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Idaho National Laboratory's FY09 & FY10 Greenhouse Gas Report

Jennifer D. Morton

June 2011

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

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Idaho National Laboratory
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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) 2009 and 2010 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 13514 requires that federal agencies and institutions document reductions in GHG emissions.

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 (occur outside INL's organizational boundaries, but are a consequence of INL's activities).

This inventory found that INL generated 103,590 and 102,413 MT of CO_2-equivalent emissions during FY09 and FY10, respectively. The following conclusions were made from looking at the results of the individual contributors to INL's FY09 and FY10 GHG inventories:

- 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 stationary combustion (facility fuels), waste disposal (including fugitive emissions from the onsite landfill and contracted disposal), mobile combustion (fleet fuels), employee commuting, and business air travel
- Sources with low emissions were wastewater treatment (onsite and contracted), fugitive emissions from refrigerants, 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 the Battelle Energy Alliance (BEA) and those managed by other contractors, it includes only that large proportion of Laboratory 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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CONTENTS

EXECUTIVE SUMMARY iii

ACKNOWLEDGMENTS v

ACRONYMS xi

1. INTRODUCTION 1

2. WHY LOOK AT GREENHOUSE GASES? 4
   - 2.1 Environmental Motivations 4
   - 2.2 Political Motivations 4
   - 2.3 INL Objectives 4
     - 2.3.1 Sustainable INL 4

3. CALCULATION APPROACH 6
   - 3.1 Selected GHG Protocol 6
   - 3.2 Defined Inventory Boundaries 6
   - 3.3 Defined Scope 6
   - 3.4 Identified Greenhouse Gas Emissions Categories 10

4. DISCUSSION AND RESULTS 12
   - 4.1 Summary 12
   - 4.2 Scope One – Direct Emissions 15
     - 4.2.1 Stationary Combustion Emissions 17
     - 4.2.2 Mobile Combustion Emissions 18
     - 4.2.3 Fugitive Emissions: Refrigerants 21
     - 4.2.4 Fugitive Emissions: Onsite Landfill 23
     - 4.2.5 Fugitive Emissions: Onsite Wastewater Treatment 25
   - 4.3 Scope Two – Indirect Emissions 27
     - 4.3.1 Purchased Electricity Emissions 29
     - 4.3.2 Transmission and Distribution Loss Emissions, Owned 30
     - 4.3.3 Renewable Energy Certificates Emissions 31
   - 4.4 Scope Three – Indirect Emissions 32
     - 4.4.1 Transmission and Distribution Loss Emissions, Shared 34
     - 4.4.2 Employee Commuting Emissions 34
     - 4.4.3 Business Air Travel Emissions 37
     - 4.4.4 Business Ground Travel: Rental Vehicle Emissions 38
     - 4.4.5 Business Ground Travel: Personal Vehicle Emissions 39
     - 4.4.6 Contracted MSW Disposal Emissions 41
     - 4.4.7 Contracted Wastewater Treatment 42

5. PUTTING INL'S FOOTPRINT INTO PERSPECTIVE 43

6. SUMMARY AND CONCLUSIONS 44

7. REFERENCES 46

Appendix A—Global Warming Potentials 47

Appendix B—Emissions Factors Used 51

Appendix C—Calculation Spreadsheets & Notes 63

Appendix D—Sample Calculation 71

Attachment 1—Receipt for RECs Purchased in FY09 75

FIGURES

Figure 1. Location map of the INL Site and major facilities. 2

Figure 2. GHG emissions from Scope 1, 2, and 3 7

Figure 3. INL's FY09 GHG emissions, by scope. 13

Figure 4. INL's FY10 GHG emissions, by scope. 13

Figure 5. INL's FY09 GHG emissions, by scope and emissions category, excluding biogenic emissions. 14

Figure 6. INL's FY10 GHG emissions, by scope and emissions category, excluding biogenic emissions. 14

Figure 7. Comparison of INL's FY08, FY09, and FY10 GHG emissions, by scope and emissions category, excluding biogenic emissions. 15

Figure 8. INL's FY09 GHG emission results for Scope 1. 15

Figure 9. INL's FY10 GHG emission results for Scope 1. 16

Figure 10. Comparison of INL's FY08, FY09, and FY10 Scope 1 GHG emissions. 16

Figure 11. INL's FY09 GHG emission results for Scope 2. 27

Figure 12. INL's FY10 GHG emission results for Scope 2. 28

Figure 13. Comparison of INL's FY08, FY09, and FY10 Scope 2 GHG emissions. 28

Figure 14. INL's FY09 GHG emission results for Scope 3. 32

Figure 15. INL's FY10 GHG emission results for Scope 3. 33

Figure 16. Comparison of INL's FY08, FY09, and FY10 Scope 3 GHG emissions. 33

Figure 17. Number of miles traveled in FY09 for sampled business travel in personally owned vehicles. 40

Figure 18. Comparison of INL's FY08, FY09, and FY10 actual, and FY20 goal GHG emissions, by scope. 44

TABLES

Table 1. GHG emissions categories identified in Guidance and TSD. 8
Table 2. INL's GHG emissions categories for Scopes 1, 2, and 3. 10
Table 3. INL's GHG emissions during FY09 and FY10. 12
Table 4. Amounts of fuel used for stationary combustion at INL during FY09. 17
Table 5. Amounts of fuel used for stationary combustion at INL during FY10. 17
Table 6. Fuel amounts and corresponding GHG emissions for INL's FY09 fleet. 19
Table 7. Fuel amounts and corresponding GHG emissions for INL's FY10 fleet. 20
Table 8. Fugitive refrigerants evaluated for GHG emissions during FY09 and FY10 at INL. 22
Table 9. Amount of solid waste produced annually since 1984 for disposal in INL's onsite CFA landfill. 24
Table 10. FY09 population data by facility for onsite wastewater treatment calculations. 26
Table 11. FY10 population data by facility for onsite wastewater treatment calculations. 26
Table 12. INL's FY09 and FY10 electrical purchases by location and provider. 29
Table 13. INL's GHG emissions from electricity and RECs purchased in FY09 and FY10. 31
Table 14. Number and type of commute miles traveled by INL employees during FY09 and FY10. 36
Table 15. Number of miles flown by INL employees during FY09 and FY10. 38
Table 16. Number of vehicle-miles traveled in rental cars by INL employees during FY09 and FY10. 39
Table A-1. Global warming potentials. 49
Table B-1. Stationary combustion conversion and emissions factors used. 53
Table B-2. Mobile combustion emissions factors used. 55
Table B-3. Electricity emissions factors used. 59
Table B-4. Employee commute, rental car miles, and personal car miles emissions factors used. 60
Table B-5. Business travel airline miles emissions factors used. 61
Table C-1. Calculation Spreadsheets and Comments for Emissions Categories included in the INL FY09 GHG Inventory. 65
Table C-2. Calculation Spreadsheets and Comments for Emissions Categories included in the INL FY10 GHG Inventory. 68

ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Project
ATR	Advanced Test Reactor
BBWI	Bechtel BWXT Idaho, LLC
BEA	Battelle Energy Alliance
CAS	Chemical Abstract Service
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
CNG	Compressed Natural Gas
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
CWI	CH2M-WG Idaho, LLC
DOE	Department of Energy
DOE-HQ	Department of Energy Headquarters
DOE-ID	Department of Energy Idaho Operations Office
eGRID	Emissions & Generation Resource Integrated Database
EIA	Energy Information Administration
EO	executive order
EPA	Environmental Protection Agency
ERCOT	Electric Reliability Council of Texas
FEMP	Federal Energy Management Program
FERC	Federal Energy Regulatory Commission
FY	fiscal year
GHG	greenhouse gas
GSA	General Services Administration
GWP	Global Warming Potential
HHV	higher heating value
ICP	Idaho Cleanup Project
INEEL	Idaho National Engineering and Environmental Laboratory (a forerunner of INL)
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology Center
INWMIS	INEEL Nonradiological Waste Management Information System
IWTS	Integrated Waste Tracking System
LandGEM	Landfill Gas Emissions Model

LMI	Land Management Institute
LNG	Liquefied Natural Gas
LPG	Liquefied Propane Gas
MFC	Materials and Fuels Complex
MRR	Mandatory Reporting of Greenhouse Gases Rule
MSW	municipal solid waste
MT	metric tonnes
NRF	Naval Reactors Facility
NWPP	Northwest Power Pool
PSS	Public Sector Standard
REC	Renewable Energy Certificate
SMC	Specific Manufacturing Capability
T&D	Transmission & Distribution
TIMS	Transportation Issues Management System
TSD	Technical Support Document
WECC	Western Electricity Coordinating Council
WRI	World Resource Institute

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1. INTRODUCTION

Idaho National Laboratory (INL) has been in operation since 1949. Battelle Energy Alliance (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 "Ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities."

The INL Site covers approximately 890 square miles of high-elevation desert in southeastern Idaho and is home to multiple facilities 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 the laboratory. Other major contractors currently operating at the INL Site include:

- CH2M WG Idaho manages the Idaho Cleanup Project (ICP), which includes the Idaho Nuclear Technology Center (INTEC) facility and the performance of cleanup work across the INL Site
- Bechtel BWXT Idaho operates the Advanced Mixed Waste Treatment Project (AMWTP)
- Bechtel Bettis operates the Naval Reactor Facilities (NRF)
- DOE Idaho Operations Office (DOE-ID).

This report will look exclusively at the greenhouse gas (GHG) emissions that INL (BEA) owns and 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), 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, approximately 30 to 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 (GSA) 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 of which are DOE-owned, 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 work-force, 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 at INL's forerunner, the National Reactor Test Station, in 1951. 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. Fiscal year (FY) 2008 was chosen as the baseline year since this calculation effort will also support EO 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," requirements to report on and reduce GHG emissions based on an FY08 baseline. This report documents the effort to calculate the GHG emissions for FY09 and FY10, and compares them to the FY08 baseline results. (For more information on INL's FY08 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: the EO 13514 "Federal Greenhouse Gas Accounting and Reporting Guidance" (referred to herein as the Guidance) [2010], and its accompanying "Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document" (referred to herein as the TSD) [2010]. 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 and TSD utilize a combination of existing guidance and regulations as their basis, including:

- The World Resource Institute's (WRI's) and Land Management Institute's (LMI's) Public Sector GHG Accounting and Reporting Standard (Public Sector Standard [PSS])
- Environmental Protection Agency's (EPA's) Climate Leaders Guidance
- EPA's "Final Rule: Mandatory Reporting of Greenhouse Gases" (MRR, 74 FR 56260), as references for their methodologies and emission factors.

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 desires within the Laboratory.

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—including air pollution, habitat degradation, and resource extraction—in mind 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 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 Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." As the name indicates, the EO requires that federal agencies "lead by example" in measuring, reporting, and reducing GHG emissions. It requires that agencies of the federal government report existing emissions and the steps taken to eliminate pollutants in a way that is transparent.

This report represents the effort to catalog INL's contribution to the INL Site carbon footprint. For purposes of compliance to 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 new metrics, such as employee commuting and travel, are new and have not been previously tracked.

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. 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

Sustainable INL is a newly launched program, part of a movement among federal agencies to evaluate current processes and establish goals for achieving sustainability. The Sustainable INL mission is to "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 continue

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 13514: energy efficiency, renewable energy, toxics reductions, recycling, sustainable buildings, electronics stewardship, fleet efficiency, and water conservation. Sustainable INL relies on management and employee participation to achieve its goals. For questions specific to Sustainable INL, visit www.inl.gov/sustainable, or contact Chris Ischay (Program Manager, 208-526-4382, Christopher.Ischay@inl.gov) or Ernest Fossum (Energy Manager, 208-526-2513, Ernest.Fossum@inl.gov).

3. CALCULATION APPROACH

3.1 Selected GHG Protocol

As mentioned in Section 1, these calculations follow the Guidance and the TSD 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 CH2M-WG Idaho, LLC (CWI), Bechtel BWXT Idaho, LLC (BBWI), and NRF. 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 FY10[a] contributions to the overall INL Site's GHG inventory:

- INL employees (including interns and temporary employees) amounted to 4,200 of the combined 8,000 (approximate) employees at the INL Site during FY10
- The total square footage of buildings owned by INL or occupied by INL personnel and used for INL operations represented 56% of the total 5.7 million square feet that made up the INL Site in FY10 (61% of 549 buildings)[b]
- The percentage of electrical power consumed by INL operations and personnel is 60.2% of the total 253,786 MWh.

3.3 Defined Scope

GHG inventories or footprints consider emissions from three emission 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 FY09 or FY10.)
- 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 a large number of 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 TSD for required reporting. Other activities that could be included in Scope 3 include the embodied emissions of purchased materials.

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a. Similar results were observed in FY09.

b. These are based on the numbers at the end of the FY10 first quarter, 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.

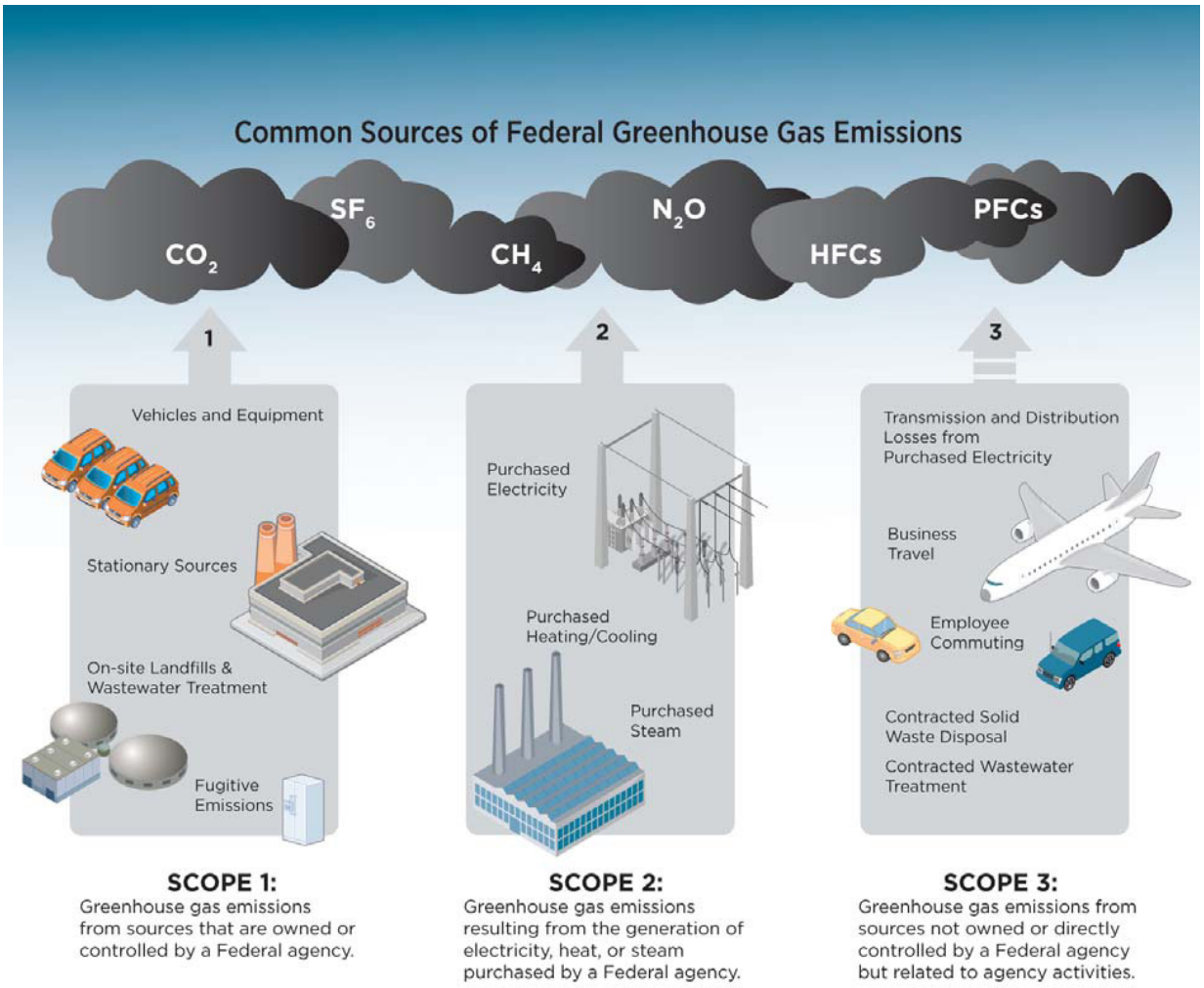

Figure 2. GHG emissions from Scope 1, 2, and 3.

This inventory considered the following six gases: CO_2, SF_6, CH_4, N_2O, HFCs, and PFCs, as required by the Guidance. 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 FY09 and FY10 calculations are based on the EPA MRR and are shown in Appendix A, "Global Warming Potentials."

The following table (Table 1) summarizes the GHG emissions categories that were identified in the Guidance and TSD, whether they were calculated for INL's FY09 and FY10 report, and their reporting status in the Guidance and TSD (identified as required or recommended for reporting). Some Scope 3 GHG sources will not be required reporting until FY11 or later since the calculation method for determining their emissions is still being developed. It should be noted that the Guidance and TSD called for reporting in FY08 (baseline year) and FY10, but not FY09; despite the lack of requirement INL made the decision to quantify their FY09 emissions to establish and understand emerging trends.

Table 1. GHG emissions categories identified in Guidance and TSD.

Scope	Emissions Category	Calculated for FY09 & FY10?	Reporting Status in Guidance and TSD
1 (Direct)	Stationary Combustion (Boilers, generators, etc.)	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Mobile Combustion (Fleet Vehicles)[c]	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Fugitive Emissions: Refrigerants	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Fugitive Emissions: Onsite Wastewater Treatment	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Industrial Process Emissions (Manufacturing or Processing Chemicals or Materials)	No, INL does not perform any of the activities listed in the TSD	Required reporting in FY08 Baseline and FY10 Inventory.
2 (Indirect)	Purchased Electricity	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Purchased Steam, Hot Water or Chilled Water	No, INL does not purchase	Required reporting in FY08 Baseline and FY10 Inventory.
	Combined Heating and Power	No, INL does not utilize	Required reporting in FY08 Baseline and FY10 Inventory.
	Purchased Steam from Waste to Energy	No, INL does not purchase	Required reporting in FY08 Baseline and FY10 Inventory.
	Transmission & Distribution (T&D) Losses (within INL's operational controls)	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Purchased Green Power (Renewable Energy Certificates [RECs])	Yes, INL purchased RECs	Required reporting in FY08 Baseline and FY10 Inventory.
3 (Indirect)	T&D Losses (outside INL's operational controls)	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Employee Commuting	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Business Air Travel	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Business Ground Travel: Rental Vehicle	Yes	Required reporting in FY08 Baseline and FY10 Inventory.

c. This includes CH_4 and N_2O from biofuel blends. Per the TSD, 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.

Table 1. (continued).

Scope	Emissions Category	Calculated for FY09 & FY10?	Reporting Status in Guidance and TSD
	Business Ground Travel: Personal Vehicle	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Contracted Municipal Solid Waste (MSW) Disposal	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Contracted Wastewater Treatment	Yes	Required reporting in FY08 Baseline and FY10 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 will 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[d]	Mobile Combustion	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Stationary Combustion	No, INL did not utilize biofuels for this category.	Required reporting in FY08 Baseline and FY10 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY08 Baseline and FY10 Inventory.
	Contracted MSW Disposal	Yes	Required reporting in FY08 Baseline and FY10 Inventory.

d. Note that biogenic emissions will not count against GHG reduction targets.

As shown in Table 1, the TSD 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 then would be recycled during the natural decomposition process and is therefore 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 TSD 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]) 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 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	Employees' home ZIP Code and work location (Human Resources) & FY10 Employee Commute Survey 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 TSD 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 TSD).
- 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 D, "Sample Calculation.") The majority of these calculations were performed following the TSD, 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 TSD). All Excel spreadsheets used for calculations were validated internally by Michael Reed, Senior Process Analyst with INL's Advanced Process and Decision Systems Department.

4. DISCUSSION AND RESULTS

4.1 Summary

Table 3 and Figure 3 through Figure 5 summarize the GHG emissions from INL during FY09 and FY10. 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 FY09 and FY10.

Scope	Emissions Category	FY09 GHG Emissions (MT CO_2e)	FY10 GHG Emissions (MT CO_2e)
1 (Direct)	Stationary Combustion	13,381	14,288
	Mobile Combustion	8,545	7,383
	Fugitive Emissions: Refrigerants	200	385
	Fugitive Emissions: Onsite Landfill	5,878	5,785
	Fugitive Emissions: Onsite Wastewater Treatment	130	136
	SCOPE 1 TOTAL	28,133	27,978
2 (Indirect)	Purchased Electricity	58,297	61,364
	Transmission & Distribution Losses (Owned)	1,450	1,470
	Purchased RECs	-6,813	-11,480
	SCOPE 2 TOTAL	52,934	51,354
3 (Indirect)	Transmission & Distribution Losses (Shared)	3,937	4,141
	Employee Commuting	9,354	10,171
	Business Air Travel	7,380	6,785
	Business Ground Travel: Rental Vehicle	337	393
	Business Ground Travel: Personal Vehicle	411	422
	Contracted MSW Disposal	903	956
	Contracted Wastewater Treatment	201	214
	SCOPE 3 TOTAL	22,523	23,082
TOTAL ANTHROPOGENIC EMISSIONS[e]		103,590	102,413
Biogenic	Mobile Combustion	723	1,182
	Fugitive Emissions: Onsite Landfill	853	840
	Contracted MSW Disposal	118	125
TOTAL BIOGENIC EMISSIONS		1,695	2,148
TOTAL EMISSIONS (ANTHROPOGENIC + BIOGENIC)		105,285	104,561

e. 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.

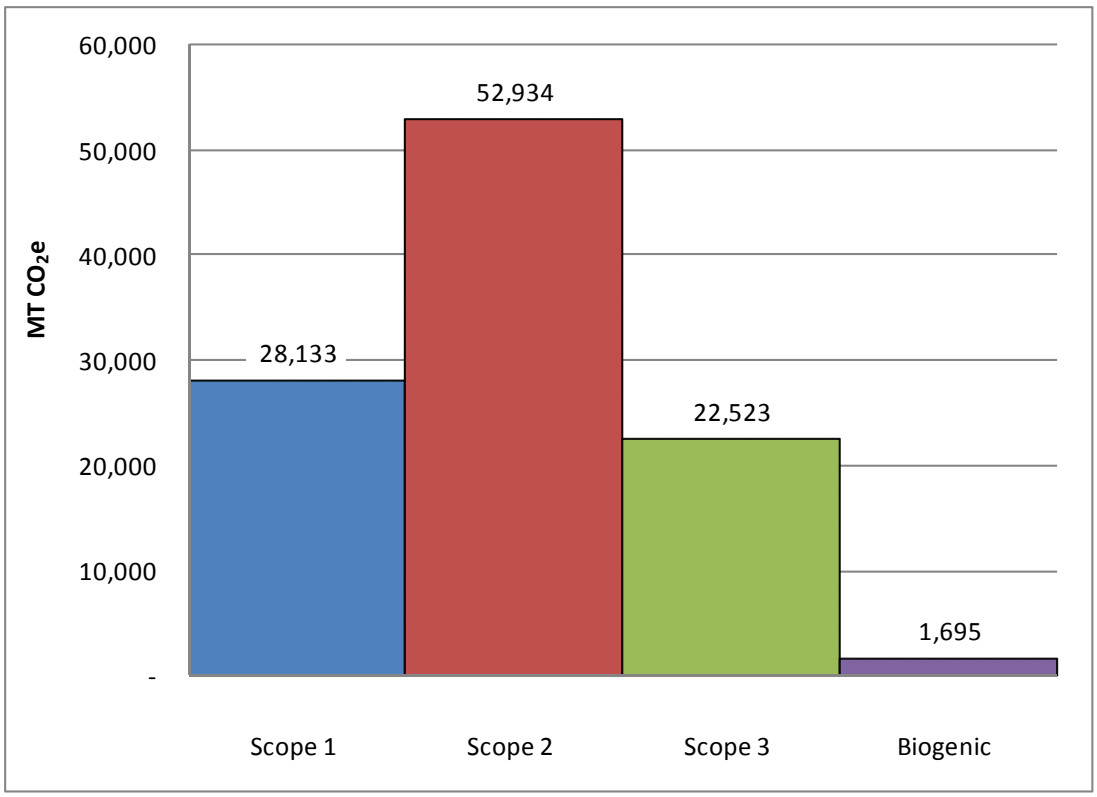

Figure 3. INL's FY09 GHG emissions, by scope.

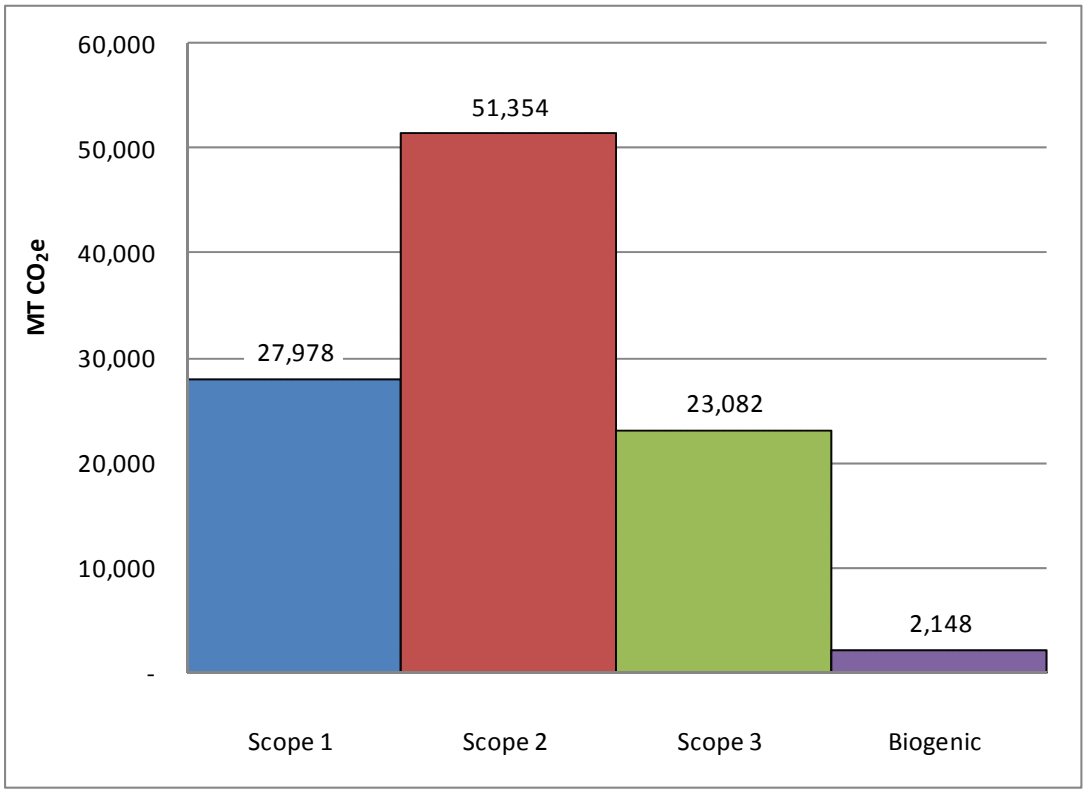

Figure 4. INL's FY10 GHG emissions, by scope.

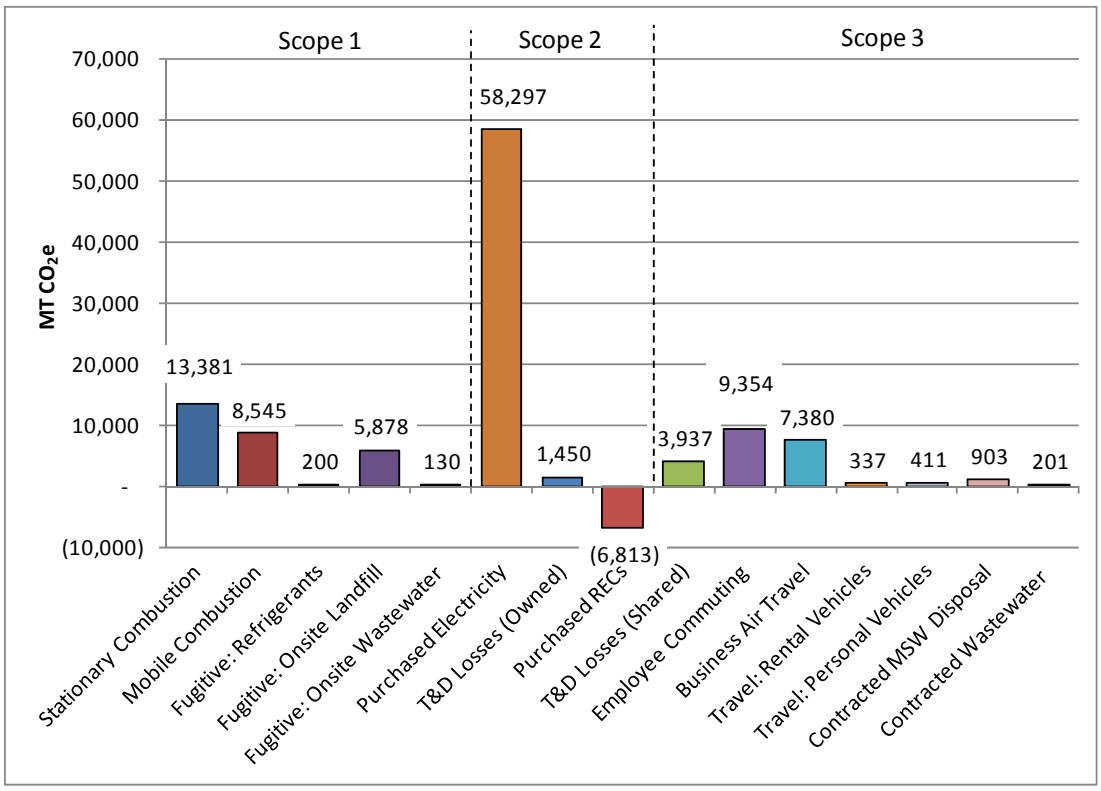

Figure 5. INL's FY09 GHG emissions, by scope and emissions category, excluding biogenic emissions.

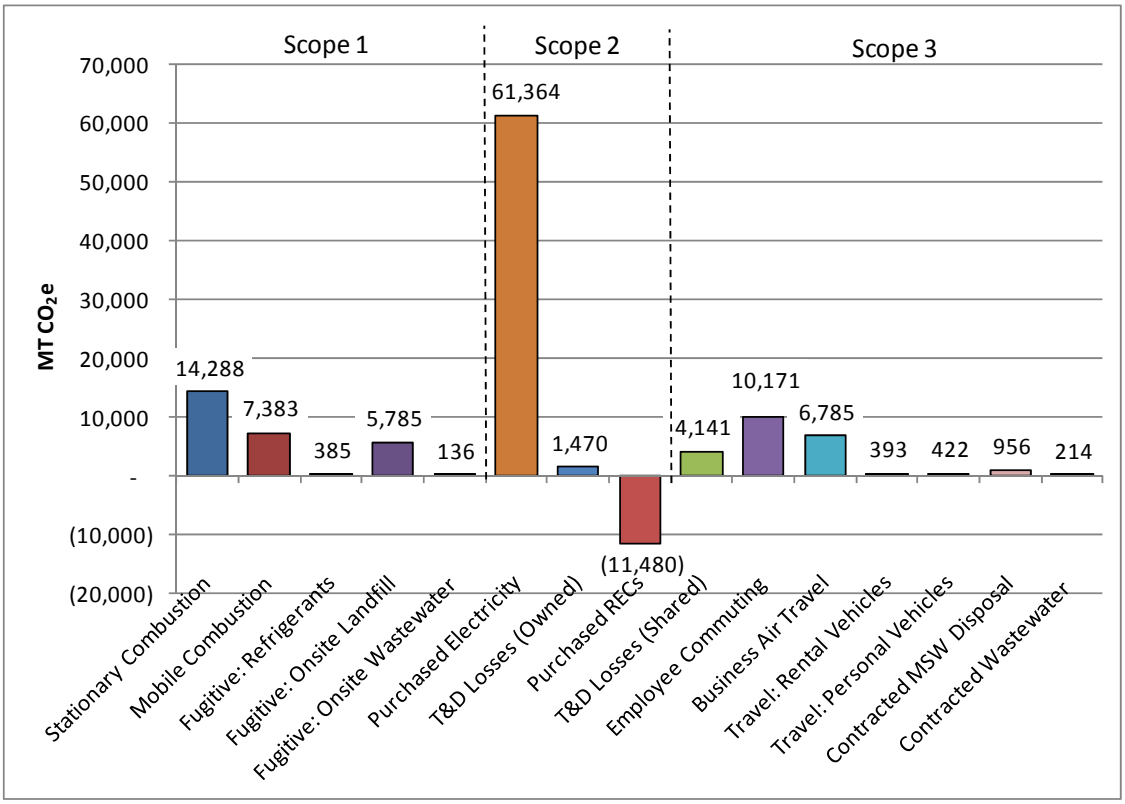

Figure 6. INL's FY10 GHG emissions, by scope and emissions category, excluding biogenic emissions.

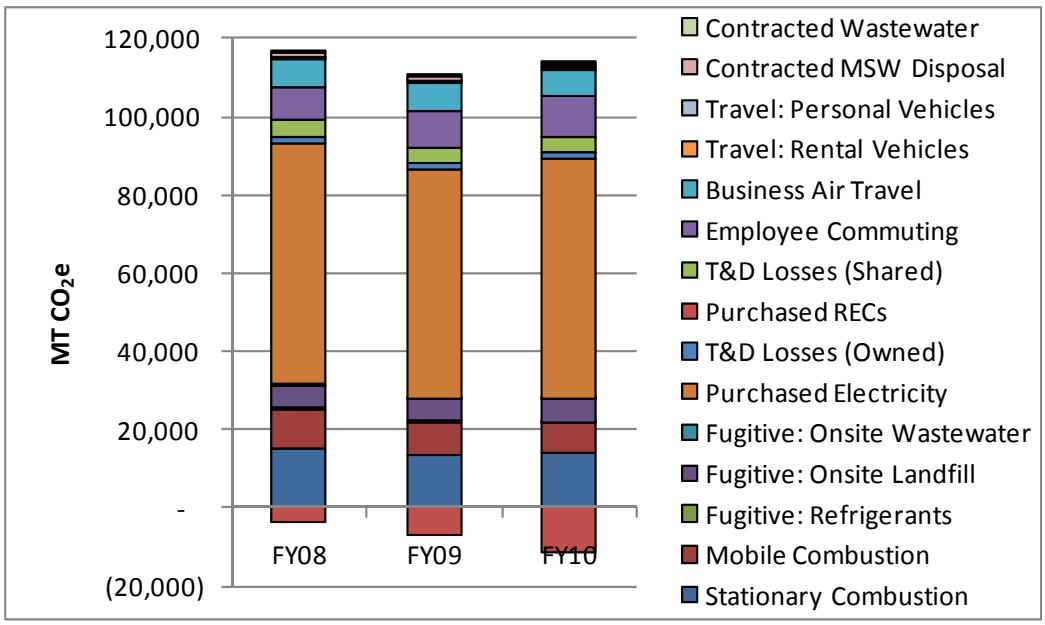

Figure 7. Comparison of INL's FY08, FY09, and FY10 GHG emissions, by scope and emissions category, excluding biogenic emissions.

4.2 Scope One – Direct Emissions

INL's FY09 and FY10 Scope 1 emissions are summarized in Figure 8 and Figure 9, with a comparison to the FY08 baseline shown in Figure 10. 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 FY08 baseline results.

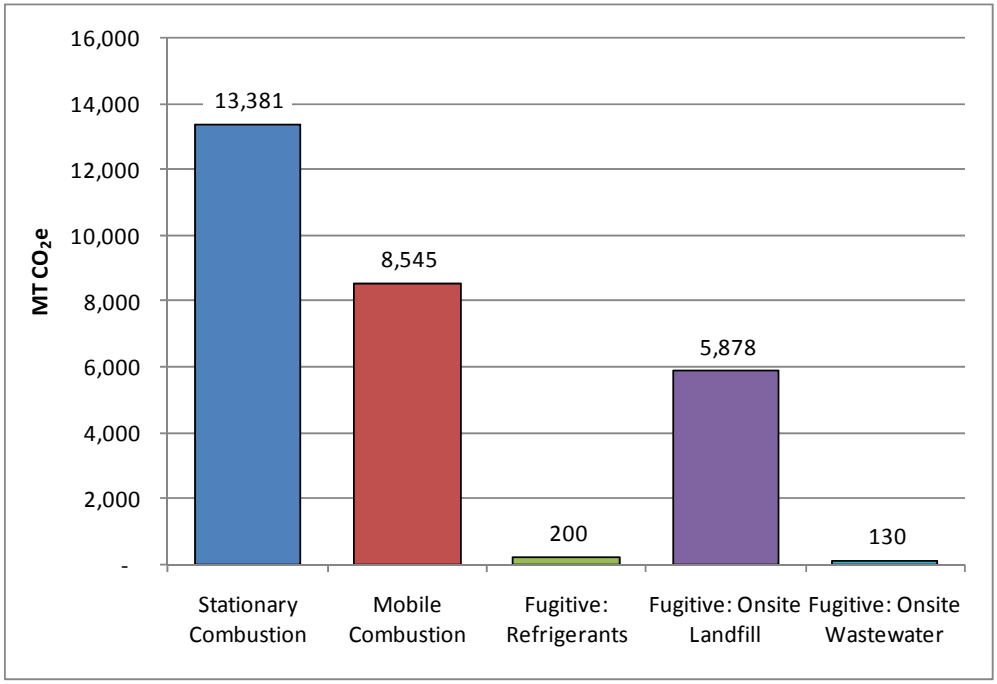

Figure 8. INL's FY09 GHG emission results for Scope 1.

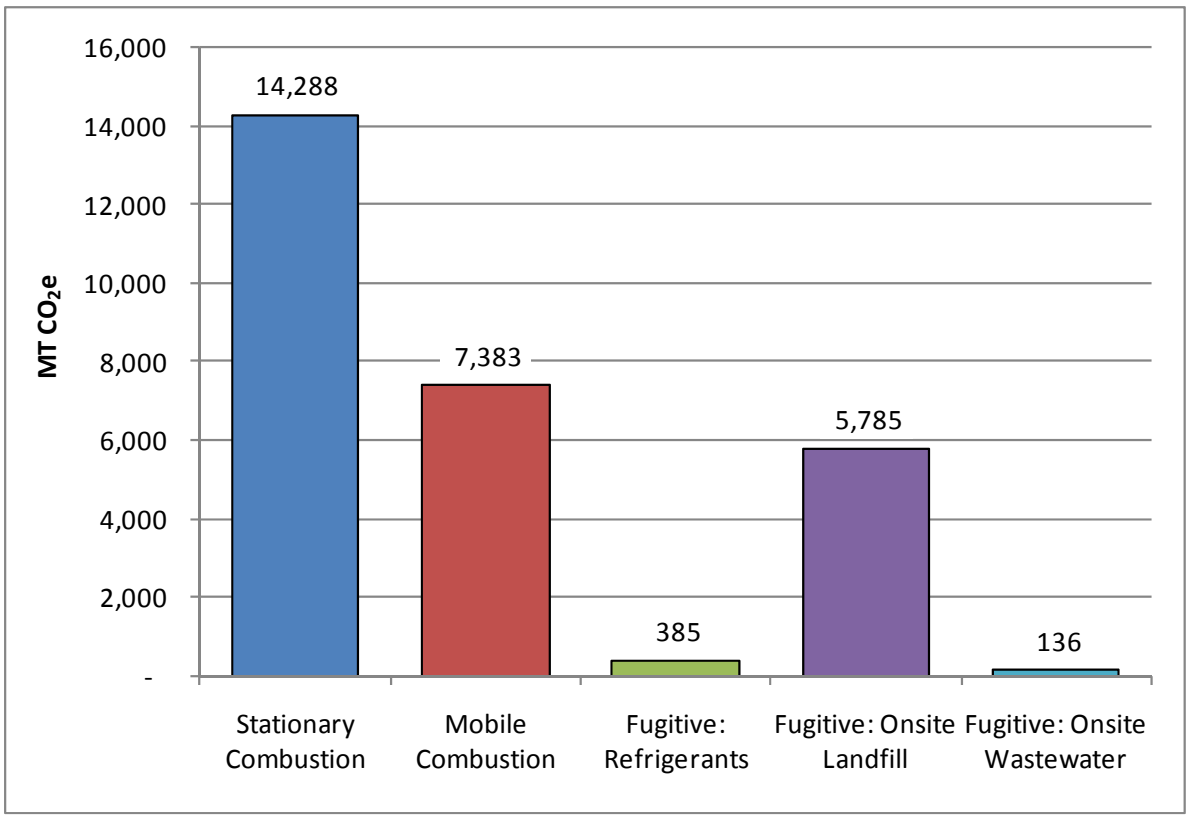

Figure 9. INL's FY10 GHG emission results for Scope 1.

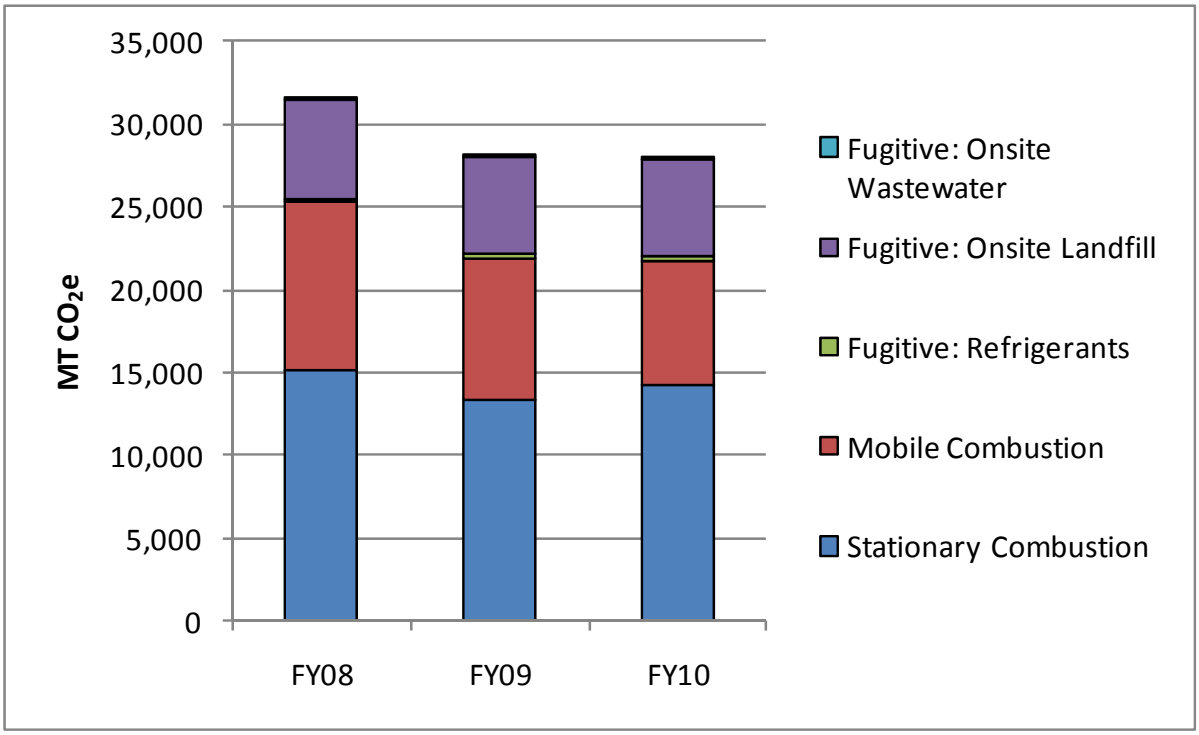

Figure 10. Comparison of INL's FY08, FY09, and FY10 Scope 1 GHG emissions.

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 TSD was adopted. This consisted of looking at the total amount of fuels used (purchased) onsite by INL. Since these data are also submitted for the Federal Energy Management Program (FEMP) Energy Report, 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 FY09 and FY10 INL used the types and amounts of fuel shown in Table 4 and Table 5 for stationary combustion.

Table 4. Amounts of fuel used for stationary combustion at INL during FY09.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	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 5. Amounts of fuel used for stationary combustion at INL during FY10.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	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

As shown in Table 4 and Table 5, INL's stationary combustion emissions were calculated to produce 13,381 and 14,288 MT CO_2e in FY09 and FY10, respectively. In FY09, this equates to 48% of INL's Scope 1 emissions, and 13% of the total anthropogenic emissions considered. In FY10 this equates to 51% of INL's Scope 1 emissions, and 14% of the total anthropogenic emissions considered.

Since these data are already collected and reported annually for the FEMP Energy Report, they are considered to be of high quality.

4.2.1.3 Lessons Learned

Since the data are already gathered at INL for the FEMP Energy Report, 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 FY08 Baseline

The FY09 results showed an overall decrease of 12% over the FY08 baseline. Looking closer at the differences between the four fuel types showed a 12% decrease in diesel, 5% decrease in LNG deliveries (to the Site), 50% decrease in propane deliveries, and an 11% increase in natural gas (to town facilities).

The FY10 results showed a 6% decrease over the FY08 baseline. Looking closer at the differences between the four fuel types showed a 6% decrease in diesel, 1% decrease in LNG deliveries (to the Site), 36% decrease in propane deliveries, and an 11% increase in natural gas (to town facilities).

The primary reason for the variance in propane use from FY08 to FY09 appears to be due to scheduling of the propane fuel shipments, with more shipments made at the end of FY08 and less at the beginning of FY09. FY10 is considered a "normal" year. Calculating propane usage from fuel deliveries is not the ideal way, but it is the only method currently available.

As for the changes in natural gas at town facilities, two new buildings (UB1 and UB2) came online in FY09, which likely accounts for the increased use in FY09 and FY10.

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). 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:

- Streamlined and automated fueling processes have been with fuel keys and gas cards, along with the GasBoy technology that automatically identifies the INL vehicle, miles traveled, amount of fuel pumped, and other key data points.
- Added 42 new fuel efficient buses; nearly half of the 103 bus fleet, have replaced aging buses in INL's fleet.
- Streamlined bus routes and transitioned to a more modern Park & Ride system.

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 FY11, INL will continue to add Park & Ride locations, and upgrade older buses with new higher efficiency models. Furthermore, tests are planned to increase the percentage of biodiesel from B20 to B50 in a select group of buses. INL is also seeking to partner with the Idaho Department of Transportation and others to improve bus-to-bus and bus-to-infrastructure communications, and to participate with automated data gathering to better define and implement fuel efficient driving practices.

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 TSD were used. INL tracks the majority of its fuel usage in the 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. 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 6 and Table 7), more specific CH_4 and N_2O emission factors were used than what is assumed for the TSD 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 B, "Emissions Factors Used."

4.2.2.2 Results Discussion

During FY09 and FY10, INL used a combination of fossil fuels and biofuels to power its diverse vehicle fleet as shown in Table 6 and Table 7. Per the TSD, the CO_2 emissions from biofuels are to be considered as biogenic rather than anthropogenic emissions,[f] and therefore they were calculated and reported separately.

Table 6. Fuel amounts and corresponding GHG emissions for INL's FY09 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[g]	Bus	219,814.50	1,909	312
	Equipment	9,462.90	83	13
	Light Duty Truck	6,551.70	57	9
	Truck	2,351.00	20	3
Diesel	Bus	302,302.50	3,088	-
	Equipment	96,249.70	991	-
	Heavy Duty	21,369.20	218	-
	Light Duty Truck	6,071.00	62	-
E10 Ethanol Fuel Blend	Bus	1,138.60	9	<1
	Equipment	76,793.90	615	44
	Light Duty Car	14,218.80	117	8
	Light Duty Truck	122,823.80	1,025	71
E85 Ethanol Fuel Blend	Bus	66.80	<1	<1
	Equipment	3,223.90	5	16
	Light Duty Car	3,398.35	6	17
	Light Duty Truck	46,965.15	80	230
Gasoline	Equipment	1,717.30	15	-
LNG	Bus	31,771.00	241	-
	Equipment	231.00	2	-
	TOTAL	966,521.10	8,545	723

f. Although a controversial position, the TSD 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.

g. 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. Tad Pearson confirmed in a December 22, 2010 phone call that this assumption was valid for FY09 and FY10.

Table 7. Fuel amounts and corresponding GHG emissions for INL's FY10 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[h]	Bus	331,916.34	2,883	471
	Equipment	14,256.11	125	20
	Light Duty Truck	8,797.74	76	12
	Truck	3,061.95	27	4
Diesel	Bus	186,610.28	1,906	-
	Equipment	54,192.00	558	-
	Heavy Duty	20,127.87	206	-
	Light Duty Truck	5,553.66	57	-
E10 Ethanol Fuel Blend	Bus	76.20	<1	<1
	Equipment	19,590.83	157	11
	Heavy Duty	6,646.48	56	4
	Light Duty Car	4,134.43	34	2
	Light Duty Truck	130,063.10	1,085	75
E85 Ethanol Fuel Blend	Equipment	1,946.67	3	10
	Light Duty Car	8,457.22	15	41
	Light Duty Truck	108,806.18	186	532
Gasoline	Equipment	845.60	7	-
LNG	Bus	38.00	<1	-
	Equipment	76.00	<1	-
	TOTAL	905,196.64	7,383	1,182

As shown in Table 6 and Table 7, INL's mobile combustion emissions were calculated to produce 8,545 MT CO_2e of anthropogenic and 723 MT CO_2e of biogenic GHG emissions in FY09, and 7,383 MT CO_2e of anthropogenic and 1,182 MT CO_2e of biogenic GHG emissions in FY10. In FY09, this equates to 30% of INL's Scope 1 emissions, and 8% of the total FY09 anthropogenic emissions considered. In FY10, this equates to 26% of INL's Scope 1 emissions, and 7% of the total anthropogenic emissions considered.

Since these data are already collected in TIMS 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, there are a few tracking and reporting items that 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, some 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 NRF general use and when INL rents heavy equipment to other contractors, but both of these are a very small amount of the total INL use.[i]

h. See previous footnote.

i. Tad Pearson confirmed these small uses of INL's fuel by other INL Site contractors in a December 22, 2010 phone call.

4.2.2.4 Comparison to FY08 Baseline

In FY09, there was a 15% decrease in GHG emissions from mobile combustion sources over the FY08 baseline, and FY10 showed a further decrease of 27% over the FY08 baseline. When considering the differences between the total amounts of fuel consumed between each of these years, there was an 8% decrease in total gallons between FY09 and FY08, and a 13% decrease in FY10 over the FY08 baseline.

In addition to the changes to the fleet discussed above, the largest contributor to the decrease in GHG emissions is due to the changes in fuel types used since FY08. The largest fuel user at INL is the buses that moved away from LNG (small amount of fuel used in FY08) and diesel (large amount of fuel used in FY08) to biodiesel (B15 blend). 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.

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.).

4.2.3.1 Calculation Method

DOE Headquarters (DOE-HQ) publicized a data call in October 2010 for each facility's FY10 fugitive emissions from refrigerants and fluorinated gases that focused on the gases listed in Table 8, identified by their Chemical Abstract Service (CAS) number. To evaluate INL's fugitive emissions during FY09 and FY10, data from the following sources was reviewed:

- Purchase, usage, and disposal data contained in Comply Plus, INL's chemical inventory database
- Use and disposal information contained on Refrigeration Service Records
- Transaction detail reports pulled from Comply Plus database for each CAS Number
- Integrated Waste Tracking System (IWTS) database queries to identify any additional disposal of refrigerants.

Queries were run in Comply Plus for the different outcomes during FY09 and FY10 using the CAS numbers. Additionally, INL obtained hard copies of the refrigerant service records. 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 less refrigerant was 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 from 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. IWTS was also queried for CAS numbers to ensure any waste disposed was captured in the total amount reported.

This methodology aligns with the default methodology presented in the TSD. INL relied on information contained in the Comply Plus inventory database and on hard copy maintenance records for HVAC systems and vehicles. The amounts of fluorinated gases emitted were calculated as detailed in examples in the TSD (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 8 were considered for their contribution to INL's GHG emissions during FY09 and FY10. A majority of the gases in the table evaluated were not considered to have any releases during FY09 and FY10, 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 8. Fugitive refrigerants evaluated for GHG emissions during FY09 and FY10 at INL.

Common Name	GWP	FY09		FY10	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	20,072.60	9	1,035.10	<1
CH_4	21	2,842.50	27	28,068.90	267
N_2O	310	0.00	0	0.00	0
HFC-23	11,700	1.50	8	0.00	0
HFC-32	650	0.00	0	5.70	2
HFC-41	150	0.00	0	0.00	0
HFC-125	2,800	0.00	0	9.40	12
HFC-134	1,000	0.00	0	0.00	0
HFC-134a	1,300	238.20	140	68.80	41
HFC-143	300	0.00	0	0.00	0
HFC-143a	3,800	0.00	0	0.00	0
HFC-152	53	0.00	0	0.00	0
HFC-152a	140	23.50	1	2.70	<1
HFC-161	12	0.00	0	0.00	0
HFC-227ca	2,900	0.00	0	0.00	0
HFC-227ea	2,900	0.00	0	46.00	61
HFC-236ca	120	0.00	0	0.00	0
HFC-236cb	1,340	0.00	0	0.00	0
HFC-236ea	1,370	0.00	0	0.00	0
HFC-236fa	6,300	0.00	0	0.00	0
HFC-245ca	560	0.00	0	0.00	0
HFC-245fa	1,030	0.00	0	0.00	0
HFC-365mfc	794	38.00	14	5.30	2
HFC-c-447-ef	250	0.00	0	0.00	0
HFC-43-10mee	1,300	0.00	0	0.00	0
PFC-14	6,500	0.00	0	0.00	0
PFC-116	9,200	0.00	0	0.00	0
PFC-218	7,000	0.00	0	0.00	0
PFC-318 or PFCc318	8,700	0.00	0	0.00	0
PFC-3-1-10	7,000	0.00	0	0.00	0
PFC-4-1-12	7,500	0.00	0	0.00	0
PFC-5-1-14	7,400	0.00	0	0.00	0
PFC-9-1-18	7,500	0.00	0	0.10	<1
c-C_3F_6	17,340	0.00	0	0.00	0
SF_6 - Sulfur Hexafluoride	23,900	0.00	0	0.00	0
NF_3	17,200	0.00	0	0.00	0
	TOTAL	23,216.30	200	29,242.00	385

As shown in Table 8, INL's fugitive emissions from refrigerants were calculated to produce 200 and 385 MT CO_2e in FY09 and FY10, respectively. In both FY09 and FY10 this equates to 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 are hard to verify as the maintenance records are completed by hand and stored in hard copy. It is difficult to be assured that all of the maintenance records have been reviewed, including fluorinated gas charges. There is some overlap in data contained on the maintenance records and that contained in Comply Plus. Comply Plus was used to verify the amounts of refrigerants emitted and the volumes reported on the maintenance records. During the data compilation, some duplicate and missing information was identified. Discrepancies were resolved by contacting maintenance personnel to verify system charges.

It may be helpful to have electronic data gathering at 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 FY08 Baseline

In FY09, there was an 18% decrease over the FY08 baseline, and in FY10 there was a 57% increase over the FY08 baseline.

INL's increase in FY10 over FY08 baseline is likely due to the discontinued use of the methane tanks for fueling LNG buses at INL. There was approximately 262,000 pounds of methane that was removed from the FY09 calculations because it was accounted for in mobile source emissions. Since the tanks were no longer being used to fuel the buses during FY10, this amount was not deducted from INL's FY10 total, which showed the product was still onsite and an increase in associated GHG emissions from 27 MT CO_2e to 275 MT CO_2e.

Overall, although the variation between years is large. It is important to keep in mind the escalation of scale—fugitive emissions are overall 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 FY08 and FY10. The FY08 baseline asked about fewer items than the FY10 data call. (INL's FY09 reporting is based on the FY10 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 FY09 and FY10. These Scope 1 calculations look at the emissions associated with solid waste disposal in the onsite landfill at the Central Facilities Area (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-municipal solid waste 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.[j] A daily soil cover is

j. 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.

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-municipal solid waste, although only a portion of this area is currently being utilized.[k]

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 a number of types of construction and demolition waste. For this calculation, only two categories of waste in INWMIS were considered, Category 1 and 2 for "regular trash" and "cafeteria waste," respectively.

EPA's Landfill Gas Emissions Model (LandGEM) was used to calculate the GHG emissions associated with the CFA landfill, as identified in the TSD 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 8 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 9.

Table 9. 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

k. CFA landfill information is based on correspondence with Norm Stanley during August 2010.

Fiscal Year	Amount of Solid Waste (tons)
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
TOTAL	215,955.73

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 5,878 and 5,785 MT CO_2e of anthropogenic emissions to the GHG inventory during FY09 and FY10, respectively. An additional 853 and 840 MT CO_2e of biogenic emissions were contributed to the GHG inventory during FY09 and FY10, respectively. In FY09, the anthropogenic emissions equate to 21% of INL's Scope 1 emissions, and 6% of the total anthropogenic emissions considered. In FY10, the anthropogenic emissions equate to 21% of INL's Scope 1 emissions, and 6% 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 landfilled prior to 1992, which had to be estimated for this calculation.

4.2.4.4 Comparison to FY08 Baseline

In FY09, there was a 1.4% decrease over the FY08 GHG baseline, and a 3% decrease in FY10 over the FY08 GHG baseline. When considering the change in the amount (weight) of waste disposed per Site employee against the FY08 baseline, FY09 showed a 23% decrease and FY10 showed an 8% decrease.

In addition to EO 13514 setting GHG goals that led to INL quantifying their annual GHG emissions, the EO covers a number of other environmental areas including waste diversion. INL is currently working to divert their solid waste to meet a goal of 50% diversion by weight by 2015; this increased diversion rate is expected to result in a decrease in the overall amount of solid waste landfilled; however, it is not guaranteed since the diversion goal only considers the waste produced within a single year rather than compared to previous years.

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

4.2.5 Fugitive Emissions: Onsite Wastewater Treatment

At its Site facilities, INL operates its own wastewater treatment, which 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 [SPERT] 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 TSD considers facultative lagoons to be anaerobic.

INL also operates a number of lagoons (including evaporative ponds) for industrial waste. Since this industrial waste does not contain significant amounts of organics, they 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 10 and Table 11 for FY09 and FY10, respectively. 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 10. FY09 population data by facility for onsite wastewater treatment calculations.

Facility Name	Wastewater Type	Number of Employees	Number of Visitors	Total Population Considered
CITRC	Septic Tank	13.75	1.38	15.13
Main INL Guard Gate	Septic Tank	2.75	0.28	3.03
			TOTAL SEPTIC POPULATION	18.15
ATR	Lagoon	453.76	45.38	499.13
CFA	Lagoon	548.00	54.80	602.80
MFC	Lagoon	738.50	73.85	812.35
SMC	Lagoon	259.00	25.90	284.90
			TOTAL LAGOON POPULATION	2,199.18

Table 11. FY10 population data by facility for onsite wastewater treatment calculations.

Facility Name	Wastewater Type	Number of Employees	Number of Visitors	Total Population Considered
CITRC	Septic Tank	9.00	0.90	9.90
EBR-I	Septic Tank	0.75	0.08	0.83
Gun Range	Septic Tank	5.25	0.53	5.78
Main INL Guard Gate	Septic Tank	3.00	0.30	3.30
			TOTAL SEPTIC POPULATION	19.80
ATR	Lagoon	483.00	48.30	531.30
CFA	Lagoon	543.25	54.33	597.58
MFC	Lagoon	801.00	80.10	881.10
SMC	Lagoon	263.25	26.33	289.58
			TOTAL LAGOON POPULATION	2,299.55

The population data from Table 10 and Table 11 were used with the calculation method in the TSD, and the default national averages (from the TSD) for the specific treatment process.

4.2.5.2 Results Discussion

INL's onsite wastewater treatment is estimated to contribute 130 MT CO_2e (129 from lagoons and 1 from septic systems) and 136 MT CO_2e (135 from lagoons and 1 from septic systems) emissions to the GHG inventory during FY09 and FY10, respectively. In both FY09 and FY10 this equates to 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 FY08 Baseline

In FY09, there was a 1% increase over the FY08 GHG baseline, and then a 6% increase in FY10 over the FY08 baseline. Since the wastewater calculations are based on employee counts, the increase in GHG emissions from wastewater directly followed the increase in employee numbers of 1% in FY09 and 6% in FY10 over the FY08 baseline.

4.3 Scope Two – Indirect Emissions

INL's FY09 and FY10 Scope 2 emissions are summarized in Figure 11 and Figure 13, with a comparison to the FY08 baseline shown in Figure 13. A discussion of INL's FY09 and FY10 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 FY08 baseline results.

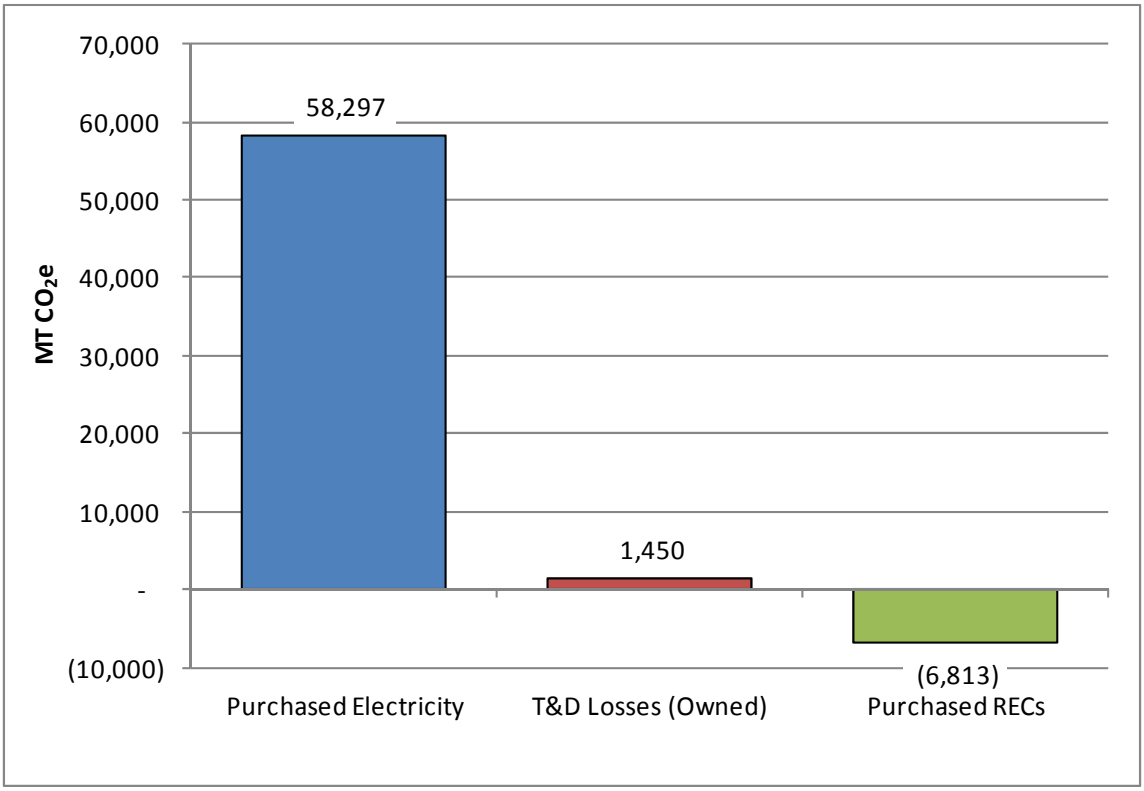

Figure 11. INL's FY09 GHG emission results for Scope 2.

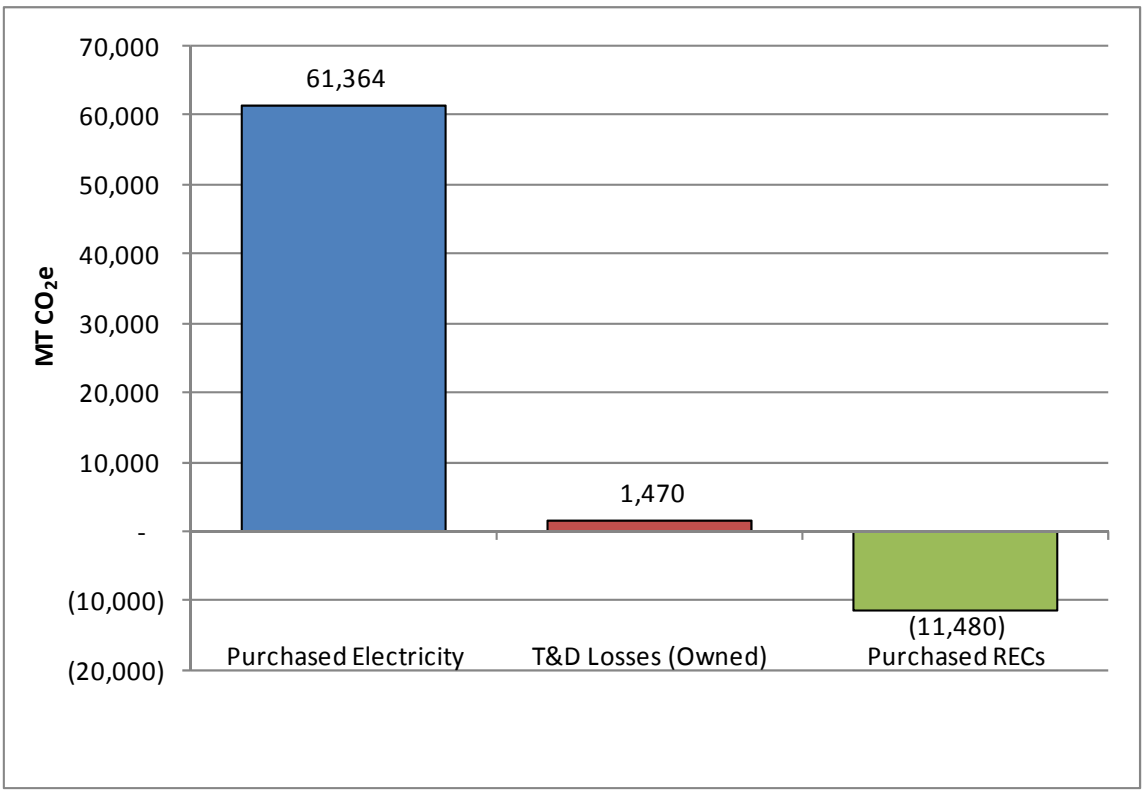

Figure 12. INL's FY10 GHG emission results for Scope 2.

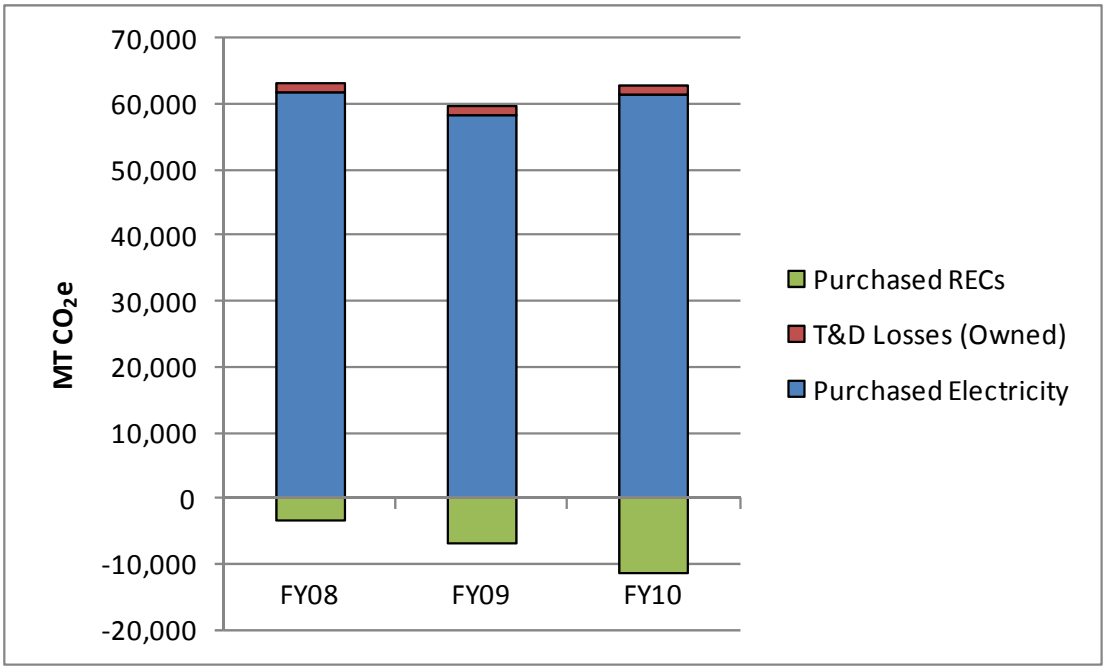

Figure 13. Comparison of INL's FY08, FY09, and FY10 Scope 2 GHG emissions.

4.3.1 Purchased Electricity Emissions

4.3.1.1 Calculation Method

These calculations follow the TSD default methodology of electricity purchases reported for the FEMP Energy Report. 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 FEMP Energy report, they are already tracked for the INL Site, and the only calculations needed were to isolate the emissions that INL owns (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 12 for FY09 and FY10.

INL purchased 145,185.58 MWh during FY09, with 30,755.08 MWh provided to non-Site locations, and 114,430.50 MWh going to INL facilities at the INL Site. In FY10, INL purchased 152,686.01 MWh, with 31,645.21 MWh provided to non-Site locations, and 121,040.80 MWh going to INL facilities at the INL Site. Per the TSD, the emission factors for purchased electricity are determined using the EPA's Emissions & 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 (EIA), and the Federal Energy Regulatory Commission (FERC). (For more information on eGRID, refer to www.epa.gov/cleanenergy/energy-resources/egrid.) All INL facilities are located in the "Western Electricity Coordinating Council (WECC) Northwest" eGRID subregion, the Northwest Power Pool (NWPP).

Table 12. INL's FY09 and FY10 electrical purchases by location and provider.

Location	Owner of T&D System	Electrical Provider	FY09 Electricity Purchase (MWh)	FY10 Electricity Purchase (MWh)
INL Site	INL	Idaho Power (includes owned T&D losses)	114,430.50	121,040.80
		SUBTOTAL (Site)	114,430.50	121,040.80
Assorted locations (excludes INL Site)	Electrical Provider	Idaho Power	56.38	56.14
Town Facilities	Electrical Provider	Idaho Falls Power	30,561.40	31,482.54
Assorted locations outside INL Site and Idaho Falls city limits	Electrical Provider	Lost River Electric Company	2.86	2.17
Assorted locations outside INL Site and Idaho Falls city limits	Electrical Provider	Rocky Mountain Power	134.44	104.37
		SUBTOTAL (Non-Site)	30,755.08	31,645.21
		TOTAL INL Purchases	145,185.58	152,686.01

4.3.1.2 Results Discussion

For FY09, the purchased electricity amounts to 59,747 MT CO_2e, which is all of INL's Scope 2 emissions (before accounting for the credit from the RECs) and 56% of the net total anthropogenic emissions considered. In FY10, the purchased electricity amounts to 62,834 MT CO_2e, which is all of INL's Scope 2 emissions (before accounting for the credit from the RECs) and 60% of the net total anthropogenic emissions considered.

4.3.1.3 Lessons Learned

Since these data are already collected and reported annually for the FEMP energy reports, they are considered to be of high quality.

4.3.1.4 Comparison to FY08 Baseline

In FY09, INL purchased 6% more electricity than the FY08 baseline, which yielded an equivalent increase in associated GHG emissions. FY10 yielded a 1% decrease over the FY08 baseline.

Efforts to reduce the overall INL carbon footprint will surely focus on reducing electricity demand since this source is such a significant contributor.

4.3.2 Transmission and Distribution Loss Emissions, Owned

4.3.2.1 Calculation Method

The TSD 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 12 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 12) 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 3.079% in FY09 and 2.951% in FY10. 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 3,523.32 and 3,571.91 MWh for FY09 and FY10 equates to 1,450 and 1,470 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 purchased electricity report above; the goal of these calculations was to isolate this amount for reporting purposes according to the TSD.

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 FY08 Baseline

Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY08 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:

- 6,920 MWh in FY09 from a wind power facility in Iowa. (See Attachment 1, "Receipt for RECs Purchased in FY09," for the receipt, which includes details on INL's RECs purchase.)
- 15,916 MWh in FY10 from a renewable energy facility in the United States.

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 in FY09 are based on the wind power facility located in Schaller, Iowa, and the "Midwest Reliability Organization (MRO West)" eGRID subregion (the subregion was determined using the facility's ZIP Code and EPA's Power Profiler Web site [www.epa.gov/cleanenergy/energy-resources/egrid]). The emission factors for the FY10 RECs purchase are based on a generic renewable energy facility in the United States with national average emissions factors.[l] (Note that the TSD calls 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.)

4.3.3.2 Results Discussion

Table 13 summarizes how much INL reduced its Scope 2 GHG emissions in FY09 and FY10 by purchasing RECs. Specifically, the RECs purchases decreased the overall Scope 2 GHG emissions by 6,813 MT CO_2e in FY09, and 11,480 MT CO_2e in FY10.

Table 13. INL's GHG emissions from electricity and RECs purchased in FY09 and FY10.

Emissions Category	FY09 GHG Emissions (MT CO_2e)	FY10 GHG Emissions (MT CO_2e)
Purchased Electricity (includes T&D losses within INL's operational controls)	59,747	62,834
Purchased RECs (displaced GHG emissions)	-6,813	-11,480
SCOPE 2 TOTAL	52,934	51,354

4.3.3.3 Lessons Learned

Since these data are based on the RECs receipts, and are already collected and reported annually for the FEMP energy reports, they are considered to be of high quality.

4.3.3.4 Comparison to FY08 Baseline

In FY09, only 5% more RECs were purchased than in FY08 (by MWh); however, the eGRID subregion where the RECs were produced had non-baseload emission factors that were almost twice as large as the region used in FY08, which accounted for a nearly 100% increase in emissions credit over FY08.

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l. As of the publication of this report, the location of INL's FY10 RECs purchase had been allocated to a location in Canada. A request has been made to have them allocated to a location within the United States to be consistent with previous years; the accompanying calculations will be updated as needed when the new location is identified.

In FY10, significantly more (140% more) RECs were purchased than FY08 (by MWh). The associated emissions avoided were calculated according to national average eGRID emission factors, which led to a 230% increase over FY08. (As noted previously the emission factors used may change to subregion specific factors when the location of the FY10 RECs purchase is identified.)

4.4 Scope Three – Indirect Emissions

INL's FY09 and FY10 Scope 3 emissions are summarized in Figure 14 and Figure 16, with a comparison to the FY08 baseline shown in Figure 16. A discussion of each of the Scope 3 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 FY08 baseline results.

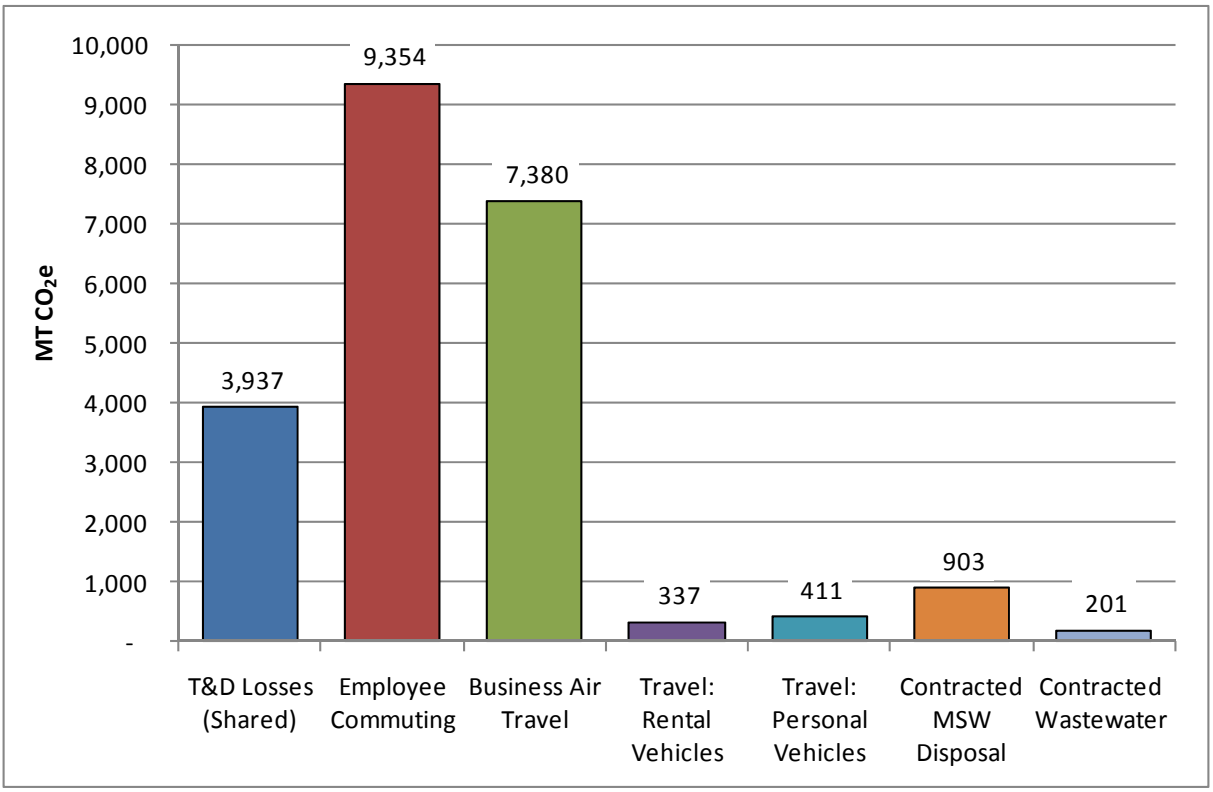

Figure 14. INL's FY09 GHG emission results for Scope 3.

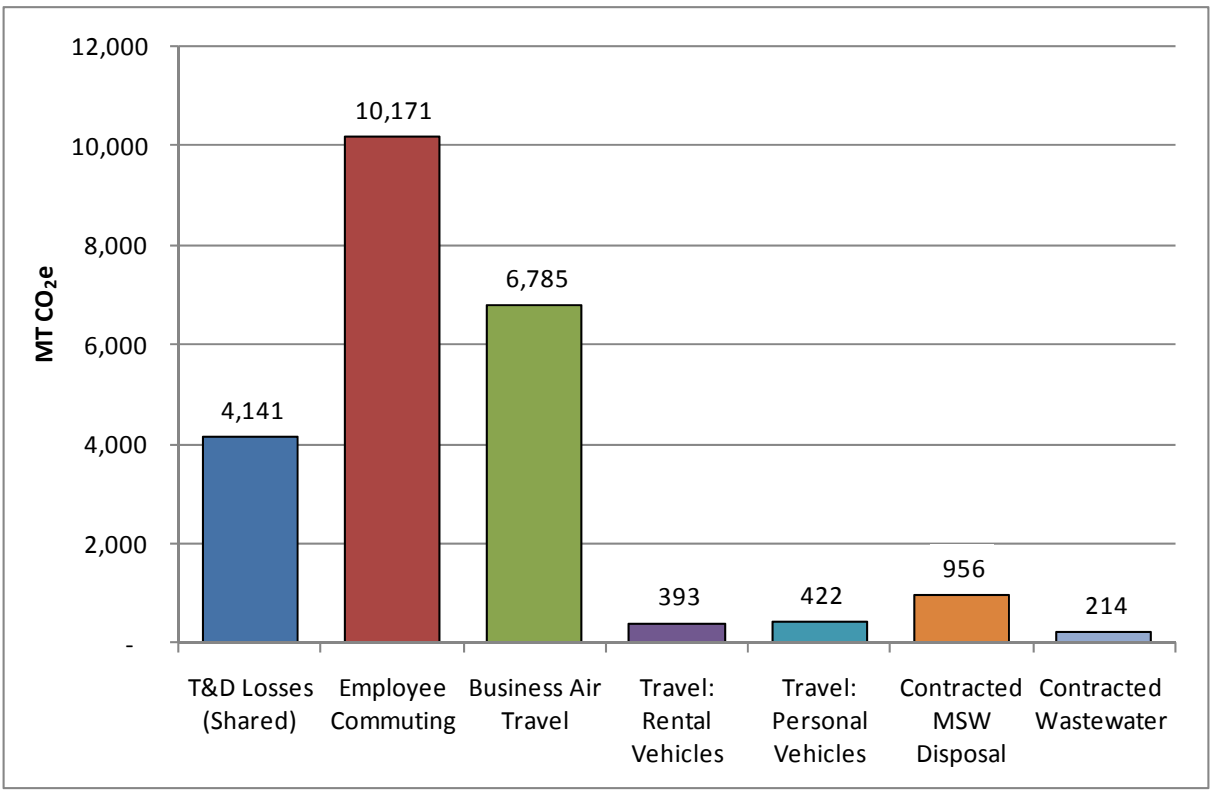

Figure 15. INL's FY10 GHG emission results for Scope 3.

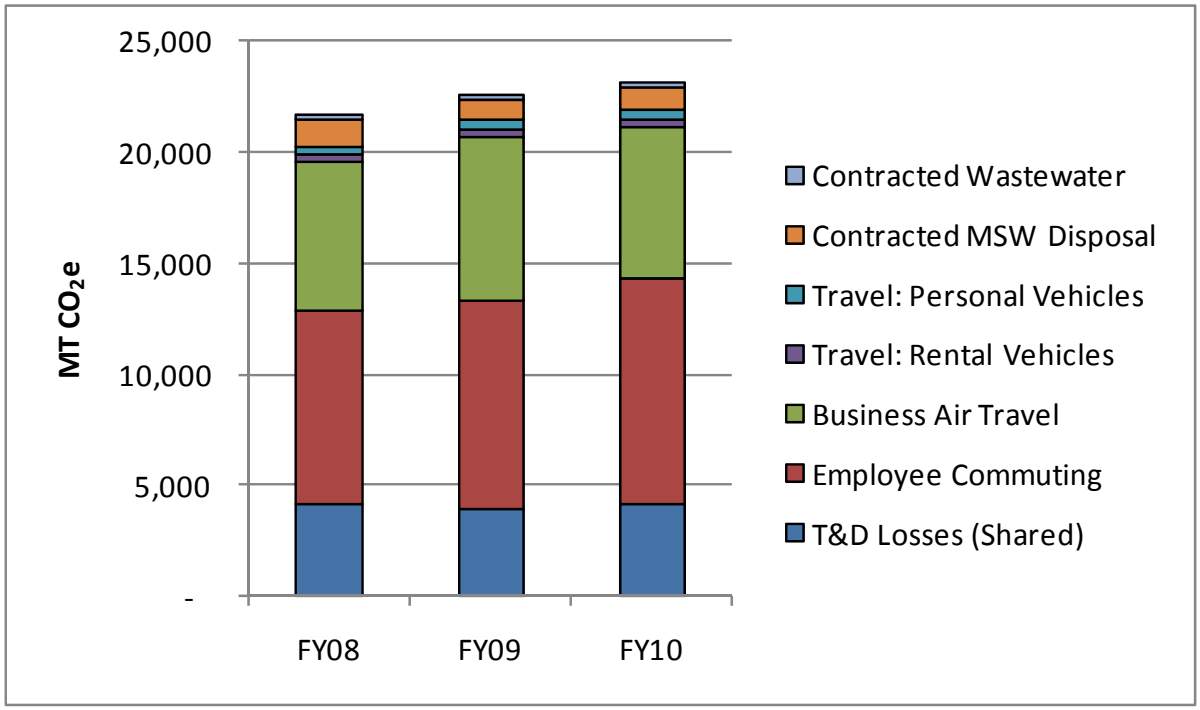

Figure 16. Comparison of INL's FY08, FY09, and FY10 Scope 3 GHG emissions.

4.4.1 Transmission and Distribution Loss Emissions, Shared

4.4.1.1 Calculation Method

The TSD provides only a default calculation methodology for determining the GHG emissions from T&D losses outside INL's operational control. This method assumes the national average T&D loss factor of 6.18% for purchased electricity, and utilizes the same eGRID subregion emission factors used for Scope 2 purchased electricity (www.epa.gov/cleanenergy/energy-resources/egrid). As stated in Section 4.3.1.1, the TSD 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 purchase 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 purchase.

4.4.1.2 Results Discussion

A T&D loss of 6.18% equates to 9,567.73 and 10,062.0 MWh for INL's FY09 and FY10 respective electricity purchases, and 3,937 and 4,141 MT CO_2e of emissions. In both FY09 and FY10 this equates to 18% of INL's Scope 3 emissions, and 4% 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 FY08 Baseline

Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY08 baseline yields the same results as Section 4.3.1.4.

4.4.2 Employee Commuting Emissions

4.4.2.1 Calculation Method

The TSD has identified an employee survey as the best source for calculating the GHG emissions from employee commuting. Since it would be difficult to expect responses in FY10 to be accurate for a survey looking at employee commuting behaviors during FY09, available historical data was gathered and combined with appropriate assumptions for the FY09 calculation, as described below. (This is the same process used for the FY08 baseline calculations.) However, for the FY10 calculation of employee commuting emissions, a survey was utilized. These processes are described below.

Initial information for the FY09 calculation was obtained from INL's Human Resources department, which provided the number of employees at a particular home ZIP Code and work location (by major facility) for the end of each quarter in FY09. These numbers for each quarter were then averaged for the year. A number of assumptions were made to determine the total number of miles that INL employees commuted to work during FY09 using their personal vehicles. (It should be noted that, with the exception of the INL bus system for employees who work at the Site, the Idaho Falls area does not have a significant public transportation system, and therefore all commuting outside of the INL buses was assumed to have been made in employees' personal vehicles.) These assumptions are described below. In general, assumptions were made to err on the conservative side. In addition, a question at the end of the FY10 employee commuting survey asked how much each employee's reported behavior in FY10 differed from FY09. The responses to this question were compiled by the INL Survey staff to validate each assumption utilized in the FY09 calculation as noted below.

The distance of a daily commute were estimated based on the following parameters:

- Commute distance was based on the distance between an employee's home ZIP Code and their work location using Google Maps.

- For workers with an unknown home ZIP Code, or a commute greater than 2 hours (based on home ZIP Code and work location in Google Maps), it was assumed that they have an alternative living situation in Idaho Falls (e.g., a second home).
- If an employee's work location was off-Site or unknown, an average annual commute was used for United States workers of 16 miles one-way (http://abcnews.go.com/Technology/Traffic/story?id=485098&page=1).

In estimating the number of employees who commute to work, the following assumptions were made:

- Assume that 41% of town employees living in Pocatello carpool to their work location with 3.7 employees per vehicle (FY10 Commute Survey Results).
- Assume that 2% of town employees living in Idaho Falls take an emission-free transportation source to work (this is an attempt to average the number of walkers and bikers across the year to account for greater participation during the warmer months and minimal participation during the winter) (FY10 Commute Survey Results).
- Assume 56.5% bus ridership for INL's employees at Site facilities (MFC, CFA, ATR, and SMC) based on average bus ticket purchases (as provided by Marc Carroll, Former Fleet Manager). These employees were removed from the commuting calculations with the exception of their drive to the bus (FY10 Commute Survey Results).
  - Assume each bus rider drives 0.36-mile each way to their bus stop for per work day (FY10 Commute Survey Results).
- Assume that 25% of INL's employees at Site facilities (MFC, CFA, ATR, and SMC) carpool to their work location with 3.7 employees per vehicle (FY10 Commute Survey Results).

The type of personal vehicle (mileage, fuel type, etc.) influences the calculation in the following ways:

- Assume that employee commute miles are divided with 67% completed in passenger cars and 32% in light-duty trucks/vans/SUVs (FY10 Commute Survey Results).
- Assume no alternative fuels, only gasoline-powered vehicles, were used (conservative assumption).

The number of work days per year was calculated based on schedules which are specific to site locations:

- Determine work schedule based on work location:
  - Town and MFC employees work a 9-80s schedule or 9 work days every 2 weeks
  - All other Site employees (CFA, ATR, and SMC) work a 4-10s schedule of 4 work days every week.
- Assume that each employee takes 4.3 work-weeks off each year during which they are not driving to work (FY10 Commute Survey Results). This includes holidays (the standard INL allotment for all employees is 2 weeks), personal leave (combined sick and vacation leave), travel, and other assorted leave such as disability.
- Do not account for part-time workers since these consist of a small component of the work force, for which the work schedules are difficult to determine (so far as they influence number of times driving to work per week [this is conservative]). (Per the FY10 Commute Survey Results, 2% of the respondents were part-time employees.)

For the FY10 employee commute emissions, a survey was used to gather the necessary data. Due to the INL employees work locations being spread across a wide geographical area (as opposed to a single location), and a desire to gather the most representative data, an extensive survey was created by the INL

Survey staff. To account for average commuting behaviors across the year, employees were asked about the following areas:

- Work location by facility (or building if at town)
- Home ZIP Code
- Primary and secondary commuting method including INL bus, personal vehicle, carpool, or walk/run/bike, and the associated details including average number of miles traveled to work each week, typical vehicle mileage, and fuel used.
- Work schedule and the number of weeks "off" that an employee did not travel to work
- Changes during the year including switching work locations, work schedule or commute vehicle
- Whether their FY10 responses were representative of FY08 and FY09 (if they were employed at INL during these years), and if not, what was different.

The FY10 employee commute survey was distributed to 4,505 employees. The distribution list included sub-contractors with INL e-mail addresses (since they were assumed to be dedicated INL employees with offices within INL offices), but did not include management at the director level and above. The survey response was higher than expected at 62% (2,777 employees completed the survey) and considered to be representative of the INL population. The results were distributed across the total INL FY10 population, which included subcontractors. The survey results are summarized in a report, as well as several Excel spreadsheets.

4.4.2.2 Results Discussion

As shown in Table 14, INL employees commuted an estimated 21.9 and 23.9 million vehicle-miles during FY09 and FY10, respectively. The associated GHG emissions were estimated to be 9,354 and 10,171 MT CO_2e. In FY09, the GHG emissions equates to 42% of INL's Scope 3 emissions, and 9% of the total anthropogenic emissions. In FY10, this equates to 44% of INL's Scope 3 emissions, and 10% of the total anthropogenic emissions.

Table 14. Number and type of commute miles traveled by INL employees during FY09 and FY10.

Type of Miles	FY09		FY10	
	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	14,667,892	5,494	15,876,348	5,947
Passenger SUV or Truck Miles, Gasoline	7,224,484	3,860	6,472,196	3,458
Motorcycle Miles	NA[m]	0	260,255	44
Passenger Car Miles, Diesel	NA[l]	0	132,135	74
Passenger SUV or Truck Miles, Diesel	NA[l]	0	1,153,449	648
TOTAL VEHICLE-MILES	21,892,377	9,354	23,894,383	10,171
Walk, run or bike Miles	65,315	0	85,636	0
TOTAL COMMUTE MILES	21,957,691	9,354	23,980,019	10,171

m. This category was not considered in the FY09 commute calculations, which assumed employees drove only gasoline cars and SUVs/trucks.

4.4.2.3 Lessons Learned

It was interesting to note that the FY10 employee commuting survey did not provide results that were significantly different than the results found in previous years with Human Resource data and assumptions. However, it is likely that the survey will be repeated in future years to continue gathering the best available data on employee commuting behaviors.

4.4.2.4 Comparison to FY08 Baseline

In FY09, there was an 8% increase in GHG emissions from employee commuting over the FY08 baseline. Accounting for the increase in employees, the number of commute miles per employee increased 5%.

In FY10, there was an 18% increase over the FY08 baseline, and the number of commute miles per employee increased 9%.

The commute survey utilized in FY10, to gather the commute data, could be considered more accurate than the methods used in FY08 and FY09, which called for a great number of assumptions.

4.4.3 Business Air Travel Emissions

INL employees took 11,603 and 12,302 trips during FY09 and FY10, respectively, as indicated by submitted and approved travel request forms. Such forms are submitted by employees to the INL travel office to make necessary reservations for both domestic and international travel on behalf of the Laboratory. Travel request forms are also submitted to secure insurance coverage for employees that do not need travel arrangements, so there are times when a form is submitted and no travel arrangements are necessary (this could lead to no Scope 3 GHG emissions calculated, for example, in the case where an employee uses an INL fleet vehicle or is carpooling in another employee's personal vehicle to an offsite location).

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 FY09 and FY10 GHG calculations, only employees travelling by commercial airline, personal vehicle, and rental vehicle were included. Travel by taxi, bus, rail, and other commercial means is 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 FY09 and FY10 inventories.

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 airline miles reported. 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 TSD 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[n] based on the length of each individual flight leg of an employee's trip (as opposed to the total mile 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

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

landing. (This is different from the FY08 calculation approach when the travel vendor was only able to provide a value for the total passenger miles traveled, and then this was multiplied by an average emission factor per mile of commercial flight.)

4.4.3.2 Results Discussion

Table 15 shows that the 35,557,952 and 32,712,904 passenger miles flown by INL employees during FY09 and FY10, respectively, resulted in an estimated 7,380 and 6,785 MT CO_2e, or 0.207 MT CO_2e per 1,000 passenger miles for each year. In FY09, this equates to 33% of INL's Scope 3 emissions, and 7% of the total anthropogenic emissions considered. In FY10, this equates to 29% of INL's Scope 3 emissions, and 7% of the total anthropogenic emissions considered.

Table 15. Number of miles flown by INL employees during FY09 and FY10.

	FY09		FY10	
Type of Miles	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
Medium haul	7,965,079	1,847	7,631,935	1,770
Long haul	23,795,526	4,470	21,778,636	4,091
TOTAL	35,557,952	7,380	32,712,904	6,785

4.4.3.3 Lessons Learned

Since this data is already tracked, it is considered accurate and no changes are needed for future reporting.

4.4.3.4 Comparison to FY08 Baseline

When comparing the FY09 inventory to the FY08 GHG baseline, there was a 10% increase in airline GHG emissions, 45% more passenger-miles flown, and an overall increase of 7% more trips[o] per employee. In FY10, there was a 2% increase in airline GHG emissions over the FY08 baseline, with 34% more passenger-miles flown, and a 9% increase in overall trips per employee.

INL employees are traveling more, particularly they are flying more. It should be noted that the FY08 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 (increase in passenger miles flown in FY09 and FY10 was much greater than the associated GHG emissions when comparing each of these metrics to the baseline year).

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 FY09 and FY10 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 TSD were applied accordingly based on these two categories.

o. The number of trips includes all of the trips coordinated by the INL travel office, and includes more than airline trips.

This calculation process followed the TSD'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).

4.4.4.2 Results Discussion

As shown in Table 16, INL's rental car use during FY09 and FY10 resulted in 337 and 393 MT CO_2e based on 790,569 and 925,357 vehicle-miles traveled respectively each year. In both FY09 and FY10 this equates to 2% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

Table 16. Number of vehicle-miles traveled in rental cars by INL employees during FY09 and FY10.

	FY09		FY10	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	533,177	200	632,548	237
Light-duty truck/van/SUV	257,392	138	292,809	156
TOTAL	790,569	338	925,357	393

4.4.4.3 Lessons Learned

Since the number of miles traveled in rental vehicles is already tracked by the rental car vendors, 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 FY08 Baseline

In FY09, there was a 4% decrease in GHG emissions from rental vehicle business travel over the FY08 baseline, while the number of miles traveled decreased by 2%. In FY10, there was a 12% increase over the FY08 baseline, and the number of miles traveled increased by 15%.

4.4.5 Business Ground Travel: Personal Vehicle Emissions

4.4.5.1 Calculation Method

During FY09 travel-expense reports were completed through paper hard copies, and the only method to determine the number of vehicle-miles completed in personal cars for business travel was to review these expense reports by hand. Therefore, it was decided to use a representative sample to determine the total number of personal vehicle-miles traveled. Of the 11,603 trips submitted for approval during FY09, 581 of their corresponding expense reports were sampled. These results are summarized in Figure 17. An average mileage per trip of 82.8 miles was calculated.

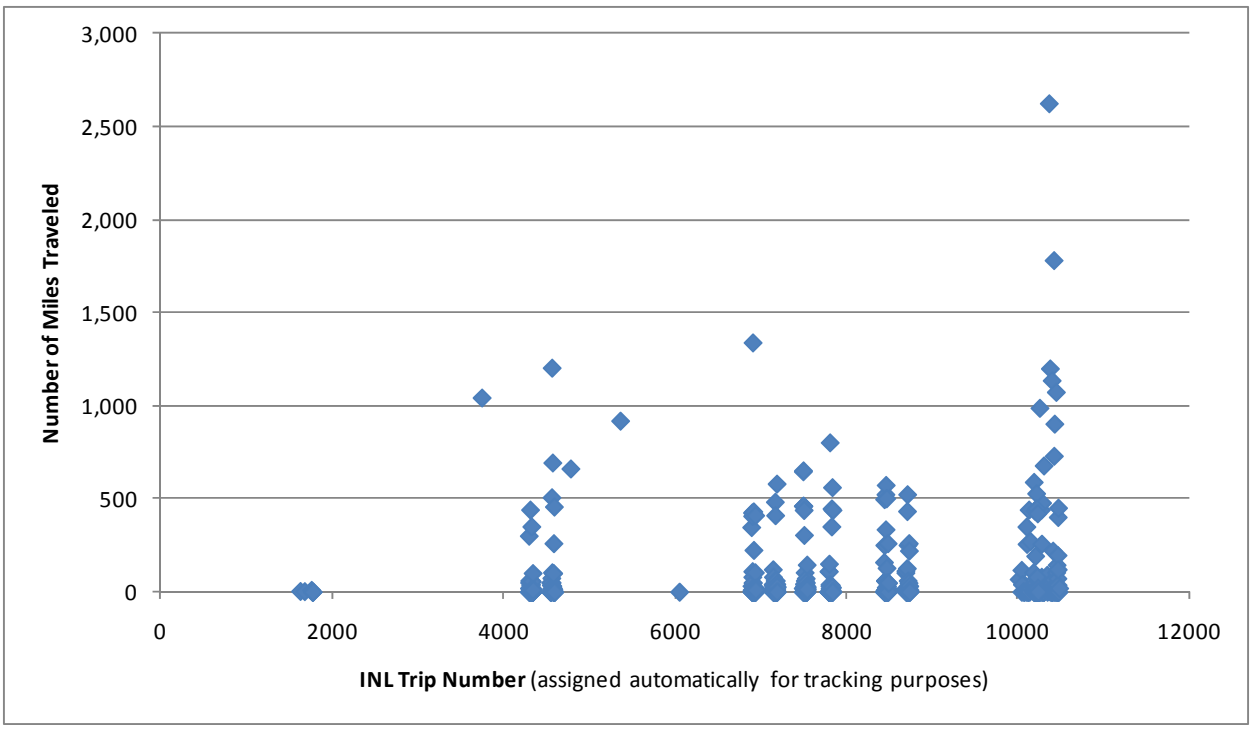

Figure 17. Number of miles traveled in FY09 for sampled business travel in personally owned vehicles.

Late in FY09, an electronic system for travel expense reports was introduced, which allowed for more streamlined and accurate tracking of personal car miles for FY10 reporting. Instead of sampling a portion of the hard copies of the expense reports submitted, the actual miles submitted for reimbursement were queried from the electronic system.

To determine which emission factors to use for calculating the associated GHG emissions during FY09 and FY10, the distribution between passenger cars and light-duty trucks/vans/SUVs that was found in the FY10 employee commute survey was used (this amounted to 67% of the travel completed in passenger cars and 32% in light-duty trucks/vans/SUVs).

4.4.5.2 Results Discussion

The 960,866 and 987,830 vehicle-miles that INL employees traveled during FY09 and FY10 resulted in an estimated 411 and 422 MT CO_2e, respectively. In both FY09 and FY10 this equates to 2% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.4.5.3 Lessons Learned

While reviewing the sampled hard copy expense reports for the FY09 calculations, many were identified as missing: a travel request form had been submitted, but there was no corresponding expense report submitted. Dick Schuman of the INL travel office identified a number of reasons that an expense report might be missing, and these include relocation, canceled trips, duplicate or rescheduled trip reports. The traveler may have chosen not to be reimbursed, or the traveler may not have incurred expenses and just needed insurance coverage (i.e., the employee traveled in a government vehicle [this would be counted in mobile combustion emissions as Scope 1], or rode with someone who was reimbursed). These reasons indicate that not all mileage traveled in personal vehicles for business travel could be tracked, even if all of the expense reports had been reviewed.

Note that although submissions for travel requests during FY09 were completed electronically, the outcome of the trip, or how the employee actually traveled, were not tracked in this system. This means

that the only way to know the outcome of a particular trip, including whether it was canceled, is to review the paper or hard copy of the submitted expense report—a time-intensive task.

The electronic system for expense reports that was introduced during FY10 will continue to allow for more streamlined and accurate reporting of personal car miles than previous years (FY08 and FY09) 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 FY08 Baseline

In FY09, there was a 1% decrease in GHG emissions from personal vehicle business travel over the FY08 baseline, while the number of miles traveled also decreased by 1%. In FY10, there was a 2% increase over the FY08 baseline, and the number of miles traveled increased by the same amount.

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 FY09 and FY10, 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%). The FY09 and FY10 volumes of 9,336 and 9,883 cubic yards, respectively, was converted to a weight based on an assumed solid waste density of 150 pounds per cubic yard (density value was selected based on EPA range [www.epa.gov/epawaste/conserve/tools/recmeas/docs/guide_b.pdf]). This resulted in weights of 741.24 tons (1,482,480.00 pounds) and 700.20 tons (1,400,400 pounds) for INL's offsite MSW disposal during FY09 and FY10, respectively.

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

4.4.6.2 Results Discussion

INL's offsite disposal of MSW during FY09 and FY10 is estimated to contribute 903 and 956 MT CO_2e to each respective year's anthropogenic GHG inventory. In both FY09 and FY10, this equates to 4% of INL's Scope 3 emissions, and 1% of the total anthropogenic emissions considered.

It was also calculated that 118.20 and 125.13 MT CO_2e of biogenic emissions were released in FY09 and FY10, respectively.

4.4.6.3 Lessons Learned

Since the quantity of INL's MSW sent for offsite disposal is based on estimated volumes and an assumed density, 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 a sample of INL's MSW might be analyzed to determine an INL-specific density. These approaches will also assist with more accurate tracking of INL's waste disposal and overall diversion rates that are additional requirements under EO 13514.

In addition to the waste volumes estimated from the city, INL has several small buildings located outside of 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 FY08 Baseline

In FY09, there was a 1.4% decrease over the FY08 baseline, and a 3% decrease in FY10 over the FY08 baseline. When considering the change in waste disposed per employee against the FY08 baseline, FY09 showed a 28% decrease and FY10 showed a 29% increase. These decreases are likely due to the change in recycling practices at town facilities in early FY09, which allowed for a greater number of items to be recycled.

As discussed previously for the onsite landfill baseline comparison, Section 4.2.4.4, the EO 13514 waste diversion goals are expected to decrease INL's amount of GHGs produced by contracted MSW disposal.

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 was provided by Human Resources as an average during FY09 and FY10, based on the total number of employees at the end of each quarter of that year. The reported number of town employees was 1,904.5 and 2,028.25 employees for FY09 and FY10, respectively. The number of visitors to the town facilities was estimated based on 10% of the number of employees. This yielded a total population of 2,094.95 and 2,231.08, which was used with the calculation method in the TSD along with default national averages (from the TSD) for the specific treatment process.

4.4.7.2 Results Discussion

INL's contracted wastewater treatment during FY09 and FY10 is estimated to contribute 201 and 214 MT CO_2e emissions to the GHG inventory. In both FY09 and FY10, this equates to 1% 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 FY08 Baseline

In FY09, there was a 6% increase over the FY08 GHG baseline, and a 13% increase in FY10 over the FY08 baseline. Since the wastewater calculations are based on employee counts, the increase in GHG emissions from wastewater directly followed the increase in INL's total employee counts of 6% in FY09 and 13% in FY10 over the FY08 baseline.

5. PUTTING INL'S FOOTPRINT INTO PERSPECTIVE

During FY09, the INL GHG inventory is estimated to have emitted 103,549 MT of anthropogenic CO_2e. This represents 25.7 MT for each employee working at INL that year. Furthermore, the total GHG emissions generated by the Laboratory during FY09 are the equivalent to the CO_2 emissions from any one of the following[p]:

- Consuming 11.6 million gallons of gasoline or more than 240,000 barrels of oil
- Driving 20,304 passenger vehicles for a year
- Supplying electricity to 12,567 homes for a year.

During FY10, the INL GHG inventory is estimated to have emitted 102,413 MT of anthropogenic CO_2e. This represents 24.2 MT for each employee working at INL that year. Furthermore, the total GHG emissions generated by the Laboratory during FY10 are the equivalent to the CO_2 emissions from any one of the following[q]:

- Consuming almost 11.5 million gallons of gasoline or more than 238,170 barrels of oil
- Driving 20,081 passenger vehicles for a year
- Supplying electricity to 12,429 homes for a year.

Comparing these equivalency results to the FY08 baseline shows that INL removed an equivalent of 1,900 vehicles from the road in FY09, and then another 230 in FY10. To meet the EO 13514 emissions goals for FY20, INL needs to reduce emissions in the equivalent of another 1,900 vehicles over the next 10 years.

p. Calculated with the EPA Greenhouse Gas Equivalencies (www.epa.gov/cleanenergy/energy-resources/calculator.html) in March 2011.

q. Calculated with the EPA Greenhouse Gas Equivalencies (www.epa.gov/cleanenergy/energy-resources/calculator.html) in March 2011.

6. SUMMARY AND CONCLUSIONS

Executive Order 13514 mandates reductions in the output of GHGs generated by federal agencies. These reductions are targeted at 28% for direct (Scope 1 and 2) emissions, and 13% for indirect (Scope 3) emissions, all by 2020 (White House 2010a and b). The EO sets 2008 as the baseline year against which reductions will be measured, and this report documents the calculations for INL's FY09 and FY10 inventories and the associated reductions. The reductions observed in GHG emissions are shown in Figure 18, along with the 2020 goal, and the specific values are as follows:

- In FY09, an 11% reduction for Scope 1 and 2, and a 4% increase for Scope 3 was calculated over the respective FY08 baseline values
- In FY10, a 13% reduction for Scope 1 and 2, and a 7% increase for Scope 3 was calculated over the respective FY08 baseline values.

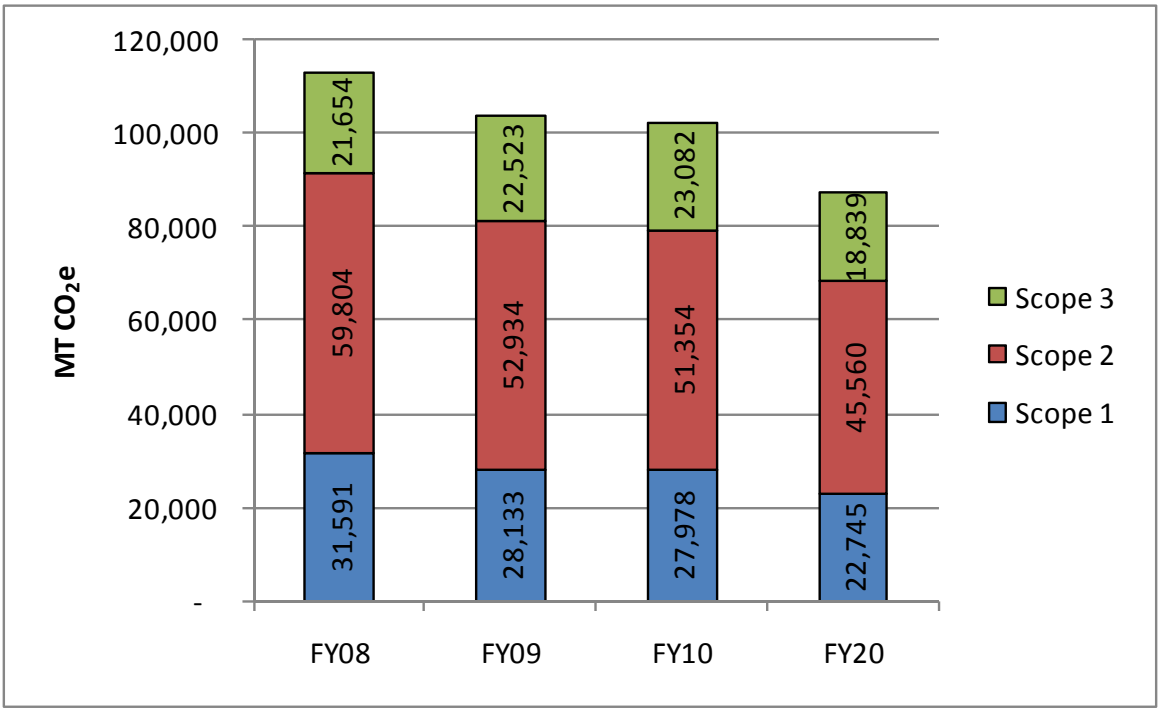

Figure 18. Comparison of INL's FY08, FY09, and FY10 actual, and FY20 goal GHG emissions, by scope.

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 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 Laboratory's concern for the environment. Some data and assumptions must be estimated using national averages supplied in the TSD.

During FY09 and FY10, INL generated 103,590 and 102,413 MT of CO_2 equivalents, respectively. Many factors influence INL's GHG emissions, including the large land area on which the Laboratory's facilities are located. The area requires long commutes, 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 FY09 and FY10 GHG inventories:

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

INL's GHG inventories for FY09 and FY10 were performed according the guidelines contained in the TSD. INL recognizes its role as a DOE-sponsored research laboratory to "lead by example" in measuring, reporting, and reducing GHG emissions. To that end, the Laboratory has already moved to promote reductions in GHGs. Now that 3 years of data have been gathered, the next step is to prepare a GHG reduction strategy that identifies activities to implement into our everyday operations that will contribute to the EO goals.

7. REFERENCES

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Appendix A

Global Warming Potentials

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 FY09 and FY10. 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
Methane	74–82–8	CH_4	21
Nitrous oxide	10024–97–2	N_2O	310
HFC–23	75–46–7	CHF_3	11,700
HFC–32	75–10–5	CH_2F_2	650
HFC–125	354–33–6	C_2HF_5	2,800
HFC–134a	811–97–2	CH_2FCF_3	1,300
HFC–152a	75–37–6	CH_3CHF_2	140
HFC–227ea	431–89–0	C_3HF_7	2,900
HFC–365mfc	406–58–6	$CH_3CF_2CH_2CF_3$	794
PFC–9-1-18	306–94–5	$C_{10}F_{18}$	7,500

Source: EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009.
Table A-1 to Subpart A of Part 98. See www.epa.gov/climatechange/emissions/downloads09/GHG-MRR-Full%20Version.pdf, Web page accessed August 2010.

Appendix B

Emissions Factors Used

Appendix B

Emissions Factors Used

B-1. SCOPE ONE – DIRECT EMISSIONS

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

Emissions Source	Factor Type	Amount	Units	Reference
Fuel Oil No. 2	HHV Conversion Factor	0.138	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	73.96	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
Liquefied Natural Gas (LNG)	HHV Conversion Factor	0.110	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	66.83	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.001	kg CH_4/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0001	kg N_2O/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.

Table B-1. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Natural Gas (Pipeline)	Conversion Factor	0.001028	MMBtu/ scf	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	Conversion Factor	96.99	scf/therm	Published conversion in common literature
	CO_2 Emission Factor	53.02	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.001	kg CH_4/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0001	kg N_2O/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
Liquefied Propane Gas (LPG)	HHV Conversion Factor	0.092	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	62.98	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-2 to Subpart C of Part 98.

Table B-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, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	70.22	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
Gasoline, Bus (Considered "Gasoline Buses")	CH_4 Emissions Factor	0.021	g CH_4/ mile	Emission Factors from Cross-Sector Tools, GHG Protocol, http://www.ghgprotocol.org/ calculation-tools/all-tools, v. 1.0, July 2009.
	N_2O Emissions Factor	0.017	g N_2O/ mile	Emission Factors from Cross-Sector Tools, GHG Protocol, http://www.ghgprotocol.org/ calculation-tools/all-tools, v. 1.0, July 2009.
Gasoline, Light Duty Car (Considered "Gasoline Passenger Car," Tier 1 [1995–2000])	CH_4 Emissions Factor	0.0271	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0429	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Light Duty Truck (Considered "Gasoline Light Duty Trucks," Tier 1 [1995–2000])	CH_4 Emissions Factor	0.0452	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0871	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Equipment (Considered "Gasoline Construction Equipment")	CH_4 Emissions Factor	0.5	g CH_4/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.22	g N_2O/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Heavy Duty (Considered "Gasoline Heavy Duty Trucks," Tier 0)	CH_4 Emissions Factor	0.0655	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Table B-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
LNG (Considered "Natural Gasoline")	HHV Conversion Factor	0.110	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	66.83	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
LNG, Bus (Considered "CNG Buses")	CH_4 Emissions Factor	1.966	g CH_4/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
LNG, Equipment (Considered "LNG Heavy Duty Vehicles")	CH_4 Emissions Factor	1.966	g CH_4/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel (Considered "Distillate Fuel Oil No. 2")	HHV Conversion Factor	0.138	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.96	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
Diesel, Bus (Considered "Diesel Heavy-Duty Trucks")	CH_4 Emissions Factor	0.0051	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Light Duty Truck (Considered "Diesel Light Trucks," Moderate)	CH_4 Emissions Factor	0.0009	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0014	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Heavy Duty (Considered "Diesel	CH_4 Emissions Factor	0.0051	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Table B-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Heavy-duty Trucks")	N_2O Emissions Factor	0.0048	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Equipment (Considered "Diesel Construction Equipment")	CH_4 Emissions Factor	0.58	g CH_4/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.26	g N_2O/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel (Considered "Biodiesel [100%]")	HHV Conversion Factor	0.128	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.84	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
Biodiesel, Bus (Considered "Diesel Heavy-Duty Trucks")	CH_4 Emissions Factor	0.0051	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Equipment (Considered "Diesel Construction Equipment")	CH_4 Emissions Factor	0.58	g CH_4/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.26	g N_2O/ gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Light Duty Truck (Considered "Diesel Light Trucks," Moderate)	CH_4 Emissions Factor	0.0009	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0014	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Heavy Duty (Considered "Diesel Heavy-Duty Vehicles")	CH_4 Emissions Factor	0.0051	g CH_4/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/ mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Ethanol (Considered "Ethanol [100%]")	HHV Conversion Factor	0.084	MMBtu/ gal	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.

Table B-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
	CO_2 Emissions Factor	68.44	kg CO_2/ MMBtu	EPA Mandatory Reporting Rule, Federal Register, Friday, October 30, 2009, Table C-1 to Subpart C of Part 98.
Ethanol, Bus (Considered "Ethanol Buses")	CH_4 Emissions Factor	0.197	g CH_4/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Ethanol, Equipment and Heavy Duty (Considered "Ethanol Heavy Duty Vehicles")	CH_4 Emissions Factor	0.197	g CH_4/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Ethanol, Light Duty Car and Truck (Considered "Ethanol Light-duty Vehicles")	CH_4 Emissions Factor	0.055	g CH_4/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.067	g N_2O/ mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

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.

B-2. SCOPE TWO – INDIRECT EMISSIONS

Table B-3. Electricity emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
INL Site Electricity Purchase (and T&D loss) (Considered "WECC Northwest" eGRID Subregion)	CO_2 Emissions Factor	409.247	kg CO_2/ MWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Output Emission Rates."
	CH_4 Emissions Factor	8.677	kg CH_4/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Output Emission Rates."
	N_2O Emissions Factor	6.758	kg N_2O/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Output Emission Rates."
FY09 RECs Purchase (Considered "MRO West" eGRID Subregion)	CO_2 Emissions Factor	979.204	kg CO_2/ MWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."
	CH_4 Emissions Factor	20.669	kg CH_4/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."
	N_2O Emissions Factor	15.977	kg N_2O/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."
FY10 RECs Purchase (Considered National Average)	CO_2 Emissions Factor	718.160	kg CO_2/ MWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."
	CH_4 Emissions Factor	16.227	kg CH_4/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."
	N_2O Emissions Factor	9.060	kg N_2O/ GWh	EPA, eGRID2007 Version 1.1 Year 2005 Summary Tables, p. 6, "Non-baseload Output Emission Rates."

B-3. SCOPE THREE – INDIRECT EMISSIONS

Table B-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	0.364	kg CO_2/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.031×10^{-3}	kg CH_4/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.032×10^{-3}	kg N_2O/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
Light-duty truck/van/SUV	CO_2 Emissions Factor	0.519	kg CO_2/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.036×10^{-3}	kg CH_4/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.047×10^{-3}	kg N_2O/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.

Table B-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	0.277	kg CO_2/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.0104	g CH_4/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.0085	g N_2O/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
Airline Miles, Medium Haul (300–700 miles)	CO_2 Emissions Factor	0.229	kg CO_2/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.0104	g CH_4/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.0085	g N_2O/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
Airline Miles, Long Haul (≥700 miles)	CO_2 Emissions Factor	0.185	kg CO_2/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.0104	g CH_4/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.0085	g N_2O/ passenger-mile	Table 4, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.

Appendix C

Calculation Spreadsheets & Notes

Appendix C

Calculation Spreadsheets & Notes

Tables C-1 and C-2 summarize the following for each of INL's emissions categories considered during FY09 and FY10 respectively:

- 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 TSD equation number(s) used, who provided the data, etc.).

Table C-1. Calculation Spreadsheets and Comments for Emissions Categories included in the INL FY09 GHG Inventory.

Scope	Emissions Category	FY09 spreadsheet for data calculation	FY09 spreadsheet for GHG calculation	Comments
All	Summary	Sheet: "Sheet1," "Overall Summary Stats 06-28-11.xlsx"	Sheet: "Sheet1" and "Summary for Plots," "Overall Summary Stats 06-28-11.xlsx"	None
1	Stationary Combustion	Sheet: "Fuel Data," "FY09 Summary for GHG - Stationary Combustion 03-22-11.xlsx"	Sheet: "GHG Emissions," "FY09 Summary for GHG - Stationary Combustion 03-22-11.xlsx"	Default methodology, Equations A-1, A-2, and A-3 Fuel data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management)
	Mobile Combustion	Sheet: "FuelSums1," "FY09 Summary for GHG - Mobile Combust 03-09-11.xlsx"	Sheet: "GHG Emissions," "FY09 Summary for GHG - Mobile Combust 03-09-11.xlsx"	Advanced methodology, Equations A-5, A-9, and A-10 (A-11 and A-12 for biogenic) Fuel data provided by Cory McHugh (INL TIMS Coordinator)
	Fugitive Emissions: Refrigerants	Sheet: "Emissions Summary Sheet,", "PPTRS FY09 Backup Summary Sheets.xlsx"	Sheet: "1. Fugitive Gases," "PPTRS FY09 fugitives worksheets protected_kif.xlsx"	Followed PPTRS Data Call Data compiled by Kim Frerichs (INL Pollution Prevention)
	Fugitive Emissions: Onsite Landfill	Sheet: "LandfillData," "Landfill Report for LandGEM 06-22-11.xlsx"	Sheet: "FY09 GHG Calcs," "Landfill Report for LandGEM 06-22-11.xlsx"	Used LandGEM and Equation A-34 from TSD Data pulled from INWMIS by Jennifer Morton (INL Pollution Prevention)

Table C-1. (continued).

Scope	Emissions Category	FY09 spreadsheet for data calculation	FY09 spreadsheet for GHG calculation	Comments
	Fugitive Emissions: Onsite Wastewater Treatment	Sheet: "Wastewater Types," "FY09 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Sheet: "Onsite Wastewater," "FY09 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Default methodology, Equations A-23 and A-24 from TSD Employee counts provided by Steph Hunt (INL Human Resources)
2	Purchased Electricity	Sheet: "Elec Totals," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Default methodology, Equations B-1 and B-2 from TSD Data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management)
	Transmission & Distribution Losses (Owned)	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Default methodology, Equations B-1 and B-2 from TSD
	Purchased RECs	"09-2435 FY09 RECs Receipt.pdf"	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Default methodology, Equations B-28 and B-29 from TSD RECs Receipts provided by Ernest Fossum (INL Energy Management)
3	Transmission & Distribution Losses (Shared)	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Sheet: "GHGCalcs," "FY09 Summary for GHG - Scope 2 03-03-11.xlsx"	Default methodology, Equations C-3, C-4, and C-5 from TSD
	Employee Commuting	Sheets: "native," "mod 1," "mod 2," "mod 3," and "mod 4," "FY09 Employee Commute for GHG 03-10-11.xlsx"	Sheet: "GHGs," "FY09 Employee Commute for GHG 03-10-11.xlsx"	Default methodology, Equations C-14, C-15, and C-16 from TSD FY09 Employee data provided by Steph Hunt (INL Human Resources)
	Business Air Travel	Sheet: "INL," "INL Total Miles-FY09-HAUL.xlsx"	Sheet: "4. Business Air Travel," "PPTRS_Air Travel BEA FY09.xlsx"	Default methodology, Equations C-1 and C-2 from TSD Data provided by TMP Travel on behalf of Dick Schuman (INL Travel Office)

Table C-1. (continued).

Scope	Emissions Category	FY09 spreadsheet for data calculation	FY09 spreadsheet for GHG calculation	Comments
	Business Ground Travel: Rental Vehicle	Sheet: "Calc-Avis-Budget," "CO2 Emissions Calculator-Idaho Natl Labs-FY09.xls"	Sheet: "Rental Car Miles to GHGs," "Rental Car GHG Calcs FY09 12-23-10.xlsx"	Advanced methodology 2, Equations C-11, C-12, and C-13 from TSD Data provided by travel vendor on behalf of Dick Schuman (INL Travel Office)
	Business Ground Travel: Personal Vehicle	Sheet: "POV Miles-combined," "FY09 POV Travel for GHG 03-08-11.xlsx"	Sheet: "GHGs," "FY09 POV Travel for GHG 03-08-11.xlsx"	Advanced methodology 2, Equations C-11, C-12, and C-13 from TSD Data pulled from INL Expense Reports by Doug Brown (INL)
	Contracted MSW Disposal	Sheets: "FY09 sml," and "FY09 30yd," "Sanitation Department Report JDM 10-15-09.xls" Sheet: "FY09 (Pounds)," "Waste Summary for CF JDM 07-05-10.xls"	Sheet: "Offsite MSW," "FY09 Offsite MSW for GHG 03-08-11.xlsx"	Default methodology, Equation C-6 from TSD (C-7 for biogenic) Data compiled by Kim Frerichs (INL Pollution Prevention)
	Contracted Wastewater Treatment	Sheet: "Wastewater Types," "FY09 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Sheet: "Offsite Wastewater," "FY09 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Default methodology, Used Equations A-19, A-20, and A-22 from TSD Employee counts provided by Steph Hunt (INL Human Resources)

Table C-2. Calculation Spreadsheets and Comments for Emissions Categories included in the INL FY10 GHG Inventory.

Scope	Emissions Category	FY10 spreadsheet for data calculation	FY10 spreadsheet for GHG calculation	Comments
All	Summary	Sheet: "Sheet1," "Overall Summary Stats 06-28-11.xlsx"	Sheet: "Sheet1" and "Summary for Plots," "Overall Summary Stats 06-28-11.xlsx"	None
1	Stationary Combustion	Sheet: "Fuel Data," "FY10 Summary for GHG - Stationary Combustion 02-08-11.xlsx"	Sheet: "GHG Emissions," "FY10 Summary for GHG - Stationary Combustion 02-08-11.xlsx"	Default methodology, Equations A-1, A-2, and A-3 Fuel data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management)
	Mobile Combustion	Sheet: "FuelSums1," "FY10 Summary for GHG - Mobile Combust 03-09-11.xlsx"	Sheet: "GHG Emissions," "FY10 Summary for GHG - Mobile Combust 03-09-11.xlsx"	Advanced methodology, Equations A-5, A-9, and A-10 (A-11 and A-12 for biogenic) Fuel data provided by Cory McHugh (INL TIMS Coordinator)
	Fugitive Emissions: Refrigerants	Sheet: "Emissions Summary Sheet,", "PPTRS FY10 Backup Summary Sheets.xlsx"	Sheet: "1. Fugitive Gases," "PPTRS FY10 fugitives worksheets 10_18_2010_ protected_kif.xlsx"	Followed PPTRS Data Call Data compiled by Kim Frerichs (INL Pollution Prevention)
	Fugitive Emissions: Onsite Landfill	Sheet: "LandfillData," "Landfill Report for LandGEM 06-22-11.xlsx"	Sheet: "FY10 GHG Calcs," "Landfill Report for LandGEM 06-22-11.xlsx"	Used LandGEM and Equation A-34 from TSD Data pulled from INWMIS by Jennifer Morton (INL Pollution Prevention)
	Fugitive Emissions: Onsite Wastewater Treatment	Sheet: "Wastewater Types," "FY10 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Sheet: "Onsite Wastewater," "FY10 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Default methodology, Equations A-23 and A-24 from TSD Employee counts provided by Steph Hunt (INL Human Resources)
2	Purchased Electricity	Sheet: "Elec Totals," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Default methodology, Equations B-1 and B-2 from TSD Data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management)

Table C-2. (continued).

Scope	Emissions Category	FY10 spreadsheet for data calculation	FY10 spreadsheet for GHG calculation	Comments
	Transmission & Distribution Losses (Owned)	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Default methodology, Equations B-1 and B-2 from TSD
	Purchased RECs	[Waiting for allocation information]	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Default methodology, Equations B-28 and B-29 from TSD RECs Receipts provided by Ernest Fossum (INL Energy Management)
3	Transmission & Distribution Losses (Shared)	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Sheet: "GHGCalcs," "FY10 Summary for GHG - Scope 2 06-28-11.xlsx"	Default methodology, Equations C-3, C-4, and C-5 from TSD
	Employee Commuting	Sheet: "Totals" and "All BEA," "FY10 Commuter Survey BEA Results.xlsx"	Sheet: "GHGs," "FY10 Commuter Survey BEA Results.xlsx"	Default methodology, Equations C-14, C-15, and C-16 from TSD FY10 Survey and calculations performed by Krista Harris and Nichole McDonald (INL Survey Team)
	Business Air Travel	Sheet: "INL," "INL Total Miles-FY10-HAUL.xlsx"	Sheet: "4. Business Air Travel," "PPTRS_Air Travel BEA FY10.xlsx"	Default methodology, Equations C-1 and C-2 from TSD Data provided by TMP Travel on behalf of Dick Schuman (INL Travel Office)
	Business Ground Travel: Rental Vehicle	Sheet: "Re-Combined Results," "FY10 Rental Car Miles Summary 01-12-11.xlsx"	Sheet: "GHG Calcs," "FY10 Rental Car Miles Summary 01-12-11.xlsx"	Advanced methodology 2, Equations C-11, C-12, and C-13 from TSD Data provided by travel vendor on behalf of Dick Schuman (INL Travel Office)
	Business Ground Travel: Personal Vehicle	Sheet: "POV Miles," "FY-2010 Vehicle Miles - Jen Morton_qry.xlsx"	Sheet: "GHGs," "FY-2010 Vehicle Miles - Jen Morton_qry.xlsx"	Advanced methodology 2, Equations C-11, C-12, and C-13 from TSD Data pulled from INL Expense Reports by Doug Brown (INL)

Table C-2. (continued).

Scope	Emissions Category	FY10 spreadsheet for data calculation	FY10 spreadsheet for GHG calculation	Comments
	Contracted MSW Disposal	Sheet: "Sheet1," "BEA FY10 Waste Numbers.xlsx"	Sheet: "Offsite MSW," "FY10 Offsite MSW for GHG 03-08-11.xlsx"	Default methodology, Equation C-6 from TSD (C-7 for biogenic) Data compiled by Kim Frerichs (INL Pollution Prevention)
	Contracted Wastewater Treatment	Sheet: "Wastewater Types," "FY10 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Sheet: "Offsite Wastewater," "FY10 Wastewater for GHG (Scope 1+3) 03-03-11.xlsx"	Default methodology, Used Equations A-19, A-20, and A-22 from TSD Employee counts provided by Steph Hunt (INL Human Resources)

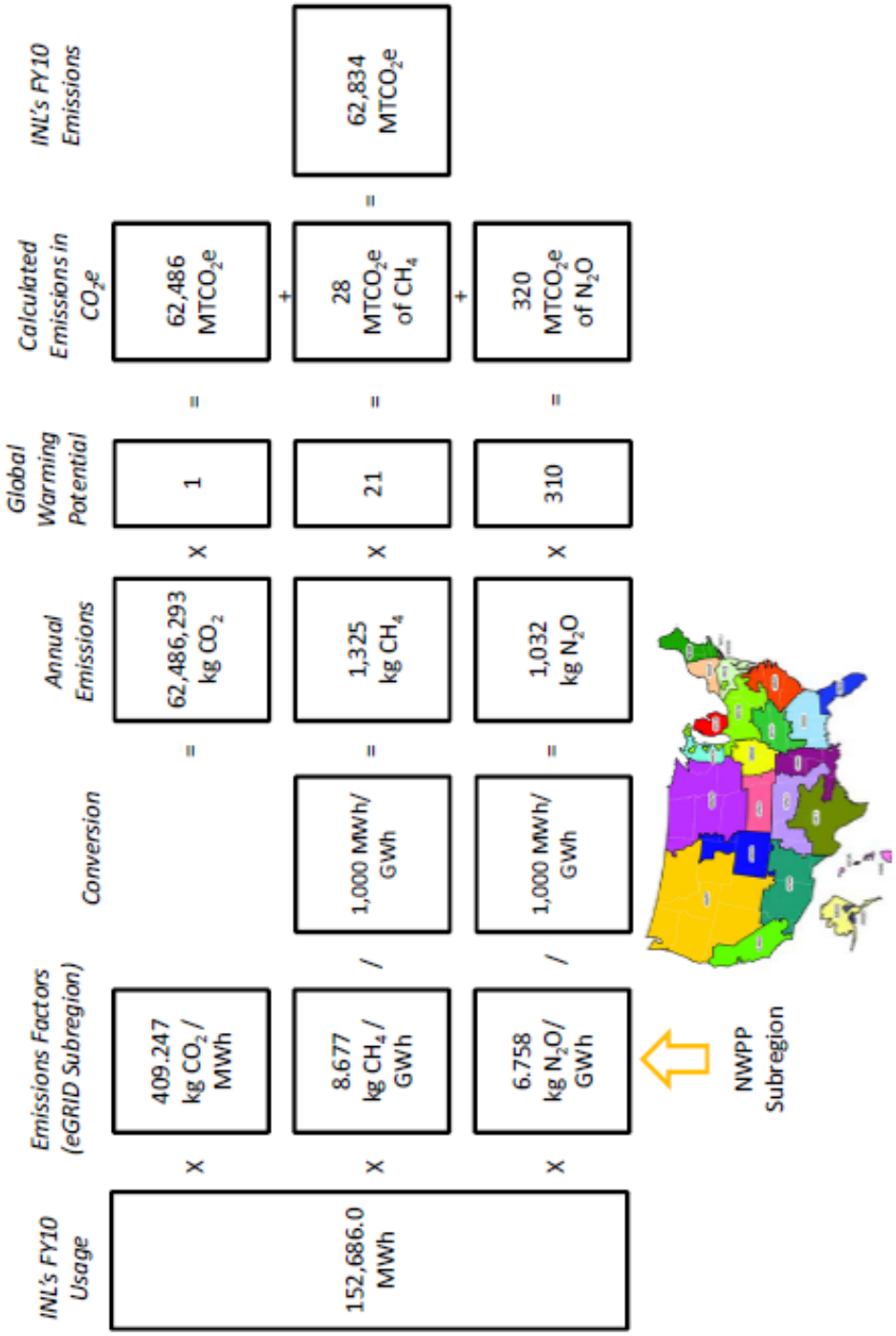
Appendix D

Sample Calculation

Appendix D

Sample Calculation

This calculation for electricity is an example of the calculation steps followed for calculating the GHG emissions from each of INL's emissions categories:



Attachment 1

Receipt for RECs Purchased in FY09

Attachment 1

Receipt for RECs Purchased in FY09

SP0600-09-C-8025

REC CERTIFICATE OF TRANSFER

Sterling Planet, Inc. certifies that title to the Renewable Energy Certificate(s) in the amounts described below, associated with power generation from the Renewable Resource(s) listed below, have been transferred to the **DOE Idaho National Laboratory** in accordance with the terms of the **DESC Contract SP0600-09- C-8025** for the delivery on **10/30/09**.

The Renewable Energy Certificate(s) transferred to the **DOE Idaho National Laboratory** include emissions, and other environmental characteristics associated with renewable resources. The Renewable Energy Certificate(s) do not include energy, capacity, or other attributes of electrical power.

Sterling Planet, Inc. represents and warrants that the environmental attributes, including any attendant emission credits, that are the subject of this Certificate of Transfer have not been and will not be sold, reserved, or conveyed to any party other than the **DOE Idaho National Laboratory** and that the electric power generated in association with these Renewable Energy Certificate(s) has not been represented to retain or possess, and will not be represented as retaining or possessing such attributes.

The Renewable Energy Certificate(s) that are the subject of this Certificate of Transfer are based upon the generation of electricity from **Intrepid Wind Farm** located in **Schaller, IA** between the dates of **7/1/08 and 3/31/10**. The total amount of Renewable Energy Certificates covered by this Certificate of Transfer is: **6,920,000 KWhs.**

STERLING PLANET, INC.

Brooke Hillebrand
10/30/09

Green-e Energy

GREEN-E ENERGY RENEWABLE GENERATOR REGISTRATION FORM AND ATTESTATION

I. Facility information

Name of Generation Facility ("Facility"): Intrepid Wind Farm

Company or Person that Owns Facility ("Seller"): MidAmerican Energy Company

Address of Facility: 506 West 2nd Street

Schaller, IA 51053

North American Electricity Reliability Corporation (NERC) region in which Facility is located:[1] MRO

Facility ID Number:[2] 56251 ☒ EIA or ☐ QF? (check one) Nameplate Capacity (MW): 175.5

Date Facility was First Operational: 12/01/2004 Date of Capacity Upgrade or Repowering:[3] NA

Contact Person: Daniel Mandernach Title: Emissions Trader

Telephone: 515-281-2683 Email Address: dlmandernach@midamerican.com

II. Renewable electricity or RECs[4] supplied to Purchaser indicated below, by fuel type

On the table below, list the renewable megawatt-hours (MWh) sold or transferred to Purchaser, broken down by quarter of generation in separate rows:

[1] If you are unsure of which region Facility is in, see http://www.nerc.com/regional/
[2] Enter Energy Information Administration (EIA) identification number for the generating facility; if no EIA number, enter the utility-assigned Qualifying Facility (QF) identification number.
[3] If applicable. Repowered facilities must meet Green-e Energy's criteria for repowering, available at http://www.Green-e Energy.org/docs/Repowering_Defin_and_Instructions.doc
[4] Renewable Energy Certificates, which represent the renewable attributes of 1 MWh of renewable electricity generation.

Fuel Type[5]	# MWh RECs / Renewable Elec. Sold	Period of Generation (quarter/yy or mm/yy)
Wind	22,809	07/08
Wind	18,812	08/08
Wind	31,302	09/08
Wind	45,977	10/08
Wind	50,109	11/08

III. Declaration

I, (print name and title) Rich Singer Vice President Fuel Emissions and Transporation, declare that the ☐ renewable electricity (electricity bundled with renewable attributes) / ☒ renewable attributes only[6] (check one) generated by Facility during the Period of Generation were sold exclusively from Seller to Sterling Planet, Inc ("Purchaser").

I further declare that:

1) all the renewable attributes (including CO_2 benefits), including any emissions offsets, reductions or claims, represented by the renewable electricity generation listed above were transferred to Purchaser;

2) to the best of my knowledge, the renewable attributes were not sold, marketed or otherwise claimed by a third party other than Purchaser;

3) Seller sold the renewable attributes only once;

4) the renewable attributes or the electricity that was generated with the attributes was not used to meet any federal, state or local renewable energy requirement, renewable energy procurement, renewable portfolio standard, or other renewable energy mandate by Seller, nor to the best of my knowledge, by any other entity other than Purchaser;[7]

5) the renewable electricity sold or electricity associated with the attributes sold was not used on-site for powering electric generation equipment (parasitic load);

6) if Purchaser is receiving electricity bundled with renewable attributes from Seller, the renewable electricity was delivered into the NERC region in which Facility is located;

7) if Facility is located in Canada, it is EcoLogo certified and was throughout the Period of Generation; and

8) the electricity that was generated with the attributes was not separately sold, separately marketed or otherwise separately represented as renewable energy by Seller, or, to the best of my knowledge, any other entity other than Purchaser.

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[5] If using biomass fuels, list out the specific type (i.e. landfill gas, wood waste, etc.) and fill in section IV below.
[6] If selling renewable attributes to Purchaser without electricity, please fill in the name of the load serving entity buying the undifferentiated electricity, if applicable, at the bottom of this Declaration section.
[7] Renewable attributes used by Purchaser for any of the purposes listed in 4) are ineligible for Green-e Energy certification.

Please indicate the following:

Is Facility owner reporting its direct greenhouse gas emissions in a legally binding cap and trade program for the time period of generation listed on this form?

☐ Yes;[8] list the cap and trade program: _____
☒ No

If Seller is providing only RECs to Purchaser and selling the associated electricity to a utility or load-serving entity, please write the name of the utility or load-serving entity here:

_____

☐ Check box if sale is part of a Qualifying Facility (QF) contract

IV. Additional statement required for and applicable to biomass facilities only

1) I attest that no more than five percent (5%) fossil fuels and other fuels that are not Green-e Energy eligible, measured on a BTU basis, were used, including as a start-up, pilot or supplemental fuel, to produce the electricity and/or RECs in the above Green-e Energy eligible biomass generation plant or biomass boiler;

2) I attest that this facility was in substantial compliance with its operating permit regarding emissions during the Period of Generation reported above;

3) I attest that if this facility is subject to New Source Review (NSR), it was compliant with all standards pertaining to NSR during the period of generation reported above; and

4) I attest that Seller owned the renewable and environmental attributes of the biomass fuels I have listed in the table below at the time of the fuel's use for electricity generation.

Biomass Fuel Type	Facility that Produced Fuel or Origin/Source of Fuel

V. Signature

As an authorized agent of Seller, I attest that the above statements are true and correct.

Richard Sinclair
Signature

March 17, 2009
Date

Urbandale, IA
Place of Execution

VP - Fuel, Emissions and Transportation

[8] In this case the renewable energy or RECs reported on this form may be ineligible for Green-e Energy certification. For more information, contact Green-e Energy Staff at 415-561-2100.