Determining Adequate Greenhouse Gas Emission Estimation Methods for Mandatory Reporting Under the Western Climate Initiative Cap-and-Trade Program

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ABSTRACT

The Western Climate Initiative (WCI) is a collaboration among Western states and Canadian provinces of Arizona, California, Montana, New Mexico, Oregon, Utah, Washington, British Columbia, Manitoba, Ontario, and Québec to develop regional strategies to address climate change. A robust and credible emissions reporting system is the cornerstone of the WCI program, and it needs to ensure that greenhouse gas (GHG) emissions (i.e., carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]) are quantified and reported in an accurate, consistent and transparent manner.

This paper discusses the WCI's recent efforts to develop an overall mandatory GHG reporting program, including identification of GHG emissions estimation methods to be used by industries when reporting GHG emissions to the WCI. The WCI reporting program affects a large number of source categories including electric generation units, petroleum refiners, iron and steel plants, cement plants, and facilities with general stationary combustion units, among others. In addition to quantification methods, the reporting "essential requirements" address policy issues related to reporting program implementation by the WCI Partner jurisdictions, such as third-party verification, report contents and record retention. The specific methods recommended for use in WCI mandatory reporting are summarized, and a case study on pulp and paper facilities illustrates how issues concerning variability in accuracy and treatment of process and biomass emissions are dealt with. Finally, the status of ongoing efforts to improve GHG emission factors for selected source categories is described.

INTRODUCTION

The Western Climate Initiative (WCI) is a collaboration among Western states and Canadian provinces to develop regional strategies to address climate change. Partners include the states of Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington, and the provinces of British Columbia, Ontario, Manitoba, and Québec. Other U.S. and Mexican states and Canadian provinces have joined as observers. WCI was created to identify, evaluate, and implement collective and cooperative ways to reduce emissions of greenhouse gases (GHGs) in the region, focusing on a market-based cap-and-trade system. The WCI Partners have recommended a GHG reduction goal of 15% below 2005 levels by 2020.

The WCI is organized into committees and/or subcommittees, charged with developing discrete aspects of the cap-and-trade program, including the following (among others):

- Scope of the cap-and-trade program (e.g., pollutants, sources, thresholds, etc.);
- Reporting requirements;
- Market operation; and
- Offsets.

The specific GHGs to be covered by the WCI cap-and-trade program are the six Kyoto Protocol gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Both the annual emissions threshold for cap and trade compliance (i.e., 25,000 metric tons) and the threshold for reporting (i.e., 10,000 metric tons) are expressed in terms of CO_2 equivalents (CO_2e) annually. CO_2 equivalents are obtained by multiplying the mass emissions of each GHG by its Global Warming Potential (GWP).

A robust and credible emissions reporting system will be the backbone of the WCI cap-and-trade program. The reporting requirements must ensure that GHG emissions are quantified and reported in an accurate, consistent, and transparent manner. Mandatory reporting will allow regulators in the WCI jurisdictions to assess compliance of regulated sources; measure progress against state, provincial and regional targets; and generate public trust in this progress. Additionally, market participants will need to rely on the accuracy and consistency of the reported data as they make decisions on which significant transactions will be based. Confidence in the reporting system will be critical to the success of the WCI cap-and-trade program.

The objective of this paper is to describe the process used and results achieved by the WCI related to development of mandatory GHG reporting requirements, focusing on emissions quantification and monitoring requirements. Our hope is that other agencies, regional bodies, and stakeholders can take advantage of worked conducted by WCI as they may move forward with developing and complying with GHG reporting requirements at the local or regional level, or even as they review and comment on the recently-proposed federal GHG mandatory reporting rule (MRR). Any opinions or conclusions expressed in this paper are solely those of the authors and may not reflect the opinions or conclusions of the WCI Partners or the WCI Reporting Committee.

Comparison of Requirements: Criteria Emissions Reporting Versus Voluntary GHG Reporting Versus Mandatory GHG Reporting for Cap-and-Trade

It is interesting to examine the basic elements and requirements of several pollutant reporting programs in order to understand their differences and similarities. Also, because the approach to inventorying GHG emissions has, for many years, relied largely on top down methods, the lessons learned from other bottom up methods can be valuable in planning a mandatory emissions reporting framework. Below is a summary of the key elements of emissions reporting programs, which are discussed for criteria pollutant reporting, voluntary GHG reporting, and mandatory GHG reporting for cap-and-trade purposes.

Inventory Purpose

Criteria pollutant inventories are used for compliance with federal Consolidated Emissions Reporting Rule (CERR) requirements, which are in turn used to analyze national air emissions trends. Also, criteria pollutant emission estimates are used as inputs to air quality models, which may be used to demonstrate compliance with National Ambient Air Quality Standards (NAAQS) or visibility goals. The criteria pollutant inventories will generally cover all source "types" (i.e., point, area, on-road motor vehicle, nonroad mobile and natural sources), and will be prepared at the county and/or facility level, or sometimes will be spatially allocated into "grids" for modeling purposes. Certain criteria pollutants are required to be reported on a regular basis (i.e., quarterly) to comply with other Federal Clean Air Act program requirements, such as the Acid Rain Program.

Voluntary GHG reporting programs provide a mechanism for industrial sources (e.g., power plants, manufacturing facilities, etc.) to calculate and register their GHG emissions for public disclosure. Also, voluntary GHG programs provide the baseline inventory on which GHG reduction actions can be based. Some voluntary programs (e.g., The Climate Registry [TCR], the California Climate Action Registry [CCAR] etc.) also facilitate the estimation and trading of emissions from "offset" projects, such as reductions of methane from livestock manure management projects, and landfill gas reduction projects.

Mandatory GHG reporting programs may serve many purposes. The WCI program requires the reporting of GHG emissions in terms of CO_2e for purposes of establishing baselines for determining "caps" for emissions to ensure that the reduction goals for the region will be met. The baseline (2010) emissions reported by sources subject to the WCI cap-and-trade program will be used to determine the amount of GHG reductions needed across the region, and assigning allowances to individual facilities for complying with specified reductions. If sources exceed their cap, then they must buy emissions (i.e., allowances) from other sources, and if sources emit below their cap, then they can sell the excess emissions allowances to facilities that may emit over their allowed cap.

Level of Reporting for Industry

For criteria pollutant inventories, industry sources report emissions at the facility level, with granularity down to the emissions unit or individual stack level. Facilities are required to report if actual or potential emissions exceed a specified threshold, or if reporting is required by a facility's air permit(s). Emissions from smaller (i.e., minor) industrial sources that are not required to report are typically estimated using estimated or actual source counts and published emissions factors and/or are treated as "area sources" within the emissions inventory.

Voluntary GHG reporting programs require reporting at either the entity or project level. Entity reporting covers all emissions within corporate boundaries, which in the case of larger corporations would include multiple facilities. Corporate boundaries may be determined on the basis of equity share, financial control, or operational control, at the option of the reporter.

Under TCR's reporting requirements, subsidiaries may report if the parent company is not reporting, but if a parent company is reporting, then the report must include all subsidiaries. Reporting of direct emissions (Scope 1) and indirect emissions from purchased electricity, heat and steam (Scope 2) is required, but reporting of other indirect emissions that are a consequence of entity activities (Scope 3) is optional. Voluntary reporting protocols generally require reporting at least at the facility level of detail, but electronic reporting systems may provide for reporting at the emissions unit level.

The highest level of aggregation for WCI mandatory GHG reporting is at the facility level for most source categories, with requirements for reporting emissions details at the unit or process level. Facilities are required to report if their GHG emissions exceed the specified threshold of 10,000 metric tons of CO_2e. Only direct emissions must be reported, and only for those source categories listed in the requirements. For some source categories, reporting will be at the entity or corporate level and, for fuel suppliers, the emissions reported will include the downstream emissions that would result from complete combustion of the fuels supplied.

Source Types

Criteria pollutant emissions inventories include all sources of the pollutants within their scope; industrial, commercial, residential, and natural. However, only the emissions from industrial and large commercial sources may be reported directly to the agency by the source facilities. Voluntary GHG reporting is designed to capture the entire corporate GHG "footprint", and may include sources which emit GHGs but not criteria pollutants, such as electrical equipment that leaks SF_6, or valves in natural

gas systems that vent CH_4. The WCI mandatory GHG reporting requirements are designed to be "economy wide," with the restriction that only those sources with sufficiently accurate emissions quantification methods are to be included in the cap-and-trade program.

Emission Estimation Methodologies

Estimation of criteria air pollutant emissions can draw upon decades of research, analysis and measurement, which have generated comprehensive publications covering all significant sources. Methods are documented in such publications as the Emissions Inventory Improvement Program (EIIP) publications and the U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42), and various emissions models (e.g., TANKS, MOBILE6, etc.).[1,2,3] Dozens of methods for direct measurement of emissions have been developed and promulgated in U.S. EPA rules, such as those requiring continuous emissions monitoring systems (CEMS) for measuring SO_2, NO_x, and other related pollutants under the Acid Rain Program.[4] The accuracy required in criteria air pollutant emissions estimation depends on the data quality objectives established for the program. For example, emissions data used to determine compliance with federal, state, or local air quality regulations may differ from those required for compliance with the federal Consolidated Emissions Reporting Rule (CERR).[5]

Estimation methodologies for GHG emissions are available from a variety of source types. International organizations have worked with governments, industry organizations, and non-governmental organizations to develop GHG inventory protocols, which include emission estimation methods. These include the Intergovernmental Panel on Climate Change (IPCC) Methodology Reports and publications of the Greenhouse Gas Protocol Initiative of the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Voluntary GHG registry programs such TCR and CCAR have drawn upon the IPCC and WRI/WBCSD protocols for their emissions estimation methods. The U.S. EPA also provides some GHG emission factors and estimation tools in AP-42 and especially in their Climate Leaders voluntary emissions reduction program. Protocols for voluntary programs generally allow the reporter to choose between two or more estimation methods differing in accuracy, and in the expertise and effort required to obtain the necessary data.

For the WCI mandatory reporting program, methods from several mandatory and voluntary GHG emissions reporting programs were examined. The choice of emission estimation methods was guided by the WCI design principle that the program should assure a rigorous and consistent accounting across all sectors and throughout the region. This was considered essential for the soundness of a program that converts emissions data into financial instruments. Therefore, methods are more prescriptive than in voluntary programs, and in general, only methods with relatively high accuracy were considered. Specifics on how emissions quantification methods were determined for the WCI program are described in the following section of this paper.

Third-Party Verification

Third-party verification is not required for criteria pollutant emissions reporting. Reports are self-certified by the reporters and/or their designated representative, and at least some data quality checks are performed by the agency receiving the reports.

Third party verification is required for voluntary GHG registries (e.g., TCR, CCAR), but not for some other voluntary programs (e.g., U.S. EPA Climate Leaders). Where third-party verification is required, it is viewed as analogous to independent accounting to assure accuracy of corporate financial statements.

Third party verification is required for some mandatory GHG reporting programs (e.g., California Air Resources Board [CARB], EU ETS), but not for others (e.g., Regional Greenhouse Gas Initiative [RGGI]). The WCI emission reporting system will rely on third-party verification for all

facilities required to hold cap-and-trade allowances; whereas, agency audits and enforcement will be the means of quality assurance for sources emitting at levels under the cap-and-trade threshold or 25,000 metric tons CO_2e, and at or above the reporting threshold of 10,000 metric tons CO_2e annually.

POLICY, PROCESS, AND PROGRESS

Prior to and during the development of the WCI cap-and-trade program, including development of the reporting requirements, many policy-related issues were dealt with. These stem from the need to develop a market-based program based on the best data obtainable, to harmonize with reporting requirements already implemented in some WCI jurisdictions, and to address differences between regulatory structures and authority in the U.S. and Canada. A process was developed to tackle the wide range of issues. The range of policy issues relating specifically to reporting which the WCI has managed to date, and the process for doing so, is described below.

Policy Issues Pertaining to WCI Reporting Requirements

Deadlines for Adoption by WCI Jurisdictions

The schedule for development and implementation of the WCI reporting requirements is determined by the start of the cap-and-trade program and the need to get emissions data prior to that time. The first WCI compliance period, for which sources will need to hold allowances, is 2012 through 2015. Emissions data are needed in 2011 to inform cap setting and allowance distributions among the WCI jurisdictions. Therefore, WCI jurisdictions will need to promulgate the necessary reporting regulations in 2009, so that 2010 emissions data will be reported in 2011.

Cap-and-Threshold Versus Reporting Threshold

The level of the emissions threshold (25,000 metric tons CO_2e) for coverage by the cap was determined based on an analysis of facility emissions data estimated using the best information available from existing sources, including air quality permits, fuel use from criteria air pollutant reporting, and CO_2 emissions reported for existing programs (i.e., U.S. EPA Clean Air Markets Division, Canadian federal reporting for large sources). The level of the threshold was set to ensure that approximately 85% to 90% of anthropogenic emissions in the WCI region would be covered by the cap. The threshold for reporting was set lower (10,000 metric tons CO_2e) so that WCI would be able to detect "leakage" of GHG emitting activities to uncapped sources, and to allow detection of sources avoiding the cap by underestimating emissions.

Differences Between U.S. and Canada Programs

To achieve consistency in reporting requirements across all the WCI jurisdictions, it has been necessary to harmonize or accommodate differences between U.S. states and Canadian provinces resulting from different legal and regulatory histories at the national level. Important technical differences include the use of different systems for units of measurement (metric versus English), and differences in commonly used analysis methods. More fundamental are differences in the degree of prescriptiveness in regulations, substantive differences in terminology and key definitions, and in traditions concerning the governmental approach to enforcement of regulations. Harmonization of technical differences, such as conversion of emissions factors between different systems of measurement, can be conceptually simple but time consuming. WCI has sought to develop mutually acceptable compromises on the more fundamental issues.

U.S. EPA Mandatory Reporting Rule (MRR)

When the five original states created the WCI in early 2007, no significant new U.S. federal action to require monitoring or reductions in greenhouse gas emissions was imminent. Development of the WCI GHG reporting requirements began in early 2008. Now, in early 2009, the U.S. EPA has proposed a comprehensive, economy-wide GHG reporting rule that would cover most industrial sources, but is not specifically designed to support a cap-and-trade system. WCI is evaluating the U.S. EPA rule and comparing it to WCI reporting requirements, but final decisions on possible harmonization cannot be made until the final version of the U.S. EPA rule is promulgated in late 2009 or early 2010.

Point of Regulation for Fuel Suppliers

To achieve economy-wide coverage of the WCI cap, it is necessary to include combustion emissions from transportation, residential and commercial fuel use, and from fuel use at small industrial facilities that are below the cap threshold for facilities. These sources are too small and too numerous to participate individually in a cap-and trade system, so these emissions will be included in the system by requiring fuel distributors to hold allowances for the ultimate downstream emissions that would result from complete combustion of the fuel they distribute.[6] The precise point of regulation is yet to be determined, and may vary by fuel and by jurisdiction. Refinery racks and pipeline terminal racks are one possible point of regulation for liquid transportation fuels, but some jurisdictions will also need to account for other commercial imports of fuel. Capped industrial sources will be obtaining fuel from distributors that are also covered by the cap, and some method needs to be developed to avoid holding both of these accountable for the same emissions.

Inclusion of Biomass and Biofuels in WCI Reporting

The WCI design calls for reporting of emissions from combustion of biomass and biofuels.[6] This differs from most other GHG reporting programs and registries, which do not require reporting of biomass and biofuel CO_2 emissions. Some emissions reporting protocols describe these emissions as "carbon neutral," but they may not be truly carbon neutral if they have been derived from practices that cause a net reduction in forest and soil carbon stocks, or if substantial amounts of fossil fuel combustion were used in upstream processing. When industrial emissions reporting is one component of a complete national or regional inventory, biomass/biofuel CO_2 is not counted at the point of emission, but instead the inventory includes an estimate of net change in biomass and soil carbon stocks. There is concern that a blanket exclusion of biomass and biofuel CO_2 from the cap could be an incentive for unsustainable forest harvesting or for fossil-fuel intensive biofuels production outside the WCI region. Before the cap-and-trade program starts, WCI jurisdictions will make determinations of the carbon neutrality of various types of biomass-derived fuels.

Necessity for Enforcement and Compliance

Enforcement and compliance issues for a cap-and-trade program are different from those in the regulatory context of criteria air pollutant enforcement. Enforcement of criteria air pollutant regulations at the facility level primarily occurs to determine that permitted emission levels are not exceeded, and that required control equipment is properly operated. If control equipment is functioning properly, and emissions are below permitted levels, then the exact amount of annual emissions is of little consequence to the regulating agency. But in a GHG cap-and-trade program, every ton of emissions is converted directly to a financial obligation or benefit. Therefore, it is important that emissions be accurately measured, no matter what their level. To ensure a high level of accuracy, the WCI program design requires third-party verification of emissions from all sources covered by the cap and trade program, and the WCI reporting requirements must specify the rules for the verification process. WCI drew heavily from the verification process of TCR and the CARB rule. In future work, WCI will also establish rules for verifier accreditation.

Process for Development of WCI Reporting Requirements

The design work of the WCI has been divided among various committees, with development of the emission reporting requirements tasked to the Reporting Committee. The Reporting Committee and other committees are each chaired by a WCI Partner representative, a high-level appointee of the Governor or Premier of the Partner jurisdiction. Partner representatives meet periodically to coordinate the activities of the Committees, make significant policy decisions, and review and approve documents released to the public. Each Committee has a staff lead to coordinate the day-to-day business of the Committee, which in the case of the Reporting Committee has been almost full time effort. The Reporting Committee has approximately 20 active members who are primarily environmental agency personnel or from the environmental staff of Governors or Premiers of the Partner jurisdictions. Personnel from TCR also participate as expert advisors.

The Reporting Committee works closely with the contractor, Eastern Research Group (ERG). Assistance from ERG has been essential in providing technical expertise needed to address source category specific issues regarding manufacturing processes and measurement and monitoring of emissions. The contractor also keeps track of Committee decisions and prepares draft documents for Committee review and approval.

Much of the work of the Committee is conducted in conference call discussions. We have found that a dedicated conference line, available for use by the Committee at any time, is essential. In the early stages of the Committee's work, conference calls were held biweekly, but as work on the reporting requirements intensified and became more detailed, calls increased to twice a week. The conference line is now in use by subgroups formed to deal with different topic areas, and for ad hoc planning calls. Another valuable tool has been web collaboration software, to provide group access to documents, manage calendars for calls, and other collaborative functions.

At appropriate stages of development of the WCI reporting requirements, opportunities for stakeholder involvement have been provided by means of review and comment on written documents, and by conference calls. The WCI web site provides a means for submitting written comments, and all comments thus submitted are posted for public review.

Progress Toward Finalizing the WCI Reporting Requirements

The initial document released by the Reporting Committee in October 2007 for public comment focused on broad policy questions about the design of the requirements, such as whether third-party verification should be required and the degree of uniformity and consistency to be achieved among the WCI jurisdictions' reporting requirements. In later releases, recommendations for the emissions reporting system were more numerous and more detailed.

The most recent document ("Background Document and Progress Report for Essential Requirements of Mandatory Reporting for the Western Climate Initiative, Third Draft", released January 6, 2009) consists of two parts. The background document provides a narrative, plain-language overview of the requirements and explanations of the decisions made, and summarizes and responds to stakeholder comments on the previous draft. In the second part, the Essential Requirements are set forth in a detailed formal style similar that used in regulations. The precise and careful wording necessitated by this format helped the Reporting Committee identify and resolve issues that may not have been evident if a strictly narrative format had been used. In the Background Document and in comments inserted in the Essential Requirements, the Committee identified remaining decisions and ongoing work, and invited stakeholder feedback on specific questions.

The next version of the reporting essential requirements will be a "final draft" and will include updates to sections previously released, in response to internal and stakeholder comments, and new

sections for source categories not previously released. The final set of essential requirements is expected in June 2009.

ESSENTIAL REQUIREMENTS OF WCI MANDATORY REPORTING

In September 2008, the WCI Partners developed final recommendations for the design of an emissions cap-and-trade program to help achieve 15% GHG emission reduction goal.[6] A key design recommendation is to develop "essential requirements" for a model WCI reporting rule, incorporating consideration for jurisdictions that already have reporting rules adopted or in process. This recommendation takes into account the fact that rules and conventions governing rule language and construction differ between the WCI jurisdictions, making it difficult to write actual rule language that would have to be adopted verbatim by each jurisdiction. Therefore, the recommendation is to create a document setting forth specific requirements that will be implemented by jurisdictional rules possibly differing in language and/or construction, but having the same substantive content and effect. Furthermore, WCI jurisdictions may opt to include reporting requirements beyond the essential requirements.

Table 1 summarizes certain elements of GHG reporting programs currently implemented within WCI jurisdictions and throughout the world. These specific programs were selected in order to understand requirements of GHG reporting programs already in place and that relate to the WCI jurisdictions or have elements (e.g., source categories, thresholds, etc.) similar to those being developed for WCI.

(It is important to note that WCI was formed and all of its work to-date has been conducted in the absence of any federal GHG reporting requirements. On March 10, 2009, as this paper was being written, the U.S. Environmental Protection Agency (U.S. EPA) issued a pre-publication version of its proposed federal Mandatory Reporting Rule (MRR). The authors of this paper acknowledge the potential significant impact that the MRR requirements may have upon the facilities subject to the WCI reporting requirements, but due to timing, we do not attempt to address this situation in this paper.)

Based on the design recommendations, and following conventions of regulatory development, 11 key essential requirements for WCI mandatory reporting were identified and prescribed for distribution to the WCI stakeholders.[7] These are discussed below.

Applicability

Applicability describes the facilities, electricity importers, and fuel suppliers that must report their emissions in order to support the cap-and-trade program. It contains reporting thresholds stated as metric tons of CO_2e per year. Applicability also addresses the point of regulation (POR) as it pertains to reporting by each included source category.

The POR, and therefore the reporting requirements, vary by source category. Many sources, including electrical generation within WCI Partner jurisdictions and most industrial source categories are regulated at, and will report at, the facility level. Electrical power imported into WCI Partner jurisdictions is regulated at the first entity that receives the imported power and delivers electricity for consumption within a WCI Partner jurisdiction, over which the WCI partner jurisdiction has regulatory authority. Fuel combustion emissions from residential sources, from commercial and industrial sources with emissions below the reporting threshold, and from transportation sources are regulated upstream of the point of combustion, where the fuels enter commerce in the WCI Partner jurisdictions. This will generally be at a distributor, though the precise point may vary by jurisdiction.

General GHG Reporting Requirements and Schedule

The general reporting requirements describe the responsibilities and requirements that are common to all reporting facilities, electricity importers, and fuel suppliers. For example, general requirements pertain to general data collection and management responsibilities, the schedule for submitting reports, where reports are to be submitted, a provision allowing the use of simplified quantification methods for de minimis sources and gases, requirements to maintain program plans, the process for making report revisions, and criteria for the accuracy of fuel use measurements.

The cap-and-trade program will launch January 1, 2012; that is the date on which the first 3-year compliance period begins for facilities and other entities with emissions exceeding the threshold of 25,000 metric tons of CO_2e per year. Mandatory measurement and monitoring for the six included GHG gas emissions will commence January 1, 2010 for all entities and facilities subject to reporting. Reporting of 2010 emissions will be due April 1, 2011. During 2009, WCI Partner jurisdictions will need to incorporate these essential requirements into their rules, which in some cases will require modifications to their existing GHG reporting rules.

For reporting years 2010 through 2011, reporters that are subject to verification requirements must complete their verification process, including submittal of a verification statement, by September 1. This deadline provides five months after reports are submitted to allow reporters and verifiers to become accustomed to the process during the early years of mandatory reporting. However, no later than reporting year 2014, verification will need to be completed earlier than September 1. The WCI program design calls for facilities, electricity importers and fuel suppliers that are subject to the cap-and-trade program to surrender allowances by July 1, beginning in 2015, the year after the first 3-year compliance period ends. Deadlines for the 2012 and subsequent reporting years will be determined later as decisions on market functioning are made by WCI.

The Climate Registry will manage WCI's regional database using a modified version of TCR's Climate Registry Information System (CRIS) to support mandatory reporting (CRIS Common Framework). Some WCI Partner jurisdictions may also choose to use the CRIS Common Framework to meet their individual jurisdictional database needs for emission collection, verification, and compliance. Other states and provinces will collect data through their independent reporting systems and databases and then transfer the data to WCI's regional database. Each WCI Partner jurisdiction will specify the format of the emissions report, but these formats will be compatible with eventual consolidation in TCR's CRIS Common Framework.

Contents of GHG Emissions Report

This element describes the general information that must be included in every emissions report, regardless of source category. To improve reporting consistency and facilitate data management throughout the WCI region, the following information is required for each report submitted by a facility, electricity importer, and fuel supplier. This includes basic information that is in addition to data and information identified in the source category-specific requirements contained in the reporting rule.

- Name of facility or other reporting entity, including identification number, physical address, mailing address and NAICS code;
- Reporting year;
- Date of report submittal;
- Total emissions aggregated from all applicable sources expressed in metric tons of CO_2e, excluding CO_2 that is captured and CO_2 emissions from the combustion of biomass fuels, which are reported separately;
- Total emissions of CO_2e from the combustion of biomass and biomass-derived fuels;

- Total annual mass of CO_2 captured for on-site use, on-site storage, or transfer off site, in metric tons;
- For applicable fuel supplier categories (transportation fuels and residential, commercial and industrial fuels), total estimated end-user combustion CO_2e emissions aggregated from all specified fuel;
- Emissions from each applicable source category or fuel supplier category in subparts WCI.20 through WCI.XX, expressed in metric tons per year of CO_2, CH_4, N_2O, HFC, PFC, and SF_6. CO_2 emissions from the combustion of biomass and biomass-derived fuels shall be reported separately;
- For electricity importers, information required in the Essential Requirements section for this source category;
- Emissions and other data for individual units, processes, activities, and operations as specified for each source category covered in the Essential Requirements;
- Emissions from each designated de minimis source or pollutant for which an alternative emission calculation method is used;
- Name and contact information including e-mail address and telephone number of the person primarily responsible for preparing and submitting the emissions report; and
- A signed and dated statement provided by the owner or operator, or their designated representative, certifying that the report has been prepared in accordance with this rule, and that, subject to verification, the statements and information contained in the emissions data report are to the best of their knowledge, true, accurate, and complete.

Any state or province may request additional information beyond that specified above.

Document Retention and Reporting Requirements

Facilities and other reporting entities must establish and maintain procedures for document retention and recordkeeping. They must retain all documents regarding the design, development and maintenance of the emissions inventory in paper, electronic, or other usable format for a period of not less than seven years following submission of each emissions data report. This is longer than some other programs require because of the three-year length of compliance periods for the WCI cap-and-trade program. They must be able to produce all documents and data they are required to retain upon request within 10 working days. In general, the retained documents and data shall be sufficient to allow for the verification of each emissions data report.

The following information must be retained in addition to information submitted as part of the emissions data report, for at least seven years.

- A list of all GHG sources (i.e., units, operations, processes, and activities) included in the emission estimates;
- All data used to calculate emissions for each source and GHG, categorized by process and fuel or material type;
- Documentation of the process for collecting emissions data;
- Any GHG emissions calculations and methods used;
- All emission factors used for emission estimates, including documentation for any factors not provided in the rule;
- All input data used for emission estimates;
- Documentation of biomass fractions for specific fuels;
- All other data submitted under this rule, including the GHG emissions report;
- All computations made to gap-fill missing data;

- Names and documentation of key facility personnel involved in emissions calculating and reporting;
- Any other information that is required for the verification of the GHG emissions report;
- A log to be prepared for each reporting year, beginning January 1, documenting all procedural changes made in GHG accounting methods and changes to instrumentation for GHG emissions estimation; and
- A copy of the GHG Inventory Management Plan (although this may be removed as a WCI reporting requirement).

For quantification methodologies based on direct measurement of emissions, the following information must be retained for at least seven years after the submission of the emissions data report:

- List of all emission points monitored;
- Collected monitoring data;
- Quality assurance and quality control information collected under the GHG Inventory Management Plan required by the Essential Requirements;
- A detailed technical description of the continuous measurement system, including documentation of any findings and approvals by federal, state, or local agencies;
- Raw and aggregated data from the continuous measurement system;
- A log book showing all system down-times, calibrations, servicing, and maintenance of the continuous measurement system; and
- Documentation of any changes in the continuous measurement system over time.

The essential requirements for quantification methods may also include some source category-specific record retention requirements.

Confidentiality

The challenge in dealing with public access to reported data is to strike an appropriate balance between revealing information that is important to the public interest while protecting information that if disclosed would harm the reporting entity. In general, air emissions data that are collected by public agencies are not considered confidential – in fact, transparent emissions data are essential to the successful operation of a cap-and-trade program. Nevertheless, in some cases, the operational and technical information that is used to calculate emissions is sensitive and could reveal trade secrets or other facts that are damaging to the reporting entity's competitive position.

While WCI design recommendations do not directly address the balance between disclosure and confidentiality, they do prescribe the disclosure of emissions information to ensure transparency, maintain public confidence, and allow the market to function properly. The WCI calls for making public in a timely manner certain data from the emissions reports, allowances, and offsets that are used for compliance. Moreover, the design recommendations call for each jurisdiction to make its data available for other jurisdiction's review and consideration for possible expansion of the cap-and-trade program. The WCI essential requirements do not call for any changes to existing Partner jurisdiction laws and regulations pertaining to confidential business information.

Compliance and Enforcement

Mandatory reporting programs are weakened if a facility, electricity importer, or fuel supplier fails to submit a report by the required deadline, submits incomplete information, fails to address missing or incorrect data, does not retain records as required by the rule, or intentionally submits false or misleading information. Compliance, for purposes of this discussion means the degree to which

facilities and other reporting entities submit timely, complete, and accurate reports. Enforcement refers to the action taken in response to a violation or non-compliance situation.

A clear definition of what actions or inactions are considered a violation not only serves notice to those subject to a regulatory requirement but it is typically considered a prerequisite to taking any enforcement action. The WCI Partners' consideration of compliance and enforcement issues focused on facilities subject to cap-and-trade obligations and did not specifically address reporting compliance and enforcement.

Designated Representative

To ensure accountability and facilitate communication, a designated individual must be responsible for certifying and submitting GHG emissions reports. Because of the legal implications, the WCI considers detailed and consistent requirements across WCI Partner jurisdictions to be important.

The designated representative of the facility, electricity importer, or fuel supplier is required to be identified in writing by an agreement that is signed by the designated representative and owners or operators of the facility or other reporting entity. The designated representative must be an individual that has responsibility for the overall operation of the facility or activity being reported, a position of equivalent responsibility, or an individual having overall responsibility for environmental matters for the company.

The designated representative may be changed at any time but all prior representations, actions, inactions, and submissions by the previous designated representative are binding on the new designated representative and the facility owners and operators. In the event of any change in ownership of the facility, electricity importer, or fuel supplier, the new owner or operator remains bound by the representations, actions, inactions, and submissions of the designated representative until the designated representative is changed.

Verification Requirements

Comprehensive mandatory and accurate reporting is especially important to a cap-and-trade program because of its focus on actual emissions performance and emission allowance trading. The WCI Partner jurisdictions have considered the advantages and disadvantages of third-party verification and jurisdictional audit and quality assurance. The WCI Partner jurisdictions note that in a cap-and-trade program, every metric ton of emissions translates into a financial obligation or benefit, whereas in existing air pollutant reporting and compliance, errors in emissions data can be inconsequential if they do not affect whether a compliance limit has been exceeded. For those facilities and entities with cap-and-trade compliance obligations (i.e., required to hold allowances), there are no inconsequential emissions totals. A high degree of accuracy and reliability for this emissions data is needed for market transparency and credibility, as well as for potential linkage to other emissions trading programs.

The goals of the WCI verification program are to root the program in international standards and best practices, to ensure high quality data, and to promote consistency across similar mandatory greenhouse gas reporting and cap-and-trade programs. The specific requirements for WCI reporting verification are mostly under development. They rely heavily on international standards (ISO 14064-3 and ISO 14065) and other verification programs, such as the TCR and CCAR.

Definitions

The Essential Requirements for reporting provide definitions that are necessary to understanding specific reporting requirements and generally avoid definitions that are not essential. For example, terms that are used in their common English context (e.g., fence line, unit) or that explain acronyms or

chemical formulae are not specifically defined. Definitions are listed in the Essential Requirements and are not repeated here. Additional definitions are under development based on the Canadian regulations from "Section 71 of the Canadian Environmental Protection Act (CEPA) 1999"and the CARB definitions from "Title 17, Subchapter 10, Article 2, Section 95102 of the California Code of Regulations."

Pollutants and Global Warming Potentials

Reporting entities must use the GWP factors when converting emissions of greenhouse gases to metric tons of carbon dioxide equivalent values (CO_2e) for purposes of estimating emissions under the rule. These factors are the same as those used regionally and internationally and are based on the IPCC Second Assessment Report, 1995, updated to add new greenhouse gases identified in the IPCC Third Assessment Report, 2001. The table is the same as contained in the TCR General Reporting Protocol, Version 1.1, May 2008. Hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are families of pollutants, and individual compounds within the families have different GWP factors.

Emissions Quantification and Monitoring

The first 10 essential requirements were dealt with in the "General Provisions" of WCI's reporting requirements. The last essential requirement (emissions quantification and monitoring) is being determined on a source category basis. Table 2 shows the listing of source categories included in the scope of the WCI cap-and-trade program. These source categories were first identified in the WCI design recommendations; however, the design states that adequate quantification methods are a prerequisite to including any source of emissions in the cap-and-trade program. Therefore, a key objective of the WCI reporting requirements are to determine adequate quantification methods by source category. Any source category with methods deemed inadequate for inclusion in the cap-and-trade program will not be included until such time that adequate method(s) are determined or developed. This is a key point that is discussed in detail later in this paper.

In the context of this section, the term "monitoring" includes the methods required for sampling, analysis, and measurement of input data needed to quantify emissions. For example, fuel consumption sampling frequency, and fuel heat content sampling and analysis methods are both considered "monitoring" requirements.

The process used to identify adequate emission quantification and monitoring methods for the WCI mandatory reporting program is discussed next, and the required methods are summarized.

GREENHOUSE GAS EMISSION QUANTIFICATION AND MONITORING METHODS

Several types of GHG quantification methods were compiled, analyzed, and selected for the WCI reporting program:

- Direct measurement of CO_2 emissions (e.g., CEMS) or fuel flow (i.e., used in combination with carbon content of fuel combusted to estimate emissions);
- Parametric monitoring (e.g., measuring something other than fuel or gas, such as measuring a catalytic feed rate), and
- Mass balance (e.g., using measured carbon content of incoming coal and discarded ash in conjunction with mass flow measurements to determine the carbon emitted as CO_2).

Issues concerning the relative accuracy of these types of methods and how they were dealt with by the WCI are discussed below, along with the overall approach used to compile, analyze, and select the methods including in the WCI reporting requirements. Also, a case study of the pulp and paper industry illustrates several of the technical and policy challenges that were addressed by the WCI.

Finally, we summarize some of the on-going challenging that are continuing to be addressed by the WCI as it finalizes the reporting requirements for the cap-and-trade program.

Assessing Adequacy of Quantification Methods

The uncertainty in the GHG emissions reported to WCI is determined by the product of the uncertainties of the various components or methods used to estimate the emissions (e.g., direct measurements of flue gas; parametric measurements of fuel flow, feed water flow and steam flow; equipment manufacturer data; etc.). Accuracy is the inverse of uncertainty; that is, a high level of accuracy is the same as a low level of uncertainty. The quantification methods required for GHG emissions reporting under the WCI cap-and-trade program should have a high level of accuracy to ensure that all emissions reported across all source categories are equal, and that each ton reported is, in fact, a ton.

Relative Accuracy of Quantification Method Types

Direct measurement of CO_2 emissions, such as data collection with a CEMS maintained to specifications, can provide a high level of measurement accuracy. On the other hand, parametric monitoring, the monitoring of process parameters as a surrogate for directly measuring emissions, would generally provide less accuracy as compared to CEMS, although often sufficient to support cap-and-trade programs. For example, pipeline quality natural gas has a relative consistent carbon composition, so measuring the flow of natural gas to a combustor is a good predictor of the CO_2 emissions from the combustor. However, the carbon content of coal, refinery gas, or field gas can be highly variable (i.e., greater than 10%) making fuel flow an inaccurate CO_2 emissions predictor for these fuels without taking special care. Other examples of parametric monitoring include measuring process feed rates, production rates, or reagent consumption rates.

A material balance approach to estimating coal combustion emissions can provide greater accuracy than parametric monitoring for these sources. In a material balance method, the carbon content of the incoming coal and of the discarded ash are measured on a frequent basis and used in conjunction with mass flow measurements to determine the carbon emitted as CO_2. Also, the accuracy of emission quantification and monitoring methods can vary depending upon the GHG being measured or estimated. For example, continuous fuel flow measurements can be fairly accurate for determining CO_2 emissions, but not at all accurate for determining CH_4 or N_2O emissions because these depend on combustion conditions.

Table 3 provides a qualitative comparison of the different types of quantification methods and their relative levels of accuracy.

Relative Accuracy of Source-Specific Methods

The relative accuracy of existing GHG quantification and monitoring methods is being evaluated for the WCI program on a source category-specific basis, especially for the source categories (combustion and noncombustion) that are candidates for inclusion in the WCI cap-and-trade program. Accuracy of annual emissions will be affected by the required frequency of measurement and the variability of the parameter(s) to be measured. Several metrics are being used to determine if source-specific methods support accurate reporting of GHG emissions, including:

1) Relative accuracy compared to CEMS measurements
2) Whether or not other cap-and-trade programs (e.g., European Union) require, recommend, or allow use of the method for a particular source category.

Based on the preliminary information on existing methods collected and examined to date, non-combustion emissions from several source categories have been judged to have inadequate quantification methods for inclusion in the WCI cap-and-trade program at this time. It should be noted that facilities in these source categories could be subject to the program if they had sufficient combustion emissions to exceed cap-and-trade thresholds.

For now, this assessment is qualitative, and based on engineering judgment, in order to expedite the identification of source categories for which sufficiently accurate methods are currently lacking. A more detailed assessment of methods for other source categories will be necessary in order to select specific methods, when more than one method exists for estimating emissions. In addition to this qualitative assessment, the fact that some source categories are not included in other cap-and-trade programs, such as the EU ETS, factor into the recommendation to not require allowance obligations for these source categories in the WCI cap-and-trade program. For example, the following emission sources do not appear to have quantification and monitoring methods accurate enough to support inclusion in a cap-and-trade program:

- Landfills – The generation of CH_4 in landfills is based on several site-specific factors, including waste composition, moisture content, temperature, availability of nutrients, waste density, and waste particle size. Historical estimation methods, such as the method published in AP-42, rely on a "first order decay" equation that includes several parameters with high uncertainty, such as the methane generation potential, which can vary by as much as ±50% from the default values provided in the methods. WCI considers this method to be highly uncertain, especially as compared to measurement of combustion emissions by CEMS. It should be noted that the Solid Waste Industry for Climate Solutions (SWICS) has proposed to replace default values with new values for landfill gas collection system efficiencies and methane oxidation in cover soils, and use new carbon storage factors for carbon sequestration.[8]
- Municipal and Industrial Wastewater Treatment Plants – The generation of CH_4 and N_2O in large open lagoons is very difficult to measure, so the emissions are normally estimated using imprecise models and emission factors. The models attempt to predict the methane and nitrous oxide byproducts from microbial processes that are highly influenced by unknown factors in the lagoons, including temperature, waste digestibility, trace nutrient levels, oxygen and nitrogen levels, and microbial species. It should be noted that WCI reporting requirements currently include methods for estimating CH_4 from wastewater treatment in some industries (i.e., refineries and pulp and paper) which is consistent with requirements under the pending federal MRR for GHGs. Final decisions on whether to include these emissions in the cap are pending.

These findings by WCI may be updated in the future based on a continuing analysis of accuracy of existing quantification and monitoring methods.

Approach to Identify Adequate Quantification Methods for WCI GHG Reporting

The first step in the process to identifying adequate methods for the WCI program was to compile, summarize, and review all existing relevant quantification methods for source categories included in the WCI reporting scope. The project team reviewed methods from these agencies and organizations:

- CARB
- IPCC
- TCR
- CCAR

- EU ETS
- RGGI
- Various industry association protocols

An early attempt was made to summarize each relevant program and method according to the following topics by source category:

- Voluntary or mandatory
- Fuel(s) covered
- Coverage (GHGs reported)
- Thresholds
- Source types covered
- Protocols used
- Emissions sources specifically excluded (e.g., units not measuring with CEMS)
- Monitoring or calculation method(s)
  - Method description
  - Relative accuracy (high, medium, low)
  - Cost (i.e., installation and operational)
  - Compatibility (e.g., level of expertise of potential facility staff as compared to level of expertise needed to operate measurement equipment)

It became apparent during this process that certain programs could provide a logical starting point for WCI's required quantification methods. For example, the WCI decided to use the CARB regulation developed under Assembly Bill 32 (AB32), the Global Warming Solutions Act of 2006 to draft requirements for the WCI source categories covered by the CARB rule (i.e., EGUs, cogeneration, refineries and refinery fuel gas, and general stationary combustion).[9] In some instances, the CARB rule requirements were changed to increase the specificity of the method and achieve a higher accuracy in the results. For example, the CARB rule allows several methods for estimating emissions for general stationary combustion sources, while the WCI requirements are more prescriptive. Also, due to limited available data and resources, the project team could not completely assess the cost and compatibility of each quantification method. At this point, the approach was adjusted to focus on the methods with the highest level of accuracy for each source category. All methods were summarized and then vetted by the WCI Reporting Committee, resulting a selection of a specific method or several methods which were presented to WCI stakeholders for comment. Based on stakeholder comments received to date, some methods are being changed and will be finalized in the near future.

During this process, several technical and policy issues surfaced and were dealt with on a case-by-case basis. For example, the WCI design requires that biomass and biofuel emissions be reported even though these emissions will not be subject to the cap. However, many GHG quantification methods do not include estimation of biomass, based on the assumed "carbon neutrality" of these fuels (i.e., the assertion that the emissions from these sources, such as combustion of wood waste, are offset by the carbon uptake of the trees planted to replace the trees harvested and whose waste is combusted). Other issues addressed included the need to word the requirements in such a way as they can be adopted in both the U.S. and Canada, where certain key terms may be defined quite differently or the jurisdiction's authority to implement certain aspects of the requirements are different.

Below is a case study of the pulp and paper industry, which illustrates how several of these challenges are being met in the process of establishing quantification method requirements for WCI.

Case Study: Pulp and Paper Industry

As for all other WCI quantification methods for source categories, we began development of a pulp and paper industry quantification method by searching the standard sources for existing GHG protocols which had already been developed, peer reviewed, and verified by implementation. These sources included CCAR, WRI, IPCC, TCR, U.S. EPA Climate Leaders, and others. Although none of these sources had developed a pulp and paper GHG protocol, they pointed to a study by the Climate Change Workgroup of the International Council of Forest and Paper Associations (ICFPA) as the definitive source of GHG emission estimation methods for pulp and paper mills.[10] The ICFPA referenced the following emissions sources for GHG emissions from pulp and paper mills, which are illustrated in Figure 1:

- CO_2 emissions from stationary fossil fuel combustion;
- CH_4 and N_2O emissions from fossil fuel-fired units, recovery furnaces, biomass-fired boilers, and lime kilns;
- CO_2 emissions from make-up calcium carbonate ($CaCO_3$) or sodium carbonate (Na_2CO_3) used in the pulp mill;
- CO_2, CH_4, and N_2O emissions from transportation and mobile sources (e.g., company-owned harvesting equipment and company-owned truck fleets);
- CH_4 emissions attributable to decomposition of mill wastes in landfills and anaerobic waste treatment operations;
- Fossil fuel-derived CO_2 exported to satellite precipitated calcium carbonate (PCC) plants
- Imports of CO_2 (e.g., for pH neutralization);
- GHG emissions associated with power and steam that is imported and consumed; and
- GHG emissions attributable to power and steam exports.

These sources can be organized into the following groups:

1) Stationary fuel combustion in boilers, kilns, and incinerators;
2) Transportation and mobile sources;
3) CO_2 imports and exports;
4) Electric power and steam imports and exports;
5) Anaerobic decomposition of wastewater and landfill wastes; and
6) Process emissions from kilns and recovery furnaces

The first four sources are covered under other WCI methods for generic or cross-cutting activities that are shared by many industries, and for which methods had already developed. The fifth source, anaerobic decomposition, is not being covered currently under the WCI because anaerobic production of N_2O and CH_4 in open water impoundments and in landfills is very difficult to accurately measure or model. As such, WCI feels that these sources should not be included in a cap-and-trade program until this limitation is resolved. The sixth source is process emissions that are unique to the pulp and paper industry and which require unique GHG estimation methods. Thus, identifying appropriate GHG quantification methods for the process emissions was the focus of this task.

The process emissions from kilns and recovery furnaces are composed of CO_2 resulting from the oxidation of organic chemicals removed from wood fibers in the pulping process. These organic chemicals are dissolved in a process stream called black liquor. In subsequent processing, these organic chemicals are partially removed from the black liquor by oxidation to CO_2 in the recovery furnace. The remaining portion of the organic chemicals in the black liquor leave the recovery furnace as a carbonate salt. This carbonate salt is calcined to CO_2 in the lime kiln.

Although the recovery furnace uses small amounts of fossil fuel during startup, the majority of its CO_2 emissions come from the oxidation of the organic chemicals in the black liquor. The CO_2 emissions from the lime kiln are composed of significant quantities of CO_2 from both the fossil fuels used to fire the kiln and the process CO_2 released from the calcination of the carbonate salts in the kiln. There is a third source of CO_2 emissions from the lime kiln: the makeup carbonate salts added to replace carbonate salts lost elsewhere in the process.

Therefore, the organic carbon in the black liquor is released partially in the recovery furnace and partially in the kiln. However, there are no simple emission factors for estimating the CO_2 emissions from these two process sources. The IPCC reports that the carbon content of black liquor can easily vary from 22 to 30 kilograms per 10^9 joules (kg/GJ) at the 95% confidence level. In addition, the portion of this carbon that is released in each piece of equipment can vary with their respective operating conditions. In an attempt to provide accurate emission estimates for both pieces of equipment, we first proposed to the project team that the WCI protocols require material balances around each unit.

Upon review of additional references suggested by the project review team, it was decided to combine these two pieces of equipment and to report just their combined process CO_2 emissions. Thus, the process CO_2 emissions from the black liquor loop are a summation of the carbon in the black liquor and the carbon in the make-up carbonate salts.

The pulp and paper mills will be required to test the total carbon content in their black liquor and report that as their total biogenic process CO_2 emissions from the black liquor loop. The mills will be required to use the WCI protocols for determining CO_2 emissions from stationary fuels combustion in the black liquor loop. These stationary combustion protocols also provide instructions for determining the fossil and biogenic portions of the fuel combustion CO_2 based on the split between the fossil and biogenic fuels used in the equipment. The mills will be given the option of using either a factor or carbonate purchase records for estimating the fossil CO_2 emissions from the calcination of make-up carbonate salts.

Summary of WCI GHG Measurement Methods

Table 4 summarizes the WCI GHG emission quantification methods for selected source categories. The table provides a way to quickly ascertain specific quantification method inputs, and could be used by other regional GHG groups to expedite development of their reporting programs. Quantification methods for other source categories are still under evaluation by WCI and its stakeholders.

On-Going Work and Remaining Challenges

Work is still on-going to complete the GHG quantification methods for the WCI reporting requirements. In this process the WCI and Reporting Committee continue to address certain policy-related and technical challenges. These include the following:

- Accuracy of methods. While the quantification methods required by WCI tend to be relatively rigorous so as to achieve the highest level of accuracy available from existing methods, some methods for certain source categories are deemed not adequate at this time (e.g., landfills and municipal wastewater treatment methods). Relatively accuracy must continue to be evaluated on a case-by-case basis in order to maximize the number of source categories covered by specific quantification methods while maintaining a high level of accuracy in reporting of emissions. The WCI recognizes the need for more accurate methods (e.g., emission factors for CH_4 and N_2O emissions) for some source categories (e.g., landfills, municipal wastewater treatment), and continues to look for funding sources and opportunities to partner with industry to develop these methods.

- Lack of monitoring methods. The WCI reporting requirements, including the quantification methods, rely entirely on existing methods contained in relevant protocols and programs (e.g., IPCC, TCR, etc.). However, many of these existing programs, while prescriptive in their methods for estimating emissions, are not prescriptive in the methods to use for obtaining the data needed to estimate emissions (e.g., quantity of fuel used, etc.). Certain measurement methods developed by ASTM are applicable, and have been prescribed, but others are not defined by ASTM and need to be researched. In some cases, WCI is relying on input from stakeholders to provide information that can be examined for applicability within the cap-and-trade reporting program.
- Harmonization with Federal MRR Requirements. A particular challenge for WCI is determining how and to what extent to harmonize with the U.S. EPA's recently proposed MRR requirements. As the WCI moves forward with its reporting requirements, to be finalized in June 2009, the U.S. EPA will be in the midst of taking public comment on its proposed rule. The WCI sees this as an opportunity to influence the outcome of the U.S. EPA rule in order to have a federal reporting program greatly similar to the WCI reporting program. Still, there is no assurance to what degree these two programs will have similar requirements when finalized. WCI is currently assessing the specific requirements in the MRR and identifying areas where it may make recommendations for changes in order to harmonize the two programs.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the hard work and diligence of the entire WCI Reporting Committee – these cannot be overemphasized. Also we would like to thank Mr. Bill Sylte of the Sierra Nevada Air Quality Group, for his contributions to the reporting background document and progress report on which major portions of this paper were based.

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KEYWORDS

Greenhouse gases
Cap-and-trade
Western Climate Initiative (WCI)
Mandatory reporting

Table 1. Scope of existing and imminent general reporting requirements for WCI jurisdictions and related programs.

Reporting Program/ Jurisdiction	Voluntary, Mandatory, Cap-and-Trade	Coverage (GHGs)	Sources/Sectors Included	Threshold(s) for Reporting	CO_2 from Biomass Provisions	GWPs	De Minimis Provisions
U.S. EPA (40 CFR Part 98)	Mandatory (currently proposed)	CO_2, CH_4, N_2O, SF_6, HFCs, PFCs, and other fluorinated GHGs (e.g., NF_2, HFEs)	Combustion, process, and fugitive emissions from a wide range of sources based on thresholds	25,000 metric tons CO_2e per year for facilities in most source categories, with capacity thresholds and/or no thresholds for selected source categories	Required, reported separately from other emissions. Not included in threshold determination.	IPCC Second Assessment Report (1995): • CO_2: 1 • CH_4: 21 • N_2O: 310 • SF_6: 23,900 HFCs and PFCs vary by gas	None
Canada (EC) (Section 71)	Mandatory, C&T (under development)	CO_2, CH_4, N_2O, SF_6, HFCs, PFCs	Emissions sources are sector dependent	Section 71 – thresholds are sector dependent *Phase 1, 100kt CO_2e	Required, reported separately from other emissions	IPCC Second Assessment Report (1995)	None
Québec	Mandatory	CO_2, CH_4, N_2O, SF_6, HFCs, PFCs	Enterprise, facility, or establishment emitting above threshold provided by an annual public notice related to the Section 46 of Canadian Environmental Protection Act (1999). Sources include stationary fuel combustion, industrial process, venting and flaring, other fugitive emissions, on-site transportation and waste and wastewater	Any enterprise, facility, or establishment emitting ≥100,000 metric tons of CO_2e	Required	IPCC Second Assessment Report (1995)	None
California	Mandatory	CO_2, CH_4, N_2O, SF_6 , HFCs and PFCs as specified by sector	Stationary combustion, process and fugitive sources from facilities that are operational as of Jan 1st, 2008, including: • Cement plants • Petroleum refineries • Hydrogen plants, • Electricity generating facilities • Electricity retail providers • Electricity marketers • Cogeneration facilities • Other facilities emitting ≥25,000 metric tons CO_2 from general stationary combustion (GSC) Not required, but may voluntarily report separately facility CO_2, CH_4, N_2O emissions from mobile combustion.	• ≥25,000 metric tons CO_2 from stationary combustion sources at petroleum refineries and hydrogen plants, and GSC sources • ≥2,500 metric tons CO_2 from stationary combustion sources at cogeneration or electricity generation facilities	Calculate and report separately all direct combustion emissions	IPCC Second Assessment Report (1995)	No more than 3% of facility's total CO_2e (not to exceed CO_2e of 20,000 metric tons)

Table 1. Continued.

Reporting Program/ Jurisdiction	Voluntary, Mandatory, Cap-and-Trade	Coverage (GHGs)	Sources/Sectors Included	Threshold(s) for Reporting	CO_2 from Biomass Provisions	GWPs	De Minimis Provisions
New Mexico	Mandatory	• First year: direct emissions of CO_2 • Second year: Direct emissions of CO_2 and CH_4. For source types specified in Part 87 • Third and subsequent years: all GHGs. For source types specified in Part 87, include indirect (as above).	Part 87 specifies Electrical generators, Petroleum refining and Cement manufacturing. Part 73 gives the state authority to require GHG emissions reporting from all sources with criteria emissions greater than 10 tons/year. Currently requiring all Title V operating permit sources to include GHG direct emissions as specified above. All oil and gas production and processing sources must report GHG emissions for 2010.	For Part 87, electrical generating units equal to or greater than 25 MW. For Part 73, authority to require GHG reporting upon request for sources emitting greater than 10 tons of a criteria pollutant or VOC.	Fuel use and fuel type must be reported; biomass is not excluded from reporting.	As specified in reporting procedures, which are published outside of rulemaking and must be as consistent as feasible with other GHG programs.	Reporting procedures (see above) may specify simplified or limited reporting requirements for up to 5% of facility emissions.
Oregon	Mandatory	Direct emissions of CO_2, CH_4, N_2O ,HFCs, PFCs, and SF_6	• Sources required to obtain a Title V Operating permit, including those under OAR Chapter 340, Division 218 • Sources required to obtain an air contaminate discharge permit, including those under OAR Chapter 340, Division 216, referred by activities and sources, and by SIC codes (pg 3-4) • Any source listed below that does not have an air permit and emits ≥2500 tons of CO_2e: - Solid waste disposal facilities - WWT facilities - EGUs - Electricity and natural gas transmission and distribution systems		Not specified. (Note: although not specified in the rules, Oregon would follow The Climate Registry General Reporting Protocol (GRP) for reporting biomass emissions.)	IPCC Second Assessment Report (1995)	

Table 1. Continued.

Reporting Program/ Jurisdiction	Voluntary, Mandatory, Cap-and-Trade	Coverage (GHGs)	Sources/Sectors Included	Threshold(s) for Reporting	CO_2 from Biomass Provisions	GWPs	De Minimis Provisions
Washington	Mandatory (under development)	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	Stationary sources and mobile source fleets	Any source that emits ≥10,000 metric tons The owner/ operator of an on-road motor vehicle fleet that emits ≥ 2,500 metric tons	Required, reported separately (not considered in totals)	IPCC Second Assessment Report (1995)	To be included in the department rules
The Climate Registry (TCR)	Voluntary	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	All Sectors Welcome: Scope 1: Stationary combustion Mobile combustion Physical and chemical processes (12 categories) fugitive sources Scopes 2 and 3 (voluntary): Indirect emissions	None	Required, CO_2 reported separately.	IPCC Second Assessment Report (1995)	No concept of de minimis. Simplified techniques may be used for up to 5% of emissions
Regional Greenhouse Gas Initiative (RGGI)	Mandatory, C&T	CO_2	Fossil fuel fired EGUs	Fossil-fuel fired EGUs with nameplate capacity ≥ 25 MW; low emitters excluded	CO_2 emissions from biomass unit can be deducted. Excludes biomass mixed with other fuels and old growth timber	Consistent with IPCC	
Climate Leaders	Voluntary	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	• On-site fuel consumption and energy use • Industrial process-related emissions (as applicable) • Onsite waste disposal • Onsite air conditioning/ refrigeration use • Indirect emissions from electricity/steam purchases • Mobile sources		CO_2 emissions required, reported separately, not included in tracking progress toward reduction goals	Consistent with IPCC	None, but documentation is needed where emissions cannot be estimated

Table 1. Continued.

Reporting Program/ Jurisdiction	Voluntary, Mandatory, Cap-and-Trade	Coverage (GHGs)	Sources/Sectors Included	Threshold(s) for Reporting	CO_2 from Biomass Provisions	GWPs	De Minimis Provisions
Europe Union Emissions Trading Scheme (EU ETS)	Mandatory, C&T	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	• Mineral oil refineries • Coke ovens • Metal ore roasting and sintering installations • Pig iron and steel • Cement clinker production • Lime production • Glass manufacturing • Ceramic products manufacturing • Pulp and paper production	Originally proposed as 25,000 metric tons of CO_2 (may be revised in the future)	Required, reported as memo item (not accounted for in total emissions), and amounts of biomass combusted	IPCC Second Assessment Report (1995)	2%, not to exceed 20,000 metric tons
United Kingdom Emissions Trading Scheme (UK ETS)	Voluntary, C&T	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	Direct emissions from on-site combustion and industrial processes (7 categories), and indirect emissions from electricity generated on the grid	10,000 metric tons CO_2e	CO_2 from biomass energy excluded	Consistent with IPCC	1% of entity emissions

Table 2. List of WCI source categories and status of methods development.

Group 1:	Group 2:	Group 3:	Group 4:
December 5, 2008	**January 6, 2009**	**April 2009**	**Future Date to be Determined**
• General Stationary Combustion[a] • Electric Generation[a] • Petroleum Refineries[a]	• Refinery Fuel Gas Combustion[a] • Cement Manufacturing • Hydrogen production • Iron and Steel Manufacturing • Lime Manufacturing • Primary Aluminum • Lead Production • Zinc Production • Coal Mines • Pulp and Paper • Coal Storage	• Cogeneration[a] • Glass Production • Soda Ash Manufacturing • Ferroalloy Production • Electronics Manufacturing • Petrochemical Production • HCFC-22 Production • Adipic Acid Manufacturing • Ammonia Manufacturing • Magnesium Production • Nitric Acid Manufacturing • Phosphoric Acid Manufacturing • SF_6 from Electrical Equipment • Nonroad Equipment at Facilities	• Electricity Importers[a] • Fuel Suppliers: Transportation Fuels[a] • Fuel Suppliers: Residential/ Commercial/Industrial Fuels[a] • Oil and Gas Production & Processing • Natural Gas Distribution • Carbon Dioxide Transfers • Landfills • Municipal/Industrial Wastewater

[a] Stationary combustion sources (direct, upstream, or downstream); all others sources are non-combustion process emission sources.

Table 3. Qualitative comparison of relative accuracy of types of quantification methods.

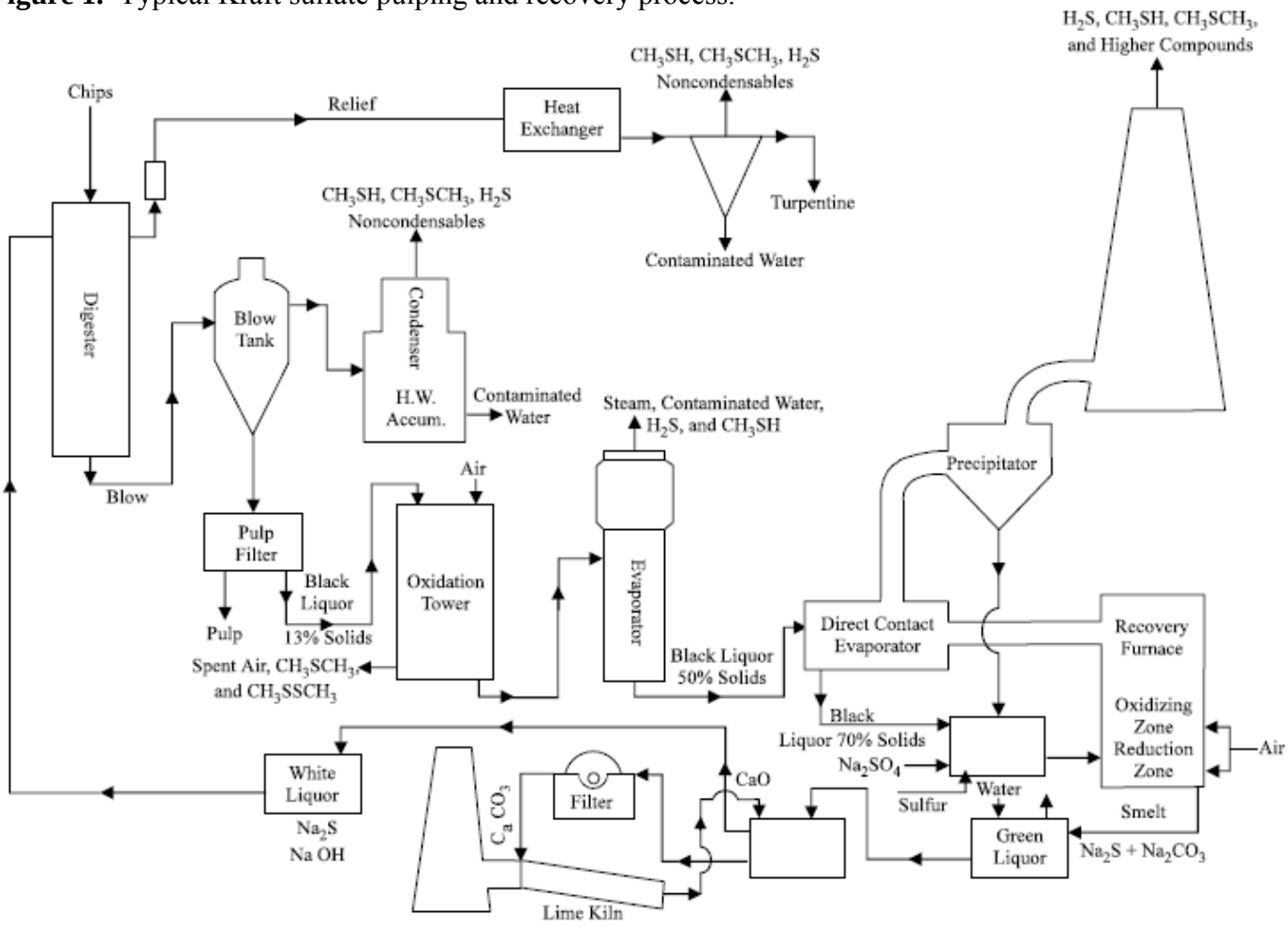
	Combustion Sources		**Process Sources**
Quantification Method Type	**CO_2**	**CH_4, N_2O (will vary based on how burner is tuned)**	**CO_2, CH_4, N_2O**
CEMS	High	High	High
Fuel Flow (Continuous)	Intermediate	Very Low	Not Applicable
Material Balance	Not Applicable	Not Applicable	Intermediate
Periodic Monitoring (e.g., weekly or monthly, hand-held; assumes steady state)	Low	Low	Low
Non-fuel Flow Parametric Monitoring (e.g., measuring something other than fuel flow, such as raw material feed rate or production output rate)	Low	Very Low	Low

Table 4. Summary of selected GHG quantification methods: recommended in January 6, 2009 WCI reporting essential requirements, or under consideration.

Source Category	Method Summary
General Stationary Combustion	• Method 1: CO_2 EF, default HHV, annual fuel consumption. Applies to facilities not subject to verification, unless HHV=975 to 1,150 GTU/ft^3 • Method 2: CO_2 EF, measured HHV, annual fuel consumption. • Method 3: Measured fuel C content, annual fuel consumption. Applies to any unit of any size, unless Method 4 is required. • Method 4: CEMS for CO_2 estimation. Applies to any unit and must be used when CEMS is required by a federal, state, provincial, or local regulation. • CH_4 and N_2O: Emission factors and either default or measured HHV These methods apply to stationary combustion emissions, only, and are required for all industries, in addition to the process emissions quantification methods described below for individual source categories
Cement Manufacturing	CO_2 emissions from process: Use a continuous emissions monitoring system (CEMS), or calculate the sum of CO_2 process emissions from kilns as CO_2 from calcination + CO_2 from raw material: <u>CO_2 from calcination:</u> • Plant-specific monthly clinker emission factor from: - Total CaO content of clinker (including calcined and uncalcined) (wt. fraction). - Uncalcined CaO of clinker (wt. fraction). - Total MgO content of clinker (including calcined and uncalcined) (wt. fraction). - Uncalcined MgO of clinker (wt. fraction). • Plant-specific monthly CKD emission factor from: – Clinker emission factor or – CKD calcination rate, determined from weight fraction of carbonate CO_2 in the CKD and weight fraction of carbonate CO_2 in the raw material. • Monthly clinker produced, metric tons • Monthly quantity CKD discarded, metric tons <u>CO_2 from raw material:</u> • Total measured organic carbon content in raw material (wt. fraction) or using a default of 0.002 • Amount of raw material consumed, metric tons/yr <u>CO_2, CH_4, and N_2O emissions from stationary fuel combustion:</u> In addition to the methods described for general stationary combustion, cement plants that combust pure biomass-derived fuels and combust fossil fuels only during periods of shutdown and maintenance may report CO_2 emissions from fossil fuels using the emission factor methodology in GSC section. "Pure" means that the biomass-derived fuels account for 97% of the total amount of carbon in the fuels burned.
Hydrogen production	• If using CEMS for estimating CO_2 from combustion, then may also use to estimate emissions from process. If CEMS are not used then calculate process CO_2 emissions using the amount of feedstock consumed and the carbon content of the feedstock (mass balance approach). • May deduct CO_2 equivalent emissions for carbon species in unconverted feedstock contained in tail-gas from a pressure swing adsorption (PSA) purification system and hydrogen plant product that is diverted to fuel gas systems, fed to downstream units, or diverted to a flare.
Lead Production	For CO_2 from process, use CEMS or calculate using mass of carbon in each carbon-containing material (other than fuel).
Zinc Production	For CO_2 from process, use CEMS
Ferroalloy Production	For CO_2 emissions from process, use CEMS or calculate using mass of carbon in each carbon-containing material (other than fuel).
Adipic Acid Manufacturing	For N_2O from process, develop facility-specific N_2O emission factor and apply to annual quantity of adipic acid produced.
Nitric Acid Manufacturing	For N_2O emissions from process, use site-specific emission factor and periodic direct monitoring of N_2O emissions to determine the relationship between nitric acid production and the amount of N_2O emissions.
Phosphoric Acid Manufacturing	For CO_2 emissions from each wet-process phosphoric acid process line, use mass balance approach with inorganic carbon content and mass of phosphate rock consumed.

BTU/ft^3 = British Thermal Unit per cubic foot
C = carbon
EF = emission factor
HHV = higher heating value

Figure 1. Typical Kraft sulfate pulping and recovery process.



Source: AP-42[1]