

Chapter 167: TRACKING AND REPORTING GROSS AND NET ANNUAL GREENHOUSE GAS EMISSIONS

SUMMARY: This Chapter establishes methods for the calculation of annual greenhouse gas emissions as required by 38 M.R.S. § 576-A, which states, “By July 1, 2021, the Department shall adopt rules to track and report to the Legislature on gross annual greenhouse gas emissions and net annual greenhouse gas emissions.” These emissions estimates will be used to assess attainment of the reductions set out in 38 M.R.S. § 576-A (1), (2) and (3). The Department Environmental Protection (Department) will use these methods to measure progress toward these reductions and toward the goals of the climate action plan described in 38 M.R.S. § 577.

1. Definitions. The following terms, as used in this Chapter, have the following meanings:

- A. Anthropogenic.** “Anthropogenic” means resulting from human activity.
- B. Biogenic emissions.** “Biogenic emissions” means emissions resulting from the combustion, harvest, digestion, fermentation, decomposition or processing of biologically based materials (e.g., emissions from municipal solid waste, landfills, and biomass and biofuels, such as wood, and ethanol). Biogenic emissions also include emissions from the natural carbon cycle.
- C. Blue carbon.** “Blue carbon” means carbon that is removed from the atmosphere through plant growth, including seaweed, and burial of organic carbon in soil in coastal ecosystems such as salt marshes and seagrass beds.
- D. Carbon budget.** “Carbon budget” means the compilation of the major pools and fluxes of carbon in Maine.
- E. Carbon neutrality.** “Carbon neutrality” means the state of net zero carbon emissions. Carbon neutrality is achieved by balancing anthropogenic emissions of carbon with sequestration of carbon.
- F. CO₂ equivalent emissions (CO₂e).** “CO₂ equivalent emissions” means the amount of GHGs emitted in terms of carbon dioxide equivalents. Each type of GHG traps heat in the atmosphere differently, with some being far more potent than others. Emissions from GHGs other than carbon dioxide are converted to carbon dioxide equivalent emissions using GWP values from the “Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change” [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], as published by the Intergovernmental Panel on Climate Change (IPCC) (Geneva, Switzerland) in 2015. The GWP values from this report are incorporated by reference herein.

NOTE: The report can be accessed at www.ipcc.ch/report/ar5/syr/, and copies of the incorporated material are also available from the Department by calling (207) 287-2235.

The mass amount of emissions (e.g., metric tons per year) for each individual GHG is multiplied by the compound-specific GWP, and the individual compound amounts in CO₂e are summed to give total GHG emissions in units of CO₂e.

- G. Commercial sector.** “Commercial sector” means an energy-consuming sector that consists of service-providing facilities and equipment including businesses; federal, state, and local governments; and other private and public organizations, such as religious, social, or fraternal

groups. The commercial sector also includes institutional living quarters; sewage treatment facilities; and generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment.

- H. EIA.** “EIA” means the U.S. Energy Information Administration.
- I. Electric power sector.** “Electric power sector” means an energy-consuming sector that consists of electricity-only and combined-heat-and-power plants within the North American Industry Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public. This sector includes electric utilities and independent power producers.
- J. Emissions inventory.** “Emissions inventory” means a comprehensive statewide estimate of pollutants released into the atmosphere.
- K. Fossil fuel.** “Fossil fuel” means natural gas, petroleum, coal, or any form of solid, liquid, or gaseous fuel derived from the fossilized remains of plants and animals that lived millions of years ago.
- L. Global warming potential (GWP).** “Global warming potential” or “GWP” is a measure of the radiative forcing (heat-absorbing ability) of a particular gas relative to that of CO₂ for a base time period after taking into account the decay rate of the gas (the amount removed from the atmosphere over a given number of years) relative to that of CO₂. Global warming potentials used in this rule are consistent with the values used in the Intergovernmental Panel on Climate Change Assessment Report.
- M. Greenhouse gas (GHG).** “Greenhouse gas” or “GHG” means any gas that is emitted into the air and that the Department determines by rule may reasonably be anticipated to cause or contribute to climate change. Greenhouse gas includes, but is not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, nitrogen trifluoride, perfluorocarbons and sulfur hexafluoride.
- N. Gross greenhouse gas emissions.** “Gross greenhouse gas emissions” means the sum of all anthropogenic greenhouse gas emissions released to the atmosphere by all sources within the State each year, regardless of how much carbon is sequestered in the environment.
- O. Heating season.** “Heating season” means the time period from October 1 – April 30 each year.
- P. Industrial sector.** “Industrial sector” means an energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 31–33); agriculture, forestry, fishing and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. This sector includes generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities.
- Q. MAIRIS.** “MAIRIS” means the Maine Air Inventory Reporting Information System, the system point source facilities use to submit their annual emissions inventories.

- R. Metric ton.** “Metric ton” is a metric unit of mass equivalent to 1,000 kilograms. A metric ton is not the same as a short ton.
- S. NAICS.** “NAICS” means the North American Industry Classification System, the system used to categorize point-source facilities into sectors (e.g., industrial, electric power, and commercial).
- T. Net greenhouse gas emissions.** “Net annual greenhouse gas emissions” means gross annual anthropogenic greenhouse gas emissions less the total amount of greenhouse gases absorbed each year by greenhouse gas sinks, natural or manmade, including, but not limited to, trees, crops, soil, and wetlands within the State.

NOTE: The definition of net annual greenhouse gas emissions in 38 M.R.S. § 574 (1-C) does not include manmade carbon sinks. Manmade carbon sinks will be included in this analysis where applicable to most accurately estimate carbon sequestered.

- U. Residential sector.** “Residential sector” means an energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances and equipment. The residential sector does not include institutional living quarters.
- V. Sector.** “Sector” means a category used to separate the sources of greenhouse gas emissions based on the area of the economy in which those sources share the same or a related product or service (i.e., residential, commercial, industrial, transportation, and electric utilities).

NOTE: The definition of sector in 38 M.R.S. § 574 (2) lists the five sectors as transportation, industrial, commercial, institutional and residential. To be consistent with EPA GHG methodology as well as the SIT, this analysis will combine the institutional and commercial sectors into the commercial sector and break out the electric utilities sector.

- W. SEDS.** “SEDS” means the U.S. Energy Information Administration State Energy Data System.
- X. Sequestration of carbon.** “Sequestration of carbon” means the geological or biological or technological process of capturing and storing atmospheric carbon dioxide.
- Y. Sink for carbon.** “Sink for carbon” or “carbon sink” means any reservoir, natural or manmade, that absorbs and stores carbon dioxide from the atmosphere (e.g., forests, vegetation, soils, the ocean).
- Z. SIT.** “SIT” means the U.S. Environmental Protection Agency’s (EPA) State Inventory Tool, a computer model developed by EPA to estimate state-specific greenhouse gas emissions.
- AA. Short ton.** “Short ton” is the United States “ton” and is equivalent 2,000 pounds. A short ton is not the same as a metric ton. A metric ton, or 1,000 kilograms, is approximately 1.1 short tons.
- BB. Source category.** “Source category” means a category used to define where greenhouse gas emissions originate based on the type of process or activity producing the greenhouse gases (i.e., industrial processes, agriculture, waste, and energy).
- CC. Source of carbon.** “Source of carbon” or “source” means any natural or manmade producer of chemical compounds containing carbon (e.g., carbon dioxide, methane). For example, degradation of plant matter and the burning of fossil fuels are a source of carbon to the atmosphere.

DD. Transportation sector. “Transportation sector” means an energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. This sector includes automobiles, trucks, buses, motorcycles, and other on-road and off-road vehicles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. The transportation sector does not include vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts); those vehicles are classified in the sector of their primary use. Natural gas used in the operation of natural gas pipelines is included in the transportation sector.

2. Covered greenhouse gases. The following GHGs shall be included in the evaluation of gross and net GHG emissions under this Chapter:

- A. carbon dioxide (CO₂);
- B. methane (CH₄);
- C. nitrous oxide (N₂O);
- D. perfluorocarbons (PFC);
- E. hydrofluorocarbons (HFC);
- F. nitrogen trifluoride (NF₃); and
- G. sulfur hexafluoride (SF₆).

3. Reporting units

- A. GHG emissions shall be expressed in units of carbon dioxide equivalents (CO₂e), metric tons of CO₂e (MTCO₂e) or millions of metric tons of CO₂e (MMTCO₂e).
- B. Fuel consumption values shall be expressed in British thermal units (Btu), millions of Btu (MMBtu), or billions of Btu (BBtu).

4. Gross greenhouse gas emissions estimates

A. Gross emissions data sources. Estimates of gross GHG emissions shall include emissions of the gases identified in section 2 (covered greenhouse gases) of this Chapter from sources within the geographic boundaries of the State of Maine as specified below.

- (1) Direct facility reporting of emissions from licensed stationary sources submitted in accordance with Department rule Chapter 137;
- (2) EPA State Inventory Tool (SIT)

The EPA publishes regular updates to datasets and GHG emission calculations in the SIT, following a standardized method of categorizing emission sources. Where directly measured values for emissions are not available, the Department shall utilize the most recently published version of the SIT for estimating emissions under this Chapter.

- (a) Emission estimates utilizing the SIT shall include the following modules and data sources:
 - (i) Agriculture

- (A) The agriculture module shall be used to calculate CO₂, CH₄, and N₂O emissions from enteric fermentation; manure management, agriculture soils, plant residues, legumes, and fertilizers; rice cultivation; liming of soils; urea fertilization; and agricultural burning.
 - (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (i)(A) above include the EPA U.S. Greenhouse Gas Inventory; EPA Air Emissions Inventory Improvement Program; United States Geological Survey (USGS) Liming Materials Yearbook; United States Department of Agriculture (USDA) Quick Stats; and the Association of American Plant Food Control Officials and the Fertilizer Institute.
- (ii) CO₂ from fossil fuel combustion (CO₂FFC)
- (A) The CO₂FFC module shall be used to calculate CO₂ emissions from fuel types by end-use sector. Fuel types include coal, natural gas, petroleum, and other. Emissions shall be calculated for the industrial, electric power, commercial, residential, and transportation sectors.
 - (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (ii)(A) above include the Energy Information Administration (EIA) State Energy Data System (SEDS); EIA Natural Gas Report; and EPA U.S. Greenhouse Gas Inventory.
- (iii) Coal
- (A) The coal module shall be used to calculate CH₄ emissions from coal mining and abandoned coal mine activities.
 - (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (iii)(A) above include the EPA U.S. Greenhouse Gas Inventory.
- (iv) Electricity consumption
- (A) The electricity consumption module shall be used to calculate CO_{2e} emissions from electricity consumption by end-use equipment types and end-use sector.
 - (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (iv)(A) above include the EIA SEDS; National Transit Database; EIA Commercial Building Energy Consumption Survey; EIA Residential Energy Consumption Survey; EIA Manufacturing Energy Consumption Survey; and EPA Emissions and Generation Resource Integrated Database.
- (v) Industrial processes
- (A) The industrial processes module shall be used to calculate CO₂, N₂O, HFC, PFC, NF₃, and SF₆ emissions from the following industrial process sectors: cement production; lime manufacture; limestone and dolomite use; soda ash manufacture and consumption; iron and steel production; ammonia manufacture; nitric acid production; adipic acid production; aluminum production; HCFC-22 production;

consumption of substitutes for ozone depleting substances; electric power transmission and distribution; and magnesium production and processing.

- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (v)(A) above include the USGS Minerals Yearbook; U.S Census; and USGS Cement Statistics and Information.

(vi) Land-use, land-use change and forestry (LULUCF)

- (A) The LULUCF module may be used to calculate CO₂, CH₄, and N₂O emissions from fertilization of settlement soils and forest fires, as well as carbon flux from forest management, urban trees, landfilled yard trimmings and food scraps, and agricultural soils. Alternatively, carbon sequestered and emitted from these sources and sinks may be estimated using methods outlined in the net greenhouse gas emissions estimates section of this Chapter.
- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (vi)(A) above include the U.S. Forest Service; EPA Advancing Sustainable Materials Management Fact Sheet; U.S Greenhouse Gas Inventory; and Association of American Plant Food Control Officials and the Fertilizer Institute.

(vii) Mobile combustion

- (A) The mobile combustion module shall be used to calculate CH₄ and N₂O emissions from highway vehicles, aviation, boats and vessels, locomotives, other non-highway sources, and alternative fuel vehicles.

NOTE: CO₂ emissions from mobile combustion are calculated in the CO₂FFC module.

- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (vii)(A) above include the EIA SEDS; FHWA Highway Statistics; EIA Adjusted Sales of Distillate Fuel Oil by End Use; and U.S Greenhouse Gas Inventory.

(viii) Natural gas and oil

- (A) The natural gas and oil module shall be used to calculate CH₄ and CO₂ emissions from all phases of natural gas systems (including production, transmission, venting and flaring, and distribution) and petroleum systems (including production, refining, transport, and storage).
- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (viii)(A) above include the EIA Petroleum Supply; EIA Crude Oil Production; EIA Number of Producing Gas Wells; EIA Number of Gas Producing Oil Wells; EIA Monthly Energy Review; and EIA Natural Gas Gross Withdraws and Production.

(ix) Municipal solid waste

- (A) The municipal solid waste module shall be used to calculate CH₄ emissions from landfilling of municipal solid waste (MSW) and CO₂ and N₂O emissions from the combustion of MSW.

NOTE: All facilities that combust MSW and many facilities that landfill MSW are required by Department rule Chapter 137 to submit facility reports of GHG emissions that are included in Section 4.A.(1) (Direct facility reporting) of this Chapter.

- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (ix)(A) above include the U.S Census; EPA Advancing Sustainable Materials Management Fact Sheet; and Landfill Methane Outreach Program Landfill and Landfill Gas Energy Project Database.

(x) Stationary combustion

- (A) The stationary combustion module shall be used to calculate CH₄ and N₂O emissions for combustion of coal, natural gas, petroleum, wood, and other fuel types by end-use sector.

- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (x)(A) above include the EIA SEDS; EIA Annual Natural Gas Report; and U.S Greenhouse Gas Inventory.

(xi) Wastewater

- (A) The wastewater module shall be used to calculate CH₄ and N₂O emissions from the treatment of municipal and industrial wastewater.

- (B) In accordance with the SIT, acceptable data sources for estimates of emissions from the activities in subsection (xi)(A) above include the USDA Quick Stats; U.S Census; and U.S Greenhouse Gas Inventory.

(xii) Synthesis Tool

Estimates of total GHG emissions from all sources in Maine included in the modules identified in the subsections (i) through (xi) above shall be generated with the synthesis tool provided with the SIT.

(b) SIT data sources

(i) Default data in SIT modules

Estimates of GHG emissions may be generated using data provided by the EPA in the SIT for Maine sources.

(ii) Department data sources

The Department shall replace or add to data for Maine sources provided in the SIT where the Department determines that more specific or accurate data are available and appropriate for use in the SIT. At a minimum this shall include the following information:

- (A) Vehicle miles traveled on Maine roads
- (B) Industrial process-specific data
- (C) Solid waste data
 - (I) Data quantifying CH₄ recovered from landfill-gas-to-energy projects and methane flared reported to the Department by licensed stationary sources.
 - (II) Quantity and type of materials landfilled in Maine reported to the Department by licensed solid waste disposal facilities.
- (iii) Renewable energy sources
 - (A) SIT estimates of GHG emissions from biogenic sources may be included in calculations of gross and net GHG emissions if the Department determines that the SIT estimates are sufficiently representative of activities in Maine.
 - (B) Biogenic emissions of CH₄ and N₂O from wood and wood waste shall not be calculated using the stationary combustion module of the SIT. Estimates of biogenic emissions of CH₄ and N₂O shall be calculated with CO₂ estimates in accordance with subsection 3 (Biogenic Emissions) below.
- (c) SIT source categories. Estimates of gross GHG emissions in MMTCO₂e from the SIT shall be provided for the following source categories:
 - (i) Energy. The energy category includes energy consuming entities in Maine, such as electric power producers, and energy consumption from the following sectors: industrial, commercial, transportation, and residential.
 - (ii) Agriculture. The agriculture category includes emissions from livestock, manure management, plant and soil residue, and cultivation practices in Maine.
 - (iii) Industrial Processes. The industrial processes category includes non-combustion activities that create emissions, such as cement production, semiconductor manufacture, and electrical power transmission and distribution in Maine.
 - (iv) Waste. The waste category includes emissions from municipal solid waste disposal and wastewater treatment activities in Maine.
- (3) Biogenic emissions. Biogenic emissions shall be estimated using the following data sources:
 - (a) Wood and wood waste (including black liquor and sludge)
 - (i) Industrial and electric power sectors
 - (A) Activity data (in Btu) for wood and wood waste consumed in Maine industrial and electric power sectors shall be collected from the EIA SEDS database by sector for years 1990 through 2009. Emission factors from 40 CFR Part 98 must be used to calculate CO₂, CH₄, and N₂O emissions based on energy (Btu) values for each year.

- (B) Data reported by licensed stationary sources for wood, bark, biomass, and wood waste (black liquor solids and sludge) combusted shall be used for the industrial and electric power sector data starting with the 2010 data year.
- (I) Throughput reported in short tons shall be converted to energy values (Btu) using the moisture content specified for that process. Throughput values reported in Btu do not need to be converted.
- (II) GHG emissions reported and based on 40 CFR Part 98 emissions factors shall be used to represent gross emissions.
- (III) NAICS codes associated with each licensed stationary source must be used to sort facilities into appropriate sectors.
 - a. Industrial sector
 - i. Manufacturing (NAICS codes 31–33)
 - ii. Agriculture, forestry, fishing and hunting (NAICS code 11)
 - iii. Mining, including oil and gas extraction (NAICS code 21)
 - iv. Construction (NAICS code 23)
 - b. Electric power sector
 - i. Electricity-only and combined-heat-and-power plants (NAICS code 22)
- (ii) Commercial sector. Activity data (in Btu) for wood and wood waste consumed for energy in Maine’s commercial sector shall be collected from the EIA SEDS database by sector for all available years. Emission factors from 40 CFR Part 98 must be used to calculate CO₂, CH₄, and N₂O emissions based on energy consumption (Btu) values for each year.
- (iii) Residential sector
 - (A) Gross GHG emissions estimates from residential combustion of biomass shall be calculated based on household surveys of primary and supplementary heating sources and fuel use. The Department will contract with an independent third party to conduct household surveys.
 - (B) Survey results given in cords shall be converted to short tons using a conversion factor of 1.8 short tons/cord.
 - (C) Residential wood shall be assumed to have an average moisture content of 36%, consistent with the EIA SEDS methodology.
 - (D) Survey results shall be extrapolated to non-participating households in Maine using the most recent census data to provide an estimate of the total short tons of residential wood combusted in Maine.
 - (E) Survey results shall be assumed to be the same for the two years included in the heating season survey period (October 1 – April 30 each year).

(F) For years when a survey is not conducted, data shall be estimated using a linear fit between survey years.

(G) Btu values and emissions of CO₂, CH₄, and N₂O shall be calculated based on 40 CFR Part 98 factors.

(b) Ethanol and biodiesel

(i) Fuel consumption data for ethanol shall be obtained from the EIA/SEDS database.

(ii) Emission factors from 40 CFR Part 98 shall be used to calculate CO₂, CH₄, and N₂O emissions.

(c) Solid waste

(i) Methane flaring data shall be obtained from licensed stationary source emission reports for all available years from 1990 - 2050.

(ii) Landfill-gas-to-energy (LFGTE) project data shall be obtained from licensed stationary source emission reports for all available years from 1990 - 2050.

(iii) Municipal solid waste data shall be obtained from licensed solid waste disposal facility reports for all available years from 1990 - 2050.

(iv) Emission factors from 40 CFR Part 98 shall be used to calculate CO₂ emissions.

(v) CO₂ from landfill off-gassing shall be calculated using the potential CH₄ emissions calculation results provided by the SIT. Landfill gas is assumed to be 50% CH₄ and 50% CO₂. The MTCO₂e values provided by the SIT for CH₄ shall be divided by the GWP value used in the SIT for CH₄ to determine metric tons of CH₄ and thus the MTCO₂e from CO₂ off-gassing.

(4) Energy consumption data. Energy consumption data shall be obtained from the EIA SEDS database by sector and fuel type.

(5) Economic data. Economic data shall be obtained from the Bureau of Economic Activity, U.S. Department of Commerce.

B. Gross emissions inventory analysis and reporting

(1) Gross emissions shall be reported by the Department as a time series from 1990 to the latest year data that are available. Estimates of annual statewide gross GHG emissions may be reported three or more years following the year in which the emissions occurred. This time series of gross emissions will be compared to the Maine greenhouse gas reduction goals listed in 38 M.R.S. § 576-A (1), (2) and (3).

(2) All GHG emissions shall be reported in metric tons or millions of metric tons of CO₂ equivalents (MMTCO₂e). CO₂e conversions shall be made using GWP values for individual greenhouse gases in the most recent final IPCC Assessment Report.

(3) Gross GHG emissions shall be reported by source category as described in section 4.A.(2)(c) (SIT source categories).

- (4) CO₂ emissions from fossil fuel combustion in Maine involving petroleum products shall be reported in MMTCO₂e.
- (5) The consumption of petroleum products shall be reported in BBtu for distillate fuel; motor gasoline; propane and liquefied petroleum gas; jet fuel and aviation gasoline; petroleum coke, asphalt, road oil, and lubricants; residual fuel oil; and kerosene.
- (6) An analysis of GHG emissions relative to state gross domestic product (GDP) shall be reported in real dollars adjusted for inflation.

5. Net GHG emissions estimates

A. Categories. Estimates of net GHG emissions in Maine shall include estimates of emissions and sequestration from the following categories:

- (1) Fossil fuels. Fossil fuel emissions shall be estimated in accordance with section 4.A.(2)(a)(ii) (CO₂ from fossil fuel combustion) of this Chapter and reported by the following sectors: transportation, residential, industrial, electric power, and commercial.
- (2) Waste. Emissions from waste shall be estimated in accordance with sections 4.A.(2)(a)(ix) (Municipal solid waste), 4.A.(2)(a)(xi) (Wastewater), and 4.A.(3)(c) (Solid waste) of this Chapter.
- (3) Forests (live biomass, dead biomass, and soils)

- (a) Acreage data shall be obtained from the USGS National Land Cover Database (NLCD).

- (b) Aboveground forest carbon data shall be obtained from the USDA Forest Service Forest Inventory and Analysis database (FIA). Fluxes shall be calculated as the difference in stock inventories between the first and last years of the analysis window. Carbon estimation methods shall follow those outlined in Annex 3 of the EPA's "Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2017" as published by EPA in 2019. The methods in this Annex 3 are incorporated by reference herein.

NOTE: The incorporated material can be accessed at www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017, and copies of the incorporated material are also available from the Department by calling (207) 287-2235.

- (c) Soils data shall be obtained from the USDA Natural Resources Conservation Service SSURGO soils database. Soil fluxes shall be calculated as differences in soil carbon stock by land use change between the first and last years of the analysis window based on the NLCD.
 - (d) When the 'forest floor' data from the FIA partially includes the SSURGO total soil measurements, the FIA forest floor carbon estimates shall be subtracted from the total SSURGO soil carbon estimates in forest soil carbon stock difference calculations.
 - (e) Shrubland non-soil component estimates shall be included in the aboveground forestland estimates.
 - (4) Wood products (sawlogs, pulp, and landfilled). Sequestration of carbon in forest products shall be estimated based on timber flows (harvest minus export plus import) from the Maine Forest Service Annual Wood Processing Reports. Processed wood shall be divided into sawlogs, pulp

logs, biomass, and fuelwood. The longevity of the products made from these four wood types shall be applied based on factors in the USFS ForGATE Tool, which estimates wood product decay and deposition into landfills. Processed wood that could be utilized outside of Maine (i.e., exports) and wood processed elsewhere that could be utilized in Maine (i.e., imports) shall not be considered in this assessment.

(5) Wetlands (biomass and soils)

(a) Non-woody wetland soil carbon shall be estimated by:

- (i) Using data from a direct monitoring network for non-woody wetland fluxes in Maine; or
- (ii) Taking the non-woody wetland land use data from the NLCD database representing the first and last year of the analysis window years and assigning a carbon value from the SSURGO database. Changes in land area by non-woody wetland soil type over time shall be used to estimate fluxes.

(b) Woody wetlands, including forested swamps and shrub swamps, shall be accounted for in the forest estimates.

(6) Agriculture (emissions and soils)

(a) Emissions from agricultural activities shall be estimated in accordance with section 4.A.(2)(a)(i) (Agriculture) of this Chapter.

(b) Accounting for agricultural soil carbon from changes in farm practices may be included if the Department determines that an available data source and methodology are sufficiently representative of activities in Maine.

(7) Urban (biomass and soils)

(a) Urban aboveground biomass carbon shall be based on the forest stock change from the FIA database.

(b) Urban soil carbon estimates shall be based on NLCD land use data that includes developed lands with different intensities ranging from open space to low, medium, and high intensity with the associated soil carbon data for the urban land use change from the SSURGO database.

(8) Inland waters (sedimentation). Inland water carbon estimates shall be based on the amount of carbon delivered to the ocean at the mouth of a river. Specifically, this is the transport of dissolved organic carbon from watersheds through surface waters (e.g., lakes and streams) to rivers and exported to the ocean. (This estimate shall not include dissolved inorganic carbon.) A preliminary estimate of 20% shall be assumed to represent the amount of dissolved organic carbon delivered to the ocean that is then sequestered by sedimentation, with the rest assumed to be lost to photo-oxidation and decomposition back to the atmosphere.

(9) Coastal waters (sedimentation and biomass; blue carbon)

(a) Blue carbon stock and flux estimates for salt marshes shall be based on:

- (i) Total salt marsh area as reported in the most recent Maine Tidal Marshes Map produced by the Department of Agriculture, Conservation and Forestry, Maine Natural Areas Program.
 - (ii) The average carbon density over the upper 1 meter.
 - (iii) The average burial rate flux for coastal marsh sediments.
- (b) Blue carbon stock and flux estimates for eelgrass shall be based on:
 - (i) The eelgrass meadow area determined by the State of Maine agencies and partners eelgrass surveys (e.g., Maine Department of Environmental Protection, Maine Department of Marine Resources, and partner mapping efforts where quality assurance is known and accepted by Department staff).
 - (ii) The average carbon density over the upper 1 meter.
 - (iii) The average burial rate flux for eelgrass beds.
- (c) Carbon stocks shall be calculated by multiplying the ecosystem area in square meters by the carbon density of a one-square-meter area. Carbon fluxes shall be calculated by multiplying the ecosystem area by the burial rate.

B. Calculations of net GHG emissions

- (1) Carbon emitted and sequestered shall be calculated for each of the categories in section 5A, above. The difference between emission and sequestration from these categories shall provide an estimate of net carbon emissions over the defined analysis window.
- (2) For conversions of carbon to CO₂e, CO₂e shall be assumed equal to the molecular weight of CO₂ (44) divided by the atomic weight of carbon (12) times the elemental carbon.
- (3) Final net GHG emissions shall be compared to the Maine goal of carbon neutrality by 2045 and reported for all years in the period of 1990-2045 for which the data identified in section 5A above are available.

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