

GREENHOUSE GAS INVENTORY PROTOCOL
Aggregate Producers and Pulverized Mineral Producers

Prepared by:

Environmental Committee
National Stone, Sand & Gravel Association
1605 King Street
Alexandria, Virginia 22314
(703) 525-8788

January 2009

TABLE OF CONTENTS

1. PURPOSE AND SCOPE	1
2. ATTRIBUTES OF THE NSSGA GHG INVENTORY PROCEDURES	2
Corporate-Level Reporting	2
Baseline and Annual Emission Reporting	2
Accuracy Goal	3
Completeness Goal	3
Transparency and Verification	3
Confidentiality	4
Greenhouse Gas Warming Potential Factors	4
Direct and Indirect Emission Calculations	5
3. INVENTORY BOUNDARIES	5
Geographical Boundaries	5
Organizational Boundaries	5
4. EMISSION INVENTORY CALCULATION PROCEDURES	6
Direct Emissions from Mobile Sources	6
Direct Emissions from Stationary Combustion Sources	8
Indirect Emissions from Purchased Electricity	9
De minimis Emissions	9
5. RECORDKEEPING AND INVENTORY VERIFICATION	10
6. VOLUNTARY REPORTING	10
7. REFERENCES	10

ACRONYMS

CCAR	California Climate Action Registry
CO₂e	Carbon Dioxide Equivalent Emissions
EPA	U.S. Environmental Protection Agency
GHG	Greenhouse Gases
GWP	Greenhouse Warming Potential
HFC	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
PFC	Perfluorocarbons
SAR	Second Assessment Report
WRI	World Resources Institute

GREENHOUSE GAS INVENTORY PROTOCOL

Aggregate Producers and Pulverized Mineral Producers

Disclaimer:

The National Stone, Sand and Gravel Association (“NSSGA”) is a nonprofit trade association, tax exempt under Section 501(c)(6) of the Internal Revenue Code, and dedicated to meeting the needs of the aggregates industry. NSSGA conducts education and training, and publishes related materials, in a variety of areas including worker safety and communications. This greenhouse gas (GHG) protocol is intended to provide information about the subject to those in the industry and other interested parties.

The information contained in this protocol is based on currently available data and is intended to be factually accurate, but further research or developments may change the current state of knowledge or best practices in the industry. The information in this protocol does not represent the official policy or position of NSSGA or any other organization or governmental entity, but simply provides information to users to enable them to enhance their safety program. Neither NSSGA nor its officers, directors, members, employees, or agents will be liable for any loss, damage, or claim with respect to any liabilities, including direct, special, indirect, or consequential damages, such as administrative penalties or citations, incurred in connection with the protocol or reliance on the information presented. Information provided in the protocol is “as is” without any warranty of accuracy, reliability, or otherwise, either express or implied, including but not limited to the implied warranties of merchantability, fitness for a particular purpose, or freedom from infringement.

This protocol is the sole and exclusive property of NSSGA. Reproduction or redistribution is prohibited without the prior written permission of NSSGA. Unauthorized duplication or distribution of this CD is prohibited. Copyright 2009 National Stone, Sand and Gravel Association. All rights reserved. Violation of copyright laws or the terms of the purchase agreement will result in civil or criminal action and applicable penalties.

1. PURPOSE AND SCOPE

This protocol will help aggregate producers and pulverized mineral producers calculate emissions of greenhouse gases (GHG) in an accurate, consistent, and verifiable manner. Using this protocol, National Stone, Sand & Gravel Association (NSSGA) member companies can determine if their emissions are above future regulatory thresholds and can participate in voluntary emissions registry programs.

The GHG inventories will provide emission baselines that NSSGA member companies can use to evaluate the impact of future regulatory programs and to receive consideration for any future regulatory initiatives concerning verified emission reductions. These procedures will also help determine the possible value of industry sector-specific GHG inventory procedures.

The GHG inventory data provide a useful tool for evaluating options for reducing GHG emissions. The GHG emissions data compiled based on this inventory protocol will help NSSGA member companies inform stockholders and public stakeholders concerning GHG emissions and emission reduction programs.

Another important objective of this protocol is to help NSSGA member companies establish GHG emission calculation procedures, record keeping procedures, verification procedures, and reporting procedures. NSSGA member companies can refine these GHG-related procedures when regulatory agencies and standards-setting organizations establish programs for GHG emission trading and credits. At the present time, the GHG inventory procedures published by leading organizations such as the World Resources Institute (WRI) and the California Climate Action Registry (CCAR) are not designed to serve GHG emission trading and credit programs. The NSSGA GHG Inventory Protocol is based on WRI and CCAR procedures; accordingly, this protocol is also not yet designed to support emission trading and credit programs.

The scope of the NSSGA GHG Inventory Protocol includes all direct and indirect sources of emissions typically present at aggregate producing plants and pulverized mineral producing plants. Direct emissions are those GHG gases formed on plant property due to fuel combustion and fugitive emissions. Indirect emissions include the GHG emissions from non-owned facilities that result due to the use of electrical power or steam on plant property. Direct sources of emissions addressed in this protocol include fuel combustion in on-road vehicles, off-road vehicles, driers, and process heater. Indirect emissions include all electrical power used in process equipment and office buildings. The scope of this protocol does not include incidental indirect emissions such as employee commuting, customer truck travel, and employee air travel. Both WRI and CCAR presently consider the reporting of these incidental indirect emissions as “optional.”

The scope of the NSSGA GHG Inventory Protocol includes all six categories of pollutants addressed in the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorcarbons (designated HFCs), perfluorocarbons (designated PFCs), and sulfur hexafluoride (SF₆). NSSGA concludes that non-CO₂ emissions are de minimis. The calculation procedures developed as part of this protocol will help NSSGA member companies demonstrate the de minimis nature of non-CO₂ emissions.

2. ATTRIBUTES OF THE NSSGA INVENTORY PROTOCOL

The inventory procedures are based on well-accepted calculation methods established by the WRI and CCAR. Use of WRI and CCAR-based calculation methods ensures consistency with GHG emission inventories prepared by numerous industrial sectors. This approach also minimizes the time commitment required by NSSGA member companies who are already participating as members of the CCAR.

The WRI and CCAR calculation procedures have been adapted to eliminate irrelevant information and to convert units-of-measure to forms common in the Aggregate and Pulverized Mineral Industries. This approach encourages NSSGA member companies to use site-specific data and emission factors to the maximum extent possible. Total GHG emission inventory values can then be converted to any units appropriate for annual reports.

Corporate-level Reporting—The NSSGA GHG Inventory Protocol compiles GHG emission data on a corporate entity level. Data for multiple facilities are combined to ensure that information such as fuel use rates and power consumption rates cannot be used by knowledgeable competitors to estimate the production capacity of specific facilities. Entity-level reports also facilitate GHG data evaluation and reporting.

The scope of the inventory procedures is limited to U.S. and Canadian facilities. No attempt is made to include GHG emissions from other geographical areas.

Baseline and Annual Emission Reporting—The NSSGA GHG Inventory Protocol will allow NSSGA member companies to determine GHG emissions for a baseline year. The procedures include annual updating of the emission factors to take into account changes in the mix of energy sources used to provide electrical power for each geographical area and take into account improvements in emission factors. As part of the annual emission reporting, members

will also have to consider any organizational changes (acquisitions, divestures, new facilities) that change the baseline inventory.

The GHG inventory procedures are tied, in part, to default emission factor tables published separately by WRI and CCAR. To allow for annual updates to the emission inventory, NSSGA will maintain electronic files of the WRI and CCAR emission factor tables applicable to each year. This file will provide the information needed by NSSGA member companies to re-check emissions for each calendar year.

Accuracy Goal—The NSSGA GHG inventory procedures are designed to yield an accuracy of 95% of the emissions. Independent auditors providing verification of the GHG emission estimates will be able to confirm this level of accuracy. It is important to note, however, that the calculation procedures performed by both NSSGA member companies and by verification auditors are subject to uncertainty due to the scientific limitations of the accuracy of the underlying emission factors. The WRI, CCAR, and NSSGA procedures do not include evaluation of the potential limitations of the underlying emission factors.

As part of the NSSGA inventory procedures, members will be able to estimate the uncertainty in the inventory procedures due to the application of standard calculation procedures to specific sources. The scope of the uncertainty evaluation includes (1) the completeness of the emission inventory, (2) the accuracy of fuel use data, (3) the accuracy of electrical power meters, (4) the representativeness of default emission factors used when site-specific ultimate analyses of fuels is not available, and (5) the representativeness of certain non-CO₂ emission factors to heavy construction equipment used at NSSGA member facilities.

Completeness Goal—In accordance with WRI and CCAR guidelines, the NSSGA Inventory Protocol will allow for GHG emission inventories that include a minimum of 95% of the direct and indirect sources. This 95% target level does not include the incidental indirect emissions associated with employee commuting, customer truck traffic, barge transport of products, rail transport of products, and employee airline travel.

The upper limit de minimis emissions are calculated for a wide variety of very small GHG emission sources. These de minimis emissions include methane and nitrous oxide emissions from mobile vehicles, nitrous oxide emissions from blasting, and HFC and PFC emissions from air conditioners. De minimis demonstrations for this large set of very small GHG emission sources reduce the burden of inventory compilation and reporting.

Transparency and Verification—The NSSGA GHG Inventory Protocol is based on a set of readily-available records. No emission testing or specialized data gathering effort is required.

The results are provided in a format that simplifies auditing by independent organizations. NSSGA member companies presently participating in the CCAR program are already subject to the independent verification requirements of annual reports. The procedures in the protocol facilitate this verification step and minimize the associated costs.

Confidentiality—The NSSGA GHG Inventory Protocol is based on records and facility-level activity data that can be kept confidential. Information concerning the methodology used to calculate the emissions and the facility-level data is available only to registry groups such as CCAR and to independent verification auditors. Publically available data are limited to the corporate identification information, the geographical scale of the emissions, and the summary data for the CO₂ equivalent emissions.

Greenhouse Gas Warming Potential Factors—The NSSGA GHG Inventory Protocol uses the Second Assessment Report (SAR) greenhouse gas warming potential (GWP) factors published in 1996 by the Intergovernmental Panel on Climate Change (IPCC). These factors are presently required by CCAR even though more recent and accurate factors were published in 2001. The GWP factors take into account the typical atmospheric impact (lifetime, radiation effects) of the six different categories of global warming gases. Carbon dioxide is assigned the lowest factor, the value of 1, considering that it has the least long term impact per unit of mass. As indicated in Table 1, methane has a much higher factor of 21. The difference in these factors suggests that one pound of methane in the atmosphere has the same long term adverse impact as twenty-one pounds of carbon dioxide.

Global Warming Potential Multipliers		
Compound	Compound	Global Warming Potential Multiplier
Carbon Dioxide	CO ₂	1
Methane	CH ₄	21
Nitrous Oxide	N ₂ O	310
Hydrofluorocarbons	HFC-23	650
	HFC-32	2,800
	HFC-125	1,300
	HFC-134a	3,800
	HFC-143a	140
	HFC-152a	2,900
	HFC-227ea	6,300
	HFC-236fa	6,300
	HFC431mee	1,300
Perfluorocarbons	CF ₄	6,500
	C ₂ F ₆	9,260
	C ₃ F ₈	7,000
	C ₄ F ₁₀	7,000
	C ₆ F ₁₄	7,400
Sulfur Hexafluoride	SF ₆	23,900

It is apparent that researchers consider nitrous oxide and the various fluorinated compounds to have a much greater impact than carbon dioxide on a unit mass basis. Carbon dioxide dominates

the greenhouse gas issue primarily because it is emitted in quantities that substantially exceed the emissions of the other known GHG compounds.

Direct and Indirect Emissions—The NSSGA GHG Inventory Protocol separately calculates the direct and indirect GHG emissions. Direct emissions come from sources that burn fuels to generate GHG compounds formed on-site. Sources of direct emissions include mobile source fuel combustion, stationary source fuel combustion, and sources such as rotary driers. Indirect emissions are caused by the consumption of electrical power, steam, or other energy purchased from a non-owned and operated facility such as a power plant. The GHG emissions from these power sources caused by the production of the energy are termed indirect emissions. The direct and indirect emissions must be tabulated separately to avoid double counting emissions when evaluating total GHG emissions from many reporting entities.

3. INVENTORY BOUNDARIES

Prior to compiling a GHG emission inventory, NSSGA member companies must determine the most appropriate geographical and organizational boundaries for that inventory. The inventory is prepared for a logical group of facilities—not a specific facility. The most important considerations in setting the inventory boundaries include (1) protection of facility-specific production information, (2) compilation of data requested by various regulatory agencies, and (3) consistency with recordkeeping practices in the corporate organization.

Geographical Boundaries—The GHG emission inventories should be compiled separately for U.S. and Canadian sources. Companies participating in the CCAR program must separate emissions in California from emissions in other states and U.S. territories. It seems likely that GHG emission reporting on a state level will eventually be required so that each state can determine the inventory, reporting, and control programs that are appropriate.

While GHG emission inventory reports will preferably be on a corporate entity basis with state-by-state subtotals, it is likely that NSSGA member companies will often find it appropriate to release inventory data for a specific facility. This information may be requested by stakeholders reviewing permit applications for new or modified facilities. In order to provide for future obligations, the NSSGA procedures are designed to allow GHG emission data reporting on a national corporate level, a state corporate level, and a specific facility level.

Organizational Boundaries—The organizational boundary of the GHG emission inventories should be clearly stated when reporting GHG emissions. Both WRI and CCAR have provided guidance on constructing logical organization boundaries for facilities owned or managed jointly by two or more corporations. CCAR presents two alternative approaches: (1) allocation of GHG emissions based on a fraction of management control, and (2) allocation of GHG emissions based on an equity share of the joint facility. References 1 and 2 provide additional information concerning the distribution of GHG emissions for complex organizational forms.

All equipment on-site at aggregate and pulverized mineral producing sources that are subject to a long term lease agreement or financing agreement is considered to be under the direct control of the facility. Emissions from the leased equipment are the responsibility of the source and should

be included in the inventory. Short-term leases, such as rental cars and other off-site equipment, are not considered in compiling the GHG emission inventories.

4. EMISSION INVENTORY CALCULATION PROCEDURES

The emission inventory calculation procedures are based on the general structure of the WRI and CCAR forms and emission factors. As encouraged by both WRI and CCAR, the NSSGA forms allow for increased emission inventory accuracy by the substitution of default emission factors with site-specific fuel data.

The calculation procedures use data that can be readily obtained and verified for each facility and source included in the inventory. The types of information that serve as input information include (1) fuel purchase records, (2) fuel firing rate records, (3) electrical power bills, and (4) HFC and PFC purchase records. No additional emission tests or facility specific activity measurements are needed to support the emission inventory calculation procedures.

A set of Excel spreadsheet input and calculation forms is provided in the Appendix. These are part of a single file that can be used to input data from the various facilities included in the organization boundary and to calculate the CO₂e emissions for each facility. Data such as fuel consumption data and facility power bill data that must be entered by the user are shown in white. Conversion factors and other standard data are provided in locked cells shaded yellow. Calculated values are shown in locked cells that are shaded grey. The GHG emissions in short tons CO₂e are totaled at the bottom of each form based on the GWP factors for each category of GHG emission. Each set of forms includes the year for which the inventory applies.

The Excel file includes all of the calculation sheets and supporting conversion factors and information needed to complete the inventory calculations. There are separate sheets for direct emissions from mobile source fuel combustion, direct emissions from stationary source fuel combustion, and indirect emissions from purchased power. Two additional forms are provided to demonstrate de minimis emissions of HFCs and PFCs from air conditioners and de minimis emissions of CO₂, CH₄, and N₂O from mobile sources or other small on-site combustion sources.

Direct and indirect GHG emissions are compiled on the summary report form. The GHG emissions data are provided in short tons CO₂e and in metric tons CO₂e to facilitate reporting in the form required by the GHG registry.

All of the forms have information concerning the locations of records used in the calculations and references to notes concerning the calculation procedures. Contact information for each facility is provided on the summary report form and the facility information form.

Direct Emissions from On-Road and Off-Road Vehicles—The emission of CO₂ from both on-road and off-road vehicles on plant property are determined entirely from the fuel purchase records. For each facility, it is necessary to calculate the total gasoline, diesel, LPG, and/or CNG purchases for a calendar year and to subtract any inventory of these fuels in plant storage vessels and tanks. The calculation yields the total quantity of each fuel used at each facility for the calendar year.

The annual fuel consumption data are then entered into Column E of the Mobile Source Form (GHG form 3). The CO₂ emissions for each type of fuel are strictly a function of the heating value and ultimate analysis (e.g. carbon, hydrogen, oxygen, sulfur, nitrogen) content of that fuel. WRI and CCAR have provided default factors to calculate the gross heat content of the fuels. These default factors have been converted to units of millions of BTUs heat input per unit of fuel and entered into Column F (gross heating value or “higher” heating value). WRI recommends the use of the higher heating value even though it is not practical to achieve this value. Some users of the protocol may wish to enter a lower heating value in Column G. Either the higher or lower heating values should then be multiplied by the total fuel consumption data to calculate the total heat input for each fuel shown in Column H.

The CO₂ emissions for each fuel depend strongly on the carbon content of the fuel. Fuels such as methane have a relatively low carbon content, while some types of coal, especially anthracite coal, have an extremely high carbon content. The WRI and CCAR default values for mass of carbon per MMBTU of fuel are specified in column I (“eye”). These are based on average U.S. values. The CO₂ emissions calculated based on actual fuel data can be as much as 20% different from these values. Accordingly, site-specific fuel composition data should be used if they are representative of the fuels used throughout the year. If the site-specific fuel ultimate analysis data are limited to just a few spot measurements, the WRI-CCAR default values are probably as accurate.

The emissions of CO₂ (Column K) are the product of the WRI-CCAR emission factor and the total heat input for each source. In GHG Form 3, the CO₂ emissions are expressed in units of short tons.

The NSSGA GHG Inventory Protocol does include the emissions of methane and nitrous oxide from mobile sources. These emissions are only weakly related to the fuel characteristics. Instead, the emissions of these two types of greenhouse gases are due primarily to the combustion conditions. In order to calculate emissions of CH₄ and N₂O, it is necessary to compile information that includes, but is not necessarily limited to the following for each category of vehicles operated: (1) type, (2) driving characteristics, (3) age, and (4) miles traveled. Compilation of the voluminous information needed to support the CH₄ and N₂O emission calculations is very time consuming. The emission factors are also not necessarily representative of the numerous types of heavy construction vehicles operated by NSSGA member companies. Accordingly, these calculations are difficult to prepare and very subject to error.

NSSGA recommends that member companies treat the vehicle specific emissions of CH₄ and N₂O as de minimis emissions. Upper limit emission estimates shown in Form GHG-8 suggest that the emissions of these two compounds are insignificant on a CO₂e basis and can be properly relegated to the de minimis inventory category.

The emissions of CO₂ from rail operations, ship/barge operations, and aircraft should be included only if these mobile sources are under the direct control of the facility. If so, the emissions are calculated using procedures parallel to those for on-road and off-road vehicles. As in the case with the vehicle emissions, CO₂ is the only significant greenhouse gas. The emissions of CH₄ and N₂O are de minimis for these other types of mobile sources.

Forklifts are another small mobile source present in many aggregate and PMD facilities. The emissions from these small sources can be calculated using the fuel purchase records for each calendar year. The calculations are essentially identical to those discussed with respect to gasoline and propane. Protocol users may wish to simply classify all forklifts as de minimis based on the relatively small fuel purchase records.

The records needed to estimate CO₂ emissions from mobile sources include (1) fuel purchase records and (2) fuel storage tank inventory records. Copies of these records should be maintained at a central location where the GHG inventory is compiled.

Direct Emissions from Stationary Source Combustion—Stationary combustion sources on-site at aggregate and pulverized mineral producing facilities include rotary driers, fluidized bed driers, natural gas-fired office building and shop heaters, and small space heaters.

GHG emissions for these sources are calculated based on the same general approach used for mobile source CO₂ emissions. Data on the higher heating content of five common fuels are listed in GHG Form 4, column F. It is important to note that many companies in the U.S. are accustomed to using data on a lower heating value basis because this is most closely related to the actual useful energy content of the fuel. Climate action registry organizations have taken a different approach by selecting the higher heating value. Reporting entities can override this decision by entering lower heating values into the calculation form and using this value to calculate the total energy input. Regardless of the type of fuel heating value used, the selected value is multiplied by the fuel consumption rate to calculate the total heat input for each combustion source as shown in Form GHG-4. A standard density factor provided by WRI-CCAR and presented in column I (“eye”) is used to calculate the total weight of the fuel fired per year shown in column J.

Two standard factors are provided in columns K and L based on WRI-CCAR standard fuel information. The weight percent carbon content of the fuel is shown based on WRI-CCAR factors in Column K. This is a factor based on the average ultimate analysis of the fuel. If site-specific fuel ultimate analyses data are available, the carbon content can be calculated directly from the laboratory reporting sheet. The second factor in form GHG-4 is the oxidation percentage of the carbon in the fuel. In most combustion systems operated by aggregate and pulverized mineral producing facilities, the production of soot and carbonaceous ash is quite low, and the oxidation factor in Column L can reasonably be assumed to be 100%. When these two factors are applied to the weight of carbon in fuel consumed per year, the total carbon dioxide emission rate is provided in Column M.

The emissions of methane and nitrous oxide from the combustion system are based on standard emission factors for the fuels. These standard emission factors are presented in Columns N and P for methane and nitrous oxide, respectively. Obviously, site-specific data are preferred to the default factors whenever possible; however, site-specific data are rare due to the cost and difficulty of testing for emissions of methane and nitrous oxide over a sufficient period to adequately characterize long-term emissions.

Several examples are imbedded in the copy of GHG Form 4 presented in the appendix to this protocol. As indicated in this form, the emissions of CO₂ substantially exceed the values for methane and nitrous oxide even considering the global warming potential impact multipliers shown at the bottom of the form. Methane and nitrous oxide contribute far less than 5% of the CO₂e calculated for many common fuels and combustion systems. For this reason, the methane and nitrous oxide emissions are totaled along with the de minimis emission estimates.

Indirect Emissions from Purchased Energy—The indirect GHG emissions due to purchased energy are calculated using Form GHG 5. The only data needed for these calculations are the annual electrical power data provided on electrical bills for each separately monitored facility or subsection of a facility. The annual electrical use data in kilowatt hours (kWh) should be calculated for each facility.

Emission factors for carbon dioxide, methane, and nitrous oxide are provided by EPA based on the distribution of electrical generating sources used by each power company in each geographical area. Regions where the electric utilities use more renewable energy sources, nuclear power, and/or hydroelectric sources have lower emission factors than those based primarily on fossil fuels. As the electric utilities gradually convert to cleaner energy sources, these geographically-oriented emission factors will decrease.

The appropriate emission factors for CO₂, CH₄, and N₂O can be retrieved from the EPA data base at www.epa.gov/cleanenergy/energy-and-you/how-clean/html. The information used in this database includes the zip code of the facility being inventoried and the electrical company that issued the electrical power bill. In the EPA system, the emission factors are expressed in units of pounds per kWh. In GHG Form 5, the data are converted to pounds per kWh.

The emissions of CO₂, CH₄, and N₂O are calculated simply by multiplying the EPA-supplied emission factor by the electrical power consumption for the year. The emissions for all facilities included within the boundary of the emission inventory should be summed at the bottom of the page. The GWP multipliers are provided at the bottom of GHG 5 to convert the emissions of CH₄ and N₂O into CO₂e emissions.

It is apparent in the examples included in the Appendix forms (GHG-5 and GHG-1), that the methane and nitrous oxide emissions do not exceed the 5% level. It would be appropriate to consider the methane and nitrous oxide as de minimis and use the calculation in the attached forms to demonstrate the low levels of these emissions.

De minimis Emissions—The WRI and CCAR systems both recognize the practical limits to the preparation of inventories of six categories of greenhouse gases emitted from potentially hundreds to thousands of individual facilities included within organizational boundaries. NSSGA recognizes the 5% de minimis threshold proposed by WRI and CCAR.

To qualify for this de minimis categorization, it is important to identify the sources considered de minimis and to include upper bound emission estimates to demonstrate that the sum of all of

the de minimis emissions does not exceed 5% of the total CO₂e emissions reported by the corporate entity.

NSSGA has provided a spreadsheet to help member companies prepare a concise de minimis inventory. The form is presently designed to address CH₄ and N₂O emissions from mobile sources and N₂O emissions from blasting. The form can be expanded as additional de minimis emission categories are identified.

6. RECORDKEEPING AND INVENTORY VERIFICATION

NSSGA encourages member companies compiling GHG inventories to compile photocopies of all fuel purchase records, fuel storage inventory records, and electrical power bills in a central area. These records must be retrievable when the inventory is audited by an independent party. The CCAR requires an independent audit once per year starting after the second year of reporting. In the future, other regulatory agencies will also probably adopt verification procedures.

In addition to the records for each facility and sources included in the boundary of the GHG inventory, NSSGA encourages member companies to retain electronic copies of all major references that provide default emission factors and other supporting information for the conversion factors. These files will be useful when checking the accuracy of calculations completed several years earlier.

7. VOLUNTARY REPORTING

Voluntary reporting of GHG emissions is required annually for participants in the CCAR program. These emissions are reported on an automated system termed "CARROT." The NSSGA GHG inventory forms are designed to provide data compatible with the input fields of the CARROT system and other similar systems that might be developed in the near future.

8. REFERENCES

1. World Resources Institute. The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard, revised edition. Washington, D.C., undated.
2. California Climate Action Registry. Greenhouse Gas Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions. Version 3.0, April 2008.