Greenhouse Gas Emission Inventory Activities of the North Carolina Division of Air Quality

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Abstract

The Division of Air Quality (DAQ) is in the process of amending its annual emissions reporting rule to add greenhouse gases (GHGs) to the list of pollutants required to be reported annually from Title V facilities. The results of this effort will be used for tracking performance of programs and assessing future priorities for DAQ, better understanding North Carolina's (NC) carbon footprint, and informing potential climate policies undertaken by the Federal government and the state. This paper discusses the state's proposed requirements of the NC GHG reporting rule and modifications made to the "Air-Emissions Reporting On-line" system. Additional resources provided to the reporting industries are also discussed.

The paper also discusses a second major effort within the Department of Environment and Natural Resources (DENR) to calculate its carbon footprint. As a Reporter to The Climate Registry, DENR will calculate, independently verify, and publicly report 2008 emissions associated with vehicle use, electricity consumption, and stationary combustion. The DAQ has been spearheading this effort, with representatives from 25 divisions forming the DENR Climate Change Work Group. This paper describes an inventory management plan, including data systems, calculation tools, and quality assurance procedures. The establishment and maintenance of an Internet based portal system, which serves as the primary communication and data management system is also described.

Introduction

The Fourth Assessment Report published by the Intergovernmental Panel on Climate Change has created an increased awareness among local, regional, state, and national governments about the impacts of GHGs on the earth's climate (IPCC 2007). This awareness, along with observed changes in ambient temperatures, prolonged drought periods, sea level rise, wildlife migration patterns, and other real observations at local levels has prompted policy makers, educators, and citizens to better understand society's contribution, mitigation options, and adaptation pathways for areas already impacted by climate change.

As the 10th most populous state in the nation, North Carolina is home to over 9 million people. The state's gross domestic product in 2007 was $371 billion (10th in the country and the same as Sweden, the 20th largest in the world). The electricity and transportation demands from its citizens and industries have resulted in the state having the 12th highest GHG emissions from fossil fuel combustion in the U.S. (EPA 2008).

On a net emissions basis (i.e., including carbon sinks), North Carolina accounted for approximately 169 million metric tons of carbon dioxide equivalent ($MMtCO_{2e}$) emissions in

2005. This amount is equal to about 2.4% of total US GHG emissions. NC's GHG emissions are rising faster than the nation as a whole. From 1990 to 2000, the state's net GHG emissions were up 39% while national net emissions rose by 24%. Net emissions are projected to be 232 $MMtCO_{2e}$ by 2020, 106% above 1990 levels. As shown in Figure 1, electricity production is projected to be the largest contributor to future emission growth, followed by the transportation sector.

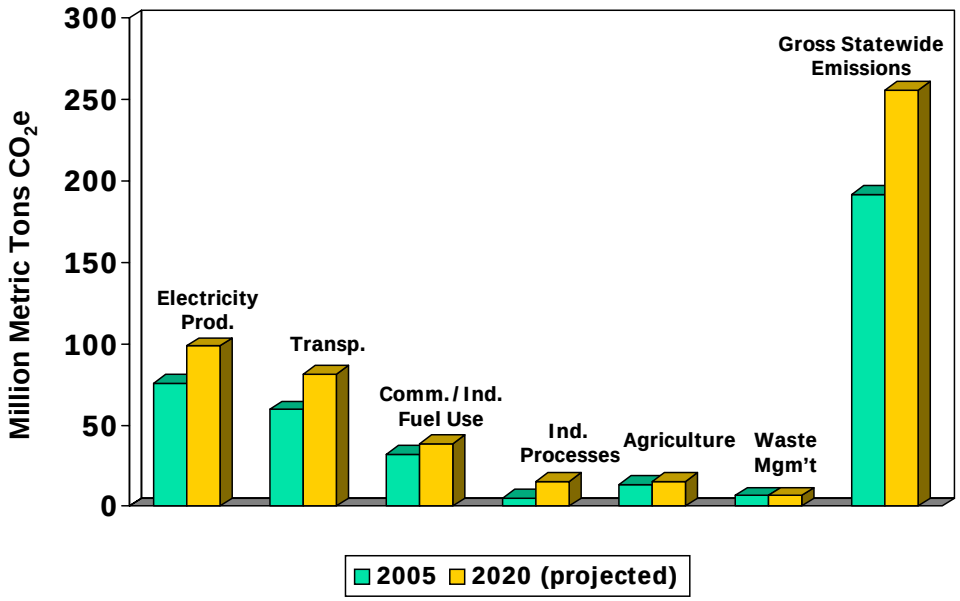

Figure 1. North Carolina GHG Emissions (Peterson et. al. 2007)

As one of the fastest growing states in the country, with a projected population of over 13 million by 2030, North Carolina's carbon footprint is expected to remain significant, and the impacts of future climate scenarios will be felt throughout the state. Regional and state impacts are harder to predict than large regional or global impacts. Regional models indicate that possible impacts in North Carolina include (Riggs et. al. 2008):

- Sea level rise could lead to flooding of low-lying areas, erosion of beaches, loss of coastal wetlands, intrusion of salt water into water supplies, and increased vulnerability of coastal areas to storms and hurricanes.
- Some plants and animals are projected to go extinct, some to decline or increase in population, and others migrate to areas with more favorable conditions. For example, along the coast, fish that need colder temperatures to survive could migrate north, while more tropical varieties could move up the coast into North Carolina.
- Diseases and pests that thrive in warmer climates could spread.
- Crops and trees that need cooler climates may not grow as well in North Carolina, while more tropical varieties might do better. For example, the spruce and fir trees growing at high altitudes in North Carolina's mountains could die out if temperatures increase.
- More severe storms and droughts could affect crop production, pests and growth rates.

- Increased occurrences in ozone concentration due to higher temperatures, resulting in poor air quality.
- Economic sectors sensitive to weather and climate will be impacted – a third of the state's economic activity comes from tourism, forestry, and agriculture.

In 2005, under the authority of the ground breaking Clean Smokestacks Act, DAQ completed studies regarding control of CO_2 emissions from coal-fired power plants and other stationary combustion sources. One of the recommendations of the DAQ reports was to proceed with a stakeholder group to work on a consensus report to include recommendations for mitigating consequences of climate change. The stakeholder group that was formed was the Climate Action Plan Advisory Group (CAPAG). In 2008, this multi-disciplinary group identified 56 specific recommendations that were believed to be most important for mitigating North Carolina's GHG emissions (CAPAG 2008). Both studies identified a plan of action for the state to institute a baseline point source emissions reporting requirement for GHGs. The inventory data would be useful to: develop a "bottom-up" inventory for the state, respond to future state/federal legislations, estimate emission reduction potentials, and examine the effectiveness of various policy measures.

The following text discusses the elements of DAQ's proposed GHG emissions reporting rule. This is followed by a discussion of the department wide initiative to "lead-by-example" which requires NC DENR to calculate, report and verify its carbon footprint to The Climate Registry.

North Carolina GHG Emissions Reporting Rule

In 2008, DAQ began rule revision activities to amend the state's existing annual emissions reporting rule to include GHGs. The rule simply states that *"the owner or operator of a Title V facility shall report by June 30th of each year the actual emissions during the previous calendar year of… carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, …"* A variety of hydroflurocarbons (HFCs), perflurocarbons (PFCs), criteria pollutants, and hazardous air pollutants are also listed in the rule.

Due to the recent release of the proposed federal Mandatory GHG Reporting Rule, the NC Environmental Management Commission has delayed voting on the rule until DAQ completes its investigation of the differences and similarities between the state and EPA reporting requirements. A discussion and vote by the commission is scheduled for May 12, 2009. Depending on the outcome of this decision, the state rule may be in effect by 2010.

For the current reporting year (i.e., calendar year 2008 emissions reporting), NC facilities are encouraged to voluntarily report GHG emissions. The planned implementation of GHG reporting takes advantage of the current reporting system which eases burden on the reporters and the state, and promotes multi-pollutant air quality management. The reporting instructions consist of the following key elements:

- Affected Facilities: sites with active Title V permits in Calendar Year 2008
- Affected Sources: emissions from direct permitted sources (on-site combustion equipment, process emissions, and fugitive emissions) and insignificant sources for which CAPs and HAPs are reported or if a facility specific threshold is met.
- Unaffected Sources: in-direct emissions from electricity/steam/heat purchase, mobile sources, and upstream operations.

- Reporting of unpermitted or exempt sources is optional but encouraged.
- Reporting Mechanism: North Carolina's internet based Air Emissions Reporting On-Line (AERO) system

The DAQ is familiarizing the industry with its reporting requirements by organizing on-site workshops and Internet based webinars. Source specific emission calculation guidance documents and spreadsheet tools for stationary source combustion have been developed to facilitate reporting of GHG emissions, along with criteria and hazardous air pollutants. Sources that use the spreadsheet tools for these other pollutants will be provided with GHG estimates based on either default fuel properties or user-specified fuel properties. This guidance allows GHGs to be reported alongside other pollutants with very little additional effort for the sources that currently use emission factor calculation approaches. This tool will greatly reduce the burden of reporting GHGs for stationary source combustion. For other types of emission sources, DAQ provides references to methodologies developed by others. The DAQ intends to align its recommended calculation method with EPA's proposed rule once that rule becomes final.

Revisions to the AERO system have been completed for NC industries to voluntarily report GHG emissions for the 2008 inventory year. AERO handles GHGs the same as other pollutants as far as adding, deleting, grouping and totaling emission sources. However, there is no Control Efficiency column in the GHG table. As shown in Figure 2, the GHG pollutant table allows users to enter emissions of selected gases. All GHG emissions are reported in short tons.

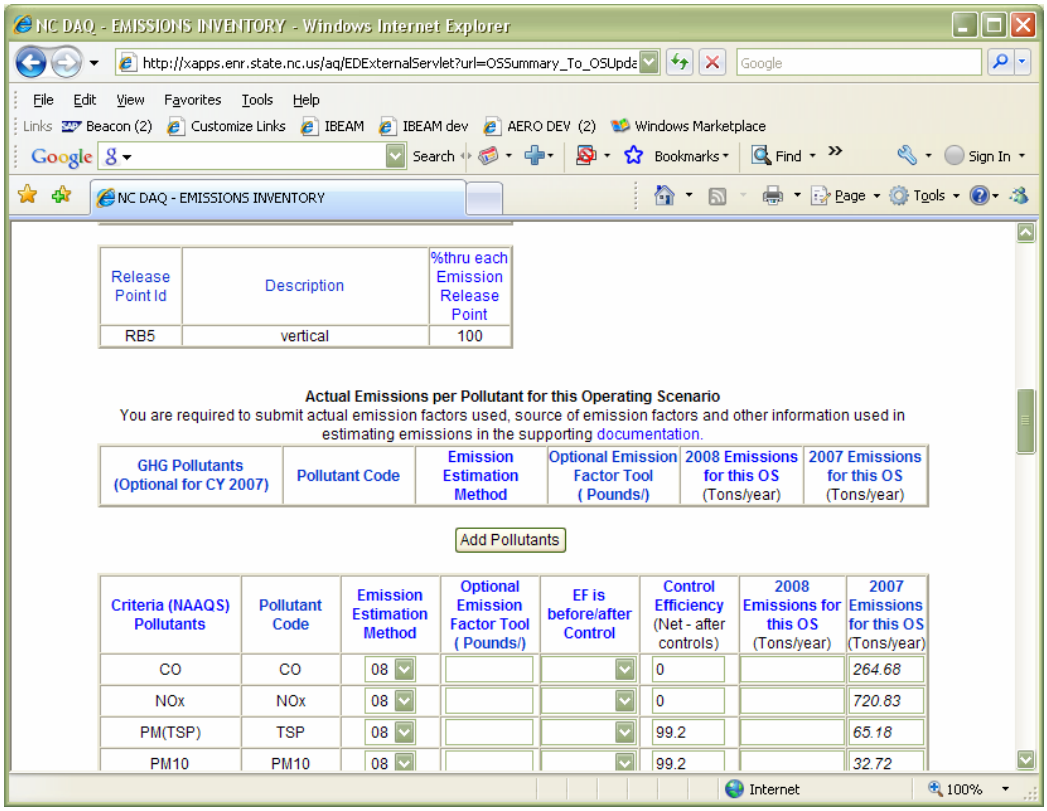

Figure 2. AERO Emissions Reporting Screen

Once emission rates for all sources are entered for each operating scenario, the facility wide emission rate is automatically calculated by AERO in the units of metric tons CO_2 equivalent, using the 1995 global warming potentials of different GHGs. Figure 3 illustrates a snap shot of an example Facility Summary Report using test data. Facilities have been using AERO to report to the state since 2003. Benefits of the system are that it is familiar to the industry, and it maintains consistency in reporting across multiple pollutants, emission source categories, and operating scenarios.

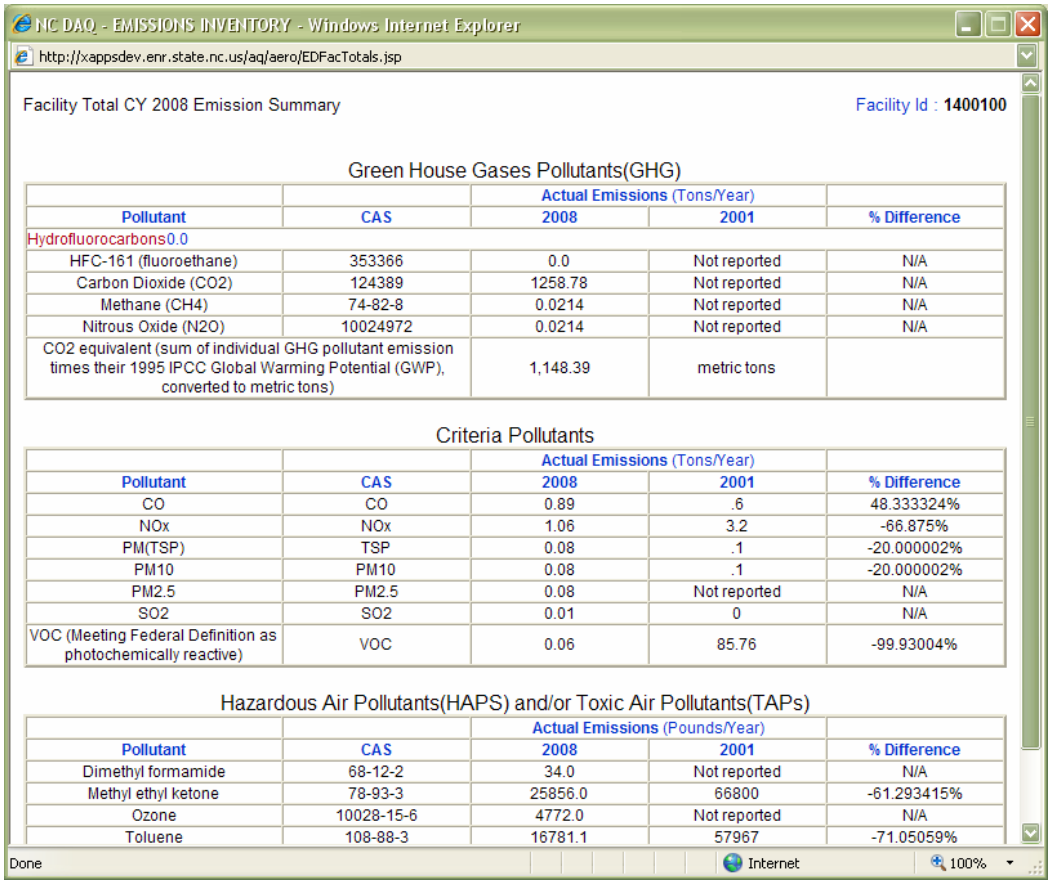

Figure 3. AERO Facility Total Emission Summary Screen

Additional information on the reporting rule, reporting instructions, and AERO system can be found on DAQ's website (http://www.ncair.org/monitor/eminv/gcc/).

DENR GHG Emission Inventory Plan

The N.C. Department of Environment and Natural Resources (DENR) is the lead stewardship agency for the preservation and protection of North Carolina's natural resources. The organization, which has offices from the mountains to the coast, administers regulatory and natural resource programs designed to protect air quality, water quality, and the public's health. The DENR works to protect fish, wildlife and wilderness areas, and manages the state parks, forests, aquariums, the NC Zoological Park, and the natural history museum.

In its commitment to demonstrate environmental leadership and lead by example, DENR has signed up to be the first department in the state to voluntarily report GHG emissions for all of its operations to The Climate Registry (TCR). TCR is a nonprofit collaboration among North American states, provinces, territories and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify and publicly report GHG emissions into a single registry. As a Founding Member of TCR, DENR will calculate, independently verify, and publicly report its emissions for the 2008-operating year. It is an exercise in multi-divisional cooperation and coordination, whose success depends on support from upper management and effective outreach from all levels of the department. The primary objectives of the initiative are to:

- quantify our carbon footprint,
- identify future energy and cost-saving measures, and
- implement emission reduction strategies that results in a more environmentally friendly and energy efficient state government operation.

All 25 divisions and program offices are participating in this effort, with the DAQ providing the overall coordination.

In order to manage the data collection of an agency that is responsible for over 2000 buildings, 1500 on-road vehicles, hundreds of off-road equipment (boats, airplanes, heavy machinery), and thousands of employees, DAQ first developed an inventory management plan (IMP) to inform division directors and to receive technical and administrative support from their staff. Representatives of each division formed the DENR Climate Change Work Group, whose responsibility became to collect actual data on electricity consumption rates, vehicle fuel records, fuel combustion rates, and other key activity factors. Key elements of the IMP are listed in Table 1.

Table 1. DENR Inventory Management Plan – Reporting Steps

	Key Activities Performed
Define Geographic Boundaries	All facilities and operations in North Carolina
Select Reporting Format Transitional Reporter or Complete	Transitional for 2008: Report CO_2, CH_4, and N_2O emissions from electricity use, on-site stationary combustion, and mobile sources Other gases and emission sources (e.g.; waste management, land management) will be reported in 2010
Define Organizational Boundaries	Control Approach/ Operation control – report 100% of the emissions from sources that are under DENR's control; includes wholly owned operations and authority on specific operations
Identify Emission Sources	Assign divisions responsible for providing data for the following sources of emissions: • Mobile combustion (vehicle fleet, off-road equipment) • Electricity Purchase • Stationary combustion (boilers, furnaces, etc.) • Biogenic emissions (wood burning, ethanol use)
Define Data Elements For each Emission	Identify the type of data to be collected, frequency of

Source Category	measurement/data collection, and data quality tiers. For example, the following data elements are required for vehicle fleet: • Vehicle specifications (make, model, type, class) • Fuel consumption (type, actual gallons consumed or estimated based on fuel ratings) • Miles traveled (actual)
Develop Data Management Plan	Identify what data is already accounted for in existing reporting systems (e.g., utility invoices, leased vehicle billing records) Prepare data entry tables for user input Establish communication protocol for data transfer (e.g., web portals) Hold training sessions and other information transfer meetings
Establish Calculation Procedures	Using data submitted from above, establish data reduction steps to arrive at final emission rates Submit emissions to The Climate Registry
Develop Quality Assurance and Quality Control Checks	Assign an independent person to review and quality assure the data from original submitted form to final reported values Establish data quality indicator goals and define corrective actions Establish clear documentation process
Develop Reporting Timeline	Establish a task specific project time line and deliverable schedule Obtain management buy-in and commitment to adhere to the established schedule

To facilitate communication among the Work Group members and other division staff submitting the data, DENR is employing its Internet based web portal system. This portal allows users with selective access to download data tables, inquire on reporting procedures, and take advantage of strategies employed by other work group members. It portal increased communication among all divisions, and brought attention to potential issues with data collection efforts. Figure 4 illustrates a screenshot of the home page.

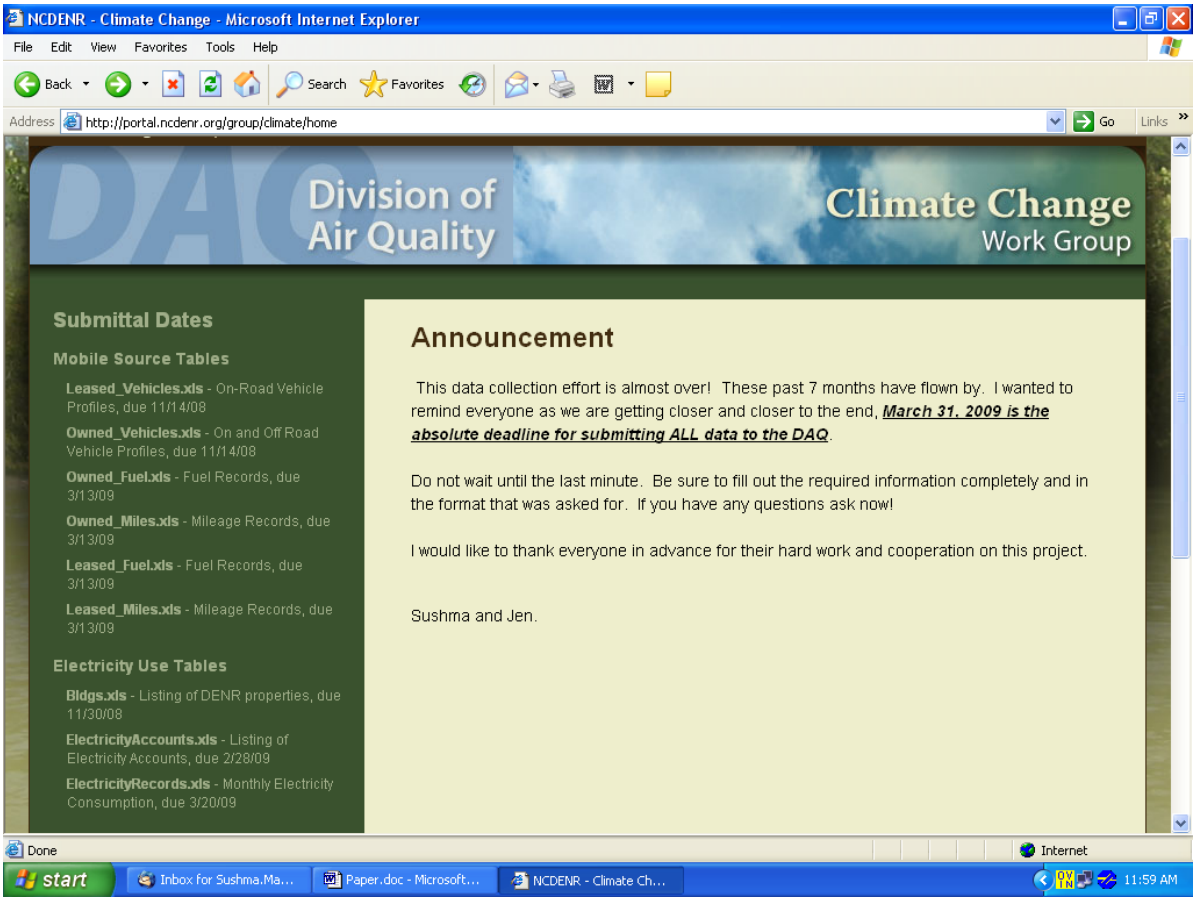

Figure 4. DENR Climate Change Web Portal – Main Communications Page

Next Steps

The DAQ is in the process of reviewing the proposed federal Mandatory GHG Reporting Rule. The proposed rule has already impacted and will likely further impact the NC rule, with regard to the status (delay of vote) and to the calculation procedures. In the coming months, DAQ will make decisions on the extent of aligning the state rule with the proposed federal rule. A decision on the outcome of the state rule and its reporting requirements will be made once the EPA's rule becomes final, which is expected to be by the end of 2009.

The DENR will report its emissions to The Climate Registry by June 30, 2009. Following this, DAQ will select an accredited verification organization to verify the reported emissions. The verification organization will follow approved protocol to evaluate the annual reported emissions. Upon completion of the verification, corrective actions taken by the Work Group, and final review by TCR, the emissions data will be made publicly available. The DENR plans to utilize the certified data to inform employees, managers, and other decision makers regarding the actual carbon footprint for our agency, and identify areas where both emission reductions and energy savings can be achieved.

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