



2020 National Emissions Inventory Technical Support Document: Introduction

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Contents

List of Tables	i
Acronyms and Chemical Notations	ii
1 Introduction	1-1
1.1 What data are included in the 2020 NEI release?	1-1
1.2 What is included in this documentation?	1-2
1.2.1 Greenhouse gases reported in the NEI.....	1-2
1.3 Where can I obtain the 2020 NEI data?.....	1-2
1.3.1 Emission Inventory System Gateway	1-2
1.3.2 NEI main webpage.....	1-3
1.3.3 Modeling files	1-3
1.4 Why is the NEI created?.....	1-3
1.5 How is the NEI created?.....	1-4
1.6 Who are the target audiences for the 2020 NEI?	1-5
1.7 What are appropriate uses of the 2020 NEI and what are the caveats about the data?.....	1-6

List of Tables

Table 1-1: Point source reporting thresholds (potential to emit) for CAPs in the AERR.....	1-5
Table 1-2: Examples of major current uses of the NEI	1-6

Acronyms and Chemical Notations

AEDT	Aviation Environmental Design Tool
AERR	Air Emissions Reporting Rule
APU	Auxiliary power unit
BEIS	Biogenics Emissions Inventory System
C1	Category 1 (commercial marine vessels)
C2	Category 2 (commercial marine vessels)
C3	Category 3 (commercial marine vessels)
CAMD	Clean Air Markets Division (of EPA Office of Air and Radiation)
CAP	Criteria Air Pollutant
CBM	Coal bed methane
CDL	Cropland Data Layer
CEC	North American Commission for Environmental Cooperation
CEM	Continuous Emissions Monitoring
CERR	Consolidated Emissions Reporting Rule
CFR	Code of Federal Regulations
CH4	Methane
CMU	Carnegie Mellon University
CMV	Commercial marine vessels
CNG	Compressed natural gas
CO	Carbon monoxide
CO2	Carbon dioxide
CSV	Comma Separated Variable
E10	10% ethanol gasoline
EDMS	Emissions and Dispersion Modeling System
EF	emission factor
EGU	Electric Generating Utility
EIS	Emission Inventory System
EAF	Electric arc furnace
EF	Emission factor
EI	Emissions Inventory
EIA	Energy Information Administration
EMFAC	Emission FACTor (model) – for California
EPA	Environmental Protection Agency
ERG	Eastern Research Group
ERTAC	Eastern Regional Technical Advisory Committee
FAA	Federal Aviation Administration
FACTS	Forest Service Activity Tracking System
FCCS	Fuel Characteristic Classification System
FETS	Fire Emissions Tracking System
FWS	United States Fish and Wildlife Service
FRS	Facility Registry System
GHG	Greenhouse gas
GIS	Geographic information systems
GSE	Ground support equipment
HAP	Hazardous Air Pollutant

HCl	Hydrogen chloride (hydrochloric acid)
Hg	Mercury
HMS	Hazard Mapping System
ICR	Information collection request
I/M	Inspection and maintenance
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Planning Model
LRTAP	Long-range Transboundary Air Pollution
LTO	Landing and takeoff
LPG	Liquified Petroleum Gas
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxics Standards
MCIP	Meteorology-Chemistry Interface Processor
MMT	Manure management train
MOBILE6	Mobile Source Emission Factor Model, version 6
MODIS	Moderate Resolution Imaging Spectroradiometer
MOVES	Motor Vehicle Emissions Simulator
MW	Megawatts
MWC	Municipal waste combustors
NAA	Nonattainment area
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NASS	USDA National Agriculture Statistical Service
NATA	National Air Toxics Assessment
NCD	National County Database
NEEDS	National Electric Energy Data System (database)
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NFEI	National Fire Emissions Inventory
NG	Natural gas
NH3	Ammonia
NMIM	National Mobile Inventory Model
NO	Nitrous oxide
NO2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen oxides
O3	Ozone
OAQPS	Office of Air Quality Standards and Planning (of EPA)
OEI	Office of Environmental Information (of EPA)
ORIS	Office of Regulatory Information Systems
OTAQ	Office of Transportation and Air Quality (of EPA)
PADD	Petroleum Administration for Defense Districts
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyl
PFAS	Per- and polyfluoroalkyl substances

PM	Particulate matter
PM25-CON	Condensable PM2.5
PM25-FIL	Filterable PM2.5
PM25-PRI	Primary PM2.5 (condensable plus filterable)
PM2.5	Particulate matter 2.5 microns or less in diameter, synonymous with PM25-PRI
PM10	Particulate matter 10 microns or less in diameter, synonymous with PM10-PRI
PM10-FIL	Filterable PM10
PM10-PRI	Primary PM10 (condensable plus filterable)
POM	Polycyclic organic matter
POTW	Publicly Owned Treatment Works
PSC	Program system code (in EIS)
RFG	Reformulated gasoline
RPD	Rate per distance
RPP	Rate per profile
RPV	Rate per vehicle
RVP	Reid Vapor Pressure
Rx	Prescribed (fire)
SCC	Source classification code
SEDS	State Energy Data System
SFv1	SMARTFIRE version 1
SFv2	SMARTFIRE version 2
S/L/T	State, local, and tribal (agencies)
SMARTFIRE	Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation
SMOKE	Sparse Matrix Operator Kernel Emissions
SO2	Sulfur dioxide
SO4	Sulfate
TAF	Terminal Area Forecasts
TRI	Toxics Release Inventory
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
VMT	Vehicle miles traveled
VOC	Volatile organic compounds
USFS	United States Forest Service
WebFIRE	Factor Information Retrieval System
WLF	Wildland fire
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting Model

1 Introduction

The Environmental Protection Agency (EPA) has released the complete 2020 National Emissions Inventory (NEI). The 2020 NEI is available on the web at the [2020 NEI Data page](#). This is the first, and final planned public release of the 2020 NEI. A partial 2020 NEI was released in January 2023 for the Point, Onroad Mobile, and Nonroad Mobile data categories. This March 2023 release includes the remaining Nonpoint data source category; other categories are the same as the January 2023 release.

1.1 What data are included in the 2020 NEI release?

The NEI is a national compilation of air emission estimates of criteria air pollutants (CAPs), the precursors of CAPs, and hazardous air pollutants (HAPs). The hazardous air pollutants that are included in the NEI are based on Section 112(b) of the Clean Air Act. State, local and tribal (S/L/T) air agencies submit emission estimates to EPA and the Agency adds information from EPA emissions programs, such as the emission trading program, Toxics Release Inventory (TRI), and data collected during rule development or compliance testing. The NEI includes estimates of emissions from stationary sources (large and small industries, commercial, institutional and consumer), mobile sources, fires and biogenic emissions. EPA uses the NEI in rule development, non-attainment area designations, and as an input to various reports and assessments. This document discusses all components of the NEI and where useful, highlights differences between the 2020 NEI and the most-recent publicly-available full NEI release, the 2017 NEI. The NEI program develops datasets, blends data from these multiple sources, and performs data processing steps that further enhance, quality assure, and augment the compiled data.

The emissions data in the NEI are compiled at different levels of granularity, depending on the data category. For point sources (in general, large facilities), emissions are inventoried at a process-level within a facility. The point data are collected from S/L/T air agencies and the EPA emissions programs including the Toxics Release Inventory, the Acid Rain Program, and the Greenhouse Gas Reporting Program. For nonpoint sources (typically smaller, yet pervasive sources) and mobile sources (both onroad and nonroad), emissions are given as county totals. For marine vessel and railroad in-transit sources, emissions are given at the sub-county polygon shape-level. For wildfires and prescribed burning, the data are compiled as day-specific, coordinate-specific (similar to point) events for both smoldering and flaming components, but in a change from the 2017 NEI in which these were categorized in an “event” portion of the inventory, these emission estimates are now aggregated to county totals for the 2020 NEI.

The pollutants included in the NEI are the pollutants associated with the National Ambient Air Quality Standards (NAAQS), known as CAPs, HAPs associated with EPA’s Air Toxics Program, and new for 2020, per- and polyfluoroalkyl (PFAS) compounds. Greenhouse gases (GHGs) are also included in the NEI for fires, mobiles sources, and point sources where reported. The CAPs have ambient concentration limits or are precursors for pollutants with such limits from the NAAQS program. These pollutants include lead (Pb), carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), sulfur dioxide (SO₂), particulate matter 10 microns or less (PM₁₀), particulate matter 2.5 microns or less (PM_{2.5}), and ammonia (NH₃), which is technically not a CAP, but an important PM precursor. The HAP pollutants include the 187 remaining HAP pollutants (methyl ethyl ketone was removed prior to the 2017 NEI) from the original 188 listed in Section 112(b) of the 1990 Clean Air Act Amendments¹. There are many different types of HAPs. For example, some are acid gases such as

¹ The original of HAPs is available on the [EPA Technology Transfer Network – Air Toxics Web Site](#).

hydrochloric acid (HCl); others are heavy metals such as mercury (Hg), nickel and cadmium; and others are organic compounds such as benzene, formaldehyde, and acetaldehyde.

1.2 What is included in this documentation?

This technical support document (TSD) provides a reference for the complete release of the 2020 NEI in March 2023, superseding the January 2023 release documenting the availability of the Point, Onroad, and Nonroad data categories of the 2020 NEI.

The primary purpose of this document is to explain the sources of information included in the inventory. This includes showing the sources of data and types of sources that are used for each data category, and then providing more information about the EPA-created components of the data. After the introductory material included in this section, Section 2 provides an overview of the contents of the inventory and some high-level summaries comparisons to the 2017 NEI, as well as a summary on the mercury emissions. Section 3 provides an overview of point sources. Sections 4 and 5 provide information for the nonroad mobile and onroad mobile data categories, respectively. Sections 6 and beyond discuss the nonpoint data category, including Fires (wild, prescribed, and agricultural field burning), and EPA methods for computing several nonpoint source categories, including but not limited to: biogenics, oil and gas production, residential wood combustion, nonpoint industrial and commercial/institutional fuel combustion, solvents utilization, commercial cooking, open burning, agricultural livestock waste and fertilizer application, and fugitive dust sources.

1.2.1 Greenhouse gases reported in the NEI

The NEI includes estimates of greenhouse gases (GHGs), due to availability of these data when modeling CAP/HAP. EPA's [Inventory of U.S. Greenhouse Gas Emissions and Sinks](#) provides official data on national greenhouse gas emissions and sinks, including GHGs from the transportation sector. The US greenhouse gas inventory (GHGI) uses internationally accepted methods outlined in Intergovernmental Panel on Climate Change (IPCC) guidance and United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines to comprehensively estimate and report national GHG emissions from the U.S. transportation sector, including highway and nonroad mobile sources, using fuel consumption data from EIA's national-level energy statistics. Recently, the EPA has also used peer-reviewed methods to further downscale the national GHGI by state and provide state-level GHG estimates. These are further described in the methodology report underlying those estimates and are available on the [State GHG Emissions and Removals](#) page to the GHG Emissions Removals home page.

1.3 Where can I obtain the 2020 NEI data?

The 2020 NEI data are available in several different ways listed below. Data are available to the reporting agencies and EPA staff via the Emission Inventory System (EIS).

1.3.1 Emission Inventory System Gateway

The [EIS Gateway](#) is available to all EPA staff, EIS data submitters (i.e., the S/L/T air agency staff), Regional Planning Organization staff that support state, local and tribal agencies, and contractors working for the EPA on emissions related work. The EIS reports functions can be used to obtain raw input datasets and create summary files from these datasets as well as older versions of the NEI such as 2017, 2014, 2011, and 2008. The 2020 NEI *dataset* in the EIS is called "2020NEI". Note that if you run facility-, unit- or process-level reports in the EIS, you will get the 2020 NEI emissions, but the facility inventory, which is dynamic in the EIS, will reflect more current information. For example, if an Agency ID has been changed since the moment we ran the reports for the public

website (January 26, 2023), then that new Agency ID will be in the Facility Inventory or a Facility Configuration report in the EIS but not in the report on the public website nor the Facility Emissions Summary reports run on the “2020NEI” dataset in the EIS.

1.3.2 NEI main webpage

Next, data from the EIS are exported for public release on the [2020 NEI Data webpage](#). The 2020 NEI Data page includes the most recent **publicly**-available version of the 2020 NEI. The 2020 NEI webpage includes the 2020 NEI plan and schedules, all publicly-available supporting materials by inventory data category (e.g., point, nonroad mobile, onroad mobile, and nonpoint), and this TSD.

Two types of point data summaries are available on the 2020 NEI Data page, facility summaries and process-level summaries. The source classification codes (SCC) data files section of the webpage provides the process level summaries for all data categories. These detailed CSV files (provided in zip files) contain emissions at the process level. Due to their size, they are broken out into EPA regions. Facility-level by pollutant summaries are also available. These CSV files must be “linked” (as opposed to imported) to open them with Microsoft® Access®. County and tribe-level summaries for events are also provided.

With the final 2020 NEI release on March 31, 2023, the 2020 NEI Data page also includes a query tool that allows for summaries by EIS Sector or the more traditional Tier 1 summary level (for CAPs only) used in the [EPA Trends Report](#). Summaries from the 2020 NEI Data site include national-, state-, and county-level emissions for CAPs, HAPs and GHGs. You can also choose which states, EIS Sectors, Tiers, and pollutants to include in custom-generated reports to download Comma Separated Value (CSV) files to import into Microsoft® Excel®, Access®, or other spreadsheet or database tools. Biogenic emissions and tribal data (but not tribal onroad emissions) are also be available from this tool. Tribal summaries are also posted under the “Additional Summary Data” section of this page.

The 2020 NEI Documentation page includes links to the 2020 NEI TSD and supporting materials referenced in this TSD. This page is a working page, meaning that content is updated as new products are developed.

1.3.3 Modeling files

The modeling files, provided on the [Air Emissions Modeling website](#), are provided in formats that can be read by the [Sparse Matrix Operator Kernel Emissions](#) (SMOKE). These files are also CSV formats that can be read by other systems, such as databases. The modeling files provide the process-level emissions apportioned to release points, and the release parameters for the release points. Release parameters include stack height, stack exit diameter, exit temperature, exit velocity and flow rate. The EPA may make changes to the NEI modeling files prior to use. The 2020 modeling platform has not yet been developed, but would be based on the 2020 NEI if it is. Any changes between the NEI and modeling platform data would be described in an accompanying TSD for the 2020 Emissions Modeling Platform, which would also be posted at the above website.

The SMOKE flat files for the 2020 NEI are/will be posted on the [2020 NEI Flat Files FTP site](#).

1.4 Why is the NEI created?

The NEI is created to provide the EPA, federal, state, local and tribal decision makers, and the national and international public the best and most complete estimates of CAP and HAP emissions. While the EPA is not directly obligated to create the NEI, the Clean Air Act authorizes the EPA Administrator to implement data collection efforts needed to properly administer the NAAQS program. Therefore, the Office of Air Quality Planning and Standards (OAQPS) maintains the NEI program in support of the NAAQS. Furthermore, the Clean

Air Act requires States to submit emissions to the EPA as part of their State Implementation Plans (SIPs) that describe how they will attain the NAAQS. The NEI is used as a starting point for many SIP inventory development efforts and for states to obtain emissions from other states needed for their modeled attainment demonstrations.

While the NAAQS program is the basis on which the EPA collects CAP emissions from the S/L/T air agencies, it does not require collection of HAP emissions. For this reason, the HAP reporting requirements are voluntary. Nevertheless, the HAP emissions are an essential part of the NEI program. These emissions estimates allow EPA to assess progress in meeting HAP reduction goals described in the Clean Air Act amendments of 1990. These reductions seek to reduce the negative impacts to people of HAP emissions in the environment, and the NEI allows the EPA to assess how much emissions have been reduced since 1990.

1.5 How is the NEI created?

The [Air Emissions Reporting Rule](#) (AERR) is the regulation that requires state and local agencies to submit CAP emissions, and the Emissions Inventory System is the data system used to collect, QA, and compile those submittals as well as EPA augmentation data. Most S/L/T air agencies also provide voluntary submissions of HAP emissions. The 2008 NEI was the first inventory compiled using the AERR, rather than its predecessor, the Consolidated Emissions Reporting Rule (CERR). The 2020 NEI is the fifth AERR-based inventory, and improvements in the 2020 NEI process reflect lessons learned by the S/L/T air agencies and EPA from the prior NEI efforts. The AERR requires agencies to report all sources of emissions, except fires and biogenic sources. Reporting of open fire sources, such as wildfires, is encouraged, but not required. Sources are divided into large groups called “data categories”: stationary sources are “point” or “nonpoint” (county totals) and mobile sources are either onroad (cars and trucks driven on roads) or nonroad (locomotives, aircraft, marine, off-road vehicles and nonroad equipment such as lawn and garden equipment).

The AERR has emissions thresholds above which States must report stationary emissions as “point” sources, with the remainder of the stationary emissions reported as “nonpoint” sources.

The AERR changed the way these reporting thresholds work, as compared to the CERR, by changing these thresholds to “potential to emit” thresholds rather than actual emissions thresholds. In both the CERR and the AERR, the emissions that are reported are actual emissions, despite that the criteria for which sources to report is now based on potential emissions. The AERR requires emissions reporting for point sources every year, with additional requirements every third year in the form of lower point source emissions thresholds, and 2020 is one of these third-year inventories.

Table 1-1 provides the potential-to-emit reporting thresholds that applied for the 2020 NEI cycle. “Type B” is the terminology in the rule that represents the lower emissions thresholds required for point sources in the triennial years. The reporting thresholds are sources with potential to emit of 100 tons/year or more for most criteria pollutants, with the exceptions of CO (1000 tons/year), and, updated starting with the 2014 inventory, Pb (0.5 tons/year, actual emissions). As shown in the table, special requirements apply to nonattainment area (NAA) sources, where even lower thresholds apply. The relevant ozone (O₃), CO, and PM₁₀ nonattainment areas that applied during the year that the S/L/T agencies submitted their data for the 2020 NEI are available on the [Nonattainment Areas for Criteria Pollutants \(Green Book\) web site](#). Note that while the AERR establishes the minimum requirements for State and local air agencies to report their stationary sources as discrete point sources, many agencies have gone beyond those minimums for many years past, i.e., they report many smaller-emitting sources as discrete point sources.

Table 1-1: Point source reporting thresholds (potential to emit) for CAPs in the AERR

Pollutant	Triennial reporting thresholds ¹	
	Type B Sources	Thresholds within Nonattainment Areas
(1) SO ₂	≥100	≥100
(2) VOC	≥100	O ₃ (moderate) ≥ 100
		O ₃ (serious) ≥ 50
		O ₃ (severe) ≥ 25
		O ₃ (extreme) ≥ 10
(3) NO _x	≥100	≥100
(4) CO	≥1000	O ₃ (all areas) ≥ 100
		CO (all areas) ≥ 100
(5) Lead	≥0.5 (actual)	≥0.5 (actual)
(6) Primary PM ₁₀	≥100	PM ₁₀ (moderate) ≥100
		PM ₁₀ (serious) ≥70
(7) Primary PM _{2.5}	≥100	≥100
(8) NH ₃	≥100	≥100

¹Thresholds for point source determination shown in tons per year of potential to emit as defined in 40 CFR part 70, with the exception of lead.

Based on the AERR requirements, S/L/T air agencies submit emissions or model inputs of point, nonpoint, onroad mobile, nonroad mobile, and fires emissions sources. With the exception of California, reporting agencies were required to submit model inputs for onroad and nonroad mobile sources instead of emissions. For the 2020 NEI, all these emissions and inputs were required to be submitted to the EPA per the AERR by December 31, 2021 (with an extension given through January 15, 2022). Once the initial reporting NEI period closed, the EPA provided feedback on data quality such as suspected outliers and missing data by comparing to previously established emissions ranges and past inventories. In addition, the EPA augmented the S/L/T data using various sources of data and augmentation procedures. This documentation provides a detailed account of EPA’s quality assurance and augmentation methods.

1.6 Who are the target audiences for the 2020 NEI?

The comprehensive nature of the NEI allows for many uses and, therefore, its target audiences include EPA staff and policy makers, the U.S. public, other federal and S/L/T decision makers, and other countries. Table 1-2 lists the major current uses of the NEI and the plans for use of the 2020 NEI in those efforts. These uses include those by the EPA in support of the NAAQS, Air Toxics, and other programs as well as uses by other federal and regional agencies and for international needs. In addition to this list, the NEI is used to respond to Congressional inquiries, provide data that supports university research, and allow environmental groups to understand sources of air pollution.

Table 1-2: Examples of major current uses of the NEI

Audience	Purposes
U.S. Public	Learn about sources of air emissions
EPA – NAAQS	Regulatory Impact Analysis – benefits estimates using air quality modeling
	NAAQS Implementations, including State Implementation Plans (SIPs)
	Monitoring Rules
	Final NAAQS designations
	NAAQS Policy Assessments
	Integrated Science Assessments
	Transport Rule air quality modeling (e.g., Clean Air Interstate Rule, Cross-State Air Pollution Rule)
EPA – Air toxics	Air Toxics Screening Assessments
	Mercury and Air Toxics Standard – mercury risk assessment and Regulatory Impact Assessment
	National Monitoring Programs Annual Report
	Toxicity Weighted emission trends for the Government Performance and Reporting Act (GPRA)
	Residual Risk and Technology Review – starting point for inventory development
EPA – other	NEI Reports – analysis of emissions inventory data
	Report on the Environment
	Air Emissions website for providing graphical access to CAP emissions for state maps and Google Earth views of facility total emissions
	Department of Transportation, national transportation sector summaries of CAPs
	Black Carbon Report to Congress
Other federal or regional agencies	Modeling in support of Regional Haze SIPs and other air quality issues
International	United Nations Environment Programme (UNEP) – global and North American Assessments
	The Organization for Economic Co-operation and Development (OECD) - environmental data and indicators report
	UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) - emission reporting requirements, air quality modeling, and science assessments
	Community Emissions Data System (CEDs) - science network for earth system, climate, and atmospheric modeling
	Commission for Environmental Cooperation (CEC) - North American emissions inventory improvement and reduction policies
	U.S. and Canada Air Quality Reports
	Arctic Contaminants Action Program (ACAP) - national environmental and emission reduction strategy for the Arctic Region
Other outside parties	Researchers and graduate students

1.7 What are appropriate uses of the 2020 NEI and what are the caveats about the data?

As shown in the preceding section, the NEI provides a readily available comprehensive inventory of both CAP and HAP emissions to meet a variety of user needs. Although the accuracy of individual emissions estimates will vary from facility-to-facility or county-to-county, the NEI largely meets the needs of these users in the aggregate. Some NEI users may wish to evaluate and revise the emission estimates for specific pollutants from specific source types for either the entire U.S. or for smaller geographical areas to meet their needs. Regulatory uses of the NEI by the EPA, such as for interstate transport, always include a public review and comment period. Large-scale assessment uses, such as the NATA study, also provide review periods and can serve as an effective screening tool for identifying potential risks.

One of the primary goals of the NEI is to provide the best assessment of current emissions levels using the data, tools and methods currently available. For significant emissions sectors of key pollutants, the available data,

tools and methods typically evolve over time in response to identified deficiencies and the need to understand the costs and benefits of proposed emissions reductions. As these method improvements have been made, there have not been consistent efforts to revise previous NEI year estimates to use the same methods as the current year. Therefore, care must be taken when reviewing different NEI year publications as a time series with the goal of determining the trend or difference in emissions from year to year. An example of such a method change in the 2008 NEI v3 and 2011 NEI is the use of the [Motor Vehicle Emissions Simulator \(MOVES\) model](#) for the onroad data category. Previous NEI years had used the [Mobile Source Emission Factor Model, version 6 \(MOBILE6\)](#) and earlier versions of the MOBILE model for this data category. The 2011 NEI (2011v2) also used an older version of MOVES (2014) that has been updated again in the current 2020 NEI (MOVES3).

There are also updates and new sources of data in the nonpoint data category; these are discussed in detail in Section 6, “Nonpoint Overview”.

Users should take caution in using the emissions data for filterable and condensable components of particulate matter (PM10-FIL, PM2.5-FIL and PM-CON), which is not complete and should not be used at any aggregated level. These data are provided for users who wish to better understand the components of the primary PM species, where they are available, in the disaggregated, process-specific emissions reports. Where not reported by S/L/T agencies, the EPA augments these components, and discussed in the overview section (2) of this TSD. However, not all sources are covered by this routine, and in mobile source and fire models, only the primary particulate species are estimated. Thus, users interested in PM emissions should use the primary species of particulate matter (PM10-PRI and PM25-PRI), described in this document simply as PM10 and PM2.5.

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