Northern Virginia Regional Greenhouse Gas Inventory
Project Plan
Northern Virginia Regional Commission
DRAFT July 17, 2013

Background

The Northern Virginia Regional Commission (NVRC) proposes to complete a regional greenhouse gas (GHG) inventory covering the Counties of Arlington, Fairfax, Loudoun, and Prince William, and the Cities of Alexandria, Falls Church, Fairfax, Manassas and Manassas Park. Emissions associated with towns will be accounted for in county totals. The inventory will report greenhouse gas emissions for the Northern Virginia region, with subsets for each of the Counties and Cities.

The work will be done in partnership with the Metropolitan Washington Council of Governments (COG). NVRC and COG will use a common inventory protocol based on ICLEI's *U.S Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*, Version 1.0, dated October 2012, as spelled out in this Project Plan.

NVRC proposes to complete the Northern Virginia inventory by October 31, 2013. This will allow sufficient time to gather needed data, complete calculations, provide for quality assurance, and prepare a regional GHG inventory report.

The 2012 ICLEI *U.S. Community Protocol* accounts for greenhouse gas emissions associated primarily with community-wide activities. This differs from earlier protocols that were based on calculations of the greenhouse gas emissions from physical sources located within a jurisdictional boundary. Using an activity based protocol avoids double counting emissions from electric generation, other energy production, waste management, or other activity in one locality where the end users are located elsewhere. This approach also does not artificially create savings due to shifting of emissions to a source outside a locality's boundaries. This approach is based on the understanding that the inventory should measure greenhouse gas emissions from those activities over which a local government or a locality's residents and businesses have some level of control.

This protocol differs from the local government operations, corporate, corporate value chain and product GHG inventory protocols that have other scopes, so results are not comparable.

The 2012 ICLEI *U.S. Community Protocol* does not directly break out greenhouse gas emissions into the Scope I, II and III categories as previous inventories. Previously scopes were defined as:

- Scope 1 are all direct GHG emissions
- Scope 2 are indirect, or upstream, GHG emissions generated from purchased electricity, heat or steam
- Scope 3 are all other indirect emissions, such as related to the extraction and production of purchased materials and fuels, electrical transmission and distribution system losses, outsourced activities, waste disposal, and other.

By accounting for emissions caused by activities within a jurisdiction's boundaries, the *2012 ICLEI Community Protocol* includes all Scope 1 direct emissions from activities within the locality, but does not count direct emissions from generated electricity, heat or steam where the product is consumed outside of the jurisdiction. The Protocol counts all Scope 2 emissions caused by activities within a jurisdiction. The includes Scope 3 emissions related to transmission and distribution of electricity and upstream emissions related to purchased fuels consumed by activities in the jurisdiction. The ICLEI protocol leaves optional reporting on other Scope 3 emissions such as upstream impacts of purchased materials and life-cycle emissions of regional businesses.

This GHG inventory will not measure emissions associated with upstream material purchases and life-cycle emissions of regional businesses as they would be accounted for in community GHG inventory where the materials are produced or consumed. This GHG inventory also will not account for emissions attributable to land use, land use changes and forestry as they are not addressed in the ICLEI community GHG protocol.

This GHG inventory will not account for greenhouse gas emissions from refrigerant leakage due the lack of available data to calculate these emissions. The protocol requires an inventory of refrigeration and air conditioning equipment in the region or a mass-balance assessment of refrigerants. (See U.S. Environmental Protection Agency, Climate Leaders. May 2008, Direct HFC and PFC Emissions from Use of Refrigeration and Air Conditioning Equipment. EPA430-K-03-004, at http://www.epa.gov/stateply/documents/resources/mfgrfg.pdf) Emissions from refrigerants will be assumed to be de minimis emissions not counted in this GHG inventory. This assumption that the emissions are de minimis is consistent with the 2007 Arlington County GHG inventory, in which fugitive emissions from the use of refrigerants equaled to only 0.0015% of the total emission.

Types of Emissions

This inventory will account for emissions of the four of the six primary greenhouse gasses regulated under the Kyoto Protocol. They include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulfur hexafluoride (SF_6)

As noted above, data is not available to quantify release of refrigerants in the region, so emissions of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are not being accounted for.

Data Quality

As with any assessment using data, the results are only as accurate as the data used. Data sources will be assessed for completeness, availability, and accuracy. Documentation of data sources will be provided in the report, with any notation of data limitations that could affect the accuracy of the report. This protocol provides that emissions may be treated as de minimis if they total to less than 5% of the full inventory emissions. The report will identify emission sources and activities excluded.

SAIC is completing a GHG inventory for Arlington County using both the County's previous methodology and the 2012 ICLEI *U.S. Community Protocol*. NVRC will compare its results with the SAIC/County inventory as part of its quality assurance process.

Scope and Data Sources

The scope and data sources used for this effort are described below. See also the attached data source list (Attachment A), ICLEI Methodology summaries (Attachment B) and *Community-wide GHG Emissions Inventory, Scoping and Reporting Tool – October 2012* (Attachment C).

- Use of electricity by the community will be calculated by NVRC:

  NVRC will allocate by jurisdiction, the utility data provided by electric utilities serving the Northern Virginia region (Dominion Virginia Power, Northern Virginia Electric Cooperative, City of Manassas Electric Department). This will be done as part of COG's utility information gathering effort. (ICLEI methodology BE.2.1)

  Consumption and resulting emissions will be calculated for the residential, commercial and governmental sectors using the EPA e-Grid2012 data for the SERC Virginia/Carolina sub-region. Note, comparing the e-Grid data to the PJM data shows the e-Grid data to be an accurate data source (PJM 2009 system average = 1137 lbs CO2/MWh; e-GRID SERC Virginia/Carolina 2009 = 1.035.87 lbs CO2/MWh). (Use ICLEI methodology BE.2.2)

  The calculation will account for upstream transmission and distribution impacts of purchased electricity used for the community using the data for the SERC Virginia/Carolina sub-region. (ICLEI methodology BE. 4.1)

  The calculation will account for the upstream emissions from electric generation. This will include both direct uses of electricity and transmission and distribution losses. The calculation will use data for the SERC Virginia/Carolina sub-region. (ICLEI methodology BE.6.1)

  Where electricity use for transportation (i.e. Metro), water and wastewater can be separately accounted for, the electricity use will be backed out of this calculation and accounted for in the topic area calculations.

  There are limited amounts of electricity used by industrial and agricultural entities in Northern Virginia. It is not possible to break out their use separately within individual jurisdictions without breaching customer confidentiality requirements. Therefore, these uses will be grouped together with commercial consumption.

  There is limited use of district heating and cooling or combined heating and cooling systems in Northern Virginia. (ICLEI methodology BE.3) Therefore, no separate calculation will be made. Energy use for these systems will be accounted for in electricity or direct fuel use calculations.

- Use of fuel in residential and commercial stationary combustion equipment by the community will be calculated by NVRC:

    NVRC will allocate by jurisdiction, the data provide by natural gas utilities serving the Northern Virginia Region (Washington Gas and Columbia Gas). This will be done as part of COG's utility information gathering effort. (ICLEI methodology BE.1.1)

    Calculate liquid and solid fuels in stationary sources based on statewide consumption data available from the US Department of Energy, Energy Information Administration and fuel use information from the Bureau of the Census, American Community Survey.

    Statewide residential fuel use data will be allocated to localities based on the per-household use and percent of households using the liquid fuel. Where the American Community Survey data is not detailed enough to allocate solid or liquid fuel use in stationary sources, statewide data will be allocated on a population-weighted basis. (ICLE methodology BE.1.2)

    Commercial building fuel use will be calculated based on the number and square feet, and classification by size; principal activity or year constructed (depending on availability of local data) of commercial building space in each locality. (ICLEI methodology BE 1.3)

    Individual adjustments will be made where there is a substantial stationary user of liquid fuel in a locality.

    Upstream impact of fuels used in stationary applications will be accounted for using ICLEI factors. (ICLEI methodology BE.5.1)

    Consumption and resulting emissions will be calculated for the residential, commercial and governmental sectors to the extent data are available for these classes of buildings. In some cases, government buildings may need to be combined with commercial buildings. There are limited amounts of natural gas used by industrial and agricultural entities in Northern Virginia. It is not possible to break out their use separately within individual jurisdictions without breaching customer confidentiality requirements. Therefore, these uses will be grouped together with commercial consumption.

    When data are available to separately account for natural gas used in transportation, emissions will be accounted for in the transportation section.

- Use of energy for on-road passenger and freight motor vehicle travel:

    The ICLEI Community Protocol gives two options for calculating on-road (and off-network (locations where the predominant activity is vehicle starts, parking and idling - parking lots, truck stops, rest areas, freight or bus terminals), transportation based emissions. Their preferred approach is to generate VMT for trips originating in a locality based on an origin-destination data from a regional transportation-demand model.   If data is not available showing trips originating or terminating in a community, then the Protocol provides an alternate method that uses the estimated vehicle miles traveled (VMT) within a locality's boundaries.

COGs Transportation Planning Board and transportation staff has previously used the MOBILE6 transportation demand model to allocate trips by road type. However, in accordance with Environmental Protection Agency requirements, COG has transitioned to the MOVES (Motor Vehicle Emissions Simulator) model. The MOVES model calculates VMT-based emissions for 13 types of vehicle classes:

- o Motorcycle;
- o Passenger car;
- o Passenger truck;
- o Light commercial truck;
- o Intercity bus;
- o Transit bus;
- o School bus;
- o Refuse truck;
- o Single unit short-haul truck;
- o Single unit long-haul truck;
- o Motorhome;
- o Combination short-haul truck;
- o Combination long-haul truck.

In order to maintain consistency with COG's Transportation Planning Board and staff, COG will use the alternate VMT-based method. MWCOG will follow the EPA guidance addressing use of the MOVES model for estimating state and local inventories of on-road greenhouse gas emissions and energy consumption. (See http://www.epa.gov/otaq/stateresources/420b12068.pdf)

The MOVES model generates output by major locality (Counties of Arlington, Fairfax, Loudoun, and Prince William, and City of Alexandria). VMT are not regularly generated for the other Northern Virginia localities. Therefore, emissions for the four smaller cities in the region will be allocated on a population weighted basis from their surrounding county emission estimates. NVRC will work with COG to review the accuracy of population-based allocation to estimate the level of uncertainty introduced by this allocation methodology.

- Use of energy for non-road transportation:

  MWCOG will calculate emissions associated with off road use using the EPA's NONROAD model. This includes emissions for all non-road mobile equipment and recreational vehicles (including recreational marine) except locomotive, commercial marine, and aircraft. (ICLEI methodology TR.8)

  NVRC will calculate emissions associates with rail haulage and travel.

  - o For freight rail, NVRC will gather data on ton-miles of rail freight haulage and railroad ton-mile/gal rate. If the actual fuel use rate is not available, the analysis will use 457 ton-mi/gal that ICLEI calculated from the federal Energy Information Administration Annual Energy Outlook. (ICLEI methodology TR.3)
  - o For VRE, NVRC will gather data on diesel fuel used by VRE from the National Transit Database Form R-30, and allocate the fuel use by train-miles in each

jurisdiction.   The fuel use in each jurisdiction will then be used as input to calculate CO2, CH4 and NO2 emissions using ICLEI emission factors. (ICLEI methodology TR.4)

- o   For Amtrak (inter-city heavy rail), NVRC will calculate annual train miles based on the length of track and Amtrak schedule to calculate energy use and resulting emissions. (ICLEI methodology TR.5)

The MOVES and NONROAD models generate GHG emission estimates for atmospheric carbon dioxide (CO_2), as well as Nitrous Oxide (N_2O) and Methane (CH_4) and their CO_2 equivalents.

The MOVES and other models generate data on direct emissions from transportation fuels. This does not account for the upstream emissions associated with the production and delivery of the transportation fuels. Therefore, lifecycle or upstream impact of the production and delivery of fuels used in mobile applications will be accounted for using scaling factors that account for the upstream emissions, using factors calculated from the Argonne national Laboratory GREET-2011 (Greenhouse Gasses, Regulate Emissions, and Energy Use in Transportation) model. (ICLEI methodology TR.9)

As there are no GHG emission inventories available for Reagan National, Dulles and BWI Thurgood Marshall airports, NVRC will calculate air travel emissions associated with air travel will be allocated based on an allocation of airline emissions as reported in the most recent United States GHG inventory. This is the same methodology used by MWCOG for its National Capital Region GHG inventory. These emissions will be allocated to Reagan National and Dulles airports based on flight miles in and out of the airports divided by 2. This then will be allocated to the population in each locality based on the 2011 MWCOG air passenger survey data. As Reagan National, Dulles or BWI Thurgood Marshall airports do not handle much freight, the freight portion of the emissions will be assumed to be allocated by passenger mile (ICLEI methodology TR.6)

The Northern Virginia GHG inventory will not include emissions from commercial marine vehicles as the region's waterways that support commercial marine vessels are jurisdictional to Maryland and the District of Columbia. (ICLEI methodology TR.4 for ferries and GR.7 for marine vessels)

- •   Generation of solid waste by the community:

The ICLEI protocol provides methodologies for calculating emissions from community-generated waste sent to landfills and combustion facilities, and for emissions from in-boundary landfills. Consistent with the approach to measure emissions generated from activities in the region, NVRC will calculate emissions from community-generated waste (ICLEI methodology SW.4 for landfilled waste; SW.7 for waste sent to combustion facilities)

The ICLEI protocol does not at this time account for GHG emissions from composting facilities due to a lack of data, standards or guidelines about emissions from composting. (ICLEI methodology SW.3) Therefore, this inventory will not account for GHG emissions from composting.

GHG emissions are generated from the equipment used for processing waste at landfills. (ICLEI methodology SW.5) To the extent that the emissions from landfill equipment are not counted in off-road emission calculations, they will be accounted for under landfill emissions.

Emissions associated with collection and transportation of wastes are accounted for in the transportation GHG inventory section, so will not be separately accounted for in this section. (ICLEI methodology SW.6)

Data on waste generated in each of the region's counties and cities, regardless of the disposal location will be collected through the NVRC/Northern Virginia Waste Managers Board, as part of the NVRC's annual waste management report. This will include residential and commercial waste, as well as land clearing, and construction and demolition waste.

Tonnage diverted to recycling will not be counted as emissions from the processing of the materials would be accounted for in other calculations such as emissions from electricity or fuel use in stationary facilities.

- Emissions related to water and wastewater treatment and conveyance:

    Emissions related to water and wastewater treatment and conveyance are generated during the treatment process, from materials released in plant discharges, from combustion of digester gas, and from electricity used to convey and treat water and wastewater.

    Water and wastewater services are provided across the Northern Virginia region by multiple public and private departments, authorities, and companies (see Attachment B). Some providers manage all water used or effluent generated in a community themselves, while others use common facilities such as the Blue Plains Advanced Wastewater Treatment Plant. Some providers or plants may have a GHG emissions inventory while others may have not. Other treatment is provided on site such as by residential wells or septic systems. The water and wastewater GHG calculation methodologies must account for the varying providers and technologies used.

    NVRC will gather information about the treatment technologies used at specific plants from the plant operators or local environmental department officials, and use the applicable ICLEI methodology depending on the specific treatment technologies used. (ICLEI methodologies WW.1 through WW.13) Where specific plant emissions data, technology and throughput data are not available, this GHG inventory will use ICLEI population-based alternate methodologies. (ICLEI methodology WW.1(alt), WW.2(alt), WW.6(alt), WW.11(alt), WW.12(alt))

    Emissions from the electricity used for water extraction, conveyance, treatment and delivery will be calculated using electricity use data when available or ICLEI default values. (ICLEI methodology WW.14) Data sources include the regional water supply plan, annual reports of the utilities, or directly from the utilities.

    Emissions from the energy used for wastewater collection will be calculated using the electricity use data when available or ICLEI default values. (ICLEI methodology WW.15)

These calculations will account for upstream impacts of purchased energy used for wastewater treatment and distribution using the same methodology as use for electric consumption in methodology. (ICLEI methodology BE.2)

Emissions from electricity used for water and wastewater systems will be backed out of community-wide electricity based emissions to avoid double counting.

- Agricultural based emissions:

  Most Northern Virginia localities have little to no agricultural operations so emissions from agricultural operations would be de minimis. However, there are some livestock and other agricultural operations in Loudoun and Prince William Counties, which will be accounted for.

  The ICLEI community protocol only accounts for emissions from livestock activities and sources. Other agricultural processes (for example vineyards or sod growing operations in Northern Virginia) that have the potential to produce GHG emissions are not accounted for due to the lack of suitable accounting methodologies.

  The ICLEI livestock methodologies are based on the population and type of livestock and manure management systems in use. (IOCLEI methodology A.1 and A.2) Most livestock in Northern Virginia are cattle and horse. NVRC will gather data on livestock populations from the Loudoun and Prince William County governments, Soil and Water Conservation Districts, Cooperative Extension Offices, the Virginia Department of Agriculture and Consumer Services, and the USDA 2007 Census of Agriculture, County Data (2012 Census data not yet available).

Report

NVRC will prepare a GHG inventory report that addresses Northern Virginia region-wide emissions and breaks out the total emissions by each of the region's counties and cities. The report will describe the assumptions, process/methodology, sources and activities included in the inventory, and community context. The community context will show emissions on a per capita, per acre, per value of gross domestic product, per sector (residential, commercial, and transportation).

The report will include necessary text, tables, and graphics. The report will describe the differences between the 2012 ICLEI *U.S. Community Protocol* and previous GHG inventories' conducted in the region.

The report will include a glossary of special terms, and appendices of the data and data sources used.

The report will be prepared so that it can be published in print form and in electronic form on the NVRC, COG, and local government web sites.

Budget/Resources Needed

The primary financial support for the regional GHG inventory will be provided from the energy program allocation NVRC member localities provide to the Commission. Stephen Walz, NVRC's Director, Regional

Energy Planning will lead the effort, including interface with COG and localities, data source identification and gathering, calculations, and drafting the report. He will be assisted by Senior Environmental Planners Dale Medearis (energy matters), Debbie Spiliotopoulos (waste matters) and Norm Goulet (water and wastewater matters) as well as Ken Billingsley, Director, Demographics and Information.   Additionally, Kibum Kim, a civil engineer from South Korea that NVRC is hosting for a year, will assist with data gathering and calculations.

At COG, Stuart Freudberg, Director, Department of Environmental Programs and Joan Rohlfs, Environmental Resources Program Director will oversee COG's effort. Jeff King, Principal Environmental Planner will lead a team that also includes MWCOG environmental staff Julia Allman and Sunil Kumar to provide data, calculations of non-road emissions and support. Ron Kirby, Director, Department of Transportation Planning, and MWCOG transportation staff will provide the transportation demand model information needed for the GHG inventory. Financial support for the staff time will come from COG's existing Environmental Programs and Transportation Planning budgets.

Schedule

Manor milestones for completion of the GHG inventory include:

- July   NVRC, COG and Local government approval of Scope and Approach
- July-August   Gather data; calculate GHG emissions; draft report
- September   Local government report review
- October   Finalize report and present to localities and COG BE-EAC and CEEPC

Attachment A: Data Sources

Metered energy utility consumption data from the MWCOG utility data collection process:

- Electricity
  - Dominion Virginia Power
    - City of Alexandria
    - County of Arlington
    - City of Fairfax
    - Part of Fairfax County
    - City of Falls Church
    - Part of Loudoun County
    - City of Manassas Park
    - Part of Prince William County
  - City of Manassas Electric Department
    - City of Manassas
  - Northern Virginia Electric Cooperative
    - Part of Fairfax County
    - Part of Loudoun County
    - Part of Prince William County

- Natural Gas
  - Columbia Gas of Virginia
    - Part of Fairfax County
    - Part of Loudoun County
    - Part of the City of Manassas
    - Part of the City of Manassas Park
    - Part of Prince William County
  - Washington Gas
    - City of Alexandria
    - City of Fairfax
    - Part of Fairfax County
    - City of Falls Church
    - Part of Loudoun County
    - Part of the City of Manassas
    - Part of the City of Manassas Park
    - Part of Prince William County

Non-metered fuel consumption data from:

- US Energy Administration, statewide energy use data
- American Community Survey, primary fuel used by residential buildings
- Commercial, multi-family and other building size, age, principal building activity, year constructed from Local government land use GIS and data systems

Ground Transportation emission data for mobile on-road vehicle emissions from MWCOG MOVES model. Off road data from MWCOG NONROAD model. Rail data from VRE or Amtrak or the National Transit Database Form R-30, and calculation of Amtrak track miles per jurisdiction.

Air travel and emission data from the U.S. national GHG inventory, flight miles from US Department of Transportation; percent of airport passengers by locality from MWCOG 2011 Passenger Survey

Solid waste data from NVRC/Northern Virginia Waste Managers Board waste management report.

Water use data from water providers' annual reports or contact with:

- Arlington County Department of Environmental Services
    - Arlington County
- Dale City Water
    - Part of Prince William County (Dale City)
- Fairfax County Water Authority
    - Cities of Fairfax, Falls Church
    - Fairfax County
- Town of Hamilton
    - Town of Hamilton
- Town of Herndon
    - Town of Herndon
- Town of Leesburg
    - Town of Leesburg
    - Part of Loudoun County
- Loudoun Water
    - Part of Loudoun County
- Town of Lovettsville
    - Town of Lovettsville
- City of Manassas, Department of Utilities
    - City of Manassas
- City of Manassas Park
    - City of Manassas Park
- Town of Middleburg
    - Town of Middleburg
- Service Authority of Prince William County
    - Part of Prince William County
- Town of Purcellville
    - Part of Loudoun County
    - Town of Purcellville
- Town of Round Hill
    - Town of Round Hill
- Virginia American Water Company
    - City of Alexandria
    - Part of Prince William County

Wastewater technology and treatment data from annual reports or contact with:

- Alexandria RENEW
  - City of Alexandria
- Arlington County Department of Environmental Services
  - Arlington County
- Dale Service Corporation
  - Part of Prince William County (Dale City)
- Fairfax County Water Authority
  - City of Fairfax
  - Fairfax County
  - City of Falls Church
- Town of Hamilton
  - Town of Hamilton
- Town of Herndon
- Town of Leesburg
  - Town of Leesburg
  - Part of Loudoun County
- Loudoun County Sanitation Authority (Loudoun Water)
  - Loudoun County
- Town of Lovettsville
  - Town of Lovettsville
- City of Manassas, Department of Utilities
  - City of Manassas
- Town of Middleburg
  - Town of Middleburg
- Service Authority of Prince William County
  - Part of Prince William County
- Town of Purcellville
  - Part of Loudoun County
  - Town of Purcellville
- Town of Quantico
  - Town of Quantico
  - Marine Corps Base Quantico
- Town of Round Hill
  - Town of Round Hill
- Upper Occoquan Service Authority
  - City of Manassas
  - City of Manassas Park
  - Part of Prince William County
  - Town of Herndon

Agricultural/livestock data from the USDA 2007 Census of Agriculture, County Data, updated by data provided by Loudoun and Prince William County economic development offices, Soil and Water Conservation Districts, Cooperative Extension offices, and the Virginia Department of Agriculture and Consumer Services.

Attachment B: Methodologies

ICLEI provides alternate methodologies for some emission types. Methodologies to be used are identified in bold type.

Summary of Built Environment GHG Emission Sources

GHG Source	GHG Types	Data Required	Available Methodologies
Emissions from Stationary Fuel Combustion	CO_2, CH_4, N_2O	Annual totals of each fuel combusted by sector	**BE.1.1, BE.1.2, BE.1.3**
Emissions from Electricity Use	CO_2, CH_4, N_2O	Annual community-wide electricity use by sector	**BE.2.1, BE 2.2**
Emissions from District Heating and Cooling Energy Use	CO_2, CH_4, N_2O	Reported emissions from district energy providers for energy used in the production of delivered heat and chilled water, or total fuels used in the production of delivered heat and chilled water	BE.3.1, BE.3.1.A
Electric Power Transmission and Distribution Losses	CO_2, CH_4, N_2O	Annual community-wide electricity use by sector	**BE.4.1**
Upstream Emissions from Energy Use	CO_2, CH_4, N_2O	Annual community-wide electricity use by sector and Annual totals of each fuel combusted by sector	**BE.5.1,** BE.5.2, BE.5.2.A
Emissions from Electric Power Production	CO_2, CH_4, N_2O, sulfur hexafluoride (SF_6)	Reported emissions by grid-connected electricity generation facilities	**BE.6.1**, BE.6.1.A.1, BE.6.1.A.2
Refrigerant Leakage and Fire Suppressant Emissions	Hydroflurocarbons (HFCs), Perflurocarbons (PFCs), Refrigerant Blends	Measurement, survey, or estimation of refrigerants and fire suppressant chemicals leaked annually.	BE.7.1, BE.7.1.A
Industrial Process Emissions	Any greenhouse gas	Reported point source emissions by individual facility.	BE.8.1

Summary of Transportation Greenhouse Gas Emission Sources

GHG Source	GHG Types	Data Required	Available Methodologies
Passenger vehicle operation	CO_2, CH_4, and N_2O	- Output of a regional travel demand model	TR.1.A
		OR	
		- Vehicle distance traveled within the jurisdiction	TR.1.B, **MOVES**
Freight and service truck operation	CO2, CH4, and N2O	- State or county level truck VMT data from FHWA HPMS or other source - Jobs in truck-generating industries for municipality, county, and/or state	TR.2.A
		OR	
		- Travel demand model output – heavy duty VMT and speeds by network link (TR.2.B), or truck trip-ends and associated trip lengths (TR.2.C), in municipality - Speed-based CO2, CH4, and N2O emission factors from MOVES or EMFAC model	TR.2.B, TR.2.C, **MOVES**
Freight rail operation	CO_2, CH_4 and N_2O	- Line-haul freight movement (annual ton-miles moved by rail line, for all rail lines traversing the community) - Switching yard activity (number of locomotives and annual hours of operation per locomotive) - Line-haul and switching locomotive emission factors	**TR.3**
Transit operation fuel combustion	CO_2	- Actual fuel use *or* -Fuel use estimated from vehicle miles traveled and vehicle fuel economy	**TR.4.A**, **MOVES**
Transit operation fuel combustion	CH_4 and N_2O	- Vehicle miles traveled by vehicle type *or* - Fuel use by vehicle type	**TR.4.B**, **MOVES**
Transit traction power	CO_2, CH_4 and N_2O	- Electricity use by mode	TR.4.C
Attribution of transit emissions		- Geographic data source of the transit agency's routes for each mode as well as the transit vehicle schedule (headways). - Number of ferry stops in each jurisdiction	TR.4.D, TR.4.E, TR.4.F, **MOVES**
Operation of inter-city passenger rail	CO2, CH4 and N2O	- Number of trains per day - Length of track within community - Energy intensity of passenger rail	**TR.5**

GHG Source	GHG Types	Data Required	Available Methodologies
Air travel – aircraft emissions	CO_2	Airport inventory	TR.6.A
		OR	
		- FAA's AEDT/SAGE emissions model output for airport in a calendar year or - ACRP Report 11 Airport Inventory Method 1 or 2	TR.6.B
Air travel – ground support equipment and vehicles	CO_2, CH_4 and N_2O	Airport inventory	TR.6.A
		OR	
		Fuel consumption of airport fleet vehicles and ground support equipment	TR.6.C, **NONROAD**
Attribution of air travel emissions		Airport passenger surveys that identify the number of passengers that are traveling to/from the community	**TR.6.D**
Marine vessels	CO_2, CH_4 and N_2O	- Total number of vessels operating within community's waters by type - Activity hours of vessel within community's waters - Maximum power (kilowatt) rating of each vessel and average load factor - Power used by ships during hoteling	TR.7A, **NONROAD**
Other off-road equipment	CO_2	- Number of building permits in jurisdiction - Number of households in jurisdiction	TR.8.A, **NONROAD**
Fuel upstream lifecycle emissions		- The same data required for TR.1 through TR.8, broken down by type of fuel - Scaling factors for full fuel-cycle emissions in Table TR.9.1	**TR.9**

Summary of Solid Waste Greenhouse Gas Emission Sources and Activities

GHG Source	GHG Types	Data Required	Available Methodologies
Landfills			
Emissions from a community's materials that are disposed of in landfills regardless of where the landfilling occurs	Fugitive CH4 emissions	- Mass of MSW sent by community to facility	**SW.4**
In-boundary landfills	Fugitive CH4 emissions	Results from EPA's MMR method OR	SW.1
		- Year landfill opened - Year landfill closed (if relevant) - Waste-in-place (wet short tons) and/or historical site-specific annual disposal tonnage - Waste characterization (defaults available) - CH4 fraction in LFG from source testing (defaults available) - Average annual rainfall in operating area (inches/year) - For partial LFG systems: Proportion of landfill surface area under the influence of gas collection systems	SW.1.1
Combustion			
Combustion of municipal solid waste (MSW) at facilities inside the community	Fossil CO_2 emissions, N_2O emissions, CH_4 emissions, biologic CO_2 emissions (optional)	- EPA	SW.2.1
Combustion of community-generated at waste combustion facilities, both inside and outside of the community	Fossil CO_2 emissions, N_2O emissions, CH_4 emissions, biologic CO_2 emissions (optional)	- Mass of MSW sent by community to facility (short tons) - Total mas of MSW combusted by facility (short tons) - GG emissions (fossil CO_2, N_2O, CH_4 emissions, biologic CO_2 reported to EPA	**SW.7**

GHG Source	GHG Types	Data Required	Available Methodologies
OR			
Combustion of municipal solid waste (MSW)	Fossil CO_2 emissions, N_2O emissions, CH_4 emissions, biologic CO_2 emissions (optional)	- Mass of MSW sent by community to facility or waste combusted at an in-boundary facility	SW.2.2 (Alternate to SW.2.1 and/or SW.7)
Composting			
Composting	CO_2 emissions, N_2O emissions, CH_4 emissions	- NA	SW.3
Collection and Transport			
Collection and transport CO_2 emissions	CO_2 emissions	- Mass of solid waste (wet short tons)	SW.6
Process			
Process CO_2 emissions associated with community-generated waste sent to landfills	CO_2e emissions	- Mass of solid waste (wet short tons)	**SW.5**

Summary of Wastewater Treatment Process, Fugitive and Stationary Greenhouse Gas Emission Sources

GHG Source	GHG Types	Data Required	Available Methodologies
Combustion of digester gas at a centralized WWTP with anaerobic digestion of biosolids – process data known	Stationary CH_4 emissions	- Digester gas (ft^3/day) - Fraction of CH_4 in biogas	WW.1.a
		OR	
		- Digester gas (ft^3/day) - BTU content of biogas	WW.1.b
Combustion of digester gas at a centralized WWTP with anaerobic digestion of biosolids – population	Stationary CH_4 emissions	- Population served	WW.1.(alt)
Combustion of digester gas at a centralized WWTP with anaerobic digestion of biosolids – process data known	Stationary N_2O emissions	- Digester gas (ft^3/day) - Fraction of CH_4 in biogas	WW.2.a
		OR	
		- Digester gas (ft^3/day) - BTU content of biogas	WW.2.b
Combustion of digester gas at a centralized WWTP with anaerobic digestion of biosolids – population served basis	Stationary N_2O emissions	- Population served	WW.2.(alt)
Combustion of digester gas at a centralized WWTP with anaerobic digestion of biosolids – process data known	Stationary CO_2 Emissions (optional)	- Digester gas (ft3/day) - BTU content of biogas	WW.3
Emissions from residuals combustion	Stationary CH_4 emissions	- Mass of material sent to combustion device	WW.4
Emissions from residuals combustion	Stationary N_2O emissions	- Mass of material sent to combustion device	WW.5
Anaerobic or Facultative Lagoons	Process CH_4 emissions emissions	- Biochemical Oxygen Demand (BOD_5) load (kilograms (kg) BOD_5/day) - Fraction of overall BOD_5 removal performance	WW.6
		OR	
		- Population served	WW.6 (alt)

GHG Source	GHG Type	Data Required	Available Methodologies
Centralized WWTP with nitrification/denitrification or aeration basin	Process N_2O emissions	- Population served	WW.7
Centralized WWTP without nitrification/denitrification or aeration basin	Process N_2O emissions	- Population served	WW.8
CO_2 emissions from the use of fossil- fuel-derived methanol for biological nitrogen removal in a WWTP	Process CO_2 emissions	- Methanol load (metric tons (mt) CH_3OH/day) - Treatment type (Raw solids, anaerobic digestion, or solid combustion)	WW.9
Cluster Package System	Process N_2O emissions	- Population served	WW.10
Septic Systems	Fugitive CH_4 emissions	- BOD_5 load (kg BOD_5/day)	WW.11
		OR	
		- Population Served	WW.11(alt)
Effluent discharge to receiving aquatic environments	Fugitive N_2O emissions	- N Load (kg N/day)	WW.12
		OR	
		- Population Served	WW.12(alt)
Attributed of wastewater emissions from systems serving multiple localities	Attributed CH_4 & N_2O emissions	- Population of community served by given facility - Total population the facility serves - Total CH_4 and N_2O emissions from facility (mt CO_2e)	$WW.13_{CH_4}$, $WW.13_{N_2O}$

Summary of Water Treatment Process, Fugitive and Stationary Greenhouse Gas Emission Sources

GHG Source	GHG Types	Data Required	Available Methodologies
Lifecycle emissions associated with water acquisition, distribution and treatment	CO_2, CH_4 and N_2O from use of electricity and fuel	- Energy consumption in each process of the water supply system, applicable to the locality (locally derived value for energy consumed/unit water consumed) OR - National average energy consumption/ unit of water - Annual volume of water passing through each process in the water supply and treatment system	**WW.14**
Lifecycle emissions associated with wastewater acquisition, distribution and treatment	CO_2, CH_4 and N_2O from use of electricity and fuel	- Energy consumption in each process of the water supply system, applicable to the locality (locally derived value for energy consumed/unit water consumed) OR - National average energy consumption/ unit of water - Annual volume of water passing through each process in the water supply and treatment system	**WW.15**

Summary of Agricultural Livestock Emission Activities and Sources

GHG Source	GHG Types	Data Required	Available Methodologies
Methane Associated with Livestock Enteric Fermentation	CH_4	- Population and type of livestock	A.1
Methane Associated with Manure Management	CH_4	- Population and type of livestock - Manure Management Systems for each livestock population	A.2.1
Methane Associated with Anaerobic Digestion	CH_4	- Population and type of livestock - Manure Management Systems for each livestock population	A.2.2
Direct Nitrous Oxide Associated with Manure Management	N_2O	- Population and type of livestock - Manure Management Systems for each livestock population	A.2.3
Indirect Nitrous Oxide Associated with Manure Management	N_2O	- Population and type of livestock - Manure Management Systems for each livestock population	A.2.4

Community-wide GHG Emissions Inventory
Community Protocol Scoping and Reporting Tool

Developed by

This tool is intended for use by local governments seeking to produce community-wide GHG emissions inventories that are consistent with version 1.0 of the Community Protocol. It is useful as a place to organize information that can be used internally as well as in creating final public reports. Use of the tool is not required in Protocol-compliant inventories, but it can help in developing features of an inventory that are required.

The Protocol calls for a step-wise process to developing an inventory, starting with scoping and ending with reporting. This tool addresses both of those steps. In **scoping**, the local government decides the emissions sources and activities it will include in the inventory, based on the stories it wishes to tell about community emissions and reporting frameworks it will use to tell them. The first part of this tool allows the user to indicate with bullets which activities and sources it intends to include in any of the reporting frameworks being used. The user should update the reporting framework columns to only reflect frameworks it is using.

The tool also uses "notation keys" for indicating why a source or activity is not being included within the scope of the inventory (a legend is provided below). Providing information about initial scoping in a final report is optional under the Protocol. By recording scoping decisions here, the user will be better able to begin the process of identifying data sources for each activity or source.

In Protocol-compliant inventory **reporting,** the local government is required to create a final report that indicates what was ultimately included and excluded from the inventory. A similar approach with bullets and notation keys is used in this part of the tool. Finally, the tool provides a place to describe line-item emissions for each included source or activity (required under the Protocol), as well as documenting which accounting methods were used (strongly recommended, but required when any non-Protocol methods used must be described).

Legend for Reporting Frameworks in Which Emissions Sources and Activities are Included

Required Activities

Five Basic Emissions Generating Activities Strongly Encouraged:

SI – Local Government Significant Influence

CA – Community-Wide Activities

HC – Household Consumption

Also Encouraged

IB – In-Boundary Sources

GC – Government Consumption

FC – Full Consumption-based Inventory

LB – Life Cycle Emissions of Community Businesses

IS – Individual Industry Sectors

OS – Create Your Own Story

Notation Keys for Excluded Emission Sources and Activities

IE – Included Elsewhere: Emissions for this activity are estimated and presented in another category of the inventory. The category where these emissions are included should be noted in explanation.

NE – Not Estimated: Emissions occur but have not been estimated or reported (e.g., data unavailable, effort required not justifiable).

NA – Not Applicable: The activity occurs but does not cause emissions; explanation should be provided.

NO – Not Occurring: The source or activity does not occur or exist within the community.

Community-wide GHG Emissions Inventory **Scoping and Reporting Tool - October 2012**			INITIAL SCOPING - INCLUDED / EXCLUDED						
				Included, under possible reporting frameworks:					
Emissions Type		**Source or Activity?**	Included as required activity	**SI**	**CA**	**HC**	**Other**	**Excluded (IE, NA, NO, or NE)**	**Explanatory Notes**
Built Environment									
Use of fuel in residential and commercial stationary combustion equipment		Source and Activity	●		●				
Industrial stationary combustion sources		Source						IE	Too few industrial consumers to separately quantify. Included in commercial use.
Electricity	Power generation in the community	Source						NE	Using activity-based method. Local generation is primarily for emergency backup. No utility-scale generation facilities are in the region.
	Use of electricity by the community	Activity	●		●				
District Heating/ Cooling	District heating/cooling facilities in the community	Source						IE	Not a common activity here; included in stationary fuel use.
	Use of district heating/cooling by the community	Activity						IE	Not a common activity here; included in stationary fuel use.
Industrial process emissions in the community		Source						IE	De minimis. Too few industrial consumers to separately quantify.
Refrigerant leakage in the community		Source						NE	Data not available.

Category	Description	Type							Status	Notes
Transportation and Other Mobile Sources										
On-road Passenger Vehicles	On-road passenger vehicles operating within the community boundary	Source							NE	Using activity-based method.
	On-road passenger vehicle travel associated with community land uses	Activity	●		●					
On-road Freight Vehicles	On-road freight and service vehicles operating within the community boundary	Source							NE	Using activity-based method.
	On-road freight and service vehicle travel associated with community land uses	Activity	●		●					
On-road transit vehicles operating within the community boundary		Source							NE	Using activity-based method.
Transit Rail	Transit rail vehicles operating within the community boundary	Source							NE	Using activity-based method.
	Use of transit rail travel by the community	Activity	●		●					
Inter-city passenger rail vehicles operating within the community boundary		Source							NE	Using activity-based method.
Freight rail vehicles operating within the community boundary		Source							NE	Using activity-based method.
Marine	Marine vessels operating within the community boundary	Source							NE	De minimis. Most commercial marine activity is in Maryland waters.
	Use of ferries by the community	Activity							NA	Ferries not in use in the community.
Off-road surface vehicles and other mobile equipment operating within the community boundary		Source	●		●					
Use of air travel by the community		Activity	●		●					
Solid Waste										
Solid Waste	Operation of solid waste disposal facilities in the community	Source							NE	Using activity-based method.
	Generation and disposal of solid waste by the community	Activity	●	●	●					
Water and Wastewater										
Potable Water - Energy Use	Operation of water delivery facilities in the community	Source							NE	Using activity-based method.
	Use of energy associated with use of potable water by the community	Activity	●	●	●					
Use of energy associated with generation of wastewater by the community		Activity	●							

Centralized Wastewater Systems - Process Emissions	Process emissions from operation of wastewater treatment facilities located in the community	Source						NE	Using activity-based method.
	Process emissions associated with generation of wastewater by the community	Activity	●	●	●				
Use of septic systems in the community		Source and activity	●			●			Measured as activity based on percent of households using septic systems.
Agriculture									
Domesticated animal production		Source	●		●				Loudoun and Prince William Counties only. De minimis in other localities.
Manure decomposition and treatment		Source	●		●				Loudoun and Prince William Counties only. De minimis in other localities.
Upstream Impacts of Community-Wide Activities									
Upstream impacts of fuels used in stationary applications by the community		Activity	●						
Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community		Activity	●						
Upstream impacts of fuels used for transportation in trips associated with the community		Activity	●						
Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary		Activity	●						
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community		Activity						NE	Would be counted in the GHG inventories of the communities where the materials are produced.
Independent Consumption-Based Accounting									
Household Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)		Activity						NE	Not doing consumption-based accounting.
Government Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)		Activity						NE	Not doing consumption-based accounting.
Life cycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)		Activity						NE	Not doing consumption-based accounting.