2020 National Emissions Inventory Technical Support Document: Point Sources

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U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, NC

Contents

List of Tables

3 Point sources

A description of sources in the point data category and the approach used to build the 2020 National Emissions Inventory (NEI) for all point sources are discussed in this section. Point sources are included in the inventory as individual facilities, usually at specific latitude/longitude coordinates, rather than as county or tribal aggregates. These facilities include large energy and industrial sites, such as electric generating utilities (EGUs), portland cement manufacturing plants, petroleum refineries, natural gas compressor stations, and facilities that manufacture pulp and paper, automobiles, machinery, chemicals, fertilizers, pharmaceuticals, glass, food products, and other products. Additionally, smaller points sources are included voluntarily by some S/L/T agencies, and can include small facilities such as crematoria, dry cleaners, and gas stations. These smaller sources may appear as point sources in one state but not another due to the voluntary nature of providing smaller sources. There are also some portable sources in the point source data category, such as hot mix asphalt facilities, which relocate frequently as a road construction project progress. The point source data category also includes emissions from the landing and take-off portions of aircraft operations, the ground support equipment at airports, and locomotive emissions within railyards. Within a point source facility, emissions are estimated and reported for individual emission units and processes. Those emissions are associated with any number of stack and fugitive release points that each have parameters needed for atmospheric modeling exercises. Some changes to aircraft for the 2020 NEI are also discussed in Section 3.2, and revisions to rail yard estimates for 2020 are included in Section 3.3.

3.1 Point source approach: 2020

The general approach to building the NEI point source inventory is to use state/local/tribal (S/L/T)-submitted emissions, locations, and release point parameters wherever possible. Missing emissions values are gap-filled with EPA data where available. Quality assurance reviews of the emission values, locations, and release point modeling parameters are done by the EPA on the most significant emission sources.

3.1.1 QA review of S/L/T data

State/local/tribal agency submittals for the 2020 NEI point sources were accepted through January 15, 2022. We then compared facility-level pollutant sums appearing in the 2020 NEI S/L/T-submitted values to the 2017 NEI. The comparison included all facilities and pollutants, including any missing from the 2020 submittals (i.e., present in 2017 but not 2020) as well as any that were new in the 2020 submittals and all that were common to both years. The comparison table also showed the 2020 emission values from the 2020 Toxics Release Inventory (TRI). To create a more focused review and comparison table, we limited these results to include only cases where the 2020 S/L/T agency-submitted facility total was more than 50 percent different from the 2017 facility total and with an absolute mass value of the difference greater than a pollutant-specific threshold amount[1]. When a facility-pollutant combination was new in 2020 or appeared only in the 2017 NEI, we included those values only when they exceeded the absolute mass values greater than the pollutant-specific thresholds

[1] These thresholds are available on the 2014v1 Supplemental Data FTP site as file "2014_point_pollutant_thresholds_qa_flag1.xlsx"

because the percent differences were undefined. We provided[2] the resulting table of 1,550 records to S/L/T agencies for review on February 2, 2022.

New for the 2020 NEI reporting cycle, we built an on-line outlier check into EIS that mimicked the above described comparison table in terms of which facilities and pollutants were flagged. The on-line version is implemented by setting a minimum and a maximum emissions outlier value for most facilities. The on-line version will replace the off-line comparison table in future years.

State/local/tribal edits to address any emissions values were accepted in the Emissions Inventory System (EIS) until July 1, 2022. (Note that a preliminary draft v1 NEI point selection was run on April 8, 2022 and updated on May 6, 2022 for purposes of beginning an identification and review of high-risk air toxic facilities – see Section 3.1.1.1 below). The S/L/T agencies did not change most of the highlighted values. Where the comparisons were exceptionally suspect, the EPA contacted the agencies by phone or by email if no edits had been made to obtain confirmation of the reported values. For a small number of cases, neither confirmation nor edits were obtained, and the value was tagged to be excluded from selection for the NEI. In some but not all of these instances, a value from TRI or the CAMD data sets was available as a replacement. A second draft v2 NEI point selection was run August 3, 2022. This draft v2 added aircraft, rail yard and EPA's EGU estimates to the preliminary draft. Note that most of the EPA EGU estimates are not needed or used in the selections because the S/L/T datasets already contain emissions for those sources which are preferentially used over the EPA EGU estimates.

Similar to previous NEI years, we quality assured the latitude-longitude coordinates at the site level. A new EIS QA check had been implemented for the 2018 NEI point submittal cycle which eliminated the need for a separate post-submittal review of the release point coordinates. In previous NEI cycles, we had reviewed, verified, and locked (in EIS) approximately 9,900 site-level coordinates of the most significant emitting facilities. For the 2020 NEI coordinate review, we compared all other site coordinate pairs to the county boundaries for the FIPS county codes reported for those facilities. We then identified all facilities that met both of the following criteria: (1) more than 20 tons total criteria pollutant emissions or more than 10 pounds total hazardous air pollutants (HAPs) for 2020, and (2) the coordinates caused the location of the facility to be more than a half mile outside of its indicated county. For these facilities, we reviewed the location using Google Earth, edited the location as needed in EIS, and locked the location in EIS.

A new critical QA check was also implemented in EIS, beginning with the 2018 NEI point source submittals, that does not allow the reporting of facility and release point coordinates that differ by more than a facility-specific amount for either latitude or longitude. The tolerance amount was set at 0.003 for most facilities, but that tolerance was increased for facilities where the above review had confirmed that the individual release point coordinates were valid. Some smaller footprint facilities that had to be reviewed due to apparent violations also had the tolerance set lower as part of the above review. Any release points outside of their site-specific tolerance from their site coordinates were reviewed. The site coordinates were adjusted if needed and locked. Any out of tolerance release point coordinates were set to use the verified site coordinates until replaced by valid in-tolerance coordinates. All release points used for 2020 emissions are therefore within the facility-specific tolerance of their site coordinates.

[2] We emailed the Emission Inventory System data submitters the table and instructions on March 13, 2019.

3.1.1.1 *S/L/T Review of draft Hazardous Air Pollutants and Risks*

In addition to QA procedures mentioned above, we prepared a review of point source Hazardous Air Pollutant (HAP) emissions. The primary goal of this review is to quality assure emissions and release point parameters of HAPS in the NEI prior to modeling for the 2020 edition of AirToxScreen, which is EPA's publicly available screening assessment of outdoor HAP concentrations and cancer and non-cancer health risks associated with lifetime exposures. Using AERMOD, we modeled HAP emissions from point sources (not including railyards and airports) in a preliminary draft of the 2020NEI (EIS dataset 2020NEI_PrelimDraftV1, from May 6, 2022), used the same health benchmarks used for AirToxScreen, and incorporated draft 2020 census block cancer and non-cancer chronic risk results into the review files as an extra metric for the review of HAP emissions.

For commercial sterilizers, EPA estimated emissions of ethylene oxide using the same methodology used for the risk modeling for the forthcoming Risk and Technology Review (RTR) proposal to amend the NESHAP for Commercial Sterilizers. Although the draft 2020NEI commercial sterilizer ethylene oxide emissions provided for S/L/T review used the same methodology and much of the same information collected in the information collection requests for the rulemaking, the draft 2020 NEI emissions reflected year 2020 ethylene oxide use and emissions control equipment in use during calendar year 2020. Several commercial sterilizers have since installed and operated additional emissions control equipment after year 2020, which were not used to estimate emissions for the 2020 NEI. Because the ethylene oxide use and the emissions controls used to estimate emissions for 2020 NEI may be different from those used for the Commercial Sterilizer RTR proposal, there may be differences in emissions between the 2020 NEI and the input files used to model risk in the forthcoming Commercial Sterilizer RTR proposal.

Risk review was provided for S/L/T at three levels: facility-wide risk; facility-pollutant specific risk with emissions; and facility-process-release point specific risk with emissions. Change sheets were provided to S/L/T agencies showing emissions in the August 3, 2022 draft 2020 NEI (EIS dataset 2020NEI_DraftV2) and included facilities with: high draft 2020 risk, high 2017 risk and low 2020 risk, significant differences between S/L/T reported emissions and TRI emissions totals, S/L/T reported emissions totaling zero for pollutants with air releases in the TRI inventory, and cobalt emissions of at least 100 pounds. Change sheets included fields for revised emissions, revised release point locations, revised release point parameters, and fields for comments and rationale. For a few states, we provided additional risk review files based on 2018 AirToxScreen risks because we were not able to provide complete risk information based on the May 2022 draft 2020 inventory. Change sheets for additional facilities were prepared and provided to S/L/T agencies upon request. Separate change sheets were provided for Commercial Sterilizer ethylene oxide emissions that detailed emission calculation parameters and associated release point information. We provided these files to S/L/T agencies and EPA Regional contacts on August 31, 2022. We conducted a webinar for S/L/T agencies on September 7, 2022. Changes/comments were due back by October 27, 2022.

We received over 150 individual comments/change requests for commercial sterilizer ethylene oxide emissions and over 2,000 comments/changes for other point sources. We reviewed these changes and created two datasets for use in the 2020 NEI selection: 2020EPA_CS_EtO (for commmerical sterilizer ethylene oxide emissions) and 2020EPA_ATS_SLT (all other HAP emissions changes from the SLT review). Changes included both process level HAP emissions and release point coordinates and parameters. In response to comments, we also incorporated into EIS a few control path pollutant control efficiencies, a few process SCC assignments, and a few facility name changes. Additionally, we tagged out (removed) 476 process-level S/L/T emissions records having zero mass that prevented TRI inventory air releases from gap-filling the NEI. Chromium speciation profile assignments were updated for several facilities.

3.1.2 Sources of EPA data and selection hierarchy

Table 3-1 lists the datasets that we used to compile the 2020 NEI point inventory and the hierarchy used to choose which data value to use for the NEI when multiple data sets are available for the same emissions source (see Section 2.2 for more detail on the EIS selection process).

The EPA developed all datasets other than those containing S/L/T agency data and the dataset containing emissions from offshore oil and gas platforms in federal waters in the Gulf of Mexico. The primary purpose of the EPA datasets is to add or "gap fill" pollutants or sources not provided by S/L/T agencies, to resolve inconsistencies in S/L/T agency-reported pollutant submissions for particulate matter (PM) (Section 3.1.3) and to speciate S/L/T agency reported total chromium into hexavalent and trivalent forms (Section 3.1.4).

The hierarchy or "order" provided in the tables below defines which data are to be used for situations where multiple datasets provide emissions for the same pollutant and emissions process. The dataset with the lowest order number on the list is preferentially used over other datasets. The table includes the rationale for why each dataset was assigned its position in the hierarchy. In addition to the order of the datasets, the selection also considers whether individual data values have been tagged (see Section 2.2.6). Any data that were tagged by the EPA in any of the datasets were not used. State/local/tribal agency data were tagged only if they were deemed to be likely outliers and were not addressed during the S/L/T agency data reviews, or if they were reported as zero emissions which would prevent the use of TRI-reported values. As in earlier NEI years, the 2020 point source selection also excludes dioxins, furans and radionuclides. The EPA has not evaluated the completeness or accuracy of the S/L/T agency dioxin and furan values nor radionuclides and does not have plans to supplement these reported emissions with other data sources to compile a complete and accurate estimate for these pollutants as part of the NEI. The 2020 NEI point source inventory does include greenhouse gas emissions. Facility total values for four GHGs (CO2, CH4, N2O, and SF6) were copied from the U.S. Greenhouse Gas Inventory Report website and matched to EIS facilities wherever possible. The GHG emissions reported there were converted from units of CO2-equivalent global-warming mass to actual mass. Any S/L/T reports for these for GHGs were also used in the 2020 NEI, but only if that EIS facility did not have that pollutant from the 2020EPA_GHG dataset, based on the selection order. S/L/T reported CO2 values of over 25,000 tons for facilities without any value from the 2020EPA_GHG dataset were reviewed, and several were tagged out as likely errors.

Table 3-1: Data sets and selection hierarchy used for 2020 NEI

Dataset name	Description and Rationale for the Order of the Selected Datasets	Order
2020EPA_GHG	Facility-level emissions for four specific GHGs from the USEPA's Greenhouse Gas Reporting Program	1
2020EPA_CS_EtO	Facility-level emissions of ethylene oxide emissions at 100 commercial sterilizer facilities, post S/L/T Review of HAPs. See Section 3.1.1.1.	2
2020EPA_ATS_SLT	Process-level emissions for facilities other than commercial sterilizers, amended via the S/L/T Review of HAPs. See Section 3.1.1.1	3

Dataset name	Description and Rationale for the Order of the Selected Datasets	Order
Responsible Agency Data Set	S/L/T agency submitted data through January 2023. These data are selected ahead of lower hierarchy datasets except where individual values in the S/L/T agency emissions were suspected outliers that were not addressed during the draft review and therefore tagged by the EPA.	4
2020EPA_CrAug	Hexavalent and trivalent chromium speciated from S/L/T agency reported chromium. The EIS augmentation function creates this dataset by applying multiplication factors largely by SCC but also by specific facility or process IDs to the S/L/T agency reported total chromium. See Section 3.1.4.	5
2020EPA_PMaug	PM components added to gap fill missing S/L/T agency data or make corrections where S/L/T agency have inconsistent emissions across PM components. Uses ratios of emission factors from the PM Augmentation Tool for covered source classification codes (SCCs). For SCCs without emission factors in the tool, checks/corrects discrepancies or missing PM species using basic relationships such as ensuring that primary PM is greater than or equal to filterable PM (see Section 3.1.3).	6
2020EPA_EGU	CAP and HAP emission unit level emissions from either the annual sum of CAMD hourly CEM data for SO2 and NOx or from emission factors used in previous NEI year inventories from AP-42 and other sources multiplied by 2020 CAMD heat input data.	7
2020EPA_TRI	TRI data for the year 2020 (see Section 3.1.5). These data are selected for a facility only when the S/L/T agency data do not include emissions for a given pollutant at any process for that facility.	8
2020EPA_TRIcr	TRI data reported as total chromium for the year 2020 speciated into the chromium III and chromium VI valence amounts, usually by use of a NAICs-based speciation profile, but possibly by use of a facility-specific profile.	9
2020EPA_LF	Landfill emissions developed by EPA using methane data from the EPA's GHG reporting rule program.	10
2020EPA_HAPAug	HAP data computed from S/L/T agency criteria pollutant data using HAP/CAP EF ratios based on the EPA Factor Information Retrieval System (WebFIRE) database as described in Section 3.1.6. These data are selected below the TRI data because the TRI data are expected to be better.	11
2020EPA_HAPAug-PMAug	This dataset was created in the same fashion as the 2020EPA_HAPAug dataset above and is a supplement to it. This dataset contains HAPs calculated by applying a ratio to PM10-FIL emissions, for those instances where the S/L/T dataset did not contain any PM10-FIL emissions, but the PM augmentation routine was able to calculate a PM10-FIL value from some PM species that was reported by the S/L/T.	12
2020EPA_Airports	CAP and HAP emissions for aircraft operations including commercial, general aviation, air taxis and military aircraft, auxiliary power units and ground support equipment computed by the EPA for approximately 20,000 airports. Methods include the use of the Federal Aviation Administration's (FAA's) Aviation Environmental Design Tool (AEDT) (see Section 3.2).	13

Dataset name	Description and Rationale for the Order of the Selected Datasets	Order
2020EPA_Rail	2020 estimates compiled by the EPA, with guidance from Eastern Regional Technical Advisory Committee (ERTAC), for most rail yards in the US. Yard emissions are associated with the operation of switcher engines at each yard (See Section 3.3).	14
2020EPA_Rail_HAPAug	This dataset was created in the same fashion as the 2020EPA_HAPAug dataset above and is a supplement to it. This dataset contains HAPs calculated by applying a ratio to PM10-FIL emissions, for those instances where the 2020EPA_Rail dataset did not contain all expected HAP VOCs and HAP Metals.	15
2017EPA_BOEM	2017 Gulfwide Emission Inventory CAP emissions from Offshore oil platforms located in Federal Waters in the Gulf of Mexico developed by the U.S. Department of the Interior, Bureau of Ocean and Energy Management (BOEM), Regulation, and Enforcement in the National Inventory Input Format and converted to the CERS format by the EPA. The state code for data from the data set is "DM" (Federal Waters).	16

3.1.3 Particulate matter augmentation

Particulate matter emissions components[3] in the NEI are primary PM10 (pollutant code PM10-PRI in the EIS and NEI) and primary PM2.5 (PM25-PRI), filterable PM10 (PM10-FIL) and filterable PM2.5 (PM25-FIL), and condensable PM (PM-CON). The NEI in its final form needs the full suite of all five of these components, but S/L/T agencies do not always report all five. EPA therefore augments the reported components to fill the missing components. In the simplest cases reported PM-CON can simply be added to reported PM10-FIL or reported PM25-FIL to determine PM10-PRI or PM25-PRI, or reported PM-CON can be subtracted from reported primary components to determine the corresponding filterable components. However, if PM-CON is not reported, or one of the size cuts is not reported, some assumptions must be made to estimate the missing components.

Beginning with the 1999 NEI EPA used the "PM Calculator" as described in an NEI conference paper [ref 2] to estimate these missing components. The PM Calculator relied on ratios of emission factors and size distribution charts from AP-42 for various SCCs and control devices to provide look-up tables of multipliers to apply to the reported PM components to estimate the unreported components. Additional information on the procedure is provided in the 2008 NEI PM augmentation documentation [ref 1]. For the 2020 NEI, EPA replaced the external PM Calculator tool with a PM Augmentation software module built into EIS. Several things had changed in the years since the PM Calculator had been developed which resulted in some changes to how the PM augmentation was done within EIS. A significant difference was that EIS had added QA checks which insured that the S/L/T reported PM components were consistent with each other. The external PM Calculator software was designed to include that check and could make overwrites to S/L/T-reported values where needed. The internal EIS augmentation starts with the premise that the S/L/T reported values do not have to be overwritten because they have already passed EIS QA checks for consistency. The internal EIS augmentation then uses simple additions or subtractions to fill in missing components wherever possible, which is a large portion of the

[3] We use the term "components" here rather than "species" to avoid confusion with the PM2.5 "species" that are used for air quality modeling (e.g., organic carbon, elemental carbon, sulfate, nitrate, and other PM).

augmentation need. Only for the cases where the combination of reported components does not allow for the simple unambiguous calculation of missing components are any assumed ratios used.

The ratios used in the PM calculator were based on SCCs and up to two control device codes. Both the SCC code table and the control device code tables were revised after the PM Calculator ratio tables were built, and EIS has no limit on the number of control devices that can be reported. For these reasons a new set of ratios between PM components were built for the EIS augmentation. These ratios are based only on SCCs, not at all on control device codes. They were developed by calculating the ratios of the national totals of the five PM components for each SCC as seen in the 2017 NEI, for both point and nonpoint SCCs. The 2017 NEI was complete for all five PM components for all processes and SCCs, reflecting both S/L/T reported mass and any PM Calculator generated fill-in mass. The calculated ratios therefore represent the weighted average of all mass in the 2017 NEI for each SCC. For each of the 32 different possible combinations of PM components that can be reported, the EIS augmentation has a defined sequence of order of which missing component to calculate, and how, including the use of the SCC-based ratios if needed.

For point sources in the 2020 NEI drafts, we noted some negative values had been calculated for PM10-FIL and PM25-FIL. Most were slightly negative, but a few were more than a few tons of PM. The slightly negative values are likely because the EIS QA check on the consistency of the S/L/T reported components has a tolerance value included of 1 ton. The larger negative values (all PM25-FIL) are because missing PM-CON is estimated by a ratio applied to reported PM10-PRI. Where the S/L/T reported PM25-PRI is smaller than the typical values used to derive the ratios, the estimated PM-CON may be more than the reported PM25-PRI. For the 2020 Point data category, we set these negative values to 0. For future NEIs we plan to evaluate changes to that calculation sequence and also a tightening of the tolerance amount used in the incoming QA check. All PM augmentation factors (point and nonpoint) used in the 2020 NEI are available in the file "PMAugmentation_28jan2023.zip" on the 2020 Supplemental data FTP site.

3.1.4 Chromium speciation

An overview of chromium speciation, as it impacts both the point and nonpoint data category, is discussed in Section 2.2.2.

The EIS generates and stores an EPA dataset containing the resultant hexavalent and trivalent chromium species. The EPA then used this dataset in the 2020 NEI selection by adding it to the selection hierarchy shown in Table 3-1, excluding the S/L/T agency total chromium from the selection through a pollutant exception to the hierarchy. This EIS feature does not speciate chromium from any of the EPA datasets because the EPA data contains only speciated chromium.

For the 2020 NEI, the EPA named this dataset "2020EPA_CrAug." Most of the speciation factors used in the 2020 NEI are SCC-based and are the same as were used for the 2008, 2011, 2014, and 2017 NEIs. There are some facility-specific factors resulting from reviews of the 2017, 2014 and 2011) National Air Toxics Assessment (NATA) data. Facility-specific factors were also provided for several facilities by the state of Indiana. The factors "Chromium_speciation_nonNAICS_28jan2023.zip", based on data that have long been used by the EPA for NATA and other risk projects, are available on the 2020 Supplemental data FTP site.

3.1.5 Use of the 2020 Toxics Release Inventory

The EPA used air emissions data from the 2020 TRI to supplement point source HAP and ammonia emissions provided to the EPA by S/L/T agencies. The resulting augmentation dataset is labeled as "2020EPA_TRI" in the Table 3-1 selection hierarchy shown above. For 2020, all TRI emissions values that could reasonably be matched to an EIS facility were loaded into the EIS for viewing and comparison if desired, but only those pollutants that were not reported anywhere at the EIS facility by the S/L/T agency were included in the 2020 NEI. The "Basic" TRI data set for 2020 from https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools was downloaded on February 8, 2022. This dataset reflected updates submitted to the TRI program through October 13, 2021.

The basis of the 2020EPA_TRI dataset is the US EPA's 2020 Toxics Release Inventory (TRI) Program. The TRI is an EPA database containing data on disposal or other releases including air emissions of over 650 toxic chemicals from approximately 21,000 facilities. One of TRI's primary purposes is to inform communities about toxic chemical releases to the environment. Data are submitted annually by U.S. facilities that meet TRI reporting criteria.

The approach used for the 2020 NEI was like that used for the 2017 NEI and 2014 NEI. The TRI emissions were included in the EIS (and the NEI) as facility-total stack and facility-total fugitive emissions processes, which matches the aggregation detail of the TRI database. The 2020 NEI retained the same procedures as had been introduced for the 2017 NEI in how we avoid double-counting of TRI and other data sources (primarily the S/L/T data). Rather than tagging each individual TRI facility-based value wherever the S/L/T had reported that pollutant at any process(es) within the same facility, we enhanced the EIS selection software to not use values from a "Facility" level dataset if a more preferred dataset (the S/L/T datasets) had the pollutant at any process within that facility (see Section 2.2.6). In addition to using this new "facility-based rule" in the selection software, we also implemented a new "pollutant family rule" into the selection software, which prevents pollutants defined as belonging to the same overlapping family of pollutants from being selected for use if a higher preference dataset has already provided a pollutant value for that family. This procedure had also been accomplished using tagging in previous NEI years.

The following steps describe in more detail the development of the 2020EPA_TRI dataset.

1. **Update the TRI_ID to EIS_ID facility-level crosswalk**
   For the 2020 NEI, the same crosswalk list of TRI Facility IDs that had been used for the 2017 NEI and added to for the 2018 and 2019 point source inventories was used as a starting point. A limited review of the 2020 TRI facilities was conducted to identify new facilities with significant emissions that had not been previously matched to an EIS facility. A total of 14 additional TRI facilities were added to the crosswalk for 2020.
2. **Map TRI pollutant codes to valid EIS pollutant codes and sum where necessary**
   Table 3-2 provides the pollutant mapping from TRI pollutants to EIS pollutants. Many of the 650 TRI pollutants do not have any EIS counterpart, and so are not shown in Table 3-2. In addition, several EIS pollutants may be reported to TRI as either of two TRI pollutants. For example, both Pb and Pb compounds may be reported to TRI, and similarly for several other metal and metal compound TRI pollutants. For the 2020 NEI we mapped TRI Hydrogen Cyanide and TRI Cyanide Compounds to their two corresponding separate EIS pollutant codes (74908 and 57125, respectively) rather than mapping both

TRI pollutants to EIS code 57125 as had been done in prior NEI years. For 2020 the EIS selection rule for related overlapping families of pollutants will prevent the selection of potentially overlapping mass from the TRI and a S/L/T dataset if the two datasets labeled the same cyanide mass with different pollutant IDs. For the 2020 NEI we added 21 PFAS compounds to the mapping list that had been added to the TRI list. These compounds are not CAA HAPs. Small amounts of five of these compounds were reported to TRI for 2020, and these were included in the 2020EPA_TRI dataset used for the 2020 NEI.
Table 3-2 shows where such pairs of TRI pollutants both correspond to the same EIS pollutant. In such cases, we summed the two TRI pollutants together as part of the step of assigning the TRI emissions to valid EIS pollutant codes. For the 2020 NEI, a total of 219 TRI pollutant codes were mapped to 208 unique EIS pollutant codes. Similar to the 2011 through 2017 NEIs, we did not use TRI emissions reported for TRI pollutants: "Certain Glycol Ethers," "Dioxin and Dioxin-like Compounds," Dichlorobenzene (mixed isomers)," and "Toluene di-isocyanate (mixed isomers)," because they do not represent the same scope as the EIS pollutants: "Glycol ethers," "Dioxins/Furans as 2,3,7,8-TCDD TEQs," "1,4-Dichlorobenzene," and "2,4-Di-isocyanate," respectively. We maintained TRI stack and fugitive emissions separately during the summation step and maintained that separation through the storage of the TRI emissions in the EIS.

Table 3-2: Mapping of TRI pollutant codes to EIS pollutant codes

TRI CAS	TRI Pollutant Name	EIS Pollutant Code	EIS Pollutant Name
79345	1,1,2,2-TETRACHLOROETHANE	79345	1,1,2,2-TETRACHLOROETHANE
79005	1,1,2-TRICHLOROETHANE	79005	1,1,2-TRICHLOROETHANE
57147	1,1-DIMETHYL HYDRAZINE	57147	1,1-DIMETHYL HYDRAZINE
120821	1,2,4-TRICHLOROBENZENE	120821	1,2,4-TRICHLOROBENZENE
96128	1,2-DIBROMO-3-CHLOROPROPANE	96128	1,2-DIBROMO-3-CHLOROPROPANE
57147	1,1-DIMETHYL HYDRAZINE	57147	1,1-Dimethyl Hydrazine
106887	1,2-BUTYLENE OXIDE	106887	1,2-EPOXYBUTANE
75558	PROPYLENEIMINE	75558	1,2-PROPYLENIMINE
106990	1,3-BUTADIENE	106990	1,3-BUTADIENE
542756	1,3-DICHLOROPROPYLENE	542756	1,3-DICHLOROPROPENE
1120714	PROPANE SULTONE	1120714	1,3-PROPANESULTONE
106467	1,4-DICHLOROBENZENE	106467	1,4-DICHLOROBENZENE
25321226	DICHLOROBENZENE (MIXED ISOMERS)		NA- pollutant not used
95954	2,4,5-TRICHLOROPHENOL	95954	2,4,5-TRICHLOROPHENOL
88062	2,4,6-TRICHLOROPHENOL	88062	2,4,6-TRICHLOROPHENOL
94757	2,4-DICHLOROPHENOXY ACETIC ACID	94757	2,4-DICHLOROPHENOXY ACETIC ACID
51285	2,4-DINITROPHENOL	51285	2,4-DINITROPHENOL
121142	2,4-DINITROTOLUENE	121142	2,4-DINITROTOLUENE
53963	2-ACETYLAMINOFLUORENE	53963	2-ACETYLAMINOFLUORENE
79469	2-NITROPROPANE	79469	2-NITROPROPANE
91941	3,3'-DICHLOROBENZIDINE	91941	3,3'- DICHLOROBENZIDINE
119904	3,3'-DIMETHOXYBENZIDINE	119904	3,3'- DIMETHOXYBENZIDINE
119937	3,3'-DIMETHYLBENZIDINE	119937	3,3'-DIMETHYLBENZIDINE
101144	4,4'-METHYLENEBIS(2-CHLOROANILINE)	101144	4,4'-METHYLENEBIS(2-CHLORANILINE)
101779	4,4'-METHYLENEDIANILINE	101779	4,4'-METHYLENEDIANILINE
534521	4,6-DINITRO-O-CRESOL	534521	4,6-DINITRO-O-CRESOL
92671	4-AMINOBIPHENYL	92671	4-AMINOBIPHENYL
60117	4-DIMETHYLAMINOAZOBENZENE	60117	4-DIMETHYLAMINOAZOBENZENE
100027	4-NITROPHENOL	100027	4-NITROPHENOL
75070	ACETALDEHYDE	75070	ACETALDEHYDE
60355	ACETAMIDE	60355	ACETAMIDE
75058	ACETONITRILE	75058	ACETONITRILE
98862	ACETOPHENONE	98862	ACETOPHENONE
107028	ACROLEIN	107028	ACROLEIN

TRI CAS	TRI Pollutant Name	EIS Pollutant Code	EIS Pollutant Name
79061	ACRYLAMIDE	79061	ACRYLAMIDE
79107	ACRYLIC ACID	79107	ACRYLIC ACID
107131	ACRYLONITRILE	107131	ACRYLONITRILE
107051	ALLYL CHLORIDE	107051	ALLYL CHLORIDE
7664417	AMMONIA	NH3	AMMONIA
62533	ANILINE	62533	ANILINE
7440360	ANTIMONY	7440360	ANTIMONY
N010	ANTIMONY COMPOUNDS	7440360	ANTIMONY
7440382	ARSENIC	7440382	ARSENIC
N020	ARSENIC COMPOUNDS	7440382	ARSENIC
1332214	ASBESTOS (FRIABLE)	1332214	ASBESTOS
71432	BENZENE	71432	BENZENE
92875	BENZIDINE	92875	BENZIDINE
98077	BENZOIC TRICHLORIDE	98077	BENZOTRICHLORIDE
100447	BENZYL CHLORIDE	100447	BENZYL CHLORIDE
7440417	BERYLLIUM	7440417	BERYLLIUM
N050	BERYLLIUM COMPOUNDS	7440417	BERYLLIUM
92524	BIPHENYL	92524	BIPHENYL
117817	DI(2-ETHYLHEXYL) PHTHALATE	117817	BIS(2-ETHYLHEXYL)PHTHALATE
542881	BIS(CHLOROMETHYL) ETHER	542881	BIS(CHLOROMETHYL)ETHER
75252	BROMOFORM	75252	BROMOFORM
7440439	CADMIUM	7440439	CADMIUM
N078	CADMIUM COMPOUNDS	7440439	CADMIUM
156627	CALCIUM CYANAMIDE	156627	CALCIUM CYANAMIDE
133062	CAPTAN	133062	CAPTAN
63252	CARBARYL	63252	CARBARYL
75150	CARBON DISULFIDE	75150	CARBON DISULFIDE
56235	CARBON TETRACHLORIDE	56235	CARBON TETRACHLORIDE
463581	CARBONYL SULFIDE	463581	CARBONYL SULFIDE
120809	CATECHOL	120809	CATECHOL
57749	CHLORDANE	57749	CHLORDANE
7782505	CHLORINE	7782505	CHLORINE
79118	CHLOROACETIC ACID	79118	CHLOROACETIC ACID
108907	CHLOROBENZENE	108907	CHLOROBENZENE
510156	CHLOROBENZILATE	510156	CHLOROBENZILATE
67663	CHLOROFORM	67663	CHLOROFORM
107302	CHLOROMETHYL METHYL ETHER	107302	CHLOROMETHYL METHYL ETHER
126998	CHLOROPRENE	126998	CHLOROPRENE
7440473	CHROMIUM	7440473	CHROMIUM
N090	CHROMIUM COMPOUNDS (EXCEPT CHROMITE ORE MINED IN THE TRANSVAAL REGION)	7440473	CHROMIUM
7440484	COBALT	7440484	COBALT
N096	COBALT COMPOUNDS	7440484	COBALT
1319773	CRESOL (MIXED ISOMERS)	1319773	CRESOL/CRESYLIC ACID (MIXED ISOMERS)
108394	M-CRESOL	108394	M-CRESOL
95487	O-CRESOL	95487	O-CRESOL
106445	P-CRESOL	106445	P-CRESOL
98828	CUMENE	98828	CUMENE
N106	CYANIDE COMPOUNDS	57125	CYANIDE
74908	HYDROGEN CYANIDE	74908	HYDROGEN CYANIDE
132649	DIBENZOFURAN	132649	DIBENZOFURAN
84742	DIBUTYL PHTHALATE	84742	DIBUTYL PHTHALATE
111444	BIS(2-CHLOROETHYL) ETHER	111444	DICHLOROETHYL ETHER
62737	DICHLORVOS	62737	DICHLORVOS
111422	DIETHANOLAMINE	111422	DIETHANOLAMINE
64675	DIETHYL SULFATE	64675	DIETHYL SULFATE
131113	DIMETHYL PHTHALATE	131113	DIMETHYL PHTHALATE
77781	DIMETHYL SULFATE	77781	DIMETHYL SULFATE

TRI CAS	TRI Pollutant Name	EIS Pollutant Code	EIS Pollutant Name
79447	DIMETHYLCARBAMYL CHLORIDE	79447	DIMETHYLCARBAMOYL CHLORIDE
N120	DIISOCYANATES		NA- pollutant not used
26471625	TOLUENE DIISOCYANATE (MIXED ISOMERS)		NA- pollutant not used
584849	TOLUENE-2,4-DIISOCYANATE	584849	2,4-TOLUENE DIISOCYANATE
N150	DIOXIN AND DIOXIN-LIKE COMPOUNDS		NA- pollutant not used
106898	EPICHLOROHYDRIN	106898	EPICHLOROHYDRIN
140885	ETHYL ACRYLATE	140885	ETHYL ACRYLATE
51796	URETHANE	51796	ETHYL CARBAMATE
75003	CHLOROETHANE	75003	ETHYL CHLORIDE
100414	ETHYLBENZENE	100414	ETHYL BENZENE
106934	1,2-DIBROMOETHANE	106934	ETHYLENE DIBROMIDE
107062	1,2-DICHLOROETHANE	107062	ETHYLENE DICHLORIDE
107211	ETHYLENE GLYCOL	107211	ETHYLENE GLYCOL
151564	ETHYLENEIMINE	151564	ETHYLENEIMINE
75218	ETHYLENE OXIDE	75218	ETHYLENE OXIDE
96457	ETHYLENE THIOUREA	96457	ETHYLENE THIOUREA
75343	ETHYLIDENE DICHLORIDE	75343	ETHYLIDENE DICHLORIDE
50000	FORMALDEHYDE	50000	FORMALDEHYDE
N230	CERTAIN GLYCOL ETHERS		N/A Pollutant not used
76448	HEPTACHLOR	76448	HEPTACHLOR
118741	HEXACHLOROBENZENE	118741	HEXACHLOROBENZENE
87683	HEXACHLORO-1,3-BUTADIENE	87683	HEXACHLOROBUTADIENE
77474	HEXACHLOROCYCLOPENTADIENE	77474	HEXACHLOROCYCLOPENTADIENE
67721	HEXACHLOROETHANE	67721	HEXACHLOROETHANE
110543	N-HEXANE	110543	HEXANE
302012	HYDRAZINE	302012	HYDRAZINE
7647010	HYDROCHLORIC ACID (1995 AND AFTER “ACID AEROSOLS” ONLY)	7647010	HYDROCHLORIC ACID
7664393	HYDROGEN FLUORIDE	7664393	HYDROGEN FLUORIDE
123319	HYDROQUINONE	123319	HYDROQUINONE
7439921	LEAD	7439921	LEAD
N420	LEAD COMPOUNDS	7439921	LEAD
58899	LINDANE	58899	1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE
108316	MALEIC ANHYDRIDE	108316	MALEIC ANHYDRIDE
7439965	MANGANESE	7439965	MANGANESE
N450	MANGANESE COMPOUNDS	7439965	MANGANESE
7439976	MERCURY	7439976	MERCURY
N458	MERCURY COMPOUNDS	7439976	MERCURY
67561	METHANOL	67561	METHANOL
72435	METHOXYCHLOR	72435	METHOXYCHLOR
74839	BROMOMETHANE	74839	METHYL BROMIDE
74873	CHLOROMETHANE	74873	METHYL CHLORIDE
71556	1,1,1-TRICHLOROETHANE	71556	METHYL CHLOROFORM
74884	METHYL IODIDE	74884	METHYL IODIDE
108101	METHYL ISOBUTYL KETONE	108101	METHYL ISOBUTYL KETONE
624839	METHYL ISOCYANATE	624839	METHYL ISOCYANATE
80626	METHYL METHACRYLATE	80626	METHYL METHACRYLATE
1634044	METHYL TERT-BUTYL ETHER	1634044	METHYL TERT-BUTYL ETHER
75092	DICHLOROMETHANE	75092	METHYLENE CHLORIDE
60344	METHYL HYDRAZINE	60344	METHYLHYDRAZINE
121697	N,N-DIMETHYLANILINE	121697	N,N-DIMETHYLANILINE
68122	N,N-DIMETHYLFORMAMIDE	68122	N,N-DIMETHYLFORMAMIDE
91203	NAPHTHALENE	91203	NAPHTHALENE
7440020	NICKEL	7440020	NICKEL
N495	NICKEL COMPOUNDS	7440020	NICKEL
98953	NITROBENZENE	98953	NITROBENZENE
684935	N-NITROSO-N-METHYLUREA	684935	N-NITROSO-N-METHYLUREA
90040	O-ANISIDINE	90040	O-ANISIDINE
95534	O-TOLUIDINE	95534	O-TOLUIDINE

TRI CAS	TRI Pollutant Name	EIS Pollutant Code	EIS Pollutant Name
123911	1,4-DIOXANE	123911	P-DIOXANE
56382	PARATHION	56382	PARATHION
82688	QUINTOZENE	82688	PENTACHLORONITROBENZENE
87865	PENTACHLOROPHENOL	87865	PENTACHLOROPHENOL
108952	PHENOL	108952	PHENOL
75445	PHOSGENE	75445	PHOSGENE
7803512	PHOSPHINE	7803512	PHOSPHINE
7723140	PHOSPHORUS (YELLOW OR WHITE)	7723140	PHOSPHORUS
85449	PHTHALIC ANHYDRIDE	85449	PHTHALIC ANHYDRIDE
1336363	POLYCHLORINATED BIPHENYLS	1336363	POLYCHLORINATED BIPHENYLS
120127	ANTHRACENE	120127	ANTHRACENE
191242	BENZO(G,H,I)PERYLENE	191242	BENZO[G,H,I,]PERYLENE
85018	PHENANTHRENE	85018	PHENANTHRENE
N590	POLYCYCLIC AROMATIC COMPOUNDS	N590	POLYCYCLIC AROMATIC COMPOUNDS (Incl 25)
106503	P-PHENYLENEDIAMINE	106503	P-PHENYLENEDIAMINE
123386	PROPIONALDEHYDE	123386	PROPIONALDEHYDE
114261	PROPOXUR	114261	PROPOXUR
78875	1,2-DICHLOROPROPANE	78875	PROPYLENE DICHLORIDE
75569	PROPYLENE OXIDE	75569	PROPYLENE OXIDE
91225	QUINOLINE	91225	QUINOLINE
106514	QUINONE	106514	QUINONE
7782492	SELENIUM	7782492	SELENIUM
N725	SELENIUM COMPOUNDS	7782492	SELENIUM
100425	STYRENE	100425	STYRENE
96093	STYRENE OXIDE	96093	STYRENE OXIDE
127184	TETRACHLOROETHYLENE	127184	TETRACHLOROETHYLENE
7550450	TITANIUM TETRACHLORIDE	7550450	TITANIUM TETRACHLORIDE
108883	TOLUENE	108883	TOLUENE
95807	2,4-DIAMINOTOLUENE	95807	TOLUENE-2,4-DIAMINE
8001352	TOXAPHENE	8001352	TOXAPHENE
79016	TRICHLOROETHYLENE	79016	TRICHLOROETHYLENE
121448	TRIETHYLAMINE	121448	TRIETHYLAMINE
1582098	TRIFLURALIN	1582098	TRIFLURALIN
108054	VINYL ACETATE	108054	VINYL ACETATE
75014	VINYL CHLORIDE	75014	VINYL CHLORIDE
75354	VINYLIDENE CHLORIDE	75354	VINYLIDENE CHLORIDE
108383	M-XYLENE	108383	M-XYLENE
95476	O-XYLENE	95476	O-XYLENE
106423	P-XYLENE	106423	P-XYLENE
1330207	XYLENE (MIXED ISOMERS)	1330207	XYLENES (MIXED ISOMERS)

3. **Split TRI total chromium emissions into hexavalent and trivalent emissions**

   The TRI allows facilities to report either “Chromium” or “Chromium compounds,” but not the hexavalent or trivalent chromium species that are needed for the NEI (see Section 3.1.4). Because the only characterization available for the TRI facilities or their emissions is the facilities’ NAICS codes, we created a NAICS-based set of fractions to split the TRI-reported total chromium emissions into the hexavalent and trivalent chromium species. For the 2020 NEI we used the same set of NAICS-based chromium split factors as was used for the 2017 NEI. For the 2017 NEI, a table of Standard Industrial Classification (SIC)-based chromium split fractions that was available from earlier year NEI usage of TRI databases had been revised to a NAICS-based set of chromium split fractions by re-assignments to closely matching NAICS description.

   Unfortunately, not all SIC-based fractions could be assigned this way, so we computed NAICS-based split fractions for any NAICS codes in the 2017 TRI data that did not already have an SIC-to-NAICS assigned split fraction. These factors were used for the remaining TRI-reported chromium. To calculate the NAICS-based factors, we summed by NAICS the total amounts of chromium III and chromium VI for the entire U.S. in the 2014 draft NEI data. These 2014 NEI S/L/T emissions were either reported directly by the S/L/T agencies as chromium III and chromium VI, or they had been split from S/L/T agency-reported total chromium by the EPA using the procedures described in Section 3.1.4. Those procedures largely rely on either SCC-based or Regulatory code-based split factors. The derived NAICS split factors, therefore, represent a weighted average of the SCC and Regulatory code-based split factors, weighted according to the mass of each chromium valence in the 2014 NEI for that NAICS.

After all TRI facilities with chromium had been assigned a NAICS-based split factor, the factors were applied separately to both the TRI stack and fugitive total chromium emissions. This resulted in speciated chromium emissions for each facility's stack and fugitive emissions that were included in the EIS as part of the 2020EPA_TRI dataset.

Similar to the S/L/T chromium speciation dataset, the TRI chromium speciation dataset includes some facility-specific values resulting from the 2011, 2014 and 2017 NATA reviews or provided by S/L/T for use in the 2017 NEI. The TRI-chromium speciation dataset "Chromium_speciation_NAICS_28jan2023.zip" is available on the 2020 Supplemental data FTP site.

4. **Write the 2020 TRI emissions to EIS Process IDs with stack and fugitive release points**
   The total facility stack and total facility fugitive emissions values from the above steps were written to a set of EIS process IDs created to reflect those facility total type emissions. In most cases, the EIS process IDs for a given facility already existed in EIS as a result of earlier NEI.

5. **Revise SCCs on the EIS Processes used for the TRI emissions**
   The 2002 and 2005 NEIs had assigned all the TRI emissions to a default process code SCC of 39999999, which caused a large amount of HAP emissions to be summed to a misleading "miscellaneous" sector. The 2008 NEI approach reduced this problem somewhat because it apportioned all TRI emissions to the multiple processes and SCCs that were used by the S/L/T agencies to report their emissions, but this apportioning created other distortions. The 2011 NEI reverted back to loading the TRI emissions as the single process stack and fugitive values as reported by facilities to the TRI, but we revised the SCCs on those single processes to something other than the default 39999999 wherever possible. The edited SCCs were determined from the largest emitting SCCs reported in the S/L/T data for each facility. The purpose of this was to allow the TRI emissions to map to something other than the "miscellaneous" sector. The procedure performed for the 2011 NEI of editing TRI processes has not been performed since, but in the 2020 NEI, we use the same TRI process IDs as earlier years. Therefore any TRI processes that were edited during the 2011 cycle to have SCCs other than 39999999 still have those SCCs. Newer TRI processes that have been added since that time have the 39999999 SCC.
   On occasion, TRI SCCs are updated where the process is known based on the type of facility or SCCs from processes for which CAPs were reported. However, there has not been a systematic approach to fill in all SCCs and for large industrial facilities, it would not be possible due to the variety of different process operations that can occur at such facilities. Most industrial facilities report a number of pollutants to the TRI, and it would not be unusual for those pollutants to be produced from a variety of different SCC processes.

3.1.6 HAP augmentation based on emission factor ratios

The 2020EPA_HAP-augmentation dataset was used for gap filling missing HAPs in the S/L/T agency-reported data. We calculated HAP emissions by multiplying the appropriate surrogate CAP emissions (provided by S/L/T agencies) by an emissions ratio of HAP to CAP EFs. For point sources, these EF ratios were largely the same as were used in the 2008 NEI v3, though additional quality assurance resulted in some changes. The ratios were computed using the EFs from WebFIRE and are based solely on the SCC code. The computation of these point HAP to CAP ratios is described in detail in the 2008 NEI documentation, Section 3.1.5.

For pollutants other than Hg, we computed ratios for only the SCCs in WebFIRE that met specific criteria: 1) the CAP and HAP WebFIRE EFs were both based on uncontrolled emissions and, 2) the units of the EF had to be the same or be able to be converted to the same units. In addition, for Hg, we added ratios for point SCCs that were not in WebFIRE for both PM10-FIL (the CAP surrogate for Hg) and Hg by using Hg or PM10-FIL factors for similar SCCs and computing the resulting ratio. That process is described (and supporting data files provided) in the 2008 NEI documentation (Section 3.1.5.2), since these additional Hg augmentation factors were used in the 2008 NEI v3 as well.

A HAP augmentation feature was built into the EIS for the 2011 cycle, and the HAP EF ratios are available to the EIS users through the reference data link “Augmentation Profile Information.” The same tables provide both the HAP augmentation factors and chromium speciation factors and were discussed in Section 2.2.2.

Since the initial set of HAP augmentation factors, factors and/or SCC-assignments were added including facility-specific HAP augmentation factors resulting from the AirToxScreen review. Also introduced for the 2017 NEI are facility-specific coke oven to SO2 ratios used to compute coke oven emissions for specific facilities with operating coke ovens that were missing coke oven emissions.

Although the HAP Augmentation emissions are computed and stored at the emission process level, the HAP Augmentation dataset for point sources is designated as a “facility-level” dataset. This means that as part of the selection processing, if the facility being evaluated has a higher preference dataset emissions value available for a pollutant at any process within the facility, none of the HAP Augmentation values are not used for that pollutant for that facility. The assumption here is that if a S/L/T has reported a pollutant for a facility at any process(es), then they have reported and accounted for all significant amounts of that pollutant for that facility, and so no HAP Augmentation is needed at the process level, and to include those HAP Augmentation values in the selection would potentially be double-counting that pollutant’s mass. Note that HAP Augmentation values for a given pollutant if the 2020EPA_TRI dataset contains that pollutant, as the TRI dataset is given a higher preference in the hierarchy and both the TRI dataset and the HAP Augmentation dataset are designated as “facility-level” datasets. All HAP augmentation factors used in the Point data category of the 2020 NEI are available in the file “HAPAugmentation_Point_28jan2023.zip” on the 2020 Supplemental data FTP site.

3.1.7 Cross-dataset pollutant family rules for overlapping pollutants

Several HAPs can be reported as either individual compounds or as a group of compounds which overlaps with those individual compounds, e.g., o-Xylene and Xylenes (mixed isomers). The 2020 NEI uses the same software process that was introduced for the 2017 NEI to prevent inclusion of both sets of overlapping pollutants from two separate datasets in the 2020 NEI selection. Starting with the 2017 inventory year we have allowed both the individual xylene isomers and Xylenes (mixed isomers) to be reported within the same dataset and used in the selection if reported in the same dataset; but we do not include both if they are reported from different datasets.

3.2 Airports: aircraft-related emissions

The EPA estimated emissions related to aircraft activity for all known U.S. airports, including seaplane ports and heliports, in the 50 states, Puerto Rico, and U.S. Virgin Islands. All of the approximately 20,000 individual airports are geographically located by latitude/longitude and stored in the NEI as point sources. As part of the development process, S/L/T agencies had the opportunity to provide both activity data as well emissions to the NEI. When activity data on landings and take-offs were provided, the EPA used that data to calculate the EPA's emissions estimates.

3.2.1 Sector Description

The aircraft sector includes all aircraft types used for public, private, and military purposes. This includes four types of aircraft: (1) commercial, (2) air taxis (AT), (3) general aviation (GA), and (4) military. A critical detail about the aircraft is whether each aircraft is turbine- or piston-driven, which allows the emissions estimation model to assign the fuel used, jet fuel or aviation gas, respectively. The fraction of turbine- and piston-driven aircraft is either collected or assumed for all aircraft types.

Commercial aircraft include those used for transporting passengers, freight, or both. Commercial aircraft tend to be larger aircraft powered with jet engines. Air taxis carry passengers, freight, or both, but usually are smaller aircraft and operate on a more limited basis than the commercial aircraft. General aviation includes most other aircraft used for recreational flying and personal transportation. Finally, military aircraft are associated with military purposes, and they sometimes have activity at non-military airports.

The national AT and GA fleets include both jet- and piston-powered aircraft. Most of the AT and GA fleets are made up of larger piston-powered aircraft, though smaller business jets can also be found in these categories. Military aircraft cover a wide range of aircraft types such as training aircraft, fighter jets, helicopters, and jet- and piston-powered planes of varying sizes.

The NEI also includes emission estimates for aircraft auxiliary power units (APUs) and aircraft ground support equipment (GSE) typically found at airports, such as aircraft refueling vehicles, baggage handling vehicles and equipment, aircraft towing vehicles, and passenger buses. These APUs and GSE are located at the airport facilities as point sources along with the aircraft exhaust emissions.

The emissions associated with airport activities are attributed to the following sources with associated source classification codes (SCC):

- Commercial aviation (SCC: 2275020000)
- Air taxis
  - Piston driven (SCC: 2275060011)
  - Turbine driven (SCC: 2275060012)
- General aviation
  - Piston driven (SCC: 2275050011)
  - Turbine driven (SCC: 2275050012)
- Military (SCC: 2275001000)

Auxiliary Power Units (SCC: 2275070000)
Ground Support Equipment

- Diesel-fueled (SCC: 2270008005)
- Gasoline-fueled (SCC: 2265008005).

3.2.2 Sources of aircraft emissions estimates

Aircraft exhaust, GSE, and APU emissions estimates are associated with aircrafts' landing and takeoff (LTO) cycle. LTO data were available from both S/L/T agencies and FAA databases. For airports where the available LTO included detailed aircraft-specific make and model information (e.g., Boeing 747-200 series), we used the FAA's Aviation Environmental Design Tool (AEDT) to estimate CAP and HAP emissions. The EPA first used the AEDT model for the 2017 NEI. Previous NEIs, including 2008 and 2011, used the FAA's previous model, Emissions and Dispersion Modeling System (EDMS). Therefore, comparisons of aircraft emissions output may be a function of model revisions, rather than an actual trend in emissions. For airports where FAA databases do not include such detail, the EPA used assumptions regarding the percent of LTOs that were associated with piston-driven (using aviation gas) versus turbine-driven (using jet fuel) aircraft. Then, the EPA estimated emissions based on the percent of each aircraft type, LTOs, and emission factors. The emissions factors (EFs) used, as well as the complete methodology for estimating aircraft exhaust from LTOs is in the aircraft documentation available in the document "2020 NEI Aviation Documentation" on the 2020 Supplemental data FTP site. For 2020 NEI, only California and Georgia submitted aircraft emissions.

Greenhouse gases included in the NEI for this category (carbon dioxide (CO_2)) are modeled using FAA- and state-supplied landing and take-off data for all aircraft types (including ground support equipment and auxiliary engines) used for public, private, and military purposes. If aircraft-specific data were available, emissions were calculated with FAA's AEDT model in conjunction with detailed aircraft activity data. If detailed data were not available a more general approach for different aircraft types (i.e., air taxis, general aviation, and military aircraft) using available generic emission estimating procedures was applied. For the US GHGI aircraft emissions include only domestic flights (as per UNFCCC guidelines emissions resulting from the combustion of fuels used for international transport activities, termed international bunker fuels under the UNFCCC, are not included in national emissions totals but are reported separately as a memo item based on the location of fuel sales). The US GHGI also includes emissions from the entire flight and not just take-off and landing operations. Therefore, the scope of aircraft emissions included in the NEI and the US GHGI (both at the national and state level) are different. See chapter 3.9 of the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks* for more information on estimates from international bunker fuels reported as memo items in the US GHGI.

In addition to airport facility point, the EPA also estimated in-flight lead (Pb - from aviation gas) emissions and allocated those emissions to counties in the nonpoint inventory. For lead only, the NEI currently accounts for lead emitted in-flight, at altitudes above the landing and takeoff cycle. This calculation is derived by calculating the total amount lead in the national estimate of leaded fuel used (aviation gas), and then subtracting the lead accounted for in the LTO cycle. The remainder is assumed to be the in-flight lead emissions (Table 3-3). That value is distributed to states by the ratio of LTOs in the state from piston aircraft engine SCCs. They are stored in a single county estimate, with county code ending in **777 to indicate 'multiple/portable' location.

Table 3-3: U.S. Inflight Lead Emissions (tons) and fuel consumption (gallons)

	2011	2014	2017	2020

Fuel Consumption (Gallons)	217,500,000	210,000,000	209,000,000	193,000,000
Total emissions in fuel (tons emissions)	483	466	464	428
Accounted for in LTO (tons emissions)	245	228	221	176
Remainder in Flight (tons emissions)	238	238	243	252

A summary of state-level in-flight lead estimates "2020Aircraft_InflightLeadByState.csv" can be found on the 2020 Supplemental data FTP site.

3.3 Rail yard-related emissions

The 2020 NEI includes estimates compiled by the EPA for most rail yards in the US. Yard emissions are associated with the operation of switcher engines at each yard. Switch yards are reported as point sources to SCC 28500201. Some states report switch yards to nonpoint (2285002010); however, EPA prefers that these emissions be reported as point sources and may be retiring this SCC in the next NEI cycle. Details for rail yards are documented in a report, "2020 National Emissions Inventory Locomotive Methodology", on the 2020 Supplemental data FTP site. S/L/Ts submitted point rail yard emissions were compared to EPA-computed emissions to avoid double counting between the S/L/T and EPA emissions.

The GHG emissions (methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O)) included in the NEI for this category are calculated using yard data collected during the 2017 NEI process and updated with yard data collected from rail companies for the 2020 NEI. Rail CO2 emissions reported in the US GHGI are based on top-down national-level fuel consumption data. The bottom-up NEI approach applied nationally may not be comparable with national or state level totals in the US GHGI given the difference in approaches.

3.4 EGUs

The EPA developed a single combined dataset of emission estimates for EGUs to be used to fill gaps for pollutants and emission units not reported by S/L/T agencies. For the 2020EPA_EGU dataset, the emissions were estimated at the unit level, because that is the level at which the CAMD heat input activity data and the CAMD CEM data are available. The 2020EPA_EGU dataset was developed from two separate sources. The two sources were the annual sums of SO2, NOx, and mercury emissions based on the hourly CEM emissions reported to the EPA's CAMD database; and heat-input based EFs that were built from AP-42 EFs and fuel heat and sulfur contents as part of the 2008 NEI development effort. We used the 2020 annual throughputs in BTUs from the CAMD database with the EF set to derive annual emissions for 2020.

We assumed that all heat input came from the primary fuel, and the EFs used reflected only that primary fuel. This introduces a small amount of uncertainty as many EGU units use a small amount of alternative fuels. The resultant unit-level estimates had to be loaded into EIS at the process-level to meet the EIS requirement that emissions can only be associated with the most detailed level. To do this for the EGU sectors, we needed to bridge the unit level (i.e., the boiler or gas turbine unit as a whole) to the process level (i.e., the individual fuels burned within the units). So, the EPA emissions were assigned to a single process for the primary fuel that was used by the responsible S/L/T agency for reporting the largest portion of their emissions. In prior years the EPA emissions were then "tagged out" wherever the S/L/T agency had reported the same pollutant at any process within the same emission unit. This approach prevented double counting of a portion of the S/L/T-reported emissions in cases where the S/L/T agency may have reported a unit's emissions using two different coal processes and a small oil process, for example. For the 2020 NEI, the selection process now includes a "Unit-level Rule", similar in operation to the "Facility-level Rule" used to prevent double-counting between the TRI or HAP Augmentation datasets and the S/L/T process-level datasets.

The matching of the 2020EPA_EGU dataset to the responsible agency facility, unit and process IDs was done largely by using the ORIS plant and CAMD boiler IDs as found in the CAMD heat input activity dataset and linking these to the same two IDs as had been stored in EIS. We also compared the facility names and counties for agreement between the S/L/T-reported values and those in CAMD, and we revised the matches wherever discrepancies were noted. As a final confirmation that the correct emissions unit and a reasonable process ID in EIS had been matched to the EPA data, the magnitudes of the SO2 and NOx emissions for all preliminary matches were compared between the S/L/T agency-reported datasets and the EPA dataset. We identified and resolved several discrepancies from this emissions comparison.

Alternative facility and unit IDs needed for matching with other databases

The 2020 NEI data contains two sets of alternate unit identifiers related to the ORIS plant and CAMD boiler IDs (as found in the CAMD heat input activity dataset) for export to the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling file. The first set is stored in EIS with a Program System Code (PSC) of "EPACAMD." The alternate unit IDs are stored as a concatenation of the ORIS Plant ID and CAMD boiler ID with "CAMDUNIT" between the two IDs. These IDs are exported to the SMOKE file in the fields named ORIS_FACILITY_CODE and ORIS_BOILER_ID. These two fields are used by the SMOKE processing software to replace the annual NEI emissions values with the appropriate hourly CEM values at model run time. The second set of alternate unit IDs are stored in EIS with a PSC of "EPAIPM" and are exported to the SMOKE file as a field named "IPM_YN." The SMOKE processing software uses this field to determine if the unit is one that will have future year projections provided by the integrated planning model (IPM). The storage format of these alternate EPAIPM unit IDs, in both EIS and in the exported SMOKE file, replicates the IDs as found in the National Electric Energy Data System **(**NEEDS) database used as input to the IPM model. The NEEDS IDs are a concatenation of the ORIS plant ID and the CAMD boiler ID, with either a "_B_" or a "_G_" between the two IDs, indicating "Boiler" or "Generator." The ORIS Plant IDs and CAMD boiler IDs as stored in the CAMD Business System (CAMDBS) dataset and in the NEEDS database are almost always the same, but there are occasional differences for the same unit. The EPACAMD alternate unit IDs available in the 2020 NEI are believed to be a complete set of all those that can safely be used for the purpose of substituting hourly CEM values without double-counting during SMOKE processing. The EPAIPM alternate unit IDs in the 2020 NEI are not a complete listing of all the NEEDS/IPM units, although most of the larger emitters do have an EPAIPM alternate unit ID. The NEEDS database includes a much larger set of smaller, non-CEM units.

3.5 Landfills

The point source emissions in the EPA's Landfill dataset includes CO and 28 HAPs, as shown in Table 3-4. This set of pollutants was included in the 1999 NEI, and we continue to use the same set of pollutants each year for a consistent time series. To estimate emissions, we used the 2020 methane emissions reported by landfill operators in compliance with Subpart HH of the Greenhouse Gas Reporting Program (GHGRP) as a "surrogate" activity indicator. We converted the methane as reported in Mg CO2 equivalent to Mg as actual methane emitted by dividing by 23 (the Global Warming Potential of methane believed to be used in the version of the 2020 GHGRP facility inventory) to get Mg methane emitted, and then multiplied by 1.1023 to get tons methane emitted[4]. We created emission factors for CO and the 28 HAPs on a per ton of methane emitted basis using the default concentrations (ppmv) in AP-42 Section 2.4 (final section dated Jan 1998), Table 2.4-1. The concentrations for toluene and benzene were taken from Table 2.4-2 of AP-42, for the case of "no or unknown" co-disposal history. Per Equation 4 of that AP-42 section, Mp=Qp x MWp x constant (at any given temperature). Writing this equation twice, for the mass of any pollutant "P" and for methane (CH4), and dividing M_p by M_{CH4} yields:

$$M_p / M_{CH4} = (Qp \times MWp \times k) / Q_{CH4} \times MW_{CH4} \times k) = (Qp/Q_{CH4}) \times (MWp/MW_{CH4})$$

in units of pounds pollutant "P" per pound CH4.

A rearrangement of Equation 3 of that AP-42 section provides $Qp/ Q_{CH4} = 1.82 \times Cp/1000000$, where the 1.82 is based upon a default methane concentration of 55 % (550,000 ppm). Plugging this expression for Qp/ Q_{CH4} into the first expression yields:

$$M_p / M_{CH4} = (1.82 \times Cp/1000000) \times (MWp/ MW_{CH4}) \times 2000, \text{ units of pounds p/ton CH4}$$

$$M_p / M_{CH4} = (1.82 \times Cp/1000000) \times (MWp/16) \times 2000 = Cp \times MWp / 4395.6$$

Table 3-4: Landfill gas emission factors for 29 EIS pollutants

Pollutant code	Pollutant description	MW	ppmv	MW x ppmv	lbs/Ton CH_4
CO	Carbon monoxide	28.01	141	3949.41	0.89849
108883	toluene	92.13	39.3	3620.709	0.82371
1330207	Xylenes	106.16	12.1	1284.536	0.29223
75092	Dichloromethane (methylene chloride)	84.94	14.3	1214.642	0.27633
7783064	Hydrogen sulfide	34.08	35.5	1209.84	0.27524
127184	Perchloroethylene (tetrachloroethylene)	165.83	3.73	618.5459	0.14072
110543	Hexane	86.18	6.57	566.2026	0.12881
100414	Ethylbenzene	106.16	4.61	489.3976	0.11134
75014	Vinyl chloride	62.5	7.34	458.75	0.10437
79016	Trichloroethylene (trichloroethene)	131.4	2.82	370.548	0.08430
107131	Acrylonitrile	53.06	6.33	335.8698	0.07641
75343	1,1-Dichloroethane (ethylidene dichloride)	98.97	2.35	232.5795	0.05291
108101	Methyl isobutyl ketone	100.16	1.87	187.2992	0.04261
79345	1,1,2,2-Tetrachloroethane	167.85	1.11	186.3135	0.04239
71432	benzene	78.11	1.91	149.1901	0.03394
75003	Chloroethane (ethyl chloride)	64.52	1.25	80.65	0.01835

[4] For more information on CO2 equivalent and global warming potential, please refer to EPA's page "Understanding Global Warming Potentials".

Pollutant code	Pollutant description	MW	ppmv	MW x ppmv	lbs/Ton CH_4
71556	1,1,1-Trichloroethane (methyl chloroform)	133.41	0.48	64.0368	0.01457
74873	Chloromethane	50.49	1.21	61.0929	0.01390
75150	Carbon disulfide	76.13	0.58	44.1554	0.01005
107062	1,2-Dichloroethane (ethylene dichloride)	98.96	0.41	40.5736	0.00923
106467	Dichlorobenzene	147	0.21	30.87	0.00702
463581	Carbonyl sulfide	60.07	0.49	29.4343	0.00670
108907	Chlorobenzene	112.56	0.25	28.14	0.00640
78875	1,2-Dichloropropane (propylene dichloride)	112.99	0.18	20.3382	0.00463
75354	1,1-Dichloroethene (vinylidene chloride)	96.94	0.2	19.388	0.00441
67663	Chloroform	119.39	0.03	3.5817	0.00081
56235	Carbon tetrachloride	153.84	0.004	0.61536	0.00014
106934	Ethylene dibromide	187.88	0.001	0.18788	0.00004
7439976	Mercury (total)	200.61	0.000292	0.058578	0.00001

3.6 BOEM

The U.S. Department of the Interior, Bureau of Ocean and Energy Management (BOEM) estimates emissions of CAPs in the Gulf of Mexico from offshore oil platforms in Federal waters, and these data have been previously incorporated into the NEI. More information on the 2017 Outer Continental Shelf (OCS) offshore data is available on the BOEMS OCS Emissions Inventory – 2017 site. Year 2020 data was not available for these sources.

3.7 PM species

For the 2020 NEI PT inventory, the five species (EC, OC, SO4, NO3, and PMFINE) of PM2.5-PRI and diesel PM (which are duplicated from the reported values of PM2.5-PRI for diesel mobile engines such as locomotives and diesel-fueled ground support equipment) are included. These species are generated by using the PM speciation ratios as found on the Air Emissions Modeling website.

3.8 References for point sources

1. Dorn, J, 2012. *Memorandum: 2011 NEI Version 2 – PM Augmentation approach.* Memorandum to Roy Huntley, US EPA. (PM augmt 2011 NEIv2 feb2012.pdf, accessible in the file "2008nei_reference.zip" on the 2008v3 NEI FTP site.
2. Strait et al. (2003). Strait, R.; MacKenzie, D.; and Huntley, R., 2003. PM Augmentation Procedures for the 1999 Point and Area Source NEI, 12th International Emission Inventory Conference – "Emission Inventories – Applying New Technologies", San Diego, April 29 – May 1, 2003.

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