Climate Pollution Reduction Grants Program:

State of Rhode Island

Quality Assurance Project Plan

Rhode Island Department of Environmental Management

November 22, 2023

1. Project Management (Group A)

1.1. Title and Approval Page

Quality Assurance Project Plan for the
Rhode Island Climate Pollution Reduction Grant

Grant Number: 00A00854

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November 22, 2023

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Daniel Burke, USEPA Region 1 Grants Project Officer: Date:
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Elise McNally, Ph.D., USEPA Region 1 Quality Assurance Manager: Date:
ELISE MCNALLY Digitally signed by ELISE MCNALLY Date: 2023.11.27 15:39:36 -05'00'

QAPP Revision History

Revision No.	Description	Author	Date
1	Original Version	Joseph Poccia	11/03/2023
2	Revised Version	Joseph Poccia	11/22/2023

1.2. Table of Contents

List of Tables

List of Exhibits

Abbreviations

CAA	Clean Air Act
CFR	Code of Federal Regulations
CCAP	Comprehensive Climate Action Plan
CPRG	Climate Pollution Reduction Grant
DEM	Rhode Island Department of Environmental Management
EPA	U.S. Environmental Protection Agency
FLIGHT	Facility Level Information on Greenhouse Gases Tool (provided by the EPA)
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program (40 CFR Part 98)
ICR	Information Collection Request
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change, and Forestry
MMTCO2e	Million metric tons carbon dioxide equivalent
OAR	EPA Office of Air and Radiation
PM	Project Manager
PO	EPA Project Officer for Grant

POP	Period of Performance
PWP	Project Work Plan
PCAP	Priority Climate Action Plan
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Rhode Island
SIT	State Inventory Tool (provided by the EPA)
TFI	Task Force on National Greenhouse Gas Inventories (developed by the IPCC)
TL	Task Leader

1.3. Distribution List

This section presents the primary staff who will be working on the project. This section presents specific staff members who will be identifying existing[1] data resources for evaluation and potential use under the project. This section also includes all other staff who will be serving in project-specific roles for implementing the Quality Assurance Project Plan. The listing in **Table 1.1** includes staff responsible for implementing independent internal quality management steps and staff serving in external oversight roles.

This QAPP and, as applicable, all major deliverables relying on existing data will be distributed to the staff presented in **Table 1.1.** Additionally, this QAPP will be provided to any unlisted staff who are assigned to perform work under this project. A secured copy of this QAPP will be maintained in the project files in DEM's SharePoint under the Office of Air Resources' directory.

Table 1.1 QAPP Distribution List

Name	**Organization**	**Role**
Daniel Burke	US EPA, Region 1	EPA Project Officer (PO)
Elise McNally, Ph.D.	US EPA, Region 1	EPA Quality Assurance Manager
Terrence Gray	RI DEM	Director, RI DEM
Elizabeth Stone	RI DEM	Grantee Project Manager, Environmental Policy Analyst II
Laurie Grandchamp	RI DEM	Administrator, Office of Air Resources
Joseph Poccia	RI DEM	Grantee Tasks 1-5 Leader, Air Quality Specialist II
Richard Enander, Ph.D.	RI DEM	Grantee Quality Assurance Manager. Deputy Administrator, Office of Customer & Technical Assistance

[1] The term "existing data" is defined by the EPA's *Environmental Information Quality Policy* (CIO 2105.3) as "… data that have been collected, derived, stored, or reported in the past or by other parties (for a different purpose and/or using different methods and quality criteria). Sometimes referred to as data from other sources." The term "secondary data" may also be used to describe "existing data" in historical EPA quality-related documents.

1.4. Project/Task Organization

The primary personnel responsible for implementation of this project are the Rhode Island Department of Environmental Management (DEM) Project Manager (PM), Quality Assurance Manager (QAM), and Task Leader (TL). Their duties are outlined briefly in this section. The project QAM is independent of the unit generating the data.

Elizabeth Stone is the DEM PM and will provide senior-level oversight as needed. The PM is responsible for DEM's technical and financial performance as well as maintaining communications with the EPA to ensure mutual understanding of grant requirements, EPA expectations, and conformity with EPA quality procedures; managing oversight and conduct of project activities including allocation of resources to specific tasks; ensuring that quality procedures are incorporated into all aspects of the project; developing, conducting, and/or overseeing QA plans as necessary; ensuring that any corrective actions are implemented; operating project activities within the documented and approved Quality Assurance Project Plan; and ensuring that all products delivered to the EPA are of specified type, quantity, and quality.

The DEM PM will assign the TL each technical task with instructions to complete a baseline emissions inventory for the sector(s) under the task, to develop sector-specific options for potential emissions reduction projects, including estimates of the potential reductions under each option, and estimates of uncertainties for each reduction option. **Table 1.1** presents the TL for each technical task who will be responsible for day-to-day task-level activities, including planning, reporting, and controlling of technical and financial resources allocated to the task by the PM. Accordingly, each TL is primarily responsible for implementing the Quality Program and this Quality Assurance Project Plan on task-level assignments.

Task-level management system. For each of the major deliverables under each task, the TL will review all QA-related plans and reports and is responsible for transmitting them to the QA Manager for review and approval. The TL is responsible for ensuring that quality procedures are implemented at the task level and for maintaining the official, approved, task-level QAPP content. The TL will discuss any concerns about quality or any proposed revisions to task-level QAPP content with the QA Manager to identify, resolve, or preclude problems or to amend task-level plans, if necessary. In addition, the TL will work with the DEM PM and the QA Manager to identify and implement quality improvements. The DEM PM is responsible for ensuring the consistency of similar or related QA measures across tasks, and the TL is responsible for overseeing task-level work performed by technical staff and providing assurance that all required QA/QC procedures are being implemented.

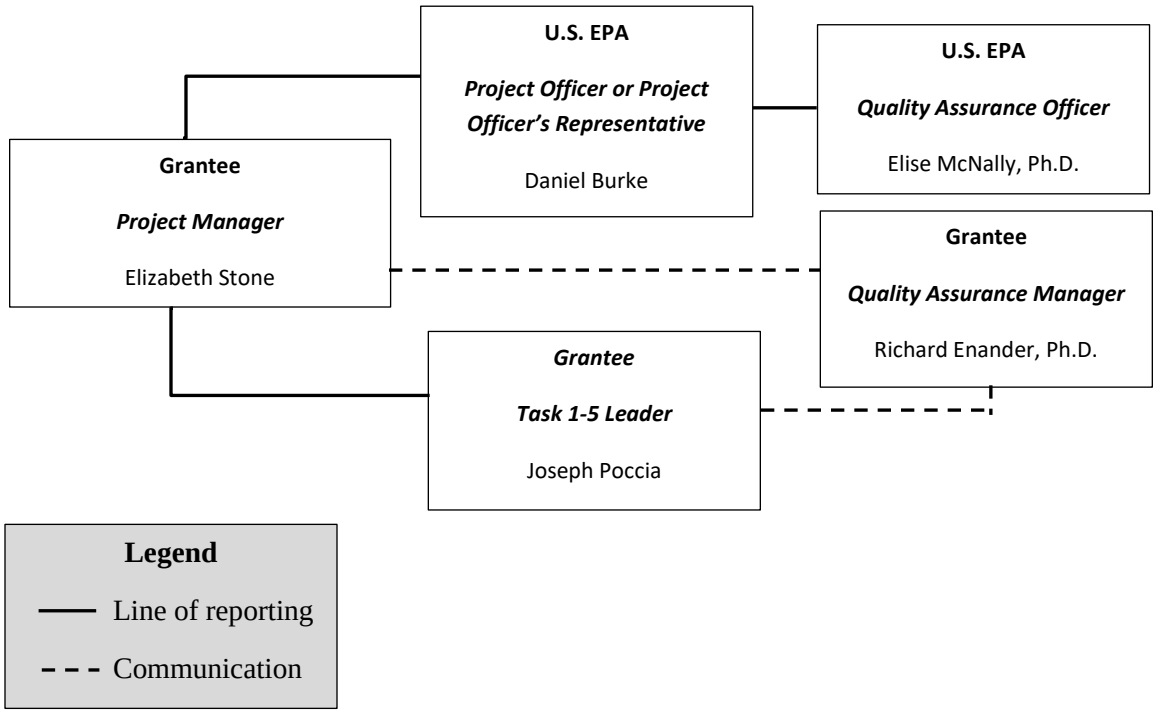
Project-level management system. Tasks are expected to proceed concurrently, in parallel. The PM will maintain close communications with the TL and ensure any difficulties encountered or proposed changes at the task level are reviewed for implications on other similar or related tasks. The PM is also responsible for communicating progress or difficulties encountered (across all tasks) to the EPA PO, who provides EPA's primary oversight function for this project at EPA OAR/ EPA Region 1 and is responsible for review and approval of this QAPP and any future revisions. The PM (with support from the TL and assigned DEM technical staff) will be responsible for consulting with the EPA PO on planning, scheduling, and implementing the QA/QC for all project deliverables and obtaining required EPA approvals.

The QA Manager, Richard Enander, is responsible for overseeing the program quality system, monitoring, and facilitating QA activities on tasks, and generally helping the DEM PM and TL understand and comply with EPA QA requirements. He is employed by the Office of Customer and Technical Assistance, which is an office in DEM. At the request of the DEM PM, Richard Enander is responsible for conducting periodic independent audits of this project's QA program. Richard Enander

will produce written documentation of the audit results and recommendation, and he will work closely with the PM to improve any deficiencies noted during these audits. Richard Enander is also responsible for assisting the PM and TL in planning, documenting, and implementing the QA requirements for this project. Working with the PM, he will ensure that process- and project-specific QA documents are developed; that required or recommended protocols are followed; that data are reduced, validated, and reported according to specific criteria; and that QC assessments are performed. He will report to the PM as needed on quality issues.

Additionally, QC functions will be carried out by other technical staff and monitored by the PM, who will work with the QA Manager to oversee this plan and implement quality improvements. Other technical staff will include persons with expertise in industrial processes and air pollution engineering, technical reviewers, database specialists, quality auditors, and technical editors. The PM will ensure that technical staff do not review work in a QA capacity for which they were a primary or contributing author. **Exhibit 1.1** presents the organizational chart.

Exhibit 1.1 Project Organization[2]



[2] Under CIO 2105-S-02.0, section 3, the organization chart must also identify any contractor relationships relevant to environmental information operations.

1.5. Problem Definition / Background

Under this project, DEM will identify, evaluate, and utilize existing data resources[3] to develop a statewide inventory of the major sources of greenhouse gas (GHG) emissions within Rhode Island and use that inventory data to develop a climate action plan. This QAPP focuses on the handling of environmental information under sector-specific tasks by technical staff charged with completing the following subtasks in a future planning project implemented in accordance with this QAPP:

1. Develop a comprehensive GHG inventory for the largest sources within each sector,
2. Develop options for reducing emissions within each sector,
3. Develop estimates or ranges of estimates for the reductions achievable under each option,
4. Develop uncertainty analyses for the emissions reduction estimate and,
5. Present the inventory and options listing in a technical report consistent with the deliverables required by the CPRG planning grants.

The GHG inventory will utilize the EPA's State Inventory Tool (SIT),[4] state-level GHG inventories prepared by the EPA,[5] and data reported to the EPA's Greenhouse Gas Reporting Program (GHGRP)[6] together with any independent, sector-specific estimates prepared by the state. The SIT will use non-default data from the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA)[8], the U.S. Energy Information Administration's (EIA) State Energy Data System (SEDS)[9], DEM's Division of Agriculture and Forest Environment (DAFE)[10], and DEM's Office of Water Resources (OWR)[11]. The state estimate for electricity consumption emissions will use data from EIA[12], the New England Power Pool Generation Information System (NEPOOL-GIS)[13], the Independent System Operators of New England (ISO-NE)[14], and Statistics Canada[15]. Other independent state estimates, including aviation, which uses data from the Rhode Island Airport Corporation (RIAC)[16], will be compared to corresponding federal estimates for validation where applicable. The statewide inventory will include the following sectors and greenhouse gases:

[3] EPA, *Environmental Information Quality Policy*, CIO 2105.3, 03/07/2023 (p. 8) provides common examples of environmental information used to support the EPA's mission at https://www.epa.gov/system/files/documents/2023-04/environmental_information_quality_policy.pdf.
[4] https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool
[5] https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals
[6] https://www.epa.gov/ghgreporting/data-sets
[8] https://www.phmsa.dot.gov/data-and-statistics/pipeline/gas-distribution-gas-gathering-gas-transmission-hazardous-liquids
[9] https://www.eia.gov/state/seds/
[10] https://dem.ri.gov/natural-resources-bureau/agriculture-and-forest-environment
[11] https://dem.ri.gov/environmental-protection-bureau/water-resources
[12] https://www.eia.gov/electricity/data/eia923/
[13] https://nepoolgis.com/
[14] https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load
[15] https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510001501
[16] https://flyri.com/riac/

RI GHG Emissions Inventory Sectors	***Greenhouse Gases (across all sectors)***
1. Transportation 2. Electricity Consumption 3. Residential Heating 4. Industry 5. Commercial Heating 6. Natural Gas Distribution 7. Waste 8. Agriculture 9. Land Use, Land Use Change, and Forestry	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Fluorinated Gases (F-gases) including Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur Hexafluoride (SF_6), and Nitrogen Trifluoride (NF_3)

1.5.1. Rationale for Selection of Sectors

For each sector included in the statewide inventory **Table 1.2** briefly describes why the sector was included in the inventory and the relative significance of the sector in terms of the magnitude of air emissions from existing inventories and the associated geographic distribution of the sources. Additionally, **Table 1.2** describes how DEM includes most "key categories" identified by the *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1: General Guidance and Reporting* developed by the IPCC Task Force on National Greenhouse Gas Inventories (TFI). DEM separates the TFI categories based on the economic sector reporting guidelines developed by EPA, with modifications that are deemed appropriate by DEM staff.

Table 1.2 Rationale for Sector Selection

Sectors Included in Inventory	**Rationale for Including in GHG Inventory**
Transportation	Transportation is the largest source of GHG emissions in Rhode Island, with 38.0% of all economy-wide emissions originating from transportation in 2020. Subsectors of transportation include *aviation, highway vehicles, and non-road sources*.
Electricity Consumption	Electricity Consumption comprised 20.6% of Rhode Island's GHG emissions in 2020. Rhode Island differs from the "Electricity Generation" reporting category used by the EPA. The purpose of this is to assess the State's compliance with R.I. General Laws § 39-26-4 (100% Renewable Energy Standard). The Rhode Island Executive Climate Change Coordinating Council (EC4) unanimously voted to adopt the electricity consumption accounting methodology on May 11, 2016.
Residential Heating	Residential Heating emissions from household oil and natural gas furnaces and boilers were responsible for 19.3% of 2020's total emissions. The IPCC-TFI does not identify the "Residential" end use specifically, so DEM follows the economic sector reporting guideline developed by EPA and used by other states for an apples-to-apples comparison.

Table 1.2 Rationale for Sector Selection

Sectors Included in Inventory	**Rationale for Including in GHG Inventory**
Industry	Industry accounted for 9.9% of Rhode Island's GHG emissions in 2020. This sector includes *industrial heating* and *industrial process*. Rhode Island follows the economic sector reporting guidelines used by the EPA by combining industrial heating and industrial processes into one sector to provide an apples-to-apples comparison with EPA and neighboring states. DEM recognizes this differs from the approach taken by the IPCC-TFI, which separates energy-related emissions from industrial activities and industrial process emissions into two distinct categories.
Commercial Heating	Commercial Heating emissions from household oil and natural gas furnaces and boilers were responsible for 8.0% of 2020's total emissions. The IPCC-TFI does not identify the "Commercial" end use specifically, so DEM follows the reporting convention developed by EPA and used by other states for Commercial Heating emissions.
Natural Gas Distribution	DEM separates fugitive methane emissions from Natural Gas Distribution into a distinct sector in response to stakeholder feedback regarding the importance of this sector's emissions. In 2020, methane leaks from Rhode Island's network of natural gas distribution mains and services contributed 2.2% of the state's total emissions. DEM recognizes that it does not follow the IPCC-TFI guidelines or EPA economic sector reporting guidelines for this sector.
Waste	DEM includes *municipal solid waste* and *wastewater* emissions in the Waste sector. Municipal solid waste emissions are reported from the state's largest landfill, the Central Landfill, for potential methane emissions and methane emissions avoided from Flaring and Landfill Gas-2-Energy. Municipal solid waste emissions accounted for 0.16% of the state's total in 2020. Wastewater treatment, both municipal and industrial, accounted for 1.04% of Rhode Island's total emissions in 2020. Wastewater emissions is the largest individual source of nitrous oxide emissions in Rhode Island. Total Waste emissions accounted for 1.2% of the state's total for 2020. DEM generally follows the IPCC-TFI guidelines for Waste rather than EPA's economic sector reporting guidelines, which separate municipal solid waste and wastewater into two distinct categories.
Agriculture	The IPCC-TFI identifies "Agriculture, Forestry, and Land Use (AFLOU)" as a combined category to report emissions and sinks from LULUCF and Agriculture. DEM differs from the IPCC-TFI reporting guidance here and separates Agriculture into its own sector to be consistent EPA's economic sector reporting guidelines. In 2020, Agriculture contributed 0.3% of the state's total emissions and was the smallest sector. Agriculture emissions in Rhode Island originate from enteric fermentation and manure management from livestock or from soil management practices.
Land Use, Land Use Change, and Forestry	DEM follows the IPCC-TFI reporting convention for natural and working lands. "Land Use, Land Use Change, and Forestry (LULUCF)" includes six categories: forest lands, croplands, grasslands, wetlands, settlement lands, and other land. DEM assumes "other land" to have a net carbon flux of 0 MMTCO2e and omits

Table 1.2 Rationale for Sector Selection

Sectors Included in Inventory	Rationale for Including in GHG Inventory
	this subsector for simplicity. In 2020, LULUCF offset 7.4% of Rhode Island's gross GHG emissions. Between 1990 and 2020, total carbon sequestration decreased by 15.7% due to a decrease amount of total forest land and an increase in the amount of forest land converted to settled land.

1.5.2. Decisions to be Made

Existing EPA datasets, the SIT, and other RI-specific datasets cover categories of GHG emissions by sector and by activity or segment. The SIT provides many default values to facilitate developing statewide estimates that are consistent with the National Inventory of GHG Emissions.[7] Task Leaders will be charged with the following decisions:

1. Determine (for each major activity estimate) if existing EPA data or the SIT default estimate for the sector/activity should be used for the statewide, baseline estimate, or should the state's estimate be derived from existing information available to the state?
2. Determine the best options for reducing emissions of air pollution and achieving the following objectives[8] under the Inflation Reduction Act:
    a. Reduce climate pollution, create good jobs, and lower energy costs for families.
    b. Accelerate work addressing environmental injustice and empowering community driven solutions in overburdened neighborhoods.
    c. Deliver cleaner air by reducing harmful air pollution in places where people live, work, play, and go to school.
3. Develop an estimate (or range) of reductions that could be achieved under each option.
4. Estimate the uncertainty of the emissions reduction estimate under each option.

1.5.3. Actions to be Taken, Action Limits, and Expected Outcomes

Existing state-level estimates prepared by the EPA, or the SIT will be utilized with federal default values for each sector/activity relevant to GHG-emitting activities within the state where appropriate. Additionally, DEM may elect to develop independent estimates of selected sectors/activities based on state need and will derive data from state or federal sources. If more than one estimate is created, DEM will compare it to pre-established federal estimates where applicable. The rationale for utilizing the state's independent estimate will be documented in the state's GHG inventory report along with the underlying data and calculation methodology. DEM expects that sectors that include major stationary sources under CAA Title V with longstanding requirements for submission of activity data and emissions estimates may be better represented in the GHG inventory based on existing data. For minor sources of GHGs, DEM expects that estimates prepared with state data will prove better than those obtained from the SIT's default data.

When identifying the best options for reducing air pollution, each Task Leader will consider the activities affecting the largest numbers of families, business establishments, recreation areas, and schools.[9] Options may include measures for achieving potential reductions in Environmental Justice (EJ)

[7] https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021
[8] CPRG Program Guidance, page 4. Available at https://www.epa.gov/inflation-reduction-act/climate-pollution-reduction-grants#CPRGProgramGuidance.
[9] Ibid.

areas, as defined by DEM. DEM expects that each task will produce up to three options for sector-specific emissions reduction projects for further consideration by management and policymakers.

1.5.4. Reason for Project

The baseline GHG inventory and options analyses developed under this project will be utilized by DEM for planning purposes to support Rhode Island's development of the following three deliverables under the CPRG Program:

- Rhode Island's **Priority Climate Action Plan** (PCAP), which is due on March 1, 2024. This plan will include near-term, implementation-ready, priority GHG reduction measures and is a prerequisite for any implementation grant.
- Rhode Island's **Comprehensive Climate Action Plan** (CCAP), which is due in 2025 (later for tribes and territories). This plan will review all sectors that are significant GHG sources or sinks and include both near- and long-term GHG emission reduction goals and strategies.
- Rhode Island's **Status Report** on progress towards goal, which is due in 2027 (not applicable to tribes or territories). This progress report will include updated analyses, plans, and next steps for key metrics.

This QAPP describes in detail the necessary QA and QC requirements and technical activities that will be implemented to ensure the baseline GHG inventory and the sector-specific emissions reduction options are reliable for the PCAP and CCAP. As necessary, revisions to the QA and QC requirements defined in this QAPP will be updated in the 2027 Status Report.

1.5.5. Relevant Clean Air Act Mandates and Authorizations

The inventory and options analyses produced under this project will support a grant application authorized under 42 U.S.C.A. § 7437 for *Greenhouse Gas Air Pollution Plans and Implementation Grants*. The inventory and options analyses will be used to evaluate opportunities for reducing GHG emissions from all major-emitting sources including both mobile source categories and stationary source categories. This project will include the fundamental research necessary to evaluate and plan new programs (and amendments to existing Clean Air Act [CAA] programs) for reducing emissions from fossil fuel combustion activities. Many sectors and activities that will be included in the GHG inventory (and subsequent emissions reductions options analyses) include major sources of criteria and toxic pollutants. Accordingly, the purpose of this project (to evaluate and plan for reductions in GHG emissions, including reductions from usage or production of fossil fuels) is also consistent with the following statutory mandates and authorizations under Clean Air Act Title I:

- ***§ 7403. Research, investigation, training, and other activities***
  (a) Research and development program for prevention and control of air pollution
  The Administrator shall establish a national research and development program for the prevention and control of air pollution ….
    (1) conduct, and promote the coordination and acceleration of, research, investigations … and studies related to the causes … extent, prevention, and control of air pollution;
    (2) encourage, cooperate with, and render technical services and provide financial assistance to air pollution control agencies and other appropriate public or private agencies, institutions, and organizations, and individuals in the conduct of such activities ….
  (b) Authorized activities of Administrator in establishing research and development program
  In carrying out the provisions of [paragraph (a)] the Administrator is authorized to–
    (1) collect and make available, through publications and other appropriate means, the results of and other information, including appropriate recommendations by him in connection therewith, pertaining to such research and other activities;….
    (2) make grants to air pollution control agencies … for purposes … in subsection (a)(1) ….

- ***§ 7404. Research related to fuels and vehicles***
  (a) Research programs; grants; ….
  The Administrator shall give special emphasis to research and development into new and improved methods, having industry-wide application, for the prevention and control of air pollution and control of air pollution resulting from the combustion of fuels… he shall–
  (1) conduct and accelerate research programs directed toward development of improved , cost-effective techniques for–
  (A) control of combustion byproducts of fuels, ….
  (B) improving efficiency of fuels combustion so as to decrease atmospheric emissions ….

- ***§ 7405. Grants for support of air pollution planning and control programs***
  (a) Amounts; limitations; assurances of plan development capability.
  (1)(A) The Administrator may make grants to air pollution control agencies … in an amount up to three-fifths of the cost of implementing programs for the prevention and control of air pollution …. For the purpose of this section, "implementing" means any activity related to the planning, developing, establishing, carrying-out, improving, or maintaining of such programs….
  (C) With respect to any air quality control region or portion thereof for which there is an applicable implementation plan under section 7410 … grants under subparagraph (A) may be made only to air pollution control agencies which have substantial responsibilities for carrying out such applicable implementation plan.

1.5.6. Information Provided by the EPA under § 7403(b)(1)

Under authority of CAA § 7403(b)(1) the EPA has provided the following resources to states to ensure reliable air emissions inventories are produced to support plans for reducing emissions:

- Agency-wide Quality Program Documents
- Quality Assurance-specific Directives
  - CIO 2105.3 – *Environmental Information Quality Policy*, April 10, 2023
  - CIO 2105-P-01.3 – *Environmental Information Quality Procedure*, March 7, 2023
  - CIO 2105-S-02.0 – EPA's Environmental Information QA Project Plan (QAPP) Standard
  - EPA Regional Sites for Quality Management Plans and Guidance:
    - Region 1
    - Region 2
    - Region 3
    - Region 4
    - Region 5
    - Region 6
    - Region 7
    - Region 8
    - Region 9
    - Region 10
- QA Guidance
  - EPA QA/G-4 – *Guidance on Systematic Planning Using Data Quality Objectives Process*
  - EPA QA/G-5 – *Guidance for Quality Assurance Project Plans*

DEM will utilize these resources, as applicable, to ensure evaluation of existing data and utilization of those data are consistent with the EPA's relevant directives and guidance.

1.6. Project / Task Description

A schedule of deliverables for the technical tasks (Tasks 1-5) for GHG inventory QAPPs is presented in **Tables 2.1** through **2.5.** The work to be performed under this project by DEM involves preparing a statewide GHG emissions inventory for Rhode Island. Existing Rhode Island GHG emissions inventories 1990-2020 will also be used for this project. The organization of the work is based on the use of the EPA's SIT[10], EPA's Motor Vehicle Emissions Simulator (MOVES), and other independent methodologies employed by DEM under the following sector-specific tasks:

Task 1: State inventory of transportation GHG emissions.

Task 2: State inventory of electricity consumption GHG emissions.

Task 3: State inventory of land use, land use change, and forestry GHG emissions and sinks.

Task 4: State inventory of GHG emissions from other major sectors:

- 4.1 Residential Heating
- 4.2 Commercial Heating
- 4.3 Industrial Heating
- 4.4 Industrial Processes

Task 5: State inventory of GHG emissions from minor sectors:

- 5.1 Natural Gas Distribution
- 5.2 Agriculture
- 5.3 Waste

For each sector-specific task, **Tables 2.1–2.5** provide planned activities and a schedule of deliverables for use by states preparing GHG inventories. The EPA's SIT, other resources, and answers to frequently asked questions are also located on the State and Tribal Greenhouse Gas Data and Resources webpage.[11]

Table 2.1 Technical Task Descriptions for Task 1.

Tasks and Deliverables	Schedule
Task 1. Transportation	
1. Overall Task Goals a. The TL will determine the data requirements for the transportation sector and document the most appropriate means of estimation in the inventory summary document. b. The TL will then complete the following tasks according to the decision made in this step. 2. Tasks for EPA's SIT: a. The TL will produce a profile of mobile source emissions using EPA's State Inventory and Projection Tool (SIT) from https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool.	Within 30 days of QAPP approval by EPA or by federally authorized delegate.

[10] https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool.
[11] https://www.epa.gov/ghgemissions/state-and-tribal-greenhouse-gas-data-and-resources.

Tasks and Deliverables	Schedule
Task 1. Transportation	
b. The TL will review the user's manual available using "Consult User's Guide" on the Control sheet. c. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-b, to complete an independent review of the data and estimation methodology for QA/QC. 3. <u>Tasks for EPA's MOVES:</u> a. The TL will obtain the most recent listing of registered motor vehicles from Rhode Island Division of Motor Vehicles (DMV) including year-manufactured, make, model, body style, fuel, county, description. b. The TL will obtain the latest vehicle miles traveled (VMT) data broken down by MOVES vehicle class (motorcycles, light duty vehicles, buses, single unit trucks, and combination trucks) and road type data broken down by MOVES road type classifications (off-network, rural restricted access, rural unrestricted access, urban restricted access, and urban unrestricted access) from the Rhode Island Division of Statewide Planning (DSP). c. The TL will coordinate with staff in DEM's Office of Air Resources to run MOVES using the DMV and DSP data and use MOVES default speed and VMT fraction. d. The TL will estimate county-level CO_2, CH_4, and N_2O emissions for on-road gasoline, diesel, and compressed natural gas (CNG) vehicles from MOVES. e. The TL will compare customized estimate to default SIT estimate and discuss differences in GHG inventory report. f. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-e, to complete an independent review of the data and estimation methodology for QA/QC. 4. <u>Tasks for Independent State Estimate:</u> a. The TL will obtain the most recent Rhode Island Airport Corporation (RIAC) GHG emissions inventory submitted to DEM's Office of Air Resources for EPA's National Emissions Inventory (NEI). b. The TL will convert the aircraft and ground-support equipment CO_2, CH_4, and N_2O estimates into million metric tons of carbon dioxide equivalent ($MMTCO_2e$) and ensure CH4 and N2O estimates use the IPCC's *Fifth Assessment Report* (AR5) global warming potential (GWP) values. c. The TL will compare customized estimate to default SIT estimate and discuss differences in GHG inventory report. d. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-c, to complete an independent review of the data and estimation methodology for QA/QC. 5. <u>Post GHG Inventory Tasks:</u> a. In the GHG inventory report or in a separate report based on the GHG inventory, DEM may include a listing of options for emissions reductions	.

Tasks and Deliverables	Schedule
Task 1. Transportation	
from this sector that includes the following components pursuant to the 2021 Act on Climate (R.I. General Laws § 42-6.2-2.): i. The specific source categories and activities affected by the proposed option. ii. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate. iii. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate. iv. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate. v. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment). vi. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.	

Table 2.2 Technical Task Descriptions for Task 2.

Tasks and Deliverables	Schedule
Task 2. Electricity Consumption	
1. <u>Overall Task Goals</u> a. The TL will determine the data requirements for the electricity consumption sector and document the most appropriate means of estimation in the inventory summary. b. The TL will then complete the following tasks according to the decision made in this step. 2. <u>Tasks for EPA's SIT</u> a. The TL will use the EPA's State Inventory and Projection Tool (SIT) at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool. b. The TL will utilize the Electricity Consumption Module for the electricity consumption sector. c. The TL will review the user's manual available using the "Consult User's Guide" button on the Control sheet. d. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-c, to complete an independent review of the data and estimation methodology for QA/QC. 3. <u>Tasks for Independent State Estimate:</u> a. The TL will complete all steps in **Appendix B: "Electricity Consumption Sector Instructions"**	Within 30 days of QAPP approval by EPA or by federally authorized delegate.

Tasks and Deliverables	Schedule
Task 2. Electricity Consumption	
b. The TL will report biogenic emissions separately and for informational purposes only according with national reporting conventions. c. The TL will compare customized estimate to default SIT estimate and discuss differences in GHG inventory report. d. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-c, to complete an independent review of the data and estimation methodology for QA/QC. 4. <u>Post GHG Inventory Tasks:</u> a. In the GHG inventory report or in a separate report based on the GHG inventory, DEM may include a listing of options for emissions reductions from this sector that includes the following components pursuant to the 2021 Act on Climate (R.I. General Laws § 42-6.2-2.): i. The specific source categories and activities affected by the proposed option. ii. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate. iii. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate. iv. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate. v. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment). vi. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.	

Table 2.3 Technical Task Descriptions for Task 3.

Tasks and Deliverables	Schedule
Task 3. Land Use, Land Use Change, and Forestry (LULUCF)	
1. <u>Overall Task Goals</u> a. The TL will determine the data requirements for the LULUCF sector and document the most appropriate means of estimation in the inventory summary. b. The TL will then complete the following tasks according to the decision made in this step. 2. <u>Tasks for EPA's SIT:</u>	Within 30 days of QAPP approval by EPA or by federally

Tasks and Deliverables	Schedule
Task 3. Land Use, Land Use Change, and Forestry (LULUCF)	
a. The TL will obtain default values from the EPA's State Inventory and Projection Tool (SIT) at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool. b. The TL will use the module entitled land-use-land-use-change-and-forestry-module.xlsm. c. The TL will review the user's manual available using the "Consult User's Guide" button on the Control sheet. This tool calculates carbon emissions and storage from forest carbon using USDA Forest Service estimates of each state through 2020. d. After selecting the state and specifying use of defaults on the Control sheet, the TL will obtain the default estimates for Rhode Island using the following sheets: i. Forest Land Remaining Forest ii. Land Converted to Forest Land iii. Forest Land Converted to Land iv. Urban Trees v. Settlement Soils vi. Burning CH4 – No default data on area burned are provided in the SIT. The acreage of fires was obtained from DEM's Division of Agriculture and Forest Environment vii. Burning N2O viii. Yard Trimmings ix. Ag Soil C Flux Default x. Summary e. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-d, to complete an independent review of the data and estimation methodology for QA/QC. 3. Tasks for Other Federal LULUCF Data Sources: a. The TL will use the federal estimates for the state and sector in the following dataset: https://www.epa.gov/system/files/other-files/2023-02/State-Level-GHG-data.zip.] b. The TL will save the zipped folder as "20XX EPA State-Level Disaggregation" in 20XX References > LULUCF c. The TL will open the zipped folder and select "State-GHG_Trends_Emissions_Sinks_LULUCF" (forth file in folder) d. The TL will click "Enable Editing" at the top e. In the tab "State_GHG_LULUCF_Tables", the TL will change the "State Postal Code" to RI f. Once the data populates, the TL will copy/paste following data only into the 20XX column of DEM's internal "LULUCF Master Table" spreadsheet: i. Forest Land Remaining Forest Land ii. Land Converted to Forest Land iii. Cropland Remaining Cropland	authorized delegate.

Tasks and Deliverables	Schedule
Task 3. Land Use, Land Use Change, and Forestry (LULUCF)	

iv. Land Converted to Cropland
v. Grassland Remaining Grassland
vi. Land Converted to Grassland
vii. Coastal Wetlands Remaining Coastal Wetlands
viii. Land Converted to Wetlands
ix. Settlement Soils
x. Land Converted to Settlements

g. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-f, to complete an independent review of the data and estimation methodology for QA/QC.

4. Tasks for Independent State Estimate:
   a. The TL will review the USDA Forest Service publication that is the basis for the federal default estimates at https://www.fs.usda.gov/research/treesearch/62418.
   b. The TL will complete an independent assessment of the federal default estimates for Forest Land Remaining Forest Land in Rhode Island using sequestration factors from DEM DAFE's *2020 Forest Action Plan*.
   c. The TL will include in the inventory document a discussion of this review compared to relevant federal default estimates versus independent estimates prepared under this subtask or versus independent estimates previously completed by the state.
   d. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-c, to complete an independent review of the data and estimation methodology for QA/QC.
5. Post GHG Inventory Tasks:
   a. In the GHG inventory report or in a separate report based on the GHG inventory, DEM may include a listing of options for emissions reductions from this sector that includes the following components pursuant to the 2021 Act on Climate (R.I. General Laws § 42-6.2-2.):
      i. The specific source categories and activities affected by the proposed option.
      ii. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate.
      iii. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate.
      iv. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate.
      v. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment).
      vi. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the

Tasks and Deliverables	Schedule
Task 3. Land Use, Land Use Change, and Forestry (LULUCF)	
community to an affected source under the option that emits toxic air pollutants.	

Table 2.4 Technical Task Descriptions for Task 4.

Tasks and Deliverables	Schedule
Task 4. State Inventory of GHG Emissions for Other Major Sectors	
1. Overall Task Goals a. The TL will determine the data requirements for the major GHG sectors and document the most appropriate means of estimation in the inventory summary. b. The TL will then complete the following tasks according to the decision made in this step. 2. Tasks for EPA's SIT: a. The TL will use the EPA's State Inventory and Projection Tool (SIT) at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool to develop estimates for the following sectors: **Major Sources** / **SIT Modules** Residential Heating CO_2, CH_4, and N_2O Emissions — co2ffc-module.xlsm, stationary-combustion-module.xlsm Commercial Heating CO_2, CH_4, and N_2O Emissions — co2ffc-module.xlsm, stationary-combustion-module.xlsm Industrial Heating CO_2, CH_4, and N_2O Emissions — co2ffc-module.xlsm, stationary-combustion-module.xlsm Industrial Process CO_2, HFC, PFC, NF_3, SF_6 Emissions — ip-module.xlsm b. The TL will omit iron & steel manufacturing, as none exists in Rhode Island. c. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-b, to complete an independent review of the data and estimation methodology for QA/QC. 3. Tasks for Independent State Estimates: a. The TL will contact Rhode Island Energy (RIE) for SF6 consumption emissions and input into DEM's internal GHG reporting spreadsheet. b. The TL will compare customized estimate to default SIT estimate if applicable and discuss differences in GHG inventory report. c. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-b, to complete an independent review of the data and estimation methodology for QA/QC. 4. Post GHG Inventory Tasks: a. In the GHG inventory report or in a separate report based on the GHG inventory, DEM may include a listing of options for emissions reductions from these sectors that includes the following components pursuant to the 2021 Act on Climate (R.I. General Laws § 42-6.2-2.):	Within 30 days of QAPP approval by EPA or by federally authorized delegate.

Tasks and Deliverables	Schedule
Task 4. State Inventory of GHG Emissions for Other Major Sectors	
i. The specific source categories and activities affected by the proposed option. ii. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate. iii. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate. iv. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate. v. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment). vi. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.	

Table 2.5 Technical Task Descriptions for Task 5.

Tasks and Deliverables	Schedule
Task 5. Compile Statewide Inventory for Minor GHG Sources	
1. Overall Task Goals a. The TL will determine the data requirements for the minor GHG sectors and document the most appropriate means of estimation in the inventory summary. b. The TL will then complete the following tasks according to the decision made in this step. 2. Tasks for EPA's SIT: a. The TL will use the EPA's State Inventory and Projection Tool (SIT) at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool to develop estimates for the following sectors using default data: **Minor Sources** / **SIT Modules** Natural Gas Distribution CH_4 / natural-gas-and-oil-module.xlsm Agriculture CO_2, CH_4, and N_2O Emissions / agriculture-module.xlsm Solid Waste CH_4 / solid-waste-module.xlsm Wastewater CH_4 and N_2O Emissions / wastewater-module.xlsm b. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete step a, to complete an independent review of the data and estimation methodology for QA/QC.	Within 30 days of QAPP approval by EPA or by federally authorized delegate.

Tasks and Deliverables	Schedule
Task 5. Compile Statewide Inventory for Minor GHG Sources	
3. Tasks for Independent State Estimate a. The TL will obtain miles of natural gas distribution mains and total number of services by material type for Rhode Island from the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) at https://www.phmsa.dot.gov/data-and-statistics/pipeline/gas-distribution-gas-gathering-gas-transmission-hazardous-liquids. i. The TL will download "Gas Distribution Annual Data" and filter by "Rhode Island" ii. The TL will input main data by material type into EPA's SIT natural-gas-and-oil-module.xlsm iii. The TL will input services data by material type into EPA's SIT natural-gas-and-oil-module.xlsm iv. The TL will compare customized estimate to EPA Facility Level Information on Greenhouse Gases Tool (FLIGHT) for The Narragansett Electric Company and discuss differences in GHG inventory report. b. The TL will obtain "fraction of population not on septic" data from DEM's Office of Water Resources (OWR) and input into EPA's SIT wastewater-module.xlsm. i. The TL will compare customized estimate to default SIT estimate and discuss differences in GHG inventory report. c. The TL will obtain a more accurate count of livestock population in Rhode Island from DEM's DAFE and add to agriculture-module.xlsm. i. The TL will compare customized estimate to default SIT estimate and discuss differences in GHG inventory report. d. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-c, to complete an independent review of the data and estimation methodology for QA/QC. 4. Tasks for EPA's FLIGHT: a. The TL will use EPA's FLIGHT for the Rhode Island Resource Recovery Corporation, in which data is submitted to EPA's GHGRP. b. The TL will convert RI Resource Recovery Corp. methane emissions to MMTCO2e using the IPCC's *Fifth Assessment Report* 100-year GWP for methane. c. The TL will input estimate into DEM's internal GHG reporting spreadsheet. d. The TL will validate against "potential methane emissions" and "methane emissions avoided from landfill gas-2-energy and flaring" from EPA's SIT solid-waste-module.xlsm. e. The PM, TL, or QAM will assign a staff member who is familiar with the GHG inventory process, but did not complete steps a-d, to complete an independent review of the data and estimation methodology for QA/QC. 5. Post GHG Inventory Tasks: a. In the GHG inventory report or in a separate report based on the GHG inventory, DEM may include a listing of options for emissions reductions from these sectors that includes the following components pursuant to the 2021 Act on Climate (R.I. General Laws § 42-6.2-2.):	

Tasks and Deliverables	Schedule
Task 5. Compile Statewide Inventory for Minor GHG Sources	
i. The specific source categories and activities affected by the proposed option. ii. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate. iii. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate. iv. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate. v. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment). vi. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.	

1.7. Quality Objectives / Criteria

The primary objectives for this project are to develop reliable inventories for each of the primary GHG-emitting sectors in Rhode Island and to identify options for reducing emissions from those sectors. Accordingly, all quality objectives and criteria are aligned with these primary objectives. The quality system used for this project is the joint responsibility of the DEM PM, TL, and QA Manager. As discussed in Section 1.4, an organizationally independent QA Manager will maintain oversight of all required measures in this QAPP. QC functions will be carried out by technical staff and will be carefully monitored by the TL, who will work with the QA Manager to identify and implement quality improvements. All activities performed under this project will conform to this QAPP.

1.7.1. Data Quality, Management, and Analyses

For this project, DEM will use a variety of QC techniques and criteria to ensure the quality of data and analyses. Data of known and documented quality are essential components for the success of the project, as these data will be used to inform the decision-making process for the Rhode Island's PCAP and CCAP as discussed in Section 1.5.4 of this QAPP. The table in **Appendix A** lists by task the specific QC techniques and criteria that are part of this QAPP.

The data quality objectives and criteria for this project are accuracy, precision, bias, completeness, representativeness, and comparability. *Accuracy* is a measure of the overall agreement of a measurement to a known value. It includes a combination of random error (precision) and systematic error (bias). *Precision* is a measure of how reproducible a measurement is or how close a calculated estimate is to the actual value. *Bias* is a systematic error in the method of measurement or calculation. If the calculated value is consistently high or consistently low, the value is said to be biased. Our goal is to ensure that information and data generated and collected are as accurate, precise, and unbiased as possible within project constraints. It is not anticipated that this project will include primary data collection. Generally, existing data and tools provided by the EPA and other qualified sources will be used for project tasks. A subject matter specialist familiar with technical reporting standards (such as a permit

writer or compliance engineer with knowledge of the state's facilities operating in the sector) will be used to QA all data utilized for developing the statewide GHG inventory. DEM will verify the accuracy of all data by checking for logical consistency among datasets. All existing environmental data shall meet the applicable criteria defined in CFR and associated guidance, such as the validation templates provided in the *EPA QA Handbook Volume II*.

Uncertainty can be evaluated using a few different approaches. The most useful uncertainty analysis is quantitative and is based on statistical characteristics of the data such as the variance and bias of estimates. In a sensitivity analysis, the effect of a single variable on the resulting emissions estimate generated by a model (or calculation) is evaluated by varying its value while holding all other variables constant. Sensitivity analyses will help focus on the data that have the greatest impact on the output data. Additional statistical tests may be utilized depending on the need for more or less rigorous tools and on the specific project activity being evaluated.

When available, data originally gathered using published methods whose applicability, sensitivity, accuracy, and precision have been fully assessed, such as EPA reference methods, will be preferred and considered to be of acceptable quality. Project decisions may be adversely impacted if, for example, existing data were used in a manner inconsistent with the originator's purpose. Metadata can be described as the amount and quality of information known about one or more facets of the data or a dataset. It can be used to summarize basic information about the data (e.g., how, why, and when the existing data were collected), which can make working with specific data or datasets easier and provides the user with more confidence. Metadata are valuable when evaluating existing data, as well as when planning for collection primary data that may be required in the future. However, the effort needed to locate and obtain original source materials can be costly. Accordingly, a graded approach to planning will be applied and ongoing discussions with the EPA will be held to determine what magnitude and rigor of QA effort are appropriate and affordable for the project.

For the data analysis completed under this project, analytical methods will be reviewed to ensure the approach is appropriate and calculations are accurate. Spreadsheets will be used to store data and complete necessary analyses. Design of spreadsheets will be configured for the intended use. All data and methodologies specific to each analysis will be defined and documented. Tables and fields will be clearly and unambiguously named. Spreadsheets will be checked to ensure algorithms call data correctly and units of measure are internally consistent. Hand-entered or electronically transferred data will be checked to ensure the data are accurately transcribed and transferred.

The draft inventory will be evaluated for GHG-emitting-sector and geographic completeness. DEM will utilize the framework of sectors in the EPA's SIT or the EPA's state-level GHG inventories to ensure that the inventory prepared under this project includes all major GHG-emitting sectors. To ensure the inventory is geographically complete, the draft inventory will also be submitted for review by DEM staff who are familiar with all activities subject to local or federal standards issued under Title I of the CAA to ensure that all major-emitting activities in all regions of the state are included in the inventory.

Representativeness is a qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. DEM will use the most complete and accurate information available to compile representative data for this project.

Data c*omparability* is a qualitative term that expresses the measure of confidence that one dataset can be compared to another and can be combined for the decision(s) to be made. DEM will compare datasets when available from different sources to check for the quality of the data. This QA step will also ensure that any highly correlated datasets or indicators are identified. Supporting data, such as

information on test methods used and complete test reports, are important to ensure the comparability of emissions data.

1.7.2. Document Preparation

All documents produced under this project will undergo internal QC review, as well as technical review and an editorial review, prior to submission to the EPA PO. QC will be performed by an engineer, scientist, or economist, as appropriate, with sufficient knowledge. The technical reviewer will review the document for accuracy and integrity of the technical methodologies, analyses, and conclusions.

An editorial review of all final documents will be performed. Editors will verify clarity, spelling, and grammatical correctness, and ensure documents are free of typographical errors. Editors will verify that references are cited correctly. This will include a comparison against the original documents.

The *QC Documentation Form* (**Appendix B**) will be used to track the approval process. The form must be completed and signed for all document deliverables. The signatures required include those of the Task Leader and technical and editorial reviewers. Completion of this form certifies that technical review, editorial review, and all required QC procedures have been completed to the satisfaction of the TL and QA Manager. Copies of these signed forms will be maintained in the project files.

1.8. Special Training / Certifications

All DEM staff assigned to work on this project shall have appropriate technical and QA training to properly perform their assignments. DEM staff serving in QAM role under this project will have completed a training course on QA/QC activities similar to the course available at https://www.epa.gov/quality/training-courses-quality-assurance-and-quality-control-activities. The PM and the TL under this project will have completed an online training course on air emissions inventory on the Air Knowledge website at https://airknowledge.gov/EMIS-SI.html.

If training is required for new staff or for particular segments of the GHG inventory, the PM in coordination with the TL will identify available training resources for the inventory segment and incorporate the required training into the project schedule.

1.9. Documents and Records

DEM will document in electronic form QC activities for this project. The TL is responsible for ensuring that copies of all completed QC forms, along with other QA records (including this QAPP), will be maintained in the project files. Project files will be retained by DEM permanently after the completion of the CCAP. The types of documentation that will be prepared for this project include:

- Planning documentation (e.g., QAPP)
- Implementation documentation (i.e., Review/Approval Forms and QA records)
- Assessment documentation (i.e., QA audit reports).

Detailed documentation of QC activities for a specific task or subtask will be maintained using the *QC Documentation Form* shown in **Appendix B**. This form will document the completion of the QC techniques planned for use on this project as listed in the table in **Appendix A**. One or more completed versions of these forms, as necessary, will be maintained in the project files. The types of documents for which QC will be conducted and documented may include raw data, data from other sources such as data bases or literature, field logs, sample preparation and analysis logs, instrument printouts, model input and output files, and results of calibration and QC checks.

Technical reviews will be used along with other technical assessments (i.e., QC checks) and QA audits to corroborate the scientific defensibility of any data analyses. A technical review (i.e., internal senior review) is a documented critical review of a specific technical work product. It is conducted by subject matter experts who are collectively equivalent (or senior) in technical expertise to those who performed the work. Given the nature of the deliverables under this project, a technical review is an in-depth assessment of the assumptions, calculations, extrapolations, alternative interpretations, and conclusions in technical work products. Technical review of proposed methods and associated data will be documented in the *QC Documentation Form* shown in **Appendix B**. The form will include the reviewer's charge, comments, and corrective actions taken.

Additionally, DEM has developed and instituted document control mechanisms for the review, revision, and distribution of QAPPs. Each QAPP has a signed approval form, title page, table of contents, and a document control format that conforms to EPA's Environmental Information QAPP Standard; see header at top of the page. The distribution list for this QAPP was presented in **Table 1.1**. During the course of the project, any revision to the QAPP will be circulated to everyone on the distribution list, as well as to any additional staff supporting this project. Any revision to the QAPP will be documented in a QAPP addendum, approved by the same signatories to this QAPP, and circulated to everyone on the distribution list by the DEM PM.

At this time, DEM does not know if the project will collect or handle personally identifiable information (PII) subject to the Privacy Act of 1974. However, if during the course of this project technical staff determine that PII is required to support project objectives, DEM will meet all requirements of the Privacy Act of 1974. **Appendix C** indicates the status of the state's determination regarding applicability of the Privacy Act of 1974 under this project.

2. Existing Data Acquisition and Management Protocols (Group B)

2.1. Sampling Process Design

2.1.1. Need and Intended Use of Data Used

As indicated in **Tables 2.1–2.5**, a wide range of data for a diverse set of GHG-emitting activities is necessary to prepare a statewide inventory. Existing data resource may include sector-specific or facility-specific GHG emissions estimates, emissions factors, or activity data for use with emissions factors. The experimental design for this inventory project relies on the EPA's State Inventory Tool (SIT) together with independent estimates prepared by DEM. The SIT allows for expedited estimates for many sectors with default entries included in the tool. Existing data resources from previously completed inventories will be utilized to develop GHG emissions estimates that are comparable to the SIT estimates. Subsequently, the SIT estimates for each sector may be compared to any independent state estimate utilized for the statewide inventory.

2.1.2. Identification of Data Sources and Acquisition

In addition to the data integrated into the EPA's SIT tool, the following data sources will be utilized under each task to develop estimates for each sector in Rhode Island:

- Task 1:
  - Vehicle registration data from the Rhode Island Division of Motor Vehicles.
  - State averages on vehicle miles traveled from the Rhode Island Division of Statewide Planning (DSP).
  - Road type distribution data from the Rhode Island DSP.
- Task 2:
  - New England/New York Electricity Generation data from EIA's Form 923
  - Renewable Energy Certificate (REC) data from the New England Power Pool Generation Information System (NEPOOL-GIS)
  - New England Electricity Generation data from the Independent System Operators New England (ISO-NE)
  - New York Electricity Generation data from EIA's Electricity Data Browser
  - Quebec and New Brunswick Electricity Generation data from Statistics Canada
- Task 3:
  - Forest resource data published by state forestry officials, including Rhode Island's *2020 Forest Action Plan*.
  - Independent estimate of urban tree cover from DEM's Division of Agriculture and Forest Environment (DAFE)
- Task 4:
  - Rhode Island Energy data on SF_6 consumption for insulating electric power lines
- Task 5:
  - U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) natural gas distribution mains and services by material type
  - Various RI-specific assumptions for wastewater treatment from DEM's Office of Water Resources
  - Various RI-specific livestock population assumptions from DEM's DAFE

A complete list of data sources proposed to develop DEM's GHG emissions inventory is included in **Appendix E**.

2.2. Quality Control

All data operations conducted for this project will involve existing, non-direct measurement data. All data received will be reviewed by a senior technical staff member to assess data quality and completeness before their use. In addition to reviewing and assessing the data collected, all data entered into spreadsheets and all calculations completed for analyses will be reviewed by a senior technical reviewer. The reviewer will evaluate the approach to ensure the methods are appropriate and have been applied correctly to the analysis. The technical reviewer will also confirm all data were entered correctly and that calculations are complete and accurate. Calculations will be checked by repeating each calculation, independently, and comparing the results of the two calculations. Any data entry and calculation errors will be identified and corrected. Data tables prepared for the draft and final reports will be checked against the spreadsheets used to store the data and complete the analysis.

Where calculations are required to assess the data/datasets, calculations will be performed using computer spreadsheets and calculators to reduce typographical or translation errors–mathematical/ statistical calculations are performed using spreadsheets or software programs with predefined formulas and functions. DEM will ensure that any manipulations performed on the data/dataset were done correctly. Such calculations could involve statistical checks to look for data outliers. One approach, for example, that may be used to identify outliers or unusual data points is sorting a datasheet for one or more data variables. This approach is a simple but effective way to highlight unusually high or low values. Graphing data using boxplots, histograms, and scatterplots is another method used to identify gaps in the data (missing data), outliers, or unusual data points. Another approach is the use of Z-scores, which can quantify the unusualness of an observation when data follow a normal distribution. A Z-score for a particular value indicates the number of standard deviations above and below the mean that the value falls. For example, a Z-score of 2 indicates that an observation is two standard deviations above the average while a Z-score of -2 indicates the value is two standard deviations below the mean. A Z-score of zero represents a value that equals the mean. As appropriate, we will also use hypothesis tests to find outliers, or an interquartile range (IQR) to calculate boundaries for what constitutes minor and major outliers. The methods used will be driven by the scale and type of data. DEM will determine outlier detection methods to be used based on the initial review of the data. Identified outliers will be highlighted to the PM, TL, or QAM with options for treatment.

2.3. Non-direct Measurements

All environmental information operations conducted on this project will involve existing, non-direct measurement data. All existing data received will be reviewed by a senior technical staff member to assess data quality and completeness before their use.

Consistent with the EPA's QA requirements, this QAPP describes the procedures that will be used to ensure the selection of appropriate data and information to support the goals and objectives of this project. Specific elements addressed by this QAPP include:

- Identifying the sources of existing data,
- Presenting the hierarchy for data selection,
- Describing the review process and data quality criteria,
- Discussing quality checks and procedures should errors be identified, and
- Explaining how data will be managed, analyzed, and interpreted.

Data presented in the GHG inventory will be traced to its source (e.g., database input and output). Key resources include data collected by the EPA (e.g., GHGRP data), and data from EPA-approved data sources (e.g., EIA Form 923 data). These sources may include primary literature (i.e., peer-reviewed journal articles and reports) or databases. We may also use approved existing sources (e.g., handbooks, databases). Original sources for all information and data contained in the document will be included in a list of references with appropriate citations. When peer-reviewed literature or EPA-approved data sources cannot be used, we will document any significant limitations to the data sources used.

We will document information regarding each dataset and our rationale/selection criteria for selecting the data sources used in the inventory. The TL will be responsible for overseeing and confirming the selection of the data for the project tasks.

Table 3.1 presents a hierarchy for data quality when identifying and reviewing available sources of data and information. When evaluating data resources, efforts will be made to identify and select data sources that most closely conform to the highest ranked criteria. Data quality metrics and documentation may not be provided by each source, and as necessary, we may consult with subject matter experts from permitted facilities or trade associations operating in Rhode Island to qualify data for use to meet project objectives.

Any available data quality information will be reviewed by DEM and project advisors to ensure that the data represent full-scale designs and commercial processes, and that they are applicable to economic and regulatory conditions in the United States. DEM will document data sources used and any significant limitations of utilized data or information to ensure that the data are appropriate for their intended use. An internal technical reviewer will review the approach for selecting and compiling data; the review will include examination of the data sources and the intended use of the data. The specific QC techniques used will depend on the technical activity or analysis to which they are applied. The DEM TL is responsible for verifying the usability of data and related information.

Table 3.1 Existing Data Quality Ranking Hierarchy

Quality Rank	Source Type
Highest	Federal, state, and local government agencies
Second	Consultant reports for state and local government agencies
Third	NGO studies; peer-reviewed journal articles; trade journal articles; conference proceedings
Fourth	Conference proceedings and other trade literature: non-peer-reviewed
Fifth	Individual estimates (e.g., via personal communication with vendors)

DEM will work with EPA to ensure that all data used for the project are appropriate for their intended use. The main criteria that will be used in the selection of the data are the quality of the data (based on peer review, credible source, and/or QA documentation), availability, suitability for the intended purpose, and agreement with SIT estimates.

DEM will use the Secondary Data Quality Ranking Hierarchy when identifying and reviewing available sources of information. The source types in **Table 3.1** appear in the order in which they are likely to meet data quality criteria. Federal government data are more likely to be from a credible source, thoroughly reviewed, suitable, available, and representative, and any exceptions to these data criteria are likely to be noted in the government data, providing transparency. Data from individuals are expected to be less reliable, not peer reviewed, and may not be suitable or representative.

If it is determined that data meeting the fourth (i.e., conference proceedings and other trade literature: non-peer-reviewed) or fifth (i.e., individual estimates such as personal communications with vendors) level are from the best or only available data source, the TL will include in the inventory a description of these data with associated limitations for review by the EPA PO or delegate.

These measures of data quality will be used to judge whether the data are acceptable for their intended use. In cases where available data do not or may not meet data quality acceptance criteria, the TL will include in the inventory a discussion for review by the EPA PO or delegate explaining how emissions estimates that relied on such data compare to SIT estimates.

We will also consider the age (i.e., date of dataset) and the representativeness of the data and will include in the inventory report for review by the EPA of any quality concerns regarding data that are outdated or that have other quality issues, like data gaps or inconsistency with other sources. Any data source utilized that is older than 10 years will specifically be flagged in the inventory report.

Representativeness will be evaluated by determining that the emissions or activity data are descriptive of conditions in the United States, data are current, and data are descriptive of similar processes within Rhode Island. Any incomplete datasets will be identified, and deficiencies will be evaluated to determine whether data are missing or confusing and if they meet the secondary-use quality objectives.

Key screening criteria will be used to screen the sources identified. The DEM TL will provide oversight to the screening process to ensure sources collected are the most relevant and meet quality

requirements. Available data and information from the selected sources will be compiled and relevant summary information will be extracted out of the information sources to develop the required output for each of the project tasks.

2.3.1. Criteria for Accepting Existing Data for Intended Use

The criteria for determining whether the data are acceptable for use in developing the statewide inventory will be based on the following:

- Data Source: Did the data originate from the federal, state, and/or local government? If so, was the data already subject to QA/QC measures? Is the data generally accepted by technical experts in the applicable field?
- Transparency: Is the data collection process and calculation methods clearly documented and available? Can the data collection and calculation method be easily made available upon request?
- Data Completeness: Is the data complete and captures its intended purpose? If not, an explanation for incompleteness should be provided upon request.

DEM will review all data sources and consult with staff expertise in applicable fields, in and outside of DEM, to ensure the data meets requirements and is within reason of estimates provided in EPA's SIT.

2.3.2. Criteria for Options Identification in Planning Phase

The criteria for reviewing all activities under each task and identifying the best options for emissions reductions will be based on the following criteria[12] in the EPA's CPRG program guidance:

1. Quantity of reductions in emissions of climate pollution under the option.
2. Number of jobs likely to be created by the option.
3. Environmental justice benefits of the project including the number of people living in overburdened neighborhoods that will benefit from the option.
4. Quantity of reductions in criteria and toxic air pollutants that can be achieved by option.
5. Number of people living, working, recreating, and going to school in the area(s) benefiting from the option.

[12] CPRG Program Guidance, page 4. Available at https://www.epa.gov/inflation-reduction-act/climate-pollution-reduction-grants#CPRGProgramGuidance.

2.4. Data Management

Data management procedures include file storage and file transfer. All project and data files will be stored on DEM project servers. Files will be organized and maintained by the TL in folders by project, task, and function, including a system of file labeling to ensure version control. Any files containing confidential business information will be stored on secure computers. The TL will make sure that staff are trained and adhere to the project file organization and version control labeling to ensure that files are placed in consistent locations. All files will be backed up each night to avoid loss of data. Data are stored in various formats that correspond to the software being used. As necessary, data will be transferred using various techniques, including email, File Transfer Protocol, or shared drives. Typically, records will be archived once the project is completed. Record retention times will be based on contractual and statutory requirements or will follow DEM practices for storing materials of up to seven years after the end of the period of performance (POP). Multiple project staff are granted access rights to the archived file system for each project. Records may be retrieved from archived file system by the TL, PM, or other project staff with access during the records retention period. As soon as allowed by applicable regulations or the grant agreement, records will be destroyed according to DEM policies and procedures. For any sensitive information that is gathered under the project, DEM's policy is consistent with EPA–recommended methods of destruction, which include degaussing, reformatting, or secure deletion of electronic records; physical destruction of electronic media; recycling; shredding; incineration; and pulping. Should the grant specify some other manner of disposition (e.g., transfer to the client), DEM will comply with that directive. As noted above, DEM has developed a file naming convention/nomenclature for electronic file tracking and record keeping. Foremost, all files must be given a short but descriptive name. For those records and files gathered or provided to DEM, the filename may include the identification of "original" in its filename.

Similarly, files that have undergone a review by an independent, qualified person will include, at the end of the filename, the initials of the reviewer or the suffix "rev" (in lieu of initials) if more than one reviewer reviewed the file, along with the date reviewed and version number, as a way to track which staff person(s) reviewed the file and when. Filenames of draft versions will follow an incremental, decimal numbering system. More specifically, each successive draft of a document is numbered sequentially from version 0.1, 0.2, 0.3… until a final version is complete. Final versions will be indicated by whole numbers (e.g., version 1.0). Final versions of documents that undergo revisions will be labeled version X.1 for the first set of revisions. While the document is under review, subsequent draft versions will increase incrementally (e.g., 1.2, 1.3, 1.4) until a revised final version is complete (e.g., version 2.0).

In the event data retrieval is requested and to prevent loss of data, all draft and final file versions will be retained electronically—that is, superseded versions will not be deleted.

Note that changes made to deliverables may be done using the software's *track changes* feature, which allows a user to track and view all changes that are made to the document version. All deliverable reviews will be documented in a QC Documentation Form (see **Appendix B**) for the project. This form will be maintained in the project files.

For this project, it is not anticipated that any special hardware or software will be used. General software available through the Microsoft Suite including Excel, PowerPoint, Access, and Word will be sufficient to perform the work (described in **Tables 2.1–2.5)** for this project.

3. Assessment and Oversight (Group C)

DEM is committed to preparing a comprehensive and reliable inventory of GHG emissions from Rhode Island. Under this project, our senior management team has dedicated the necessary resources to ensure we deliver an inventory that can be relied upon for future policy decisions. Accordingly, under this project, we will concurrently implement existing quality management systems that DEM has previously utilized for submissions to the EPA under Title I of the Act where task-level deliverables will be subjected to required, regular reviews (e.g., quarterly) to ensure that technical, financial, and schedule requirements of this project are consistent with the EPA PO's and QAM's expectations. This section discusses Elements C.1 (assessments and response actions) and C.2 (reporting) applicable to this project.

3.1. Assessments and Response Actions

The QA program includes periodic review of data files and draft deliverables. The essential steps in the QA program are as follows:

1. Identify and define the problem
2. Assign responsibility for investigating the problem
3. Investigate and determine the cause of the problem
4. Assign and accept responsibility for implementing appropriate corrective actions
5. Establish the effectiveness of and implement the corrective action
6. Verify that the corrective action has eliminated the problem.

The TL will provide day-to-day oversight of the quality system. Periodic project file reviews will be carried out by the QA Manager, at least once per year to verify that required records, documentation, and technical review information are maintained in the files. The QA Manager will ensure that problems found during the review are brought to the attention of the Task Leader and are corrected immediately. All nonconforming data will be noted, and corrective measures to bring nonconforming data into conformance will be recorded.

The TL and QA Manager are responsible for determining if the quality system established for the project is appropriate and functioning in a manner that ensures the integrity of all work products. All technical staff have roles and will participate in the corrective action process. Corrective actions for errors found during QC checks will be determined by the TL and, if necessary, with the QA Manager. The originator of the work will make the corrections and will note on the QC form that the errors were corrected. A reviewer or the TL, not involved in the creation of the work, will review the corrections to ensure the errors were corrected. Any problems noted during audits will be reviewed and corrected by the QA Manager and discussed with the TL as needed. Depending on the severity of the deficiency, the TL may consult the QA Manager and stop work until the cited deficiency is resolved. Deficiencies identified and their resolution will be documented in monthly project reports, as applicable. The QA Manager and TL will comply and respond to all internal and EPA audits on the project, as needed. The QA Manager will produce a report outlining any corrective actions taken.

3.2. Reports to Management

The periodic progress reports (to the EPA PO) required in the grant agreement will be reviewed by the PM and the PM's manager to ensure the project is meeting milestones and that the resources committed to the project are sufficient to meet project objectives. These periodic progress reports will describe the status of the project, accomplishments during the reporting period, activities planned for the next period, and any special problems or events including any QA/QC issues. Reports to the EPA will be drafted by the TL or other project staff familiar with project activities during the reporting period.

Any QC issues impacting the quality of a deliverable, the project budget, or schedule will be identified and promptly discussed with the TL and the PM or QAM as appropriate. All significant findings will be included in monthly reports with the methods used to resolve the specific QC issue or the recommendations for resolution for consideration by the EPA's PO or designee.

Based on the technical work completed during the reporting period, progress reports will be reviewed internally by an independent, qualified technical person (equivalent or senior to the TL), prior to submitting to the PM. The PM will conduct a final review of the report before transmitting the progress report to the EPA PO and the PM's manager will be cc'd on all progress reports.

4. Data Validation and Usability (Group D)

4.1. Data Review, Verification, Validation

All work conducted under this project will be subject to technical and editorial review. When existing data for the same GHG-emitting activity are available from multiple sources, the background information documents will be reviewed for all sources to determine the dataset that is the most representative of operations in the state. Additionally, the inventory report will include the vintage of the existing data resource and preference will be given to the most recent dataset that is representative of similar GHG-emitting activities in the state. Reviews will be conducted by an independent, qualified person—or a person not directly involved in the production of the deliverable. The term "validation" refers to whether the data meet the QAPP-defined user requirements while the term "verification" refers to whether conclusions can be correctly drawn from the data. The quality of data used and generated for the project will be reviewed and verified at multiple levels by the project team. This review will be conducted by the DEM TL or a senior technical reviewer with specific, applicable expertise. All original and modified data files will be reviewed for input, handling, and calculation errors. Additionally, all units of measure will be checked for consistency. Any potential issues identified through this review process will be evaluated and, if necessary, data will be corrected, and analysis will be revised as necessary, using corrected data. These corrections will be documented in project records. These measures of data quality will be used to judge whether the data are acceptable for their intended use. In cases where available data do not or may not meet data quality acceptance criteria, the TL will document these findings in the inventory along with corrective actions or use of alternative data sources.

4.2. Verification and Validation Methods

As a standard operating procedure, all data (retrieved and generated) will be verified and validated through a review of data files by an independent, qualified technical staff member (i.e., someone other than the document originator), and ultimately, the DEM TL. A checklist of QC activities for deliverables under this project is provided as **Appendix A**. Forms for documenting QC activities and review of deliverables are included in **Appendix B**. Documentation of calculations will be included in spreadsheet work products and in supporting memoranda, as appropriate.

The TL is responsible for day-to-day technical activities of tasks, including planning, data gathering, documentation, reporting, and controlling technical and financial resources. The TL is the primary person responsible for quality of work on tasks under this project and will approve all-related plans and reports. These reports will be transmitted by the TL to the QAM for final review and approval.

Source data will be verified and validated through a review of data files by the technical staff, and ultimately the TL. Reviews of analyses will include a thorough evaluation of content and calculated values. All original and modified data files will be reviewed for input, handling, and calculation errors. Additionally, all measurement units will be checked for consistency. Any potential issues identified through this review process will be evaluated, errors corrected, and analysis repeated using the corrected data. All corrections will be documented in project records.

Source data will be verified and validated through a review of data files by the technical staff, and ultimately the TL. Typical data verification reviews can include checks of the following:

- Data sources are clearly documented,
- Calculations are appropriately documented,
- All relevant assumptions are clearly documented,
- Conclusions are relevant and supported by results, and
- Text is well-written and easy to understand.

The documented review process will be stored with deliverables for the project. For the narrative describing the methodologies used for the inventory, all comments on drafts will be clearly and concisely summarized including a description of how substantive issues raised by commenters were resolved.

As discussed in Section 1.7, QC objectives include verification that data in database tables are stored and transferred correctly, algorithms call data correctly, units are internally consistent, and reports pull the required data. These data management issues will be addressed as part of the QC checks of data acquisition and document preparation.

For this project, it is not anticipated that any special data validation software will be required. However, where calculations are required to assess the data/datasets, calculations will be performed using computer spreadsheets (like Excel spreadsheets with predefined functions, or formulas) and calculators to reduce typographical or translation errors. General software available through the Microsoft Suite including Excel, PowerPoint, Access, and Word will be sufficient to perform the work as described in Section 1.6 for this project.

4.3. Reconciliation with User Requirements

All data (retrieved and generated) and deliverables in this project will be analyzed and reconciled with project data quality requirements. To ensure deliverables meet user requirements, the TL or senior technical lead will review all data and deliverables throughout the project to ensure that the data, methodologies, and tools used meet data quality objectives, are clearly conveyed, and represent sound and established science.

DEM will review each project with the EPA at the planning stage to ensure the approach is fundamentally sound and will meet the project objectives. The TL or senior technical lead will evaluate data continuously during the life term of the project to ensure they are of sufficient quality and quantity to meet the project goals. Prior to submission of draft and final products, the TL or senior technical lead will make a final assessment to determine whether the objectives have been fulfilled in a technically sound manner. Assumptions made in preparing project analyses will be clearly specified in the inventory.

As discussed in Section 1.7.1, uncertainty can be evaluated using a few different approaches. The most useful uncertainty analysis is quantitative and is based on statistical characteristics of the data such as the variance and bias of estimates. In a sensitivity analysis, the effect of a single variable on the resulting emissions estimate generated by a model (or calculation) is evaluated by varying its value while holding all other variables constant. Sensitivity analyses will help focus on the data that have the greatest impact on the output data. Additional statistical tests may be utilized depending on the need for more or less rigorous tools and on the specific inventory activity being evaluated.

5. References

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USDA Forest Service, *Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2019* at https://www.fs.usda.gov/research/treesearch/62418. Accessed on 7/26/2023.

US DOT, *Highway Statistics Series* at https://www.fhwa.dot.gov/policyinformation/statistics/2021/vm1.cfm . Accessed on 7/26/2023.

Appendix A: Check Lists of Quality Control Activities for Deliverables

Deliverables	Quality Control Procedures
Statewide inventory of GHG emissions from all sectors identified in 1.5.1 of this QAPP with documentation on the following QC activities: 1. Summary document describing data sources and QC measures of data acquisition steps. 2. Thorough descriptions of methodologies used and QC measures for each. 3. Documentation of QAPP implementation. 4. List of potential emissions reductions from each determination with explanation of each option.	1. Quantitative review of statewide inventory's data sources, calculation methodologies, and coverage of emission and sinks within Rhode Island. All data sources used are vetted for official use and are well-documented from creation to publication. Methodologies are appropriate for a statewide inventory and have been reviewed by subject matter experts in applicable fields. Calculations are precise, accurate, and were completed with computer software and often verified with written mathematics. 2. Review by TL or senior technical reviewer—analytical methods and results are explained clearly, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate. 3. Editor review—writing is clear, concise, and complete. Summary reports are free of grammatical and typographical errors.

Appendix B: QC Documentation Form

DEM
Documentation of QA Review and Approval of Electronic Deliverables

Approvals on this form verify that all technical and editorial reviews have been completed and the deliverable meets the criteria for scientific defensibility, technical and editorial accuracy, and presentation clarify as outlined in the Quality Assurance (QA) Project Plan, QA Narrative, Quality Management Plan, and/or according to direction from the EPA PO.

Client: EPA Region 1
Grant Number: 00A00854
EPA Project Officer: Daniel Burke
Project Name: Rhode Island CPRG
Grantee Org. Project Manager:

QA Form Details

Item Number	File Name (Copy the name of the file reviewed)	Deliverable Description	Date Sent to Client	Deliverable (Draft)	Deliverable (Final)	Document Originator	QA Review Information (Review Type)	(Reviewer Name)	(Date Review was Performed)	(Brief Summary of Review Findings and Other Notes)	QA Review Information (Have all Findings Been Resolved?)	(Originator Signature)	(Reviewer Signature)	(File Location) *Copy Long Folder Path Name*
01				☐	☐		***Technical***				☐ Yes			
02				☐	☐		***Technical***				☐ Yes			
03				☐	☐		***Technical***				☐ Yes			
04				☐	☐		***Technical***				☐ Yes			
05				☐	☐		***Technical***				☐ Yes			
06				☐	☐		***Technical***				☐ Yes			

Appendix C: Compliance with Requirements Under the Privacy Act of 1974

Important Note about Personally Identifiable Information (PII)

The Privacy Act of 1974 (5 U.S.C. § 552a) mandates how federal agencies maintain records about individuals. Per OMB Circular A-130, Personally Identifiable Information (PII) is "information that can be used to distinguish or trace an individual's identity, either alone or when combined with other information that is linked or linkable to a specific individual."

EPA systems/applications that collect PII must comply with EPA's Privacy Policy and procedures to guard against unauthorized disclosure or misuse of PII in all forms. For more information click here. If PII are collected, then the QAPP will describe how the PII are managed and controlled.

Personally identifiable information (PII):

Please verify one of the following two options by checking the corresponding box:

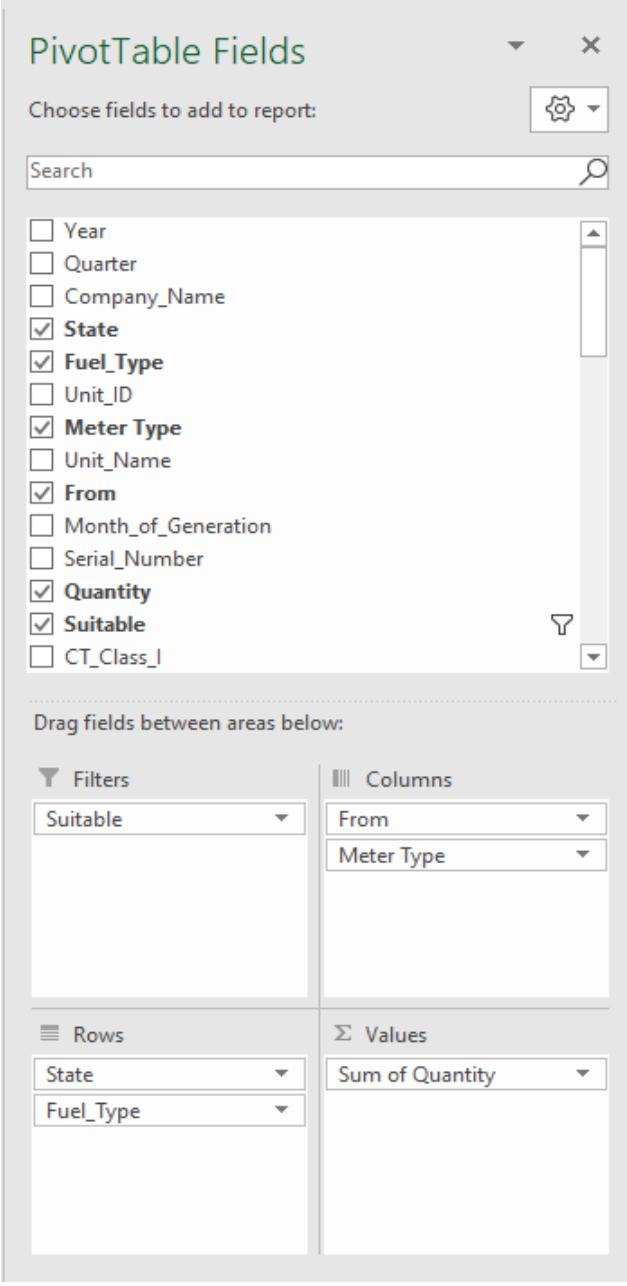
1. This project **will not** collect Personally Identifiable Information (PII): ☒
2. This project **will** collect Personally Identifiable Information (PII): ☐

This QAPP will comply with 5 U.S.C. § 552a and EPA's Privacy Policy.

Appendix D: Electricity Consumption Sector Instructions

Part I: Obtaining and Preparing NEPOOL-GIS Energy Certificates

1. Log-in to NEPOOL GIS: https://www1.nepoolgis.com/myModule/myPage.asp
2. Go to "Reports" tab at the top-right of page
3. Under *State Regulator Reports*, click on "GIS Generators"
4. Setting should include:
    - Status = "Approved"
    - Fuel Type = all selected
    - Eligibilities = all selected
    - State = "All"
    - Include Import Generators = "No"
5. Click "View Report" and save as a CSV file titled 'GIS Generators'
6. Next change 'Include Import Generators' to "Yes"
7. Click "View Report" and save as a CSV file titled 'Import Generators'
8. Open a new Microsoft Excel workbook and import the 'GIS Generators' and 'Import Generators' CSV files
9. Save the workbook as '20XX NEPOOL-GIS Data"
10. Return to the NEPOOL GIS 'Reports' tab
11. Under *State Regulator Reports*, click on "Settled Certificates by LSE and State"
12. For each state, download the settled certificate by quarter and select all fuel types. Click on "View Report" and **save as CSV files** named NEPOOL_STATE_Q#. Example: NEPOOL_CT_Q1
13. Once each state's settled certificates are downloaded for each quarter, create new tabs in the '20XX NEPOOL-GIS Data'
14. Each state should have its own tab with all four quarters of settled certificate data.
15. Return to the NEPOOL GIS 'Reports' tab
16. Under *State Regulator Reports*, click on "Reserved Certificate Transactions"
17. For all states, download the reserved certificate by quarter and select all fuel types. Click on "View Report" and **save as CSV files** named NEPOOL_Reserved_Q#.
18. Combine all reserved certificates into a single tab titled 'Reserved Certificates'
19. For the settled certificates and the reserved certificates, add columns in each state's tab. It's best to copy/paste the formulas from a previous year's NEPOOL-GIS workbook and adjust the values in red:
    - "Meter Type" to the left of "Unit_Name" to indicate the type of meter: = LEFT(F2,1)
    - "From" to the left of "Month_of_Generation" to indicate where the certificate was generated: =IF(LEFT(F2,1)="I", VLOOKUP(F2,ImportGenerators!$A$2:D$120,4,FALSE),VLOOKUP(F2,GISGenerators!$A$2:$E$78944,4,FALSE))
    - "Suitable" to the left of "CT_Class_I" to indicate if the certificate is RPS eligible: =IF(OR(COUNTIF(BK2:CS2,"Yes")>0,BB2="Nuclear"),"Yes","No")
20. Double-click bottom-right of first cell to populate all rows.
21. Next, for each state and the "Reserved Certificates" tab, highlight the entire data selection and create a pivot table with the fields shown below:



22. Once the pivot table is created, it will populate a new tab. Ensure the new tab is directly next to the tab where the data was highlighted.
23. Delete the bar chart that is automatically generated (not the table).
24. Rename the new tab “RI Pivot”, “VT Pivot”, etc. and move directly after the “settled” tab.
25. In the pivot table for each state, change “Suitable” to “Yes” in row 1
26. Here is an example for the pivot table:

Suitable	Yes													
Sum of Quantity	State From													
	CONNECTICUT			MAINE				MASSACHUSETTS				NEW BRUNSWICK		
Row Labels	M	N	CONNECTICUT Total	I	M	N	MAINE Total	M	N	MASSACHUSETTS Total	I			
Connecticut	1685921	779541	2465462	81594	848225	9510	939329	96004	11035	107039	18729			
Biomass	269159		269159											
Digester gas		6163	6163											
Fuel cell	177933	155447	333380											
Hydroelectric/Hydropower	112815	3768	116583		24332	3510	27842	56182		56182				
Landfill gas	7077		7077		17107		17107	26418	8861	35279				
Natural Gas		131419	131419											
Solar Photovoltaic	57507	470526	528033		15242	484	15726		2174	2174				
Trash-to-energy	1061430		1061430											
Wind		12218	12218	20745	393209		413954	7366		7366	18729			
Wood				60849	398335	5516	464700	6038		6038				
Grand Total	1685921	779541	2465462	81594	848225	9510	939329	96004	11035	107039	18729			

27. Create a new tab to the right of each pivot tab titled “RI Summary”, “VT Summary”, etc.
28. Copy/paste the pre-formatted tables for each state’s summary tab from the previous year’s workbook. Clear all data from the settled and reserved tables (NOT the “all certificates” table) with “clear contents” feature.
29. Take the pivot table output for each state and copy/paste the **data only** into the pre-formatted tables.
30. Do this for the settled and reserved certificates for each state. This takes some time, as the certificate totals need to be copied/pasted individually.
31. Ensure all certificates (settled and reserved) are compiled into one “All Certificates” table for each state.
32. **End of Part I.**

Part II: Performing Emissions Calculations

Form 923 Generation Data

1. Obtain electric generation data from EIA Form 923: https://www.eia.gov/electricity/data/eia923/ EIA Form 923 is a self-certified survey from electric generation sources on the ISO-New England grid.
2. Download “20XX: EIA-923” zip file
3. Open zipped folder and then open “EIA923_Schedules_2_3_4_5_M_12_2019_Final_Revision” Excel spreadsheet
4. Go to tab “Page 1 Generation and Fuel Data”
5. Copy/paste entire tab into a new workbook titled “20XX MA-CT Electric Sector Methodology” Excel spreadsheet. If overwriting previous year’s workbook, replace data in “Form 923 Data Generation Data” sheet
6. Delete columns T:CM, R, Q, and J (this leaves 22 columns)
7. Create 4 new columns (starting in row 6, after column V):
    - Leave this blank.
    - “Unit HEAT RATES – electric (MMBTU/MWh)”
    - “CHP NG Heat Rates”
    - CHP DFO Heat Rates”

    Copy and paste the formulas from the previous year to row 6.
8. In column Y, rows 2:4, copy the following codes:
    - GT

- NG
- DFO

9. The above codes are used to calculate heat rates for energy generators that use natural gas or oil based on fuel consumption and generation rate.
10. Remove all rows other than CT, MA, ME, NH, NY, RI, Plant State, and VT using this simple trick "Delete Hidden Rows by Creating a Temporary Column: https://spreadsheetplanet.com/delete-filtered-rows-excel/
    - In column G, "filter" out all states except New England and New York
    - Add a temporary column to the left of "Plant Id"
    - In the first box, add "0". Double-click the bottom-right of box to populate all rows
    - Next, clear the filter for column H. This leaves "0"s next to only New England and New York generators
    - In column A, "filter" out the "0"s so that only the blank cells exist
    - Select all rows and delete.
    - Finally, clear the filter for column A. This leaves only New England and New York generators
    - Delete column A.
11. Once there are only rows left for the New England states (and NY), copy the formulas from the previous year's calculations. Here's an example:

GT
NG
DFO

	Year-To-Date									
Physical Unit Label	Total Fuel Consumption Quantity	Electric Fuel Consumption Quantity	Total Fuel Consumption MMBtu	Elec Fuel Consumption MMBtu	Net Generation (Megawatthours)	YEAR	Blank	Unit HEAT RATES - electric (MMBTU/MWh)	CHP NG Heat Rates	CHP DFO Heat Rates
								Average CHP-NG Heat Rate for Region =		6.1
								Average CHP-DFO Heat Rate for Region =		5.6
	These values are for filtered checking							Weighted Average Wood Heat Rate for Region =		14.5
	866,135,260	789,142,152	2,306,108,934	2,170,471,957	233,259,605			Weighted Average LFG Heat Rate for Region =		11.6
				MMBTU/MWh =	9.30			Elec Fuel Consumption MMBTU (positive gen only)	POSITIVE Net Generation MWh	WEIGHTED AVG HEAT RATE (used in Heat Rate Table on 'GIS' tab)
	558,920	558,920	12,304,437	12,304,437	1,136,318			12,304,437	1,136,318	10.8
	0	0	0	0	0			0	0	#DIV/0!
	173,605	160,275	1,007,667	930,340	96,106			930,340	96,106	9.7
	162,963,837	156,768,917	167,885,826	161,507,306	21,422,655			161,502,326	21,422,655	7.5
	1,129,712	1,129,712	15,290,433	15,290,433	826,193			15,290,433	826,193	18.5
	0	0	0	0	0			0	0	#DIV/0!
	655	655	15,720	15,720	531			15,720	531	29.6
	0	0	0	0	0			0	0	#DIV/0!
	298,698	298,698	1,881,472	1,881,472	149,450			1,881,472	149,450	12.6
	0	0	0	0	0			0	0	#DIV/0!
	6,691	6,691	37,865	37,865	2,552			37,865	2,552	14.8
	0	0	0	0	0			0	0	#DIV/0!
	0	0	0	0	0			0	0	#DIV/0!
	0	0	0	0	0			0	0	
	3,664,506	3,664,506	1,788,269	1,788,269	141,083			1,788,269	141,083	12.7
	2,008,372	2,008,372	15,914,652	15,914,652	859,920			15,914,652	859,920	18.5
	0	0	0	0	0			0	0	#DIV/0!
	249,330	249,330	2,279,348	2,279,348	130,813			2,279,348	130,813	17.4
	0	0	0	0	0			0	0	#DIV/0!

12. Check ALL FORMULAS to ensure they're considering all EIA data above. When these tables are copied/pasted from previous years, they're set up to only use data through a certain row. Ensure formulas are referencing the correct cells in this workbook.

GWPs & EFs

13. Create a new sheet titled "GWPS & EFs"
14. This sheet can be switched between SAR, AR4 (100 year), AR4 (20 year), AR5 (100 year) and AR5 (20 year) GWPs.

15. Copy/paste all rows and columns from previous year's "GWPS & EFs" tab. Should be an easy transfer, adjust formulas as needed. Skip this step if overwriting previous year's workbook. Here's an example of the workbook:

Global Warming Potential

Using the dropdown list in **orange**, select the IPCC report whose Global Warming Potentials you would like to use. Do not edit the **gray** cells.

IPCC Report	CH4	N2O
AR4, 100-yea	25	298

	CH4	N2O
SAR	21	310
AR4, 100-yea	25	298
AR5, 100-yea	28	265
AR4, 20-year	72	289
AR5, 20-year	84	264

SAR = 1996 Second Assessment Report
AR4 = 2007 Fourth Assessment Report
AR5 = 2014 Fifth Assessment Report

Emission Factor Selection

Sources for emission factors were chosen based on two criteria: 1) geographic scope of the data relative to the emission sources, and 2) the regularity with which the data are updated. Based on these parameters, EIA

Emission Factors - CO2

Fuel Type	IPCC Emission Factors (CO2 lb/MMBtu) HHV	EIA Emission Factors (CO2 lb/MMBtu) HHV
Non-Biogenic		
bituminous coal	209.04	205.69
sub-bituminous coal	212.35	214.29
distillate petroleum		161.29
natural gas	117.44	117.00
non-biogenic component of municipal solid waste	202.63	
other		
tire derived fuel		189.53
petroleum coke	215.45	225.09
residual petroleum	171.03	173.70
jet fuel	157.99	156.31
kerosene	158.88	159.39
waste oil	161.97	205.69
gaseous propane		139.05
Biogenic		
landfill gas	114.30	
biogenic component of municipal solid waste	209.34	
black liquor	199.50	
wood/wood waste solids	234.46	
sludge waste		
other biomass solids	209.34	
other biomass liquids	199.50	
other biomass gas	114.30	

Generation CO2e

16. Create a new sheet titled "Generation CO2e".
17. Copy/paste the entire sheet over from the previous year. Skip this step if overwriting previous year's workbook.
18. Adjust formulas as appropriately to ensure all cells are referencing the correct cells in the current year's workbook. Compare to previous years for accuracy. Here's an example table in the workbook:

Rhode Island - Total CO2e
2019

	CO2e (lb)
Non-Biogenic CO2e	**6,223,894,239**
CO2e from CO2 from Non-Biogenic Fuels (Non-Part 75 units)	6,216,243,004
CO2e from CO2 from Non-Biogenic Fuels (Part 75 units)	0
CO2e from CH4 from Non-Biogenic Fuels	2,935,300
CO2e from N2O from Non-Biogenic Fuels	3,514,257
CO2e from CH4 from Biogenic Fuels	359,058
CO2e from N2O from Biogenic Fuels	842,620
Biogenic CO2e	**233,702,149**

Rhode Island
Fuels

Fuel Type	Fuel Codes from EIA	Form 923 Heat Input Consumed for Electricity by non-Part 75 units (MMBtu)	Form 923 All Heat Input Consumed for Electricity (MMBtu)
Non-Biogenic		To calculate CO2	To calculate CH4 and N2O
bituminous coal	BIT	0	0
sub-bituminous coal	SUB	0	0
distillate petroleum	DFO	78,033	78,033
natural gas	NG	53,023,080	53,023,080
non-biogenic component of municipal solid waste	MSN	0	0
other	OTH	0	0
tire derived fuel	TDF	0	0
petroleum coke	PC	0	0
residual petroleum	RFO	0	0
jet fuel	JF	0	0
kerosene	KER	0	0
waste oil	WO	0	0
gaseous propane	PG	0	0
Biogenic			
landfill gas	LFG	2,035,827	2,035,827
biogenic component of municipal solid waste	MSB	0	0
black liquor	BLQ	0	0
wood/wood waste solids	WDS	0	0
sludge waste	SLW	0	0
other biomass solids	OBS	0	0
other biomass liquids	OBL	0	0
other biomass gas	OBG	0	0

GIS

19. Create a new sheet titled "GIS". Copy/paste entire sheet from previous year. Skip this step if overwriting previous year's workbook.
20. Starting in column P, row 65, are the GIS certificate tables. Copy **data only** from each state summary sheet in 20XX NEPOOL-GIS Data workbook.
21. Starting in column A, row 33, is the 20XX Heat Rate Table. Ensure table is referencing the correct cells on the Form 923 data sheet. (See previous year's example)
22. MMBTU tables starting in column A, row 65 should pull data from the REC tables and the heat rate table above.
23. Here's an example of a REC table in the GIS sheet:

RHODE ISLAND Fuel	Connecticut			Massachusetts			Maine			New Hampshire			Rhode Island			Vermont			Total MSS MWh	Total NON MWh
	MSS	NON	TOTAL	MSS	NON	TOTAL	MSS	NON	TOTAL	MSS	NON	TOTAL	MSS	NON	TOTAL	MSS	NON	TOTAL		
Biogas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomass	-	-	-	-	-	-	127,079	6	127,085	9,929	-	9,929	-	-	-	-	1,141	1,141	137,008	1,147
Coal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Digester Gas	-	-	-	-	-	-	10,000	-	10,000	-	-	-	-	-	-	-	-	-	10,000	-
Energy Storage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel cell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydroelectric/Hydropower	2,584	-	2,584	19,421	-	19,421	121,752	-	121,752	51,892	-	51,892	3,693	-	3,693	3,620	15,389	19,009	202,962	15,389
Hydrokinetic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Landfill gas	-	-	-	-	-	-	-	-	-	-	-	-	208,264	-	208,264	-	-	-	208,264	-
Municipal solid waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural gas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Photovoltaic	1,891	-	1,891	-	-	-	-	-	-	-	-	-	63,891	73,759	137,650	-	20,359	20,359	65,782	94,118
Trash-to-energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wind	-	-	-	9,895	252	10,147	33,458	-	33,458	24,015	-	24,015	166,160	2,562	168,722	7,208	-	7,208	240,736	2,814
Wood	-	-	-	-	-	-	-	-	-	4,721	-	4,721	-	-	-	-	-	-	4,721	-
	4,475	-	**4,475**	**29,316**	**252**	**29,568**	**292,289**	**6**	**292,295**	**90,557**	-	**90,557**	**442,008**	**76,321**	**518,329**	**10,828**	**36,889**	**47,717**	**869,473**	**113,468**

24. Here's an example of a MMBTU table in the GIS sheet:

From RHODE ISLAND FUELS	RI fuel-specific MSS MMBTUs to CT	RI fuel-specific NON MMBTUs to CT	RI fuel-specific MSS MMBTUs to MA	RI fuel-specific NON MMBTUs to MA	RI fuel-specific MSS MMBTUs to ME	RI fuel-specific NON MMBTUs to ME	RI fuel-specific MSS MMBTUs to NH	RI fuel-specific NON MMBTUs to NH	RI fuel-specific MSS MMBTUs to RI	RI fuel-specific NON MMBTUs to RI	RI fuel-specific MSS MMBTUs to VT	RI fuel-specific NON MMBTUs to VT
Biogas	-	-	-	-	-	-	-	-			-	-
Biomass	-	-	-	-	-	-	-	-			-	-
Coal	-	-	-	-	-	-	-	-			-	-
Diesel	-	-	-	-	-	-	-	-			-	-
Digester Gas	-	-	-	-	97,972.2	-	-	-			-	-
Energy Storage	-	-	-	-	-	-	-	-			-	-
Fuel cell	-	-	-	-	-	-	-	-			-	-
Hydroelectric/Hydropower	-	-	-	-	-	-	-	-			-	-
Hydrokinetic	-	-	-	-	-	-	-	-			-	-
Jet	-	-	-	-	-	-	-	-			-	-
Landfill gas	-	-	-	-	-	-	-	-			-	-
Municipal solid waste	-	-	-	-	-	-	-	-			-	-
Natural gas	-	-	-	-	-	-	-	-			-	-
Nuclear	-	-	-	-	-	-	-	-			-	-
Oil	-	-	-	-	-	-	-	-			-	-
Solar Photovoltaic	-	-	-	-	-	-	-	-			-	-
Trash-to-energy	-	-	-	-	-	-	-	-			-	-
Wind	-	-	-	-	-	-	-	-			-	-
Wood	-	-	-	-	-	-	-	-			-	-
TOTAL lbs CO2e	-	-	-	-	97,972.2	-	-	-	-	-	-	-

GIS Heat Input

25. Create a new sheet titled "GIS Heat Input" and copy/paste entire sheet from previous year. Skip this step if overwriting previous year's example.
26. This sheet features many VLOOKUP formulas that pull data from the GIS sheet.
27. Spot check against previous year's sheet to ensure cells are referencing the correct data. If any cells display "#N/A" or "#VALUE" error, the next sheet will not work. Change cell F30, which references the Form 923 page.
28. After F30 is changed, all values should automatically calculate.
29. Here's an example of a heat input table:

Rhode Island Fuels Adding to Total CO2e							
Fuel Types	Into State - MSS Meter (MMBtu)	Into State - IMP Meter (MMBtu)2	Into State - NON Meter (MMBtu)	Out of State - MSS Meter (MMBtu)	*Form 923 trash split	-	Net Heat Input from all GIS certificates (MMBtu)
Non Biogenic							
distillate petroleum and oil	-	-	-	-			-
natural gas	-	-	-	-			-
non-biogenic component of municipal solid waste and trash	-	-	-	-	0.550		-
Biogenic							
landfill gas	-	79,911	-	-			79,911
biogenic component of municipal solid waste and trash	-	-	-	-	0.450		-
biomass and wood/wood waste solids	-	-	-	-			-
biogas and digester gas	-	-	-	-			-

GIS CO2e

30. Create a new sheet titled "GIS CO2e" and copy/paste entire sheet from previous year. Skip this step if overwriting previous year's example.
31. This sheet calculates all the CO2e associated with the RECs for each state in three different categories:
    - Net transfer GIS emissions
    - ISO-MSS emissions removed from state.
    - ISO-MSS emissions that settle in-state.
32. Cells in this sheet mainly reference the GWPs & EFs sheet and the GIS Heat Input sheet. Compare to previous year to ensure cells are referencing correct fuel types.
33. Here's an example GIS CO2e table:

Rhode Island - Total CO2e 2019		Rhode Island Fuels			Rhode Island CO2	Rhode Island CH4		Rhode Island N2O	
	CO2e (lb)	Fuel Type	Fuel Codes from EIA	Heat Input from GIS certificates (MMBtu)	Calculated CO2 (lb)	CH4 (lb)	CO2e (lb)	N2O (lb)	CO2e (lb)
Non-Biogenic CO2e	**47,169**	**Non-Biogenic**							
CO2e from CO2 from Non-Biogenic Fuels	0	distillate petroleum	DFO	0	0	0	0	0	
CO2e from CH4 from Non-Biogenic Fuels	0	natural gas	NG	0	0	0	0	0	
CO2e from N2O from Non-Biogenic Fuels	0	non-biogenic component of municipal solid waste	MSN	0	0	0	0	0	
CO2e from CH4 from Biogenic Fuels	14,094				**0**		**0**		
CO2e from N2O from Biogenic Fuels	33,075								
Biogenic CO2e	**9,173,338**	**Biogenic**							
		landfill gas	LFG	79,911	9,173,338	564	14,094	111	3
		biogenic component of municipal solid waste	MSB	0	0	0	0	0	
		wood/wood waste solids	WDS	0	0	0	0	0	
		biogas and digester gas	OBG	0	0	0	0	0	
					9,173,338		**14,094**		3

ISO-NE

34. Create a new sheet titled "ISO-NE Data" and copy/paste entire sheet from previous year. Skip this step if overwriting previous year's workbook.
35. Go to https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load and download "Annual Generation and Load Data for ISO NE and the Six New England States"
36. Replace *ISO-NE Generation (GWh)* data in row 5 with the "Generation" data for 20XX
37. Replace *ISO-NE Load (GWh)* data in row 9 with the "Net Energy for Load"
38. For the imports, go back to https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load and download "20XX Net Energy and Peak Load by Source".
39. Click the 20XX sheet on the last page of the newly downloaded workbook.
40. Scroll down to "20XX Imports (GWh)*". **Add the separate NY imports together** to obtain an import total for NY and **add the separate QC imports together** to obtain an import total for QC. Replace *Canada Imports (GWh)* in row 13 with the NY imports, NB imports, and QC imports.

41. The pumping will be calculated automatically. "Pumping" is distributed to each state based on the *proportion each state's load is to the total load*.
42. Go to https://www.eia.gov/electricity/data/browser/ to retrieve electricity generation data for New York.
    - Choose "net generation" under "Change data set"
    - Under "geography" filter out all states except NY.
    - View by "annual" – NY generation data is the "all fuels" total. Multiply by 1,000 to convert from thousand MWh to MWh.
    - Insert this value under "NY Electricity Generation" in row 21 of spreadsheet.
43. Go to https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510001501 to retrieve electricity generation data for Quebec and New Brunswick.
    - Under "geography" select Quebec.
    - Change reference period to Jan. 20XX – Dec. 20XX
    - Add up monthly MWh from row "Total all types of electricity generation"
    - Insert this total under "QC Electricity Generation" in row 21 of spreadsheet.
    - Repeat this process for New Brunswick.
44. Here's an example of the ISO-NE Data sheet:

ISO-NE Generation (GWh)

Total	ME	NH	VT	CT	RI	MA
102,562	8,670	17,770	1,410	33,481	7,456	33,775

ISO-NE Load (GWh)

Total	ME	NH	VT	CT	RI	MA
121,217	11,486	11,589	5,484	29,311	7,976	55,370

Canada Imports (GWh)

Total	NY	NB	QC
23,260	4,445	4,320	14,495

Pre-Pumping Imports (GWh)
18,655

Total Pumping (GWh)
4,605

ISO-NE Load with Pumping (GWh)

ISO-NE	ME	NH	VT	CT	RI	MA
125,822	11,922	12,030	5,693	30,424	8,279	57,474

NY, NB, and QC Electricity Generation (MWh)

NY	NB	QC
128,025,000	12,248,571	214,375,372

Master Tables

45. Create a new sheet titled "Master Tables" and copy/paste entire sheet from previous year. Skip this step if overwriting previous year's workbook.
46. Check **all cells** to ensure they're referencing the correct places throughout the entire document. NOTE: if you're calculating emissions for a state other than RI, you'll need to make sure all cells in the *Master Table: Non-Biogenic GHG Emissions* and *Master Tables: Biogenic GHG Emissions* are referencing the correct state.
47. This sheet calculates a wide variety of electric load, imports, and emissions from all six New England states.
48. Continue past this step to the final sheet in the workbook.
49. Here's an example of the Master Tables sheet:

Master Table: Non-Biogenic GHG Emissions

RI Basic Information				RI Import Need	RI Share of New England Imports		RI Total I
RI Electric Generation (MWh)	RI Electric Load (MWh)	RI Electric Load Including Pumping (MWh)	Non-Biogenic GHG Emissions from Electricity Generation (CO2e lb)	RI Electricity Imports [Gen-Load] (MWh)	Total of State/Region Shortfalls [incl. NY, PEI, Q] (MWh)	RI Fraction of Intra-NE imports	Imports to RI from other NE States (MWh)
7,155,873	8,015,405	8,310,244	6,192,740,879	1,154,370	31,789,049	0.04	449,027

Master Table: Biogenic GHG Emissions

RI Basic Information				RI Import Need	RI Share of New England Imports		RI Total I
RI Electric Generation (MWh)	RI Electric Load (MWh)	RI Electric Load Including Pumping (MWh)	Biogenic CO2 Emissions from Electricity Generation (lb)	RI Electricity Imports [Gen-Load] (MWh)	Total of State/Region Shortfalls [incl. NY, PEI, Q] (MWh)	RI Fraction of Intra-NE imports	Imports to RI from other NE States (MWh)
7,155,873	8,015,405	8,310,244	281,055,049	1,154,370	31,789,049	0.04	449,027

SUMMARY TABLE: CO2e emissions (lbs) from settled and reserved RECs

STATE / PROVINCE	NON-BIOGENIC	BIOGENIC
MA	90,210,566	814,464,965
CT	30,945,676	(4,763,730,453)
ME	(144,008,984)	2,393,535,675
NH	14,595,746	1,185,157,413
RI	294,397	57,254,287
VT	15,944,482	1,281,239,355

SUMMARY TABLE: REC Transfers and Net Generation Adjustment

STATE / PROVINCE	RECs Imported	RECs Exported to NE
MA	1,143,942	3,078,865
CT	936,744	2,986,207
ME	4,757,265	1,125,056
NH	3,998,438	554,165
RI	86,021	425,035
VT	1,475,891	2,267,331

Summary

50. Create a new sheet titled “Summary” and copy/paste entire sheet from previous year. Skip this step if overwriting previous year’s workbook.
51. The “Emissions from RECs in Rhode Island” table will automatically update pulling data from the above REC tables and the emission factor tables found beginning in cell I50.
52. If calculating emissions for a state other than RI, update cell D15 to reflect the new sum. Otherwise, skip this step.
53. The table beginning in cell A2 displays the final calculation to achieve the total electricity consumption emissions for Rhode Island. Update cell references as needed if calculating emissions for a different state.
54. The total electricity consumption emissions are in cell D21.
55. The total emissions if biogenic emissions are counted as zero are in cell C21.
56. **End of Part II.**

Appendix E: Summary of Proposed Data Sources for the *Rhode Island Greenhouse Gas Emissions Inventory*

ENERGY

Electricity Consumption

- New England/New York Electricity Generation (by source): Energy Information Administration (EIA) Form 923
- Renewable Energy Certificates (RECs): New England Power Pool Generation Information System (NEPOOL-GIS)
- New England Electricity Generation (total): Independent System Operators New England (ISO-NE)
- New York Electricity Generation (total): EIA Electricity Data Browser
- Quebec and New Brunswick Electricity Generation (total): Statistics Canada

Natural Gas Distribution

- Natural Gas Mains & Services: Pipeline and Hazardous Materials Safety Administration (PHMSA), data → EPA State Inventory Tool (SIT) Oil & Gas module

RESIDENTIAL

Residential Heating

- Natural Gas, Petroleum, and Wood CO_2: EIA State Energy Data System (SEDS) data → EPA SIT CO_2FFC module
- Natural Gas, Petroleum, and Wood CH_4 and N_2O: EIA SEDS data → EPA SIT Stationary Sources module

COMMERCIAL

Commercial Heating

- Natural Gas, Petroleum, and Wood CO_2: EIA SEDS data → EPA SIT CO_2FFC module
- Natural Gas, Petroleum, and Wood CH_4 and N_2O: EIA SEDS data → EPA SIT Stationary Sources module

TRANSPORTATION

Aviation

- Aircraft & Support Equipment: Rhode Island Airport Corporation (RIAC) annual air pollution Inventory

Highway Vehicles

- On-Road Gasoline: EPA MOVES or EPA SIT Mobile Combustion module
- On-Road Diesel: EPA MOVES or EPA SIT Mobile Combustion module
- Liquified Petroleum Gas (LPG): EPA SIT Mobile Combustion module
- Natural Gas (LNG and CNG): EPA MOVES (CNG only) or EPA SIT Mobile Combustion module

Nonroad Sources

- Marine: EPA SIT Mobile Combustion module
- Rail: EPA SIT Mobile Combustion module
- Other: EPA SIT Mobile Combustion module

INDUSTRIAL

Industrial Heating

- Natural Gas, Petroleum, and Wood CO_2: EIA SEDS data → EPA SIT CO_2FFC module
- Natural Gas, Petroleum, and Wood CH_4 and N_2O: EIA SEDS data → EPA SIT Stationary Sources module

Industrial Processes

- Urea Consumption and Soda Ash: EPA SIT Industrial Processes module
- SF_6 Consumption: Rhode Island Energy annual data request

AGRICULTURE

Agriculture

- Enteric Fermentation and Manure Management: DEM Division of Agriculture and Forest Environment data → EPA SIT Agriculture module
- Soil Management: DEM Division of Agriculture and Forest Environment data → EPA SIT Agriculture module

WASTE

Solid Waste

- Potential CH_4 Emissions: EPA FLIGHT for the Rhode Island Resource Recovery Corporation
- CH_4 Emissions Avoided from Flaring & Landfill Gas-2-Energy: EPA FLIGHT for the Rhode Island Resource Recovery Corporation

Wastewater

- Municipal: DEM Office of Water Resources data → EPA SIT Wastewater module
- Industrial: DEM Office of Water Resources data, USDA New England Field Office data, EPA SIT Agriculture module data → EPA SIT Wastewater module

LAND USE, LAND USE CHANGE, AND FORESTRY

Forest Land

- Forest Land Remaining Forest Land: DEM Division of Agriculture and Forest Environment *2020 Forest Action Plan* data, U.S. Forest Service Forest Inventory & Analysis program
- Land Converted to Forest Land: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation

Croplands

- Cropland Remaining Cropland: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation
- Land Converted to Cropland: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation

Grasslands

- Grassland Remaining Grassland: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation
- Land Converted to Grassland: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation

Wetlands

- Wetlands Remaining Wetlands (COASTAL ONLY): *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation
- Land Converted to Wetlands (COASTAL ONLY): EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation

Settlements

- Settlements Remaining Settlements: DEM Division of Agriculture and Forest Environment 2015 iTree study data, DEM Division of Planning & Development data → EPA SIT Land Use, Land Use Change, and Forestry module, EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation
- Land Converted to Settlements: EPA *U.S. Inventory of GHG Emissions and Sinks* state-level disaggregation