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Revision 0

Idaho National Laboratory's FY 2021 Greenhouse Gas Report

January 2023

Kimberly Scully

Idaho National Laboratory

INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance, LLC

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Idaho Falls, Idaho 83415

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EXECUTIVE SUMMARY

A greenhouse gas (GHG) inventory is a systematic approach to account for the production and release of certain gases generated by an institution from various emission sources. The gases of interest are those that climate science has identified as related to anthropogenic global climate change. This document presents an inventory of GHGs generated during Fiscal Year (FY) 2021 by Idaho National Laboratory (INL)—a Department of Energy (DOE)-sponsored entity located in southeastern Idaho.

In recent years, concern has grown about the environmental impact of GHGs. This, together with a desire to decrease harmful environmental impacts, would be enough to encourage the calculation of an inventory of the total GHGs generated at INL. Additionally, INL has a desire to see how its emissions compare with similar institutions, including other DOE national laboratories. Executive Order 13834 requires that federal agencies and institutions track and report GHG emissions where required.

INL's GHG inventory was calculated according to methodologies identified in federal GHG guidance documents using operational control boundaries. It measures emissions generated in three scopes: (1) INL emissions produced directly by stationary or mobile combustion and by fugitive emissions, (2) the share of emissions generated by entities from which INL purchased electrical power, and (3) indirect or shared emissions generated by outsourced activities that benefit INL (occurring outside INL's organizational boundaries but are a consequence of INL's activities).

This inventory found that INL generated 81,185.05 metric tons (MT) of CO_2-equivalent (CO_2e) emissions during FY 2021. The following conclusions were made from looking at the results of the individual contributors to INL's FY 2021 GHG inventory:

- Electricity (including the associated transmission and distribution losses) is the largest contributor to INL's GHG inventory, with over 50% of the CO_2e emissions
- Other sources with high emissions were mobile combustion (fleet fuels), employee commuting, stationary combustion (facility fuels), and waste disposal (fugitive emissions from the onsite landfill)
- Sources with low emissions were waste disposal (contracted disposal), fugitive emissions from refrigerants, wastewater treatment (onsite and contracted), and business ground travel (in personal and rental vehicles).

This report details the methods behind quantifying INL's GHG inventory and discusses lessons learned on better practices by which information important to tracking GHGs can be tracked and recorded. It is important to note that because this report differentiates between those portions of INL that are managed and operated by Battelle Energy Alliance, LLC (BEA) and those managed by other contractors, it includes only INL's activities overseen by BEA. It is assumed that other contractors will provide similar reporting for those activities they manage, where appropriate.

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- Chris Ischay, Sustainable INL Program Manager
- Caitlin Nate, Sustainable INL Program Specialist
- Heather Rohrbaugh, INL Editor.

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ACRONYMS

ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance
CAS	Chemical Abstract Service
CEDR	Consolidated Energy Data Report
CFA	Central Facilities Area
CH_4	methane
CITRC	Critical Infrastructure Test Range Complex
CNG	Compressed Natural Gas
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
CY	cubic yard
DOE	Department of Energy
DOE-HQ	Department of Energy Headquarters
DOE-ID	Department of Energy Idaho Operations Office
eGRID	Emissions & Generation Resource Integrated Database
EO	executive order
EPA	Environmental Protection Agency
FMP	Fluor Marine Propulsion, LLC
FY	fiscal year
GHG	greenhouse gas
GWP	Global Warming Potential
HFC	hydrofluorocarbon
HHV	higher heating value
HVAC	heating, ventilating, and air conditioning
INEEL	Idaho National Engineering and Environmental Laboratory (a forerunner of INL)
INL	Idaho National Laboratory
INWMIS	INEEL Nonradiological Waste Management Information System
LandGEM	Landfill Gas Emissions Model
LNG	Liquefied Natural Gas
LPG	Liquefied Propane Gas
MFC	Materials and Fuels Complex
GHGRP	Mandatory Reporting of Greenhouse Gases Rule
MSW	municipal solid waste
MT	metric tons
N_2O	nitrous oxide
NF_3	nitrogen trifluoride
NWPP	Northwest Power Pool
PFC	perfluorocarbon
REC	Renewable Energy Certificate
SF_6	sulfur hexafluoride
SMC	Specific Manufacturing Capability
T&D	Transmission and Distribution
TIMS	Transportation Issues Management System
WECC	Western Electricity Coordinating Council

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1. INTRODUCTION

Idaho National Laboratory (INL) has been in operation since 1949. Battelle Energy Alliance, LLC (BEA) currently operates INL for the Department of Energy (DOE). In addition to specializing in nuclear energy, INL supports the overall DOE missions in energy research, science, and national defense as indicated in their stated mission to "Discover, demonstrate and secure innovative nuclear energy solutions, clean energy options and critical infrastructure."

The INL Site covers approximately 890 square miles of high-elevation desert in southeastern Idaho and is home to multiple facilities that are operated by several contractors in addition to BEA. BEA is currently the largest contractor and is responsible for day-to-day management and operation of INL. Through fiscal year (FY) 2021, other major contractors operating at the INL Site included:

- Idaho Environmental Coalition manages the Idaho Cleanup Project, which includes the Idaho Nuclear Technology Center facility and the performance of cleanup work across the INL Site, and operates the Advanced Mixed Waste Treatment Project
- Fluor Marine Propulsion, LLC (FMP) operates the Naval Reactor Facilities
- DOE Idaho Operations Office (DOE-ID).

This report will look exclusively at the greenhouse gas (GHG) emissions that INL (BEA) owns; it is assumed that other contractors will provide similar reporting for the activities they control. All attempts have been made to look only at INL's emissions unless otherwise indicated. In this report "INL" is used to indicate the BEA operations and employees to which this report applies, while "INL Site" will apply to the entire geographical area and all contractors.

INL's employees work at multiple locations throughout the INL Site, as indicated in Figure 1. The metropolitan area closest to the Site is Idaho Falls, which is also the location of the Research and Education Campus or "town" facilities. The major campuses within the INL Site where INL employees work include the Advanced Test Reactor (ATR) Complex (45 miles west of Idaho Falls), Central Facilities Area (CFA), Materials and Fuels Complex (MFC; 28 miles west of Idaho Falls), and the Specific Manufacturing Capability (SMC; 60 miles northwest of Idaho Falls). The INL Site's large geographical area and long history make for some unique characteristics, including:

- Long Commutes. Approximately half of INL's employees work at Site desert locations that are between 30 and 50 miles west of Idaho Falls, and ride INL buses or utilize their own personal vehicles to commute to work.
- Large Transportation Fleet. INL operates a large vehicle fleet that includes light-duty passenger vehicles, commercial buses, and off-road equipment. This fleet is being modernized through a transition to General Services Administration vehicles. INL's commercial buses are used for transporting employees from all INL Site contractors on their commute to and from the Site facilities.
- Antiquated Facilities. The INL Site includes hundreds of buildings, some are DOE-owned and some leased; however, many of these buildings are aged. INL is in the process of modernizing its buildings to support the INL mission, attract and retain its workforce, and satisfy Executive Order (EO) requirements.

Figure 1. Location map of the INL Site and major facilities.

On a historical note, INL is home to the peaceful atom—the world's first usable amount of electricity produced from nuclear energy was generated in 1951 at INL's forerunner, the National Reactor Test Station. With such a long history and a commitment to revitalizing nuclear energy, a low-carbon source of energy, it is only appropriate that INL would be interested in lowering its own GHG emissions.

The first step to quantifying any GHG savings is to establish a baseline. FY 2008 was chosen as the baseline year since this calculation effort will also support EO 13834, "Efficient Federal Operations," requirements to report on and reduce GHG emissions based on an FY 2008 baseline. This report documents the effort to calculate the GHG emissions for FY 2021 and compares them to the FY 2008 baseline results. (For more information on INL's FY 2008 GHG Baseline results, see INL/EXT-10-19264, "Idaho National Laboratory's Greenhouse Gas FY08 Baseline.")

This report documents the methodology and calculations to determine the INL GHG inventory and provides perspective on the results of INL's GHG inventory (also referred to as the carbon footprint). Methodology is still being fine-tuned for calculating GHGs, particularly at the federal level where the intent is to standardize the emissions categories considered and the associated calculations to standardize reporting. These GHG inventory calculations follow the most current methodology available at the time of writing: the EO 13834 and the "Federal Greenhouse Gas Accounting and Reporting Guidance, Council on Environmental Quality, January 17, 2016," (referred to herein as the Guidance) [2016]. In addition to standardizing the methodology, these documents attempt to best utilize the data that federal facilities are already required to report, such as fuel (for energy and fleet) and electricity usage. The Guidance uses a combination of existing guidance and regulations as their basis, including:

- The World Resource Institute's and Land Management Institute's Public Sector GHG Accounting and Reporting Standard (Public Sector Standard)

- Environmental Protection Agency's (EPA) Climate Leaders Guidance
- EPA's "GHG Reporting Program" (GHGRP, 40 CFR 98), as references for their methodologies and emission factors.

1.1 Changes from Previous Year's Reporting

While EO 13834 does not specifically identify GHG reduction goal percentages, BEA is keeping the same percentage goals for consistency in comparing annual emissions.

During the preparation of the FY 2021 report, it was discovered that the incorrect eGRID factor was being applied to the Renewable Energy Credit (REC) purchases. Prior to FY 2021, non-baseload emission factors were used instead of the regional emission factors. The FY 2021 report applied the updated emission factors to account for this correction, while the historical emissions were not changed.

However, as energy supply generation mix changes, eGRID factors are continually updated to account for generation mix changes. Current eGRID factors will be applied to historical records in the FY 2022 report, starting with the baseline year of FY 2019.

In FY 2021, INL had to revise the methodology for collecting employee commute data. Previously a survey or extrapolated numbers were used. In FY 2020, a 70.4% factor for onsite working was used due to the global pandemic (COVID-19). In FY 2021, numbers were no longer being collected at the laboratory level for employees working onsite; therefore, each directorate was requested to provide monthly onsite, hybrid, and offsite worker numbers. Hybrid workers were assumed to have worked 2 days onsite and 2 days offsite. This data provided an overall average percent of employees commuting to their work locations. FY 2020 data was used to determine number of miles commuted based on teleworking factors gathered from the directorates. These assumptions were included in employee-based category calculations (i.e., commute survey and onsite wastewater treatment). Other categories were directly affected by the cancelation of business travel, such as airline miles, rental cars, and personal vehicle travel.

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2. WHY LOOK AT GREENHOUSE GASES?

INL has many reasons to calculate the organization's GHG emissions, including environmental and political pressures external to INL as well as internal requirements within INL. INL is one of four national laboratories participating in the Net-Zero Labs initiative, sponsored by DOE. The Net-Zero initiative's goal is to be net-zero carbon emissions by 2031.

When considering the results of this analysis, it will be important to consider the limits of the analysis. While a GHG inventory is currently the popular method for assessing an organization's environmental impacts, it is focused on just one impact to the earth: climate change. It is important to keep the full lifecycle effects of various sources of environmental impact in mind—including air pollution, habitat degradation, and resource extraction—when making a decision or drawing any overall conclusions.

2.1 Environmental Motivations

Environmental impacts come in a variety of forms. Many emitted pollutants have been the subject of historical environmental regulation (e.g., air pollutants by the Clean Air Act of 1963 or water pollutants by the Federal Water Pollution Control Amendments of 1972). Climate change (sometimes called global warming) is a primary focus of current scientific inquiry, and policymaking reflects the current understanding of the impact of GHGs in causing anthropogenic climate change. Policies currently being considered include the introduction of carbon taxes or carbon-emissions trading—a market-based system of incentives aimed at achieving reductions in emissions of GHGs. Such a system might bear a similarity to the trading system in place in the United States that regulates SO_2 emissions under the Clean Air Act of 1990.

2.2 Political Motivations

This effort of identifying and calculating GHG emissions supports EO 13834, "Efficient Federal Operations," signed in May 2018. The EO requires that federal agencies and institutions track and report, where required, GHG emissions.

This report represents the effort to catalog INL's contribution to the INL Site carbon footprint. To be in compliance with the EO, some emission metrics must be separated from information that INL already tracks and reports for the entire Site (e.g., fuels and electricity), and several metrics, such as employee commuting and travel, are tracked now to comply with the EO.

2.3 INL Objectives

INL chooses to support efforts to monitor and reduce GHG emissions for several reasons. These include an existing Battelle Corporate initiative that seeks to monitor and reduce the corporate contribution to GHG emissions. As a research institution committed to making contributions in the areas of energy research and national security, INL has mission-based interests in the clean, sustainable production of energy. Its historical interest in nuclear reactor testing represents a longstanding commitment to low-carbon power generation.

INL is committed to sustainability. A GHG inventory is an accepted method of identifying environmental impacts and assessing major contributions to GHG emissions and the best methods to reduce them.

2.3.1 Sustainable INL

The Sustainable INL Program is part of a movement among federal agencies to evaluate current processes and establish goals for achieving sustainability. The Sustainable INL mission is to "enable researchers who ensure the nation's energy security with safe, competitive, and sustainable energy systems without compromising the ability of future generations to meet their own needs." Its intent is to enable innovation and research while simultaneously improving energy efficiency, becoming responsible environmental stewards, and conserving natural resources. Focus areas within the program include those covered in EO 13834: greenhouse gas emission reduction, energy efficiency, sustainable buildings, community involvement, data center efficiency, renewable energy, water conservation, fleet efficiency, sustainable acquisition, recycling (Pollution Prevention), electronics stewardship, and climate change adaptation. Sustainable INL relies on management and employee participation to achieve its goals. For questions specific to Sustainable INL, visit www.inl.gov/about-inl/inl-safety/sustainability/, or contact Chris Ischay (Program Manager, [208] 526-4382, Christopher.Ischay@inl.gov), Trevor Terrill (Energy Manager, [208] 526-5848, Trevor.Terrill@inl.gov), Maryl Fisher (Senior Energy Analyst, [208] 526-8340, Maryl.Fisher@inl.gov), or Caitlin Nate (Sustainability Specialist, [208] 526-0339, Caitlin.Nate@inl.gov).

3. CALCULATION APPROACH

3.1 Selected GHG Protocol

As mentioned in Section 1, these calculations follow the Guidance unless otherwise indicated.

3.2 Defined Inventory Boundaries

This GHG inventory considers all INL-owned operations, including buildings and employees. As mentioned in the Introduction, several other contractors operate on the INL Site, including Idaho Environmental Coalition and FMP. Facilities managed by these other contractors were not included in this inventory. Some non-INL employees (including DOE-ID) are located in several INL buildings that were included in these calculations, but since INL pays for the operations (e.g., boiler fuels, electricity, solid waste removal) and thus has operational control, these were counted in the INL inventory. Operations directly associated with the employees of other contractors (such as employee travel and employee commuting) were not included in INL's inventory GHG calculations.

The following metrics are offered to give a sense of scale for INL's and FY 2021 contributions to the overall INL Site's GHG inventory:

- INL employees (including interns and temporary employees) amounted to 5,133 of the combined 6,900 (approximate) employees at the INL Site during FY 2021 (excluding Naval Reactors Facility)
- The total square footage of buildings owned by INL or occupied by INL personnel and used for INL operations represented 60.0% of the total 6.15 million square feet that made up the INL Site in FY 2021 (59.6% of 609 buildings)[a]
- The percentage of electrical power consumed by INL operations and personnel is 72.9% of the total 219,805 MWh.

3.3 Defined Scope

GHG inventories or footprints consider emissions from three emissions scopes (Scope 1, 2, and 3) as indicated in Figure 2, and described below:

- Scope 1: Direct or INL-owned emissions that are produced onsite, such as stationary combustion (from fuel combustion), mobile combustion (from fleet vehicles), and fugitive emissions (from refrigerants, onsite landfills, and onsite wastewater treatment). These include emissions that may benefit another entity or contractor, but for which INL controls or owns the associated process.
- Scope 2: Indirect or shared emissions produced by INL's electricity, heat, and steam purchases. (Note that INL did not purchase heat or steam during FY 2021.)
- Scope 3: Indirect or shared emissions generated by outsourced activities that benefit INL (occur outside INL's organizational boundaries but are a consequence of INL's activities). This can include many activities, but for purposes of this inventory, INL focused on transmission and distribution losses, employee commuting, employee travel, contracted waste disposal, and contracted wastewater treatment since these categories were identified in the Guidance for required reporting. Other activities that could be included in Scope 3 include the embodied emissions of purchased materials.

a. These are based on the numbers provided in the FIMS snapshot at the end of FY 2021 (typically in November of the next fiscal year), which is considered representative for the entire year. INL's portion is based on the buildings that belong to the DOE Nuclear Energy program, while the remaining buildings at the INL Site belong to the Environmental Management program. The total number of buildings only includes those considered energy-consuming, to be consistent with information submitted in the annual DOE Sustainability Dashboard.

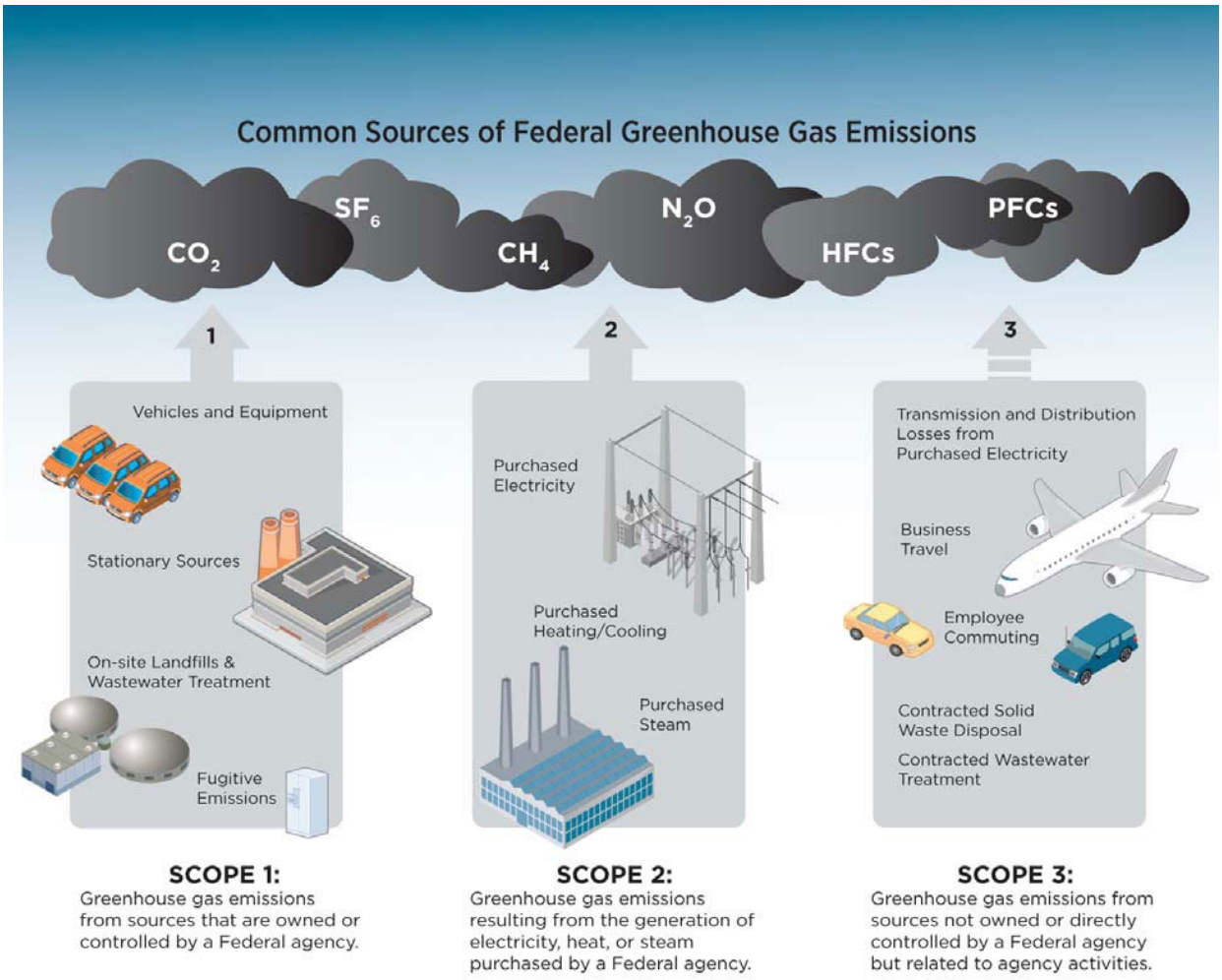

Figure 2. GHG emissions from Scope 1, 2, and 3.

This inventory considered the following six gases: carbon dioxide (CO_2), sulfur hexafluoride (SF_6), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), as required by the Guidance. Nitrogen trifluoride (NF_3) and other GHGs with high global warming potential (GWP) are identified for optional reporting.

The GWP of the gases considered was used to convert all GHG emissions to units of carbon dioxide equivalent (CO_2e)—a means of describing the cumulative effect of all GHGs weighted by their 100-year warming potential. The GWP indicates each gas's heat-trapping impact relative to CO_2, which has a GWP of 1.0 and functions as a warming index. The GWP values used for the FY 2021 calculations are based on the EPA Chapter 40, Part 98 of the Code of Federal Regulations (40 CFR 98) values and are shown in Appendix A, Global Warming Potentials.

Table 1 summarizes the GHG emissions categories that were identified in the Guidance, whether they were calculated for INL's FY 2021 report, and their reporting status in the Guidance (identified as required or recommended for reporting). Some Scope 3 GHG sources will not require reporting until FY 2022 or later since the calculation method for determining their emissions is still being developed.

Table 1. GHG emissions categories identified in Guidance.

Scope	Emissions Category	Calculated for FY 2021	Reporting Status in Guidance
1 (Direct)	Stationary Combustion (Boilers, Generators, etc.)	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Mobile Combustion (Fleet Vehicles)[a]	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Fugitive Emissions: Refrigerants	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Fugitive Emissions: Onsite Wastewater Treatment	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Industrial Process Emissions (Manufacturing or Processing Chemicals or Materials)	No, INL does not perform any of the activities listed in the Guidance	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
2 (Indirect)	Purchased Electricity	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Purchased Steam, Hot Water, or Chilled Water	No, INL does not purchase	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Combined Heating and Power	No, INL does not utilize	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Purchased Steam from Waste to Energy	No, INL does not purchase	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Transmission & Distribution (T&D) Losses (within INL's operational controls)	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Purchased Green Power (Renewable Energy Certificates [RECs])	Yes, INL purchased RECs	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
3 (Indirect)	T&D Losses (outside INL's operational controls)	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Employee Commuting	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Business Air Travel	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Business Ground Travel: Rental Vehicle	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Business Ground Travel: Personal Vehicle	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Contracted Municipal Solid Waste (MSW) Disposal	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.

Table 1. (continued).

Scope	Emissions Category	Calculated for FY 2021	Reporting Status in Guidance
3 (Indirect) (cont'd)	Contracted Wastewater Treatment	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Vendor and Contractor Emissions (Indirect emissions in the supply chain)	No, will wait for additional guidance.	Do not require reporting at this time, but future inventories are expected to include these emissions. It is expected that this category will be a large contributor to INL's GHG inventory.
	Fuel Production	No	Do not require reporting at this time, but future inventories are expected to include these emissions.
	Land Management (changes that sequester or release GHGs)	No	Do not require reporting at this time.
	Biomass Combustion, Enteric Fermentation, Composting, and Manure Management	No, INL does not perform.	Do not require reporting at this time.
Biogenic[b]	Mobile Combustion	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Stationary Combustion	No, INL did not utilize biofuels for this category.	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.
	Contracted MSW Disposal	Yes	Required reporting in FY 2008 Baseline and FY 2021 Inventory.

a. This includes CH_4 and N_2O from biofuel blends. Per the Guidance, biogenic CO_2 emissions generated from combustion of biofuels are counted separately since this carbon would have been released through the plant's natural decomposition.
b. Note that biogenic emissions will not count against GHG reduction targets.

As shown in Table 1, the Guidance differentiates between anthropogenic and biogenic emissions for reporting purposes. Anthropogenic emissions are those that are human caused, while biogenic emissions are considered to be those that would have been released due to naturally occurring processes (without human involvement). For example, when considering the combustion of biofuels versus fossil fuels, the carbon from biofuels is absorbed from the atmosphere during plant growth and recycled during the natural decomposition process; therefore, the combustion of biofuels is considered biogenic, while the carbon from fossil fuels has been locked in the earth for millennia and will yield a net increase in atmospheric carbon relative to what would have occurred naturally. Although the Guidance requires reporting of biogenic emissions, they will not count against an agency's GHG reduction targets; therefore, INL will focus on their anthropogenic emissions.

3.4 Identified Greenhouse Gas Emissions Categories

After identifying which GHG emission categories in Table 1 would need to be calculated for INL, the next step is to identify where to find the INL-specific organizational data for performing the calculations. Table 2 summarizes the INL-specific data sources for each emissions category.

Table 2. INL's GHG emissions categories for Scopes 1, 2, and 3.

Scope	Emissions Category	INL Data Source
1 (Direct)	Stationary Combustion (Boilers, Generators, etc.)	Fuel consumption reports (INL's Quarterly Energy Reports and Fuel Sheets)
	Mobile Consumption (Fleet Vehicles)	Fuel consumption database (Transportation Issues Management System [TIMS]), WEX card fuel purchases, and Fuel Sheets
	Fugitive Emissions: Refrigerants	Refrigerant purchases, use, and disposal (Comply Plus Database)
	Fugitive Emissions: Onsite Landfill	INL Landfill records (INEEL Nonradiological Waste Management Information System [INWMIS])
	Fugitive Emissions: Onsite Wastewater Treatment	INL's Environmental Support & Services and Human Resources staff
2 (Indirect)	Purchased Electricity	INL's Quarterly Energy Reports
	Purchased RECs	RECs Purchase Documentation
3 (Indirect)	T&D Losses	INL's Quarterly Energy Reports
	Employee Commuting	FY 2021 Employee Hybrid/work Schedule Results
	Business Air Travel	INL Travel Office
	Business Ground Travel: Rental Vehicle	INL Travel Office
	Business Ground Travel: Personal Vehicle	INL Travel Office
	Contracted MSW Disposal	City of Idaho Falls Sanitation invoice records
	Contracted Wastewater Treatment	City of Idaho Falls
Biogenic	Mobile Combustion	Fuel consumption databases (TIMS)
	Fugitive Emissions: Onsite Landfill	INL landfill records (INWMIS)
	Contracted MSW Disposal	City of Idaho Falls Sanitation invoice records

The identification of sources of information for the different emissions allows for the:

- Collecting of necessary data from sources identified in Table 2.
- Gathering of necessary emissions factors (the Guidance was consulted as a primary document, and then the EPA's Climate Leaders guidance was referenced if the applicable emissions factors were not available in the Guidance).
- Calculating inventory of INL's GHG emissions categories. For each emissions category, the GHG emissions were calculated in metric tons of CO_2e based on INL-specific data, emission factors, and applicable GWPs. (A sample calculation is shown in Appendix B, Sample Calculation.) The majority of these calculations were performed following the Guidance, with Excel spreadsheets prepared specifically for establishing INL's GHG inventory. Exceptions to this process are noted in the sections below and include the emissions from the onsite landfill, which were calculated using an EPA model (per the Guidance).

4. DISCUSSION AND RESULTS

4.1 Summary

Table 3 and Figure 3 through Figure 5 summarize the GHG emissions from INL during FY 2021. Details on the emission factors and calculation methods used, as well as a discussion of the individual results, follow in the sections below.

Table 3. INL's GHG emissions during FY 2021.

Scope	Emissions Category	FY 2021 GHG Emissions (MT CO_2e)
1 (Direct)	Stationary Combustion	6,071.40
	Mobile Combustion	9,326.13
	Fugitive Emissions: Refrigerants	11.37
	Fugitive Emissions: Onsite Landfill	5,823.00
	Fugitive Emissions: Onsite Wastewater Treatment	157.54
	SCOPE 1 TOTAL	21,389.45
2 (Indirect)	Purchased Electricity	52,350.46
	Transmission & Distribution Losses (Owned)	620.43
	Purchased RECs	(4,323.94)
	SCOPE 2 TOTAL	48,646.95
3 (Indirect)	Transmission & Distribution Losses (Shared)	2,813.35
	Employee Commuting	7,053.37
	Business Air Travel	672.28
	Business Ground Travel: Rental Vehicle	198.37
	Business Ground Travel: Personal Vehicle	146.63
	Contracted MSW Disposal	260.22
	Contracted Wastewater Treatment	4.43
	SCOPE 3 TOTAL	11,148.66
TOTAL ANTHROPOGENIC EMISSIONS[a]		**81,185.05**
Biogenic	Mobile Combustion	248.31
	Fugitive Emissions: Onsite Landfill	710.10
	Contracted MSW Disposal	31.81
TOTAL BIOGENIC EMISSIONS		**990.22**
TOTAL EMISSIONS (ANTHROPOGENIC + BIOGENIC)		**82,175.27**

a. INL will report these numbers as their overall emissions. Furthermore, INL will try to reduce this number in future years.

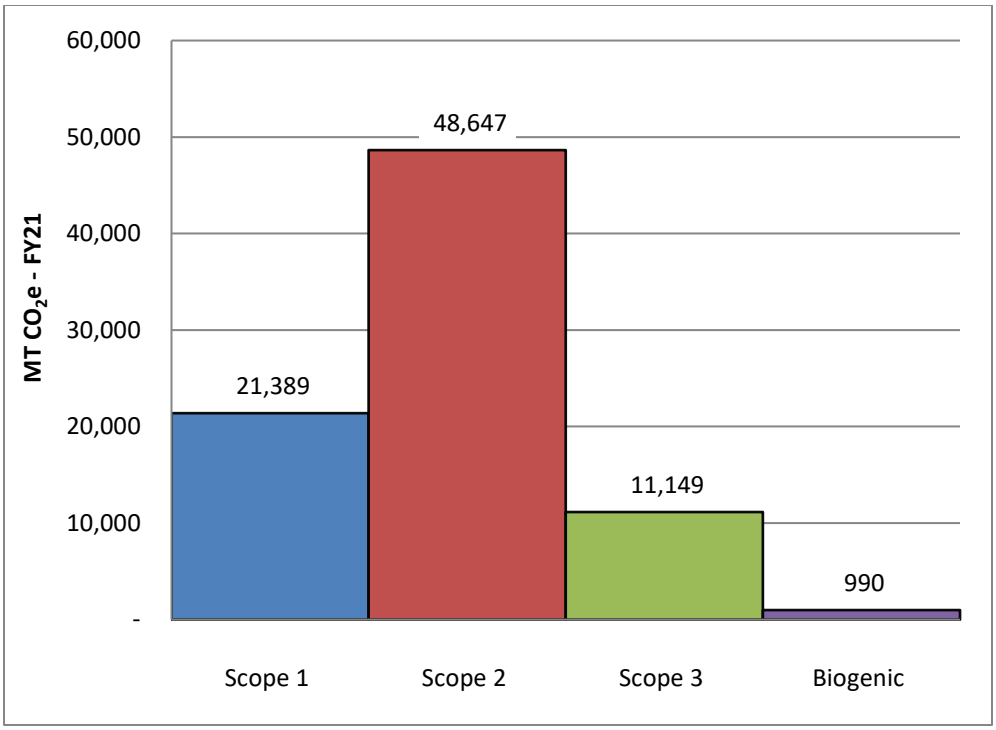

Figure 3. INL's FY 2021 GHG emissions, by scope.

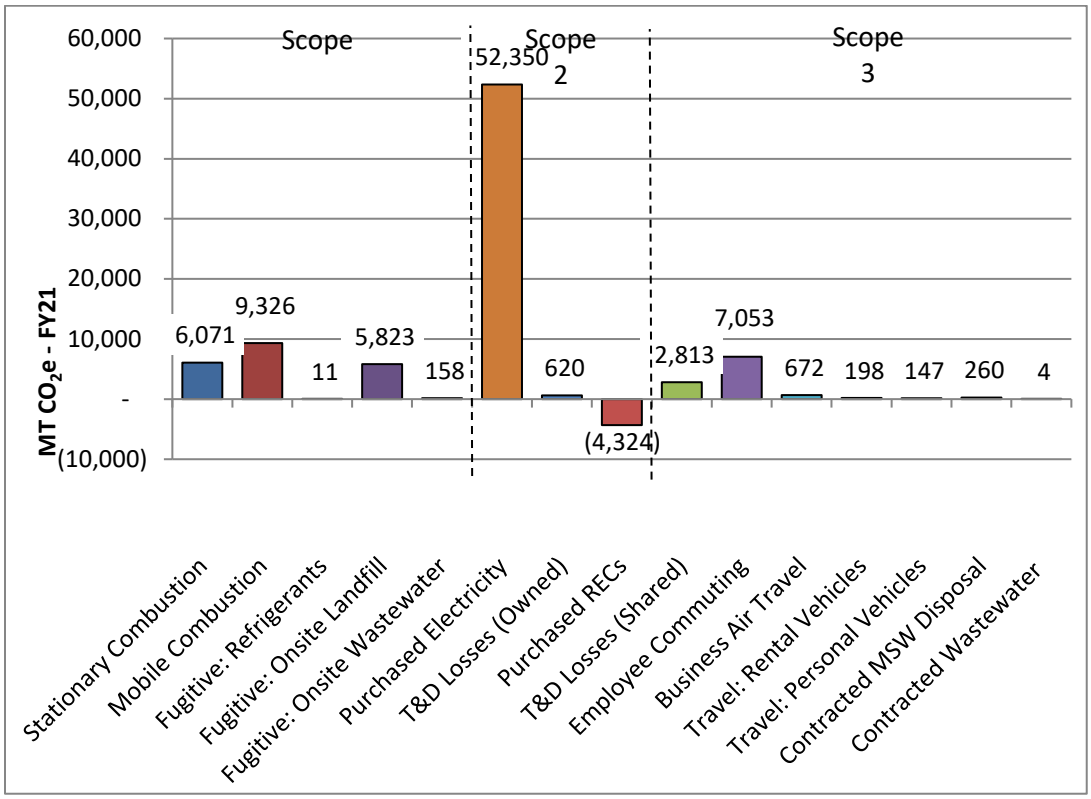

Figure 4. INL's FY 2021 GHG emissions, by scope and emissions category, excluding biogenic emissions.

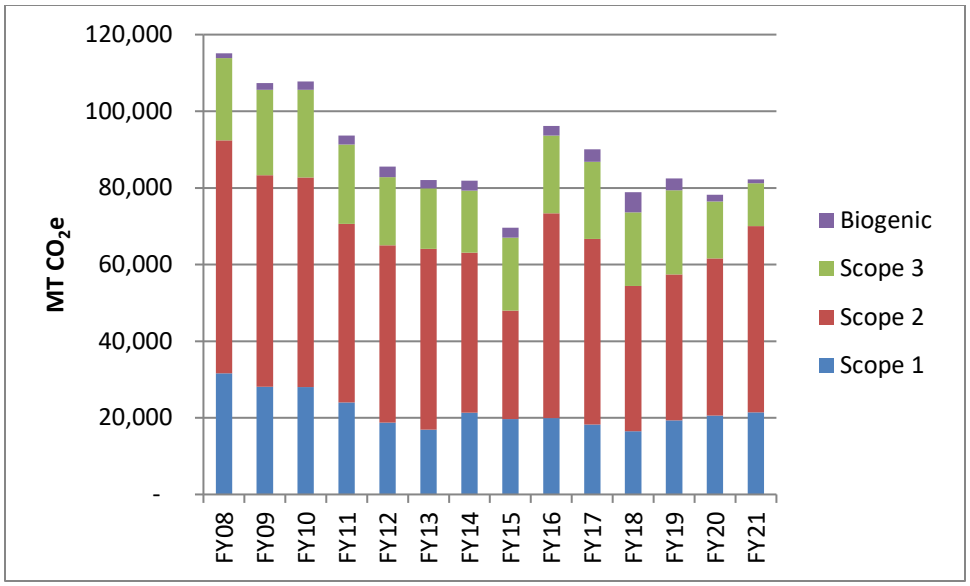

Figure 5. Comparison of INL's FY 2008 through FY 2021 GHG emissions, by scope and emissions category, including biogenic emissions.[b]

4.2 Scope One – Direct Emissions

INL's FY 2021 Scope 1 emissions are summarized in Figure 6, with a comparison to the FY 2008 baseline shown in Figure 7. A discussion of each of the Scope 1 emissions categories follows and includes the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY 2008 baseline results. A comprehensive table, as well as the FY 2008 baseline emissions and the subsequent FY data is included in Appendix C, Scope 1 Comprehensive Tables.

b. Scope 2 numbers for all years were revised in FY 2020 as a result of a revision to Scope 2 total calculations.

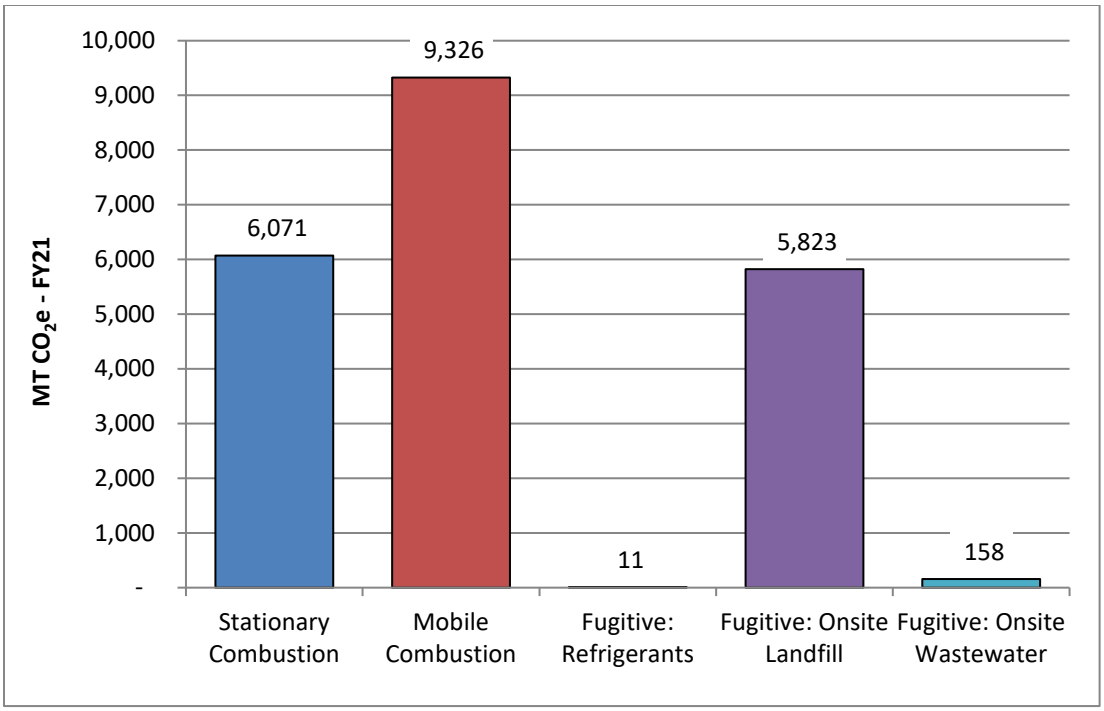

Figure 6. INL's FY 2021 GHG emission results for Scope 1.

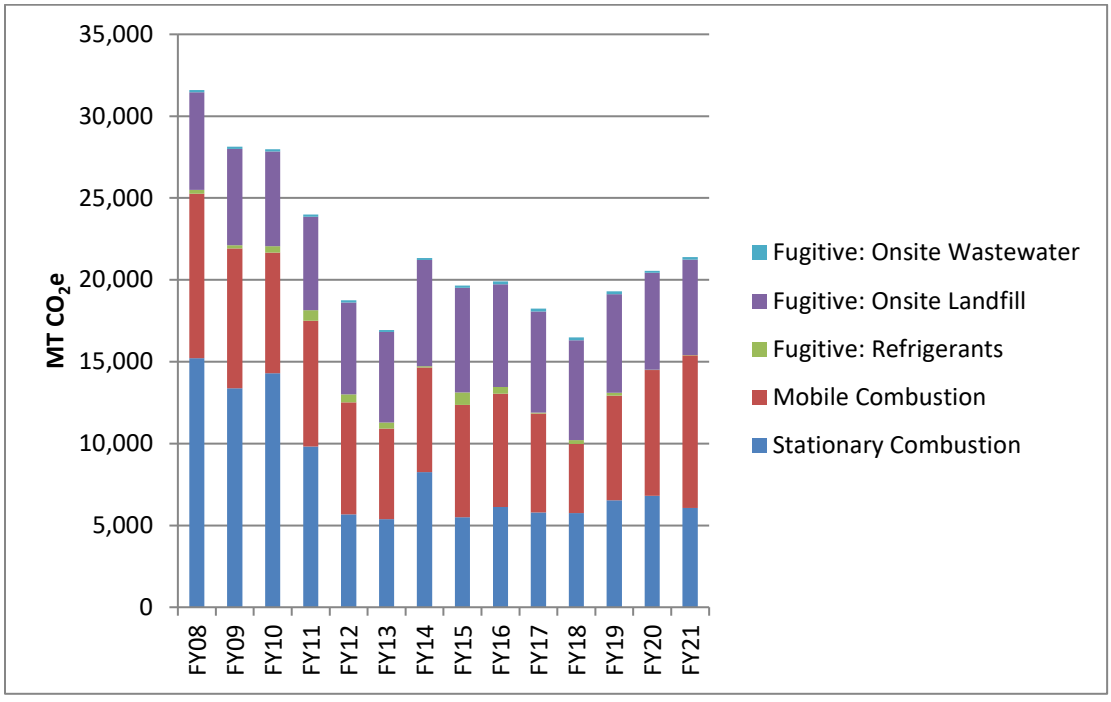

Figure 7. Comparison of INL's FY 2008 through FY 2021 Scope 1 GHG emissions.

4.2.1 Stationary Combustion Emissions

4.2.1.1 Calculation Method. To estimate the GHG emissions of INL's stationary combustion from boilers and generators, the default methodology identified in the Guidance was adopted. This consisted of obtaining the total amount of fuels used (purchased) onsite by INL. Since these data are also submitted for the DOE Sustainability Dashboard, and are already tracked for the INL Site, the only calculations needed were to isolate the emissions that INL owns from those owned by other INL Site contractors by separating the fuels purchased for INL-operated facilities.

4.2.1.2 Results Discussion. During FY 2021, INL used the types and amounts of fuel shown in Table 4 for stationary combustion.

Table 4. Amounts of fuel used for stationary combustion at INL during FY 2021.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	193,458.90	Gallons	1,981.31
Liquefied Natural Gas (LNG)	45,121.00	Gallons	333.21
Liquefied Propane Gas (LPG)	47,018.90	Gallons	273.06
Natural Gas (Pipeline)	659,104.90	Therms	3,483.84
		TOTAL	**6,071.40**

As shown in Table 4, INL's stationary combustion emissions were calculated to produce 6,071 MT CO_2e in FY 2021. In FY 2021, this equates to 28.4% of INL's Scope 1 emissions, and 7.5% of the total anthropogenic emissions considered.

Since these data are already collected and reported annually for the DOE Sustainability Dashboard, they are considered to be of high quality.

4.2.1.3 Lessons Learned. Since the data are already gathered at INL for the DOE Sustainability Dashboard, no changes are needed for reporting in future years. In addition, the data are considered accurate, with all INL-owned sources of stationary combustion included.

4.2.1.4 Comparison to FY 2008 Baseline. The FY 2021 results showed a 60.1% decrease over the FY 2008 baseline. Looking closer at the differences among the four fuel types showed an 84.5% decrease in diesel, 3.5% increase in LNG deliveries (to the Site), 68.5% decrease in propane deliveries, and a 178.6% increase in natural gas (to town facilities).

MFC discontinued use of diesel-fueled boilers in 2011 and 2012 and ATR Complex switched from diesel-fueled boilers to electric boilers with battery backup in May 2015, resulting in a significant decrease in diesel usage compared with FY 2008. As for the LNG changes at Site facilities, LNG is the primary source for heating at two buildings at the Site and the winter of 2020 was relatively cool. As for the changes in natural gas at town facilities, operations improved system delivery of natural gas, several new buildings have come online since FY 2008, and occupancy of the town facilities increased.

4.2.2 Mobile Combustion Emissions

INL operates a large vehicle fleet that includes everything from light-duty passenger vehicles to commercial buses to off-road equipment (including bulldozers, backhoes, cranes, road graders, dump trucks, tractors, manlifts, and even a compactor for the onsite landfill).[c] This fleet is being modernized by a variety of methods to lower overall fuel consumption and increase the use of alternative fuels, including the following:

- In FY 2021, acquired a Caterpillar D6XE Crawler Tractor dozer with an electric drive. IBL also installed and is currently evaluating a no-idle system on an agency owned bucket truck. This allows the bucket to run without idling the truck.
- Continued to evaluate and use renewable diesel (R99) fuel for all 86 buses in the INL fleet. INL selected R99 fuel as a replacement for the 20% biodiesel blend B20 in April 2017; however, due to the significantly high unit cost, R99 was not used in FY 2021, resulting in an increase in the use of petroleum-based diesel fuel. It is anticipated that R99 will be used in the future if costs decrease.
- Installed solar panels on all regular run buses to help keep the batteries charged while the buses sit idle over the weekends. This helps reduce the load on the charging systems and ensures the buses start during cold temperatures.
- Compiled quarterly flex-fuel usage and calculated the percentage of E85 used compared to unleaded gasoline. INL uses this data, when needed, to encourage the use of E85.
- Utilized low-speed electric vehicles in place of diesel-powered utility task vehicles (UTVs) across INL. Initial reviews are positive regarding safety features (i.e., outside mirrors and a backup camera), as well as slower deacceleration than the diesel-powered UTVs. However, heating performance is still an issue.

INL's commercial buses are used for transporting other INL Site contractor employees, as well as BEA employees, on their commute to and from the Site facilities. Since INL owns the bus operations for all Site contractors, these emissions are considered Scope 1 for INL.

During FY 2021, INL continued to:

- Continue efforts to build and install no-idle solar-powered HVAC systems on additional buses.
- Continue the installation of no-idle solar-powered HVAC systems on additional light-duty vehicles.
- Support further testing and deployment of a commercial no-idle system with MCI and Bergstrom. MCI, Bergstrom, and BEA will partner to evaluate the data and encourage potential commercial implementation and offering of the no-idle system as an option in General Services Administration (GSA)-leased vehicles.

As BEA had various issues with R99 in FY 2018, BEA continues to work to mitigate these issues and will continue to expand the rollout of R99 in additional vehicles and equipment that run on diesel.

c. Confirmed in February 11, 2014, e-mail from Tad Pearson and in discussion with Kathy Miles.

4.2.2.1 Calculation Method. To calculate the GHG emissions from INL's mobile combustion sources, a combination of the default and advanced methodology from the Guidance were used. INL tracks the majority of its fuel usage in TIMS, which tracks fuel used by vehicle type for road vehicles (when fuel taxes are paid), as well as a number of other vehicle metrics. Fuel purchases from WEX cards (offsite fueling card) were included in the total fuel purchased for FY 2021. A small portion of INL's fuel use is tracked with fuel sheets for off-road equipment (for which no fuel taxes are paid).

Since the amount of each type of fuel consumed by general vehicle type (bus, light-duty truck, light-duty car, equipment, and heavy-duty truck) was known (see Table 5), more specific CH_4 and N_2O emission factors were used than what is assumed for the Guidance default methodology. Since the number of miles traveled by vehicle type is not tracked accurately (some employees bypass inputting this value while refueling), the average mileage by vehicle type was used to calculate this value. For CH_4 and N_2O emission factors based on the vehicle's emission control technology (approximated by the vehicle model year) conservative assumptions were made as indicated in Appendix D, Emissions Factors Used.

Table 5. Fuel amounts and corresponding GHG emissions for INL's FY 2021 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
Diesel	Bus	449,534.22	4,592.36	—
	Equipment	99,627.96	1,026.01	—
	Heavy Duty	64,186.62	656.00	—
	Light-Duty Car	0.00	—	—
	Light-Duty Truck	0.00	—	—
E10 Ethanol Fuel Blend	Bus	—	—	—
	Equipment	11,594.37	92.80	6.67
	Heavy Duty	80,604.77	644.69	46.34
	Light-Duty Car	121,917.46	975.69	70.09
	Light-Duty Truck	166,375.81	1,328.33	95.65
E85 Ethanol Fuel Blend	Equipment	0.00	—	—
	Heavy Duty	1,077.04	1.89	5.26
	Light-Duty Car	2,651.97	4.60	12.96
	Light-Duty Truck	2,320.63	3.76	11.34
R99 Renewable Diesel	Bus	0.00	—	—
	Equipment	0.00	—	—
	Heavy Duty	0.00	—	
	Light Duty Truck	—	—	—
TOTAL		**999,890.85**	**9,326.13**	**248.31**

4.2.2.2 *Results Discussion.*

During FY 2021, INL used a combination of fossil fuels and biofuels to power its diverse vehicle fleet as shown in Table 5. Per the Guidance, the CO_2 emissions from biofuels are to be considered biogenic rather than anthropogenic emissions[d]; therefore, they were calculated and reported separately.

As shown in Table 5, INL's mobile combustion emissions were calculated to produce 9,326.13 MT CO_2e of anthropogenic and 248.31 MT CO_2e of biogenic GHG emissions in FY 2021. In FY 2021, this equates to 43.6% of INL's Scope 1 emissions, and 11.5% of the total FY 2021 anthropogenic emissions considered.

Since these data are already collected in TIMS, WEX card records, and fuel sheets, they are considered to be of high quality, with all INL-owned sources of mobile combustion included.

4.2.2.3 *Lessons Learned.*

Since the data for calculating GHG emissions from mobile combustion are already gathered at INL with TIMS, no major changes are needed for reporting in future years. However, a few tracking and reporting items could slightly improve the overall accuracy. As discussed above, the accuracy of the calculations could be improved slightly if the total miles driven were tracked along with the gallons of fuel consumed in each vehicle, and more specific vehicle information, including model year, was reported when determining the applicable CH_4 and N_2O emission factors. (Both mileage and emissions control technology affect the GHG contributions from CH_4 and N_2O, which are a small portion of the GHG compared to the CO_2 contribution.) Furthermore, other INL Site contractors' fuel use is tracked in TIMS and not readily identified as non-INL use that can be separated from INL's numbers. This includes when INL rents heavy equipment to other contractors, but these are a very small portion of the total INL use.[e]

4.2.2.4 *Comparison to FY 2008 Baseline.*

In FY 2021, GHG emissions from mobile combustion sources decreased 7.1% over the FY 2008 Baseline. When considering the differences between the total amounts of fuel consumed between these years, there was a 4.3% decrease in total gallons between FY 2021 and FY 2008.

In addition to the changes to the fleet discussed above, the largest contributor to the decrease in GHG emissions in previous years, is due to the changes in fuel types used since FY 2008. The largest fuel user at INL is the buses that were moved away from LNG (small amount of fuel used in FY 2008) and diesel (large amount of fuel used in FY 2008) to biodiesel (B20 blend) and R99 (Renewable Diesel) mixtures. Furthermore, in light-duty vehicles ethanol (E85) replaced gasoline use. These changes yielded a decrease in the associated anthropogenic emissions, and an increase in biogenic emissions. However, mobile combustion GHG emissions increased in FY 2021 from the previous year due to the termination of R99 use among fuel mixtures.

4.2.3 Fugitive Emissions: Refrigerants

Fugitive emissions from refrigerants and fluorinated gases are those GHG emissions from equipment and vehicles that are not captured or destroyed by an emissions control system (those that do not pass through a stack, chimney, etc.).

d. Although a controversial position, the Guidance states that biogenic emissions in the form of CO_2 emissions generated from biofuel combustion are to be counted separately since this carbon would have been released through the plant's natural decomposition. The CH_4 and N_2O emissions from the combustion of biofuel blends are not considered biogenic emissions.

e. Tad Pearson confirmed these small uses of INL's fuel by other INL Site contractors in a February 11, 2014, e-mail.

4.2.3.1 Calculation Method.

DOE Headquarters (DOE-HQ) publicized a data call in October 2010 for each facility's FY 2010 fugitive emissions from refrigerants and fluorinated gases that focused on the gases listed in Table 6, identified by their Chemical Abstract Service (CAS) number. The list of refrigerants has expanded over the years and the FY 2021 DOE Sustainability Dashboard was used for this year's reporting. The Guidance simple mass balance calculation takes several factors into consideration when calculating emissions, including inventory differences at the beginning and end of the reporting year and how much product was received, used, recovered, or disposed. The Guidance methodology was followed for this report for consistency with previous inventories. To evaluate INL's fugitive emissions during FY 2021, data from the following sources was reviewed:

- Purchase, usage, and disposal data contained in INL's chemical inventory database, Comply Plus
- Use and disposal information contained on Refrigeration Service Records
- Transaction and adjustment detail reports pulled from Comply Plus database for each CAS number.

Queries were run in Comply Plus for the different outcomes during FY 2021 using the CAS numbers. Additionally, INL obtained electronic and hard copies of the refrigerant service records from different facilities. These records were reviewed to determine if there was a difference between the amount of refrigerant recovered from a system and its total full capacity. If fewer refrigerants were recovered than the system's full charge amount, the difference was determined to have been released (used). If there was no difference, then there was no release. Additionally, if the refrigerant service record indicated the equipment would be disposed, any difference in the amount recovered and the full charge was considered a released (used) amount. If refrigerants were disposed, the quantity indicated on the refrigerant service record was included as disposed on the spreadsheet. Transaction detail reports were run in Comply Plus for each CAS number for the specific date range to ensure no duplicate entries from the refrigerant service record and the information maintained in Comply Plus. Any duplicate data was removed from the total amount reported. Adjustment queries were also run in Comply Plus to account for "manual" changes to inventory data that are not included in the transaction detail reports. These manual changes typically occur during chemical inventories performed by chemical coordinators. Negative values calculated are results of "found" inventory that was previously reported as used.

This methodology aligns with the default methodology presented in the Guidance. INL relied on information contained in the Comply Plus inventory database and on hard-copy maintenance records for heating, ventilation, and air conditioning (HVAC) systems and vehicles. The amounts of fluorinated gases emitted were calculated as detailed in examples in the Guidance (depending on the original units of the gas included in the database or on the maintenance record).

4.2.3.2 Results Discussion.

Using the method described above, the fugitive refrigerant emissions in Table 6 were considered for their contribution to INL's GHG emissions during FY 2021. Most of the evaluated gases in the table were not considered to have any releases during FY 2021, but they are listed in the table to show that they have been evaluated. Also shown in the table is the GWP of each gas, which indicates each gas heat-trapping impact relative to CO_2.

Table 6. Fugitive refrigerants evaluated for GHG emissions during FY 2021 at INL.

Common Name	GWP[a]	FY 2021 Guidance	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	0.00	0.00
CH_4	25	(54.60)	(0.62)
N_2O	298	0.00	0.00

Table 6. (continued).

Common Name	GWP[a]	FY 2021 Guidance	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
HFC-23	14,800	0.00	0.00
HFC-32	675	2.97	0.91
HFC-41	92	0.00	0.00
HFC-1234yf; HFO-1234yf	0.31	0.00	0.00
HFC-125	3,500	3.78	6.01
HFC-134	1,100	0.00	0.00
HFC-134a	1,430	5.07	3.29
HFC-143	353	0.00	0.00
HFC-143a	4,470	0.88	1.78
HFC-152	53	0.00	0.00
HFC-152a	124	0.00	0.00
HFC-161	12	0.00	0.00
HFC-227ca	NL	0.00	0.00
HFC-227ea	3,220	0.00	0.00
HFC-236ca	NL	0.00	0.00
HFC-236cb	1,340	0.00	0.00
HFC-236ea	1,370	0.00	0.00
HFC-236fa	9,810	0.00	0.00
HFC-245ca	693	0.00	0.00
HFC-245fa	1,030	0.00	0.00
HFC-365mfc	794	0.00	0.00
HFC-c-447-ef	NL	NE	NE
HFC-43-10mee	1,640	0.00	0.00
HFE-449s1 (HFE-7100)	297	0.00	0.00
PFC-14	7,390	0.00	0.00
PFC-116	12,200	0.00	0.00
PFC-218	8,830	0.00	0.00
PFC-318 or PFCc318	10,300	0.00	0.00
PFC-3-1-10	8,860	0.00	0.00
PFC-4-1-12	9,160	0.00	0.00
PFC-5-1-14	9,300	0.00	0.00
PFC-9-1-18	7,500	0.00	0.00
c-C3F6	17,340	0.00	0.00

Table 6. (continued).

Common Name	GWP[a]	FY 2021 Guidance	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
Methyl perfluoroisobutyl ether	0	0.00	0.00
SF6 – Sulfur Hexafluoride	22,800	0.00	0.00
NF3	17,200	0.00	0.00
TOTAL		-41.89	11.37

a. Numerous GWPs were updated in November 2013, for reporting consideration in 2014. Updated GWPs (noted in red).
NL = Not listed. GWP not listed for compound.
NE = Not evaluated. Refrigerant was not included in Consolidated Energy Data Report data call.

As shown in Table 6, INL's fugitive emissions from refrigerants were calculated to produce 11.37 MT CO_2e in FY 2021. In FY 2021, this equates to 0.1% of INL's Scope 1 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.2.3.3 Lessons Learned. The accuracy of the data used to calculate GHG emissions from refrigerants is hard to verify as some of the maintenance records are completed by hand and stored in hard copy. It is difficult to be assured that all maintenance records have been reviewed, including fluorinated gas charges. Some overlap exists in data contained on the maintenance records and Comply Plus. Comply Plus was used to verify the amounts of refrigerants emitted and the volumes reported on the maintenance records.

It may be helpful to have electronic data gathering at the point of entry (i.e., maintenance personnel enter the data directly into an electronic system that updates to Comply Plus automatically, removing one potential source of error in data entry). Also, this would eliminate the requirement to obtain hard copies of the maintenance records and remove one source of information to review during the calculations.

4.2.3.4 Comparison to FY 2008 Baseline. INL's decrease in FY 2021 over FY 2008 baseline is likely due to natural variations in fugitive purchasing cycles, improved data collection abilities, physical inventory adjustments, and using the simplified mass balance approach for calculating release emissions.

Generally, although the variation between years can be large, it is important to keep in mind the escalation of scale—overall fugitive emissions are a small contributor to the total INL GHG footprint. And although slight changes make for large changes within this emissions category, they are insignificant when compared to the total footprint.

It should be noted that INL's reporting is based on the DOE-HQ data calls for FY 2008 and FY 2021. The FY 2008 baseline data call requested information on fewer items than the FY 2021 data call.

4.2.4 Fugitive Emissions: Onsite Landfill

INL utilized a combination of both an onsite and offsite (contracted) landfill for non-hazardous solid waste disposal during FY 2021. These Scope 1 calculations look at the emissions associated with solid waste disposal in the onsite landfill at CFA, while the Scope 3 calculations look at the emissions associated with contracted MSW disposal from town facilities that go to an offsite landfill.

INL operates the landfill at CFA, which accepts waste from all INL Site contractors. The CFA landfill currently includes one open designated area for compactable non-MSW that has been receiving waste since 1984. Three other designated waste areas have been opened and closed since 1947 and are no longer receiving waste. The CFA landfill has no landfill gas collection or destruction, is not subject to Title V GHG reporting, and has no formalized operating permit.[f] A daily soil cover is applied to produce an estimated overall soil-to-trash ratio of one-to-one. Of the 198 acres currently designated as landfill space at CFA, 150 acres have been designated for compactable non-MSW, although only a portion of this area is currently being utilized.[g]

4.2.4.1 Calculation Method. To determine the Scope 1 emissions associated with INL's onsite landfill, the historical quantities of solid waste were pulled from the INWMIS database. INWMIS tracks the amounts (by both weight and volume) and types of waste collected from each Site facility for delivery to the CFA landfill. INWMIS tracks multiple types of waste, including numerous types of construction and demolition waste. For this calculation, only two categories of waste in INWMIS were considered: Category 1 for "regular trash" and Category 2 for "cafeteria waste."

EPA's Landfill Gas Emissions Model (LandGEM) was used to calculate the GHG emissions associated with the CFA landfill, as identified in the Guidance methodology. LandGEM utilizes the mass of solid waste disposed from the year the landfill was opened until the year it was closed. The historical data shown in Table 7 were input to LandGEM to get the estimated annual amounts of CO_2 (biogenic) and CH_4 (anthropogenic) produced. These calculations only considered the open portion of the CFA landfill (open since 1984) and ignored the three areas that have been closed. Since INWMIS only includes data starting in 1992, the solid waste amounts for 1984 through 1991 were estimated based on an average trend from the available data (average of the previous 5 years). The solid waste disposed of in the CFA landfill is documented in Table 7.

f. INL's CFA landfill does not receive household waste, but it does receive a portion of waste that is MSW-like. It is operated according to a State of Idaho-approved non-municipal solid waste operating plan, which prohibits disposal of many substances including hazardous waste and sludge.

g. CFA landfill information is based on correspondence with Kathy Hernandez, e-mail dated January 29, 2013, and continued conversations with the current landfill manager, Shane Arnold.

Table 7. Amount of solid waste produced annually since 1984 for disposal in INL's onsite CFA landfill.

Fiscal Year	Amount of Solid Waste (tons)
1984	15,196.35
1985	15,196.35
1986	15,196.35
1987	15,196.35
1988	15,196.35
1989	15,196.35
1990	15,196.35
1991	15,196.35
1992	40,540.28
1993	8,308.58
1994	13,707.36
1995	9,178.26
1996	4,247.27
1997	1,436.32
1998	3,479.26
1999	1,135.21
2000	1,091.80
2001	972.30
2002	1,099.19
2003	1,299.64
2004	1,639.89
2005	1,070.45
2006	1,754.07
2007	1,145.95
2008	826.64
2009	647.06
2010	805.48
2011	708.65
2012	663.54
2013	567.14
2014	610.95
2015	618.91
2016	675.14
2017	703.94
2018	700.40
2019	608.07
2020	457.19
2021	455.06
TOTAL	222,116.54

4.2.4.2 Results Discussion. INL's disposal of non-hazardous solid waste in the onsite landfill at CFA is estimated to conservatively contribute 5,823 MT CO_2e of anthropogenic emissions to the GHG inventory during FY 2021. An additional 710.10 MT CO_2e of biogenic emissions were contributed to the GHG inventory during FY 2021. In FY 2021, the anthropogenic emissions equate to 27.2% of INL's Scope 1 emissions, and 7.2% of the total anthropogenic emissions considered.

4.2.4.3 Lessons Learned. Since INL currently tracks the quantities and types of materials sent to the onsite landfill at CFA, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years. However, additional searching may identify the amounts deposited in the landfill prior to 1992; this information had to be estimated for this calculation.

4.2.4.4 Comparison to FY 2008 Baseline. In FY 2021, GHG emissions from the landfill decreased 2.3% over the FY 2008 GHG baseline. When considering the change in the amount (weight) of waste disposed per Site employee against the FY 2008 baseline, FY 2021 showed a 57.3% decrease. It should be noted that the GWP for CH_4 increased 16% from 21 to 25, resulting in a larger increase in emissions regardless of a decrease in waste being disposed (there is a 45.0% decrease in the amount of waste sent to the landfill over the FY 2008 GHG baseline).

In addition to EO 13834 indicating GHG emissions should be tracked and reported, where required, that led to INL quantifying their annual GHG emissions, the EO covers a number of other environmental areas, including waste prevention and recycling. INL is currently working to divert their solid waste to meet a goal of 50% diversion by weight each year; this diversion rate is expected to result in a decrease in the overall amount of solid waste deposited in the landfill; however, it is not guaranteed since the diversion goal only considers the waste produced within a single year rather than with previous years.

It should be noted that the onsite landfill GHG calculations (the LandGEM) rely predominately on historical waste disposal amounts rather than current information. A significant lag time occurs before the current actions will have a notable effect on the associated GHG emissions, particularly diversion efforts (e.g., recycling).

4.2.5 Fugitive Emissions: Onsite Wastewater Treatment

At its Site facilities, INL operates its own wastewater treatment that consists of a combination of lagoons and septic systems. Evaporative lagoons are located at the major facilities, while septic tanks are located at the smaller or remote locations, including Experimental Breeder Reactor I, SMC fire station, the Gun Range, the Main INL Guard Gate, and the Critical Infrastructure Test Range Complex (CITRC) (formerly known as the Special Power Excursion Test Reactor Tests II, III, and IV). It should be noted that the evaporative lagoons are facultative, with an aerobic upper layer and an anaerobic lower layer. The methodology behind the Guidance considers facultative lagoons to be anaerobic.

INL also operates several lagoons (including evaporative ponds) for industrial waste. Since this industrial waste does not contain significant amounts of organics, the lagoons were not considered in these calculations.

4.2.5.1 Calculation Method. INL's data on onsite lagoons used for wastewater treatment are identified by facility in Table 8 for FY 2021. INL's Human Resources department provided the employee counts at each facility as an average for the year based on the numbers at the end of each quarter. The number of visitors to each facility was estimated based on 10% of the number of employees—a conservative estimate to account for subcontractors and visitors.

Table 8. FY 2021 population data by facility for onsite wastewater treatment calculations.

Facility Name	Wastewater Type	Number of Employees	Number of Visitors	Total Population Considered
EBR-I	Septic Tank	0.00	0.00	0.00
CITRC	Septic Tank	1	0.1	0.994
Gun Range	Septic Tank	3.33	0.333	3.311
Main INL Guard Gate	Septic Tank	0.00	0.00	0.00
			TOTAL SEPTIC POPULATION	4.306
ATR	Lagoon	546	54.575	453.245
CFA	Lagoon	525	52.483	521.891
MFC	Lagoon	1127	112.742	976.007
SMC	Lagoon	320	32.033	343.906
			TOTAL LAGOON POPULATION	2,295.050

The population data from Table 8 were used with the calculation method in the Guidance, and the default national averages (from the Guidance) for the specific treatment process. It should be noted that EBR-1 is only open seasonally and could not open due to the COVID-19 pandemic in FY 2021 and Human Resources department numbers did not report any employees at the Main INL Guard Gate. Also, the total population considered was adjusted based on the COVID-19 facility-specific factors determined in the Employee Commute section (see Section 4.4.2).

4.2.5.2 Results Discussion. INL's onsite wastewater treatment is estimated to contribute 157.54 MT CO_2e (157.27 from lagoons and 0.27from septic systems) emissions to the GHG inventory during FY 2021. In FY 2021 this equates to less than 1% of INL's Scope 1 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.2.5.3 Lessons Learned. For future inventories it is believed that site-specific data and the factors unique to INL would produce more accurate results than calculations based on national averages. In addition, future calculations for industrial waste treatment should be included, even though these are likely minimal GHG contributors relative to the lagoons.

4.2.5.4 Comparison to FY 2008 Baseline. In FY 2021, there was an apparent 22.2% increase over the FY 2008 GHG Baseline; however, in FY 2014 the GWP for CH_4 increased from 21 to 25. When FY 2008 baseline numbers were recalculated with the updated GWP, emissions from onsite wastewater actually increased 0.9%. Since the wastewater calculations are based on employee counts and were factored for the reduced number of onsite employees for the COVID-19 pandemic, the increase in GHG emissions from wastewater generally followed the increase in Site employee numbers of 28.8% in FY 2021 over the FY 2008 baseline.

4.3 Scope Two – Indirect Emissions

INL's FY 2021 Scope 2 emissions are summarized in Figure 8, with a comparison to the FY 2008 baseline shown in Figure 9. A discussion of INL's FY 2021 Scope 2 emissions categories follows, including the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY 2008 baseline results. A comprehensive table, as well as the FY 2008 baseline emissions and the subsequent FY data, is included in Appendix E, Scope 2 Comprehensive Tables.

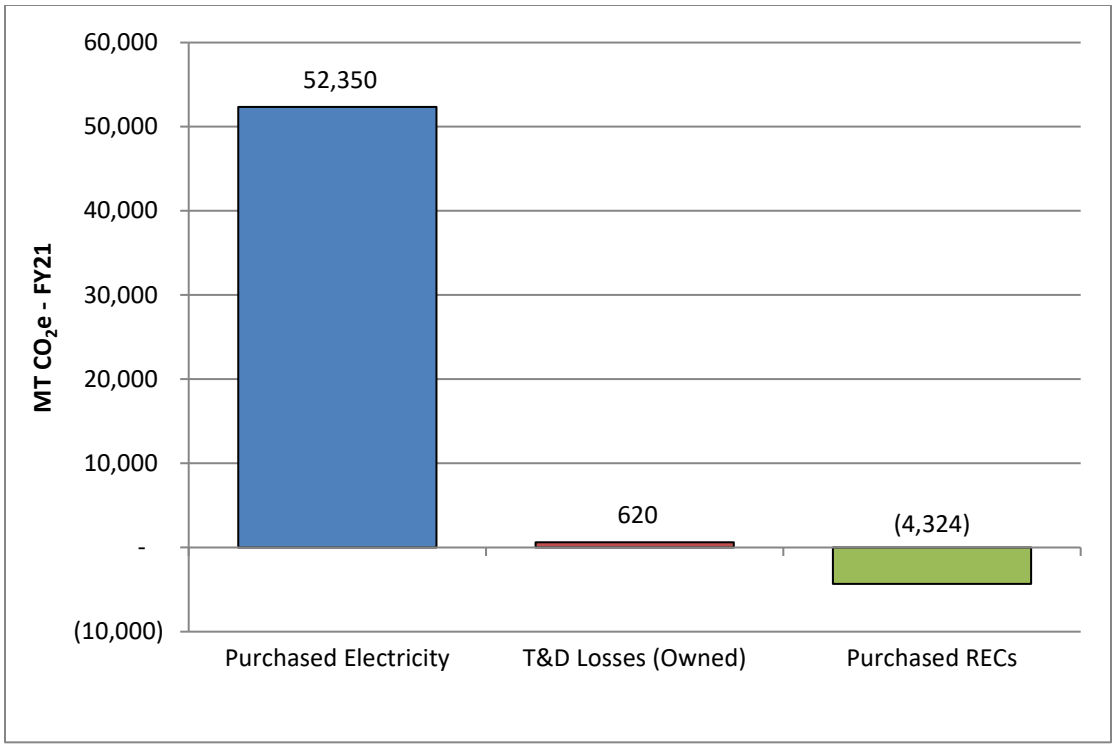

Figure 8. INL's FY 2021 GHG emission results for Scope 2.

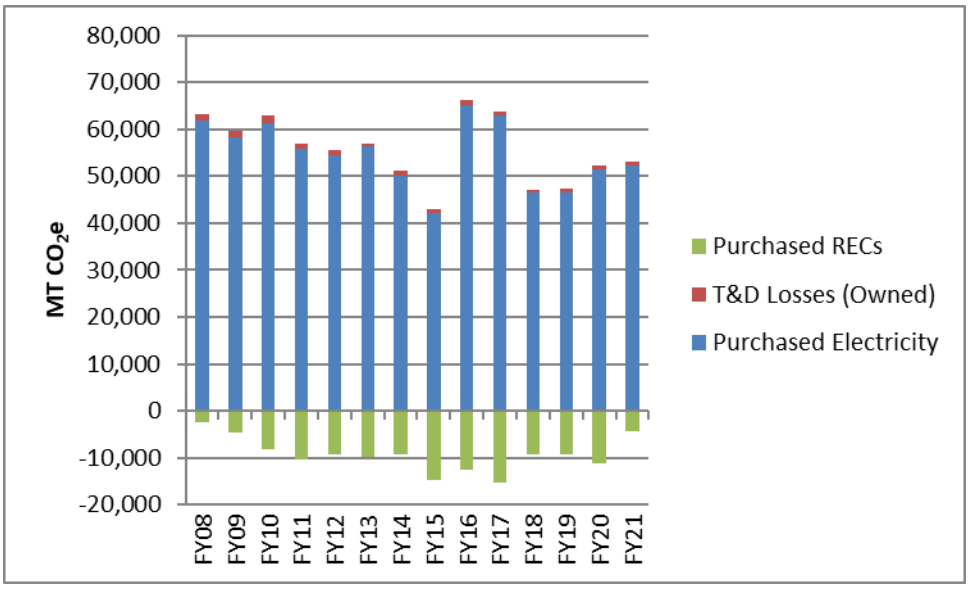

Figure 9. Comparison of INL's FY 2008 through FY 2021 Scope 2 GHG emissions.[h]

h. Scope 2 numbers for FY 2011 and FY 2012 were revised in FY 2013 as a result of a revision to Scope 2 total calculations.

4.3.1 Purchased Electricity Emissions

4.3.1.1 Calculation Method. These calculations follow the Guidance default methodology of electricity purchases reported for the DOE Sustainability Dashboard. The amounts are determined based on a combination of monthly electrical bills and INL's onsite electricity meters. Since these data are also submitted in the DOE Sustainability Dashboard and they are tracked for the INL Site, the only calculations needed were to isolate the emissions owned by INL (consumed in INL-operated facilities) from the other INL Site contractors.

INL purchases electricity from four different electrical utilities to support the operations of its different facilities: Idaho Falls Power supplies electricity to the town facilities, Idaho Power supplies electricity to the Site facilities as well as some small locations outside of Idaho Falls city limits, and Rocky Mountain Power and Lost River Electrical Company provide electricity to some of the smaller buildings and equipment outside of Idaho Falls city limits, including lighting at some bus lots. The breakdown in electrical purchases by electrical provider is shown in Table 9 for FY 2021.

INL purchased 160,322.38 MWh during FY 2021, with 51,893.39 MWh provided to non-Site locations, and 108,216.61 MWh going to INL facilities at the INL Site. Per the Guidance, the emission factors for purchased electricity are determined using the EPA's Emissions and Generation Resource Integrated Database (eGRID) and the location of INL's facilities. eGRID uses subregional emission factors based on plant-specific data in that region, as reported to the EPA, the Energy Information Administration, and the Federal Energy Regulatory Commission. (For more information on eGRID, refer to https://www.epa.gov/energy/egrid.) All INL facilities are located in the Western Electricity Coordinating Council (WECC) Northwest eGRID subregion, the Northwest Power Pool (NWPP).

Table 9. INL's FY 2021 electrical purchases by location and provider.

Location	Owner of T&D System	Electrical Provider	FY 2021 Electricity Purchase (MWh)
INL Site	INL	Idaho Power (includes owned T&D losses)	108,216.61
SUBTOTAL (Site)			108,216.61
Assorted Locations (excludes INL Site)	Electrical Provider	Idaho Power	100.68
Town Facilities	Electrical Provider	Idaho Falls Power	51,893.39
Assorted Locations Outside INL Site and Idaho Falls City Limits	Electrical Provider	Lost River Electric Company	3.19
Assorted Locations Outside INL Site and Idaho Falls City Limits	Electrical Provider	Rocky Mountain Power	108.50
		SUBTOTAL (Non-Site)	52,105.76
		TOTAL INL Purchases	160,322.38

4.3.1.2 Results Discussion. For FY 2021, the purchased electricity and owned T&D losses amount to 52,970.89 MT CO_2e, which is all INL's Scope 2 emissions (before accounting for the credit from the RECs) and 64.0% of the net total anthropogenic emissions considered.

4.3.1.3 Lessons Learned. Since these data are already collected and reported annually for the DOE Sustainability Dashboard, they are considered to be of high quality.

4.3.1.4 Comparison to FY 2008 Baseline. In FY 2021, INL purchased 4.3% more electricity than the FY 2008 Baseline yet yielded a 15.2% decrease in associated GHG emissions. The eGRID emission factors highly influence GHG emission amounts. The eGRID emission factors were updated for this year's reporting and increased by 11.9%. As the eGRID factors are updated periodically, previous year emissions were not recalculated.

Efforts to reduce the overall INL carbon footprint will focus on reducing electricity demand and increasing REC purchases since this source is such a significant contributor. Efforts are also underway to secure clean energy from our service provides and operation of an onsite micro-grid to minimize purchased electricity.

4.3.2 Transmission and Distribution Loss Emissions, Owned

4.3.2.1 Calculation Method. The Guidance calls for differentiating between T&D losses within INL's operational controls and those outside INL's operational controls as Scope 2 and 3, respectively, based on whether the organization owns the associated transmission lines. To facilitate this differentiation, electricity purchases in Table 9 are identified according to who owns the T&D system: INL or the electrical provider. Since INL owns the electrical grid at the Site, and the T&D losses are considered within INL's operational controls, the electricity purchase for the Site from Idaho Power (shown in Table 10) includes the associated T&D losses. (The Scope 3 T&D losses [outside INL's operational controls] are based on the total INL electrical purchase.)

The amount of INL's owned T&D losses was calculated based on an average T&D loss factor of 1.756% in FY 2021. This percentage was determined based on the difference between the total amount of electricity purchased for the INL Site (based on the Idaho Power meter at the Scoville, Idaho substation) and the total metered amounts at individual Site facilities (this difference accounts for the losses within the INL Site).

4.3.2.2 Results Discussion. The owned T&D losses of 1,900.07 MWh for FY 2021 equates to 620.43 MT CO_2e of emissions. It should be noted that this T&D loss is already accounted for in the purchased electricity emissions, and simply reduces the GHG emissions from the purchased electricity report above; the goal of these calculations was to isolate this amount for reporting purposes according to the Guidance.

4.3.2.3 Lessons Learned. Since this calculation is based on a percentage of the GHG emissions presented for INL's Scope 2 electricity purchases, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years.

4.3.2.4 Comparison to FY 2008 Baseline. Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY 2008 Baseline yields the same results as Section 4.3.1.4.

4.3.3 Renewable Energy Certificates Emissions

4.3.3.1 Calculation Method. In addition to the electricity purchased directly for its facilities, INL purchased the following amount of RECs to offset a portion of its carbon emissions:

- 13,242.00 MWh in FY 2021 from multiple wind power projects in Idaho, Washington, Oregon, and Wyoming. (See Appendix F, Receipt for RECs Purchased in FY 2021, for the receipt, which includes details on INL's total RECs purchase, included all INL contractors). When EO 13834 was issued in May 2018, the required REC purchase % was reduced from 15% of purchased electricity to 7.5% (deferring back to statute-driven requirements).

INL did not actually purchase renewable energy, but rather purchased the RECs or certified environmental benefits of the renewable energy generated in another region to support the growth and expansion of the renewable energy industry as a whole. INL is credited for the GHG emissions that this renewable energy did not emit.

The emission factors for the RECs purchased for FY 2021 are based on the wind generation and hydro-efficiency facility locations in Idaho, Washington, Oregon, and Wyoming, and the NWPP of the WECC eGRID subregion (the subregion was determined using the facility's ZIP Codes and EPA's Power Profiler Website [https://www.epa.gov/energy/egrid]). (Note previous reports continued to follow the earlier Guidance that called for using the eGRID non-baseload emission rates for calculating the GHG emissions associated with RECs, as opposed to the baseload emission rates used for emissions from purchased electricity; however, this was changed this year. The same regional baseload emissions rate was used to calculate the offsets from RECs purchased.)

4.3.3.2 Results Discussion. Table 10 summarizes how much INL reduced its Scope 2 GHG emissions in FY 2021 by purchasing RECs. Specifically, the RECs purchased decreased the overall Scope 2 GHG emissions by 4,323.94 MT CO_2e in FY 2021.

Table 10. INL's GHG emissions from electricity and RECs purchased in FY 2021.

Emissions Category	FY 2021 GHG Emissions (MT CO_2e)
Purchased Electricity (includes T&D losses within INL's operational controls)	52,970.89
Purchased RECs (displaced GHG emissions)	(4,323.94)
SCOPE 2 TOTAL	48,646.95

4.3.3.3 Lessons Learned. Since these data are based on the RECs receipts and are already collected and reported annually for the DOE Sustainability Dashboard, they are considered to be of high quality.

4.3.3.4 Comparison to FY 2008 Baseline. In FY 2021, significantly more (189.4 % more) RECs were purchased than FY 2008 (by MWh). The associated emissions avoided were calculated according to the NWPP subregional eGRID emission factors, which led to a 76.8 % increase over FY 2008.

4.4 Scope Three – Indirect Emissions

INL's FY 2021 Scope 3 emissions are summarized in Figure 10, with a comparison to the FY 2008 baseline shown in Figure 11. Each of the Scope 3 emissions categories is discussed here and includes the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY 2008 baseline results. A comprehensive table, as well as the FY 2008 baseline emissions and the subsequent FY data, is included in Appendix G, Scope 3 Comprehensive Tables.

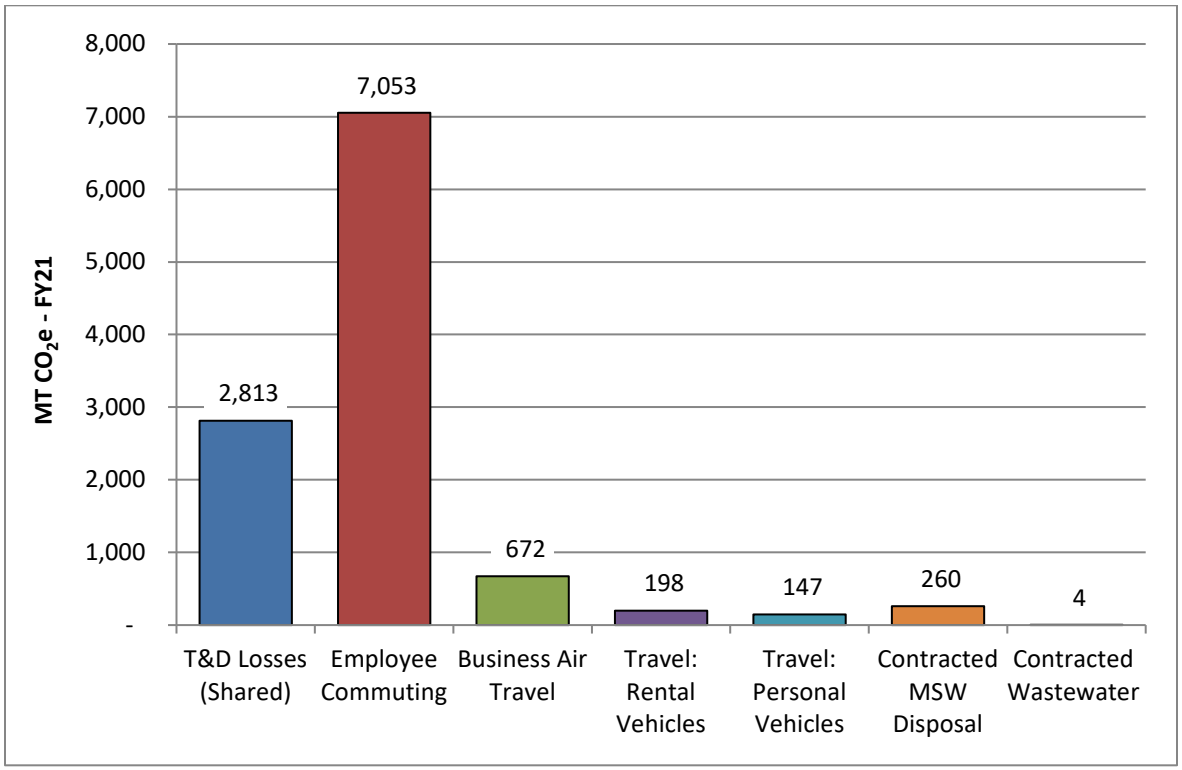

Figure 10. INL's FY 2021 GHG emission results for Scope 3.

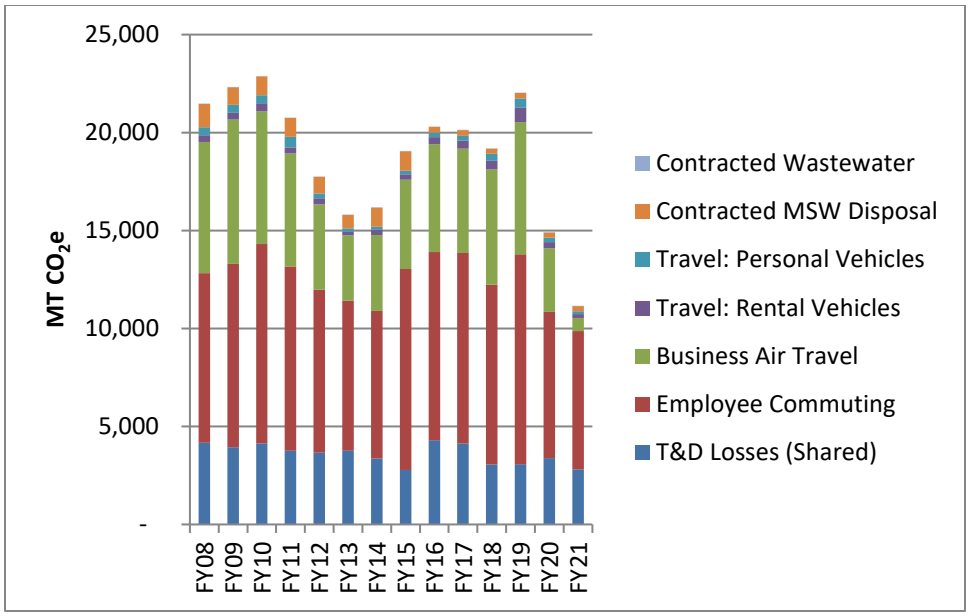

Figure 11. Comparison of INL's FY 2008 through FY 2021 Scope 3 GHG emissions.

4.4.1 Transmission and Distribution Loss Emissions, Shared

4.4.1.1 Calculation Method. The Guidance provides only a default calculation methodology for determining the GHG emissions from T&D losses outside INL's operational control. This method assumes the regional average T&D loss factor of 5.1% for purchased electricity and utilizes the same eGRID subregion emission factors used for Scope 2 purchased electricity (https://www.epa.gov/energy/egrid). As stated in Section 5.3.1.1, the Guidance differentiates between T&D losses inside and outside of INL's operational controls. While the owned T&D losses reported in Scope 2 are based only on the electricity purchased at the Site where INL owns the T&D lines, the Scope 3 shared T&D losses are based on INL's total annual electrical purchases.

4.4.1.2 Results Discussion. A T&D loss of 5.1% equates to 10,565.24 MWh for INL's FY 2021 electricity purchases, and 2,813.35 MT CO_2e of emissions. In FY 2021 this equates to 25.2% of INL's Scope 3 emissions, and 3.5% of the total anthropogenic emissions considered.

4.4.1.3 Lessons Learned. Since this calculation is based on a percentage of the GHG emissions presented for INL's Scope 2 electricity purchases, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years.

4.4.1.4 Comparison to FY 2008 Baseline. Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY 2008 Baseline yields the same results as Section 4.3.1.4.

4.4.2 Employee Commuting Emissions

4.4.2.1 Calculation Method. The Guidance identified an employee survey as the best source for calculating the GHG emissions from employee commuting. Employee commuting behaviors for FY 2008 and FY 2009 were calculated by utilizing available historical data that was gathered and combined with appropriate assumptions for FY 2008 and FY 2009 calculation. Because of the impacts of COVID-19, the FY 2021 calculation of employee commuting emissions were based on estimates calculated from the monthly number of employees provided by Human Resources and monthly commuting percentages provided by each directorate. This resulted in facility-specific factors for the employees commuting for FY 2021, which were:

- ATR: 75.5%
- CFA: 90.4%
- MFC: 78.7%
- REC: 29.7%
- SMC: 97.6%.

In FY 2021, INL extrapolated the total INL miles traveled based on average results from the previous years' surveys (FY 2019, 2017, and 2016) instead of conducting an employee commute survey, as was done in previous years. These extrapolated numbers were then factored for the COVID-19 commuting assumptions to estimate total number of miles commuted by INL employees.

4.4.2.2 Results Discussion. As shown in Table 11, INL employees commuted an estimated 17.3 million vehicle-miles during FY 2021. The associated GHG emissions were estimated to be 7,053.37 MT CO_2e. In FY 2021, the GHG emissions equates to 63.3% of INL's Scope 3 emissions, and 8.7% of the total anthropogenic emissions.

Table 11. Number and type of commute miles traveled by INL employees during FY 2021.

Type of Miles	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	9,964,437	3,587.15
Passenger SUV or Truck Miles, Gasoline	5,400,563	2,657.38
Motorcycle Miles	65,182	12.70
Passenger Car Miles, Diesel	171,742	77.64
Passenger SUV or Truck Miles, Diesel	1,079,442	605.83
Passenger Car Miles, Alternative Fuel	593,071	112.67
TOTAL VEHICLE MILES	17,274,437	7,053.37
Walk, Run, or Bike Miles	70,345	
TOTAL COMMUTE MILES	17,344,782	7,053.37

4.4.2.3 Lessons Learned. Since these data are collected from employee survey responses, they are considered accurate. In FY 2021, INL did not collect data from an employee commute survey, rather data was extrapolated based on the 3-year average from FY 2019, 17, and 16 and factored for the directorate and facility-specific commuting estimates. INL is planning on conducting an employee commute survey every other year.

4.4.2.4 *Comparison to FY 2008 Baseline.*

In FY 2021, there was an 18.5% decrease in GHG emissions from employees commuting over the FY 2008 Baseline, a 14.7% decrease in the total number of commute miles, and a 35.0% decrease in the number of commute miles per employee. The reduction in number of commute miles per employee are likely due to the COVID-19 enforcement of maximum teleworking. Vehicle and fuel-type data is not available for FY 2008 baseline, but compared to FY 2020, there was decrease in the number of alternative fuel vehicle miles of 112,802 representing a decrease of 16.0% between FY 2020 and FY 2021.

The extrapolated and factored method used to gather the commute data in FY 2021 could be considered more accurate than the method used in FY 2008, which called for a great number of assumptions.

4.4.3 Business Air Travel Emissions

INL employees took 1,556 business trips during FY 2021, as indicated by submitted and approved travel request forms. Employees submit the forms to the INL Travel Office to make necessary reservations for both domestic and international travel on behalf of INL. Travel request forms are also submitted to secure insurance coverage for employees when travel arrangements are not needed in the cases where employees use an INL fleet vehicle or is carpooling in another employee's personal vehicle to an offsite location (this could lead to no Scope 3 GHG emissions calculated).

Each trip can include commercial airline and/or ground travel (in both personal and rental cars). Ground travel by taxi, bus, or rail is less common and is currently only tracked as a dollar value when an employee requests reimbursement. For the FY 2021 GHG calculations, only employees traveling by commercial airline, personal vehicle, and rental vehicle were included. GHG calculations for travel by taxi, bus, rail, and other commercial means are not currently tracked; furthermore, they are considered de minimis when compared to these other transportation means, especially airline travel. It is also considered likely that INL travelers with large ground transportation needs will rent a car rather than take public transportation; thus, these emissions are included in INL's FY 2021 inventory.

INL travel requests are submitted by full-time INL employees as well as by subcontractors, student interns, and prospective employees traveling for interviews, house hunting, and/or relocation. If an employee is performing work for others, their trip may be paid for and arranged by the external entity, and thus these data would not be tracked by the INL Travel Office nor included in the reported airline miles. This would also apply to tracking the associated personal and rental car miles. In these cases, the "other" would own the associated GHG emissions.

4.4.3.1 *Calculation Method.*

The Guidance provides one calculation method (the default methodology) for calculating the GHGs of airline travel, which is based on the actual flight miles traveled. This data was provided by the travel vendor as total passenger-miles traveled on short-, medium-, and long-haul flights[i] based on the length of each individual flight leg of an employee's trip (as opposed to the total miles between the starting and destination airports). These passenger-miles were then multiplied by the appropriate emission factors for short-, medium-, and long-haul flights that account for the increased GHG emissions during take-off and landing. (This is different from the FY 2008 calculation approach when the travel vendor was only able to provide a value for the total passenger-miles traveled, and then it was multiplied by an average emission factor per mile of commercial flight.)

i. Short haul are flight segments <300 miles, medium haul are flight segments 300–699 miles, and long haul are flight segments >700 miles.

4.4.3.2 Results Discussion. Table 12 shows that the 3,412,719 passenger-miles flown by INL employees during FY 2021 resulted in an estimated 672.28 MT CO_2e, or 0.197 MT CO_2e per 1,000 passenger-miles for the year. In FY 2021, this equates to 6.0% of INL's Scope 3 emissions and 0.8% of the total anthropogenic emissions considered.

Table 12. Number of miles flown by INL employees during FY 2021.

Type of Miles	FY 2021	
	Number of Passenger-Miles	GHG Emissions (MT CO_2e)
Short Haul	353,652	98.25
Medium Haul	539,735	88.28
Long Haul	2,519,332	485.75
TOTAL	3,412,719	672.28

4.4.3.3 Lessons Learned. Since this data is already tracked and reported in the DOE Sustainability Dashboard, it is considered accurate and no changes are needed for future reporting.

4.4.3.4 Comparison to FY 2008 Baseline. When comparing the FY 2021 inventory to the FY 2008 GHG baseline, there was an 89.9% decrease in airline GHG emissions, 86.0% fewer passenger-miles flown, and an overall 88.7% decrease in the number of trips[j] per employee.

INL employees traveled fewer miles in FY 2021 than in FY 2008, mainly due to the COVID-19 implementation of a travel ban. It should be noted that the FY 2008 passenger-miles were not able to be broken down into flight length, which resulted in using an emissions factor for unknown flight lengths that appears to have been more conservative than using emission factors specific to the flight segment length.

4.4.4 Business Ground Travel: Rental Vehicle Emissions

4.4.4.1 Calculation Method. For calculating the GHG emissions from rental vehicles, the INL Travel Office was able to provide the total number of miles that INL employees traveled during FY 2021 by each vehicle class. This data was provided by the rental car vendor.

Vehicle classes were divided into two categories: passenger cars and light-duty trucks/vans/SUVs. The emission factors from the Guidance were applied accordingly based on these two categories.

This calculation process followed the Guidance's advanced methodology since the number of miles traveled in each rental car class was known (the default methodology called for making assumptions on the numbers of vehicle miles per rental car use).

j. The number of trips includes all of the trips coordinated by the INL Travel Office and includes more than airline trips.

4.4.4.2 Results Discussion. As shown in Table 13, INL's rental car use during FY 2021 resulted in 198.37 MT CO_2e based on 495,259 vehicle-miles traveled this year. In FY 2021 this equates to 1.8% of INL's Scope 3 emissions, and 0.2% of the total anthropogenic emissions considered.

Table 13. Number of vehicle-miles traveled in rental cars by INL employees during FY 2021.

	FY 2021	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	267,297	91.85
Light-Duty Truck/Van/SUV	227,962	106.52
TOTAL	495,259	198.37

4.4.4.3 Lessons Learned. Since the number of miles traveled in rental vehicles is already tracked by the rental car vendors and reported in the DOE Sustainability Dashboard, these data are considered to be of high quality, and no changes are needed for tracking the data in future years.

4.4.4.4 Comparison to FY 2008 Baseline. In FY 2021, GHG emissions from rental vehicle business travel decreased 43.5% over the FY 2008 Baseline, while the number of miles traveled decreased by 38.5%. The largest decrease was from passenger car miles, decreasing 46.5% over the FY 2008 baseline, while SUV or truck miles decreased by 25.6%.

4.4.5 Business Ground Travel: Personal Vehicle Emissions

4.4.5.1 Calculation Method. For calculating the GHG emissions from personal vehicles, the INL Travel Office was able to provide the total number of miles that INL employees traveled during FY 2021 in personal vehicles as submitted in electronic expense reports for reimbursement. The expense report programmer provided this data to the INL Travel Office.

To determine which emission factors to use for calculating the associated GHG emissions during FY 2021, the distribution between passenger cars and light-duty trucks/vans/SUVs that was found in the FY 2021 employee commute survey was used (this amounted to 62% of the travel completed in passenger cars and 38% in light-duty trucks/vans/SUVs).

4.4.5.2 Results Discussion. The 375,821 vehicle-miles that INL employees traveled during FY 2021 resulted in an estimated 146.63 MT CO_2e. In FY 2021, this equates to 1.3% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.4.5.3 Lessons Learned. The continuously improving electronic system for expense reports will continue to allow for more streamlined and accurate reporting of personal car miles than previous years (FY 2008 and FY 2009) when a representative sample was used. An additional assumption could be removed in future years if employees were asked to indicate the type of vehicle they used for their personal vehicle miles during the reimbursement process (since the actual distribution between the type of vehicles traveled was not known, an assumption was made based on the commute survey responses).

4.4.5.4 Comparison to FY 2008 Baseline. In FY 2021, GHG emissions from personal vehicle business travel decreased 64.5% over the FY 2008 Baseline, while the number of miles traveled also decreased by 61.1%. Much of this reduction is likely due to the implementation of a travel ban during COVID-19.

4.4.6 Contracted MSW Disposal Emissions

4.4.6.1 Calculation Method. To determine the Scope 3 emissions associated with INL's contracted offsite waste disposal from town facilities during FY 2021, the quantity of MSW sent to an offsite landfill was compiled. This information came from the City of Idaho Falls invoice records of the trash-collection history for each town building, including dumpster location, size of dumpster, and pick-up frequency.

Since the City of Idaho Falls does not track actual volumes or weights of solid waste collected from INL facilities, the records of dumpster size and pick-up frequency from monthly invoices were used to calculate an estimated volume (assuming dumpster fill rates of 80%). A site-specific density was used for FY 2021. The site-specific density was calculated from a waste audit conducted in July 2016. Based on the waste audit, town MSW density is calculated using 46 pounds per cubic yard (lbs/CY). The FY 2021 volume of 8,192 cubic yards, was converted to a weight based on the site-specific density.[k] This resulted in a weight of 188.41 tons (376,813 pounds) for INL's offsite MSW disposal during FY 2021.

The Guidance default methodology identifies the EPA's municipal solid waste mass balance model to calculate the GHG emissions associated with offsite MSW disposal. The estimated weight of INL's MSW disposed offsite was used with the calculation method in the Guidance, along with default national averages (from the Guidance).

4.4.6.2 Results Discussion. INL's offsite disposal of MSW during FY 2021 is estimated to contribute 260.22 MT CO_2e to FY 2021's anthropogenic GHG inventory. In FY 2021, this equates to 2.34% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

It was also calculated that 31.81 MT CO_2e of biogenic emissions associated with MSW disposal were released in FY 2021.

4.4.6.3 Lessons Learned. Since the quantity of INL's MSW sent for offsite disposal is based on estimated volumes, it would be preferable to work with the City of Idaho Falls to get actual weights collected. If actual weights are not available, then actual volumes could be collected, and could be analyzed using the site-specific density. These approaches will also assist with more accurate tracking of INL's waste disposal and overall diversion rates that are in line with the waste prevention and recycling goals under EO 13834.

In addition to the waste volumes estimated from the city, INL has several small buildings located outside of the Idaho Falls city limits that were not included in the amount of MSW collected from INL for offsite disposal. In future years it would be good to include these amounts.

4.4.6.4 Comparison to FY 2008 Baseline. In FY 2021, GHGs decreased 78.1% over the FY 2008 baseline. When considering the change in waste disposed per employee against the FY 2008 baseline, FY 2021 showed an 84.7% decrease. These decreases are substantially due to the change from using an assumed density to the site-specific density. A portion is also due to the change in recycling practices at INL Site and town facilities, which allows for a greater number of items to be recycled.

As discussed previously in Section 4.2.4.4 for the onsite landfill baseline comparison, the EO 13834 waste prevention and recycling goals are expected to decrease INL's amount of GHGs produced by contracted MSW disposal.

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k. Historic calculations used an assumed solid waste density of 150 pounds per cubic yard (density value was selected based on EPA range [www.archive.epa.gov/wastes/conserve/tools/recmeas/web/pdf/guide_b.pdf]). This source has been updated (https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf) as of 2016, however historic numbers were not updated since site-specific data is now known.

4.4.7 Contracted Wastewater Treatment

4.4.7.1 Calculation Method. Wastewater from INL's town facilities is sent for treatment to the City of Idaho Falls' wastewater treatment plant and is INL's only source of offsite contracted treatment.

Employee counts at INL's town facilities were provided by Human Resources as an average during FY 2021, based on the total number of employees at the end of each month of the year. The reported number of town employees was 2,407 employees for FY 2021. The number of visitors to the town facilities was estimated based on 10% of the number of employees. This yielded a total population of 2,647 then factored for the 29.7% onsite workers during COVID-19 operations, resulting in a population of 786 onsite town employees, which was used with the calculation method in the Guidance along with default national averages (from the Guidance) for the specific treatment process.

4.4.7.2 Results Discussion. INL's contracted wastewater treatment during FY 2021 is estimated to contribute 4.43 MT CO_2e[l] emissions to the GHG inventory. In FY 2021, this equates to less than 0.0% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.4.7.3 Lessons Learned. For future inventories it is believed that site-specific data and factors would produce more accurate results than calculations based on national averages.

4.4.7.4 Comparison to FY 2008 Baseline. In FY 2021, there was an approximate 61.8% decrease over the FY 2008 GHG baseline (as recalculated in FY 2016, see footnote). Since the wastewater calculations are based on employee counts, the decrease in GHG emissions from wastewater generally followed the factored decrease in INL's total town onsite employee counts of 60.3%, not including the 10% visitor numbers, and full realization of water reduction activities implemented previously.

l. It should be noted that during the FY 2012 calculations, it was discovered that an incorrect equation was used for FY 2008 and subsequent years. The Guidance directions indicated the reporting portal would automatically calculate emissions from flaring. This was missed in previous years. For FY 2008 percentage comparisons, the FY 2008 data was revised for total emissions from contracted wastewater treatment of 12.25 MT CO_2e, resulting in a 7.9% increase for FY 2012 for both population change and for GHG emissions. ("Offsite Wastewater (FY08)" tab in "FY12 Wastewater for GHG (Scope 1+3) 9Oct12.xlsx"). In FY 2016 it was discovered the FY 2008 WWTP baseline assumption was different (to include nitrification/denitrification) than the actual operations of the centralized WWTP (no consistent use of nitrification/denitrification). To have a more accurate comparison, the FY 2008 baseline (and subsequent years) was recalculated with the assumption of no nitrification/denitrification and should be 11.60 MT CO_2e.

5. PUTTING INL'S FOOTPRINT INTO PERSPECTIVE

During FY 2021, the INL GHG inventory is estimated to have emitted 81,185.05 MT of anthropogenic CO_2e. This represents 15.8 MT for each employee working at INL that year. Furthermore, the total GHG emissions generated by INL during FY 2021 are the equivalent to the CO_2 emissions from any one of the following.[m]

- Consuming approximately 9.2 million gallons of gasoline or more than 189,501 barrels of oil
- Driving 17,636 passenger vehicles for 1 year
- Supplying electricity to 15,926 homes for 1 year.

Comparing these equivalency results to the FY 2008 baseline shows that INL removed an equivalent of 4,507 vehicles from the road in FY 2021. As an overall reduction goal, INL is progressing to meet the total emissions goals for FY 2025, which is the basis of this report. The FY 2025 target goal for INL is 62,318 MT of anthropogenic CO_2e.

m. Calculated with the EPA Greenhouse Gas Equivalencies (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) in April 2022.

6. SUMMARY AND CONCLUSIONS

The previous EO 13693 mandated reductions in the output of GHGs generated by federal agencies. These reductions were targeted at 50% for direct (Scope 1 and 2) emissions and 25% for indirect (Scope 3) emissions, all by 2025 (White House 2015). The EO set 2008 as the baseline year against which reductions would be measured. INL maintained those goals for consistency and this report documents the calculations for INL's FY 2021 inventory and the associated reductions. The reductions observed in GHG emissions are shown in Figure 12 along with the 2025 goal. The specific values in FY 2021 consist of a 24.2% reduction for Scopes 1 and 2, and a 48.1% decrease for Scope 3 was calculated over the respective FY 2008 baseline values.

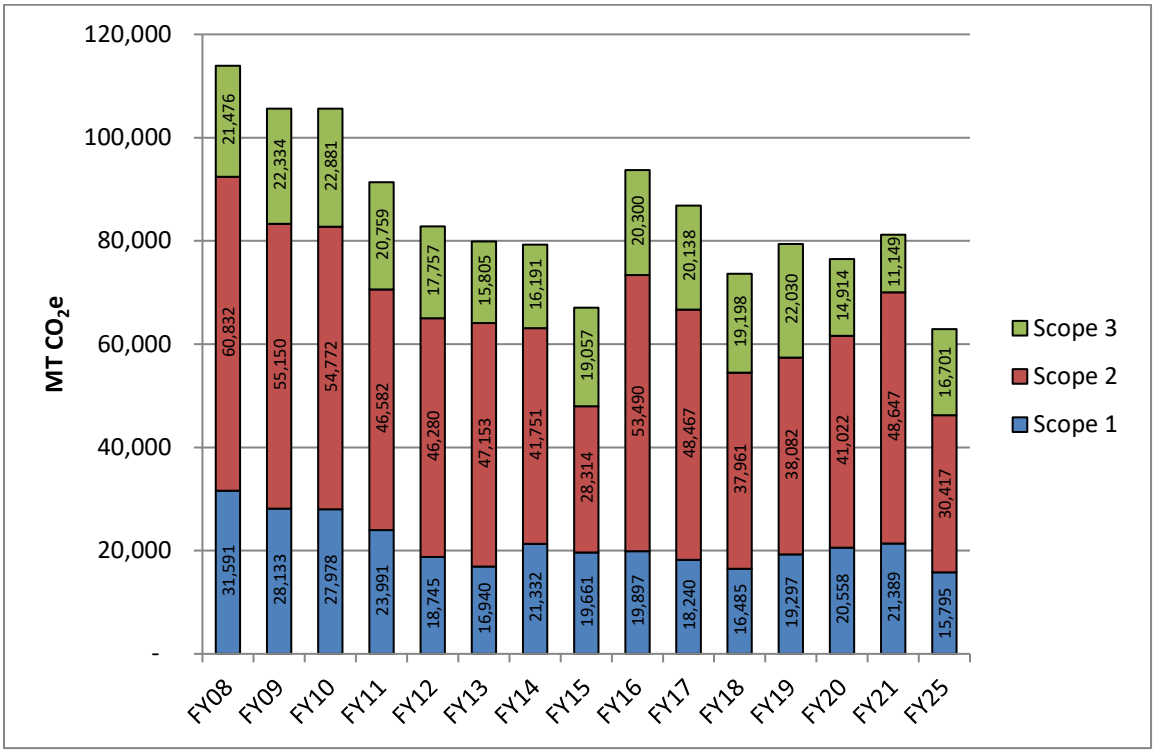

Figure 12. Comparison of INL's FY 2008 through FY 2021 actual, and FY 2025 goal GHG emissions, by scope.[n]

While preparing this inventory, it was observed that much of the data needed to quantify INL's GHG emissions already exist in high-quality form, since they are recorded and tracked for reports to other federal entities. Some information is less accessible, but it can be approximated from existing records and will be better tracked in the future due to the standards established by INL in response to the EO and the INL's concern for the environment. Some data and assumptions must be estimated using national averages supplied in the Guidance.

n. Scope 2 numbers for FY 2011 and FY 2012 were revised in FY 2013 as a result of a revision to Scope 2 total calculations. In preparing the FY 2021 report, additional changes were made to FY 2008 – FY 2019 REC calculations, as described earlier, which resulted in a change to the FY 2025 goal values.

During FY 2021, INL generated 81,185.05 MT of CO_2 equivalents, respectively. Many factors influence INL's GHG emissions, including the large land area on which the INL's facilities are located. The area requires long commutes and an extensive fleet to provide transportation for desert Site workers, and contains antiquated facilities that were built before the current appreciation for energy efficiency and high-performance design. These factors tie directly to the following conclusions from INL's FY 2021 GHG inventory:

- Electricity (including the associated transmission and distribution losses) is the largest contributor to INL's GHG inventory, with over 50% of the CO_2e emissions
- Other sources with high emissions were mobile combustion (fleet fuels), employee commuting, stationary combustion (facility fuels), and waste disposal (fugitive emissions from the onsite landfill)
- Sources with low emissions were waste disposal (contracted disposal), fugitive emissions from refrigerants, wastewater treatment (onsite and contracted), and business ground travel (in personal and rental vehicles).

INL's GHG inventory for FY 2021 was performed according to the guidelines contained in the Guidance. INL recognizes its role as a DOE-sponsored research laboratory to "lead by example" in measuring, reporting, and reducing GHG emissions. To that end, INL has already moved to promote reductions in GHGs. Now that more than 10 years of data have been gathered, the next step is to continue to implement GHG reduction strategy activities into everyday operations that will contribute to the EO goals and continue to reduce GHG emissions.

7. REFERENCES

40 CFR 98, "Mandatory Greenhouse Gas Reporting," https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98?toc=1, Webpage accessed May 2022.

EPA Climate Leaders, "GHG Emission Factors Hub (April 2021)", eGRID factors, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, April 2021, Tables 6 & 8. https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub. Webpage accessed May 2021.

Executive Order (EO) 13834, "Efficient Federal Operations," May 17, 2018.

Greenhouse Gas Protocol, "Emission Factors from Cross Sector Tools March 2017.xlsx", from https://ghgprotocol.org/calculation-tools. Webpage accessed May 2021.

WECC, "State/Provincial/Voluntary Compliance Report," Appendix F, April 2018.

White House, "Federal Greenhouse Gas Accounting and Reporting Guidance," January 17, 2016.

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Appendix A

Global Warming Potentials

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Appendix A

Global Warming Potentials

Table A-1 below shows the GWPs for the GHGs that were considered to have been released by INL during FY 2021. All GWP values shown are based on those used in the EPA Mandatory Reporting Rule.

Table A-1. Global warming potentials.

Name	CAS No.	Chemical Formula	Global Warming Potential (100 year)
Carbon dioxide	124–38–9	CO_2	1
HFC–125	354–33–6	C_2HF_5	3,500
HFC–32	75-10-5	CH_2F_2	675
HFC–134a	811–97–2	CH_2FCF_3	1,430
HFC–143a	420-46-2	$C_2H_3F_3$	4,470
Methane	74-82-8	CH_4	25
Source: EPA Mandatory Reporting Rule, 40 CFR 98. Table A-1 to Subpart A of Part 98. http://www.ecfr.gov/, Webpage accessed May 2022.			

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Appendix B

Sample Calculation

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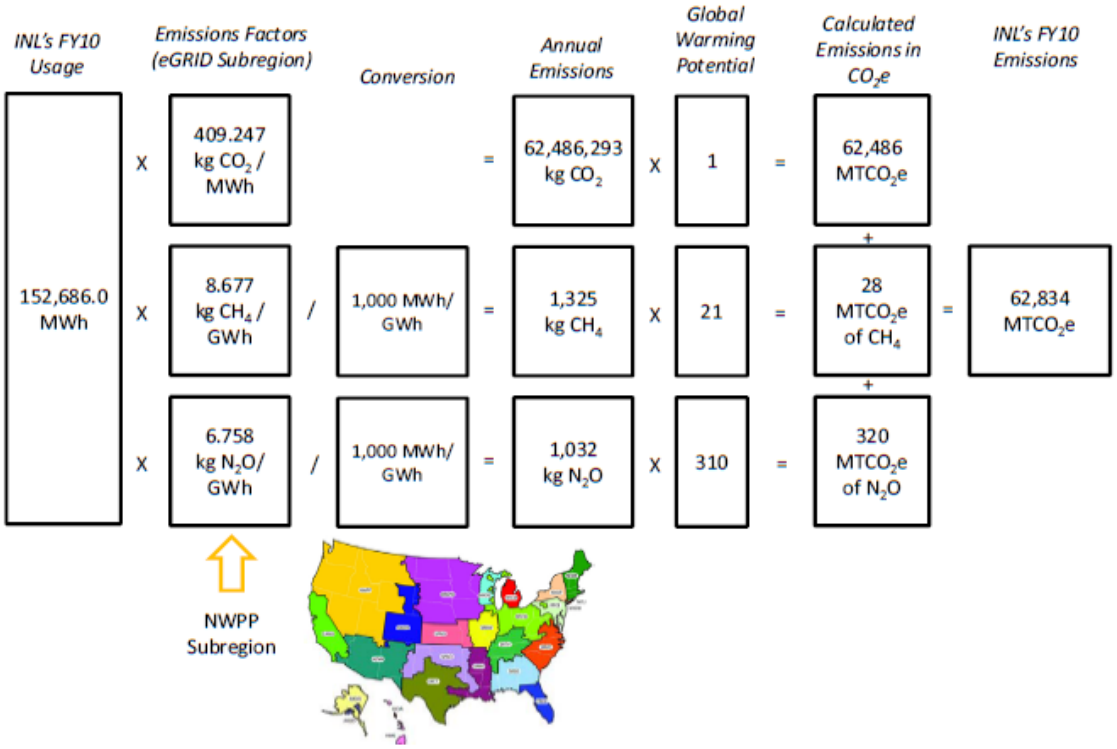
Appendix B

Sample Calculation

The following diagram is an example of the steps followed for calculating the GHG emissions from each of INL's emissions categories.



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Appendix C

Scope 1 Comprehensive Tables

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Appendix C

Scope 1 Comprehensive Tables

Table C-1. INL's GHG emissions from FY 2008 to FY 2021.

Scope	Emissions Category	FY 2008 GHG Emissions (MT CO_2e)	FY 2009 GHG Emissions (MT CO_2e)	FY 2010 GHG Emissions (MT CO_2e)	FY 2011 GHG Emissions (MT CO_2e)[a]	FY 2012 GHG Emissions (MT CO_2e)	FY 2013 GHG Emissions (MT CO_2e)	FY 2014 GHG Emissions (MT CO_2e)	FY 2015 GHG Emissions (MT CO_2e)	FY 2016 GHG Emissions (MT CO_2e)	FY 2017 GHG Emissions (MT CO_2e)	FY 2018 GHG Emissions (MT CO_2e)	FY 2019 GHG Emissions (MT CO_2e)	FY 2020 GHG Emissions (MT CO_2e)	FY 2021 GHG Emissions (MT CO_2e)
1 (Direct)	Stationary Combustion	15,213	13,381	14,288	9,826	5,682	5,391	8,249	5,505	6,130	5,785	5,753	6,540	6,816	6,071
	Mobile Combustion	10,040	8,545	7,383	7,680	6,834	5,523	6,396	6,863	6,912	6,044	4,216	6,393	7,668	9,326
	Fugitive Emissions: Refrigerants	245	200	385	640	481	372	89	764	414	57	249	176	24	11
	Fugitive Emissions: Onsite Landfill	5,963	5,878	5,785	5,702	5,617	5,532	6,480	6,381	6,282	6,190	6,100	6,010	5,920	5,823
	Fugitive Emissions: Onsite Wastewater Treatment	129	130	136	142	131	123	118	148	159	165	168	177	130	158
	SCOPE 1 TOTAL	31,591	28,133	27,978	23,991	18,745	16,940	21,332	19,661	19,897	18,240	16,485	19,297	20,558	21,389
2 (Indirect)	Purchased Electricity	61,746	58,297	61,364	55,862	54,595	56,242	50,198	42,281	65,156	62,873	46,407	46,545	51,516	52,350
	Transmission & Distribution Losses (Owned)	1,532	1,450	1,470	1,109	975	796	919	652	1003	971	686	710	763	620
	Purchased RECs[b]	(2,446)	(4,597)	(8,062)	(10,389)	(9,290)	(9,885)	(9,366)	(14,619)	(12,669)	(15,376)	(9,132)	(9,173)	(11,257)	(4,324)
	SCOPE 2 TOTAL	60,832	55,150	54,772	46,582	46,280	47,153	41,751	28,314	53,490	48,467	37,961	38,082	41,022	48,647
3 (Indirect)	Transmission & Distribution Losses (Shared)	4,170	3,937	4,141	3,754	3,662	3,759	3,367	2,786	4,294	4,143	3,058	3,067	3,391	2,813
	Employee Commuting	8,657	9,354	10,171	9,410	8,313	7,666	7,525	10,248	9,617	9,713	9,175	10,716	7,463	7,053
	Business Air Travel	6,687	7,380	6,785	5,765	4,364	3,320	3,875	4,559	5,493	5,314	5,882	6,746	3,241	672
	Business Ground Travel: Rental Vehicle	351	337	393	319	300	186	286	272	357	420	449	758	317	198
	Business Ground Travel: Personal Vehicle	413	411	422	531	251	185	143	183	232	237	346	455	228	147
	Contracted MSW Disposal	1,187	903	956	967	853	677	985	999	295	298	276	248	264	260
	Contracted Wastewater Treatment[c]	12	12	13	13	13	11	10	11	12	12	12	13	10	4
	SCOPE 3 TOTAL	21,476	22,334	22,881	20,759	17,757	15,805	16,191	19,057	20,300	20,138	19,198	22,003	14,914	11,149
TOTAL ANTHROPOGENIC EMISSIONS[d]		113,899	105,618	105,630	91,332	82,782	79,898	79,274	67,032	93,686	86,845	73,644	79,381	76,484	81,185
Biogenic	Mobile Combustion	162	723	1,182	1,339	1,855	1,274	1,667	1,707	1,636	2,459	4,439	2,266	1,000	248
	Fugitive Emissions: Onsite Landfill	866	853	840	828	816	803	790	778	766	755	744	733	722	710
	Contracted MSW Disposal	155	118	125	127	112	89	108	110	32	33	30	30	32	32
TOTAL BIOGENIC EMISSIONS		1,184	1,695	2,148	2,294	2,782	2,165	2,566	2,595	2,434	3,246	5,213	3,030	1,754	990
TOTAL EMISSIONS (ANTHROPOGENIC + BIOGENIC)		115,082	107,312	107,778	93,625	85,564	82,063	81,840	69,627	96,121	90,091	78,856	82,412	78,248	82,175

a. Scope 2 numbers for FY 2011 and FY 2012 were revised in FY 2013 as a result of a revision to Scope 2 total calculations performed in FY 2013.

b. In FY 2020 it was discovered that REC purchases were incorrectly reported – full REC purchases were credited to BEA, although they were actually purchased for all INL.

c. In FY 2017 it was discovered the FY 2008 WWTP baseline assumption was different (to include nitrification/denitrification) than the actual operations of the centralized WWTP (no consistent use of nitrification/denitrification). To have a more accurate comparison, the FY 2008 baseline (and subsequent years) was recalculated with the assumption of no nitrification/denitrification and should be 11.6 MT CO_2e. All emissions calculations were updated accordingly.

d. These are the numbers that INL will report as their overall emissions. Furthermore, this is the number that INL will be trying to reduce in future years.

Table C-2. Amounts of fuel used for stationary combustion at INL during FY 2008.

Energy Type	Fuel Used		GHG Emissions (MT CO2e)
	Amount	Units	
Fuel Oil No. 2	1,247,088	Gallons	12,771
Liquefied Natural Gas (LNG)	43,590	Gallons	321
Liquefied Propane Gas (LPG)	149,475	Gallons	870
Natural Gas (Pipeline)	236,600	Therms	1,252
		TOTAL	15,213

Table C-3. Amounts of fuel used for stationary combustion at INL during FY 2009.

Energy Type	Fuel Used		GHG Emissions (MT CO2e)
	Amount	Units	
Fuel Oil No. 2	1,098,582	Gallons	11,250
Liquefied Natural Gas (LNG)	41,259	Gallons	304
Liquefied Propane Gas (LPG)	74,660	Gallons	434
Natural Gas (Pipeline)	263,099	Therms	1,392
		TOTAL	13,381

Table C-4. Amounts of fuel used for stationary combustion at INL during FY 2010.

Energy Type	Fuel Used		GHG Emissions (MT CO2e)
	Amount	Units	
Fuel Oil No. 2	1,173,716	Gallons	12,020
Liquefied Natural Gas (LNG)	43,284	Gallons	318
Liquefied Propane Gas (LPG)	95,586	Gallons	556
Natural Gas (Pipeline)	263,433	Therms	1,394
		TOTAL	14,288

Table C-5. Amounts of fuel used for stationary combustion at INL during FY 2011.

Energy Type	Fuel Used		GHG Emissions (MT CO2e)
	Amount	Units	
Fuel Oil No. 2	751,045	Gallons	7,691
Liquefied Natural Gas (LNG)	35,392	Gallons	260
Liquefied Propane Gas (LPG)	58,659	Gallons	341
Natural Gas (Pipeline)	289,757	Therms	1,533
		TOTAL	9,826

Table C-6. Amounts of fuel used for stationary combustion at INL during FY 2012.

Energy Type	Fuel Used		GHG Emissions (MT CO2e)
	Amount	Units	
Fuel Oil No. 2	371,587	Gallons	3,805
Liquefied Natural Gas (LNG)	36,263	Gallons	267
Liquefied Propane Gas (LPG)	53,366	Gallons	310
Natural Gas (Pipeline)	245,554	Therms	1,299
		TOTAL	5,682

Table C-7. Amounts of fuel used for stationary combustion at INL during FY 2013.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	309,029	Gallons	3,165
Liquefied Natural Gas (LNG)	32,664	Gallons	240
Liquefied Propane Gas (LPG)	57,138	Gallons	332
Natural Gas (Pipeline)	312,433	Therms	1,653
		TOTAL	5,391

Table C-8. Amounts of fuel used for stationary combustion at INL during FY 2014.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	466,282	Gallons	4,775
Liquefied Natural Gas (LNG)	38,997	Gallons	287
Liquefied Propane Gas (LPG)	61,495	Gallons	351
Natural Gas (Pipeline)	535,400	Therms	2,836
		TOTAL	8,249

Table C-9. Amounts of fuel used for stationary combustion at INL during FY 2015.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	189,217	Gallons	1,938
Liquefied Natural Gas (LNG)	24,851	Gallons	183
Liquefied Propane Gas (LPG)	98,333	Gallons	561
Natural Gas (Pipeline)	533,192	Therms	2,824
		TOTAL	5,505

Table C-10. Amounts of fuel used for stationary combustion at INL during FY 2016.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	190,473	Gallons	1,951
Liquefied Natural Gas (LNG)	35,721	Gallons	263
Liquefied Propane Gas (LPG)	113,553	Gallons	647
Natural Gas (Pipeline)	617,312	Therms	3,269
		TOTAL	5,505

Table C-11. Amounts of fuel used for stationary combustion at INL during FY 2017.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	160,331	Gallons	1,642.03
Liquefied Natural Gas (LNG)	30,313	Gallons	223.19
Liquefied Propane Gas (LPG)	119,946	Gallons	683.77
Natural Gas (Pipeline)	610,954	Therms	3,229.33
		TOTAL	5,578

Table C-12. Amounts of fuel used for stationary combustion at INL during FY 2018.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	1,997.02	Gallons	1,642.03
Liquefied Natural Gas (LNG)	327.91	Gallons	223.19
Liquefied Propane Gas (LPG)	671.07	Gallons	683.77
Natural Gas (Pipeline)	2,756.52	Therms	3,229.33
		TOTAL	5,752.5

Table C-13. Amounts of fuel used for stationary combustion at INL during FY 2019.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	279,882.00	Gallons	2,866.41
Liquefied Natural Gas (LNG)	38,118.00	Gallons	281.49
Liquefied Propane Gas (LPG)	67,038.00	Gallons	382.16
Natural Gas (Pipeline)	569,514.00	Therms	3,010.29
		TOTAL	6,540.40

Table C-14. Amounts of fuel used for stationary combustion at INL during FY 2021.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	193,459	Gallons	1,981.31
Liquefied Natural Gas (LNG)	45,121	Gallons	333.21
Liquefied Propane Gas (LPG)	47,019	Gallons	273.06
Natural Gas (Pipeline)	659,105	Therms	3,483.84
		TOTAL	6,071.40

Table C-15. Fuel amounts and corresponding GHG emissions for INL's FY 2008 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[a]	Bus	50,677.20	440	72
	Equipment	77.10	1	<1
	Heavy Duty	836.50	7	1.19
	Light-Duty Truck	19.60	<1	<1
Compressed Natural Gas (CNG)	Bus	90.00	1	—
	Light-Duty Car	54.30	<1	—
	Light-Duty Truck	437.40	3	—
Diesel	Bus	544,548.50	5,563	—
	Equipment	50,229.00	517	—
	Heavy Duty	50,066.80	512	—
	Light-Duty Truck	10,326.70	105	—
E85 Ethanol Fuel Blend	Light-Duty Car	2,063.20	4	10.08
	Light-Duty Truck	16,195.00	27	79.14
Gasoline	Bus	2,391.50	21	—
	Equipment	5,803.10	51	—
	Heavy Duty	6,852.90	64	—
	Light-Duty Car	15,529.40	141	—
	Light-Duty Truck	241,383.42	2,228	—
LNG	Bus	45,964.30	348	—
	Light-Duty Truck	30.00	<1	—
Propane	Equipment	851.90	5	—
	TOTAL	1,044,427.83	10,040	162

a. Carol Comstock clarified in a December 10, 2009, phone call that BEA utilizes a combination of B10 (used in winter) and B20 (used in summer), and the exact amounts of each blend are not currently tracked (at least not in such a way that can easily be reported). Assume a 50/50 split of B10 and B20, and therefore refer to the biodiesel blend as B15.

Since the vehicle type category was reported a bit differently than the subsequent years, only FY 2009–FY 2021 is combined in the comprehensive tables on the following pages.

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Table C-16. Fuel amounts and corresponding GHG emissions for INL's fleet—FY 2009 to FY 2011.

Fuel Type	Vehicle Type	FY 2009			FY 2010			FY 2011		
		Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[a]	Bus	219,814.50	1,909	312	331,916.34	2,883	471	363,731.46	3,159	516
	Equipment	9,462.90	83	13	14,256.11	125	20	5,454.84	48	8
	Light-Duty Truck	6,551.70	57	9	8,797.74	76	12	2,118.54	18	3
	Truck	2,351.00	20	3	3,061.95	27	4	546.93	5	1
Diesel	Bus	302,302.50	3,088	—	186,610.28	1,906	—	164,017.55	1,676	—
	Equipment	96,249.70	991	—	54,192.00	558	—	78,481.02	808	—
	Heavy Duty	21,369.20	218	—	20,127.87	206	—	32,963.00	337	—
	Light-Duty Truck	6,071.00	62	—	5,553.66	57	—	7,540.25	77	—
E10 Ethanol Fuel Blend	Bus	1,138.60	9	<1	76.20	<1	<1	—	—	—
	Equipment	76,793.90	615	44	19,590.83	157	11	22,401.88	179	13
	Light-Duty Car	14,218.80	117	8	6,646.48	56	4	6,242.52	52	4
	Light-Duty Truck	122,823.80	1,025	71	4,134.43	34	2	1,907.45	16	1
E85 Ethanol Fuel Blend	Bus	66.80	<1	<1	130,063.10	1,085	75	125,990.31	1,051	72
	Equipment	3,223.90	5	16	1,946.67	3	10	647.81	1	3
	Light-Duty Car	3,398.35	6	17	8,457.22	15	41	8,583.05	15	42
	Light-Duty Truck	46,965.15	80	230	108,806.18	186	532	138,476.16	236	677
Gasoline	Equipment	1,717.30	15	—	845.60	7	—	—	—	—
LNG	Bus	31,771.00	241	—	38.00	<1	—	—	—	—
	Equipment	231.00	2	—	76.00	<1	—	—	—	—
TOTAL		966,521.10	8,545	723	905,196.64	7,383	1,182	959,102.76	7,680	1,339

a. Carol Comstock clarified in a December 10, 2009, phone call that BEA utilizes a combination of B10 (used in winter) and B20 (used in summer), and the exact amounts of each blend are not currently tracked (at least not in such a way that can be easily reported). Assume a 50/50 split of B10 and B20, and refer to the biodiesel blend as B15. Tad Pearson confirmed in a December 22, 2010, phone call that this assumption was valid for FY 2009 and FY 2010.

Table C-17. Fuel amounts and corresponding GHG emissions for INL's fleet—FY 2012 to FY 2015.

Fuel Type	Vehicle Type	FY 2012			FY 2013			FY 2014			FY 2015		
		Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B20 Biodiesel Blend[a]	Bus	389,607.82	3,184.95	736.48	386,333.66	3,158.18	730.29	428,397.73	3,501.95	809.80	438,355.55	3,583.35	828.63
	Equipment	4,026.97	33.24	5.71	3,434.83	28.36	6.49	3,397.53	28.05	6.42	4,877.18	40.27	9.22
	Heavy Duty	765.48	6.26	1.45	364.34	2.98	0.69	84.42	0.69	0.16	302.04	2.47	0.57
	Light-Duty Truck	—	—	—	—	—	—	94.55	0.77	0.18	136.88	1.12	0.26
Compressed Natural Gas (CNG)	Bus	—	—	—	—	—	—	—	—	—	—	—	—
	Light-Duty Car	—	—	—	—	—	—	—	—	—			
	Light-Duty Truck	—	—	—	—	—	—	—	—	—			
Diesel	Bus	106,683.01	1,089.88	—	27,738.99	283.38	—	27,119.78	277.05	—	17,024.09	173.92	—
	Equipment	46,311.52	476.97	—	38,224.96	393.69	—	36,691.64	377.87	—	67,390.69	694.02	—
	Heavy Duty	26,717.37	273.07	—	28,485.68	291.14	—	38,909.46	397.66	—	56,982.22	582.37	—
	Light Duty Car[b]	—	—	—	6.01	0.06	—	6.01	0.06	—	—	—	—
	Light-Duty Truck	6,966.56	71.16	—	5,977.91	61.06	—	10,285.37	105.05	—	9,246.66	94.44	—
E85 Ethanol Fuel Blend	Equipment	1,367.85	2.29	6.68	2,669.71	4.33	13.05	2,749.37	4.44	13.44	1,480.46	2.39	7.23
	Light-Duty Car	7,302.10	13.17	35.68	6,292.66	11.22	30.75	6,250.13	11.06	30.54	5,262.08	9.31	25.71
	Light-Duty Truck	199,673.62	341.30	975.73	84,519.11	142.54	413.01	144,530.18	242.28	706.26	150,741.77	252.69	736.62
Gasoline	Bus	3,464.86	29.08	1.99	119.68	0.95	0.07	389.54	3.10	0.22	—	—	—
	Equipment	1,625.20	13.38	0.93	20,177.56	161.52	11.60	14,036.47	112.34	8.07	13,567.62	112.23	8.06
	Heavy Duty	133,636.56	1,114.90	76.83	2,999.46	25.17	1.72	3,883.23	32.53	2.23	3,533.71	29.60	2.03
	Light-Duty Car	—	—	—	1,501.70	12.36	0.86	1,352.14	11.12	0.78	589.16	4.84	0.34
	Light-Duty Truck	1,367.85	2.29	6.68	113,383.25	945.93	65.18	154,862.58	1,289.89	89.03	153,633.47	1,279.65	88.32
TOTAL		951,170.45	6,833.91	1,854.72	722,229.52	5,522.88	1,273.72	873,040.13	6,395.91	1,667.14	923,123.58	6,862.68	1,706.99

a. Per October 11, 2012, e-mail from Tad Pearson, BEA utilized a B20 (20% biodiesel blend) for the FY 2012 reporting year. BEA continued to use the B20 for subsequent years (FY 2013–FY 2021).
b. New category for FY 2013.

Table C-18. Fuel amounts and corresponding GHG emissions for INL's fleet—FY 2016 to 2021.

Fuel Type	Vehicle Type	FY 2016			FY 2017			FY 2018			FY 2019			FY 2020			FY 2021		
		Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B20 Biodiesel Blend[a]	Bus	419,171.00	3,426.53	792.36	275,269.33	2,250.20	520.34	—	—	—	—	—	—	—	—	—	—	—	—
	Equipment	6,738.38	55.64	12.74	5,490.00	45.33	10.38	—	—	—	—	—	—	—	—	—	—	—	—
	Heavy Duty	346.49	2.83	0.65	440.11	3.60	0.83	—	—	—	—	—	—	—	—	—	—	—	—
	Light-Duty Truck	44.52	0.36	0.65	9.59	0.08	0.02	—	—	—	—	—	—	—	—	—	—	—	—
Compressed Natural Gas (CNG)	Bus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Light-Duty Car	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Light-Duty Truck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diesel	Bus	12,330.09	125.96	—	16,811.18	171.74	—	27,078.84	276.63	—	276,385.73	2,823.51	—	353,849.12	3,614.86	—	449,534.22	4,592.36	—
	Equipment	63,002.37	648.83	—	87,056.62	896.53	—	123,515.24	1,271.99	—	77,440.96	797.50	—	74,202.95	764.18	—	99,627.96	1,026.01	—
	Heavy Duty	69,461.50	709.91	—	48,898.50	499.75	—	56,079.95	573.15	—	62,184.96	635.54	—	68,955.79	704.74	—	64,186.62	656.00	—
	Light Duty Car[b]	—	—	—	0.00	—	—	0.00	—	—	0.00		—	0.00	—	—	0.00	—	—
	Light-Duty Truck	10,882.41	111.15	—	9,710.45	99.18	—	4,915.70	50.21	—	0.00	—	—	0.00	—	—	0.00	—	—
E85 Ethanol Fuel Blend	Equipment	1,318.09	2.13	6.44	835.73	1.35	4.08	284.68	0.46	1.39	47.06	0.08	0.23	11.91	0.02	0.06	—	—	—
	Heavy Duty	—	—	—	2,163.72	3.93	10.57	22,421.25	40.68	109.56	15,094.61	26.44	73.76	12,598.96	22.07	61.57	1,077.04	1.89	5.26
	Light-Duty Car	2,776.33	4.91	13.57	1,792.47	3.17	8.76	15,556.91	27.54	76.02	17,310.79	30.02	84.59	14,548.02	25.23	71.09	2,651.97	4.60	12.96
	Light-Duty Truck	143,336.44	240.28	700.43	96,181.57	161.23	470.00	48,161.86	80.73	235.35	71,782.59	116.20	350.77	60,275.29	97.57	294.54	2,320.63	3.76	11.34
Gasoline/E10 Fuel Blend	Bus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Equipment	17,170.50	137.43	9.87	17,931.40	143.52	10.31	16,821.46	134.63	9.67	8,302.75	66.45	4.77	9,356.83	74.89	5.38	11,594.37	92.80	6.67
	Heavy Duty	20,892.31	147.99	12.01	60,858.54	509.75	34.99	66,686.89	558.57	38.34	58,031.55	464.15	33.36	61,264.86	490.01	35.22	80,604.77	644.69	46.34
	Light-Duty Car	521.70	4.29	0.30	1,314.46	10.81	0.76	72,405.49	595.20	41.63	78,815.15	630.75	45.31	14,548.02	25.23	71.09	1,077.04	975.69	70.09
	Light-Duty Truck	152,032.59	1,266.31	87.40	145,757.05	1,214.04	83.80	70,309.87	585.63	40.42	99,127.82	791.43	56.99	60,275.29	97.57	295.54	2,651.97	1,328.33	95.65
R99[c]	Bus	—	—	—	137,723.58	1.29	1,301.70	409,090.60	3.82	3,866.53	170,255.31	1.59	1,609.17	42,05.44	0.39	397.02	0.00	—	—
	Equipment	—	—	—	2,746.77	28.29	—	1,578.73	16.26	—	930.22	9.58		194.14	2.00	—	0.00	—	—
	Heavy Duty	—	—	—	220.20	0.00	2.08	2,087.18	0.03	19.73	785.42	0.01	7.42	5.63	0.00	0.05	0.00	—	—
	Light-Duty Truck	—	—	—	4.80	0.00	0.05	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL		920,024.73	6,911.56	1,635.86	911,216.08	6,043.78	2,458.66	936,994.65	4,215.53	4,438.63	936,494.92	6,393.26	2,266.39	931,426.85	7,667.54	999.54	999,890.85	9,326.13	248.31

a. Per October 11, 2012, e-mail from Tad Pearson, BEA utilized a B20 (20% biodiesel blend) for the FY 2012 reporting year. BEA continued to use the B20 for subsequent years (FY 2013–FY 2017).
b. New category for FY 2013.
c. Renewable Diesel (R99) began use in May 2017, discontinued for FY 2021

Table C-19. Fugitive refrigerants evaluated for GHG emissions from FY 2008 to FY 2013 at INL.

Common Name	GWP	FY 2008		FY 2009		FY 2010		FY 2011		FY 2012		FY 2013	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	NE	NE	20,072.60	9	1,849.18	1	1,849.18	1	3.22	0.0	−39.81	−0.02
CH_4	21	NE	NE	2,842.50	27	32,961.47	314	32,961.47	314	−588.29	−5.6.0	33,106.47	315.36
N_2O	310	NE	NE	0.00	0	20.18	3	20.18	3	0.0	0.0	0.0	0.0
HFC-23	11,700	0.43	2	1.50	8	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-32	650	71.99	21	0.00	0	92.13	27	92.13	27	180.5	53.22	30.75	9.07
HFC-41	150	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-125	2,800	88.98	113	0.00	0	100.15	127	100.15	127	60.12	76.35	31.25	39.69
HFC-134	1,000	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-134a	1,300	173.15	102	238.20	140	316.35	187	316.35	187	419.61	247.44	13.07	7.70
HFC-143	300	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-143a	3,800	0.20	<1	0.00	0	−18.72	−32	−18.72	−32	20.76	35.78	0.0	0.0
HFC-152	53	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-152a	140	23.88	2	23.50	1	3.28	0	3.28	0	77.22	4.90	0.29	0.02
HFC-161	12	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-227ca	2,900	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-227ea	2,900	0.00	0	0.00	0	46.0	61	46.0	61	0.0	0.0	0.0	0.0
HFC-236ca	120	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236cb	1,340	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236ea	1,370	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236fa	6,300	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-245ca	560	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-245fa	1,030	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-365mfc	794	3.86	1	38.00	14	−0.4	0	−0.4	0	0.9	0.32	0.0	0.0
HFC-c-447-ef	250	0.00	0	0.00	0	NE	NE	NE	NE	NE	NE	NE	NE
HFC-43-10mee	1,300	1.69	1	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-14	6,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-116	9,200	0.51	2	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-218	7,000	0.00	0	0.00	0	0.0	0	0.0	0	1.1	3.5	0.0	0.0
PFC-318 or PFCc318	8,700	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-3-1-10	7,000	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-4-1-12	7,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-5-1-14	7,400	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-9-1-18	7,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
c-C_3F_6	17,340	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
SF_6 - Sulfur Hexafluoride	23,900	0.00	0	0.00	0	−4.28	−46	−4.28	−46	6.0	65.05	0.0	0.0
NF_3	17,200	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
TOTAL		364.69	245	23,216.30	200	29,242.00	385	35,365.34	640	181.15	480.96	33,142.02	371.82

NE = Not evaluated. Refrigerant was not included in data call table.

Table C-20. Fugitive refrigerants evaluated for GHG emissions for FY 2014–FY 2021 at INL.

Common Name	GWP	FY 2014		FY 2015		FY 2016		FY 2017		FY 2018		FY 2019		FY 2020		FY 2021	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	−137.78	−0.06	−114.95	−0.05	−19.51	−0.01	-119.50	-0.05	-518.50	−0.24	0	0	106.67	0.05	0.00	0.00
CH_4	25	123.35	1.40	34,699.70	393.49	38.427.66	435.77	325.78	3.69	25,902.02	293.73	0	0	0.00	0.00	(54.60)	(0.62)
N_2O	298	0.0	0.0	0.00	0.00	1.05	0.14	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-23	14,800	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-32	675	49.2	15.06	21.90	6.71	-15.00	-4.59	67.00	20.51	-14.81	-4.54	84.58	25.90	12.78	3.91	2.97	0.91
HFC-41	92	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-1234yf; HFO-1234yf	0.31	—	—	—	—	—	—	—	—	—	—	10.00	0.00	0.00	0.00	0.00	0.00
HFC-125	3,500	38.75	61.52	22.50	35.72	-15.00	-23.81	50.56	80.27	-14.81	-23.52	85.72	136.09	12.78	20.29	3.78	6.01
HFC-134	1,100	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134a	1,430	17.55	11.38	55.22	35.82	4.48	2.91	-14.06	-9.12	-25.45	-16.51	20.99	13.61	-0.35	-0.23	5.07	3.29
HFC-143	353	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-143a	4,470	0.0	0.0	0.00	0.00	0.00	0.00	-11.52	-23.36	0.00	0.00	0.39	0.79	0.00	0.00	0.88	1.78
HFC-152	53	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152a	124	1.7	0.10	0.00	0.00	5.47	0.31	15.11	0.85	0.00	0.00	0	0	0.00	0.00	0.00	0.00
HFC-161	12	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ca	NL	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	3,220	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236ca	NL	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236cb	1,340	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236ea	1,370	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	9,810	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-245ca	693	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-245fa	1,030	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-365mfc	794	0.0	0.0	0.00	0.00	28.80	10.37	-16.92	-6.09	0.72	0.26	0	0	0.00	0.00	0.00	0.00
HFC-c-447-ef	NL	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-43-10mee	1,640	0.0	0.0	0.00	0.00	-9.60	-7.14	-12.92	-9.61	0.00	0.00	0	0	0.00	0.00	0.00	0.00
HFE-449s1 (HFE-7100)	297	—	—	—	—	—	—	—	—	—	—	0	0	0.00	0.00	0.00	0.00
PFC-14	7,390	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-116	12,200	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-218	8,830	0.0	0.0	-0.05	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-318 or PFCc318	10,300	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-3-1-10	8,860	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-4-1-12	9,160	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-5-1-14	9,300	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC-9-1-18	7,500	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-C_3F_6	17,340	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methyl perfluoroisobutyl ether	0	—	—	—	—	—	—	—	—	—	—	0	0.00	0.00	0.00	0.00	0.00
SF_6 - Sulfur Hexafluoride	22,800	0.0	0.0	28.26	292.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NF_3	17,200	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL	95.77	89.41	34,712.58	763.83	38,408.35	413.94	283.68	57.11	25,329.17	249.20	201.68	176.39	131.88	24.02	-41.89	11.37

NE = Not evaluated. Refrigerant was not included in data call table.
Updated GWPs in 2014 are in red

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Appendix D

Emissions Factors Used

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Appendix D

Emissions Factors Used

D-1. SCOPE ONE – DIRECT EMISSIONS

Table D-1. Stationary combustion conversion and emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Fuel Oil No. 2	Higher Heating Value (HHV) Conversion Factor	0.138	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	73.96	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
Liquefied Natural Gas (LNG)	HHV Conversion Factor	0.110	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	66.88	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.

Table D-1. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Natural Gas (Pipeline)	Conversion Factor	0.001026	MMBtu/scf	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	Conversion Factor	96.99	scf/therm	Published conversion in common literature.
	CO_2 Emission Factor	53.06	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.001	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0001	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
Liquefied Propane Gas (LPG)	HHV Conversion Factor	0.091	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	62.87	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.

Table D-2. Mobile combustion emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Gasoline (Considered "Motor gasoline")	HHV Conversion Factor	0.125	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	70.22	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Gasoline, Bus (Considered "Bus - Gasoline")	CH_4 Emissions Factor	0.021	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx"
	N_2O Emissions Factor	0.017	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Gasoline, Light-Duty Car (Considered "Passenger Car – Gasoline – Year 2005-present")	CH_4 Emissions Factor	0.0147	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0079	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Gasoline, Light-Duty Truck (Considered "Light Goods Vehicle – Gasoline – Year 2005-present")	CH_4 Emissions Factor	0.0157	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0101	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Gasoline, Equipment (Considered "Construction Equipment - Gasoline")	CH_4 Emissions Factor	0.5	g CH_4/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.22	g N_2O/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Gasoline, Heavy Duty (Considered "Heavy Duty Vehicle – Rigid – Gasoline – Year 2005-present")	CH_4 Emissions Factor	0.0326	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.177	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Diesel (Considered "Distillate Fuel Oil No. 2")	HHV Conversion Factor	0.138	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.96	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Diesel, Bus (Considered "Bus - Diesel")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0048	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Diesel, Light Duty Car (Considered "Passenger Car – Diesel – Year 1993 to present")	CH_4 Emissions Factor	0.0005	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0010	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Diesel, Light-Duty Truck (Considered "Light Goods Vehicle – Diesel – Year 1996 - present")	CH_4 Emissions Factor	0.001	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0015	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Diesel, Heavy Duty (Considered "Heavy Duty – Rigid 0 Diesel – Year 1960-present")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0048	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Diesel, Equipment (Considered "Construction Equipment – Diesel Fuel")	CH_4 Emissions Factor	0.58	g CH_4/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.26	g N_2O/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Biodiesel/R99 (Considered "Biodiesel [100%]")	HHV Conversion Factor	0.128	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.84	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Biodiesel/R99, Bus (Considered "Bus - Diesel")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0048	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Biodiesel/R99, Equipment (Considered "Construction Equipment – Diesel Fuel")	CH_4 Emissions Factor	0.58	g CH_4/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.26	g N_2O/gal	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Biodiesel/R99, Light-Duty Truck (Considered "Light Goods Vehicle - Diesel - Year 1996-present")	CH_4 Emissions Factor	0.001	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0015	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Biodiesel/R99, Heavy-Duty (Considered "Heavy Duty Vehicle - Rigid - Diesel - Year 1960-present")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.0048	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Ethanol (Considered "Ethanol [100%]")	HHV Conversion Factor	0.084	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	68.44	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Ethanol, Bus (Considered "Heavy Duty Vehicle - Rigid - Ethanol")	CH_4 Emissions Factor	0.197	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.175	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Ethanol, Equipment and Heavy Duty (Considered "Heavy Duty Vehicle - Rigid - Ethanol")	CH_4 Emissions Factor	0.197	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.175	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
Ethanol, Light-Duty Car and Truck (Considered "Light Goods Vehicle - Ethanol")	CH_4 Emissions Factor	0.055	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."
	N_2O Emissions Factor	0.067	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (March 2017).xlsx."

Fugitive emissions are based directly on the GWP of the various gases emitted, so no additional table is provided from Table 8 that was shown previously in the main body.

D-2. SCOPE TWO – INDIRECT EMISSIONS

Table D-3. Electricity emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
INL Site Electricity Purchase (and T&D loss) and RECs purchase (Considered NWPP of "WECC" eGRID Subregion)	CO_2 Emissions Factor	715.2	lb CO_2/MWh	EPA, Climate Leaders, eGRID 2019, Table 6, p. 4, "Subregion Output Emission Rates."
	CH_4 Emissions Factor	0.068	lb CH_4/MWh	EPA, Climate Leaders, eGRID 2019, Table 6, p. 4, "Subregion Output Emission Rates."
	N_2O Emissions Factor	0.010	lb N_2O/MWh	EPA, Climate Leaders, eGRID 2019, Table 6, p. 4, "Subregion Output Emission Rates."

D-3. SCOPE THREE – INDIRECT EMISSIONS

Table D-4. Employee commute, rental car miles, and personal car miles emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Passenger Cars	CO_2 Emissions Factor	0.341	kg CO_2/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".
	CH_4 Emissions Factor	9.00×10^{-6}	kg CH_4/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".
	N_2O Emissions Factor	8.00×10^{-6}	kg N_2O/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".
Light-Duty Truck/Van/SUV	CO_2 Emissions Factor	0.464	kg CO_2/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".
	CH_4 Emissions Factor	1.20×10^{-5}	kg CH_4/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".
	N_2O Emissions Factor	1.00×10^{-5}	kg N_2O/ vehicle-mile	Table 10, EPA Climate Leaders, Business Travel and Employee Commuting, Emission Factors for Greenhouse Gas Inventories, "GHG Emission Factors Hub (April 2021).pdf".

Table D-5. Business travel airline miles emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Airline Miles, Short Haul (<300 miles)	CO_2 Emissions Factor	0.275	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	CH_4 Emissions Factor	9.1×10^{-6}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	N_2O Emissions Factor	8.7×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
Airline Miles, Medium Haul (300–700 miles)	CO_2 Emissions Factor	0.162	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	CH_4 Emissions Factor	8.0×10^{-7}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	N_2O Emissions Factor	5.2×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
Airline Miles, Long Haul (≥700 miles)	CO_2 Emissions Factor	0.191	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	CH_4 Emissions Factor	8.0×10^{-7}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"
	N_2O Emissions Factor	6×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2021 Dashboard Verification - INL All - Broken Links.xlsx"

Appendix E

Scope 2 Comprehensive Tables

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Appendix E

Scope 2 Comprehensive Tables

Table E-1. INL's GHG emissions from electricity and RECs purchased in FY 2008–FY 2021.

Emissions Category	FY 2008 GHG Emissions (MT CO_2e)	FY 2009 GHG Emissions (MT CO_2e)	FY 2010 GHG Emissions (MT CO_2e)	FY 2011 GHG Emissions (MT CO_2e)[a]	FY 2012 GHG Emissions (MT CO_2e)	FY 2013 GHG Emissions (MT CO_2e)	FY 2014 GHG Emissions (MT CO_2e)	FY 2015 GHG Emissions (MT CO_2e)	FY 2016 GHG Emissions (MT CO_2e)	FY 2017 GHG Emissions (MT CO_2e)	FY 2018 GHG Emissions (MT CO_2e)[b]	FY 2019 GHG Emissions (MT CO_2e)[b]	FY 2020 GHG Emissions (MT CO_2e)[b]	FY 2021 GHG Emissions (MT CO_2e)[b]
Purchased Electricity (includes T&D losses within INL's operational controls)	63,278	59,747	62,834	56,971	55,570	57,038	51,117	42,933	66,159	63,844	47,092	47,254	52,279	52,971
Purchased RECs (displaced GHG emissions)[c]	(2,446)	(4,597)	(8,062)	(10,389)	(9,290)	(9,885)	(9,366)	(14,619)	(12,669)	(15,377)	(9,132)	(9,173)	(11,257)	(4,324)
SCOPE 2 TOTAL	60,832	55,150	54,772	46,582	46,280	47,153	41,751	28,314	53,490	48,467	37,961	38,082	41,022	48,647

Scope 2 numbers for FY 2011 and FY 2012 were revised in FY 2013 as a result of a revision to Scope 2 total calculations.

RECs purchased in FY 2018 were split between FY 2018 and FY 2019 due to a change in statutory requirement for REC purchase % (i.e. purchased 15% in FY 2018, but only 7.5% was required)

During preparation of FY 2020 report, it was discovered that all RECs purchased were incorrectly applied to BEA; however, they were purchased for all INL. All REC numbers were updated, and subsequently all Scope 2 Totals.

Appendix F

Receipt for RECs Purchased in FY 2021

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Appendix F

Receipt for RECs Purchased in FY 2021

IDAHO FALLS POWER

RENEWABLE ENERGY CERTIFICATE SALES AGREEMENT

This sales agreement ("Confirmation") confirms the transaction ("Transaction") between **Idaho Falls Power** ("Seller") and **Battelle Energy Alliance** ("Purchaser"), each individually a "Party" and together the "Parties", effective as of **April, 1 2021** (the "Confirmation Effective Date").

COMMERCIAL TERMS

<table>
<tr><td>Seller: COUNTERPARTY A</td><td colspan="2">Purchaser: COUNTERPARTY B</td></tr>
<tr><td>Contact Information:</td><td>Seller
Address:
140 S. Capital
Idaho Falls, ID 83405

Contact: Bear Prairie
Tel: 208-612-8429
Email: bprairie@ifpower.org
Fax: 208-612-8435</td><td>Purchaser
Address:
PO Box 1625
Idaho Falls, ID 83415

Contact: Rebecca Amonson
Tel: 208-526-0792
Email: acctpay@inl.gov
Fax: 208-526-7095</td></tr>
<tr><td>Addresses For Formal Notices:</td><td>Seller
Address:
P.O. Box 50220
Idaho Falls, ID 83405-0220

Attention: Bear Prairie
Tel: 208-612-8429
Email: bprairie@ifpower.org
Fax: 208-612-8435</td><td>Purchaser
Address:
PO Box 1625
Idaho Falls, ID 83415

Attention: Rebecca Amonson
Tel: 208-526-0792
Email: acctpay@inl.gov
Fax: 208-526-7095</td></tr>
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<tr><td>□ Firm Bundled REC</td></tr>
<tr><td>□ Resource Contingent REC</td></tr>
<tr><td>□ Resource Contingent Bundled REC</td></tr>
<tr><td>□ Facility As-Run REC</td></tr>
<tr><td>□ Facility As-Run Bundled REC</td></tr>
<tr><td>□ Other I(specify) _____</td></tr>
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<tr><td>☑ Program Attributes (this designation is effective only if an Applicable Program is identified below) (Note: WREGIS and possibly other Tracking Systems will not recognize a Program Attributes REC, or may treat it as an All Attributes REC)</td></tr>
<tr><th>Applicable Program</th></tr>
<tr><td>Green-e Energy Eligible</td></tr>
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<tr><th>Certification Authority</th></tr>
<tr><td>☑WREGIS</td></tr>
<tr><td>□ Center for Resource Solutions Green-e</td></tr>
<tr><td>□ Other _____.</td></tr>
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<tr><td>Product Vintage:</td><td>April 2020 – March 2022</td></tr>
<tr><td>Resource Type:</td><td>Wind Generation Facilities & Qualifying Hydro Efficiency Upgrades</td></tr>
<tr><td>Project (s)</td><td>
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<tr><td>Location:</td><td>Bonneville County, Idaho</td></tr>
<tr><td>WREGIS ID:</td><td>W3260</td></tr>
<tr><td>Vintage:</td><td>April 2020 – March 2022</td></tr>
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<tr><td>Name of Facility:</td><td>Klondike III</td></tr>
<tr><td>Location:</td><td>Oregon</td></tr>
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<tr><td>Vintage:</td><td>April 2020 – March 2022</td></tr>
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<tr><td>Location:</td><td>Oregon</td></tr>
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<tr><td>Contract Price:</td><td>$93,152.25 Dollars</td></tr>
<tr><td>Delivery Term:</td><td>Idaho Falls Power will retire in the WREGIS system the contract quantity of REC's on behalf of the Purchaser in a Retirement Sub-account.</td></tr>
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SPECIAL PROVISIONS

2.01 Additional Definitions.

"Environmental Attributes" means "Green Attributes". "Green Attributes" means any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the generation

from the Project, and its avoided emission of pollutants. Green Attributes include but are not limited to Renewable Energy Credits, as well as: (1) any avoided emission of pollutants to the air, soil or water such as sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO) and other pollutants; (2) any avoided emissions of carbon dioxide (CO2), methane (CH4), nitrous oxide, hydro fluorocarbons, per fluorocarbons, sulfur hexafluoride and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change, or otherwise by law, to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere;[1] (3) the reporting rights to these avoided emissions, such as Green Tag Reporting Rights. Green Tag Reporting Rights are the right of a Green Tag Purchaser to report the ownership of accumulated Green Tags in compliance with federal or state law, if applicable, and to a federal or state agency or any other party at the Green Tag Purchaser's discretion, and include without limitation those Green Tag Reporting Rights accruing under Section 1605(b) of The Energy Policy Act of 1992 and any present or future federal, state, or local law, regulation or bill, and international or foreign emissions trading program. Green Tags are accumulated on a MWh basis and one Green Tag represents the Green Attributes associated with one (1) MWh of Energy. Green Attributes do not include (i) any energy, capacity, reliability or other power attributes from the Project, (ii) production tax credits associated with the construction or operation of the Project and other financial incentives in the form of credits, reductions or allowances associated with the Project that are applicable to a state or federal income taxation obligation, (iii) fuel-related subsidies or "tipping fees" that may be paid to the Seller to accept certain fuels, or local subsidies received by the generator for the destruction of particular preexisting pollutants or the promotion of local environmental benefits, or (iv) emission reduction credits encumbered or used by the Project for compliance with local, state, or federal operating and/or air quality permits. If the Project is a biomass or biogas facility and Seller receives any tradable Green Attributes based on the greenhouse gas reduction benefits or other emission offsets attributed to its fuel usage, it shall provide Purchaser with sufficient Green Attributes to ensure that there are zero net emissions associated with the production of electricity from the Project.

"PPT" means Pacific Prevailing Time.

"Project" means the Eligible Renewable Resource(s) specified in Article One.

"WREGIS" means the Western Renewable Energy Generation Information System or its successor organization recognized under applicable laws for the registration, transfer or ownership of RECs, Environmental Attributes or Green Attributes.

"WREGIS Certificate" means "Certificate" as defined by WREGIS in the WREGIS Operating Rules. A WREGIS Certificate represents all of the renewable and environmental attributes from one MWh of electricity generation from a renewable energy Generating Unit registered with the WREGIS tracking system or a certificate imported from a Compatible Certificate Tracking System that has been converted to a WREGIS Certificate unless otherwise specified in more detail in Resource Type from table above.

"WREGIS Operating Rules" means the operating rules and requirements adopted by WREGIS.

"Retirement Sub-account" means the repository for WREGIS Certificates that the Account Holder wants to designate as retired and removed from circulation. Once a Certificate has been transferred into a WREGIS Retirement Sub-account, it cannot be transferred again to any other account or Subaccount.

"Retirement of Certificates" means the action taken to remove a Certificate from circulation within WREGIS.

2.02 Additional Representations and Warranties.

(a) During the Term, each Party represents and warrants to the other that:

(i) It is an "eligible commercial entity" and an "eligible contract participant" within the meaning of United States Commodity Exchange Act §§1a(11) and 1a(12), respectively, and this

[1] Avoided emissions may or may not have any value for GHG compliance purposes. Although avoided emissions are included in the list of Green Attributes, this inclusion does not create any right to use those avoided emissions to comply with any GHG regulatory program.

Transaction has been subject to individual negotiation by the Parties;

(ii) It is duly organized, validly existing and in good standing under the law of the jurisdiction of its formation;

(iii) It shall maintain its status as a "forward contract merchant" within the meaning of the United States Bankruptcy Code (for as long as such term has the same definition as in effect as of the date of this Transaction) and

(iv) It is acting for its own account and is sophisticated, experienced and knowledgeable regarding the electricity industry and financial matters, is able to evaluate the risks and merits of the transactions contemplated herein and is not relying in any manner on the other Party for advice or analysis regarding the risks or merits of any such transaction; and

(v) Neither Party is a fiduciary of the other.

(b) Seller, and, if applicable, its successors, further represents and warrants to Purchaser throughout the Term of this Transaction that:

(i) Seller hereby provides and conveys all Green Attributes associated with all electricity generation from the Project to Buyer as part of the Product being delivered. Seller represents and warrants that Seller holds the rights to all Green Attributes from the REC's, and Seller agrees to convey and hereby conveys all such Green Attributes to Buyer as included in the delivery of the Product from the Project.

(ii) Seller has not and will not sell, pledge, assign, transfer or otherwise dispose of any of its rights and interests in and to the Green Attributes sold to Purchaser pursuant to this Transaction to any person or entity other than Purchaser, or report to any person or entity that such Green Attributes belong to any person or entity other than Purchaser;

(iii) All of the Green Attributes and energy generation from the REC's being sold to Purchaser have been sold to Purchaser and have not been sold or committed separately to any third party;

(iv) The Projects qualifies and is certified by WREGIS as an Eligible Renewable Energy Resource;

(v) The Green Attributes have not been used to meet any federal, state or local renewable energy requirement, renewable energy procurement, renewable portfolio standard, or other renewable energy mandate by Seller or, to Seller's knowledge, any third party;

(vi) Seller has and during the Term shall continue to maintain Certification from WREGIS.

2.03 Payment and Title Transfer of RECs.

(a) Seller's invoice shall include a charge for the REC's. Ownership of Green Attributes will be transferred through WREGIS to the Purchaser through permanent retirement in WREGIS on the Business Day following receipt of payment from Purchaser to Seller and notification to permanently retire the RECs into the Sellers designated Retirement Sub-account.

(b) Failure of Title Transfer**:** In the event that WREGIS fails to deliver or restricts acceptance of the Green Attributes, then each Party will provide the other Party with all documents, communications, and information sent to or received from WREGIS that pertain thereto. The Parties will cooperate, each at its own expense, to assure the completion of all actions and items required for transfer of the Green Attributes, and will promptly complete any and all uncompleted actions and items. If following such efforts WREGIS does not transfer the Green Attributes for reasons beyond either the Buyer's or Seller's control, Seller will provide an Attestation to Buyer and the event described hereto will not be considered an Event of Default or a failure to deliver Green Attribute

2.04 Governing Law. THIS CONFIRMATION AGREEMENT AND THE RIGHTS AND DUTIES OF THE PARTIES HEREUNDER SHALL BE GOVERNED BY AND CONSTRUED, ENFORCED AND PERFORMED IN ACCORDANCE WITH THE LAWS OF THE STATE OF IDAHO, WITHOUT REGARD

TO PRINCIPLES OF CONFLICTS OF LAW. TO THE EXTENT ENFORCEABLE AT SUCH TIME, EACH PARTY WAIVES ITS RESPECTIVE RIGHT TO ANY JURY TRIAL WITH RESPECT TO ANY LITIGATION ARISING UNDER OR IN CONNECTION WITH THIS AGREEMENT.

2.05 **Regulatory.** The Parties intend the rates, terms and conditions of service specified in this Transaction to remain fixed throughout the Term regardless of any changes in underlying costs that would justify a change in rates under traditional cost of service principles. The Parties agree that they shall not make unilateral application to FERC for a change in rates, terms and conditions herein under Section 205 and/or 206 of The Federal Power Act nor shall either Party seek any change in the rates, terms and conditions herein based upon changes in its costs of service. Neither Party shall unilaterally seek to obtain from the FERC any relief changing the rate, charge, classification, or other term or condition of this Transaction, notwithstanding any subsequent changes in applicable law or market conditions that may occur.

ACKNOWLEDGED AND AGREED TO AS OF THE CONFIRMATION EFFECTIVE DATE:

By:	Bear Prairie	**By:**	
Date:	10/13/2022	**Date:**	
Name:	Bear Prairie	**Name:**	
Title:	Assistant General Manager	**Title:**	

Revised/Updated REC Distribution for Historical RECs and FY 2021

Renewable Energy Certificate Update/Correction

Sustainable INL

Updated: 8/3/21

Purchase Fiscal Year	Consumption Fiscal Year	Total Electricity (MWh)	NRF Electricity (MWh)	BEA Electricity (MWh)	Fluor Electricity (MWh)	Total RECs (MWh)	NRF RECs (MWh)	BEA RECs (MWh)	Fluor RECs (MWh)	Total RECs for Dashboard (MWh)	Total RECs for Calculation Check	REC % of Total
2007	2006	237,953	19,053	151,479	67,420	**6,800**	0	4,706	2,094	**6,800**	**6,800**	3%
2008	2007	239,996	20,704	152,018	67,273	**6,600**	0	4,575	2,025	**6,600**	**6,600**	3%
2009	2008	251,826	21,173	155,634	75,019	**6,920**	0	4,669	2,251	**6,920**	**6,920**	3%
2010	2009	239,134	20,564	149,028	69,543	**16,393**	0	11,177	5,216	**16,393**	**16,393**	7.5%
2011	2010	245,650	20,086	152,848	72,716	**16,900**	0	11,452	5,448	**16,900**	**16,900**	7.5%
2012	2011	242,166	21,521	145,555	75,090	**22,000**	0	14,513	7,487	**22,000**	**22,000**	10%
2013	2012	243,135	21,622	148,730	72,783	**23,000**	0	15,443	7,557	**23,000**	**23,000**	10%
2014	2013	247,328	21,806	153,227	72,295	**24,750**	2,182	15,333	7,235	**22,568**	**24,750**	10%
2015	2014	243,926	21,644	152,911	69,371	**32,400**	2,875	20,311	9,214	**29,525**	**32,400**	13%
2016	2015	229,038	20,713	139,300	69,025	**29,200**	2,641	17,759	8,800	**26,559**	**29,200**	13%
2017	2016	243,434	21,909	160,468	61,057	**32,700**	2,943	21,555	8,202	**29,757**	**32,700**	13%
2018	2017	241,639	24,035	154,693	62,911	**20,500**	2,039	13,124	5,337	**18,461**	**20,500**	8%
2019	2018	242,745	21,495	156,100	65,151	**20,500**	1,815	13,183	5,502	**18,685**	**20,500**	8%
2020	2019	243,464	21,002	156,840	65,622	**24,319**	2,098	15,666	6,555	**22,221**	**24,319**	10%
2021	2020	261,477	21,789	176,551	63,137	**19,611**	1,634	13,242	4,735	**17,977**	**19,611**	7.5%

Appendix G

Scope 3 Comprehensive Tables

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Appendix G

Scope 3 Comprehensive Tables

Table G-1. Number and type of commute miles traveled by INL employees during FY 2008 to FY 2015.

Type of Miles	FY 2008		FY 2009		FY 2010		FY 2011		FY 2012		FY 2013		FY 2014		FY 2015	
	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	NA[a]	0	14,667,892	5,494	15,876,348	5,947	13,148,613.94	4,925	12,191,061.62	4,566.42	10,557,232.51	3,954.43	10,156,632.59	3,801.74	10,668,699.81	5,343.24
Passenger SUV or Truck Miles, Gasoline	NA[a]	0	7,224,484	3,860	6,472,196	3,458	6,762,734.90	3,612	5,790,039.03	3,093.77	5,318,564.68	2,841.85	5,444,415.77	2,906.81	5,966,269.03	3,811.81
Motorcycle Miles	NA[a]	0	NA[b]	0	260,255	44	206,003.65	35	141,226.58	24.10	99,987.66	17.06	134,752.07	23.02	97,138.84	23.45
Passenger Car Miles, Diesel	NA[a]	0	NA[b]	0	132,135	74	397,064.15	223	227,665.87	102.92	455,001.37	205.68	474,717.50	214.60	331,921.20	181.66
Passenger SUV or Truck Miles, Diesel	NA[a]	0	NA[b]	0	1,153,449	648	1,091,658.30	613	772,147.64	433.52	971,366.78	545.37	809,677.42	454.43	863,313.19	753.99
Passenger Car Miles, Alternative Fuel	NA[a]	0	NA[b]	0	NA[c]	—	481,231.75	35	489,078.99	92.44	540,463.54	102.08	655,286.82	124.49	621,265.39	133.36
TOTAL VEHICLE MILES	20,260,127	8,657	21,892,377	9,354	23,894,383	10,171	22,087,306.70	9,410	19,611,219.73	8,313.16	17,942,616.54	7,666.47	17,675,482.17	7,525.08	18,548,607.46	10,247.52
Walk, run, or bike Miles	NA[a]	0	65,315	0	85,636	0	514,043.20	0	84,320.40	0	48,837.72	0	46,189.87	0	80,688.11	0
TOTAL COMMUTE MILES	20,260,127	8,657	21,957,691	9,354	23,980,019	10,171	22,601,349.90	9,410	19,695,540.14	8,313.16	17,991,454.27	7,666.47	17,721,672.04	7,525.08	18,629,295.57	10,247.52

a. This category was not considered in the FY 2008 commute calculations, which only estimated total number of commute vehicle miles.
b. This category was not considered in the FY 2009 commute calculations, which assumed employees drove only gasoline cars and SUVs/trucks.
c. This was a new category included in the FY 2011 employee commute survey and was not included in the FY 2010 commute survey.

Table G-2. Number and type of commute miles traveled by INL employees during FY 2016 to FY 2021.

	FY 2016		FY 2017		FY 2018		FY 2019		FY 2020		FY 2021	
Type of Miles	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	12,698,096.50	4,753.04	12,580,154.35	4,708.89	12,087,086.37	4,570.71	14,724,598.96	5,300.78	10,235,869	3,684.86	9,964,437	3,587.15
Passenger SUV or Truck Miles, Gasoline	7,261,771.79	3,877.10	7,393,318.86	3,947.33	6,964,134.09	3,608.09	8,499,731.78	4,182.34	5,978,373	2,942.69	5,400,563	2,657.38
Motorcycle Miles	118,566.30	20.26	96,930.89	16.56	104,383.41	22.81	77,175.38	15.04	77,975	15.19	65,182	12.70
Passenger Car Miles, Diesel	370,592.60	167.53	141,442.96	63.94	282,470.44	135.35	299,792.77	135.52	208,924	94.45	171,742	77.64
Passenger SUV or Truck Miles, Diesel	1,179,758.84	662.13	1,452,986.59	815.48	1,175,947.22	686.89	1,499,180.86	841.41	1,056,782	593.11	1,079,442	605.83
Passenger Car Miles, Alternative Fuel	720,804.00	136.94	845,635.88	160.65	737,979.28	151.44	1,267,625.13	240.83	705,873	134.10	593,071	112.67
TOTAL VEHICLE MILES	22,349,590	9,617.00	22,510,469.53	9,712.86	21,352,000.82	9,175.29	26,368,094.87	10,715.91	18,263,796	7,463.41	17,274,437	7,053.37
Walk, run, or bike Miles	124.769.20	0	103,882.53	0	115,426.22	0	86,961.55	0	93,207	0	70,345	
TOTAL COMMUTE MILES	22,349,590	9.617.00	22,614,352	9,712.8	21,467,427	9,175.29	26,455,056.42	10,715.91	18,357,003	7,463.41	17,344,782	7,053.37

Table G-3. Number of miles flown by INL employees during FY 2008.

Type of Miles	Number of Passenger-Miles	GHG Emissions (MT CO_2e)
Domestic	18,861,146	5,165
International	5,558,308	1,522
TOTAL	24,419,454	6,687

Since airline miles were further broken down into short-, medium-, and long-haul flights, subsequent years are included in the following table:

Table G-4. Number of miles flown by INL employees during FY 2009–FY 2015.

	FY 2009		FY 2010		FY 2011		FY 2012		FY 2013		FY 2014		FY 2015	
Type of Miles	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)
Short Haul	3,797,347	1,063	3,302,333	924	2,861,280	801	2,231,351	653	1,676,050	491	1,924,764	535	2,200,131	611
Medium Haul	7,965,079	1,847	7,631,935	1,770	4,750,674	1,102	3,482,410	582	2,477,466	414	3,038,297	497	3,702,956	605
Long Haul	23,795,526	4,470	21,778,636	4,091	20,561,904	3,863	16,371,756	3,129	12,639,219	2,415	14,745,751	2,843	17,332,661	3,341
TOTAL	35,557,952	7,380	32,712,904	6,785	28,173,858	5,765	22,085,517	4,364	16,792,735	3,320	19,708,812	3,875	23,235,748	4,558

Table G-5. Number of miles flown by INL employees during FY 2016–FY 2021.

	FY 2016		FY 2017		FY 2018		FY 2019		FY 2020		FY 2021	
Type of Miles	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger- Miles	GHG Emissions (MT CO_2e)
Short Haul	2,681,701	745.03	2,598,971	722.046	2,918,613	810.85	3,229,678	897.27	1,613,740	448.33	353,652	98.25
Medium Haul	4,530,056	740.98	4,628,342	757.056	4,873,276	797.12	5,85,078	957.22	2,881,296	471.29	539,735	88.28
Long Haul	20,780,764	4,006.70	19,890,213	3,834.992	22,167,772	4,274.12	25,370,586	4,891.65	12,039,139	3,321.24	2,519,332	485.75
TOTAL	27,992,521	5,492.71	27,117,526	5,314.09	29,959,661	5,882.09	34,452,342	6,746.14	16,534,175	3,240.86	3,412,719	672.28

Table G-6. Number of vehicle-miles traveled in rental cars by INL employees during FY 2008–FY 2015.

	FY 2008		FY 2009		FY 2010		FY 2011		FY 2012		FY 2013		FY 2014		FY 2015	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	499,500	187	533,177	200	490,076	183	632,548	237	478,904	179	415,295	156	636,701	238	625,821	234
Light-Duty Truck/Van/SUV	306,413	164	257,392	138	254,027	136	292,809	156	225,320	120	56,992	30	90,108	48	70,737	37
TOTAL	805,913	351	790,569	338	744,103	319	925,357	393	704,225	300	472,287	186	726,809	286	696,558	272

Table G-7. Number of vehicle-miles traveled in rental cars by INL employees during FY 2016–FY 2021.

	FY 2016		FY 2017		FY 2018		FY 2019		FY 2020		FY 2021	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	610,502	228.52	325,013	121.66	522,639	195.63	737,294	255.66	433,210	146.26	267,297	91.85
Light-Duty Truck/Van/SUV	241,117	128.73	216,675	115.68	320,327	171.02	1,051,522	502.46	368,080	170.89	227,962	106.52
TOTAL	851,619	357.25	541,689	237.34	842,966	366.65	1,788,816	758.12	801,290	317.15	495,259	198.37

Appendix H

Calculation Spreadsheets and Notes

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Appendix H

Calculation Spreadsheets and Notes

Table H-1 summarizes the following for each of INL's emissions categories considered during FY 2021:

- Source spreadsheets for data calculation (e.g., calculating how much waste INL produced based on quantities from each facility)
- Source spreadsheets for GHG calculation (e.g., calculating how many GHGs were produced by INL's annual waste disposal)
- Applicable comments (the Guidance equation number[s] used, who provided the data, etc.).

Table H-1. Calculation spreadsheets and comments for emissions categories included in the INL FY 2021 GHG inventory.

Scope	Emissions Category	FY 2021 Spreadsheet for Data Calculation	FY 2021 Spreadsheet for GHG Calculation	Comments
All	Summary	Sheet: "Sheet1," "Overall Summary Stats – 17Feb2022.xlsx"	Sheet: "Sheet1" and "Summary for Plots," "Overall Summary Stats – 17Feb2022.xlsx"	None.
1	Stationary Combustion	Sheet: "Fuel Data," "FY21 Summary for GHG - Stationary Combustion 16Feb2022.xlsx"	Sheet: "GHG Emissions," "FY21 Summary for GHG - Stationary Combustion 16Feb2022.xlsx"	Default Methodology, Equations A-1, A-2, and A-3. Fuel data provided by Maryl Fisher (INL Energy Management).
	Mobile Combustion	Sheets: "Report (Sorted)" and "GSA WEX FY21 (categorized)," "FY21 Summary for GHG – Mobile Combustion – 10Dec2021"	Sheet: "GHG Emissions," " FY21 Summary for GHG – Mobile Combustion – 10Dec2021"	Alternate Methodology, Equations A-5, A-9, and A-10 (A-11 and A-12 for biogenic). Fuel data extracted from INL TIMS database, by Brandon Rainey and WEX card purchases by Cherene Laird – GHG Summary Revised Report by Kim Scully (INL Pollution Prevention).
	Fugitive Emissions: Refrigerants	Sheet: "Emissions Summary Sheet,", "GHG Report FY21 Backup Summary Sheets – 14Oct2021.xlsx"	Sheet: "Emissions Summary Sheet,", "GHG Report FY21 Backup Summary Sheets – 14Oct2021.xlsx"	Alternate Methodology, Equations A-15 and A-16. Data compiled by Kim Scully (INL Pollution Prevention).

Table H-1. (continued).

Scope	Emissions Category	FY 2021 Spreadsheet for Data Calculation	FY 2021 Spreadsheet for GHG Calculation	Comments
1 (cont'd)	Fugitive Emissions: Onsite Landfill	Sheet: "Landfill Data," "Landfill Report for LandGEM 28Oct2021.xlsx"	Sheet: "FY21 GHG Calcs," "Landfill Report for LandGEM 28Oct2021.xlsx"	Used LandGEM v302 and Equation A-34 from Guidance. Data pulled from INWMIS by Kim Scully (INL Pollution Prevention).
	Fugitive Emissions: Onsite Wastewater Treatment	Sheet: "Wastewater Types," "FY21 Wastewater for GHG (Scope 1+3) - 17Oct2021.xlsx"	Sheet: "Onsite Wastewater," "FY21 Wastewater for GHG (Scope 1+3) - 17Oct2021.xlsx"	Default Methodology, Equations A-23 and A-24 and A-26 from Guidance. Employee counts provided by Lynette Martin (INL Human Resources).
2	Purchased Electricity	Sheet: "Elec Totals," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Default Methodology, Equations B-1 and B-2 from Guidance. Data provided by Maryl Fisher and Jacqueline Swanson (INL Energy Management).
	Transmission and Distribution Losses (Owned)	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Default Methodology, Equations B-1 and B-2 from TSD. T&D loss information provided by Ernest Fossum (INL Energy Management).
	Purchased RECs	"IFP REC Sales Agreement (INL) – 2021.pdf"	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Default Methodology, Section B.6.1 from Guidance. RECs Receipts provided by Maryl Fisher(INL Energy Management).
	REC History Revisions	Sheet: "Updated REC History Corrections – 3Aug2021.xlsx"	Sheet: "Updated REC History Corrections – 3Aug2021.xlsx"	Default Methodology, Section B.6.1 from Guidance. RECs Revisions provided by Ernest Fossum (INL Energy Management).

Table H-1. (continued).

Scope	Emissions Category	FY 2021 Spreadsheet for Data Calculation	FY 2021 Spreadsheet for GHG Calculation	Comments
3	Transmission and Distribution Losses (Shared)	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Sheet: "GHGCalcs," "FY21 Summary for GHG - Scope 2 16Feb2022.xlsx"	Default Methodology, Equations C-5, C-6, and C-7 from Guidance.
	Employee Commuting	Sheet: "BEA Totals," "FY21 BEA Numbers.xlsx"	Sheet: "8.3 Commute," "CEDR FY 2021 Dashboard Verification – BEA Only – Broken Links.xlsx"	Default Methodology, Equations C-14, C-15, C-16, C-17, and C-18 from Guidance. FY20 Employee commute data provided by Jodi Grgich (INL Systems Engineering), COVID-19 Telework numbers provided by various directorate level administrative assistants.
3 (cont'd)	Business Air Travel	Sheet: "Sheet1," "INL-100120-093021-MILES-updated.xlsx" and Sheet: "Summary." "INL – Air CO_2 Report.xlsx"	Sheet: "8.1 Air Travel," "CEDR FY 2021 Dashboard Verification – BEA Only – Broken Links.xlsx"	Default Methodology, Equations C-1 and C-2 from Guidance. Data provided by Travel Leisure on behalf of INL Travel Office.
	Business Ground Travel: Rental Vehicle	Sheets: "Subtotaled," "FY21 Rental Car Miles Summary 1Nov2021.xls"	Sheet: "GHGs," "FY21 Rental Car Miles Summary 1Nov2021.xlsx"	Advanced Methodology 2, Equations C-11, C-12, and C-13 from Guidance. Data provided by travel vendors on behalf of INL Travel Office.
	Business Ground Travel: Personal Vehicle	Sheet: "POV Totals," "2021 POV Miles.xlsx"	Sheet: "GHGs," "2021 POV Miles.xlsx"	Advanced Methodology 2, Equations C-11, C-12, and C-13 from Guidance. Data pulled from INL Concur travel system – provided by Ryan Ballain (INL PFC).
	Contracted MSW Disposal	Sheets: "FY21 sml," "FY21 30yd," and "Summary," "Sanitation Department Report FY21.xls"	Sheet: "Offsite MSW," "FY21 Offsite MSW for GHG – 27Oct2021.xlsx"	Default Methodology, Equation C-22 from Guidance (C-23 for biogenic). Data compiled by Kim Scully (INL Pollution Prevention).

Table H-1. (continued).

Scope	Emissions Category	FY 2021 Spreadsheet for Data Calculation	FY 2021 Spreadsheet for GHG Calculation	Comments
	Contracted Wastewater Treatment	Sheet: "Wastewater Types," "FY21 Wastewater for GHG (Scope 1+3) - 27Oct2021.xlsx"	Sheet: "Offsite Wastewater," "FY21 Wastewater for GHG (Scope 1+3) - 27Oct2021.xlsx"	Default Methodology, Used Equations A-19, A-20, and A-22 from Guidance. Employee counts provided by Lynette Martin (INL Human Resources).