CA	Colusa		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06013	06	013	CA	Contra Costa		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06015	06	015	CA	Del Norte		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06017	06	017	CA	El Dorado		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06019	06	019	CA	Fresno		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06021	06	021	CA	Glenn		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06023	06	023	CA	Humboldt		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06025	06	025	CA	Imperial		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06027	06	027	CA	Inyo		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06029	06	029	CA	Kern		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06031	06	031	CA	Kings		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06033	06	033	CA	Lake		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06035	06	035	CA	Lassen		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06037	06	037	CA	Los Angeles		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06039	06	039	CA	Madera		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06041	06	041	CA	Marin		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06043	06	043	CA	Mariposa		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06045	06	045	CA	Mendocino		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06047	06	047	CA	Merced		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06049	06	049	CA	Modoc		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06051	06	051	CA	Mono		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06053	06	053	CA	Monterey		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06055	06	055	CA	Napa		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06057	06	057	CA	Nevada		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06059	06	059	CA	Orange		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06061	06	061	CA	Placer		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06063	06	063	CA	Plumas		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06065	06	065	CA	Riverside		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06067	06	067	CA	Sacramento		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06069	06	069	CA	San Benito		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06071	06	071	CA	San Bernardino		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06073	06	073	CA	San Diego		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06075	06	075	CA	San Francisco		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06077	06	077	CA	San Joaquin		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06079	06	079	CA	San Luis Obispo		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06081	06	081	CA	San Mateo		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06083	06	083	CA	Santa Barbara		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06085	06	085	CA	Santa Clara		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06087	06	087	CA	Santa Cruz		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06089	06	089	CA	Shasta		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06091	06	091	CA	Sierra		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06093	06	093	CA	Siskiyou		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06095	06	095	CA	Solano		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06097	06	097	CA	Sonoma		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
06099	06	099	CA	Stanislaus		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06101	06	101	CA	Sutter		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06103	06	103	CA	Tehama		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06105	06	105	CA	Trinity		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06107	06	107	CA	Tulare		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06109	06	109	CA	Tuolumne		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06111	06	111	CA	Ventura		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06113	06	113	CA	Yolo		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
06115	06	115	CA	Yuba		AAM-LA	70	60	65	65		AAM-LA	70	60	65	65
08001	08	001	CO	Adams		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08003	08	003	CO	Alamosa		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08005	08	005	CO	Arapahoe		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08007	08	007	CO	Archuleta		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08009	08	009	CO	Baca		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08011	08	011	CO	Bent		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08013	08	013	CO	Boulder		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08015	08	015	CO	Chaffee		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08017	08	017	CO	Cheyenne		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08019	08	019	CO	Clear Creek		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08021	08	021	CO	Conejos		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08023	08	023	CO	Costilla		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08025	08	025	CO	Crowley		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08027	08	027	CO	Custer		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08029	08	029	CO	Delta		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08031	08	031	CO	Denver		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08033	08	033	CO	Dolores		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08035	08	035	CO	Douglas		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08037	08	037	CO	Eagle		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08039	08	039	CO	Elbert		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08041	08	041	CO	El Paso		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08043	08	043	CO	Fremont		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08045	08	045	CO	Garfield		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08047	08	047	CO	Gilpin		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08049	08	049	CO	Grand		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08051	08	051	CO	Gunnison		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08053	08	053	CO	Hinsdale		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08055	08	055	CO	Huerfano		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08057	08	057	CO	Jackson		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08059	08	059	CO	Jefferson		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08061	08	061	CO	Kiowa		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08063	08	063	CO	Kit Carson		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08065	08	065	CO	Lake		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08067	08	067	CO	La Plata		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08069	08	069	CO	Larimer		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08071	08	071	CO	Las Animas		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08073	08	073	CO	Lincoln		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
08075	08	075	CO	Logan		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08077	08	077	CO	Mesa		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08079	08	079	CO	Mineral		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08081	08	081	CO	Moffat		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08083	08	083	CO	Montezuma		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08085	08	085	CO	Montrose		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08087	08	087	CO	Morgan		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08089	08	089	CO	Otero		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08091	08	091	CO	Ouray		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08093	08	093	CO	Park		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08095	08	095	CO	Phillips		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08097	08	097	CO	Pitkin		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08099	08	099	CO	Prowers		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08101	08	101	CO	Pueblo		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08103	08	103	CO	Rio Blanco		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08105	08	105	CO	Rio Grande		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08107	08	107	CO	Routt		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08109	08	109	CO	Saguache		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08111	08	111	CO	San Juan		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08113	08	113	CO	San Miguel		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08115	08	115	CO	Sedgwick		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08117	08	117	CO	Summit		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08119	08	119	CO	Teller		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08121	08	121	CO	Washington		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08123	08	123	CO	Weld		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
08125	08	125	CO	Yuma		AAM-DN	330	330	330	330		NIPER-RM	2400	2400	2400	2400
16001	16	001	ID	Ada		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16003	16	003	ID	Adams		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16005	16	005	ID	Bannock		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16007	16	007	ID	Bear Lake		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16009	16	009	ID	Benewah		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16011	16	011	ID	Bingham		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16013	16	013	ID	Blaine		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16015	16	015	ID	Boise		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16017	16	017	ID	Bonner		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16019	16	019	ID	Bonneville		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16021	16	021	ID	Boundary		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16023	16	023	ID	Butte		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16025	16	025	ID	Camas		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16027	16	027	ID	Canyon		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16029	16	029	ID	Caribou		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16031	16	031	ID	Cassia		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16033	16	033	ID	Clark		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16035	16	035	ID	Clearwater		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16037	16	037	ID	Custer		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16039	16	039	ID	Elmore		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
16041	16	041	ID	Franklin		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16043	16	043	ID	Fremont		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16045	16	045	ID	Gem		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16047	16	047	ID	Gooding		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16049	16	049	ID	Idaho		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16051	16	051	ID	Jefferson		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16053	16	053	ID	Jerome		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16055	16	055	ID	Kootenai		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16057	16	057	ID	Latah		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16059	16	059	ID	Lemhi		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16061	16	061	ID	Lewis		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16063	16	063	ID	Lincoln		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16065	16	065	ID	Madison		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16067	16	067	ID	Minidoka		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16069	16	069	ID	Nez Perce		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16071	16	071	ID	Oneida		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16073	16	073	ID	Owyhee		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16075	16	075	ID	Payette		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16077	16	077	ID	Power		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16079	16	079	ID	Shoshone		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16081	16	081	ID	Teton		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16083	16	083	ID	Twin Falls		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16085	16	085	ID	Valley		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
16087	16	087	ID	Washington		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
30001	30	001	MT	Beaverhead		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30003	30	003	MT	Big Horn		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30005	30	005	MT	Blaine		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30007	30	007	MT	Broadwater		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30009	30	009	MT	Carbon		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30011	30	011	MT	Carter		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30013	30	013	MT	Cascade		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30015	30	015	MT	Chouteau		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30017	30	017	MT	Custer		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30019	30	019	MT	Daniels		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30021	30	021	MT	Dawson		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30023	30	023	MT	Deer Lodge		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30025	30	025	MT	Fallon		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30027	30	027	MT	Fergus		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30029	30	029	MT	Flat Head		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30031	30	031	MT	Gallatin		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30033	30	033	MT	Garfield		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30035	30	035	MT	Glacier		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30037	30	037	MT	Golden Valley		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30039	30	039	MT	Granite		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30041	30	041	MT	Hill		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30043	30	043	MT	Jefferson		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						**2002 Diesel Fuel Sulfur Levels (ppm)**			
	State	County				Data	**On-Highway**					Data	**Off-Highway**			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
30045	30	045	MT	Judith Basin		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30047	30	047	MT	Lake		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30049	30	049	MT	Lewis and Clark		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30051	30	051	MT	Liberty		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30053	30	053	MT	Lincoln		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30055	30	055	MT	Mc Cone		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30057	30	057	MT	Madison		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30059	30	059	MT	Meagher		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30061	30	061	MT	Mineral		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30063	30	063	MT	Missoula		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30065	30	065	MT	Musselshell		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30067	30	067	MT	Park		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30069	30	069	MT	Petroleum		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30071	30	071	MT	Phillips		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30073	30	073	MT	Pondera		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30075	30	075	MT	Powder River		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30077	30	077	MT	Powell		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30079	30	079	MT	Prairie		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30081	30	081	MT	Ravalli		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30083	30	083	MT	Richland		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30085	30	085	MT	Roosevelt		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30087	30	087	MT	Rosebud		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30089	30	089	MT	Sanders		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30091	30	091	MT	Sheridan		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30093	30	093	MT	Silver Bow		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30095	30	095	MT	Stillwater		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30097	30	097	MT	Sweet Grass		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30099	30	099	MT	Teton		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30101	30	101	MT	Toole		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30103	30	103	MT	Treasure		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30105	30	105	MT	Valley		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30107	30	107	MT	Wheatland		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30109	30	109	MT	Wibaux		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30111	30	111	MT	Yellowstone		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
30113	30	113	MT	Yellowstone Park		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
32001	32	001	NV	Churchill		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32003	32	003	NV	Clark		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
32005	32	005	NV	Douglas		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32007	32	007	NV	Elko		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32009	32	009	NV	Esmeralda		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
32011	32	011	NV	Eureka		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32013	32	013	NV	Humboldt		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32015	32	015	NV	Lander		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32017	32	017	NV	Lincoln		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
32019	32	019	NV	Lyon		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32021	32	021	NV	Mineral		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
32023	32	023	NV	Nye		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
32027	32	027	NV	Pershing		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32029	32	029	NV	Storey		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32031	32	031	NV	Washoe		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32033	32	033	NV	White Pine		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
32510	32	510	NV	Carson City		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
35001	35	001	NM	Bernalillo		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35003	35	003	NM	Catron		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35005	35	005	NM	Chaves		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35006	35	006	NM	Cibola		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35007	35	007	NM	Colfax		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35009	35	009	NM	Curry		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35011	35	011	NM	De Baca		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35013	35	013	NM	Dona Ana		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35015	35	015	NM	Eddy		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35017	35	017	NM	Grant		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35019	35	019	NM	Guadalupe		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35021	35	021	NM	Harding		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35023	35	023	NM	Hidalgo		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35025	35	025	NM	Lea		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35027	35	027	NM	Lincoln		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35028	35	028	NM	Los Alamos		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35029	35	029	NM	Luna		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35031	35	031	NM	Mc Kinley		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35033	35	033	NM	Mora		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35035	35	035	NM	Otero		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35037	35	037	NM	Quay		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35039	35	039	NM	Rio Arriba		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35041	35	041	NM	Roosevelt		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35043	35	043	NM	Sandoval		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35045	35	045	NM	San Juan		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35047	35	047	NM	San Miguel		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35049	35	049	NM	Santa Fe		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35051	35	051	NM	Sierra		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35053	35	053	NM	Socorro		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35055	35	055	NM	Taos		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35057	35	057	NM	Torrance		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35059	35	059	NM	Union		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
35061	35	061	NM	Valencia		AAM-ALB	330	350	340	340		NIPER-RM	2400	2400	2400	2400
38001	38	001	ND	Adams		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38003	38	003	ND	Barnes		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38005	38	005	ND	Benson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38007	38	007	ND	Billings		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38009	38	009	ND	Bottineau		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38011	38	011	ND	Bowman		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38013	38	013	ND	Burke		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
38015	38	015	ND	Burleigh		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38017	38	017	ND	Cass		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38019	38	019	ND	Cavalier		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38021	38	021	ND	Dickey		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38023	38	023	ND	Divide		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38025	38	025	ND	Dunn		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38027	38	027	ND	Eddy		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38029	38	029	ND	Emmons		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38031	38	031	ND	Foster		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38033	38	033	ND	Golden Valley		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38035	38	035	ND	Grand Forks		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38037	38	037	ND	Grant		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38039	38	039	ND	Griggs		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38041	38	041	ND	Hettinger		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38043	38	043	ND	Kidder		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38045	38	045	ND	La Moure		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38047	38	047	ND	Logan		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38049	38	049	ND	Mc Henry		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38051	38	051	ND	Mc Intosh		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38053	38	053	ND	Mc Kenzie		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38055	38	055	ND	Mc Lean		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38057	38	057	ND	Mercer		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38059	38	059	ND	Morton		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38061	38	061	ND	Mountrail		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38063	38	063	ND	Nelson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38065	38	065	ND	Oliver		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38067	38	067	ND	Pembina		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38069	38	069	ND	Pierce		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38071	38	071	ND	Ramsey		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38073	38	073	ND	Ransom		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38075	38	075	ND	Renville		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38077	38	077	ND	Richland		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38079	38	079	ND	Rolette		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38081	38	081	ND	Sargent		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38083	38	083	ND	Sheridan		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38085	38	085	ND	Sioux		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38087	38	087	ND	Slope		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38089	38	089	ND	Stark		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400
38091	38	091	ND	Steele		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38093	38	093	ND	Stutsman		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38095	38	095	ND	Towner		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38097	38	097	ND	Traill		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38099	38	099	ND	Walsh		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38101	38	101	ND	Ward		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38103	38	103	ND	Wells		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
38105	38	105	ND	Williams		AAM-BL	270	250	260	260		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
41001	41	001	OR	Baker		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41003	41	003	OR	Benton		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41005	41	005	OR	Clackamas		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41007	41	007	OR	Clatsop		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41009	41	009	OR	Columbia		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41011	41	011	OR	Coos		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41013	41	013	OR	Crook		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41015	41	015	OR	Curry		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41017	41	017	OR	Deschutes		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41019	41	019	OR	Douglas		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41021	41	021	OR	Gilliam		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41023	41	023	OR	Grant		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41025	41	025	OR	Harney		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41027	41	027	OR	Hood River		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41029	41	029	OR	Jackson		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41031	41	031	OR	Jefferson		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41033	41	033	OR	Josephine		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41035	41	035	OR	Klamath		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41037	41	037	OR	Lake		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41039	41	039	OR	Lane		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41041	41	041	OR	Lincoln		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41043	41	043	OR	Linn		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41045	41	045	OR	Malheur		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41047	41	047	OR	Marion		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41049	41	049	OR	Morrow		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41051	41	051	OR	Multnomah		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41053	41	053	OR	Polk		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41055	41	055	OR	Sherman		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41057	41	057	OR	Tillamook		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41059	41	059	OR	Umatilla		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41061	41	061	OR	Union		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41063	41	063	OR	Wallowa		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41065	41	065	OR	Wasco		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41067	41	067	OR	Washington		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
41069	41	069	OR	Wheeler		NIPER-M	370	370	370	370		NIPER-W	3400	3400	3400	3400
41071	41	071	OR	Yamhill		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
46003	46	003	SD	Aurora		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46005	46	005	SD	Beadle		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46007	46	007	SD	Bennett		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46009	46	009	SD	Bon Homme		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46011	46	011	SD	Brookings		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46013	46	013	SD	Brown		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46015	46	015	SD	Brule		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46017	46	017	SD	Buffalo		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46019	46	019	SD	Butte		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46021	46	021	SD	Campbell		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	On-Highway					Data	Off-Highway			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
46023	46	023	SD	Charles Mix		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46025	46	025	SD	Clark		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46027	46	027	SD	Clay		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46029	46	029	SD	Codington		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46031	46	031	SD	Corson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46033	46	033	SD	Custer		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46035	46	035	SD	Davison		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46037	46	037	SD	Day		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46039	46	039	SD	Deuel		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46041	46	041	SD	Dewey		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46043	46	043	SD	Douglas		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46045	46	045	SD	Edmunds		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46047	46	047	SD	Fall River		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46049	46	049	SD	Faulk		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46051	46	051	SD	Grant		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46053	46	053	SD	Gregory		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46055	46	055	SD	Haakon		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46057	46	057	SD	Hamlin		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46059	46	059	SD	Hand		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46061	46	061	SD	Hanson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46063	46	063	SD	Harding		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46065	46	065	SD	Hughes		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46067	46	067	SD	Hutchinson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46069	46	069	SD	Hyde		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46071	46	071	SD	Jackson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46073	46	073	SD	Jerauld		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46075	46	075	SD	Jones		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46077	46	077	SD	Kingsbury		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46079	46	079	SD	Lake		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46081	46	081	SD	Lawrence		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46083	46	083	SD	Lincoln		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46085	46	085	SD	Lyman		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46087	46	087	SD	Mc Cook		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46089	46	089	SD	Mc Pherson		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46091	46	091	SD	Marshall		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46093	46	093	SD	Meade		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46095	46	095	SD	Mellette		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46097	46	097	SD	Miner		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46099	46	099	SD	Minnehaha		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46101	46	101	SD	Moody		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46103	46	103	SD	Pennington		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46105	46	105	SD	Perkins		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
46107	46	107	SD	Potter		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46109	46	109	SD	Roberts		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46111	46	111	SD	Sanborn		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46113	46	113	SD	Shannon		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						**2002 Diesel Fuel Sulfur Levels (ppm)**			
	State	County				Data	**On-Highway**					Data	**Off-Highway**			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
46115	46	115	SD	Spink		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46117	46	117	SD	Stanley		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46119	46	119	SD	Sully		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46121	46	121	SD	Todd		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46123	46	123	SD	Tripp		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46125	46	125	SD	Turner		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46127	46	127	SD	Union		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46129	46	129	SD	Walworth		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46135	46	135	SD	Yankton		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
46137	46	137	SD	Ziebach		NIPER-C	360	360	360	360		NIPER-C	3710	3710	3710	3710
49001	49	001	UT	Beaver		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49003	49	003	UT	Box Elder		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49005	49	005	UT	Cache		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49007	49	007	UT	Carbon		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49009	49	009	UT	Daggett		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49011	49	011	UT	Davis		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49013	49	013	UT	Duchesne		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49015	49	015	UT	Emery		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49017	49	017	UT	Garfield		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49019	49	019	UT	Grand		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49021	49	021	UT	Iron		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49023	49	023	UT	Juab		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49025	49	025	UT	Kane		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49027	49	027	UT	Millard		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49029	49	029	UT	Morgan		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49031	49	031	UT	Piute		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49033	49	033	UT	Rich		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49035	49	035	UT	Salt Lake		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49037	49	037	UT	San Juan		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49039	49	039	UT	Sanpete		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49041	49	041	UT	Sevier		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49043	49	043	UT	Summit		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49045	49	045	UT	Tooele		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49047	49	047	UT	Uintah		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49049	49	049	UT	Utah		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49051	49	051	UT	Wasatch		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49053	49	053	UT	Washington		NIPER-N	360	360	360	360		NIPER-W	3400	3400	3400	3400
49055	49	055	UT	Wayne		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
49057	49	057	UT	Weber		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
53001	53	001	WA	Adams		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53003	53	003	WA	Asotin		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53005	53	005	WA	Benton		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53007	53	007	WA	Chelan		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53009	53	009	WA	Clallam		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53011	53	011	WA	Clark		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53013	53	013	WA	Columbia		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400

							2002 Diesel Fuel Sulfur Levels (ppm)						**2002 Diesel Fuel Sulfur Levels (ppm)**			
	State	County				Data	**On-Highway**					Data	**Off-Highway**			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
53015	53	015	WA	Cowlitz		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53017	53	017	WA	Douglas		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53019	53	019	WA	Ferry		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53021	53	021	WA	Franklin		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53023	53	023	WA	Garfield		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53025	53	025	WA	Grant		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53027	53	027	WA	Grays Harbor		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53029	53	029	WA	Island		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53031	53	031	WA	Jefferson		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53033	53	033	WA	King		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53035	53	035	WA	Kitsap		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53037	53	037	WA	Kittitas		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53039	53	039	WA	Klickitat		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53041	53	041	WA	Lewis		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53043	53	043	WA	Lincoln		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53045	53	045	WA	Mason		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53047	53	047	WA	Okanogan		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53049	53	049	WA	Pacific		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53051	53	051	WA	Pend Oreille		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53053	53	053	WA	Pierce		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53055	53	055	WA	San Juan		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53057	53	057	WA	Skagit		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53059	53	059	WA	Skamania		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53061	53	061	WA	Snohomish		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53063	53	063	WA	Spokane		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53065	53	065	WA	Stevens		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53067	53	067	WA	Thurston		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53069	53	069	WA	Wahkiakum		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53071	53	071	WA	Walla Walla		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53073	53	073	WA	Whatcom		AAM-SE	360	340	350	350		NIPER-W	3400	3400	3400	3400
53075	53	075	WA	Whitman		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
53077	53	077	WA	Yakima		NIPER-L	390	390	390	390		NIPER-W	3400	3400	3400	3400
56001	56	001	WY	Albany		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56003	56	003	WY	Big Horn		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56005	56	005	WY	Campbell		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56007	56	007	WY	Carbon		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56009	56	009	WY	Converse		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56011	56	011	WY	Crook		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56013	56	013	WY	Fremont		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56015	56	015	WY	Goshen		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56017	56	017	WY	Hot Springs		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56019	56	019	WY	Johnson		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56021	56	021	WY	Laramie		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56023	56	023	WY	Lincoln		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56025	56	025	WY	Natrona		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56027	56	027	WY	Niobrara		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400

							2002 Diesel Fuel Sulfur Levels (ppm)						2002 Diesel Fuel Sulfur Levels (ppm)			
	State	County				Data	**On-Highway**					Data	**Off-Highway**			
FIPS	No.	No.	State	County		Source	Winter	Summer	Spring	Fall		Source	Winter	Summer	Spring	Fall
56029	56	029	WY	Park		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56031	56	031	WY	Platte		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56033	56	033	WY	Sheridan		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56035	56	035	WY	Sublette		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56037	56	037	WY	Sweetwater		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56039	56	039	WY	Teton		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56041	56	041	WY	Uinta		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56043	56	043	WY	Washakie		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400
56045	56	045	WY	Weston		NIPER-RM	350	350	350	350		NIPER-RM	2400	2400	2400	2400

Appendix B

Geographic Characterization of Ship Emissions for the U.S. West Coast – Final Task 1 Report – Corbett and Wang, 2005.

Geographic Characterization of Ship Emissions for the U.S. West Coast

Final Task 1 Report

Submitted by

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14 April 2005

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Geographic Characterization of Ship Emissions for the U.S. West Coast

Background

Research has demonstrated that air pollutants emitted from marine vessels account for a significant portion of emissions inventory and contribute to air quality problems in many coastal and metropolitan regions, and globally *(1, 2).* Better understanding is needed of the spatial distribution of ship activities and emissions to assess accurately the impact on air quality at local, regional, and global scales. Without an accurate representation, scientists cannot effectively inform policy decisions regarding human health and environment *(1)*. Policy makers rely upon geographical representation of transportation emissions that include ship traffic on multiple scales.

The uneven distribution of emissions from commercial shipping is a result of uneven spatial distribution of economic activities, the components of the Marine Transportation System (MTS), including ports, sea routes, and ship activities *(3)*. Geographically characterizing the actual positions of the components of the MTS is critical to better understand and evaluate MTS impacts on safety, security, the environment, and human health. Due to the mobility of ships engaged in global trade, poorly integrated models and limited data, however, this task has been a great challenge.

To develop emissions inventories and assign their spatial distribution, the activity level of the pollution source must be determined, emissions resulting from this activity must be computed, and the results must be assigned to a location *(1)*. While ship inventories for air emissions from ships have become more precise, greater improvement is needed in representing the geographic allocation of inventory information for atmospheric scientists, pollution modelers, and policy makers to evaluate potential impacts of pollution on the environment and human health.

Attempts to geographically assign international shipping traffic began nearly a decade ago. Corbett et al. geographically resolved global inventory of ship emissions by deriving international shipping traffic intensities from voluntarily reported, ship-based weather observations *(1, 3, 4)*. Olivier et al. assigned global emissions estimates to major shipping lanes *(5)*. These approaches showed qualitatively good agreement with regionally resolved ship inventories *(6, 7)*, but resolution differences or inconsistent assumptions prevented reconciling geographic assignment of ship activity among different spatial scales *(1)*. Recently, Endresen et al. presented a new and perhaps more accurate methodology for globally assigning emissions from international marine bunkers, which is a significant contribution. They argued that emissions can be allocated more accurately across ship traffic profiles by using vessel size to weight the allocation to each grid *(1, 8)*. Regionally, ENTEC presented the distribution of shipping emissions over the European Monitoring and Evaluation Programme (EMEP) domain on an individual 50 km x 50 km grid square resolution for the year 2000 *(9)*.

This work is an application of the approaches for geographic characterization of marine vessel emissions developed by researchers and published in peer-reviewed literature *(1, 3, 4)*. Recent developments and possible improvements have been taken into account *(8, 10, 11)*. Efforts have been made in this work to address potential statistical and geographic sampling bias caused by over-reporting and non-response ships. This will be discussed in detailed in the following sections.

Overview of this work

The objective of this work is to quickly develop simple emissions inventories for six air pollutants (NOx, SOx, CO2, HC, PM, and CO) from marine vessels for year 2002 for the U.S. West Coast. The final products of this work include this report and raster files (data sets) with 36km x 36km resolution for the pollutants for each of the 12 months. The value of the grid of the raster files is the amount of pollutants emitted from marine vessels in one period in that grid. The raster files cover the U.S. West Coast and the coordinates for the four corners of the raster files are: SW corner (-2736, -2088), NW corner (-2736, 1944), SE corner (-216, -2088), NE corner (-216, 1944).

The approach employed in this work is illustrated in Figure 1. We adopted global ship emissions inventories co-developed by one of the researchers of this work and published in peer-reviewed journal *(1)*. Adjustments have been made to reflect the comments from our colleagues *(10, 11)*.

The International Comprehensive Ocean-Atmosphere Data Set (ICOADS) *(12)* was used as the proxy of the distribution of U.S. west coast ship traffic and emissions. Efforts have been made to improve the representativeness of ICOADS of the emissions from commercial cargo fleet by selecting only observations made by cargo ships, trimming several ships with exceptionally high reporting biases, and weighting observations by ship power, a major factor that determines the magnitude of ship air emissions and is a more direct indicator of emissions than gross tonnage used previously *(8)*. Three-year ICOADS samples were used to improve the geographic representation of ship traffic and emissions. Detailed discussions are included in the following sections.

Ship data was identified in the Lloyd's Register CD-ROM, which maintains over 100,000 vessels and is perhaps the largest database of commercially-available maritime data in the world *(13)*. These ship data were then joined with matching vessel information in ICOADS and the observations made by ships identified in the ship dataset were weighted by ship power. We assume emissions are proportional to ship power. Average emissions per power-weighted observation were obtained by dividing global ship emissions inventory by the sum of ship power of all individual observations. The sum of power of all individual observations in each raster grid in one period was obtained by spatial analysis with ArcGIS 9.0, a product of Environmental Systems Research Institute (ESRI) *(14)*. Emissions in each grid were obtained by multiplying emissions per unit of ship power with ship power in each grid in one period.

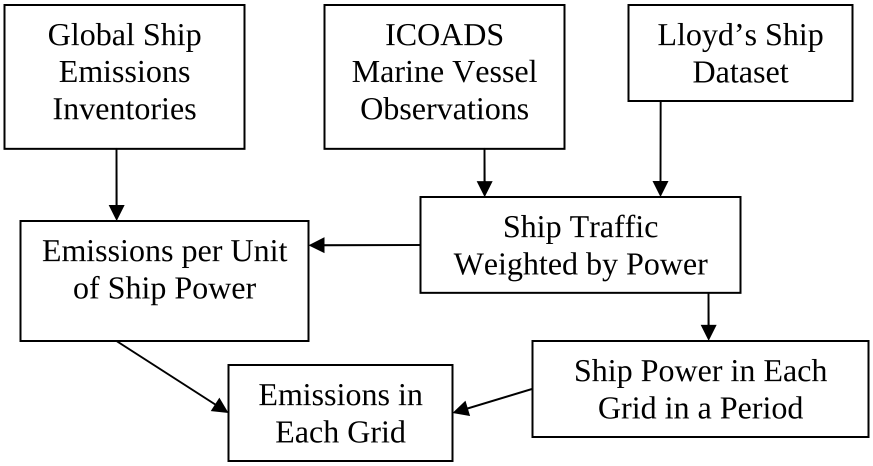


Figure 1. Approach employed in this work.

Choosing Global Ship Emissions Inventory

A reliable and up-to-date ship emission inventory is one of the prerequisites to improve the accuracy of geographic characterization of ship emissions with the approach for this work (the other prerequisites include a good representation of ship traffic pattern and intensity, and a good ship dataset). There are, however, significant differences among the various global ship emission inventories *(10)*, inventories estimated by one approach may be 50% higher than inventories estimated by another approach *(1, 8, 10)*.

Corbett and Koehler addressed the significant uncertainty in the global ship emission inventories by employing a bottom-up estimate of fuel consumption and vessel activity for internationally registered fleets *(1)*. They identified model bias in previous work, which assumed internationally registered ships primarily consume international marine fuels, and increased previous ship emissions inventories for pollutants, among which, global NOx emissions are more than doubled with the updated emissions inventory *(1)*. Results from Corbett and Koehler's analysis are provided in table 1.

Endresen et al. argued that Corbett and Koehler overestimated fuel consumption and air emissions from international shipping and offered differing assumptions and clarifying information that reduced the estimate of ship emissions by Corbett and Koehler *(10, 11)*. Endresen et al. claimed that reported marine fuel statistics were essentially accurate and complete, and they did not argue fundamentally against the accuracy of Corbett and Koehler's activity-based methodology *(1, 10, 11)*. .

Corbett and Koehler incorporated revised assumptions suggested by Endresen et al. into their activity-based model, such as operating hours, load profile, and specific fuel consumption, and indeed reduced the estimates from their previous work but within uncertainty bounds *(11)*. Their revised model produces rather good agreement with the upper-bound annual fuel use claimed by Endresen et al. for the entire registered fleet *(11)*. However, according to Corbett's and Koehler's activity-based model, even the revised inputs suggested by Endresen et al resulted in larger inventories than previously estimated using fuel-based methods.

Generally speaking, we believe Corbett's and Koehler's activity-based methodology is the best model currently available for estimating global emissions inventories from international shipping and Endresen et al. have helped narrow the uncertainty of the results of this model. We believe that model results under these revised inputs data currently represent the best global emissions inventories and were adopted in this work. The revised results are also provided in Table 1.

Table 1. Updated and Revised Global Cargo Fleet Emissions Inventory

	Global Ship Emissions Inventory (Tg)			
	Lower-Lower Bound	Lower Bound	Base Case	Upper Bound
Fuel	130	175	203	222
NOx (N)	4.17	4.68	5	6.79
SOx (S)	4.21	4.52	4.72	6.54
CO2 (C)	164	171	176	249
HC (Total HC)	0.459	0.53	0.574	0.778
PM (PM10)	0.755	1.02	1.19	1.97
CO	0.911	1.01	1.08	1.5

Creating Ship Characteristics Dataset

We created a ship characteristics dataset by deriving data from Lloyd's Register of Ships. The attributes in the dataset include unique ship identifier, which associates vessel type and other characteristics used to analyze the representativeness of the ICOADS fleet of the world fleet. This information also can be used for the analysis of emissions by ship segments, and ship total main engine power, which is used to weight individual ICOADS observations under the assumption that ship emissions are proportional to ship power. Ship identifiers are used as the key index of the dataset, and are used to evaluate individual ship observation frequencies in ICOADS. All ships included in our dataset have valid total main engine power data.

Totally 15,048 unique vessel identifiers are included in our dataset. Due to some data quality issues, around 150 identifiers may not be unique (about 1% of percent of the 15,048 unique identifiers); these records have more than two vessels with different ship types, which we believe is hardly possible unless the ship has been converted from one type to another. For the analysis of this work, we deleted duplicate identifiers. We believe this will not have a significant effect on the results of our analysis. We also understand that this ship dataset is only a subset of the world commercial fleet, and far from complete due to the missing of ship power data for many ships in the Lloyd's ship dataset.

Based on criteria from Lloyd's Register *(13)*, the ships were classified into nine groups, including container ship, tanker, bulk carrier, general cargo ship, passenger ship, reefer, RO-RO, fishing vessel, and miscellaneous types of ship, to simplify the analysis. For details of ship grouping, see appendix A.

Choosing Marine Vessel Traffic and Emissions Proxy

Representing spatial (and temporal) activity of commercial shipping is fundamentally similar to modeling any mobile source: the location and intensity the fleet activity must be depicted. This can be done using sampled data representing fleetwide spatial activity, and theoretically would be most accurate if all ships reported their locations regularly. There are two data sets, ICOADS and Automated Mutual-assistance Vessel Rescue system (AMVER), which have been used by researchers as proxies of global ship traffic to geographically resolve the global emissions inventories *(3, 4, 8)*. Although there is some overlap between the COADS and AMVER datasets with about 33% of the AMVER vessels are weather observation vessels, different data sets lead to highly different regional perturbations of air pollutants *(8)*. This analysis uses vessel traffic patterns derived from ICOADS to represent spatial distribution of shipping lanes and vessel traffic on those shipping lanes. In this section, we compare the strengths and weaknesses of ICOADS and AMVER datasets.

Description of ICOADS and AMVER

ICOADS is the world's largest dataset for global marine surface observations, and is developed and maintained as a cooperative effort between several research institutes. ICOADS data is collected primarily from ships (merchant, ocean research, fishing, navy, etc) and moored and drifting buoys. The dataset contains the identifier of the ship, and the time and position of the ship when making report besides those meteorological and oceanographic variables *(15)*. Table 2 summarizes the ICOADS data used for this work.

AMVER, sponsored by the United States Coast Guard, is a global ship reporting system used worldwide by search and rescue authorities to arrange for assistance to persons in distress at sea. Participation is free, voluntary, and open to merchant ships of all flags, but had been limited to ships over 1000 gross tons, on a voyage of 24 hours or longer. Recently, however, enrollment has been expanded to accommodate vessels outside the normal criteria, such as cruise ships, research vessels and fish processors. Participating ships are expected to regularly report their positions to AMVER to improve the chance that the ship closest to the position of distress be identified *(16)*.

Table 2. Summary of ICOADS

Year	Total Obs.	Identified ships[1]	Obs. by identified ships	Cargo Ships[2]	Obs. by cargo ships	Cargo Ships after trimming[3]	Obs. by cargo ships after trimming
2002	966,194	2,564	651,698	2,177	509,843	2,172	474,929
2001	1,029,132	2,127	631,211	1,803	497,657	1,798	460,329
2000	1,096,795	1,972	572,037	1,655	449,948	1,650	417,299
Sum	**3,092,121**	**N/A**	**1,854,946**	**N/A**	**1,457,448**	**N/A**	**1,352,557**

1. Using 15,048 unique ship identifiers with valid ship power from Lloyds Registry.
2. We identified properties for 2,453 unique cargo ships from 2000 to 2002.
3. Five over-reporting ships are trimmed

Number of Vessels Reporting

The main source of marine surface observations for ICOADS is the Voluntary Observing Ships (VOS) fleet *(8)*, and ICOADS contains as many VOS data as they have been able to gather and blend together *(17)*. The number of ships on the VOS Fleet List has continued to decline from a peak of 7,700 in 1984/85, and is currently estimated at only about 4000 ships worldwide *(18)*.

Using the 2004 version of Lloyd's Ship Register, we identified 2,564 unique ships report to ICOADS in year 2002, about 2,177 of which are cargo vessels (excluding fishing, passenger, and miscellaneous vessels). Similarly, we identified 1,803 and 1,655 unique cargo vessels from 2001 and 2000 ICOADS respectively. Since Lloyd's Ship Register normally does not keep records for ships no longer in service (e.g., scrapped), we expected the decline of the number of ships identified. Nearly 2,500 unique vessels were identified from the three-year (2000-2002) ICOADS. We anticipate that more ships can be identified if we use the same year ICOADS and Lloyd's data and, importantly, when the "delayed mode" data is blended into ICOADS *(17)*. This could be a potential future improvement in ICOADS data as a proxy of the accuracy of geographically resolved ships emissions.

In any case, the number of cargo ships that can be identified from ICOADS is much higher than that claimed for AMVER by Endresen et al *(8)*. In contrast, although there are about 12,000 vessels from more than 100 nations in the AMVER database, with approximately 2,700-3,000 vessels reporting mainly daily *(8)*, we do not know how many more ships report to AMVER in a given year than ICOADS. Ultimately, combining these overlapping data sets may also improve the quality of data for this purpose.

Addressing Sampling Bias

Since ship type, size, and power can be identified for individual ICOADS observations by matching ICOADS ship identifiers with ship registry information, and since ship emissions can be distributed accordingly to take into account large variation in emission between small and large vessels, there is no intrinsic advantage to AMVER over ICOADS as claimed by Endresen et al *(8)*. We also show in this work that, with the use a combination of three-year (2000-2002) ICOADS samples, the geographic representativeness of ICOADS of ship traffic and emissions can be improved. Detailed discussions are included in the following sections.

Endresen et al. observed that ICOADS data seem to include some stationary platforms, and this may cause significant error for regional studies covering the areas with stationary vessels *(8)*. They also observed that ICOADS perhaps results in too high emissions in the northern Atlantic and in particular between 40° and 60° N, likely caused by overrepresentation of non-cargo vessel records (mainly research, support, and fishing vessels) *(8)*. We addressed the first issue by only using data reported by ships; we addressed the second issue by selecting only ICOADS observations made by cargo vessels and adjusting our emissions inventory to represent only these commercial marine vessels. (This effort, then, excludes CMV emissions by oceangoing passenger vessels, which may be most relevant for major cruise-ship routes and ports.)

Other potential biases include extremely frequent reporting by a few vessels. Figure 2 shows that five (or 0.2%) of the 2,453 cargo vessels made 7.20% of the ICOADS observations by cargo vessels from 2000 to 2002. Most of these observations were made in the northern Atlantic. We believe these ships are probably responsible for much of the over-sampling bias in the Atlantic, which would directly affect the quality of West Coast inventories (potentially underestimating emissions in the West). We trimmed these over-reported cargo vessels to address this bias. We chose a natural break between the sixth and the fifth most frequently reported vessels, where the latter made almost three times more observations than the former.

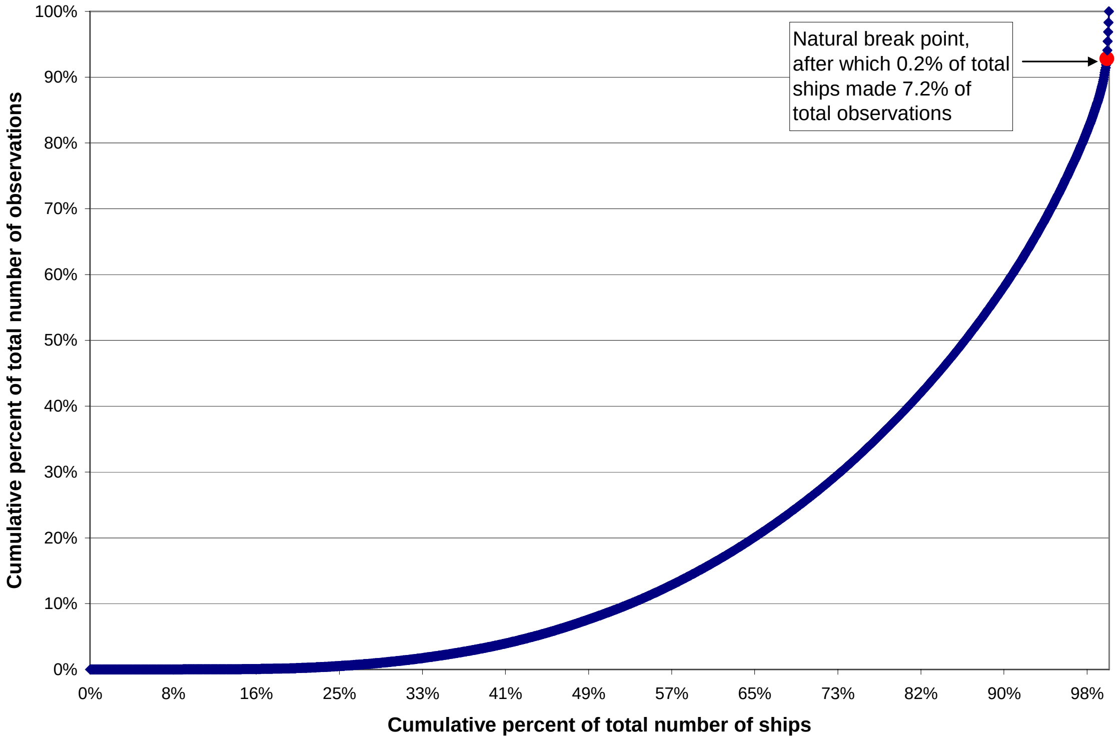


Figure 2. **Cumulative percent of number of ICOADS observations by cumulative percent of number of ships from 2000 to 2002.**

Endresen et al. claim that the AMVER fleet best reflects the international cargo fleet by vessel types, size, and reporting frequency, followed by Purple Finder (PF), and ICOADS *(8)*; however, they compared observations in AMVER and PF mainly made by cargo vessels with observations made by all types of vessels in ICOADS. Endresen et al. also admit that AMVER seems to over-represent large cargo vessels, particularly liquid and dry bulk cargo ships, perhaps because participation in AMVER has been generally limited to merchant ships of all flags over 1000 GT, on a voyage of 24 hours or longer *(8)*. Our analysis indicates that ICOADS covers a wider range of ships in terms of ship type, size, and engine power (132 ~74,640 kw), ICOADS observations perhaps better represent the world ship traffic as characterized by international fleet registries. Of course, combining AMVER and ICOADS data sets for the same year could provide a better representative sample of spatially resolved ship activity than either data set alone.

Figure 3 shows that ICOADS over-sampled container ship and refrigerated cargo (i.e., reefer) traffic – especially container ship traffic – and that ICOADS under-sampled general cargo ship and tanker traffic – particularly general cargo ship traffic. By comparison, AMVER over-sampled bulk carrier, tanker, and container ship traffic, especially bulk carrier traffic, and significantly under-sampled general cargo ship, RO-RO, and reefer traffic. The extent of oversampling depicted in Figure 3 assumes that all the ships in the world cargo fleet spend the same time at sea and make report at a same interval; unfortunately, neither of the two assumptions is true. Further analysis would be required to conclude with confidence that one dataset is a better representation of the world cargo traffic over the other one.

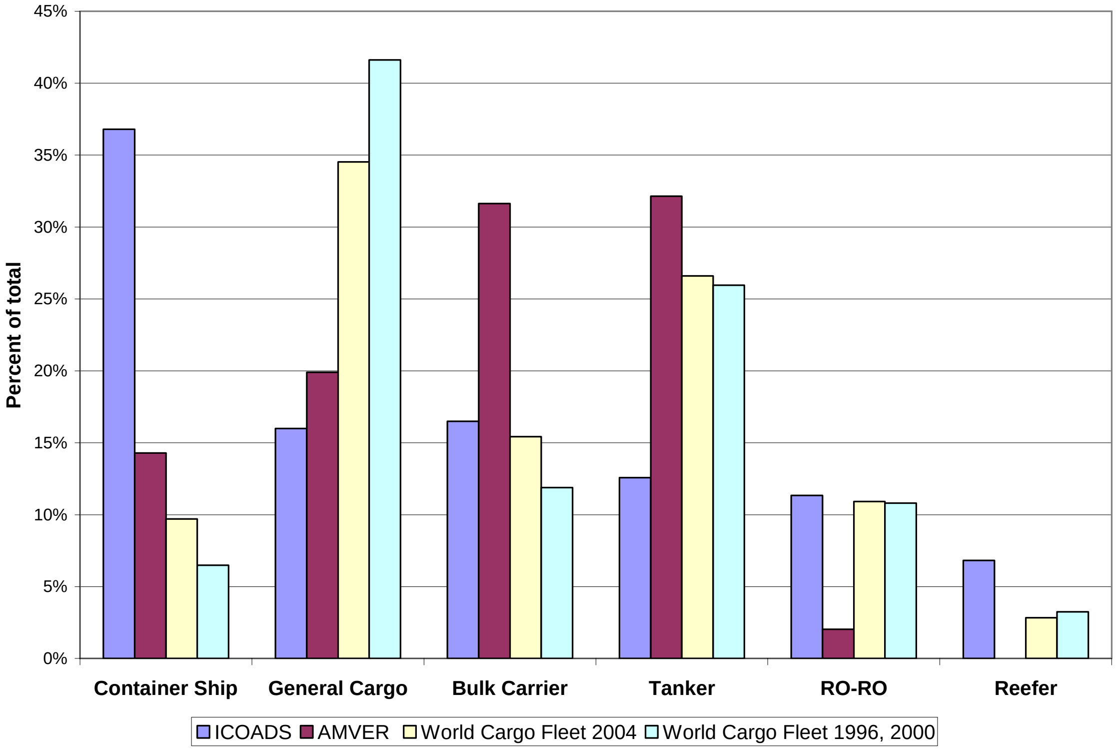


Figure 3. **Comparison between world cargo fleet profile and ICOADS and AMVER observations by ship type. ICOADS as three-year (2000-2002) data with five over-reported vessels trimmed; AMVER as derived from Endresen et al. *(8)*; World cargo fleet 2004 as derived from Lloyd's Ship Register version 2004; World cargo fleet 1996, 2000 as derived from Endresen et al. *(8)*.**

Figure 4 shows that unadjusted ICOADS data will assign significantly more emissions than AMVER data to the region between 40°-60° north and assign significantly fewer emissions to the region between 0°-20° north. Although the emissions assigned to latitudes based on PF mostly fall between ICOADS and AMVER, we cannot conclude that PF better represents the spatial distribution of ship traffic since there are fewer ships in PF database *(8)*. Most importantly, since neither AMVER nor ICOADS sampling is geographically random and both data samples also can be spatially biased, based on this comparison only, we cannot prove that one dataset is better than another for West Coast regional inventory purposes. We are developing independent methods to validate and adjust these data using more complete port call statistics.

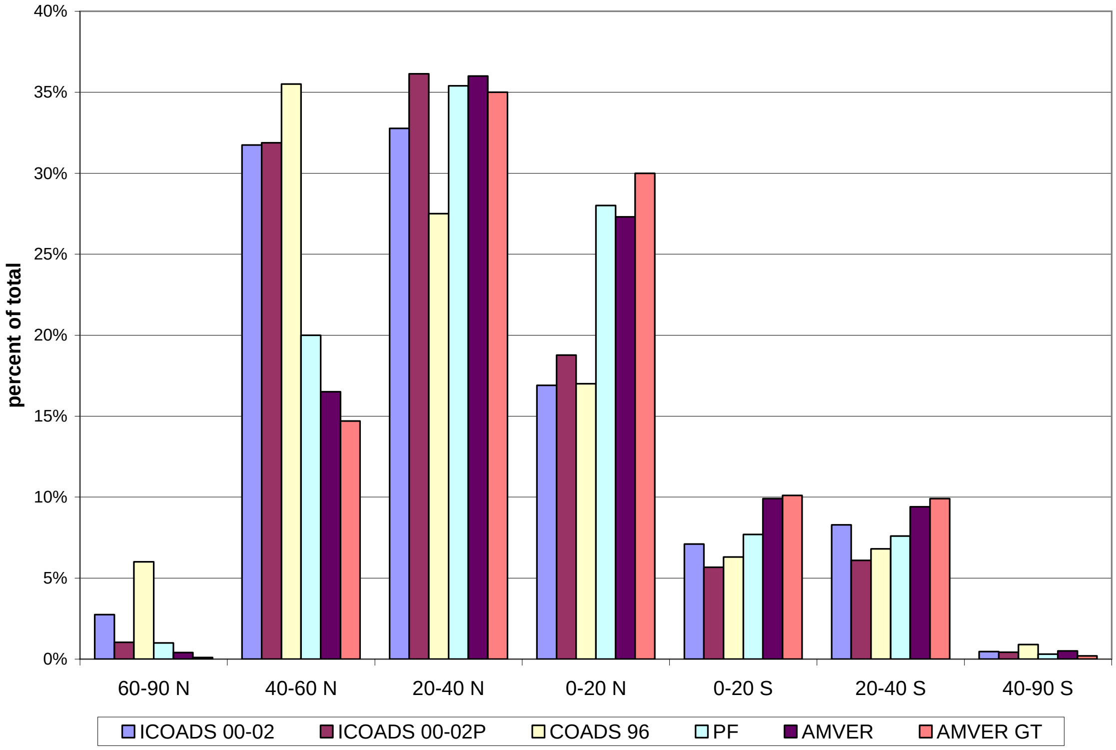


Figure 4. Comparison of relative distribution of emission indicator at different latitudes between ICOADS, AMVER, and PF. ICOADS 00-02 as three-year (2000-2002) number of cargo vessel observations with five over-reported vessels trimmed; ICOADS 00-02P as three-year (2000-2002) number of cargo vessel observations weighted by power with five over-reported vessels trimmed; COADS 96 as derived from Endresen et al. *(8)* for the year 1996 including non-cargo vessels; PF as Purple Finder data derived from Endresen et al. *(8)* for the year 2000; AMVER as derived from Endresen et al. *(8)* for the year 2000; AMVER GT as derived from Endresen et al. *(8)* for the year 2000 and weighted by GT.

Summary of the comparison

With the above discussion, we identify certain strengths of the unadjusted ICOADS sample. Some are common for both ICOADS and AMVER. These include:

1. The ability to identify specific vessels for individual ICOADS observations and associate them with actual power, tonnage, etc., using ship registry databases enables direct spatial consideration of the important factors necessary to evaluate environmental impacts, such as ship emissions.
2. The spatial representation of shipping lanes is excellent, especially for the major trade routes. This has been verified by comparison of major trade routes of commodities with ICOADS routes according to vessel types associated with these commodities.
3. Seasonal variation in shipping lanes is consistent over time, and predictable. Weather routing behavior is clearly identified in the ICOADS samples, and this seasonal variability (analyzed through monthly resolved data).
4. There is very little inter-annual variability in shipping lanes. An analysis of twenty years of monthly resolved ICOADS data demonstrates that from year to year, and season to

season, the same shipping lanes are used by different sets of vessels reporting to ICOADS.

5. The number of observations and sample of world fleet vessels by type is large enough to support statistical analysis and correction for known bias.

The above discussion also demonstrates that both ICOADS and AMVER datasets are biased. The data as obtained has the following known limitations:

1. Voluntary reporting conditions create a sample bias that is globally non-random in terms of the vessel types relative to the world fleet. This can be quantified and corrected at a global level through simple weighting adjustments.
2. Variability in reporting by vessel type ***may*** demonstrate different non-random behavior locally than implied by the global sample bias, above.
3. Variability of the reporting frequency among vessels of the same type is large and non-random. This can be quantified and corrected at a global level through simple weighting adjustments.
4. Variability in reporting frequency by geographic region ***is apparent*** and non-random. For example almost all the observations made by the five vessels with the highest reporting frequencies in the three years (2000-2002) are all located in the North Atlantic.
5. Items 2 and 4 require more advanced adjustment and/or validation with independent data samples or comprehensive traffic analysis.

Geographically resolved emissions inventories can be quickly produced based on ICOADS or AMVER. We understand that neither dataset is SPATIALLY RANDOM, since international trade and shipping is clearly not random. We would not favor one version over the other arbitrarily without validating using plotted routes based on port-arrival or find other independent samples. The non-random spatial distribution of ICOADS or AMVER samples limits the extent we can improve the accuracy of this type of approach.

However, ICOADS is open to public for research purposes and can be obtained from ICOADS website, whereas AMVER is strictly protected and used only in a bona fide maritime emergency as claimed by AMVER *(16)*. Only one or two researchers, all of them are non-U.S. researchers, have been given access to AMVER data for research purposes under special agreement. Given the difficulty of obtaining AMVER data, and importantly, the fact that both dataset have strengths and weaknesses in representing global ship traffic, and the fact that neither can be proved better than the other, ICOADS is chosen for this work. We make efforts to correct potential sampling bias caused by over-reporting and non-response ships.

Choosing Coordinate System and Resolution

Generally there are two types of coordinate system: Geographic Coordinate Systems and Projected Coordinate Systems. Coordinate system can be chosen based on needs, including the extent of the map, the spatial attributes that should be preserved most, etc. The ESRI ArcGIS offers many coordinate systems that we can choose from.

Maps produced with different projected coordinate systems look different. The map projection process will cause distortions in one or more of the following spatial properties: distance, area, shape, and direction. Although no projection can preserve all these properties, each one, each projection is distinguished by its suitability for representing a particular portion and amount of the earth's surface and by its ability to preserve distance, area, shape, or direction.

Some map projections minimize distortion in one property at the expense of another, while others strive to balance the overall distortion (19).

Here are a few things to consider when selecting a projection (19):

- Which spatial properties do you want to preserve?
- Where is the area you're mapping? (e.g. polar region or equatorial region?)
- What shape is the area you're mapping? Is it square? Is it wider in the east–west direction?
- How big is the area you're mapping? On large-scale maps, such as street maps, distortion may be negligible because your map covers only a small part of the earth's surface. On small-scale maps, where a small distance on the map represents a considerable distance on the earth, distortion may have a bigger impact, especially if you use your map to compare or measure shape, area, or distance.

Per the request from the client, the USA Contiguous Lambert Conformal Conic Projection coordinate system, which is one of the best for middle latitudes, was chosen for this work, and 36km X 36km resolution was used.

Choosing Appropriate Means to Correct Sampling Bias

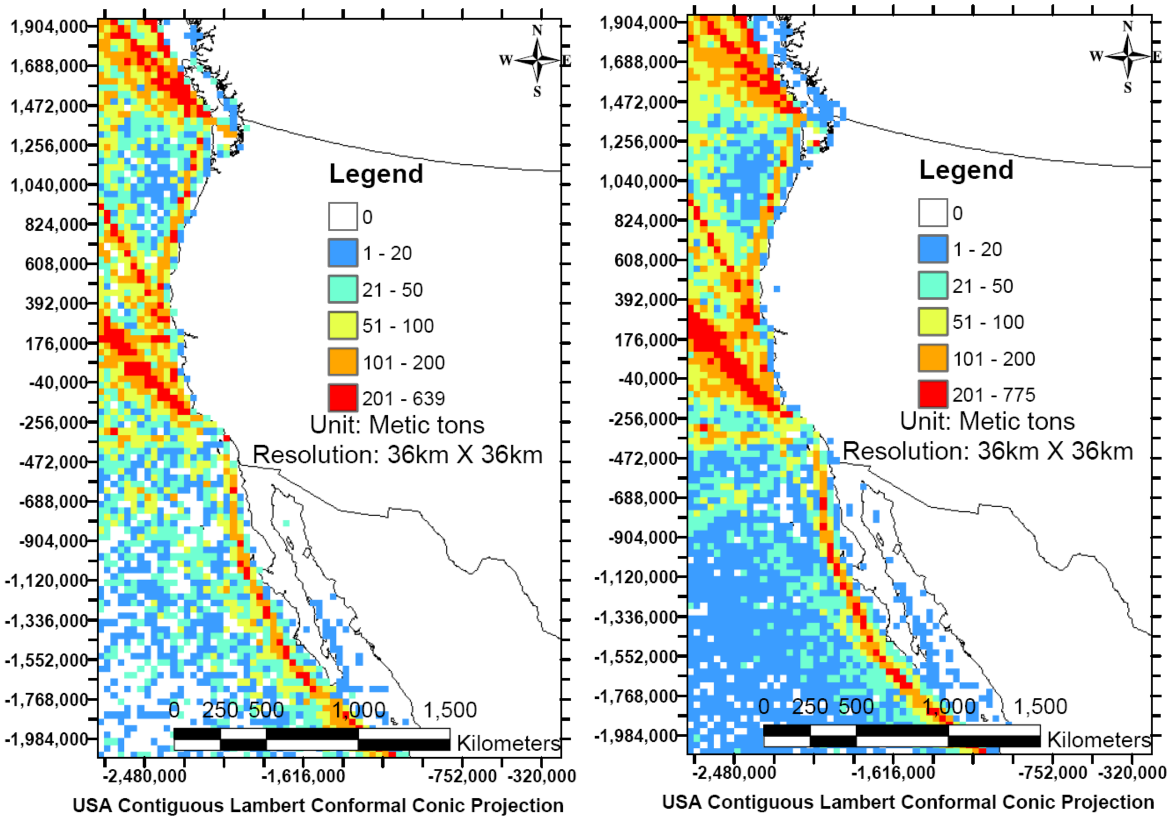
In this section, we discuss the effects of different means that could potentially to some extent correct the statistical and geographical sampling bias of ICOADS and improve the accuracy of the geographic distribution of ship emissions.

Evaluating the Effects of Using Three-Year with Single Year ICOADS Data

We understand that if two conditions hold, it will be better to use a combination of three-year samples rather than a single year data. One condition is that temporal changes of ship traffic pattern and intensity are not important or annual changes are not apparent. The other condition is that, with more observations in the three-year combination, the statistical and geographical sampling bias can be potentially reduced and, therefore, the accuracy of the distribution of emissions can be potentially improved.

According to navigation knowledge and experience, ships travel along well-established shipping lanes between each pair of ports with certain deviation *(20)*. The fact that there are established distances between different ports and well-understood by cargo logistics planners is good evidence that ships travel along well defined paths. We acknowledge different types and different sizes of vessels might take different paths between the same origin and destination. We also understand that the international trade pattern does not change much annually. With these understandings, we didn't anticipate significant annual changes of the geographic distribution of global ship traffic, and accordingly the distribution of air emissions from shipping activities won't change much annually under the assumption that air emissions are proportional to the intensity of ship traffic which can be weighted if possible.

Figure 5a shows the distribution of marine vessel nitrogen emissions inventory based on ICOADS 2002 data weighted by ship power. Figure 5b shows the distribution based on a combination of three-year (2000-2002) data also weighted by ship power. They look quite similar except that shipping lanes in Figure 5b look smoother and emissions are assigned to more grids. Given the facts that the number of observations almost tripled in the three-year combination dataset, and the change of geographic distribution of ship traffic and emissions in a short term is not significant, we understand that it is likely the three-year ICOADS data better represent the ship traffic and emissions.

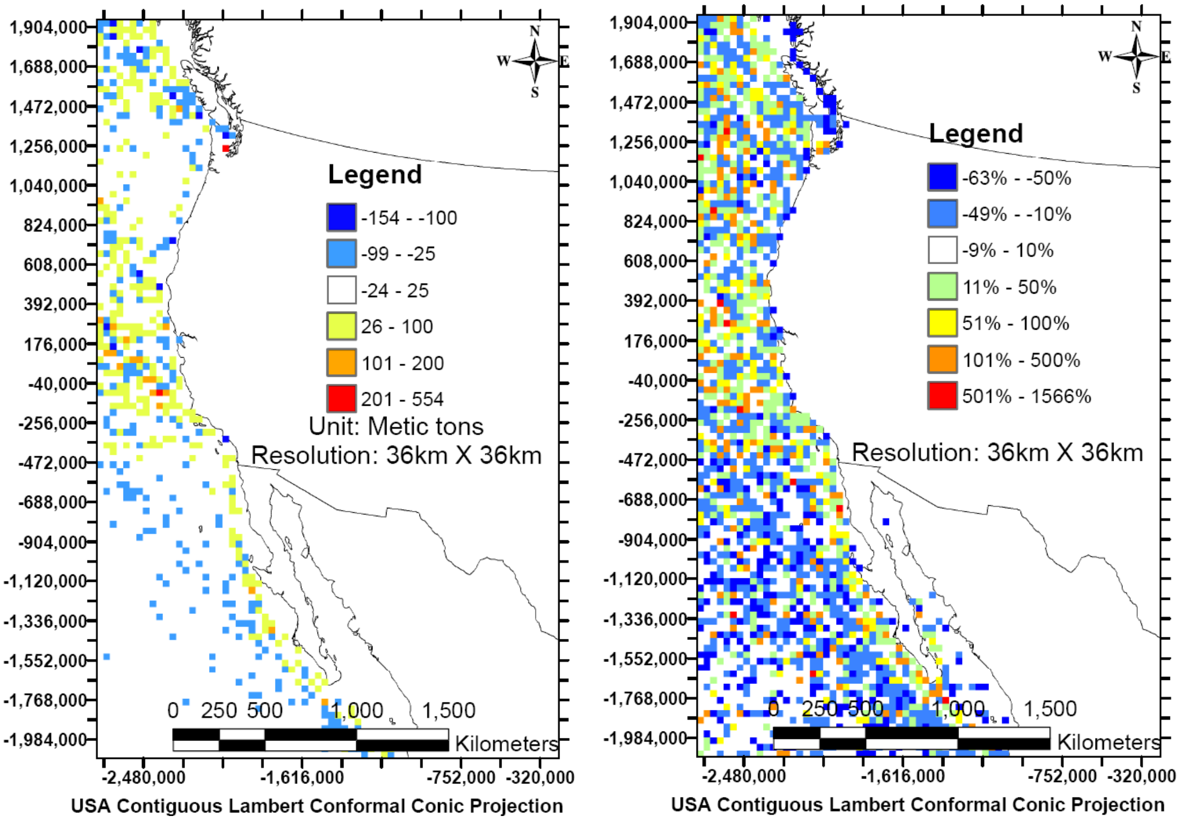


(a) (b)

Figure 5. a) Nitrogen emissions inventory for 2002 distributed using one year of ICOADS data (2002); b) Nitrogen emissions inventory for 2002 distributed using three years of ICOADS data (2000-2002).

With ArcGIS spatial analyst tools, the two results can be compared quantitatively. We obtained the difference of emissions in using the one-year and three-year data by subtracting the gridded raster data for Figure 5a and Figure 5b. Figure 6a shows the result of this comparison. For most grids, the difference is 25 tons more or less with in a 36km x 36km grid. For a small percent of grids, the difference is between 25 to 100 tons more or less. For an extremely small number of grids, the difference may be greater than 100 tons and up to around 550 tons. Most of the grids with significant difference are located in major shipping lanes. This is largely caused by the fact that ships make report randomly along shipping lanes.

We further obtained the percent of change by dividing the raster data for Figure 6a with the raster data for Figure 5a. Figure 6b shows the result. We noticed that the positive and negative numbers occur almost randomly on the map. This phenomenon may be caused by inherent randomness of ship reporting.

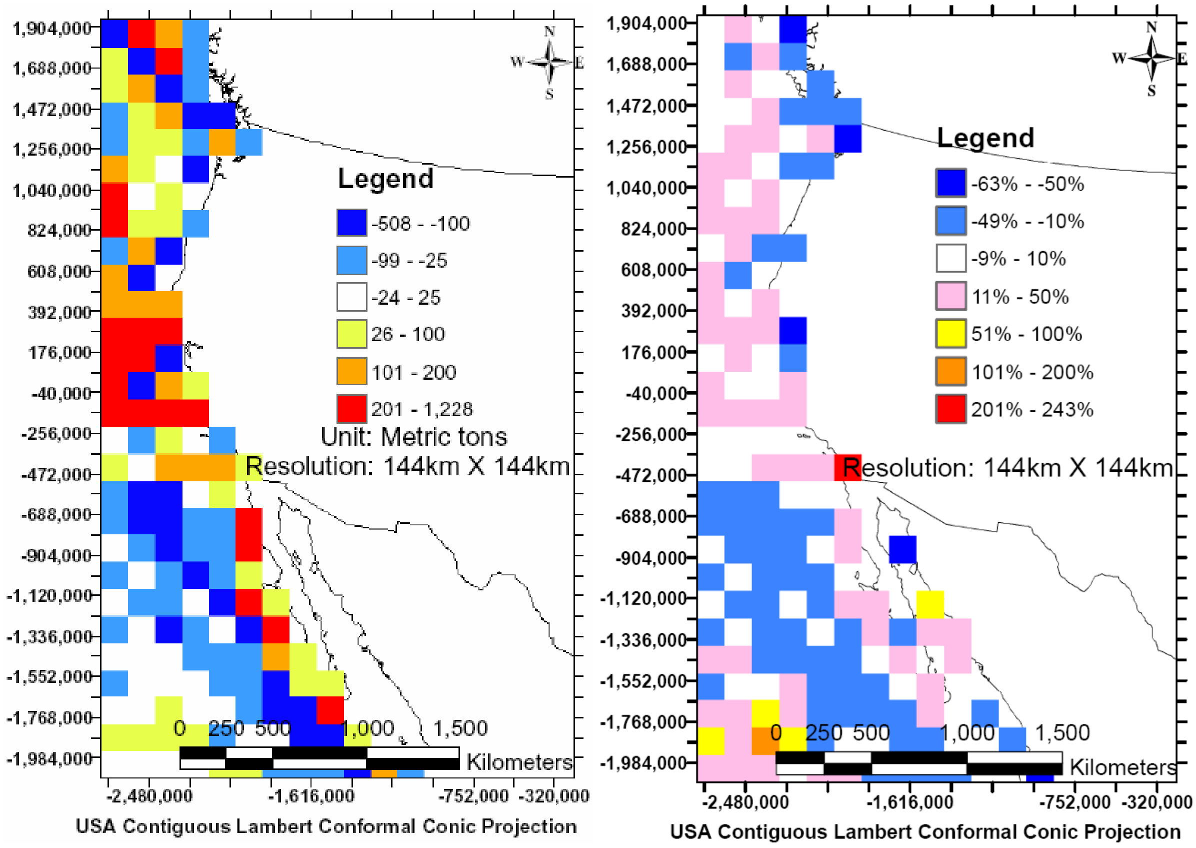


(a) (b)

Figure 6. a) Comparison between the distribution of ship nitrogen emission with 2000-2002 three-year data and 2002 single year data; b) Percent of change between the distribution of ship nitrogen emission with 2000-2002 three-year data and 2002 single year data.

The effect of using three-year data is resolution dependent. Figure 7a and Figure 7b compare the 36km x 36km resolution with a resolution four times coarser (144 X 144 km). Although the change of absolute number of tons of emissions in one grid is greater with coarser resolution, the percentage of change is much smaller than with the finer resolution. This suggests that using three-year data improves the quality of the spatial representation, and that the effect of using three-year data on a regional scale significantly larger than the grid size is not significant.

We confirmed that multi-year ICOADS data didn't change much the geographic distribution of the emission inventories by evaluating the whole west coast is one grid; the difference in total emissions is be only about 3%. With more data in the three-year dataset, however, non-response bias may be reduced further, the distribution will be statistically more reliable, and the shipping lanes look smoother. Moreover, emissions are, on the one hand, assigned more to the major shipping lines, with the correction of the randomness of ship reporting on shipping lanes, and on the other hand, spread to more areas. We believe the three-year ICOADS combination is more representative of the general ship traffic pattern, and can likely represent emissions more accurately. With this understanding, we decided to use the combination of three year (2000-2002) data as the proxy of the distribution of ship traffic.

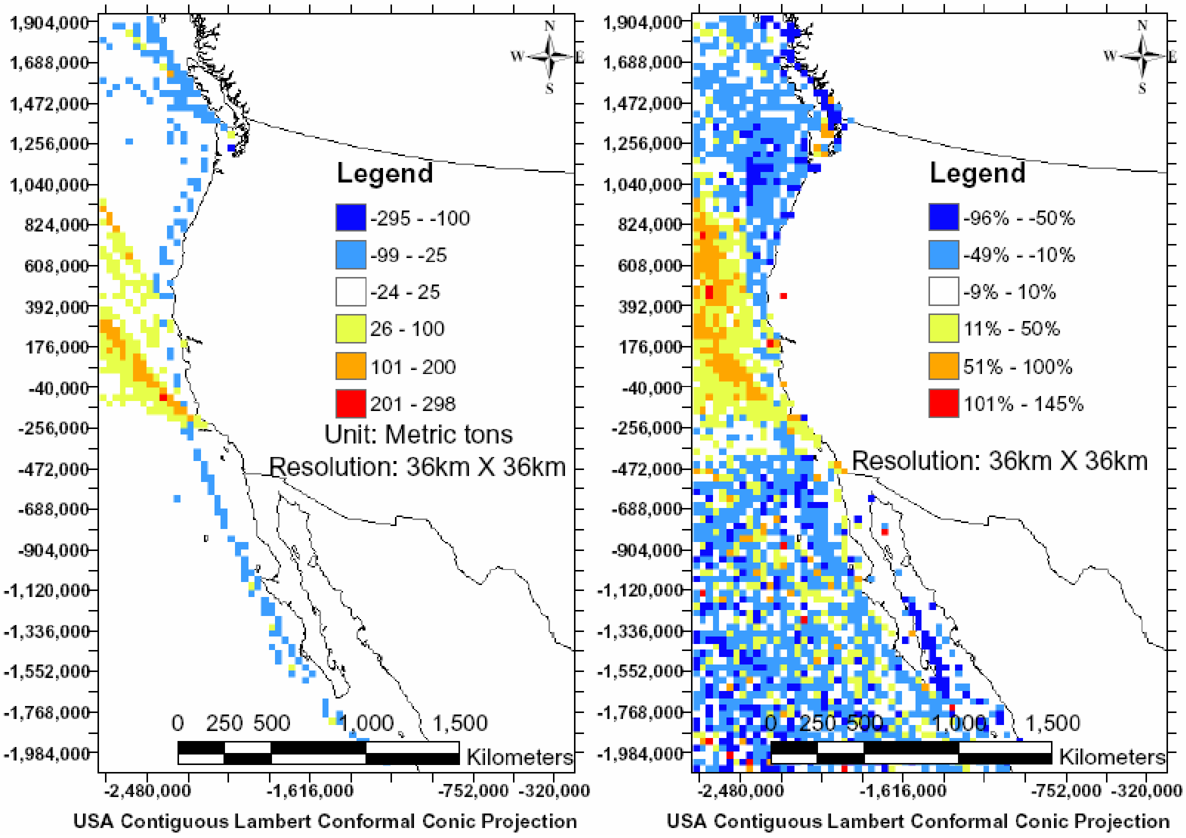


(a) (b)

Figure 7. a) Comparison between the distribution of ship nitrogen emission with 2000-2002 three-year data and 2002 single year data; b) Percent of change between the distribution of ship nitrogen emission with 2000-2002 three-year data and 2002 single year data.

Evaluating the Effects of Weighting Observations with Ship Engine Power

Ships vary greatly in size and engine power. With some ships are only hundreds deadweight tonnage (DWT), ships with more than 100,000 (DWT) are common, and some tankers are even up to half million tons DWT. According, the total engine power for one large ship may be thousands times of the engine power of a small ship. In the ICOADS fleet, ship power ranges from a hundred kilowatts to more than 70,000 kilowatts. Previous studies assumed ICOADS ships were identical and emissions inventories were distributed proportional to the number of observations in one location *(3)*. Endresen et al. used ship gross tonnage, which is related to ship engine power, to weight the observations, and perhaps improved the accuracy of the distribution of ship emissions. In this section, we discuss the effects of using ship engine power, which is more directly related to ship emissions, to weight the observations.



(a) (b)

Figure 8. a) Comparison between the distribution of ship nitrogen emission with power weighted and non-weighted method; and b) Percent of change between the distribution of ship nitrogen emission with power weighted and non-weighted method.

Figure 8a and Figure 8b show the effects of using ship power to weight the ICOADS observations to distribute the emissions. Figure 8a, which was produced by subtracting non-weighted emission distribution from the power-weighted distribution, shows the change of amount of emissions in each grid. Most changes occur on major shipping lanes, especially the great circle route to East Asia for container ships with large engine power. The changes range from about negative 300 metric tons to about positive 300 metric tons nitrogen. Generally, the power-weighted method increases the emissions assigned to ocean-shipping lanes while decreases the emissions to coastal routes. The power-weighted method increases the nitrogen emissions assigned to the area showed in Figure 8a by about 18%.

Figure 8b was produced by dividing the raster data for Figure 8a by the raster data produced with non-weighted method. The percent of change ranges from about negative 100% to about positive 150%. Most grids have 50% of change of emissions more or less.

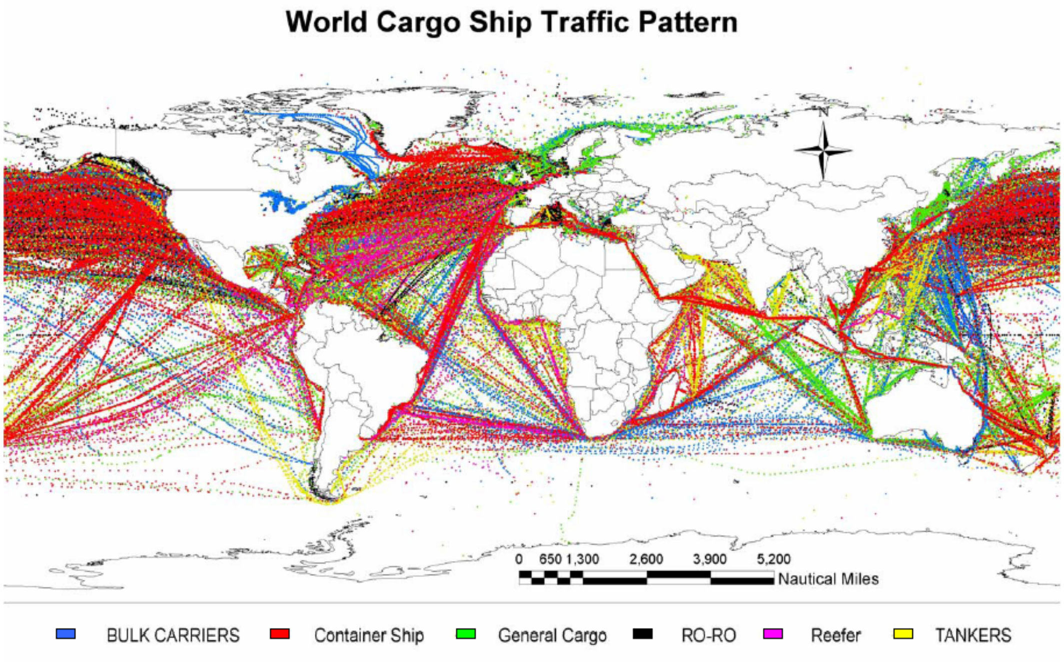


Figure 9. World cargo ship traffic pattern by ship type. Observations of cargo vessels in ICOADS are used as a proxy of world ship traffic without adjustment.

With the facts that ships vary greatly in size, engine power, etc., and ships, primary container ships and tankers (see Figure 9), travel along the U.S. West Coast are relatively larger than other regions, we believe the power-weighted method is more accurate than the method that assumes all ships are identical. We choose the power-weighted method to improve the accuracy of this work.

Producing Raster Files

As described briefly in the overview discussion at the beginning of the work, we follow the following general steps to spatially assign regional emissions. We allocate the global inventory work previously published (from Table 1) to locations where the most installed power is operating – the major shipping lanes with the most powerful vessels. This is discussed in more detail below.

1. Identify the vessels and engines in the ICOADS sample.
2. Assign an emissions indicator to each observation using rated vessel power. When we convert to a raster format, we sum these to identify which 36km x 36km gridded cells have the greatest contribution to emissions accordingly.
3. Apply equation 1 to each grid cell to convert the power-based emissions indicator to an estimate of total emissions in that gridded cell.

Based on the above discussion, we use the combination of three-year (2000-2002) ICOADS data as the proxy of the ship traffic pattern, and we distribute the emission inventory to each grid proportional to the number of observations in that grid weighted by the power of the ship that made the individual observations. We believe the approach we use is simpler, with fewer assumptions, and can produce datasets with sufficient accuracy for this task and the purpose of this work.

We produced monthly emission inventories for 2002 for the six pollutants, including NOx, SOx, CO_2, CH_4, PM_{10}, and CO. The inventories are first bounded by the uncertainty of the global inventories with lower bound, best guess, and upper bound three scenarios. Considering the discussion addressing the sampling bias, the emissions assigned to a small number of grids (36km X 36km) may be extremely uncertain. The uncertainties caused by sampling are generally small for most of the grids in the studied area, especially with a coarser resolution. Importantly, the uncertainties for neighboring grids often can offset each other with negative and positive values.

The emissions of one pollutant in one cell, 36km X 36km in this work is calculated as equation (1):

$$e_i = \frac{e_g}{p_g} \times p_i \qquad (1)$$

Where e_i as emissions of one pollutant from cell i in one period, year 2002 or one month of 2002 in this work; e_g as the global ship emissions inventory for that pollutant in 2002; p_g is the sum of the total main engine power of ICOADS observations; p_i is the sum of the total main engine power of ICOADS observations in cell i.

Totally 234 raster files were produced. The final products were imported into a geodatabase. The name of the raster file has three or four parts. The raster files with a name of three parts are annual ship emissions. The first part of the name denotes the pollutant, where n for nitrogen, s for sulfur, c2 for CO_2, hc for CH_4, co for CO, and pm for PM_{10}. The second part of the name denotes the scenario, where l for lower bound, b for best guess, and u for upper bound. The third part is the last two digits of the year. The name of monthly raster files has the fourth part, which denotes the month of the emissions.

Per the request of the client, the raster files were converted into ASCII files with ArcGIS conversion tool. The name of the ASCII files has three parts: [pollutant]_[case]_[period].txt. For example: ch4_base_annual.txt is the base case inventory for annual CH4 emissions; noxnitrogen_upper_annual.txt is the upper bound of the inventory for annual nitrogen emissions; and co2carbon_lower_07.txt is the lower bound of the carbon emissions as CO_2 in July 2002.

Conclusions, Future Work and Recommendations

In this work, we employed an approach published in peer-reviewed literature with adjustments by taking into account of recent developments to produce ship emissions inventory for the U.S. West Coast. Efforts have been made in this work to address potential statistical and geographic sampling bias caused by over-reporting and non-response ships to improve the accuracy of the products-geographically resolved emissions inventories.

After a review of current available ship emissions inventories, we believe the inventories produced by Corbett and Koehler's model with adjusted inputs are the best for this work.

By comparing ICOADS with AMVER dataset, we understand that neither actual ship traffic or either dataset is SPATIALLY RANDOM. We would not favor one version over the other arbitrarily without validating using plotted routes based on port-arrival or find other independent samples. Given the availability of ICOADS data, its apparent larger size, and the fact that both datasets have similar strengths and weaknesses in representing global ship traffic, ICOADS data are appropriate for this analysis.

We observed that using multi-year ICOADS data didn't change much the geographic distribution of the emission inventories. With more data in the three-year dataset, the non-response bias can be reduced, the distribution may be statistically more reliable, and the shipping lanes look smoother with gaps being filled, and emissions are assigned perhaps more accurate.

With ship type, size, and power being identified for individual ICOADS observations based on ship identifiers by joining ICOADS with a ship dataset, we were able to weight individual observations with ship power. We believe the power-weighted method is more accurate than previous methods that assumed all ships are identical.

We anticipate that more ships can be identified if we use the same year ICOADS and Lloyd's data and, importantly, if the delayed mode data is blended into ICOADS. This could be a potential improvement in the future of the accuracy of geographically resolved ships emissions using ICOADS as a proxy.

Future effort (described in optional tasks under this scope of work) includes deriving traffic profile from port activities data, like the USACE Entrance and Clearance data to validate and/or recalibrate emissions profiles according to shipping activities records. This may modify vessel-type inventories to be more accurate, although it may not explicitly capture vessels transiting the West Coast but not calling on U.S. ports.

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Appendix A

Ship Group	**Ship Type**	**Ship Group**	**Ship Type**
Bulk Carrier	Aggregates Carrier	General Cargo	Deck Cargo Ship
	Alumina Carrier		General Cargo
	Bulk / Oil Carrier		Palletised Cargo Ship
	Bulk Carrier		Barge Carrier
	Cement Carrier		Heavy Load Carrier
	Limestone Carrier		Livestock Carrier
	Mud Carrier		Log-Tipping Ship
	Ore / Oil Carrier		Nuclear Fuel Carrier
	Ore Carrier		Pearl Shells Carrier
	Powder Carrier		Pulp Carrier
	Refined Sugar Carrier		Stone Carrier
	Self-Discharging Bulk Carrier		Passenger / General Cargo Ship
	Urea Carrier	Passenger	Passenger (Cruise) Ship
	Wood Chips Carrier		Passenger
Container Ship	Container Ship	Reefer	Refrigerated Cargo Ship
	Passenger / Container Ship	RO-RO	Container Ro-Ro Cargo Ship
Fishing	Fish Carrier		Landing Craft
	Fish Factory Ship		Passenger / Ro-Ro Cargo
	Fishing Support Vessel		Passenger Landing Craft
	Fishing Vessel		Ro-Ro Cargo
	Live-Fish Carrier		Vehicles Carrier
	Seal-Catcher	Miscellaneous	Anchor Hoy
	Trawler		Buoy / Lighthouse Vessel
	Whale-Catcher		Cable-Layer
Tanker	Beer Tanker		Crane Ship
	Bitumen Tanker		Crewboat
	Chemical / Oil Products Tanker		Dredger
	Chemical Tanker		Fire-Fighting Vessel
	Coal / Oil Mixture Tanker		Hopper Dredger
	Crude Oil Tanker		Hospital Vessel
	Edible Oil Tanker		Icebreaker
	Fish Oil Tanker		Kelp Dredger
	Fruit Juice Tanker		Launch (Unspecified)
	Latex Tanker		Mooring Vessel
	LNG Tanker		Motor Hopper
	LPG Tanker		Patrol Vessel
	Molasses Tanker		Pilot Vessel
	Oil Products Tanker		Pollution Control Vessel
	Oil-Sludge Tanker		Pusher Tug
	Vegetable Oil Tanker		Research Vessel
	Water Tanker		Salvage Ship
	Wine Tanker		Search & Rescue Vessel
	Oil Tanker		Supply Vessel
	Other Liquids Tanker		Tank-Cleaning Vessel
Miscellaneous	Pipe-Layer		Tender (Unspecified)
	Production Testing Vessel		Training Ship
	Standby-Safety Vessel		Trans-Shipment Vessel
	Well-Stimulation Vessel		Tug
	Other Activities		Utility Vessel
	Towing / Pushing		Waste Disposal Vessel
	Sail Training Ship		Work / Repair Vessel
	Yacht		Naval / Naval Auxiliary
	Air Cushion Vehicle		Other Non-Merchant Ships
	Drilling Ship		Barge
	Offshore Processing Ship		Pontoon
	Offshore Supply Ship		Offshore Tug / Supply Ship
	Offshore Support Vessel		