

Table of Contents

1	TABLE OF CONTENTS	VI
2	LIST OF TABLES, FIGURES, BOXES, AND EQUATIONS.....	IX
3	EXECUTIVE SUMMARY	ES-1
4	ES.1 Background Information	ES-2
5	ES.2 Recent Trends in U.S. Greenhouse Gas Emissions and Sinks	ES-4
6	ES.3 Overview of Sector Emissions and Trends	ES-16
7	ES.4 Other Information.....	ES-20
8	1. INTRODUCTION.....	1-1
9	1.1 Background Information	1-3
10	1.2 National Inventory Arrangements.....	1-11
11	1.3 Inventory Process	1-13
12	1.4 Methodology and Data Sources	1-17
13	1.5 Key Categories.....	1-18
14	1.6 Quality Assurance and Quality Control (QA/QC).....	1-24
15	1.7 Uncertainty Analysis of Emission Estimates.....	1-29
16	1.8 Completeness.....	1-32
17	1.9 Organization of Report.....	1-32
18	2. TRENDS IN GREENHOUSE GAS EMISSIONS AND REMOVALS	2-1
19	2.1 Overview of U.S. Greenhouse Gas Emissions and Sinks Trends	2-1
20	2.2 Emissions by Economic Sector	2-28
21	2.3 Precursor Greenhouse Gas Emissions (CO, NOx, NMVOCs, and SO ₂) – TO BE UPDATED FOR FINAL INVENTORY REPORT	2-40
22	3. ENERGY	3-1
23	3.1 Fossil Fuel Combustion (CRF Source Category 1A).....	3-7
24	3.2 Carbon Emitted from Non-Energy Uses of Fossil Fuels (CRF Source Category 1A)	3-51
25	3.3 Incineration of Waste (CRF Source Category 1A5).....	3-59
26	3.4 Coal Mining (CRF Source Category 1B1a).....	3-63

1	3.5	Abandoned Underground Coal Mines (CRF Source Category 1B1a)	3-71
2	3.6	Petroleum Systems (CRF Source Category 1B2a)	3-75
3	3.7	Natural Gas Systems (CRF Source Category 1B2b).....	3-93
4	3.8	Abandoned Oil and Gas Wells (CRF Source Categories 1B2a and 1B2b).....	3-112
5	3.9	International Bunker Fuels (CRF Source Category 1: Memo Items)	3-117
6	3.10	Biomass and Biofuels Consumption (CRF Source Category 1A)	3-122
7	3.11	Energy Sources of Precursor Greenhouse Gas – TO BE UPDATED FOR FINAL INVENTORY REPORT	3-127
8	4.	INDUSTRIAL PROCESSES AND PRODUCT USE	4-1
9	4.1	Cement Production (CRF Source Category 2A1)	4-10
10	4.2	Lime Production (CRF Source Category 2A2)	4-14
11	4.3	Glass Production (CRF Source Category 2A3).....	4-20
12	4.4	Other Process Uses of Carbonates (CRF Source Category 2A4)	4-24
13	4.5	Ammonia Production (CRF Source Category 2B1).....	4-28
14	4.6	Urea Consumption for Non-Agricultural Purposes.....	4-33
15	4.7	Nitric Acid Production (CRF Source Category 2B2).....	4-36
16	4.8	Adipic Acid Production (CRF Source Category 2B3)	4-41
17	4.9	Caprolactam, Glyoxal and Glyoxylic Acid Production (CRF Source Category 2B4)	4-45
18	4.10	Carbide Production and Consumption (CRF Source Category 2B5)	4-48
19	4.11	Titanium Dioxide Production (CRF Source Category 2B6).....	4-52
20	4.12	Soda Ash Production (CRF Source Category 2B7)	4-55
21	4.13	Petrochemical Production (CRF Source Category 2B8)	4-58
22	4.14	HCFC-22 Production (CRF Source Category 2B9a).....	4-67
23	4.15	Carbon Dioxide Consumption (CRF Source Category 2B10).....	4-70
24	4.16	Phosphoric Acid Production (CRF Source Category 2B10)	4-73
25	4.17	Iron and Steel Production (CRF Source Category 2C1) and Metallurgical Coke Production	4-77
26	4.18	Ferroalloy Production (CRF Source Category 2C2)	4-89
27	4.19	Aluminum Production (CRF Source Category 2C3).....	4-93
28	4.20	Magnesium Production and Processing (CRF Source Category 2C4)	4-100
29	4.21	Lead Production (CRF Source Category 2C5).....	4-106
30	4.22	Zinc Production (CRF Source Category 2C6).....	4-109
31	4.23	Electronics Industry (CRF Source Category 2E)	4-115
32	4.24	Substitution of Ozone Depleting Substances (CRF Source Category 2F)	4-132
33	4.25	Electrical Transmission and Distribution (CRF Source Category 2G1)	4-141
34	4.26	Nitrous Oxide from Product Uses (CRF Source Category 2G3).....	4-153
35	4.27	Industrial Processes and Product Use Sources of Precursor Gases.....	4-156

1	5. AGRICULTURE	5-1
2	5.1 Enteric Fermentation (CRF Source Category 3A)	5-4
3	5.2 Manure Management (CRF Source Category 3B)	5-12
4	5.3 Rice Cultivation (CRF Source Category 3C).....	5-21
5	5.4 Agricultural Soil Management (CRF Source Category 3D).....	5-28
6	5.5 Liming (CRF Source Category 3G)	5-48
7	5.6 Urea Fertilization (CRF Source Category 3H).....	5-51
8	5.7 Field Burning of Agricultural Residues (CRF Source Category 3F)	5-53
9	6. LAND USE, LAND-USE CHANGE, AND FORESTRY	6-1
10	6.1 Representation of the U.S. Land Base	6-9
11	6.2 Forest Land Remaining Forest Land (CRF Category 4A1)	6-24
12	6.3 Land Converted to Forest Land (CRF Source Category 4A2)	6-48
13	6.4 Cropland Remaining Cropland (CRF Category 4B1).....	6-56
14	6.5 Land Converted to Cropland (CRF Category 4B2).....	6-67
15	6.6 Grassland Remaining Grassland (CRF Category 4C1)	6-75
16	6.7 Land Converted to Grassland (CRF Category 4C2)	6-87
17	6.8 Wetlands Remaining Wetlands (CRF Category 4D1)	6-95
18	6.9 Land Converted to Wetlands (CRF Source Category 4D2).....	6-138
19	6.10 Settlements Remaining Settlements (CRF Category 4E1)	6-160
20	6.11 Land Converted to Settlements (CRF Category 4E2)	6-181
21	6.12 Other Land Remaining Other Land (CRF Category 4F1)	6-188
22	6.13 Land Converted to Other Land (CRF Category 4F2)	6-188
23	7. WASTE.....	7-1
24	7.1 Landfills (CRF Source Category 5A1).....	7-4
25	7.2 Wastewater Treatment and Discharge (CRF Source Category 5D)	7-21
26	7.3 Composting (CRF Source Category 5B1).....	7-55
27	7.4 Anaerobic Digestion at Biogas Facilities (CRF Source Category 5B2)	7-60
28	7.5 Waste Incineration (CRF Source Category 5C1)	7-66
29	7.6 Waste Sources of Precursor Greenhouse Gases – TO BE UPDATED FOR FINAL INVENTORY REPORT	7-67
30	8. OTHER	8-1
31	9. RECALCULATIONS AND IMPROVEMENTS	9-1
32	REFERENCES AND ABBREVIATIONS.....	9-1
33		
34		

List of Tables, Figures, Boxes, and Equations

Tables

4	Table ES-1: Global Warming Potentials (100-Year Time Horizon) Used in this Report	ES-3
5	Table ES-2: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks (MMT CO ₂ Eq.)	ES-4
6	Table ES-3: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks by IPCC Sector/Category (MMT CO ₂ Eq.)	ES-16
8	Table ES-4: U.S. Greenhouse Gas Emissions and Removals (Net Flux) from Land Use, Land-Use Change, and Forestry (MMT CO ₂ Eq.).....	ES-19
10	Table ES-5: U.S. Greenhouse Gas Emissions Allocated to Economic Sectors (MMT CO ₂ Eq.)	ES-21
11	Table ES-6: U.S. Greenhouse Gas Emissions with Electricity-Related Emissions Distributed by Economic Sector (MMT CO ₂ Eq.)	ES-22
13	Table ES-7: Recent Trends in Various U.S. Data (Index 1990 = 100).....	ES-23
14	Table 1-1: Global Atmospheric Concentration, Rate of Concentration Change, and Atmospheric Lifetime of Selected Greenhouse Gases	1-5
16	Table 1-2: Global Warming Potentials and Atmospheric Lifetimes (Years) Used in this Report	1-10
17	Table 1-3: Comparison of 100-Year GWP values	1-11
18	Table 1-4: Summary of Key Categories for the United States (1990 and 2021) by Sector	1-19
19	Table 1-5: Estimated Overall Inventory Quantitative Uncertainty for 1990 (MMT CO ₂ Eq. and Percent) – TO BE UPDATED FOR FINAL INVENTORY REPORT	1-29
21	Table 1-6: Estimated Overall Inventory Quantitative Uncertainty for 2020 (MMT CO ₂ Eq. and Percent) – TO BE UPDATED FOR FINAL INVENTORY REPORT	1-30
23	Table 1-7: Quantitative Assessment of Trend Uncertainty (MMT CO ₂ Eq. and Percent)	1-31
24	Table 1-8: IPCC Sector Descriptions.....	1-32
25	Table 1-9: List of Annexes	1-33
26	Table 2-1: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks (MMT CO ₂ Eq.).....	2-3
27	Table 2-2: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks (kt)	2-6
28	Table 2-3: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks by IPCC Sector/Category (MMT CO ₂ Eq.)..	2-9
29	Table 2-4: Emissions from Energy (MMT CO ₂ Eq.).....	2-11
30	Table 2-5: CO ₂ Emissions from Fossil Fuel Combustion by End-Use Sector (MMT CO ₂ Eq.).....	2-14
31	Table 2-6: Emissions from Industrial Processes and Product Use (MMT CO ₂ Eq.)	2-19
32	Table 2-7: Emissions from Agriculture (MMT CO ₂ Eq.)	2-22
33	Table 2-8: U.S. Greenhouse Gas Emissions and Removals (Net Flux) from Land Use, Land-Use Change, and Forestry (MMT CO ₂ Eq.)	2-24
35	Table 2-9: Emissions from Waste (MMT CO ₂ Eq.).....	2-27

1	Table 2-10: U.S. Greenhouse Gas Emissions Allocated to Economic Sectors (MMT CO ₂ Eq. and Percent of Total in 2021).....	2-29
3	Table 2-11: Electric Power-Related Greenhouse Gas Emissions (MMT CO ₂ Eq.).....	2-33
4	Table 2-12: U.S. Greenhouse Gas Emissions by Economic Sector and Gas with Electricity-Related Emissions Distributed (MMT CO ₂ Eq.) and Percent of Total in 2021.....	2-34
6	Table 2-13: Transportation-Related Greenhouse Gas Emissions (MMT CO ₂ Eq.).....	2-37
7	Table 2-14: Recent Trends in Various U.S. Data (Index 1990 = 100)	2-39
8	Table 2-15: Emissions of NO _x , CO, NMVOCs, and SO ₂ (kt)	2-41
9	Table 3-1: CO ₂ , CH ₄ , and N ₂ O Emissions from Energy (MMT CO ₂ Eq.).....	3-3
10	Table 3-2: CO ₂ , CH ₄ , and N ₂ O Emissions from Energy (kt)	3-4
11	Table 3-3: CO ₂ , CH ₄ , and N ₂ O Emissions from Fossil Fuel Combustion (MMT CO ₂ Eq.).....	3-7
12	Table 3-4: CO ₂ , CH ₄ , and N ₂ O Emissions from Fossil Fuel Combustion (kt)	3-7
13	Table 3-5: CO ₂ Emissions from Fossil Fuel Combustion by Fuel Type and Sector (MMT CO ₂ Eq.).....	3-8
14	Table 3-6: Annual Change in CO ₂ Emissions and Total 2021 CO ₂ Emissions from Fossil Fuel Combustion for Selected Fuels and Sectors (MMT CO ₂ Eq. and Percent).....	3-9
16	Table 3-7: CO ₂ Emissions from Stationary Fossil Fuel Combustion (MMT CO ₂ Eq.)	3-13
17	Table 3-8: CH ₄ Emissions from Stationary Combustion (MMT CO ₂ Eq.)	3-14
18	Table 3-9: N ₂ O Emissions from Stationary Combustion (MMT CO ₂ Eq.).....	3-14
19	Table 3-10: CO ₂ , CH ₄ , and N ₂ O Emissions from Fossil Fuel Combustion by Sector (MMT CO ₂ Eq.).....	3-15
20	Table 3-11: CO ₂ , CH ₄ , and N ₂ O Emissions from Fossil Fuel Combustion by End-Use Sector with Electricity Emissions Distributed (MMT CO ₂ Eq.)	3-16
22	Table 3-12: Electric Power Generation by Fuel Type (Percent)	3-17
23	Table 3-13: CO ₂ Emissions from Fossil Fuel Combustion in Transportation End-Use Sector (MMT CO ₂ Eq.).....	3-27
24	Table 3-14: CH ₄ Emissions from Mobile Combustion (MMT CO ₂ Eq.)	3-30
25	Table 3-15: N ₂ O Emissions from Mobile Combustion (MMT CO ₂ Eq.).....	3-31
26	Table 3-16: Carbon Intensity from Direct Fossil Fuel Combustion by Sector (MMT CO ₂ Eq./QBtu).....	3-36
27	Table 3-17: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Energy-Related Fossil Fuel Combustion by Fuel Type and Sector (MMT CO ₂ Eq. and Percent)	3-39
29	Table 3-18: Comparison of Electric Power Sector Emissions (MMT CO ₂ Eq. and Percent)	3-40
30	Table 3-19: Comparison of Emissions Factors (MMT Carbon/QBtu).....	3-40
31	Table 3-20: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and N ₂ O Emissions from Energy-Related Stationary Combustion, Including Biomass (MMT CO ₂ Eq. and Percent)	3-45
33	Table 3-21: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and N ₂ O Emissions from Mobile Sources (MMT CO ₂ Eq. and Percent)	3-49
35	Table 3-22: CO ₂ Emissions from Non-Energy Use Fossil Fuel Consumption (MMT CO ₂ Eq. and Percent C).....	3-52
36	Table 3-23: Adjusted Consumption of Fossil Fuels for Non-Energy Uses (TBtu)	3-53
37	Table 3-24: 2021 Adjusted Non-Energy Use Fossil Fuel Consumption, Storage, and Emissions	3-54

1	Table 3-25: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Non-Energy Uses of Fossil Fuels (MMT CO ₂ Eq. and Percent).....	3-56
3	Table 3-26: Approach 2 Quantitative Uncertainty Estimates for Storage Factors of Non-Energy Uses of Fossil Fuels (Percent)	3-57
5	Table 3-27: CO ₂ , CH ₄ , and N ₂ O Emissions from the Combustion of Waste (MMT CO ₂ Eq.).....	3-60
6	Table 3-28: CO ₂ , CH ₄ , and N ₂ O Emissions from the Combustion of Waste (kt)	3-60
7	Table 3-29: Municipal Solid Waste Combusted (Short Tons)	3-60
8	Table 3-30: Calculated Fossil CO ₂ Content per Ton Waste Combusted (kg CO ₂ /Short Ton Combusted)	3-61
9	Table 3-31: CO ₂ Emissions from Combustion of Tires (MMT CO ₂ Eq.).....	3-61
10	Table 3-32: Approach 2 Quantitative Uncertainty Estimates for CO ₂ and N ₂ O from the Incineration of Waste (MMT CO ₂ Eq. and Percent)	3-62
12	Table 3-33: Coal Production (kt)	3-63
13	Table 3-34: CH ₄ Emissions from Coal Mining (MMT CO ₂ Eq.)	3-64
14	Table 3-35: CH ₄ Emissions from Coal Mining (kt)	3-64
15	Table 3-36: CO ₂ Emissions from Coal Mining (MMT CO ₂ Eq.)	3-67
16	Table 3-37: CO ₂ Emissions from Coal Mining (kt)	3-68
17	Table 3-38: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Coal Mining (MMT CO ₂ Eq. and Percent)	3-70
19	Table 3-39: CH ₄ Emissions from Abandoned Coal Mines (MMT CO ₂ Eq.).....	3-72
20	Table 3-40: CH ₄ Emissions from Abandoned Coal Mines (kt)	3-72
21	Table 3-41: Number of Gassy Abandoned Mines Present in U.S. Basins in 2021, Grouped by Class According to Post-Abandonment State	3-73
23	Table 3-42: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Abandoned Underground Coal Mines (MMT CO ₂ Eq. and Percent).....	3-75
25	Table 3-43: Total Greenhouse Gas Emissions (CO ₂ , CH ₄ , and N ₂ O) from Petroleum Systems (MMT CO ₂ Eq.).....	3-77
26	Table 3-44: CH ₄ Emissions from Petroleum Systems (MMT CO ₂ Eq.)	3-78
27	Table 3-45: CH ₄ Emissions from Petroleum Systems (kt CH ₄).....	3-78
28	Table 3-46: CO ₂ Emissions from Petroleum Systems (MMT CO ₂).....	3-78
29	Table 3-47: CO ₂ Emissions from Petroleum Systems (kt CO ₂)	3-78
30	Table 3-48: N ₂ O Emissions from Petroleum Systems (Metric Tons CO ₂ Eq.).....	3-79
31	Table 3-49: N ₂ O Emissions from Petroleum Systems (Metric Tons N ₂ O)	3-79
32	Table 3-50: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Petroleum Systems (MMT CO ₂ Eq. and Percent).....	3-82
34	Table 3-51: Recalculations of CO ₂ in Petroleum Systems (MMT CO ₂)	3-85
35	Table 3-52: Recalculations of CH ₄ in Petroleum Systems (MMT CO ₂ Eq.)	3-86
36	Table 3-53: Pneumatic Controllers National CH ₄ Emissions (Metric Tons CH ₄)	3-87
37	Table 3-54: Production Equipment Leaks National CH ₄ Emissions (Metric Tons CH ₄).....	3-87
38	Table 3-55: Chemical Injection Pumps National CH ₄ Emissions (Metric Tons CH ₄)	3-88

1	Table 3-56: Storage Tanks National CH ₄ Emissions (Metric Tons CH ₄)	3-88
2	Table 3-57: Storage Tanks National CO ₂ Emissions (kt CO ₂)	3-89
3	Table 3-58: Associated Gas Flaring National CO ₂ Emissions (kt CO ₂).....	3-89
4	Table 3-59: Miscellaneous Production Flaring National CO ₂ Emissions (kt CO ₂)	3-90
5	Table 3-60: Miscellaneous Production Flaring National CH ₄ Emissions (Metric Tons CH ₄)	3-90
6	Table 3-61: Offshore Production National CH ₄ Emissions (Metric Tons CH ₄).....	3-90
7	Table 3-62: Refining National CO ₂ Emissions (kt CO ₂)	3-91
8	Table 3-63: Quantity of CO ₂ Captured and Extracted for EOR Operations (kt CO ₂)	3-92
9	Table 3-64: Geologic Sequestration Information Reported Under GHGRP Subpart RR	3-92
10	Table 3-65: Total Greenhouse Gas Emissions (CH ₄ , CO ₂ , and N ₂ O) from Natural Gas Systems (MMT CO ₂ Eq.)....	3-96
11	Table 3-66: CH ₄ Emissions from Natural Gas Systems (MMT CO ₂ Eq.)	3-96
12	Table 3-67: CH ₄ Emissions from Natural Gas Systems (kt)	3-96
13	Table 3-68: CO ₂ Emissions from Natural Gas Systems (MMT).....	3-97
14	Table 3-69: CO ₂ Emissions from Natural Gas Systems (kt)	3-97
15	Table 3-70: N ₂ O Emissions from Natural Gas Systems (Metric Tons CO ₂ Eq.).....	3-97
16	Table 3-71: N ₂ O Emissions from Natural Gas Systems (Metric Tons N ₂ O)	3-97
17	Table 3-72: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and Non-combustion CO ₂ Emissions from Natural Gas Systems (MMT CO ₂ Eq. and Percent).....	3-100
19	Table 3-73: Recalculations of CO ₂ in Natural Gas Systems (MMT CO ₂)	3-103
20	Table 3-74: Recalculations of CH ₄ in Natural Gas Systems (MMT CO ₂ Eq.)	3-104
21	Table 3-75: Pneumatic Controllers National CH ₄ Emissions (Metric Tons CH ₄).....	3-105
22	Table 3-76: Storage Tanks National CH ₄ Emissions (Metric Tons CH ₄)	3-105
23	Table 3-77: Storage Tanks National CO ₂ Emissions (kt CO ₂)	3-106
24	Table 3-78: Production Equipment Leaks National CH ₄ Emissions (Metric Tons CH ₄).....	3-106
25	Table 3-79: Chemical Injection Pumps National CH ₄ Emissions (Metric Tons CH ₄)	3-107
26	Table 3-80: Liquids Unloading National CH ₄ Emissions (Metric Tons CH ₄)	3-108
27	Table 3-81: Liquids Unloading National CO ₂ Emissions (Metric Tons CO ₂).....	3-108
28	Table 3-82: Miscellaneous Production Flaring National Emissions (kt CO ₂)	3-108
29	Table 3-83: Tanks National Emissions (Metric Tons CH ₄)	3-109
30	Table 3-84: Station Blowdowns National Emissions (Metric Tons CH ₄).....	3-109
31	Table 3-85: Dehydrator Vents National Emissions (Metric Tons CH ₄)	3-109
32	Table 3-86: Dehydrator Vents National Emissions (kt CO ₂).....	3-109
33	Table 3-87: Production Storage Tanks National Emissions (kt CO ₂)	3-110
34	Table 3-88: Processing Segment Flares National CO ₂ Emissions (kt CO ₂).....	3-110
35	Table 3-89: AGR Vents National CO ₂ Emissions (kt CO ₂).....	3-110
36	Table 3-90: Mains – Unprotected Steel National CH ₄ Emissions (Metric Tons CH ₄).....	3-111

1	Table 3-91: Post-Meter National CH ₄ Emissions (Metric Tons CH ₄)	3-111
2	Table 3-92: CH ₄ Emissions from Abandoned Oil and Gas Wells (MMT CO ₂ Eq.)	3-112
3	Table 3-93: CH ₄ Emissions from Abandoned Oil and Gas Wells (kt).....	3-112
4	Table 3-94: CO ₂ Emissions from Abandoned Oil and Gas Wells (MMT CO ₂)	3-113
5	Table 3-95: CO ₂ Emissions from Abandoned Oil and Gas Wells (kt).....	3-113
6	Table 3-96: Abandoned Oil Wells Activity Data, CH ₄ and CO ₂ Emissions (kt).....	3-114
7	Table 3-97: Abandoned Gas Wells Activity Data, CH ₄ and CO ₂ Emissions (kt).....	3-114
8	Table 3-98: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Petroleum and Natural 9 Gas Systems (MMT CO ₂ Eq. and Percent).....	3-115
10	Table 3-99: CO ₂ , CH ₄ , and N ₂ O Emissions from International Bunker Fuels (MMT CO ₂ Eq.)	3-118
11	Table 3-100: CO ₂ , CH ₄ , and N ₂ O Emissions from International Bunker Fuels (kt).....	3-118
12	Table 3-101: Aviation Jet Fuel Consumption for International Transport (Million Gallons).....	3-119
13	Table 3-102: Marine Fuel Consumption for International Transport (Million Gallons).....	3-120
14	Table 3-103: CO ₂ Emissions from Wood Consumption by End-Use Sector (MMT CO ₂ Eq.)	3-122
15	Table 3-104: CO ₂ Emissions from Wood Consumption by End-Use Sector (kt).....	3-123
16	Table 3-105: CO ₂ Emissions from Biogenic Components of MSW (MMT CO ₂ Eq.).....	3-123
17	Table 3-106: CO ₂ Emissions from Biogenic Components of MSW (kt)	3-123
18	Table 3-107: CO ₂ Emissions from Ethanol Consumption (MMT CO ₂ Eq.)	3-123
19	Table 3-108: CO ₂ Emissions from Ethanol Consumption (kt).....	3-123
20	Table 3-109: CO ₂ Emissions from Biodiesel Consumption (MMT CO ₂ Eq.)	3-124
21	Table 3-110: CO ₂ Emissions from Biodiesel Consumption (kt)	3-124
22	Table 3-111: Calculated Biogenic CO ₂ Content per Ton Waste (kg CO ₂ /Short Ton Combusted).....	3-124
23	Table 3-112: Woody Biomass Consumption by Sector (Trillion Btu)	3-125
24	Table 3-113: Ethanol Consumption by Sector (Trillion Btu)	3-125
25	Table 3-114: Biodiesel Consumption by Sector (Trillion Btu)	3-125
26	Table 3-115: NO _x , CO, NMVOC, and SO ₂ Emissions from Energy-Related Activities (kt).....	3-127
27	Table 4-1: Emissions from Industrial Processes and Product Use (MMT CO ₂ Eq.)	4-4
28	Table 4-2: Emissions from Industrial Processes and Product Use (kt)	4-5
29	Table 4-3: CO ₂ Emissions from Cement Production (MMT CO ₂ Eq. and kt).....	4-10
30	Table 4-4: Clinker Production (kt).....	4-12
31	Table 4-5: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Cement Production (MMT CO ₂ 32 Eq. and Percent)	4-12
33	Table 4-6: CO ₂ Emissions from Lime Production (MMT CO ₂ Eq. and kt)	4-15
34	Table 4-7: Gross, Recovered, and Net CO ₂ Emissions from Lime Production (kt)	4-15
35	Table 4-8: High-Calcium- and Dolomitic-Quicklime, High-Calcium- and Dolomitic-Hydrated, and Dead-Burned- 36 Dolomite Lime Production (kt)	4-17

1	Table 4-9: Adjusted Lime Production (kt)	4-17
2	Table 4-10: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Lime Production (MMT CO ₂ Eq. and Percent)	4-18
4	Table 4-11: CO ₂ Emissions from Glass Production (MMT CO ₂ Eq. and kt).....	4-21
5	Table 4-12: Limestone, Dolomite, Soda Ash, and Other Carbonates Used in Glass Production (kt) and Average Annual Production Index for Glass and Glass Product Manufacturing.....	4-22
7	Table 4-13: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Glass Production (MMT CO ₂ Eq. and Percent)	4-23
9	Table 4-14: CO ₂ Emissions from Other Process Uses of Carbonates (MMT CO ₂ Eq.)	4-25
10	Table 4-15: CO ₂ Emissions from Other Process Uses of Carbonates (kt).....	4-25
11	Table 4-16: Limestone and Dolomite Consumption (kt).....	4-26
12	Table 4-17: Soda Ash Consumption Not Associated with Glass Manufacturing (kt)	4-27
13	Table 4-18: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Other Process Uses of Carbonates (MMT CO ₂ Eq. and Percent)	4-28
15	Table 4-19: CO ₂ Emissions from Ammonia Production (MMT CO ₂ Eq.).....	4-30
16	Table 4-20: CO ₂ Emissions from Ammonia Production (kt)	4-30
17	Table 4-21: Total Ammonia Production, Total Urea Production, and RecoveredCO ₂ Consumed for Urea Production (kt)	4-31
19	Table 4-22: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Ammonia Production (MMT CO ₂ Eq. and Percent)	4-32
21	Table 4-23: CO ₂ Emissions from Urea Consumption for Non-Agricultural Purposes (MMT CO ₂ Eq.).....	4-34
22	Table 4-24: CO ₂ Emissions from Urea Consumption for Non-Agricultural Purposes (kt)	4-34
23	Table 4-25: Urea Production, Urea Applied as Fertilizer, Urea Imports, and Urea Exports (kt)	4-35
24	Table 4-26: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Urea Consumption for Non-Agricultural Purposes (MMT CO ₂ Eq. and Percent)	4-35
26	Table 4-27: N ₂ O Emissions from Nitric Acid Production (MMT CO ₂ Eq. and kt N ₂ O).....	4-37
27	Table 4-28: Nitric Acid Production (kt)	4-39
28	Table 4-29: Approach 2 Quantitative Uncertainty Estimates for N ₂ O Emissions from Nitric Acid Production (MMT CO ₂ Eq. and Percent)	4-40
30	Table 4-30: N ₂ O Emissions from Adipic Acid Production (MMT CO ₂ Eq. and kt N ₂ O)	4-42
31	Table 4-31: Adipic Acid Production (kt)	4-43
32	Table 4-32: Approach 2 Quantitative Uncertainty Estimates for N ₂ O Emissions from Adipic Acid Production (MMT CO ₂ Eq. and Percent)	4-43
34	Table 4-33: N ₂ O Emissions from Caprolactam Production (MMT CO ₂ Eq. and kt N ₂ O).....	4-46
35	Table 4-34: Caprolactam Production (kt).....	4-47
36	Table 4-35: Approach 2 Quantitative Uncertainty Estimates for N ₂ O Emissions from Caprolactam, Glyoxal and Glyoxylic Acid Production (MMT CO ₂ Eq. and Percent)	4-47
38	Table 4-36: CO ₂ and CH ₄ Emissions from Silicon Carbide Production and Consumption (MMT CO ₂ Eq.)	4-49
39	Table 4-37: CO ₂ and CH ₄ Emissions from Silicon Carbide Production and Consumption (kt).....	4-49

1	Table 4-38: Production and Consumption of Silicon Carbide (Metric Tons).....	4-51
2	Table 4-39: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Silicon Carbide	
3	Production and Consumption (MMT CO ₂ Eq. and Percent)	4-51
4	Table 4-40: CO ₂ Emissions from Titanium Dioxide (MMT CO ₂ Eq. and kt).....	4-53
5	Table 4-41: Titanium Dioxide Production (kt).....	4-54
6	Table 4-42: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Titanium Dioxide Production	
7	(MMT CO ₂ Eq. and Percent)	4-55
8	Table 4-43: CO ₂ Emissions from Soda Ash Production (MMT CO ₂ Eq. and kt CO ₂).....	4-56
9	Table 4-44: Trona Ore Used in Soda Ash Production (kt)	4-57
10	Table 4-45: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Soda Ash Production (MMT	
11	CO ₂ Eq. and Percent)	4-58
12	Table 4-46: CO ₂ and CH ₄ Emissions from Petrochemical Production (MMT CO ₂ Eq.)	4-60
13	Table 4-47: CO ₂ and CH ₄ Emissions from Petrochemical Production (kt).....	4-60
14	Table 4-48: Production of Selected Petrochemicals (kt)	4-63
15	Table 4-49: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Petrochemical Production and	
16	CO ₂ Emissions from Petrochemical Production (MMT CO ₂ Eq. and Percent).....	4-64
17	Table 4-50: HFC-23 Emissions from HCFC-22 Production (MMT CO ₂ Eq. and kt HFC-23)	4-67
18	Table 4-51: HCFC-22 Production (kt)	4-68
19	Table 4-52: Approach 2 Quantitative Uncertainty Estimates for HFC-23 Emissions from HCFC-22 Production (MMT	
20	CO ₂ Eq. and Percent)	4-69
21	Table 4-53: CO ₂ Emissions from CO ₂ Consumption (MMT CO ₂ Eq. and kt)	4-70
22	Table 4-54: CO ₂ Production (kt CO ₂) and the Percent Used for Non-EOR Applications	4-71
23	Table 4-55: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from CO ₂ Consumption (MMT CO ₂	
24	Eq. and Percent)	4-72
25	Table 4-56: CO ₂ Emissions from Phosphoric Acid Production (MMT CO ₂ Eq. and kt)	4-74
26	Table 4-57: Phosphate Rock Domestic Consumption, Exports, and Imports (kt)	4-75
27	Table 4-58: Chemical Composition of Phosphate Rock (Percent by Weight)	4-75
28	Table 4-59: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Phosphoric Acid Production	
29	(MMT CO ₂ Eq. and Percent).....	4-76
30	Table 4-60: CO ₂ Emissions from Metallurgical Coke Production (MMT CO ₂ Eq.)	4-78
31	Table 4-61: CO ₂ Emissions from Metallurgical Coke Production (kt).....	4-78
32	Table 4-62: CO ₂ Emissions from Iron and Steel Production (MMT CO ₂ Eq.).....	4-79
33	Table 4-63: CO ₂ Emissions from Iron and Steel Production (kt)	4-79
34	Table 4-64: CH ₄ Emissions from Iron and Steel Production (MMT CO ₂ Eq.).....	4-79
35	Table 4-65: CH ₄ Emissions from Iron and Steel Production (kt)	4-80
36	Table 4-66: Material Carbon Contents for Metallurgical Coke Production	4-81
37	Table 4-67: Production and Consumption Data for the Calculation of CO ₂ Emissions from Metallurgical Coke	
38	Production (Thousand Metric Tons)	4-82

1	Table 4-68: Production and Consumption Data for the Calculation of CO ₂ Emissions from Metallurgical Coke Production (Million ft ³).....	4-82
3	Table 4-69: Material Carbon Contents for Iron and Steel Production.....	4-83
4	Table 4-70: CH ₄ Emission Factors for Sinter and Pig Iron Production.....	4-84
5	Table 4-71: CO ₂ Emission Factors for Sinter Production, Direct Reduced Iron Production, and Pellet Production	4-84
6	Table 4-72: Production and Consumption Data for the Calculation of CO ₂ and CH ₄ Emissions from Iron and Steel Production (Thousand Metric Tons)	4-85
8	Table 4-73: Production and Consumption Data for the Calculation of CO ₂ Emissions from Iron and Steel Production (Million ft ³ unless otherwise specified)	4-86
10	Table 4-74: Approach 2 Quantitative Uncertainty Estimates for CO ₂ and CH ₄ Emissions from Iron and Steel Production and Metallurgical Coke Production (MMT CO ₂ Eq. and Percent)	4-87
12	Table 4-75: CO ₂ and CH ₄ Emissions from Ferroalloy Production (MMT CO ₂ Eq.)	4-89
13	Table 4-76: CO ₂ and CH ₄ Emissions from Ferroalloy Production (kt).....	4-89
14	Table 4-77: Production of Ferroalloys (Metric Tons)	4-91
15	Table 4-78: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Ferroalloy Production (MMT CO ₂ Eq. and Percent)	4-92
17	Table 4-79: CO ₂ Emissions from Aluminum Production (MMT CO ₂ Eq. and kt)	4-94
18	Table 4-80: PFC Emissions from Aluminum Production (MMT CO ₂ Eq.).....	4-94
19	Table 4-81: PFC Emissions from Aluminum Production (kt)	4-94
20	Table 4-82: Summary of HVAE Emissions	4-97
21	Table 4-83: Summary of LVAE Emissions	4-98
22	Table 4-84: Production of Primary Aluminum (kt).....	4-98
23	Table 4-85: Approach 2 Quantitative Uncertainty Estimates for CO ₂ and PFC Emissions from Aluminum Production (MMT CO ₂ Eq. and Percent).....	4-99
25	Table 4-86: SF ₆ , HFC-134a, FK 5-1-12 and CO ₂ Emissions from Magnesium Production and Processing (MMT CO ₂ Eq.).....	4-100
27	Table 4-87: SF ₆ , HFC-134a, FK 5-1-12 and CO ₂ Emissions from Magnesium Production and Processing (kt)	4-100
28	Table 4-88: SF ₆ Emission Factors (kg SF ₆ per metric ton of magnesium).....	4-103
29	Table 4-89: Approach 2 Quantitative Uncertainty Estimates for SF ₆ , HFC-134a and CO ₂ Emissions from Magnesium Production and Processing (MMT CO ₂ Eq. and Percent)	4-104
31	Table 4-90: CO ₂ Emissions from Lead Production (MMT CO ₂ Eq. and kt).....	4-107
32	Table 4-91: Lead Production (Metric Tons)	4-107
33	Table 4-92: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Lead Production (MMT CO ₂ Eq. and Percent)	4-108
35	Table 4-93: CO ₂ Emissions from Zinc Production (MMT CO ₂ Eq. and kt).....	4-110
36	Table 4-94: Zinc Production (Metric Tons)	4-111
37	Table 4-95: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Zinc Production (MMT CO ₂ Eq. and Percent)	4-114
39	Table 4-96: PFC, HFC, SF ₆ , NF ₃ , and N ₂ O Emissions from Electronics Industry (MMT CO ₂ Eq.)	4-117

1	Table 4-97: PFC, HFC, SF ₆ , NF ₃ , and N ₂ O Emissions from Semiconductor Manufacture (Metric Tons)	4-118
2	Table 4-98: F-HTF Emissions from Electronics Manufacture by Compound Group (kt CO ₂ Eq.)	4-118
3	Table 4-99: Approach 2 Quantitative Uncertainty Estimates for HFC, PFC, SF ₆ , NF ₃ and N ₂ O Emissions from Electronics Manufacture (MMT CO ₂ Eq. and Percent)	4-130
5	Table 4-100: Emissions of HFCs, PFCs, and CO ₂ from ODS Substitutes (MMT CO ₂ Eq.).....	4-132
6	Table 4-101: Emissions of HFCs, PFCs, and CO ₂ from ODS Substitution (Metric Tons)	4-133
7	Table 4-102: Emissions of HFCs, PFCs, and CO ₂ from ODS Substitutes (MMT CO ₂ Eq.) by Sector.....	4-134
8	Table 4-103: Approach 2 Quantitative Uncertainty Estimates for HFC and PFC Emissions from ODS Substitutes (MMT CO ₂ Eq. and Percent).....	4-137
10	Table 4-104: SF ₆ and CF ₄ Emissions from Electric Power Systems and Electrical Equipment Manufacturers (MMT CO ₂ Eq.).....	4-142
12	Table 4-105: SF ₆ and CF ₄ Emissions from Electric Power Systems and Electrical Equipment Manufacturers (kt) 4-142	
13	Table 4-106: GHGRP-only Average Emission Rate (kg per mile)	4-146
14	Table 4-107: Categorization of Utilities and Timeseries for Application of Corresponding Emission Estimation Methodologies.....	4-146
16	Table 4-108: Approach 2 Quantitative Uncertainty Estimates for SF ₆ and CF ₄ Emissions from Electrical Transmission and Distribution (MMT CO ₂ Eq. and Percent).....	4-148
18	Table 4-109: N ₂ O Production (kt)	4-153
19	Table 4-110: N ₂ O Emissions from N ₂ O Product Usage (MMT CO ₂ Eq. and kt).....	4-153
20	Table 4-111: Approach 2 Quantitative Uncertainty Estimates for N ₂ O Emissions from N ₂ O Product Usage (MMT CO ₂ Eq. and Percent)	4-155
22	Table 4-112: NO _x , CO, NMVOC, and SO ₂ Emissions from Industrial Processes and Product Use (kt).....	4-156
23	Table 5-1: Emissions from Agriculture (MMT CO ₂ Eq.)	5-3
24	Table 5-2: Emissions from Agriculture (kt)	5-3
25	Table 5-3: CH ₄ Emissions from Enteric Fermentation (MMT CO ₂ Eq.).....	5-5
26	Table 5-4: CH ₄ Emissions from Enteric Fermentation (kt)	5-5
27	Table 5-5: Cattle Sub-Population Categories for 2021 Population Estimates	5-8
28	Table 5-6: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Enteric Fermentation (MMT CO ₂ Eq. and Percent)	5-10
30	Table 5-7: CH ₄ and N ₂ O Emissions from Manure Management (MMT CO ₂ Eq.)	5-13
31	Table 5-8: CH ₄ and N ₂ O Emissions from Manure Management (kt)	5-14
32	Table 5-9: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and N ₂ O (Direct and Indirect) Emissions from Manure Management (MMT CO ₂ Eq. and Percent)	5-19
34	Table 5-10: IPCC (2006) Implied Emission Factor Default Values Compared with Calculated Values for CH ₄ from Manure Management (kg/head/year)	5-20
36	Table 5-11: CH ₄ Emissions from Rice Cultivation (MMT CO ₂ Eq.)	5-22
37	Table 5-12: CH ₄ Emissions from Rice Cultivation (kt)	5-23
38	Table 5-13: Rice Area Harvested (1,000 Hectares)	5-25

1	Table 5-14: Average Ratooned Area as Percent of Primary Growth Area (Percent)	5-26
2	Table 5-15: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Rice Cultivation (MMT CO ₂ Eq. and Percent)	5-27
4	Table 5-16: N ₂ O Emissions from Agricultural Soils (MMT CO ₂ Eq.)	5-31
5	Table 5-17: N ₂ O Emissions from Agricultural Soils (kt)	5-31
6	Table 5-18: Direct N ₂ O Emissions from Agricultural Soils by Land Use Type and N Input Type (MMT CO ₂ Eq.)	5-31
7	Table 5-19: Indirect N ₂ O Emissions from Agricultural Soils (MMT CO ₂ Eq.)	5-32
8	Table 5-20: Quantitative Uncertainty Estimates of N ₂ O Emissions from Agricultural Soil Management in 2021 (MMT CO ₂ Eq. and Percent).....	5-46
10	Table 5-21: Emissions from Liming (MMT CO ₂ Eq.)	5-48
11	Table 5-22: Emissions from Liming (MMT C)	5-48
12	Table 5-23: Applied Minerals (MMT).....	5-50
13	Table 5-24: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Emissions from Liming (MMT CO ₂ Eq. and Percent)	5-50
15	Table 5-25: CO ₂ Emissions from Urea Fertilization (MMT CO ₂ Eq.)	5-51
16	Table 5-26: CO ₂ Emissions from Urea Fertilization (MMT C)	5-51
17	Table 5-27: Applied Urea (MMT)	5-52
18	Table 5-28: Quantitative Uncertainty Estimates for CO ₂ Emissions from Urea Fertilization (MMT CO ₂ Eq. and Percent)	5-52
20	Table 5-29: CH ₄ and N ₂ O Emissions from Field Burning of Agricultural Residues (MMT CO ₂ Eq.)	5-54
21	Table 5-30: CH ₄ , N ₂ O, CO, and NO _x Emissions from Field Burning of Agricultural Residues (kt)	5-55
22	Table 5-31: Agricultural Crop Production (kt of Product)	5-58
23	Table 5-32: U.S. Average Percent Crop Area Burned by Crop (Percent).....	5-59
24	Table 5-33: Parameters for Estimating Emissions from Field Burning of Agricultural Residues.....	5-59
25	Table 5-34: Greenhouse Gas Emission Ratios and Conversion Factors	5-60
26	Table 5-35: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and N ₂ O Emissions from Field Burning of Agricultural Residues (MMT CO ₂ Eq. and Percent).....	5-61
28	Table 6-1: Emissions and Removals (Net Flux) from Land Use, Land-Use Change, and Forestry (MMT CO ₂ Eq.)	6-4
29	Table 6-2: Emissions and Removals from Land Use, Land-Use Change, and Forestry by Gas (MMT CO ₂ Eq.)	6-6
30	Table 6-3: Emissions and Removals from Land Use, Land-Use Change, and Forestry by Gas (kt).....	6-7
31	Table 6-4: Managed and Unmanaged Land Area by Land-Use Categories for All 50 States (Thousands of Hectares)	6-11
33	Table 6-5: Land Use and Land-Use Change for the U.S. Managed Land Base for All 50 States (Thousands of Hectares)	6-11
35	Table 6-6: Data Sources Used to Determine Land Use and Land Area for the Conterminous United States, Hawaii, and Alaska.....	6-17
37	Table 6-7: Total Land Area (Hectares) by Land Use Category for U.S. Territories	6-24

1	Table 6-8: Net CO ₂ Flux from Forest Ecosystem Pools in Forest Land Remaining Forest Land and Harvested Wood Pools (MMT CO ₂ Eq.)	6-28
3	Table 6-9: Net C Flux from Forest Ecosystem Pools in Forest Land Remaining Forest Land and Harvested Wood Pools (MMT C)	6-29
5	Table 6-10: Forest Area (1,000 ha) and C Stocks in Forest Land Remaining Forest Land and Harvested Wood Pools (MMT C).....	6-30
7	Table 6-11: Estimates of CO ₂ (MMT per Year) Emissions ^a from Forest Fires in the Conterminous 48 States and Alaska.....	6-32
9	Table 6-12: Quantitative Uncertainty Estimates for Net CO ₂ Flux from Forest Land Remaining Forest Land: Changes in Forest C Stocks (MMT CO ₂ Eq. and Percent)	6-36
11	Table 6-13: Recalculations of Forest Area (1,000 ha) and C Stocks in Forest Land Remaining Forest Land and Harvested Wood Pools (MMT C)	6-38
13	Table 6-14: Recalculations of Net C Flux from Forest Ecosystem Pools in Forest Land Remaining Forest Land and Harvested Wood Pools (MMT C)	6-38
15	Table 6-15: Non-CO ₂ Emissions from Forest Fires (MMT CO ₂ Eq.) ^a	6-40
16	Table 6-16: Non-CO ₂ Emissions from Forest Fires (kt) ^a	6-40
17	Table 6-17: Quantitative Uncertainty Estimates of Non-CO ₂ Emissions from Forest Fires (MMT CO ₂ Eq. and Percent) ^a	6-41
19	Table 6-18: N ₂ O Fluxes from Soils in Forest Land Remaining Forest Land and Land Converted to Forest Land (MMT CO ₂ Eq. and kt N ₂ O)	6-42
21	Table 6-19: Quantitative Uncertainty Estimates of N ₂ O Fluxes from Soils in Forest Land Remaining Forest Land and Land Converted to Forest Land (MMT CO ₂ Eq. and Percent)	6-43
23	Table 6-20: Non-CO ₂ Emissions from Drained Organic Forest Soils ^{a,b} (MMT CO ₂ Eq.)	6-45
24	Table 6-21: Non-CO ₂ Emissions from Drained Organic Forest Soils ^{a,b} (kt)	6-45
25	Table 6-22: States identified as having Drained Organic Soils, Area of Forest on Drained Organic Soils, and Sampling Error	6-46
27	Table 6-23: Quantitative Uncertainty Estimates for Non-CO ₂ Emissions on Drained Organic Forest Soils (MMT CO ₂ Eq. and Percent) ^a	6-47
29	Table 6-24: Net CO ₂ Flux from Forest C Pools in Land Converted to Forest Land by Land Use Change Category (MMT CO ₂ Eq.)	6-49
31	Table 6-25: Net C Flux from Forest C Pools in Land Converted to Forest Land by Land Use Change Category (MMT C).....	6-50
33	Table 6-26: Quantitative Uncertainty Estimates for Forest C Pool Stock Changes (MMT CO ₂ Eq. per Year) in 2021 from Land Converted to Forest Land by Land Use Change	6-53
35	Table 6-27: Recalculations of the Net C Flux from Forest C Pools in Land Converted to Forest Land by Land Use Change Category (MMT C).....	6-55
37	Table 6-28: Net CO ₂ Flux from Soil C Stock Changes in Cropland Remaining Cropland (MMT CO ₂ Eq.).....	6-57
38	Table 6-29: Net CO ₂ Flux from Soil C Stock Changes in Cropland Remaining Cropland (MMT C)	6-57
39	Table 6-30: Approach 2 Quantitative Uncertainty Estimates for Soil C Stock Changes occurring within Cropland Remaining Cropland (MMT CO ₂ Eq. and Percent)	6-65

1	Table 6-31: Comparison of Managed Land Area in Cropland Remaining Cropland and Area in the Current Cropland 2 Remaining Cropland Inventory (Thousand Hectares).....	6-66
3	Table 6-32: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes in Land Converted to 4 Cropland by Land Use Change Category (MMT CO ₂ Eq.).....	6-68
5	Table 6-33: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes in Land Converted to 6 Cropland (MMT C)	6-69
7	Table 6-34: Approach 2 Quantitative Uncertainty Estimates for Soil, Dead Organic Matter and Biomass C Stock 8 Changes occurring within Land Converted to Cropland (MMT CO ₂ Eq. and Percent).....	6-72
9	Table 6-35: Comparison of Managed Land Area in Land Converted to Cropland and the Area in the current Land 10 Converted to Cropland Inventory (Thousand Hectares).....	6-74
11	Table 6-36: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes in Grassland Remaining 12 Grassland (MMT CO ₂ Eq.)	6-76
13	Table 6-37: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes in Grassland Remaining 14 Grassland (MMT C)	6-76
15	Table 6-38: Approach 2 Quantitative Uncertainty Estimates for C Stock Changes Occurring Within Grassland 16 Remaining Grassland (MMT CO ₂ Eq. and Percent)	6-81
17	Table 6-39: Comparison of Managed Land Area in Grassland Remaining Grassland and the Area in the current 18 Grassland Remaining Grassland Inventory (Thousand Hectares).....	6-83
19	Table 6-40: CH ₄ and N ₂ O Emissions from Biomass Burning in Grassland (MMT CO ₂ Eq.)	6-84
20	Table 6-41: CH ₄ , N ₂ O, CO, and NO _x Emissions from Biomass Burning in Grassland (kt).....	6-84
21	Table 6-42: Thousands of Grassland Hectares Burned Annually	6-85
22	Table 6-43: Uncertainty Estimates for Non-CO ₂ Greenhouse Gas Emissions from Biomass Burning in Grassland 23 (MMT CO ₂ Eq. and Percent).....	6-86
24	Table 6-44: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes for Land Converted to 25 Grassland (MMT CO ₂ Eq.)	6-88
26	Table 6-45: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes for Land Converted to 27 Grassland (MMT C)	6-88
28	Table 6-46: Approach 2 Quantitative Uncertainty Estimates for Soil, Dead Organic Matter and Biomass C Stock 29 Changes occurring within Land Converted to Grassland (MMT CO ₂ Eq. and Percent).....	6-92
30	Table 6-47: Comparison of Managed Land Area in Land Converted to Grassland and Area in the current Land 31 Converted to Grassland Inventory (Thousand Hectares)	6-94
32	Table 6-48: Emissions from Peatlands Remaining Peatlands (MMT CO ₂ Eq.)	6-97
33	Table 6-49: Emissions from Peatlands Remaining Peatlands (kt).....	6-97
34	Table 6-50: Peat Production of Conterminous 48 States (kt)	6-98
35	Table 6-51: Peat Production of Alaska (Thousand Cubic Meters)	6-98
36	Table 6-52: Peat Production Area of Conterminous 48 States (Hectares)	6-99
37	Table 6-53: Peat Production Area of Alaska (Hectares).....	6-99
38	Table 6-54: Peat Production (Hectares).....	6-99
39	Table 6-55: Approach 2 Quantitative Uncertainty Estimates for CO ₂ , CH ₄ , and N ₂ O Emissions from Peatlands 40 Remaining Peatlands (MMT CO ₂ Eq. and Percent)	6-101

1	Table 6-56: Emissions and Removals from Coastal Wetlands Remaining Coastal Wetlands (MMT CO ₂ Eq.)	6-104
2	Table 6-57: Net CO ₂ Flux from C Stock Changes in Vegetated Coastal Wetlands Remaining Vegetated Coastal	
3	Wetlands (MMT CO ₂ Eq.).....	6-105
4	Table 6-58: Net CO ₂ Flux from C Stock Changes in Vegetated Coastal Wetlands Remaining Vegetated Coastal	
5	Wetlands (MMT C).....	6-105
6	Table 6-59: CH ₄ Emissions from Vegetated Coastal Wetlands Remaining Vegetated Coastal Wetlands (MMT CO ₂	
7	Eq. and kt CH ₄).....	6-105
8	Table 6-60: Area of Vegetated Coastal Wetlands Remaining Vegetated Coastal Wetlands, Vegetated Coastal	
9	Wetlands Converted to Unvegetated Open Water Coastal Wetlands, and Unvegetated Open Water Coastal	
10	Wetlands Converted to Vegetated Coastal Wetlands (ha).....	6-106
11	Table 6-61: Aboveground Biomass Carbon Stocks for Vegetated Coastal Wetlands (t C ha ⁻¹).....	6-106
12	Table 6-62: Root to Shoot Ratios for Vegetated Coastal Wetlands	6-107
13	Table 6-63: Annual Soil Carbon Accumulation Rates for Vegetated Coastal Wetlands (t C ha ⁻¹ yr ⁻¹).....	6-107
14	Table 6-64: IPCC Approach 1 Quantitative Uncertainty Estimates for C Stock Changes and CH ₄ Emissions occurring	
15	within Vegetated Coastal Wetlands Remaining Vegetated Coastal Wetlands in 2021 (MMT CO ₂ Eq. and Percent)..	
16	6-108	
17	Table 6-65: Net CO ₂ Flux from C Stock Changes in Vegetated Coastal Wetlands Converted to Unvegetated Open	
18	Water Coastal Wetlands (MMT CO ₂ Eq.)	6-110
19	Table 6-66: Net CO ₂ Flux from C Stock Changes in Vegetated Coastal Wetlands Converted to Unvegetated Open	
20	Water Coastal Wetlands (MMT C).....	6-111
21	Table 6-67: Approach 1 Quantitative Uncertainty Estimates for CO ₂ Flux Occurring within Vegetated Coastal	
22	Wetlands Converted to Unvegetated Open Water Coastal Wetlands in 2020 (MMT CO ₂ Eq. and Percent)	6-113
23	Table 6-68: CO ₂ Flux from C Stock Changes from Unvegetated Open Water Coastal Wetlands Converted to	
24	Vegetated Coastal Wetlands (MMT CO ₂ Eq.)	6-114
25	Table 6-69: CO ₂ Flux from C Stock Changes from Unvegetated Open Water Coastal Wetlands Converted to	
26	Vegetated Coastal Wetlands (MMT C)	6-115
27	Table 6-70: Approach 1 Quantitative Uncertainty Estimates for C Stock Changes Occurring within Unvegetated	
28	Open Water Coastal Wetlands Converted to Vegetated Coastal Wetlands in 2021 (MMT CO ₂ Eq. and Percent) 6-117	
29	Table 6-71: N ₂ O Emissions from Aquaculture in Coastal Wetlands (MMT CO ₂ Eq. and kt N ₂ O)	6-118
30	Table 6-72: Approach 1 Quantitative Uncertainty Estimates for N ₂ O Emissions from Aquaculture Production in	
31	Coastal Wetlands in 2021 (MMT CO ₂ Eq. and Percent).....	6-119
32	Table 6-73: CH ₄ Emissions from Flooded Land Remaining Flooded Land—Reservoirs (MMT CO ₂ Eq.)	6-121
33	Table 6-74: CH ₄ Emissions from Flooded Land Remaining Flooded Land—Reservoirs (kt CH ₄)	6-121
34	Table 6-75: Surface and Downstream CH ₄ Emissions from Reservoirs in Flooded Land Remaining Flooded Land in	
35	2021 (kt CH ₄).....	6-122
36	Table 6-76: IPCC (2019) Default CH ₄ Emission Factors for Surface Emission from Reservoirs in Flooded Land	
37	Remaining Flooded Land	6-124
38	Table 6-77: National Totals of Reservoir Surface Area in Flooded Land Remaining Flooded Land (millions of ha) ... 6-	
39	125	
40	Table 6-78: State Breakdown of Reservoir Surface Area in Flooded Land Remaining Flooded Land (millions of ha) 6-	
41	125	

1	Table 6-79: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Reservoirs in Flooded Land Remaining Flooded Land	6-127
3	Table 6-80: CH ₄ Emissions from Other Constructed Waterbodies in Flooded Land Remaining Flooded Land (MMT CO ₂ Eq.).....	6-128
5	Table 6-81: CH ₄ Emissions from Other Constructed Waterbodies in Flooded Land Remaining Flooded Land (kt CH ₄)	6-129
7	Table 6-82: CH ₄ Emissions from Other Constructed Waterbodies in Flooded Land Remaining Flooded Land in 2021 (kt CH ₄).....	6-129
9	Table 6-83: IPCC (2019) Default CH ₄ Emission Factors for Surface Emissions from Other Constructed Waterbodies in Flooded Land Remaining Flooded Land.....	6-131
11	Table 6-84: Predictors used in Decision Tree to Identify Canal/Ditches	6-132
12	Table 6-85: Validation Results for Ditch/Canal Classification Decision Tree	6-132
13	Table 6-86: National Surface Area Totals in Flooded Land Remaining Flooded Land - Other Constructed Waterbodies (ha).....	6-133
15	Table 6-87: State Totals of Surface Area in Flooded Land Remaining Flooded Land— Canals and Ditches (ha) .	6-134
16	Table 6-88: State Totals of Surface Area in Flooded Land Remaining Flooded Land— Freshwater Ponds (ha)...	6-135
17	Table 6-89: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Other Constructed Waterbodies in Flooded Land Remaining Flooded Land	6-136
19	Table 6-90: Net CO ₂ Flux from C Stock Changes in Land Converted to Vegetated Coastal Wetlands (MMT CO ₂ Eq.)	6-139
21	Table 6-91: Net CO ₂ Flux from C Stock Changes in Land Converted to Vegetated Coastal Wetlands (MMT C) ...	6-139
22	Table 6-92: CH ₄ Emissions from Land Converted to Vegetated Coastal Wetlands (MMT CO ₂ Eq. and kt CH ₄)....	6-140
23	Table 6-93: Approach 1 Quantitative Uncertainty Estimates for C Stock Changes occurring within Land Converted to Vegetated Coastal Wetlands in 2021 (MMT CO ₂ Eq. and Percent)	6-142
25	Table 6-94: CH ₄ Emissions from Land Converted to Flooded Land - Reservoirs (MMT CO ₂ Eq.)	6-145
26	Table 6-95: CH ₄ Emissions from Land Converted to Flooded Land—Reservoirs (kt CH ₄)	6-145
27	Table 6-96: CO ₂ Emissions from Land Converted to Flooded Land—Reservoirs (MMT CO ₂)	6-146
28	Table 6-97: CO ₂ Emissions from Land Converted to Flooded Land—Reservoirs (MMT C)	6-146
29	Table 6-98: Methane and CO ₂ Emissions from Reservoirs in Land Converted to Flooded Land in 2021 (kt CH ₄ ; kt CO ₂).....	6-146
31	Table 6-99: IPCC (2019) Default CH ₄ and CO ₂ Emission Factors for Surface Emissions from Reservoirs in Land Converted to Flooded Land	6-148
33	Table 6-100: National Totals of Reservoir Surface Area in Land Converted to Flooded Land (thousands of ha)..	6-149
34	Table 6-101: State Breakdown of Reservoir Surface Area in Land Converted to Flooded Land (thousands of ha)	6-150
36	Table 6-102: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Reservoirs in Land Converted to Flooded Land	6-151
38	Table 6-103: CH ₄ Emissions from Other Constructed Waterbodies in Land Converted to Flooded Land (MMT CO ₂ Eq.).....	6-153
40	Table 6-104: CH ₄ Emissions from Other Constructed Waterbodies in Land Converted to Flooded Land (kt CH ₄)	6-153

1	Table 6-105: CO ₂ Emissions from Other Constructed Waterbodies in Land Converted to Flooded Land (MMT CO ₂)..	6-153
2	.....
3	Table 6-106: CO ₂ Emissions from Other Constructed Waterbodies in Land Converted to Flooded Land (MMT C)....	6-
4	154	
5	Table 6-107: CH ₄ and CO ₂ Emissions from Other Constructed Waterbodies in Land Converted to Flooded Land in	
6	2021 (MT CO ₂ Eq.)	6-154
7	Table 6-108: IPCC Default Methane and CO ₂ Emission Factors for Other Constructed Waterbodies in Land	
8	Converted to Flooded Land	6-155
9	Table 6-109: National Surface Area Totals of Other Constructed Waterbodies in Land Converted to Flooded Land	
10	(ha).....	6-156
11	Table 6-110: State Surface Area Totals of Other Constructed Waterbodies in Land Converted to Flooded Land (ha)	
12	.....	6-157
13	Table 6-111: Approach 2 Quantitative Uncertainty Estimates for CH ₄ and CO ₂ Emissions from Other Constructed	
14	Waterbodies in Land Converted to Flooded Land	6-158
15	Table 6-112: Net CO ₂ Flux from Soil C Stock Changes in Settlements Remaining Settlements (MMT CO ₂ Eq.)... 6-160	
16	Table 6-113: Net CO ₂ Flux from Soil C Stock Changes in Settlements Remaining Settlements (MMT C)..... 6-161	
17	Table 6-114: Thousands of Hectares of Drained Organic Soils in Settlements Remaining Settlements	6-161
18	Table 6-115: Uncertainty Estimates for CO ₂ Emissions from Drained Organic Soils in Settlements Remaining	
19	Settlements (MMT CO ₂ Eq. and Percent)	6-162
20	Table 6-116: Area of Managed Land in Settlements Remaining Settlements that is not included in the current	
21	Inventory (Thousand Hectares)	6-162
22	Table 6-117: Net Flux from Trees in Settlements Remaining Settlements (MMT CO ₂ Eq. and MMT C) ^a	6-164
23	Table 6-118: Carbon Storage (kg C/m ² tree cover), Gross and Net Sequestration (kg C/m ² tree cover/year) and Tree	
24	Cover (percent) among Sampled U.S. Cities (see Nowak et al. 2013)	6-166
25	Table 6-119: Estimated Annual C Sequestration, Tree Cover, and Annual C Sequestration per Area of Tree Cover	
26	for settlement areas in the United States by State and the District of Columbia (2021)	6-168
27	Table 6-120: Approach 2 Quantitative Uncertainty Estimates for Net CO ₂ Flux from Changes in C Stocks in	
28	Settlement Trees (MMT CO ₂ Eq. and Percent)	6-170
29	Table 6-121: Recalculations of the Settlement Tree Categories.....	6-170
30	Table 6-122: N ₂ O Emissions from Soils in Settlements Remaining Settlements (MMT CO ₂ Eq. and kt N ₂ O)	6-171
31	Table 6-123: Quantitative Uncertainty Estimates of N ₂ O Emissions from Soils in Settlements Remaining	
32	Settlements (MMT CO ₂ Eq. and Percent)	6-173
33	Table 6-124: Net Changes in Yard Trimmings and Food Scrap Carbon Stocks in Landfills (MMT CO ₂ Eq.)	6-175
34	Table 6-125: Net Changes in Yard Trimmings and Food Scrap Carbon Stocks in Landfills (MMT C)	6-175
35	Table 6-126: Moisture Contents, C Storage Factors (Proportions of Initial C Sequestered), Initial C Contents, and	
36	Decay Rates for Yard Trimmings and Food Scraps in Landfills	6-178
37	Table 6-127: C Stocks in Yard Trimmings and Food Scraps in Landfills (MMT C).....	6-179
38	Table 6-128: Approach 2 Quantitative Uncertainty Estimates for CO ₂ Flux from Yard Trimmings and Food Scraps in	
39	Landfills (MMT CO ₂ Eq. and Percent)	6-179
40	Table 6-129: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes for Land Converted to	
41	Settlements (MMT CO ₂ Eq.).....	6-182

1	Table 6-130: Net CO ₂ Flux from Soil, Dead Organic Matter and Biomass C Stock Changes for Land Converted to Settlements (MMT C)	6-182
3	Table 6-131: Approach 2 Quantitative Uncertainty Estimates for Soil, Dead Organic Matter and Biomass C Stock Changes occurring within Land Converted to Settlements (MMT CO ₂ Eq. and Percent)	6-185
5	Table 6-132: Area of Managed Land in Land Converted to Settlements that is not included in the current Inventory (Thousand Hectares).....	6-187
7	Table 7-1: Emissions from Waste (MMT CO ₂ Eq.).....	7-2
8	Table 7-2: Emissions from Waste (kt)	7-2
9	Table 7-3: CH ₄ Emissions from Landfills (MMT CO ₂ Eq.).....	7-7
10	Table 7-4: CH ₄ Emissions from Landfills (kt)	7-7
11	Table 7-5: Approach 2 Quantitative Uncertainty Estimates for CH ₄ Emissions from Landfills (MMT CO ₂ Eq. and Percent)	7-15
13	Table 7-6: Materials Discarded in the Municipal Waste Stream by Waste Type from 1990 to 2018 (Percent)....	7-20
14	Table 7-7: CH ₄ and N ₂ O Emissions from Domestic and Industrial Wastewater Treatment (MMT CO ₂ Eq.).....	7-23
15	Table 7-8: CH ₄ and N ₂ O Emissions from Domestic and Industrial Wastewater Treatment (kt)	7-23
16	Table 7-9: Domestic Wastewater CH ₄ Emissions from Septic and Centralized Systems (2021, kt, MMT CO ₂ Eq. and Percent)	7-25
18	Table 7-10: Variables and Data Sources for CH ₄ Emissions from Septic Systems.....	7-25
19	Table 7-11: Variables and Data Sources for Organics in Domestic Wastewater	7-26
20	Table 7-12: U.S. Population (Millions) and Domestic Wastewater TOW (kt)	7-27
21	Table 7-13: Variables and Data Sources for Organics in Centralized Domestic Wastewater	7-28
22	Table 7-14: Variables and Data Sources for CH ₄ Emissions from Centrally Treated Aerobic Systems (Other than Constructed Wetlands).....	7-28
24	Table 7-15: Variables and Data Sources for CH ₄ Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands)	7-30
26	Table 7-16: Variables and Data Sources for CH ₄ Emissions from Centrally Treated Anaerobic Systems	7-31
27	Table 7-17: Variables and Data Sources for Emissions from Anaerobic Sludge Digesters	7-31
28	Table 7-18: Variables and Data Sources for CH ₄ Emissions from Centrally Treated Systems Discharge	7-32
29	Table 7-19: Total Industrial Wastewater CH ₄ Emissions by Sector (2021, MMT CO ₂ Eq. and Percent).....	7-34
30	Table 7-20: U.S. Pulp and Paper, Meat, Poultry, Vegetables, Fruits and Juices, Ethanol, Breweries, and Petroleum Refining Production (MMT)	7-36
32	Table 7-21: U.S. Industrial Wastewater Characteristics Data (2021).....	7-36
33	Table 7-22: U.S. Industrial Wastewater Treatment Activity Data.....	7-37
34	Table 7-23: Sludge Variables for Aerobic Treatment Systems.....	7-37
35	Table 7-24: Fraction of TOW Removed During Treatment by Industry	7-38
36	Table 7-25: Wastewater Outflow (m ³ /ton) for Pulp, Paper, and Paperboard Mills	7-39
37	Table 7-26: Wastewater Outflow (m ³ /ton) and BOD Production (g/L) for U.S. Vegetables, Fruits, and Juices Production	7-40

1	Table 7-27: Domestic Wastewater N ₂ O Emissions from Septic and Centralized Systems (2021, kt, MMT CO ₂ Eq. and Percent)	7-42
3	Table 7-28: Variables and Data Sources for Protein Consumed	7-43
4	Table 7-29: Variables and Data Sources for N ₂ O Emissions from Septic System.....	7-44
5	Table 7-30: Variables and Data Sources for Non-Consumed Protein and Nitrogen Entering Centralized Systems	7-45
6	Table 7-31: Variables and Data Sources for N ₂ O Emissions from Centrally Treated Aerobic Systems (Other than Constructed Wetlands).....	7-46
8	Table 7-32: Variables and Data Sources for N ₂ O Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands)	7-47
10	Table 7-33: Variables and Data Sources for N ₂ O Emissions from Centrally Treated Anaerobic Systems.....	7-48
11	Table 7-34: U.S. Population (Millions) Fraction of Population Served by Centralized Wastewater Treatment (percent), Protein Supply (kg/person-year), and Protein Consumed (kg/person-year)	7-48
13	Table 7-35: Variables and Data Sources for N ₂ O Emissions from Centrally Treated Systems Discharge	7-49
14	Table 7-36: Total Industrial Wastewater N ₂ O Emissions by Sector (2021, MMT CO ₂ Eq. and Percent)	7-50
15	Table 7-37: U.S. Industrial Wastewater Nitrogen Data	7-51
16	Table 7-38: Industrial Wastewater Nitrogen Discharged in 2018 by Sector (kg N)	7-52
17	Table 7-39: Approach 2 Quantitative Uncertainty Estimates for 2021 Emissions from Wastewater Treatment (MMT CO ₂ Eq. and Percent)	7-53
19	Table 7-40: CH ₄ and N ₂ O Emissions from Composting (MMT CO ₂ Eq.)	7-57
20	Table 7-41: CH ₄ and N ₂ O Emissions from Composting (kt)	7-57
21	Table 7-42: U.S. Waste Composted (kt).....	7-58
22	Table 7-43: Tier 1 Quantitative Uncertainty Estimates for Emissions from Composting (MMT CO ₂ Eq. and Percent)	7-58
24	Table 7-44: CH ₄ Emissions from Anaerobic Digestion at Biogas Facilities (MMT CO ₂ Eq.) from 1990-2021	7-61
25	Table 7-45: CH ₄ Emissions from Anaerobic Digestion at Biogas Facilities (kt) from 1990-2021.....	7-61
26	Table 7-46: U.S. Waste Digested (kt) from 1990-2021	7-63
27	Table 7-47: Estimated Number of Stand-Alone AD Facilities Operating ^a from 1990-2021	7-64
28	Table 7-48: Estimated Biogas Produced and Methane Recovered from Anaerobic Digestion at Biogas Facilities Operating from 1990-2021 ^a	7-64
30	Table 7-49: Approach 1 Quantitative Uncertainty Estimates for Emissions from Anaerobic Digestion (MMT CO ₂ Eq. and Percent)	7-65
32	Table 7-50: Emissions of NO _x , CO, NMVOC, and SO ₂ from Waste (kt).....	7-67
33	Table 9-1: Revisions to the U.S. Greenhouse Gas Emissions, Including Quantitative Change Related to the Use of AR5 GWP Values (MMT CO ₂ Eq.)	9-5
35	Table 9-2: Revisions to U.S. Greenhouse Gas Emissions and Removals (Net Flux) from Land Use, Land-Use Change, and Forestry, Including Quantitative Change Related to the Use of AR5 GWP Values (MMT CO ₂ Eq.)	9-8
37	Table 9-3: Revisions to U.S. Greenhouse Gas Emissions, Excluding Quantitative Change Related to the Use of AR5 GWP Values (MMT CO ₂ Eq.)	9-9

1	Table 9-4: Revisions to U.S. Greenhouse Gas Emissions and Removals (Net Flux) from Land Use, Land-Use Change,	
2	and Forestry, Excluding Quantitative Change Related to the Use of AR5 GWP Values (MMT CO ₂ Eq.).....	9-11

3 Figures

4	Figure ES-1: U.S. Greenhouse Gas Emissions and Sinks by Gas	ES-5
5	Figure ES-2: Annual Percent Change in Gross U.S. Greenhouse Gas Emissions and Sinks Relative to the Previous	
6	Year.....	ES-6
7	Figure ES-3: 2021 Total Gross U.S. Greenhouse Gas Emissions by Gas (Percentages based on MMT CO ₂ Eq.).....	ES-7
8	Figure ES-4: 2021 Sources of CO ₂ Emissions.....	ES-8
9	Figure ES-5: 2021 CO ₂ Emissions from Fossil Fuel Combustion by Sector and Fuel Type.....	ES-9
10	Figure ES-6: 2021 End-Use Sector Emissions of CO ₂ from Fossil Fuel Combustion	ES-10
11	Figure ES-7: Electric Power Generation and Emissions	ES-12
12	Figure ES-8: 2021 Sources of CH ₄ Emissions.....	ES-13
13	Figure ES-9: 2021 Sources of N ₂ O Emissions	ES-14
14	Figure ES-10: 2021 Sources of HFCs, PFCs, SF ₆ , and NF ₃ Emissions	ES-15
15	Figure ES-11: U.S. Greenhouse Gas Emissions and Sinks by IPCC Sector/Category	ES-16
16	Figure ES-12: 2021 U.S. Energy Consumption by Energy Source (Percent)	ES-17
17	Figure ES-13: U.S. Greenhouse Gas Emissions Allocated to Economic Sectors	ES-21
18	Figure ES-14: U.S. Greenhouse Gas Emissions with Electricity-Related Emissions Distributed to Economic Sectors	
19	.....ES-23	
20	Figure ES-15: U.S. Greenhouse Gas Emissions Per Capita and Per Dollar of Gross Domestic Product (GDP)	ES-24
21	Figure ES-16: 2021 Key Categories (Approach 1 including LULUCF) ^a	ES-25
22	Figure 1-1: National Inventory Arrangements and Process Diagram	1-12
23	Figure 1-2: U.S. QA/QC Plan Summary	1-26
24	Figure 2-1: U.S. Greenhouse Gas Emissions and Sinks by Gas.....	2-2
25	Figure 2-2: Annual Percent Change in Gross U.S. Greenhouse Gas Emissions Relative to the Previous Year	2-2
26	Figure 2-3: 2021 Gross Total U.S. Greenhouse Gas Emissions by Gas (Percentages based on MMT CO ₂ Eq.).....	2-3
27	Figure 2-4: U.S. Greenhouse Gas Emissions and Sinks by IPCC Sector	2-9
28	Figure 2-5: Trends in Energy Sector Greenhouse Gas Sources	2-11
29	Figure 2-6: Trends in CO ₂ Emissions from Fossil Fuel Combustion by End-Use Sector and Fuel Type	2-15
30	Figure 2-7: Trends in End-Use Sector Emissions of CO ₂ from Fossil Fuel Combustion	2-16
31	Figure 2-8: Electric Power Generation (Billion kWh) and Emissions (MMT CO ₂ Eq.).....	2-17
32	Figure 2-9: Trends in Industrial Processes and Product Use Sector Greenhouse Gas Sources	2-19
33	Figure 2-10: Trends in Agriculture Sector Greenhouse Gas Sources	2-21
34	Figure 2-11: Trends in Emissions and Removals (Net CO ₂ Flux) from Land Use, Land-Use Change, and Forestry..	2-24
35	Figure 2-12: Trends in Waste Sector Greenhouse Gas Sources.....	2-27
36	Figure 2-13: U.S. Greenhouse Gas Emissions Allocated to Economic Sectors	2-28

1	Figure 2-14: U.S. Greenhouse Gas Emissions with Electricity-Related Emissions Distributed to Economic Sectors	2-34
2	.....
3	Figure 2-15: Trends in Transportation-Related Greenhouse Gas Emissions	2-37
4	Figure 2-16: U.S. Greenhouse Gas Emissions Per Capita and Per Dollar of Gross Domestic Product	2-40
5	Figure 3-1: 2021 Energy Sector Greenhouse Gas Sources	3-2
6	Figure 3-2: Trends in Energy Sector Greenhouse Gas Sources	3-2
7	Figure 3-3: 2021 U.S. Fossil Carbon Flows	3-2
8	Figure 3-4: 2021 U.S. Energy Use by Energy Source	3-10
9	Figure 3-5: Annual U.S. Energy Use	3-11
10	Figure 3-6: 2021 CO ₂ Emissions from Fossil Fuel Combustion by Sector and Fuel Type	3-11
11	Figure 3-7: Annual Deviations from Normal Heating Degree Days for the United States (1950–2021, Index Normal = 100)	3-12
13	Figure 3-8: Annual Deviations from Normal Cooling Degree Days for the United States (1950–2021, Index Normal = 100)	3-12
15	Figure 3-9: Fuels Used in Electric Power Generation and Total Electric Power Sector CO ₂ Emissions	3-18
16	Figure 3-10: Electric Power Retail Sales by End-Use Sector	3-19
17	Figure 3-11: Industrial Production Indices (Index 2017=100)	3-20
18	Figure 3-12: Fuels and Electricity Used in Industrial Sector, Industrial Output, and Total Sector CO ₂ Emissions (Including Electricity)	3-21
20	Figure 3-13: Fuels and Electricity Used in Residential and Commercial Sectors, Heating and Cooling Degree Days, and Total Sector CO ₂ Emissions (Including Electricity)	3-22
22	Figure 3-14: Fuels Used in Transportation Sector, On-road VMT, and Total Sector CO ₂ Emissions	3-25
23	Figure 3-15: Sales-Weighted Fuel Economy of New Passenger Cars and Light-Duty Trucks, 1990–2021	3-27
24	Figure 3-16: Sales of New Passenger Cars and Light-Duty Trucks, 1990–2021	3-27
25	Figure 3-17: Mobile Source CH ₄ and N ₂ O Emissions	3-30
26	Figure 3-18: U.S. Energy Consumption and Energy-Related CO ₂ Emissions Per Capita and Per Dollar GDP	3-37
27	Figure 4-1: 2021 Industrial Processes and Product Use Sector Greenhouse Gas Sources	4-2
28	Figure 4-2: Trends in Industrial Processes and Product Use Sector Greenhouse Gas Sources	4-3
29	Figure 4-3: U.S. Emissions of SF ₆ Comparison ^a	4-150
30	Figure 5-1: 2021 Agriculture Sector Greenhouse Gas Emission Sources	5-1
31	Figure 5-2: Trends in Agriculture Sector Greenhouse Gas Emission Sources	5-2
32	Figure 5-3: Annual CH ₄ Emissions from Rice Cultivation, 2015	5-24
33	Figure 5-4: Sources and Pathways of N that Result in N ₂ O Emissions from Agricultural Soil Management	5-30
34	Figure 5-5: Croplands, 2020 Annual Direct N ₂ O Emissions Estimated Using the Tier 3 DayCent Model	5-33
35	Figure 5-6: Grasslands, 2020 Annual Direct N ₂ O Emissions Estimated Using the Tier 3 DayCent Model	5-33
36	Figure 5-7: Croplands, 2020 Annual Indirect N ₂ O Emissions from Volatilization Using the Tier 3 DayCent Model	5-34

1	Figure 5-8: Grasslands, 2020 Annual Indirect N ₂ O Emissions from Volatilization Using the Tier 3 DayCent Model	5-35
2	.....
3	Figure 5-9: Croplands, 2020 Annual Indirect N ₂ O Emissions from Leaching and Runoff Using the Tier 3 DayCent Model	5-35
4	.....
5	Figure 5-10: Grasslands, 2020 Annual Indirect N ₂ O Emissions from Leaching and Runoff Using the Tier 3 DayCent Model	5-36
6	.....
7	Figure 6-1: 2021 LULUCF Chapter Greenhouse Gas Sources and Sinks.....	6-3
8	Figure 6-2: Trends in Emissions and Removals (Net CO ₂ Flux) from Land Use, Land-Use Change, and Forestry	6-3
9	Figure 6-3: Percent of Total Land Area for Each State in the General Land Use Categories for 2021	6-13
10	Figure 6-4: Changes in Forest Area by Region for Forest Land Remaining Forest Land in the conterminous United States and Alaska (1990-2021)	6-27
11	.....
12	Figure 6-5: Estimated Net Annual Changes in C Stocks for All C Pools in Forest Land Remaining Forest Land in the Conterminous United States and Alaska (1990-2021).....	6-31
13	.....
14	Figure 6-6: Total Net Annual Soil C Stock Changes for Mineral Soils under Agricultural Management within States, 2015, Cropland Remaining Cropland.....	6-58
15	.....
16	Figure 6-7: Total Net Annual Soil C Stock Changes for Organic Soils under Agricultural Management within States, 2015, Cropland Remaining Cropland.....	6-59
17	.....
18	Figure 6-8: Total Net Annual Soil C Stock Changes for Mineral Soils under Agricultural Management within States, 2015, Grassland Remaining Grassland	6-77
19	.....
20	Figure 6-9: Total Net Annual Soil C Stock Changes for Organic Soils under Agricultural Management within States, 2015, Grassland Remaining Grassland	6-78
21	.....
22	Figure 6-10: U.S. Reservoirs (black polygons) in the Flooded Land Remaining Flooded Land Category in 2021. .	6-121
23	Figure 6-11: Total CH ₄ Emissions (Downstream + Surface) from Reservoirs in Flooded Land Remaining Flooded Land in 2021 (kt CH ₄).....	6-122
24	.....
25	Figure 6-12: Selected Features from NWI that Meet Flooded Lands Criteria	6-125
26	Figure 6-13: 2021 CH ₄ Emissions from A) Ditches and Canals and B) Freshwater Ponds in Flooded Land Remaining Flooded Land (kt CH ₄)	6-130
27	.....
28	Figure 6-14: Left: NWI Features Identified as Canals/Ditches (pink) by Unique Narrow, Linear/Angular Morphology. Right: Non-Canal/Ditches with More Natural Morphology (blue)	6-132
29	.....
30	Figure 6-15: Structure of Decision Tree Used to Identify Canals/Ditches	6-133
31	Figure 6-16: 2021 Surface Area of A) Ditches and Canals and B) Freshwater Ponds in Flooded Land Remaining Flooded Land (hectares)	6-134
32	.....
33	Figure 6-17: U.S. Reservoirs (black polygons) in the Land Converted to Flooded Land Category in 2021	6-145
34	Figure 6-18: 2021 A) CH ₄ and B) CO ₂ Emissions from U.S. Reservoirs in Land Converted to Flooded Land	6-146
35	Figure 6-19: Selected Features from NWI that meet Flooded Lands Criteria.....	6-149
36	Figure 6-20: Number of Dams Built per Year from 1990 through 2021	6-150
37	Figure 6-21: 2021 A) CH ₄ and B) CO ₂ Emissions from Other Constructed Waterbodies (Freshwater Ponds) in Land Converted to Flooded Land (MT CO ₂ Eq.).....	6-155
38	.....
39	Figure 6-22: Surface Area of Other Constructed Waterbodies in Land Converted to Flooded Land (ha)	6-157
40	Figure 7-1: 2021 Waste Sector Greenhouse Gas Sources.....	7-1

1	Figure 7-2: Trends in Waste Sector Greenhouse Gas Sources.....	7-2
2	Figure 7-3: Methodologies Used Across the Time Series to Compile the U.S. Inventory of Emission Estimates for MSW Landfills	7-9
4	Figure 7-4: Management of Municipal Solid Waste in the United States, 2018.....	7-18
5	Figure 7-5: MSW Management Trends from 1990 to 2018.....	7-19
6	Figure 7-6: Percent of Degradable Materials Diverted from Landfills from 1990 to 2018 (Percent)	7-20
7	Figure 9-1: Impacts from Recalculations to U.S. Greenhouse Gas Emissions by Sector, Including Quantitative Change Related to the Use of AR5 GWP Values	9-5

9 **Boxes**

10	Box ES-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals, including Relationship to EPA's Greenhouse Gas Reporting Program	ES-2
12	Box ES-2: Trends in Various U.S. Greenhouse Gas Emissions-Related Data.....	ES-23
13	Box ES-3: Use of Ambient Measurements Systems for Validation of Emission Inventories.....	ES-26
14	Box 1-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals, including Relationship to EPA's Greenhouse Gas Reporting Program	1-2
16	Box 1-2: The <i>IPCC Sixth Assessment Report</i> and Global Warming Potentials.....	1-10
17	Box 1-3: Examples of Verification Activities.....	1-27
18	Box 2-1: Methodology for Aggregating Emissions by Economic Sector	2-31
19	Box 2-2: Trends in Various U.S. Greenhouse Gas Emissions-Related Data.....	2-39
20	Box 3-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals, including Relationship to EPA's Greenhouse Gas Reporting Program	3-6
22	Box 3-2: Weather and Non-Fossil Energy Effects on CO ₂ Emissions from Fossil Fuel Combustion Trends	3-11
23	Box 3-3: Uses of Greenhouse Gas Reporting Program Data and Improvements in Reporting Emissions from Industrial Sector Fossil Fuel Combustion.....	3-21
25	Box 3-4: Carbon Intensity of U.S. Energy Consumption	3-35
26	Box 3-5: Reporting of Lubricants, Waxes, and Asphalt and Road Oil Product Use in Energy Sector	3-55
27	Box 3-6: Carbon Dioxide Transport, Injection, and Geological Storage.....	3-91
28	Box 4-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals.....	4-7
29	Box 4-2: Industrial Process and Product Use Data from EPA's Greenhouse Gas Reporting Program	4-9
30	Box 5-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals.....	5-4
31	Box 5-2: Surrogate Data Method.....	5-26
32	Box 5-3: Tier 1 vs. Tier 3 Approach for Estimating N ₂ O Emissions.....	5-37
33	Box 5-4: Data Splicing Method	5-39
34	Box 5-5: Comparison of the Tier 2 U.S. Inventory Approach and IPCC (2006) Default Approach	5-49
35	Box 5-6: Comparison of Tier 2 U.S. Inventory Approach and IPCC (2006) Default Approach	5-57
36	Box 6-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals.....	6-9
37	Box 6-2: Preliminary Estimates of Land Use in U.S. Territories	6-23

1	Box 6-3: CO ₂ Emissions from Forest Fires	6-31
2	Box 6-4: Surrogate Data Method.....	6-61
3	Box 6-5: Tier 3 Approach for Soil C Stocks Compared to Tier 1 or 2 Approaches.....	6-62
4	Box 7-1: Methodological Approach for Estimating and Reporting U.S. Emissions and Removals, including 5 Relationship to Greenhouse Gas Reporting Data	7-3
6	Box 7-2: Description of a Modern, Managed Landfill in the United States	7-5
7	Box 7-3: Nationwide Municipal Solid Waste Data Sources.....	7-13
8	Box 7-4: Overview of U.S. Solid Waste Management Trends	7-18

9 Equations

10	Equation 1-1: Calculating CO ₂ Equivalent Emissions.....	1-9
11	Equation 3-1: Estimating Fugitive CO ₂ Emissions from Underground Mines	3-68
12	Equation 3-2: Estimating CO ₂ Emissions from Drained Methane Flared or Catalytically Oxidized	3-69
13	Equation 3-3: Decline Function to Estimate Venting Abandoned Mine Methane Emissions.....	3-72
14	Equation 3-4: Decline Function to Estimate Flooded Abandoned Mine Methane Emissions	3-73
15	Equation 4-1: <i>2006 IPCC Guidelines</i> Tier 1 Emission Factor for Clinker (precursor to Equation 2.4)	4-11
16	Equation 4-2: <i>2006 IPCC Guidelines</i> Tier 2 Emission Factor for Lime Production, High-Calcium Lime (Equation 2.9) ..	4-16
18	Equation 4-3: <i>2006 IPCC Guidelines</i> Tier 2 Emission Factor for Lime Production, Dolomitic Lime (Equation 2.9) ..	4-16
19	Equation 4-4: <i>2006 IPCC Guidelines</i> Tier 3: N ₂ O Emissions From Nitric Acid Production (Equation 3.6)	4-39
20	Equation 4-5: <i>2006 IPCC Guidelines</i> Tier 2: N ₂ O Emissions From Adipic Acid Production (Equation 3.8)	4-42
21	Equation 4-6: <i>2006 IPCC Guidelines</i> Tier 1: N ₂ O Emissions From Caprolactam Production (Equation 3.9)	4-46
22	Equation 4-7: <i>2006 IPCC Guidelines</i> Tier 1: Emissions from Carbide Production (Equation 3.11)	4-50
23	Equation 4-8: <i>2006 IPCC Guidelines</i> Tier 1: CO ₂ Emissions from Titanium Production (Equation 3.12).....	4-53
24	Equation 4-9: CO ₂ Emissions from Phosphoric Acid Production	4-74
25	Equation 4-10: CO ₂ Emissions from Coke, Pig Iron, EAF Steel, and BOF Steel Production, based on <i>2006 IPCC Guidelines</i> Tier 2 Methodologies	4-80
27	Equation 4-11: <i>2006 IPCC Guidelines</i> Tier 1: Emissions from Sinter, Direct Reduced Iron, and Pellet Production (Equations 4.6, 4.7, and 4.8)	4-80
29	Equation 4-12: <i>2006 IPCC Guidelines</i> Tier 1: CO ₂ Emissions for Ferroalloy Production (Equation 4.15)	4-90
30	Equation 4-13: <i>2006 IPCC Guidelines</i> Tier 1: CH ₄ Emissions for Ferroalloy Production (Equation 4.18)	4-90
31	Equation 4-14: CF ₄ Emissions Resulting from Low Voltage Anode Effects	4-97
32	Equation 4-15: <i>2006 IPCC Guidelines</i> Tier 1: CO ₂ Emissions From Lead Production (Equation 4.32).....	4-107
33	Equation 4-16: <i>2006 IPCC Guidelines</i> Tier 1: CO ₂ Emissions From Zinc Production (Equation 4.33)	4-111
34	Equation 4-17: Waelz Kiln CO ₂ Emission Factor for Zinc Produced	4-112
35	Equation 4-18: Waelz Kiln CO ₂ Emission Factor for EAF Dust Consumed.....	4-112
36	Equation 4-19: Total Emissions from Electronics Industry	4-127

1	Equation 4-20: Total Emissions from Semiconductor Manufacturing.....	4-127
2	Equation 4-21: Total Emissions from MEMS Manufacturing.....	4-129
3	Equation 4-22: Total Emissions from PV Manufacturing.....	4-129
4	Equation 4-23: Estimation for SF ₆ Emissions from Electric Power Systems	4-143
5	Equation 4-24: Regression Equation for Estimating SF ₆ Emissions of Non-Reporting Facilities in 1999	4-145
6	Equation 4-25: Regression Equation for Estimating SF ₆ Emissions of GHGRP-Only Reporters in 2011.....	4-145
7	Equation 4-26: N ₂ O Emissions from Product Use	4-153
8	Equation 5-1: Elemental C or N Released through Oxidation of Crop Residues.....	5-56
9	Equation 5-2: Emissions from Crop Residue Burning	5-57
10	Equation 5-3: Estimation of Greenhouse Gas Emissions from Fire	5-57
11	Equation 6-1: Net State Annual Carbon Sequestration	6-168
12	Equation 6-2: Total C Stock for Yard Trimmings and Food Scraps in Landfills.....	6-177
13	Equation 6-3: C Stock Annual Flux for Yard Trimmings and Food Scraps in Landfills	6-178
14	Equation 7-1: Landfill Methane Generation	7-8
15	Equation 7-2: Net Methane Emissions from MSW Landfills.....	7-8
16	Equation 7-3: Net Methane Emissions from Industrial Waste Landfills	7-12
17	Equation 7-4: Total Domestic CH ₄ Emissions from Wastewater Treatment and Discharge	7-25
18	Equation 7-5: CH ₄ Emissions from Septic Systems	7-25
19	Equation 7-6: Total Wastewater BOD ₅ Produced per Capita (U.S.-Specific [ERG 2018a]).....	7-26
20	Equation 7-7: Total Organically Degradable Material in Domestic Wastewater (IPCC 2019 [Eq. 6.3])	7-26
21	Equation 7-8: Total Domestic CH ₄ Emissions from Centrally Treated Aerobic Systems.....	7-28
22	Equation 7-9: Total Organics in Centralized Wastewater Treatment [IPCC 2019 (Eq. 6.3A)].....	7-28
23	Equation 7-10: Organic Component Removed from Aerobic Wastewater Treatment (IPCC 2019 [Eq. 6.3B])	7-28
24	Equation 7-11: Emissions from Centrally Treated Aerobic Systems (other than Constructed Wetlands) (IPCC 2019 [Eq. 6.1])	7-28
26	Equation 7-12: Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands Only) [IPCC 2014 (Eq. 6.1)].....	7-30
28	Equation 7-13: Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands used as Tertiary Treatment) (U.S. Specific).....	7-30
30	Equation 7-14: Emissions from Centrally Treated Anaerobic Systems [IPCC 2019 (Eq. 6.1)]	7-31
31	Equation 7-15: Emissions from Anaerobic Sludge Digesters (U.S. Specific)	7-31
32	Equation 7-16: Emissions from Centrally Treated Systems Discharge (U.S.-Specific)	7-32
33	Equation 7-17: Total Organics in Centralized Treatment Effluent (IPCC 2019 [Eq. 6.3D]).....	7-32
34	Equation 7-18: Total Organics in Effluent Discharged to Reservoirs, Lakes, or Estuaries (U.S.-Specific)	7-32
35	Equation 7-19: Total Organics in Effluent Discharged to Other Waterbodies (U.S.-Specific).....	7-32
36	Equation 7-20: Total CH ₄ Emissions from Industrial Wastewater	7-34

1	Equation 7-21: TOW in Industry Wastewater Treatment Systems	7-34
2	Equation 7-22: Organic Component Removed from Aerobic Wastewater Treatment – Pulp, Paper, and Paperboard	7-35
4	Equation 7-23: Organic Component Removed from Aerobic Treatment Plants	7-35
5	Equation 7-24: Raw Sludge Removed from Wastewater Treatment as Dry Mass	7-35
6	Equation 7-25: CH ₄ Emissions from Industrial Wastewater Treatment Discharge.....	7-37
7	Equation 7-26: TOW in Industrial Wastewater Effluent.....	7-38
8	Equation 7-27: Emissions from Pulp and Paper Discharge (U.S. Specific)	7-39
9	Equation 7-28: Total Organics in Pulp and Paper Effluent Discharged to Reservoirs, Lakes, Or Estuaries (U.S. Specific)	7-39
11	Equation 7-29: Total Organics in Pulp and Paper Effluent Discharged to Other Waterbodies (U.S. Specific).....	7-39
12	Equation 7-30: Total Domestic N ₂ O Emissions from Wastewater Treatment and Discharge	7-42
13	Equation 7-31: Annual per Capita Protein Supply (U.S. Specific)	7-43
14	Equation 7-32: Consumed Protein [IPCC 2019 (Eq. 6.10A)]	7-43
15	Equation 7-33: Total Nitrogen Entering Septic Systems (IPCC 2019 [Eq. 6.10])	7-43
16	Equation 7-34: Emissions from Septic Systems (IPCC 2019 [Eq. 6.9])	7-44
17	Equation 7-35: Total Nitrogen Entering Centralized Systems (IPCC 2019 [Eq. 10]).....	7-45
18	Equation 7-36: Total Domestic N ₂ O Emissions from Centrally Treated Aerobic Systems	7-46
19	Equation 7-37: Emissions from Centrally Treated Aerobic Systems (other than Constructed Wetlands) (IPCC 2019 [Eq. 6.9])	7-46
21	Equation 7-38: Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands Only) (IPCC 2014 [Eq. 6.9]).....	7-46
23	Equation 7-39: Emissions from Centrally Treated Aerobic Systems (Constructed Wetlands used as Tertiary Treatment) (U.S.-Specific).....	7-46
25	Equation 7-40: Emissions from Centrally Treated Anaerobic Systems (IPCC 2019 [Eq. 6.9]) C (kt N ₂ O/year).....	7-47
26	Equation 7-41: Emissions from Centrally Treated Systems Discharge (U.S.-Specific)	7-49
27	Equation 7-42: Total Organics in Centralized Treatment Effluent (IPCC 2019 [Eq. 6.8])	7-49
28	Equation 7-43: Total Nitrogen in Effluent Discharged to Impaired Waterbodies (U.S.-Specific)	7-49
29	Equation 7-44: Total Nitrogen in Effluent Discharged to Nonimpaired Waterbodies (U.S.-Specific).....	7-49
30	Equation 7-45: Total Nitrogen in Industrial Wastewater	7-51
31	Equation 7-46: N ₂ O Emissions from Industrial Wastewater Treatment Plants	7-51
32	Equation 7-47: N ₂ O Emissions from Industrial Wastewater Treatment Effluent	7-52
33	Equation 7-48: Greenhouse Gas Emission Calculation for Composting	7-57
34	Equation 7-49: Methane Emissions Calculation for Anaerobic Digestion	7-61
35	Equation 7-50: Recovered Methane Estimation for Anaerobic Digestion.....	7-62
36	Equation 7-51: Weighted Average of Waste Processed	7-62
37		