ANNEX 5 Assessment of the Sources and Sinks of Greenhouse Gas Emissions Not Included

This report is intended to be a comprehensive assessment of anthropogenic[135] sources and sinks of greenhouse gas emissions for the United States, but certain sources and/or sinks have been identified which are not included in the estimates presented for various reasons. Before discussing these sources and sinks, it is important to note that processes or activities that are not *anthropogenic in origin* or do not result in a *net source or sink* of greenhouse gas emissions are intentionally excluded from a national inventory of anthropogenic greenhouse gas emissions, UNFCCC reporting guidelines and methodological framework from the IPCC for national inventories.

The anthropogenic source and sink category of greenhouse gas emissions described in this annex are not included in the U.S. national inventory estimates. The reasons for not including that source in the national greenhouse gas Inventory include one or more of the following:

- Emissions and/or removals do not occur within the United States.
- A methodology for estimating emissions and/or removals from a source and/or sink does not currently exist.
- Though an estimating method has been developed, adequate data are not currently available to estimate emissions and/or removals.
- Emissions and/or removals are determined to be insignificant in terms of overall national emissions, as defined per UNFCCC reporting guidelines, based on available data or a preliminary assessment of significance. Further, data collection to estimate emissions and/or removals would require disproportionate amount of effort (e.g., dependent on additional resources and impact improvements to key categories, etc.).

In general, data availability remains the primary constraint for estimating and including the emissions and removals from source and sink categories that do occur within the United States and are not estimated, as discussed further below. Methods to estimate emissions and removals from these categories are available in the *2006 IPCC Guidelines* and or its supplements and refinements. Many of these categories are insignificant in terms of overall national emissions based on available proxy information, qualitative information on activity levels per national circumstances, and/or expert judgment, and not including them introduces a very minor bias.

Reporting of inventories to the UNFCCC under Decision 24/CP.19 states that "Where methodological or data gaps in inventories exist, information on these gaps should be presented in a transparent manner." Furthermore, these reporting guidelines allow a country to indicate if a disproportionate amount of effort would be required to collect data for a gas from a specific category that would be insignificant in terms of the overall level and trend in national emissions.[136] Specifically, where the notation key "NE," meaning not estimated, is used in the Common Reporting Format (CRF)[137] tables that accompany this Inventory report submission to the UNFCCC, countries are required to further describe why such emissions or removals have not been estimated (UNFCCC 2013).

Based on the UNFCCC reporting guidance mentioned above, the United States is providing more information on the significance of these excluded categories below and aims to update information on the significance to the extent feasible during each annual compilation cycle. Data availability may impact the feasibility of undertaking a quantitative

[135] The term "anthropogenic," in this context, refers to greenhouse gas emissions and removals that are a direct result of human activities or are the result of natural processes that have been affected by human activities (*2006 IPCC Guidelines for National Greenhouse Gas Inventories*).

[136] Paragraph 37(b) of Decision 24/CP.19 "Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention." See http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf.

[137] See http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/2759.php.

significance assessment. The United States is continually working to improve the understanding of such sources or sinks and seeking to find the data required to estimate related emissions, prioritizing efforts and resources for significant categories. As such improvements are implemented, new emission and removal categories will be quantified and included in the Inventory to enhance completeness of the Inventory. The full list of sources and sink categories not estimated, along with explanations for their exclusion, is provided in Table 9 of the CRF submission.

Source and Sink Categories Not Estimated

This section provides additional information on the reasons each category was not estimated, arranged by sector and source or sink category. A summary of these exclusions, including the estimated level of emissions where feasible, is included in Table A-220 Per 37(b) of the UNFCCC Reporting Guidelines Decision 24/CP.19, considering overall level and trend of U.S. emissions, the threshold for significance for estimating emissions from a specific category is 500 kt CO_2 Eq. Collectively, per paragraph 37(b) of the UNFCCC Reporting Guidelines noted above, these exclusions should not exceed 0.1 percent of gross emissions, or 6.34 MMT CO_2 Eq. (6,340 kt CO_2 Eq.). While it is not possible to proxy all categories due to the availability of data and the disproportionate efforts to collect data necessary to estimate emissions and/or removals, categories for which proxies have been estimated total 5.7 MMT CO_2 Eq. (5,742 kt CO_2 Eq.).

Table A-220: Summary of Sources and Sinks Not Included in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021

CRF Category Number	Source/Sink Category	Gas(es)	Reason for Exclusion	Estimated 2021 Emissions (kt CO_2 Eq.)
Energy				
1.A Fossil Fuel Combustion *1.A.3 Transport*				
1.A.3.a	Domestic Aviation-Biomass	N_2O	Prior to 2011, no biobased jet fuel was assumed to be used for domestic aviation. After 2011 several airlines performed commercial passenger flights with biofuel blends and have offtake agreements with biofuel suppliers. Furthermore, biofuel jet fuel can qualify under the U.S. Renewable Fuel Standard (RFS) program. The RFS is a national policy that requires a certain volume of renewable fuel to replace or reduce the quantity of petroleum-based transportation fuel, heating oil or jet fuel. An analysis was conducted based on the total volume of biofuel jet fuel produced in 2020 under the RFS program. Emissions of N_2O were estimated based on the factors for jet fuel combustion. As for jet fuel use in commercial aircraft, contributions of methane (CH_4) emissions are reported as zero.	0.4
1.A.3.b.iv	Motorcycles-Biomass	CH_4 and N_2O	Emissions from ethanol mixed with gasoline in low blends are included in the on-road gasoline emissions for motorcycles. If there is any use of high blend ethanol fuel in motorcycles, it is considered insignificant. The percent of VMT from high ethanol blends in light duty gas vehicles (flex fuel vehicles) is less than 1 percent. If the same percentage is applied to motorcycle VMT with assumed flex fuel CH_4 and N_2O emission factors, it results in estimated emissions of 0.0015 kt CO_2 Eq.	0.0015
1.A.3.c	Railways-Biomass	CH_4 and N_2O	There are no readily available data sources to estimate the use of biofuel in railways. Railways represent about 6 percent of all diesel fuel use. An assumption can be made that railways consume that same percentage of biofuels (6 percent of all biodiesel). Based on that assumption for biofuel use and applying fossil fuel CH_4 and N_2O factors results in estimated emissions of 12.9 kt CO_2 Eq. per year.	12.9
1.A.3.d	Domestic Navigation-Biomass	CH_4 and N_2O	There are no readily available data sources to estimate the use of biofuel in domestic navigation. Domestic navigation represents about 3 percent of all diesel fuel use and about 1 percent of all gasoline fuel use. An assumption can be made that domestic navigation consumes that same percentage of biofuels (3 percent of all biodiesel and 1 percent of all ethanol use). Based on that assumption for biofuel use and applying fossil fuel CH_4 and N_2O factors results in estimated emissions of 39.0 kt CO_2 Eq. per year.	39.0
1.A.3.d	Domestic Navigation—Gaseous Fuels	CO_2	Emissions from gaseous fuel use in domestic navigation are not currently estimated. Gaseous fuels are used in liquid natural gas (LNG) tankers and are being demonstrated in a small number of other ships. Data are not available to	NE

			characterize these uses currently.	
1.A.3.e Other Transportation				
1.A.3.e.i	Pipeline Transport—Liquid Fuels	CO_2, CH_4 and N_2O	Use of liquid fuels to power pipeline pumps is uncommon, but has occurred. Data for fuel used in various activities including pipelines are based on survey data conducted by the U.S. Energy Information Association (EIA). From January 1983 through December 2009, EIA Survey data included information on liquid fuel used to power pipelines reported in terms of crude oil product supplied. Reporting of crude oil used for this purpose was discontinued after December 2009. Beginning with data for January 2010, product supplied for pipeline fuel is assumed to equal zero. 1997 was the last year of data reported on pipeline fuel. Taking the data reported for 1997 of 797,000 barrels of crude oil and using conversion factors of 5.8 MMBtu/bbl and 20.21 MMT C/Qbtu results in estimated emissions of 342.6 kt CO_2.	342.6
1.A.3.e.i	Pipeline Transport—Gaseous Fuels	CH_4 and N_2O	CO_2 emissions from gaseous fuels used as pipeline transport fuel are estimated in the Inventory, however CH_4 and N_2O emissions from gaseous pipeline fuel use have not been estimated. The CO_2 / non-CO_2 emissions split for other natural gas combustion can be used to estimate emissions. Based on that analysis, non-CO_2 emissions represent approximately 0.43 percent of CO_2 emissions from all natural gas combustion. If that percentage is applied to CO_2 emissions from natural gas use as pipeline fuel, it results in an emissions estimate of 179.6 kt CO_2 Eq. in 2017.	179.6
1.A.3.e.ii	Non-Transportation Mobile-Biomass	CH_4 and N_2O	There are no readily available data sources to estimate the use of biofuel in non-transportation mobile sources. These sources represent about 21 percent of all diesel fuel use and about 4 percent of all gasoline fuel use. An assumption can be made that these sources consume that same percentage of biofuels (21 percent of all biodiesel and 4 percent of all ethanol use). Based on that assumption for biofuel use and applying fossil fuel CH_4 and N_2O factors results in estimated emissions of 256.4 kt CO_2 Eq. per year.	256.4
1.A.5.a Other Stationary				
1.A.5.a	Incineration of Waste: Medical Waste Incineration	CO_2	The category 1.A.5.a Other Stationary sources not specified elsewhere includes emissions from waste incineration of the municipal waste stream and waste tires. The category also includes emissions from non-energy uses of fuels which includes an energy recovery component that includes emissions from waste gas, waste oils, tars, and related materials from the industrial sector. While this is not a comprehensive inclusion of hazardous industrial waste, it does capture a subset. A portion of hazardous industrial waste not captured is from medical waste. However, a conservative analysis was conducted based on a study of hospital/medical/infectious waste incinerator (HMIWI) facilities in the United	342

			States[138] showing that medical waste incineration emissions could be considered insignificant. The analysis was based on assuming the total amount of annual waste throughput was of fossil origin and an assumption of 68.9 percent carbon composition of the waste. It was determined that annual greenhouse gas emissions for medical waste incineration are approximately 333 kt CO_2 Eq. per year. Related to 5.C.1, based on data on the amount of sewage sludge incinerated and assumed emission factors for N_2O and CH_4 from EPA's GHGRP for biomass solids, emissions were estimated to be approximately 9 kt CO_2 Eq. per year. Approximated emissions associated with sewage sludge incineration are considered insignificant for the purposes of inventory reporting under the UNFCCC.	
1.A.5.a	Stationary Fuel Combustion: Biomass in U.S. Territories	CH_4 and N_2O	Data are not available to estimate emissions from biomass in U.S. Territories. However, biomass consumption is likely small in comparison with other fuel types. An estimate of non-CO_2 emissions from biomass fuels used in Territories can be made based on assuming the same ratio of domestic biomass non-CO_2 emissions to fossil fuel CO_2 emissions. Non-Territories data indicate that biomass non-CO_2 emissions represents 0.2 percent of fossil fuel combustion CO_2 emissions. Applying this same percentage to proxy U.S. Territories fossil fuel combustion CO_2 emissions results in estimated emissions of 74.8 kt CO_2 Eq. from biomass in U.S. Territories.	74.8
1.B Fugitive Emissions from Fuels ***1.B.1 – Solid Fuels***				
1.B.1.a.1.ii, 1.B.1.a.2.ii	Fugitive Emissions from Coal Mining Related to Post-Mining Activities	CO_2	A preliminary analysis by EPA determined that fugitive CO_2 emissions for post-mining activities related to underground coal mining and surface coal mining are negligible. EPA calculated the ratio of underground post-mining CH_4 emissions to net underground CH_4 emissions (0.12). This ratio was then applied to the net underground CO_2 emissions to estimate underground post-mining CO_2 emissions. The underground post-mining CO_2 emissions were estimated to be 236 kt for 2020. Similarly, surface post-mining CO_2 emissions were estimated by multiplying the ratio of surface post-mining CH_4 and surface CH_4 emissions (0.22) with surface CO_2 estimates. The surface post-mining CO_2 emissions were estimated to be 54 kt. Total CO_2 emissions from post-mining activities (underground and surface) were estimated to be 290 kt for 2020. Note, fugitive CO_2 emissions from active underground and surface coal mining are reported based on methods in the *IPCC 2019 Refinement.* Neither the *2006 IPCC*	290

[138] RTI (2009). Updated Hospital/Medical/Infectious Waste Incinerator (HMIWI) Inventory Database.

			Guidelines nor the *IPCC 2019 Refinement* provide any method for estimating fugitive CO_2 emissions from post-mining activities (see section 3.4 of Chapter 3 of the *Inventory*).	
1.B.1.a.1.iii	Fugitive Emissions from Abandoned Underground Coal Mines	CO_2	A preliminary analysis by EPA determined that CO_2 emissions for abandoned underground coal mining activities are negligible. EPA notes that neither the *2006 IPCC Guidelines* nor the *IPCC 2019 Refinement* provide any method for estimating fugitive CO_2 emissions from Abandoned Underground Coal Mines. The analysis was based on gas composition data from two abandoned underground mines in two different states.[139] An average ratio of CO_2 to CH_4 composition in mine gas was derived for abandoned mines. This ratio was applied as a percentage (1.5 percent) to CH_4 emission estimates to derive an estimate of CO_2 emissions for abandoned mines. Applying a CO_2 emission rate as a percentage of CH_4 emissions for abandoned coal mines results in a national emission estimate below 93 kt CO_2 Eq. per year. Future inventories may quantify these emissions, if it is deemed it will not require a disproportionate amount of effort.	93
Industrial Processes and Product Use				
2.A Mineral Industry				
2.A.4.a	Other Process Uses of Carbonates: Ceramics	CO_2	Data are currently not available to apply IPCC methods and estimate CO_2 emissions from ceramics production. The *2006 IPCC Guidelines* specify that activity data should consist of national production data for bricks and roof tiles, vitrified clay pipes, and refractory products or the total quantity of carbonates used in ceramics production, which is not currently available. EPA plans to use data on clay sold or used in the U.S. for ceramics production in lieu of activity data listed above to approximate carbonate use for ceramics production (USGS 2020 Minerals Commodity Summaries for Clay). Using a Tier 1 method, default mix of 85 percent limestone and 15 percent dolomite, and the IPCC defaults carbonate content of clay (10 percent) and loss factor (1.1), national emissions from ceramics production for 2021 were estimated to be 0.4 million metric tons of CO_2 (401 kt CO_2 Eq.). This estimate does not include emissions from the calcination of other raw materials for ceramics production, including shale, limestone, dolomite, and witherite. EPA has made progress on identifying data on clay sold or used in the United States for ceramics production over the full time series and intends to include this subcategory in the 2024 submission.	401
2.A.4.c	Other Process Uses of Carbonates: Non-metallurgical Magnesium Production	CO_2	Data are currently not available to apply IPCC methods and estimate CO_2 emissions from non-metallurgical magnesium production. During the Expert Review process for compilation of the current Inventory, EPA sought expert solicitation on data for	NE

[139] Ibid.

			non-metallurgical magnesium production but has yet to identify data sources to apply IPCC methods to proxy emissions and assess significance.	
2.B. Chemical Industry				
2.B.4.b	Glyoxal Production	N_2O	Data are currently not available to apply IPCC methods and estimate N_2O emissions from glyoxal production. EPA continues to conduct outreach to relevant trade associations and review EPA and other potential databases that may contain the necessary data. Glyoxal production is believed to have taken place earlier in the time series: two facilities have been identified as having produced some amount of glyoxal but the facility in Geismar, Louisiana closed in 2014 and the other facility in Charlotte, North Carolina ceased production in 2012. Whether production is still occurring in the United States remains unknown. Data reported to EPA under the Toxic Substances Control Act (TSCA) indicate that several facilities imported glyoxal in 2011 through 2015, but no facility except the Geismar facility self-identified as a domestic manufacturer. In 2015, four facilities claimed that their production status (i.e., as a domestic manufacturer or as an importer) and their quantities of domestically manufactured and/or imported glyoxal were confidential business information (CBI). Thus, it is possible that one or more of these four facilities could be a domestic manufacturer. It is also possible that there are other facilities in the U.S. that do not have to report under TSCA because their total production volume is less than 25,000 pounds per year or they are exempt from reporting because they are a small manufacturer based on their total company sales revenue. To assess the significance of emissions from glyoxal production, EPA used limited data on the range of domestic production and imports (U.S. EPA ChemView for data submitted under TSCA in 2023 and 2016) and assumptions that half of the amount was domestically produced, liquid-phase oxidation of acetaldehyde with nitric acid process accounts for 20 percent of total glyoxal production, and N_2O control equipment have an efficiency of 80 percent, to estimate process emissions of 71,000 mt CO_2 Eq. or 71 kt CO_2 Eq. per year in recent years, which does not exceed the category-level threshold for significance of 500 kt CO_2 Eq. Any further progress on outreach will be included in next (i.e., 1990 through 2022) Inventory report.	71
2.B.4.c	Glyoxylic Acid Production	N_2O	Data are currently not available to apply IPCC methods and estimate N_2O emissions from glyoxal production. EPA continues to conduct outreach to relevant trade associations reviewing EPA and other potential databases that may contain the necessary data. It is unclear how much or whether glyoxylic acid is currently produced in the United States. In 2015, four facilities reported glyoxylic acid data under the Toxic Substances Control Act (TSCA), but each of these facilities reported no	NE

			domestically manufactured glyoxylic acid. It is possible that there are facilities in the United States. that do not have to report under TSCA because their total production volume is less than 25,000 pounds per year or they are exempt from reporting because they are a small manufacturer based on their total company sales revenue. Research suggests that glyoxylic acid may not be produced in the U.S. at levels that would exceed the category-level threshold for significance of 500 kt CO_2 Eq. Any further progress on outreach will be included in next (i.e., 1990 through 2022) Inventory report.	
2.B.8.d	Petrochemical and Carbon Black Production	CO_2 recovery	EPA's GHGRP has data starting in reporting year 2010 on the amount of CO_2 captured, including at petrochemical facilities and ethylene oxide processes. Due to schedule and resource constraints, data on CO_2 sequestration have not been compiled and need to be reviewed to better understand available data to estimate the fate of these captured emissions. Any CO_2 potentially captured from petrochemical facilities is currently assumed to be released.	NE
2.B.9.b	Other Fluorochemical Production	HFCs, PFCs, SF_6, and NF_3	EPA has collected chemical-specific emissions data from fluorochemical producers since 2015 (for 2011 and following years) under the GHGRP. However, resources have not been available to estimate emissions from fluorochemical producers for 1990 through 2010. Both production levels and levels of control are known to have varied between 1990 and 2011, and some facilities closed while others opened over this time period, complicating efforts to develop estimates. Emissions of HFCs, PFCs, SF_6, and NF_3 were 3,257 kt CO_2 Eq. in 2021. EPA plans to include estimates of emissions from other fluorochemical production in the April 2024 submission.	3,257
2.C. Metal Industry				
2.C.1.c	Iron and Steel Production: Direct Reduced Iron (DRI) Production	CH_4	Data are currently not available to apply IPCC methods and estimate CH_4 emissions from DRI production. An assumed emission factor can be developed based on the default energy consumption of 12.5 GJ natural gas per metric ton of DRI produced. This assumption and annual DRI production in metric tons results in CH_4 emissions of 0.74 kt CO_2. Eq.	0.74
2.E Electronics Industry				
2.E.2	Fluorinated Gas Emissions from Electronics Industry: TFT Flat Panel Displays	HFCs, PFCs, SF_6, and NF_3	In addition to requiring reporting of emissions from semiconductor manufacturing, micro-electro-mechanical systems (MEMs), and photovoltaic cells, EPA's GHGRP requires the reporting of emissions from the manufacture of flat panel displays. However, no flat panel displays manufacturing facilities have ever reported to EPA's GHGRP, indicating that there are no facilities in the United States that have exceeded the GHGRP's applicability threshold for display manufacturers since 2010. The available information on this sector indicates that these emissions are	NE

			well below the significance threshold.[140] Per this published literature, the United States has never been a significant display manufacturer aside from a small amount of manufacturing in the 1990s, but not mass production.	
2.G Other				
2.G.2	Other Product Manufacture and Use: SF_6 and PFCs from Other Product Use	SF_6	Emissions of SF_6 occur from particle accelerators and military applications, and emissions of PFCs and other F-GHGs occur from military applications such as use of fluorinated heat transfer fluids (HTFs). Emissions from some particle accelerators and from military applications are reported by the U.S. government to the Federal Energy Management Program along with emissions of other fluorinated greenhouse gases (e.g., HFCs from mobile and stationary air conditioning) under the categories "Fugitive Fluorinated Gases and Other Fugitive Emissions" and "Industrial Process Emissions." Analysis of the underlying data for 2021 indicated "fugitive" emissions of SF_6 of approximately 162 kt CO_2 Eq. from the U.S. government as a whole, and "process" emissions of SF_6 of approximately 174 kt CO_2 Eq. (Emissions of SF_6 that are known to be accounted for elsewhere, such as under Electrical Transmission and Distribution, have been excluded from these totals.) The sources of the "fugitive" emissions of SF_6 were not identified. R&D activities and particle accelerators accounted for 95 percent of SF_6 "process" emissions in 2021. Note, fugitive emissions of approximately 149 kt CO_2 Eq. of compounds that are commonly used as fluorinated HTFs (HFEs and fully fluorinated compounds, likely perfluoroamines, perfluoromorpholines, and/or PFPMIEs) were also reported. Per paragraph 33 of the UN reporting guidelines, such "additional GHGs" should be reported separately from national totals so are not considered in estimates of 2021 emissions. EPA still plans to contact reporting agencies to better understand the sources of the emissions and the estimation methods used by reporters, which may equate emissions to consumption and therefore over- or underestimate some emissions, depending on the circumstances. This step will help EPA improve its assessment of significance and prioritize incorporating estimates in future Inventory submissions, but has been postponed due to focus on new EPA programs to improve data collection on HFCs (e.g., implementation of regulations phasing down production and consumption of HFCs).	336
Agriculture				
3.A Livestock				
3.A.4	Enteric Fermentation: Camels	CH_4	Enteric fermentation emissions from camels are not estimated because there is no significant population of camels in the United States. Due to limited data	2.8

[140] The Display Industry: Fast to Grow, Slow to Change Article in Information Display 28(5):18-21 · May 2012 with 4. DOI: 10.1002/j.2637-496X.2012.tb00504.x The Display Industry: Fast to Grow, Slow to Change. Available online at: http://archive.informationdisplay.org/id-archive/2012/may-june/display-marketplace-the-display-industry-fast-to.

			availability (no population data are available from the USDA Agricultural Census), the estimates are based on use of IPCC defaults and population data from Baum, Doug (2010).[141] Based on this source, a Tier 1 estimate of enteric fermentation CH_4 emissions from camels results in a value of approximately 2.8 kt CO_2 Eq. per year from 1990 to 2020. See Chapter 5.1 for more information.	
3.A.4	Enteric Fermentation: Poultry	CH_4	No IPCC method has been developed for determining enteric fermentation CH_4 emissions from poultry. See Chapter 5.1.	No method provided in *2006 IPCC Guidelines*
3.B.1.4, 3.B.2	Manure Management: Camels	CH_4 and N_2O	Manure management emissions from camels are not estimated because there is no significant population of camels in the United States.[142] Due to limited data availability and disproportionate effort to collect time-series data (i.e., no population data is available from the Agricultural Census), this estimate is based on population data from Baum, Doug (2010).[143] Based on this source, a Tier 1 estimate of manure management CH_4 and N_2O emissions from camels results in a value of approximately 0.14 kt CO_2 Eq. per year from 1990 to 2020. See Chapter 5.2 for more information.	0.1
3.F Field Burning of Agricultural Residues				
3.F.1.4, 3.F.4	Sugarcane	CH_4 and N_2O	Currently available data did not allow for identification of burning of sugarcane. Based on prior analysis, EPA estimates that sugarcane emissions may range from less than 10.4 to 61.2 kt CO_2 Eq. (0.42 kt CH_4 to 2.45 kt CH_4), and less than 11.4 kt CO_2 Eq. (0.04 kt N_2O), across the 1990 to 2016 time series. The estimate for 2016 (37.8 kt CO_2 Eq.) is the most recent estimate available and can be used as a proxy for 2020. See the Planned Improvements section in Chapter 5.7 Field Burning of Agricultural Residues for more information.	37.8
Land Use, Land-Use Change, and Forestry				
4.A Forest Land				
4.A(II)	Emissions and Removals from Rewetting of Organic and Mineral Soils	CO_2 and CH_4	Not required based on the *2006 IPCC Guidelines*. Emissions from this source may be estimated in future Inventories using guidance from the *2013 Wetlands Supplement* when data necessary for classifying the area of rewetted organic and mineral soils become available.	NE, encouraged not required reporting
4.A.1 Forest Land Remaining Forest Land				
4.A.1	N mineralization/ immobilization	N_2O	Direct N_2O emissions from N mineralization/immobilization associated with loss or gain of soil organic matter resulting from change of land use or management of mineral soils will be estimated in a future Inventory. They are not estimated	NE

[141] *The status of the camel in the United States of America*. Available online at: https://www.soas.ac.uk/camelconference2011/file84331.pdf.

[142] Paragraph 37(b) of Decision 24/CP.19 "Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention." See http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf.

[143] *The status of the camel in the United States of America*. Available online at: https://www.soas.ac.uk/camelconference2011/file84331.pdf.

			currently because resources have limited EPA's ability to use the available data on soil carbon stock changes on forest lands to estimate these emissions.	
4.B Cropland				
4.B(II)	Emissions and Removals from Rewetting of Organic and Mineral Soils	CO_2 and CH_4	Not required based on the *2006 IPCC Guidelines*. Emissions from this source may be estimated in future Inventories using guidance from the *2013 Wetlands Supplement* when data necessary for classifying the area of rewetted organic and mineral soils become available, except for CH_4 emissions from drainage and rewetting for rice cultivation.	NE, encouraged not required reporting
4.B.1 Cropland Remaining Cropland				
4.B.1	Carbon Stock Change in Living Biomass and Dead Organic Matter	CO_2	Carbon stock change in living biomass and dead organic matter are not estimated, other than for forest land converted to cropland, because data are currently not available. The impact of management on perennial biomass C is currently under investigation for agroforestry management and will be included in a future Inventory if stock changes are significant and activity data can be compiled for this source.	NE
4.B.1(V)	Biomass Burning—Controlled Burning	CO_2	Emissions of CO_2 from biomass burning on Croplands Remaining Cropland are only relevant for perennial biomass and as noted under 4.B.1 above. EPA does not currently include carbon stock change for perennial biomass on Cropland Remaining Cropland. The CO_2 emissions from controlled burning of crop biomass are not estimated for annual crops as they are part of the annual cycle of C and not considered net emissions. Methane and N_2O emissions are included under 3.F Field Burning of Agricultural Residues.	NE
4.B.1(V)	Biomass Burning—Wildfires	CO_2, CH_4, and N_2O	Emissions from wildfires are not estimated because the activity data on fire area and fuel load, particularly for perennial vegetation, are not available to apply IPCC methods.	NE
4.B.2 Land Converted to Cropland				
4.B.2	Carbon Stock Change in Perennial Living Biomass and Dead Organic Matter	CO_2	Carbon stock change in living biomass and dead organic matter are not estimated, other than for forest land converted to cropland, because data are currently not available. The impact of management on perennial biomass C is currently under investigation for agroforestry management and will be included in a future Inventory if stock changes are significant and activity data can be compiled for this source.	NE
4.B.2(V)	Biomass Burning—Wildfires and Controlled Burning	CO_2	Emissions of CO_2 from biomass burning on Land Converted to Cropland are only relevant for perennial biomass and as noted under 4.B.2 above EPA does not currently include carbon stock change for perennial biomass on Land Converted to Cropland. Emissions from wildfires are not estimated because the activity data on fire area and fuel load, particularly for perennial vegetation, are not available.	NE

4.C Grassland				
4.C(II)	Emissions and Removals from Rewetting of Organic and Mineral Soils	CO_2 and CH_4	Not required based on the *2006 IPCC Guidelines*. Emissions from this source may be estimated in future Inventories using guidance from the *2013 Wetlands Supplement* when data necessary for classifying the area of rewetted organic and mineral soils become available.	NE, encouraged not required reporting
4.C.2 Land Converted to Grassland				
4.C.2	Carbon Stock Change in Living Biomass and Dead Organic Matter	CO_2	Carbon stock change in living biomass and dead organic matter are not estimated, other than for forest land converted to grassland, because data are currently not available. The impact of management on perennial biomass C is currently under investigation for agroforestry management and will be included in a future Inventory if stock changes are significant and activity data can be compiled for this source.	NE
4.D Wetlands				
4.D(II)	Flooded Lands and Peat Extraction Lands: Emissions and Removals from Drainage and Rewetting and Other Management of Organic and Mineral Soils	CO_2, CH_4, and N_2O	Data are currently not available to apply IPCC methods and estimate emissions from rewetting of peat extraction lands and flooded lands.	NE
4.D.1 Wetlands Remaining Wetlands				
4.D.1(V)	Biomass Burning: Controlled Burning, Wildfires	CO_2, CH_4, and N_2O	Data are not currently available to apply IPCC methods to estimate emissions from biomass burning in Wetlands.	NE
4.D.2 Land Converted to Wetlands				
4.D.2(V)	Biomass Burning: Controlled Burning, Wildfires	CO_2, CH_4, and N_2O	Data are not currently available to apply IPCC methods to estimate emissions from biomass burning in Wetlands.	NE
4.E Settlements				
4.E(V)	Biomass Burning in Settlements	CO_2, CH_4, and N_2O	Data are currently not available to apply IPCC methods to estimate emissions from biomass burning in Settlements.	NE
4.E.1 Settlements Remaining Settlements				
4.E.1	Settlements Remaining Settlements	CH_4	Data are not currently available to apply IPCC methods to estimate CH_4 emissions in Settlements.	NE
4.E.1	Direct N_2O Emissions from N Mineralization/Immobilization (Mineral Soils)	N_2O	Activity data are not available on N_2O emissions from nitrogen mineralization/immobilization in *Settlements Remaining Settlements* and *Land Converted to Settlements* as a result of soil organic carbon stock losses from land use conversion and management.	NE
4.E.2 Land Converted to Settlements				
4.E.2	Direct N_2O Emissions from N Mineralization/Immobilization	N_2O	Activity data are not available on N_2O emissions from nitrogen mineralization/immobilization in *Settlements Remaining Settlements* and *Land Converted to Settlements* as a result of soil organic carbon stock losses from land	NE

			use conversion and management.	
4.F Other Land				
4.F(V)	Carbon Stock Change, Biomass Burning	CO_2, CH_4, and N_2O	While the United States is conducting research to track carbon pools for other land, it is unable to estimate CO_2, CH_4 and N_2O emissions for other land or land converted to other land. See section 6.13 of the NIR.	NE
Waste				
5.A.1 Solid Waste Disposal				
5.A.1.a	Managed Waste Disposal Sites-Anaerobic	CH_4	The amount of CH_4 flared and the amount of CH_4 for energy recovery is not estimated for the years 2005 through 2020 in the time series. A methodological change was made for 2005 to the current Inventory year to use the directly reported net CH_4 emissions from the EPA's GHGRP versus estimate CH_4 generation and recovery. See the Methodology explanation in Section 7.1.	NE
5.B Biological Treatment of Solid Waste				
5.B.1.a	Composting – Municipal Solid Waste	Recovered CH_4 and N_2O	CH_4 and N_2O emissions from combustion of the recovered gas at composting sites are very small "so good practice in the Waste Sector does not require their estimation." (IPCC 2006, Volume 5, Chapter 4, pp. 4.5). EPA will periodically assess trends and based on significance consider reflecting as data become available and prioritize with other improvements to make best use of available resources. Estimating emissions at this time, given the likely significance, would require a disproportionate amount of effort, so this will be considered for future Inventories based on trends and available data.	NE
5.C Waste Incineration				
5.C.1	Waste Incineration	CH_4 and N_2O from incineration of sewage sludge	See details under 1.A.5.a Incineration of Waste: Medical Waste Incineration.	See above
5.D Wastewater Treatment				
5.D.2	Industrial Wastewater	CH_4	Emissions associated with sludge generated from the treatment of industrial wastewater is not included because the likely level of emissions is insignificant and because quantitative activity data on who operates anaerobic sludge digesters is unavailable. It would require a disproportionate amount of effort to collect this data, and more recent methodological work also suggests this is the case (i.e., Table 6.3 (Updated) in the *IPCC 2019 Refinement* only identifies CH_4 emissions from anaerobic digestion of sludge as a source of emissions to be reported in the Wastewater sector [note that N_2O is noted as "not significant" in Table 6.8A]). Methane emissions from the wastewater treatment category are not considered a key source category (see Annex 1, Table A-1). In addition, the United States continues to review the six industries included in the wastewater sector to	5

		determine if activity data are sufficient to include methane emissions from anaerobic digestion of sludge. The United States has worked first with the pulp and paper industry to confirm that virtually no pulp and paper mills operate anaerobic sludge digesters and will continue to identify stakeholders in the remaining five industries to confirm sludge management techniques. The United States notes that methane emissions associated with anaerobic digestion of ethanol waste (a combination of process wastewater and solids) is already included in the Inventory and is not considered sludge management. The United States believes the likely level of emissions associated with anaerobic digestion of industrial wastewater sludge is less than 5 kt CO_2 Eq., which is considered insignificant for the purposes of inventory reporting under the UNFCCC.

NE (Not Estimated), indicating also it is not possible to derive a likely level of emissions and/or removals or quantified estimate due to lack of approximated activity data and/or in some cases also default emission factors but a method is available in the *2006 IPCC Guidelines*.

While summarized below in Table A-221, information on coverage of activities within the United States, the District of Columbia, and U.S. Territories is provided in the sectoral chapters with details in the category-specific estimate discussions as relevant. U.S. Territories include American Samoa, Guam, Puerto Rico, U.S. Virgin Islands, Commonwealth of Northern Mariana Islands, and other minor outlying Pacific Islands which have no permanent population and are inhabited by military and/or scientific purposes.[144] As part of continuous improvement efforts, EPA reviews coverage on an ongoing basis to ensure emission and removal categories are included across all geographic areas including U.S. Territories where they are occurring.

Table A-221: Summary of Geographic Completeness

CRF Sector	Geographic Completeness
Energy	Includes emissions from all 50 states, including Hawaii and Alaska, and the District of Columbia. Emissions are also included from U.S. Territories to the extent they are known to occur (e.g., coal mining does not occur in U.S. Territories). For some sources there is a lack of detailed information on U.S. Territories, including non-CO_2 emissions, so emissions estimates may not be available at same levels of disaggregation those covering the states and District of Columbia.
Industrial Processes and Product Use	Includes emissions from all 50 states, including Hawaii and Alaska, as well as from the District of Columbia and U.S. Territories to the extent to which industries are occurring. While most IPPU sources do not occur in U.S. Territories (e.g., electronics manufacturing does not occur in U.S. Territories), they are estimated and accounted for where they are known to occur (e.g., substitutes from ozone depleting substance substitutes, cement production, lime production, and electrical transmission and distribution).
Agriculture	Emissions reported in the Agriculture chapter include those from all states; however, for Hawaii and Alaska some agricultural practices that can affect nitrogen availability in the soil, and thus result in N_2O emissions, are not included (i.e., for field burning of agricultural residues, agricultural soil management). In addition, U.S. Territories and the District of Columbia are not estimated due to incomplete data, with the exception of Urea Fertilization in Puerto Rico. Emissions currently not estimated for U.S. Territories have not been approximated for significance. Other minor outlying U.S. territories in the Pacific Islands have no permanent populations (e.g., Baker Island) and therefore EPA assumes no agriculture activities are occurring.
Land Use, Land Use Change and Forestry	Emissions and removals reported in the LULUCF chapter include those from all states, however, for Hawaii and Alaska some emissions and removals from land use and land use change are not included. Specifically for Alaska, carbon stock changes from coastal wetlands, cropland and lands converted to cropland, grasslands and lands converted to grassland, settlements and lands converted to settlements, N_2O from settlement soils, non-CO_2 emission from grassfires, and CO_2 and non-CO_2 emissions from flooded lands are not estimated. For Hawaii, carbon stock changes from forest land, and all wetlands are not estimated. See chapter sections on Uncertainty and Planned Improvements for more details. In addition, U.S. Territories are not included (see Box 6). Emissions currently not estimated for U.S. Territories have not yet been approximated for significance.
Waste	Emissions reported in the Waste chapter for landfills, wastewater treatment, and anaerobic digestion at biogas facilities include those from all 50 states, including Hawaii and Alaska, the District of Columbia. as well as from U.S. Territories. Emissions from landfills include modern, managed sites in most U.S. Territories except for outlying Pacific Islands. Emissions from domestic wastewater treatment include most U.S. Territories except for outlying Pacific Islands. Those emissions are likely insignificant as those outlying Pacific Islands (e.g., Baker Island) have no permanent population. No industrial wastewater treatment emissions are estimated for U.S. Territories, due to

[144] More information is available at: https://www.usgs.gov/faqs/how-are-us-states-territories-and-commonwealths-designated-geographic-names-information-system.

	lack of data availability. However, industrial wastewater treatment emissions are not expected for outlying Pacific Islands and assumed to be small for other U.S. Territories. Emissions for composting include all states and Puerto Rico, except Alaska. Some composting operations in Alaska are known, but these consist of aerated composting facilities. Composting emissions are not included from the remaining U.S. Territories, and these are assumed to be small and have not yet been approximated. Similarly, EPA is not aware of any anerobic digestion at biogas facilities in U.S. Territories but will review this on an ongoing basis to include these emissions if they are occurring.