



**Georgia-Pacific**

# Inventory of Greenhouse Gases



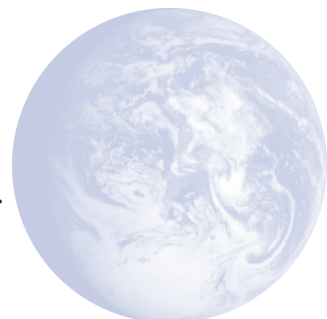
**Protocol**  
2004 Edition



# **PROTOCOL<sup>®</sup>**

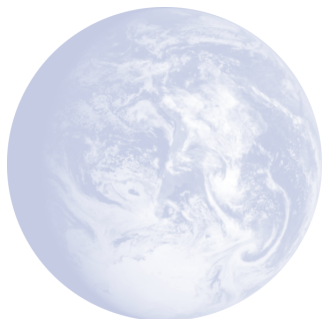
**2004 Edition**

**FOR THE  
INVENTORY OF GREENHOUSE GASES  
IN GEORGIA-PACIFIC CORPORATION**

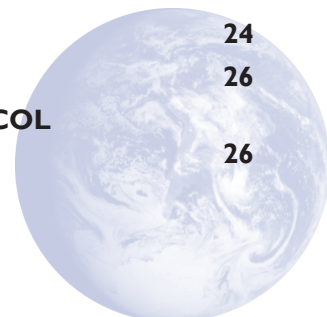


### **Working Group on GHG Inventory**

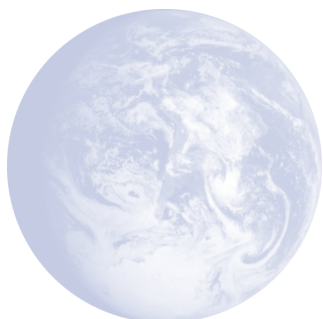
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## FOREWORD

A Greenhouse Gas (GHG) Inventory is a tool that can be used by a corporation to identify climate change control issues within the organization. The corporation can use the results of the inventory to develop strategies for managing the issues in the future, including developing policy and implementing emissions controls. It also can be an effective tool for use in communicating the corporation's performance in these areas to shareholders and stakeholders using a reliable source of data collection and methodology. Presently, two major climate change regimes are emerging: the European Union (based on the Kyoto Protocol) and the United States regime, which is still in development. Because of the international character of Georgia-Pacific, this Protocol has been designed with flexibility to potentially benefit from future linkage to these regimes in the trading sense, and potential crediting at the domestic level.

In 1998, the GP Climate Change Task Force (CCTF) sponsored its first GHG inventory. At that time, the company relied on its Energy Consumption Annual Report for deriving direct and indirect GHG emissions. In addition, the CCTF also examined the removal portion of the inventory, the carbon sinks in timberland and in end products. The study obtained both gross carbon stock changes during the year and the harvested amounts from the detailed records of the company's forestry managers. With this information, it was possible for the corporation to get a fairly accurate picture of its net contribution to GHG emissions. A carbon balance of the system in consideration indicated the data used and the estimates made were accurate. The results of the study were later used to develop a new application of Life Cycle Impact Assessment (LCIA)

for GHG inventories. After proper peer review, the International Organization of Standardization (ISO) accepted an example of the novel application and it now appears in ISO TC 14047, example number three published in late 2003.

After some important structural changes within Georgia-Pacific in 2000 and 2001, the CCTF decided it should complete a new GHG inventory that would reflect the corporation's current GHG emission situation. A Working Group was created to implement the CCTF decision. As part of the criteria for the project, the CCTF developed a Protocol in 2002 to guide the inventory work, as well as to provide transparency in all the details and assumptions for current and subsequent inventories. Also, the Protocol was developed in such a way that it would reflect other GHG inventory protocols with a certain level of consensus.

The first GP Protocol was based on the original World Business Council for Sustainable Development and the World Resources Institute (WRI/WBCSD) Greenhouse Gas Protocol for entities.<sup>1</sup> That consensus document, available since the fall of 2001, was very well received and accepted worldwide as the first step for developing accurate GHG inventories. In adapting it to specific corporate conditions and the particularities of the forest products industrial sector, the GP Working Group maintained the fundamental intent of the WRI/WBCSD document in the first GP Protocol of 2002.

Soon after the issuance of the original GHG Protocol, WRI/WBCSD undertook a revision that took almost two years. In March 2004 the revised edition, *The Greenhouse Gas Protocol — A Corporate Accounting and Reporting Standard*,

<sup>1</sup> World Resources Institute (WRI) and World Business Council for Sustainable Development. 2001a. *The Greenhouse Gas Protocol: a corporate accounting and reporting standard*.



was published. We considered timely to review and revise our 2002 GP GHG Protocol

- a) to ensure its alignment with the new revised edition of the WRI/WBCSD GHG Protocol
- b) to improve our 2002 Protocol with the experience gained in two GHG inventories

The Working Group is satisfied that the GP Protocol is still aligned with the WRI/WBCSD revised edition of March 2004. In fact, certain differences in the original revisions of the GP and the WRI/WBCSD Protocols have been reconciled. As in the GP Protocol, indirect GHG emissions must be quantified in the revised edition of WRI/WBCSD. Likewise, the new revised edition makes clear that CO<sub>2</sub> from biomass combustion are excluded from direct GHG emissions. The GP Protocol has recognized this exclusion since the beginning. Furthermore, the new revised edition of WRI/WBCSD, in its Appendix B, recognizes the role of carbon sequestration and the pools created, and their possible reporting as a separate category. GP has had a leading role in the applicability of carbon sinks to entity's GHG inventories and in the development of accurate but practical methodology useful to corporations of all sizes (See Appendix).

GP's GHG Protocol is a basic document to be used in the preparation of the base year inventory report as well as in subsequent updates and revisions. It provides basic instructions for the linkage of individual emissions reduction and/or removal projects with the general corporate (entity) inventory and the ultimate creation of a project registry. It also will properly record improvements in GHG emission intensity as well as measures that have avoided or prevented GHG emissions, even if they are not available for trading or crediting in some regimes. This is important in order to maintain the same level of quality and consistency in inputs to the inventory. Its importance is further stressed when realizing that individual projects may be eventually considered

for trading or crediting and, as such, are subject to certain verification and validation requirements. It also will properly record improvements in GHG emission intensity as well as measures that have avoided or prevented GHG emissions.

The GP Protocol also provides a "procedural home" or "registry" for a variety of internal energy conservation projects or directed actions carried on within the corporation that do not currently have a proper climate change identification and justification. Some of these projects could be suitable for participation in future trading and crediting programs that may become part of emerging climate change regimes. The GP Working Group anticipates that our Protocol procedures also will be helpful in future registration with official programs such as the Department of Energy's (DOE) I605 (b).

Since the first GP Protocol, we have made progress in developing the linkage between the GHG inventory and internal reduction projects. Changes have been introduced in the CAPMOD system (capital request and approval), so projects with energy savings resulting in GHG reductions would be properly quantified and then retrieved from our Investment Tracking System (ITS). The final steps, linkage of the two systems and proper training of those preparing submission of capital requests, are planned for 2005.

The CCTF hopes that the Protocol will provide a durable and practical guide to continuously assess the climate change performance of the company in a credible and transparent manner throughout any structural change.

Sergio F. Galeano, Ph.D., D.E.E.  
Chair, Climate Change Task Force

## GHG INVENTORY – PROTOCOL

**INTRODUCTION.** In 1998 and 1999, Georgia-Pacific conducted its first Greenhouse Gas (GHG) inventory. At that time, a GHG risk management approach appeared to be a reasonable goal since climate control policies were being developed both domestically and internationally. The company recognized that both business and environmental risks were associated with the possible outcomes of a GHG policy. These conditions were, and still are, very relevant to the company's operations. They also are still linked to the final policy determinations on the nature of the GHG emitted (biomass or fossil fuel oxidation), the controls that would be applied and the credits allowable for carbon pools both in forests and product systems.

Today, an adequate corporate strategy requires the identification and quantification of both GHG emissions and removals, and a GHG Protocol is a necessary instrument in helping formulate sustainable and efficient strategies.

GP facilities and the affected corporate departments will adhere to the guidelines of this Protocol for the purpose of establishing a greenhouse gas (GHG) inventory and for publicly reporting GHG emissions data as needed. In order to accommodate different types of facilities, both in the U.S. and other countries, the Protocol provides a structured, yet flexible approach to gathering energy and production information and transforming it into the relevant GHG emission reduction, removals, avoidance and intensity data. It builds on prior GHG inventory and analysis experience, existing corporate practices and accounting standards, as well as GP's prior experience in corporate energy/fuels consumption reports. The North American and European energy/fuels reporting systems are compatible,

which should result in a smooth roll-up for GHG corporate aggregation purposes.

The Protocol addresses the estimation and reporting of the three greenhouse gases (GHGs) of recognized importance for the forest products industrial sector: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Of the three, carbon dioxide is most prevalent, while methane and nitrous oxides are less common in GP operations. As a result of the Montreal Protocol, a corporate survey was conducted several years ago on additional recognized GHGs, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) both for products and supplies. The results indicated no use or release of such chemicals. This condition is of course maintained at present.

GP's CCTF developed the original GP Protocol based on information received principally from the **"GHG Protocol,"** an effort of the World Resources Institute and the World Business Council for Sustainable Development, which used the expertise of business, consultants, government and non-government agencies to develop the standards for how the inventory should be conducted. It also consulted with the Energy Information Agency of the U.S. Department of Energy, whose Form EIA-1605 is used to monitor voluntary reduction efforts.<sup>2</sup> Emerging approaches such as those initiated by North American and European paper industries (Calculating Tools in development by the National Council of Air and Stream Improvement (NCASI)) also were considered because of their usefulness in specific process emissions data and conversion factors. The contents of the GP Protocol are compatible with and do not contradict the substance and intent of the aforementioned efforts, but are

<sup>2</sup> International Energy Agency (IEA). 1998. The Role of Bioenergy in Greenhouse Gas Mitigation. International Energy Agency. Paris. [http://www.ieabioenergy.com/media/6\\_pospapa4.pdf](http://www.ieabioenergy.com/media/6_pospapa4.pdf) (14 Feb. 2002)



tailored to Georgia-Pacific and the forest products industry. We have further examined the revised version (March 2004) of the WRI/WBCSD Protocol and concluded we are still aligned to its principles and practices.

GP is a manufacturer of primary and end-use forest products. The end-use products are considered essential elements of the “product carbon pool” either because of their useful life or final disposal in landfills. Consequently, the Protocol addresses the carbon or carbon dioxide equivalent “removals”<sup>3</sup> that could be accrued because of the company’s manufacturing capacity that contributes to the national carbon product pool. Calculation for carbon pools is not yet available in the major referenced protocol. Nevertheless, it was part of the first GP GHG Inventory and is still an element of the official U.S. GHG Inventory National Annual Report to the United Nations. GP has developed a quantification method, GPCARB<sup>TM</sup>, designed for manufacturing facilities. It has been widely assessed and accepted by the AF&PA (American Forest and Paper Association) under the generic name of “100-yr method”. The calculation of annual product carbon pools is limited to the end-use products and not to those in landfills. A discernable chain of custody exists in the former but not in the latter.

The final approval and inclusion of the removals from the product carbon pool in the ISO 14047 standard is evidence of how this element of the GP Protocol is being accepted internationally. The operational boundaries of the inventory are not necessarily expanded beyond the manufacturing site. For the calculation of the product carbon pool removals, the model reaches downstream from the manufacturing

site into the product chain only to capture the useful life and retirement factors of different products.

Recently, we have seen emerging initiatives at the state level (Georgia and California) to facilitate registration of both forest and product carbon pools. Georgia-Pacific has actively helped these efforts sharing our experiences and methodology. Today, the company does not own timberland, thus the net forest carbon sequestration that was part of the first GP GHG inventory is not considered in this Protocol; however, procedures are readily available should the corporation move back into such business or manage for carbon in new sites. Nevertheless, interest still exists for the product carbon pools as a result of the manufacturing and marketing of end products of biomass origin. The estimated “removals” are important to the forest products manufacturing companies from a communications and public relations point of view because of possible future domestic crediting. They also are important in the transition toward a less intensive fossil carbon economy.

Georgia-Pacific not only manufactures forest products, but also utilizes significant amounts of biomass fuels derived from forest residues, debarking operations, industrial residues from wood product operations and pelletized wastepaper. These fuels satisfy approximately 60 percent of the energy requirements of the corporation, displacing the equivalent amount of more critical fossil fuels and their GHG emissions. In addition, the carbon dioxide emissions from the oxidation (combustion) processes are considered neutral, but reporting them is important<sup>4</sup> to the corporation’s energy and climate change strategies.

<sup>3</sup> Product carbon pool removals are essentially adjustments to prior reductions made in estimating the net carbon sequestration removals. In such estimations, harvested biomass is booked as a total emission in the annual inventory. Nevertheless, it is recognized that biomass products store sequestered carbon longer than one year, e.g. building products materials last for decades or centuries. Recognized models provide reliable tools to calculate these removals for different biomass product categories in annual terms and according to annual production. The approach used in the GP Protocol is modeled after the official U.S. GHG National Inventory report to the U.N. with some modifications to adapt it to manufacturing organizations. The Inter-governmental Panel on Climate Change (IPCC) also sanctions the approach as a viable option.

<sup>4</sup> Various domestic and international organizations have recognized the accounting and scientific reasons for such neutrality or net-zero. In their preparation of the U.S. GHG National Inventory report to the UN FCCC, the Intergovernmental Panel on Climate Change (IPCC), the Department of Energy and the EPA recognized that these emissions do not add to the atmospheric concentrations of carbon dioxide. Several technical documents, such as ISO 14047, also have addressed such distinction.

## I - CRITERIA

The elements of the criteria selected by the GP Climate Change Task Force Working Group (WG) for the GHG Inventory are:

- 1 GLOBAL- North America, South America and Europe, and any future facilities identified elsewhere;
- 2 COMPREHENSIVE  
IN SOURCES: Manufacturing, Transportation, etc.  
IN GHGs<sup>5</sup>: CO<sub>2</sub> , N<sub>2</sub>O, CH<sub>4</sub> ;
- 3 CONSUMPTION-BASED — ON FUEL & ELECTRICITY IN 2000;
- 4 UNIFORM
  - 4.1-For Emissions- Fossil Fuel/ Biomass
  - 4.2-For Carbon Sinks and Pools
    - Product Carbon Pool- Consensus in Model
    - Forest Carbon Pool- In owned forestland
  - 4.3- For Product Categories and Product Unit Designations;
  - 4.4- For Activities Designated as Climate Change Projects;
- 5 CAPABLE OF YIELDING RESULTS IN:
  - 5.1- Absolute values; and
  - 5.2- Per Unit Product, by the use of Emission Intensity Ratios;
  - 5.3- Avoided emissions projects, measures or products;
- 6 CAPABLE OF STANDING UP TO SCRUTINY (Public/ third-party validation/ verification);
- 7 A MINIMUM EFFORT TO THE OPERATING BUSINESS UNITS;
- 8 DESIGNED TO PROPERLY LINK PROJECTS TO THE INVENTORY; and
- 9 SUITABLE FOR USE IN SEPARATE ANALYSES.

The following information provides the recommended methods for implementing the Criteria.

## 2 - INVENTORY PRINCIPLES

**2.1- GENERAL PRINCIPLES FOR INVENTORY DESIGN.** It is important to provide principles for the design of a standard GHG Inventory since the corporation includes many new facilities, some of which may have used other types of inventory programs in the past.

**SEPARABILITY.** *A GHG Inventory is different than an Energy Consumption inventory:* In an Energy Consumption inventory, the quantities in the scope levels or categories can be added; however, in a GHG inventory, adding scope levels would lead to double counting or a potential unfair future liability.

Only direct emissions and removal scope levels or categories are amenable for algebraic addition. This principle is more relevant in GP since the company issues energy consumption reports annually.

*A GHG Inventory is not a Life Cycle Inventory (LCI):* Unlike a Life Cycle Inventory (LCI) that focuses on the product system, the GHG inventory is focused on the entity. Regardless of whether the inventory is taken for analysis, verification or other purposes, it is important that the focus remains consistently on the entity rather than the product.

<sup>5</sup>Carbon dioxide is anticipated to be the overwhelmingly important GHG, with methane in specific processes. Nitrous oxides are included to establish a factual reason for their inclusion or exclusion in subsequent updates of the inventory.



Although they are different methodologies, product Life Cycle Approaches (LCA) could be useful as tools for validation or verification.

**LINKAGE.** *The Entity Inventory Shall Allow for Linkage to Project GHG Accounting:* GHG emissions reduction or removal projects are linked to an entity. As such, information about the entity may be needed for the crediting and validation of potential projects. The entity inventory establishes boundaries that reflect the potential project justification for consideration of additionality, business as usual, etc. Because of the emerging nature of many climate change regimes, a proper registry of projects should be maintained. One that is compatible with the inventory protocol and available in the future for claims of trading or crediting. The GHG inventory is not a policy document. Rather, it is an inventory whose results can be used for multiple purposes.

**COMPLETENESS.** *The Inventory Accounting shall Include Emission Reductions, Removals, Sequestration, Offsets, Emission Avoidance, and Emission Intensity Ratios:* Entities such as GP have the potential for crediting removals due to the nature of the biomass raw materials and final products that end their life cycles in recognized carbon pools. Carbon pool estimations are easily traceable to the manufacturing production rate.

The boundaries and scope of the inventory should be appropriate for, and representative of, the businesses, operations or activities of Georgia-Pacific. All material sources within the chosen scope would be included in the inventory. After proper assessment, any exclusion should be stated and justified.

Likewise, the corporation and other intended users of the inventory have an interest in improvements on the emission intensity per unit of production (an efficiency indicator for fuels and resource conservation), as well as measures and techniques that have avoided emissions had they not been implemented.

**2.2 - ACCOUNTING PRINCIPLES AND STANDARDS.** In developing and reporting the corporate GHG emission inventory, the Working Group used the U.S. Generally Accepted Accounting Principles, or GAAP, and the International Accounting Standards, or IAS, as references. These documents provide recognized worldwide guidance for financial accounting and reporting. Although no certified accountants are part of the Task Force, these principles are embodied in the business procedures that resulted in the basic information retrieved for the inventory. Certified accountants were involved in those procedures.

As in any professional accounting practice, similar general accounting principles should be applied to the GHG Inventory to ensure that the information is:

- a true and fair account of the organization's emissions and pools; and
- a credible and factual analysis in its general presentation as a final report.

**RELEVANCE.** The Protocol should define boundaries that properly reflect the GHG emissions of the organization and the needs of the information user. These boundaries take into consideration:

- the business context- geographically, by product line, by markets;
- organizational issues- wholly owned, joint venture, etc.;
- operational characteristics; and
- inclusions and exclusions.

**CONSISTENCY.** Inventory protocol, execution and reported data should be prepared in such a way that valid year-to-year comparisons can be made. Changes should be clearly stated and documented to allow continued year-to-year comparison and traceable baseline adjustments. The GHG inventory presentation should provide sufficient business context to help managers understand it clearly.

**ACCURACY.** Calculations should be precise for the intended use of the data. Reasonable assurances should be made as to the integrity of the GHG emissions/pools information. Effective controls should be in place to ensure that systematic errors are avoided, random errors are minimized and uncertainties are quantified.

**TRANSPARENCY/VERIFIABILITY.** The data should be clear and should state any assumptions, methodologies and models used. All relevant issues will be addressed in a factual and coherent manner, and should be based on clear and current records. Procedures to implement this principle will assume that a third-party will eventually verify the information in the future. The possibility of “review panels” in the future makes it even more important for the report to be transparent and clear for those individuals without specific technical expertise on these issues.

**2.3 - VALIDATION AND VERIFICATION.**

When validation/verification is conducted in a GHG inventory, either internally or by a third party, clearly stated principles must be followed during the execution of the task. Besides the certification statement, the verifier should be requested to prepare and provide GP with a report on the steps taken during the verification, the findings, the materiality of discrepancies or errors and suggestion to correct and improve on the findings. The new international guidance efforts ISO 19011 and ISO 14064, still in development, could provide a helpful and broadly recognized format to conduct the validation/verification process as it relates to both the entity and the project inventories. The WRI/WBCSD protocol also offers suggestions on the matter that should be considered. GP is working diligently in helping ISO 14064 become a useful standard for entities’ GHG inventories and report.

**3. INVENTORY BOUNDARIES**

The boundaries of the GHG Inventory are commonly defined as organizational and operational. There also is a *temporal* boundary defined by the base year. The Task Force set the GHG Inventory base year as the year 2000, for facilities owned or controlled by GP as of August 31, 2001.

**3.1 - ORGANIZATIONAL BOUNDARIES.**

GP does not wholly own all the facilities and businesses in the GHG Inventory. Domestically and abroad, the company participates in incorporated or non-incorporated joint ventures. Whenever GP has majority ownership or a controlling interest, the company will include and report the emissions from the operated facilities, without apportionment, as part of the consolidated corporate emissions statement. In these cases, the GP Protocol will follow the recommendations of the WRI/WBCSD’s, revised edition in its Table I,

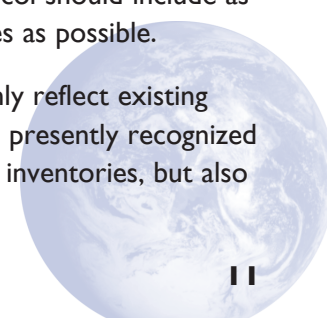
regarding company and subsidiaries based on financials control. The inventory should capture all facilities in North America (NAFTA countries), Europe, South America and elsewhere.

**3.2 - OPERATIONAL BOUNDARIES.**

The setting of Operational boundaries should address both the facility sites and the types of GHG emissions and removals.

The property manufacturing site limits are the typical site boundaries, and could include manufacturing source emissions as well as fugitive emissions. They also could include other sites such as company-owned landfills and wastewater treatment facilities. The Protocol should include as many of these operational sites as possible.

GHG emissions should not only reflect existing “scope levels” or “categories” presently recognized in many state-of-the-art GHG inventories, but also



the “removals” component of the climate change control equation. In doing so, the inventory should reflect specific characteristics of the practices, fuels and products of the forest products industrial sector. Scope levels or reporting categories have been expanded according to the principles listed earlier and are based on GP’s previous industry experience, as well as recognized international and domestic guidance on these issues.

The concept of scope levels or categories does not imply a progressive addition of precedents to a particular level. The GP energy consumption inventory (Blue Book) adds these reporting levels because they represent the total net consumption of energy required to manufacture the company’s products. However, GHG emission, removals, avoidance and offsets are considered differently.

**3.2.1 - DIRECT GHG EMISSIONS (SCOPE LEVEL 1).** Direct GHG emissions are from sources that are owned or controlled by Georgia-Pacific Corp. *worldwide*. They are the result of:

- production of electricity or steam by fossil fuels;
- production of electricity or steam by biomass fuels other than CO<sub>2</sub>;
- pulping chemical recovery (recovery furnaces and lime kilns);
- chemical processing;
- transportation of goods or employees in GP vehicles; or
- fugitive emissions, other than carbon dioxide, from:
  - company-owned wastewater treatment systems;
  - landfills (for facility operations); or
  - other sources.

GHG emissions resulting from the generation of exported electricity, heat and/or steam also must be considered in this category (Scope 1).

### 3.2.2 - INDIRECT CONTRIBUTIONS OF GHG EMISSIONS (SCOPE LEVEL 2).

Scope Level 2 emissions are those not created or owned by the company, and that *physically occur* at sites or operations owned or controlled by another organization. In reality, the consumption of certain products such as imported electricity, heat and steam are important in reduction efforts regardless of ownership and the fact that the emissions are not realized at the GP facility itself. Electricity consumption at many GP facilities is significant. Any reduction in this imported product is important for general sustainability purposes and for GP’s strategic climate change plans since it indirectly contributes to the reduction of GHG elsewhere. Other measures such as outsourcing must be considered as indirect emissions. When business strategies dictate the use of outsourcing, it would be valuable to incorporate those measures into the manufacturing plan and the resultant emissions estimated and reported under this category.

### 3.2.3 - BIOMASS NEUTRAL EMISSIONS (SCOPE LEVEL 3).

Biomass neutral emissions have been added to GP’s GHG Inventory and is unique to the forest products industrial sector. Regardless of whether carbon dioxide is emitted from the company’s facilities, it is not added to the direct emissions. The carbon dioxide from biomass oxidation, which is neutral, indicates the “net zero” property of the carbon dioxide emissions from biomass oxidation. Such net-zero characteristics are widely and officially recognized. As indicated earlier, this reporting category is not a “safe harbor” for these types of emissions. On the contrary, it is an important element of the company’s strategic and forward thinking initiatives. In fact, several innovative projects underway are intended to improve efficiency in energy generation with biofuels.<sup>6</sup>

<sup>6</sup> Ideally, efficiency improvements in biomass fuels utilization will revert into real reductions of biomass fuel, and the available biomass fuel will displace fossil fuels and reduce indirect contributions to GHG from electricity imports.

In the revised edition of the WRI/WBCSD, CO<sub>2</sub> emissions from biomass combustion are also excluded from direct GHG emissions.

**3.2.3.1 - LIME KILN CO<sub>2</sub> EMISSIONS.** Since our original Protocol, we have documented that the burning of the CaCO<sub>3</sub> from the causticizing process are in fact biomass CO<sub>2</sub> emissions and are to be excluded from direct GHG emissions. For three years we have been making this point to the U.S. Greenhouse Gas Inventory team - Finally, this year, EPA acknowledged the soundness of our point and so stated in the national inventory report.

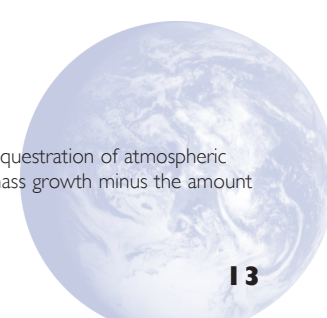
**3.2.4 - REMOVALS BY SEQUESTRATION AND IN PRODUCT CARBON POOLS (SCOPE LEVEL 4).** This category or scope level was not specifically indicated in the original WRI/WBCSD protocol but the new revised edition dedicates its Appendix B to this subject encouraging separate reporting of these quantities as “other information”. Carbon sequestration is relevant to forest products companies such as Georgia-Pacific. It reflects the characteristics of the forest products industry sector whereby *removals*<sup>7</sup> occur in many cases as the result of everyday operations (managing forestland) and not necessarily on isolated projects. Besides sequestration storage in forests (forest sink), sequestered carbon also is stored in biomass products manufactured by the entity (product sink). Adjustments to the carbon harvested wood converted into forest products is an approach sanctioned by the IPCC and used in the annual US GHG Inventory report to the UNFCCC. We have adapted their nationwide approach to the corporation’s production.

**3.2.5 - OTHER CATEGORIES.** *Reporting specific, discrete projects related to emission reductions, removals, offsets and avoided or prevented emissions is another level that needs clear linkage with the*

entity inventory. Project inventory is different from entity inventory because the project explicitly addresses either a reduction, a removal or the avoidance of otherwise occurring GHG emissions. Projects are entered in a registry after proper verification. The purpose of the GHG Inventory categories is to provide a coherent and organized way to inventory and report GHG emissions and activities, including projects. Because projects influence the entity inventory in very direct ways, some general guidance should be given on:

- **Emission Reduction projects.** Only facility projects that reduce the emissions reported in the base year inventory for 2000 should be considered. It is logical to assume that the benefits or reductions of such projects would be immediately reflected in the inventory results at that facility. If it is not substantial, the reduction could be masked by other variables, including production rates and subtle changes in the production mix at the facility. The accounting for those projects needs to be specific, but the entity GHG inventory must register the projects and the verified reductions. Further analysis will determine if the entity inventory results accurately reflect the project improvement, but it should not be a requirement in the validation or verification of the project. More of this is explained in Section 4.
- **Removal projects - Afforestation, reforestation.** These types of discrete projects (different from the product carbon pool removals) also should be recorded in the registry of the inventory as they take place. The projects do not include normal forest management activities such as replanting, etc. Their removal quantity should be estimated for subsequent “netting” with the emission numbers of the inventory.

<sup>7</sup>“Removals” is a term used since the UN Framework Convention in Climate Change (FCCC) to describe the effect of sequestration of atmospheric carbon dioxide by geological or biochemical mechanisms. Net removals are conventionally the result of annual stock biomass growth minus the amount harvested (the latter booked initially as a total emission).



- **Avoided or prevented emissions.** These projects could be difficult to justify for trading or crediting. Nevertheless, their appearance as a level or category of the inventory is important to the corporation for multiple purposes such as recognition of efforts, communications and public relations. These projects, or directed actions, are analogous to the “pollution prevention” in traditional environmental management. Some of these avoided emissions could be reflected in the inventory as improvements in the intensity ratio (i.e., tons C per ton product). Others, like avoided emissions due to recycling, will not.
- **Projects Reducing Indirect Contributions to GHG Emissions.** The reduction of electrical consumption is an important strategic feature in the company’s energy conservation efforts. As such, it is intimately linked to GHG emissions reduction, wherever it occurs. It is not clear if these projects will be eligible for trading; however, they should be entered into the entity’s inventory system for future consideration. Recognition, and even crediting, of these projects is not unusual at the domestic level.
- **Offset Projects.** A category has been added to the Inventory to include offset projects that are the result of the corporation’s acquisition or sale of GHG credit units. In such cases, the inventory results in the category of Direct Emissions will either decrease or increase, based on the amount purchased or sold.

**3.2.6 - REFLECTING RECYCLING**

**EFFORTS.** The Protocol reflects the benefits of recycling in three ways:

- by proper corrections to the retirement age of end-use products according to their recycling rate or number of uses;
- by estimating the amount of carbon sequestered by the avoided use of trees due to recycling (extension of the sequestration capacity of the forest). These estimations will

produce quantities that could be considered avoided emissions; however, the Protocol prefers to signify them in terms of their recycling nature. GHG emissions from energy not used in harvesting the corresponding volume of displaced fiber can also be counted as avoided.

- by considering avoided GHG emissions at the landfills from the decomposition of the quantity of wastepaper that otherwise would have reached the landfill if not recovered/recycled by the company.

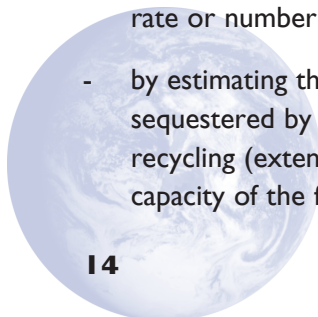
For purposes of accounting clarity and to prevent double-counting, only the quantity recycled by the company in its facilities will be reported regardless if the amount recovered by GP is larger (30% larger).

**3.3- FACILITIES TO BE CONSIDERED.**

A corporation the size of Georgia-Pacific has a continuous turnover of facilities, i.e., purchases, divestitures, start-ups and shutdowns. Thus, a cut-off date should be established for a base year and for accounting of the base year emissions. The GP Climate Change Task Force Working Group chose **August 31, 2001**, as the cut-off date for the base year emissions in 2000. This date was chosen to more accurately reflect the current corporation after the acquisitions and divestitures that took place during 2000 and 2001. Only the facilities owned by GP at that time were inventoried for their 2000 energy data. Even if a purchase took place in early 2001, the facility was included in the report. Facilities that belonged to GP at sometime in 2000, but that as of August 31, 2001, were no longer GP facilities, were not considered for the inventory, as in the case of several Fort James facilities that were subsequently sold to SCA, Domtar and Pine Creek.

**3.4. - DISTRIBUTION CENTERS AND**

**WAREHOUSING.** Distribution centers and GP divisions that engage in commercial wood and paper products transactions with retailers or



private customers are included in the GHG inventory. Once inventoried, their material significance will be assessed. If they are not considered significant, they may not be included in subsequent inventories according to the Protocol accounting principles.

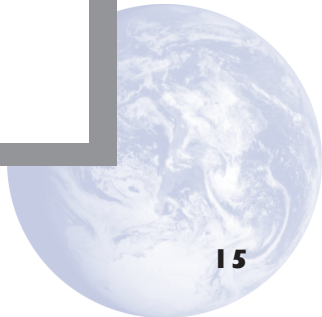
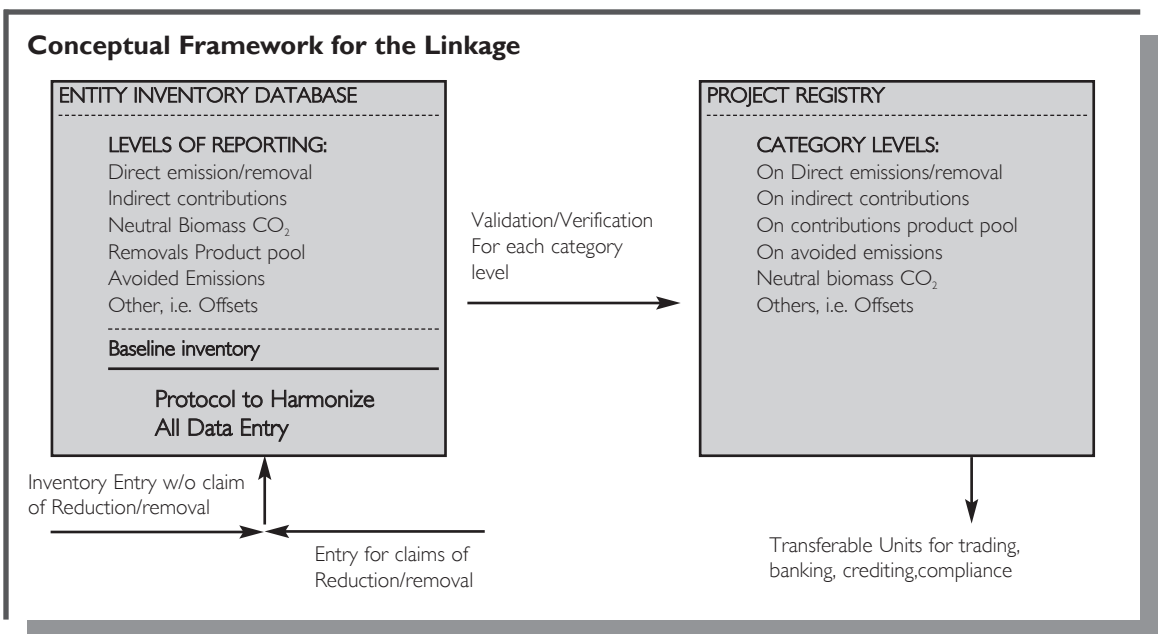
*Stand alone warehousing facilities (not part of the integrated mill, converting operation, wood product mill or chemical plant) will be included in the GHG inventory if owned or leased exclusively and in their entirety by GP. Warehousing services provided by commercial entities other than GP are not considered part of the GHG inventory.*

## 4 - LINKAGE OF SPECIFIC PROJECTS TO THE GHG INVENTORY

The GHG inventory of an entity needs to provide linkage between the accounting of the everyday operations of the corporation and specific, discrete GHG projects. In addition to properly accounting for and reporting these projects, emerging regimes in climate change projects demand special attention to this linkage as a way to ensure possible future benefits and avoid double counting. The procedural framework provided indicates how climate change projects must be accounted for as part of the comprehensive GHG inventory, as well as how they will be entered into a registry for future claims or benefits. It is useful, particularly for forest products companies, to view the GHG

inventory as a balance sheet where debits (emissions) and credits (removals/reductions) are counted to obtain a net figure.

**4.1- FRAMEWORK MODEL.** The following graph outlines a simplified framework model for such a system. The box at the left reflects the GHG entity inventory database, while the box at the right reflects the project registry of discrete reduction or removal projects. All entries in the inventory system, whether they represent an entity's day-to-day operations or a specific project, follow the Protocol's requirements and are comparable to the entity and the specific project



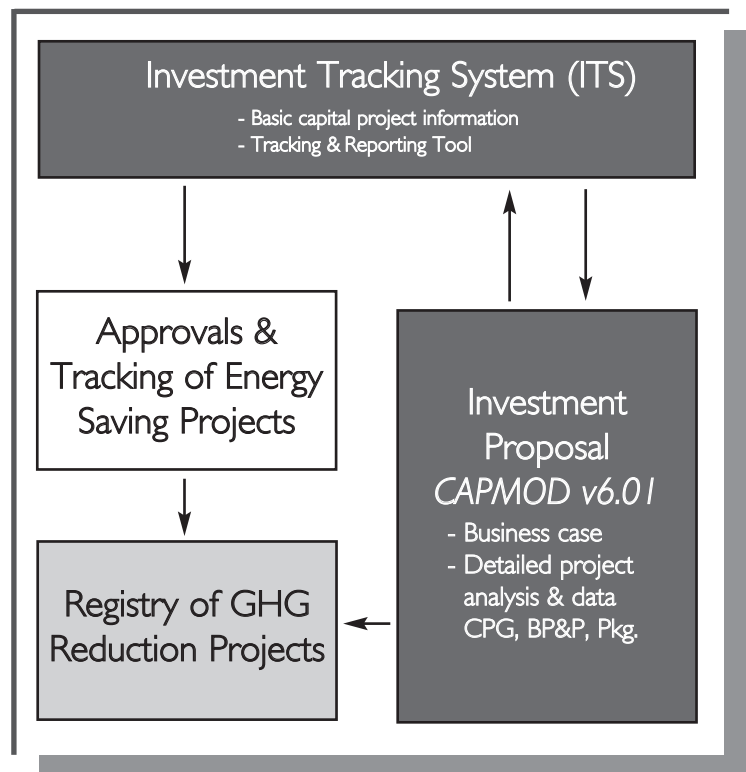
baseline as required. Both the United States and European Union may add requirements to the fundamental framework to validate a project in either country or regime.

**4.2- REGISTRY OF PROJECTS.** Among the criteria set forth for the GP GHG Inventory is the ability to utilize projects for purposes of trading or crediting according to specific existing or future policies either at the international or the domestic level. The precise requirements of various international trading regimes are not fully known at this time, nor are the domestic final trading and crediting requirements and procedures. Through the GHG inventory, the Protocol provides a registry whereby specific projects are entered according to similar categories or levels within the operational boundaries. That information is then readily available for regulatory, marketing and public relations efforts. Thus, the registry would consist of discrete accounts based on the project category and number of projects in the category.

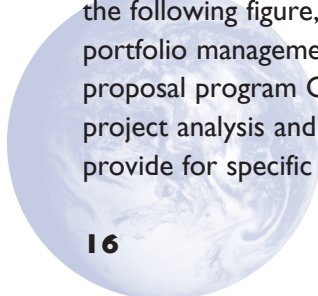
An internal or external validation/verification procedure would then ensure that the registry records the same degree of quality or “correctness” for all projects.

**4.2.1 - IMPLEMENTATION STEPS FOR THE REGISTRY.** The implementation of an efficient and effective registry for GHG reduction projects requires modification and adaptation of traditional internal financial mechanisms and reporting procedures. Since inception, we promote the concept that in our line of products and manufacturing technology, energy savings translate, except isolated instances, into GHG emission reductions. We consider that energy savings would be an understandable “locator” of projects for all our management. As depicted in the following figure, a simplification of our capital portfolio management system, an investment proposal program CAPMOD addresses detailed project analysis and data. It was modified to provide for specific identification and quantification

of any energy saving element of the capital project and subsequent reduction in GHG. Once this was done and the necessary forms modified, there was need to prepare our Investment Tracking System, ITS, to search and retrieve for those projects identified in CAPMOD as GHG reduction projects. Upon analysis and approval as a GHG reduction project, the energy saving project will become part of the “registry”. At this moment, two elements in achieving the linkage are pending. Training is needed for the hundred of engineers and managers who prepare, review and approve of capital request projects. Also, the electronics linkage between ITS and CAPMOD is pending. We are planning to complete these steps in 2005, after proper funding.



**4.3 - PROJECT JUSTIFICATION BY CATEGORY OR LEVEL.** The procedural framework of the GP Protocol, linking projects to the corporation’s GHG inventory, allows for the results of GP projects to always be part of the final netting of the inventory. The calculation procedures in Section 7 of this Protocol ensure



that the expectations of projects are properly reflected in that reporting. The results of projects other than those created solely for the purpose of trading or selling will be reflected in the next inventory. In this way, issues of leakage and double counting, etc., are eliminated or curtailed to acceptable levels within the entity boundaries. If a project is created only for the purposes of trading, the inventory system will register it too. If the transaction is completed within a year, the credit and debit entries will properly track the transaction in the inventory report.

At this time, the Protocol does not define or describe the validation/verification requirements or procedures for projects in their entirety since they are specific to different countries and regimes. Nevertheless, projects in the GP Inventory's registry would enjoy a "floor" of quality and verification that would help them meet any additional requirements.

**4.4 SELECTING A "CLIMATE CHANGE PROJECT:"** Projects are the lifeblood of GP manufacturing and service activities. The company's design and improvement teams generate projects at the corporate, mill or plant level and within specific departments of the mill or plant. Because of the diverse nature of the projects, the Protocol distinguishes between the inventory itself and the registry of certain projects by defining projects as those discrete or continuous directed actions of the organization that creates a decrease in GHG emissions (reduction) or an increase in removals between existing conditions and the results of the specific directed action. Thus, projects can be either:

- **Created by GP:**
  - to be an integral part of the GHG inventory, in the reduction/removal side of the balance sheet;
  - to be sold (reductions/removals to be traded) for financial purposes; or

- **Purchased by GP (offsets):**
  - to improve the balance sheet, as needed.

**GUIDING EXAMPLES AND RULES ON SELECTION OF CLIMATE CHANGE PROJECTS.**

In general, a climate change project must be a discrete, differentiable effort with the specific purpose of climate change improvements. It should be of sufficient size to justify the reporting, accounting and validation efforts. For example, normal equipment maintenance and retirement should not be considered climate change projects simply because there is an expectation that the new unit is more efficient than the replaced unit. The benefits of the replacement will be already reflected in the final GHG inventory, for example, in a lower GHG emission intensity ratio. Consequently, the recommended screening to classify a project as a climate change project will not deny the facility of its right to have their efforts properly recorded and reflected.

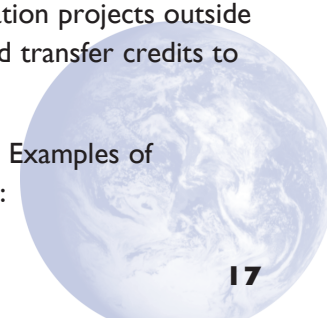
However, if an entity has a project replacing all existing electric motors with a more super-efficient model before its normal retirement age and they are still in normal operation, this project could be considered a "climate change project" and register the anticipated results, etc. in a discrete account in the registry. Nevertheless, the real GHG emission reduction would appear in the next inventory according to the resultant savings in electrical consumption (purchased and self-generated) that will appear in the next inventory according to the calculating procedures in the Protocol.

*Offset project examples.*

Examples of offset project include:

- a) The purchase of emission credits from another entity;
- b) Investment in GHG mitigation projects outside the entity's boundaries and transfer credits to the entity.

*Sequestration project examples.* Examples of sequestration projects include:



- a) The planting trees in a given area (not part of the forest management replanting process) and following the carbon stock changes;
  - b) Specific participation in protection trust activities of large tracts of land or forests.
  - c) Capturing of GHG and storing or converting it into other products or fuels. An example is the capturing of CO<sub>2</sub> from lime kiln and manufacturing Precipitated Calcium Carbonated (PCC).
- Reduction project examples.* Examples of reduction projects include:
- a) New technical developments that are designed and implemented for specific climate change improvement purposes (reduction of GHG), whether or not other processes are included or benefited;
  - b) Shifting of fuels with lower carbon content or to biomass fuels.
- Avoided emissions project examples.* Examples of avoided emissions projects include:
- a) Installation of more energy efficiency equipment, energy management systems, energy efficiency devices, etc.;
  - b) Increases in recycling of products and the recycled content of those manufactured by the entity. They extend the carbon storage benefit of forests while continuing sequestering additional atmospheric carbon dioxide with corresponding energy savings (and GHG emissions) that otherwise would be released in harvesting the replaced fiber.
  - c) Some divisions or regional facilities embark on programs with multiple activities that individually are difficult to categorize as climate change projects. Nevertheless, the positive results are evidenced by the reduction in the energy intensity ratio (and consequently the GHG emission intensity ratio). These results could be reflected in the category of avoided emissions, calculating the emissions that would have occurred had the program not been implemented. However, the avoided tons of GHGs in this case may not be tradable units.

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## 5- BASE YEAR AND BASE YEAR EMISSIONS

In our 2004 edition, we have replaced the term “baseline” with “base year emissions” to avoid any confusion with projects such as Clean Development Mechanism, CDM.

The term “base year emissions” is used in the Protocol to complement the term “baseline” as used in the context of the Kyoto and other sovereign programs. The base year emissions is a reference against which emissions performance can be measured over time — usually annual emissions for a selected base year. The base year is the calendar year in which the inventory starts. Once GP creates a base year for GHG emissions, a number of variables can account for the change in

emissions level from year to year, including organic growth, outsourcing, mergers, acquisitions, divestitures, changes in production, product portfolio, etc. Factors such as globalization, competition, expansion and consolidation in many key sectors also impact the corporation’s energy consumption. Tracking progress over time can be a challenging prospect, particularly if and when GP publicly commits to targets based on absolute emissions in a historical base year. All the listed elements have a bearing on the reality and perception of GP’s performance on GHG stabilization.

### 5.1 - GENERAL RULE FOR ADJUSTMENT.

*Base year emissions adjustment* should be considered at the onset of the GHG inventory. A base year emissions without adjustments or complementing indicators is not a relevant performance measurement because it does not take into account the dynamics of growth, purchase and divestiture of companies and structural changes in the company. The base year emissions' transparency, chain of custody and traceability are critical so that it can be readjusted according to any new rule, accounting practice or verification procedure.

A simple rule to apply to the different situations arisen from the activities of GP is as follows:

- If GHG emissions are created or eliminated, the base year emissions is not adjusted;
- If GHG emissions are transferred, the base year emissions is adjusted.

**5.2 - ADJUSTMENT FOR ORGANIC GROWTH. CHANGES IN PRODUCTION LEVELS AT EXISTING FACILITIES.** Organic growth refers to the increase or decrease in production output, change in product mix, plant closures and new plant openings. A new plant opening represents an increase in production output, but is different than a plant acquisition because the latter transaction only transfers GHG emissions from one company's GHG balance sheet to another. This sort of adjustment may not be pertinent in the environment of stabilization and further GHG reduction.

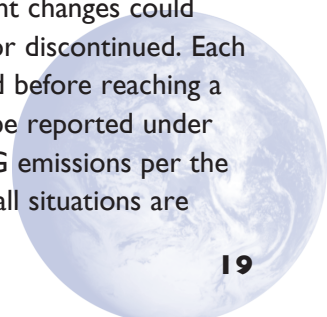
Decoupling organic growth from base year emissions is a key aspect of absolute performance. Nevertheless, coupling organic growth to GHG emissions is a practical approach that provides useful information on the performance of the corporation. It does not negate or hide performance based on absolute terms. The WRI/WBCSD GHG Protocol recommends that the base year emissions not be adjusted for organic growth. The GP Protocol will not adjust the

baseline for organic growth but will include GHG emission intensity ratios in the inventory analysis and reporting based on actual production and emissions for the year in consideration.

**5.3 - ADJUSTMENT FOR STRUCTURAL CHANGES.** The GP Protocol adjusts primarily for transfer of emissions ownership occurring through acquisitions and divestitures; it does not, however, distort performance with respect to absolute emissions. Here are some guidelines for adjustments due to transfers in ownership:

- When the sale of an operating unit or business results in a material change in GP's total GHG emissions, the base year emissions will be lowered by the percentage change in emissions. A value of five percent is generally accepted as a guideline for defining a material change and the need for a change in the base year emissions;
- When the acquisition of an existing business or operating unit results in a material increase in the company's total GHG emissions, the base year emissions will be increased by the percentage change in emissions;
- The five percent change indicative of materiality is applicable to each category only and not to fictitious totals;
- When an operating unit is shut down but not sold, no adjustment will be made to the base year emissions;
- For incremental production increases, such as opening a new facility, the base year emissions should not be adjusted the same way as it is for an acquisition.

**5.4 - OUTSOURCING AND OTHER ADJUSTMENTS.** Occasionally, the base year emissions may need to be adjusted for other reasons. For example, significant changes could occur if outsourcing is begun or discontinued. Each situation needs to be evaluated before reaching a decision. Outsourcing should be reported under Indirect Contributions to GHG emissions per the WRI/WBCSD protocol. Not all situations are



described, specifically if no outsourcing occurred at the time of the base year emissions. Adjustments that increase or decrease the base year emissions may be justified according to the new practices. The reasons for any future reevaluation of the decision to adjust the base year emissions must be clearly explained.

Emissions factors also could be changed and newer ones accepted on consensus if such corrections to the baseline appear logical and reasonable. In the design of the inventory workbook, the Working Group recommends a unified system that allows for automatic correction of all cells in any spreadsheet when one correction is made. This important feature makes recognition of baseline adjustments more easily verifiable.

**5.5 - CHAIN OF CUSTODY OF BASE YEAR EMISSIONS ADJUSTMENTS.** Once the base year emissions are completed and accepted as the original, those in charge of the basic documentation and workbook must ensure the integrity of the original base year emissions and the proper recording of any authorized adjustments. A “chain of custody” system must be designed to ensure this provision is implemented. If, for example, the workbook is created in Windows<sup>®</sup> Excel, it should be protected and filed separately from the original.

In addition, a manual system should authorize only one or two persons to introduce changes and to log in details.

All procedures must be in writing.

Whenever the base year emissions are adjusted both the original and the adjusted entire workbooks will be kept properly identified and dated thus ensuring complete traceability of the adjustments.

Database programs such as SQL and ACCESS also are effective for workbook management. Any time someone attempts to alter a cell, they are prompted to enter a date and a name/password that should match an approved person. They also have a log system to record information on all corrections of changes permitted since the inception of the original file.

Regardless of the final format, GP will have a system that ensures only proper adjustments are made, by authorized personnel, and in a completely traceable manner for future verifications and audits. In this sense, the original report and workbooks will be kept intact and subsequent adjustments reported and shown in new workbooks reflecting the specific changes and the resultant “adjusted base year inventory.”

## 6. RATIO INDICATORS

GP management and stakeholders are interested in two principal aspects of GHG emissions management: the level of absolute GHG emissions and the reduction of GHG emissions, measured in *ratio indicators*. Ratio indicators provide information *on the efficiency of an activity*, the intensity of an impact or the quality of a value or achievement. Ratios could facilitate comparison between similar products or processes. They also are used to compare the performance and achievements of one firm, business unit or company to another for

better understanding and interpretation of these achievements. The data and information collected for the GHG Inventory must allow for the use of the following ratio indicators:

**6.1-INTENSITY RATIOS.** Intensity ratios express GHG impact per unit of activity or unit of value. A declining intensity ratio reflects a positive performance improvement. GHG emission intensity is a preferred intensity ratio (e.g. tons of CO<sub>2</sub> equivalent per tons of communication papers).

This is the preferred type of ratio for the GHG inventory, with a tangible link to issues relevant to the corporation (emissions due to the production of articles). This Protocol recommends the use of GHG emission intensity ratios.

**6.2 PRODUCTIVITY/EFFICIENCY RATIOS.**

Productivity/efficiency ratios express the value or achievement of a business as it relates to its GHG impact. Increasing efficiency ratios reflect a positive performance improvement. A common efficiency ratio that could be used to further analyze the inventory results is sales dollars per ton of CO<sub>2</sub> equivalent (e.g., in economic Input/output life cycle analysis, EIO-LCA). Productivity/efficiency ratios are susceptible to frequent adjustments based on the value of the dollar, the GDP in a given year and

cyclical price conditions in certain markets. This is not the preferred type of ratio for a company’s GHG inventory.

**6.3- TRANSPARENCY/VERIFIABILITY FOR RATIOS.**

The principle of transparency must be applied equally to all the data and considerations employed in determining ratio indicators. The objective is to create detailed audit information regarding how the inventory was compiled. Otherwise, neither internal nor external verifiers would be able to adequately examine it for the purpose of providing assurance about the reported inventory and its use. The eventual use of “citizen panels” mandates that the report be also clear and easy to read throughout its organization.

**7- CALCULATION METHODOLOGY**

**7.1 - USE OF GP ENERGY REPORTING**

**FORMAT.** The GP Annual Energy Report (Blue Book) was the reference database and report format used for the first inventory in 1998. It also will be used as the reference database and format for gathering data and designing the workbook and worksheets. The information in the tables shown in Tabs III and IV of the Blue Book was followed as a guide and was adapted from other databases into this format. These databases are the Fort James “White Book” and the European energy/fuel database. The data presented in the “Blue Book” uses BTU and kWh for all locations and product lines. Consequently, other databases and their fuel and electricity reporting systems should be converted and reported in this format.

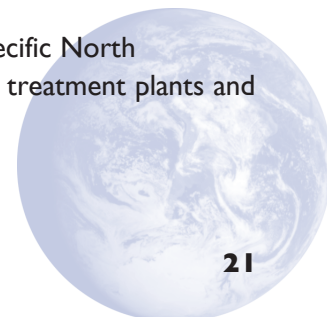
The “Blue Book” provides information by product line (aggregating locations) and by product line with locations (disaggregating). It does not, however, list information by location for those that produce multiple products.

Each facility reports its energy use (tables in Tabs III and IV of the Blue Book) annually by completing a “Fuel & Energy Consumption Data” worksheet. A detailed Guide/Instructions document (See Appendix 3) provides all instructions and detailed factors for converting purchases and process data into energy measurements. Finally, GP’s corporate staff reviews the entries and verifies the accuracy of the submitted data.

**7.2 - CATEGORIES OF GHG EMISSION**

**SOURCES.** A general categorization is as follows:

- Stationary Combustion (from GP, European and Latin America databases)
- Mobile Combustion (specific databases)
- Process Emissions (specific lime kiln and tail gas databases)
- Fugitive Emissions (specific North America’s wastewater treatment plants and landfill databases)



This categorization is very similar to the one in the revised edition of the WRI/WBCSD protocol. GP Protocol further sub-categorizes them according to their nature as biomass and fossil fuel.

**7.3 - ROLL-UP OF FACILITY ENERGY DATA INTO CORPORATE ENERGY DATA.**

A workbook containing several worksheets rolls up the information into the tables appearing in Tabs III and IV of the “Blue Book.” Databases that are not yet in the annual energy reporting system need to be assessed for quality and completeness. That assessment is expected to be positive since the basic information is derived from purchased fuel and electricity receipts and other process data for self-generated fuels and electricity, which are subject to similar scrutiny because of their cost control relevance. In general, the data needs to be converted into BTUs as mentioned earlier. Once complete, the results will be comparable.

The data check from the energy consumption survey or reports must include a variance check approach to alert to notable differences or lack of differences from year to year, etc. This is done now for the Blue Book as well as for other databases.

**7.4 - WORKSHEETS ORGANIZATION AND PHASES FROM ENERGY TO GHG EMISSIONS.**

Excel workbooks and worksheets will be developed and used to gather and transform the initial energy information into GHG emissions. The series of data collection and transformation worksheets are broadly designed as:

*C-1- Energy worksheets* These worksheets consolidate energy consumption data from the three major databases- “Blue Book”, “White Book” and European consumption data.

The fuel and categories in Tab IV of the GP “Blue Book” are:

- A- Electricity
- B- Coal
- C- Residual Fuel

- D- Distillate/Diesel
- E- Liquid Propane
- F- Natural Gas
- G- Wood Waste (biofuels, B.L., etc.)
- H- Steam

Similar categories exist in the other databases. The GP Annual Energy Report (“Blue Book”), in Tab IV, sub-tab A, provides information on the individual power companies that supply electricity to all domestic company locations. This information could be used to develop an accurate emissions factor for each facility’s purchased electricity. The Working Group decided to use the EIA’s adjusted regional electricity emission factors by states published by EIA (Appendix C- Form EIA ±1605, 2000). Electricity emission factors for the European operations also were adjusted for similar regional factors developed by the EIA. The EIA data for the U.S. addresses both carbon dioxide and methane; however, the European data is only for carbon dioxide. More recently, NCASI has issued both for paper and wood products manufacturing facilities, separate calculating tools that we use.

Envisioned worksheets include:

Energy consumption by product line and facility location (in BTUs and kW-hr). From fossil fuels and imported electricity, steam (WS #1). From biomass fuels, self-generated and purchased (WS #2);

Energy consumption by product line Fossil fuels and imported electricity, steam (WS #3). Biomass fuels, self-generated, purchased (WS #4).

*C-2- A “swing” worksheet* will provide all necessary emission factors and conversions for both fossil and biomass fuels as well as electricity emission factors for different regions of North America and Europe. For the sake of transparency and simplicity, the sources of the factors will be noted in this worksheet for future reference.

C-3- GHG emissions workbook- With the necessary adaptations, the workbook will have worksheets such as:

Direct GHG Emissions by Product line with Facility Emissions (WS #5) by Product Line (WS #6) ;

Indirect Contributions to GHG Emissions by Product line with Facility Emissions (WS #7) by Product Line (WS #8);

Emissions from Biomass Energy (self-generated) by Product line with Facility Location (WS #9) (purchased) by Product Line with Facility Location (WS #10); (self-generated) by Product Line (WS #11) (purchased) by Product Line (WS #12); and

Total Direct, Indirect Contribution & Biomass Emissions per Unit Production (emission intensity rates) (WS #13).

Other spreadsheets detailing GHG emissions from wastewater treatment systems, landfills, “tail gases,” lime kiln production, etc., will be added to the general workbook if possible.

**7.4.1 - DESIGN OF WORKBOOK.** The workbook is an essential element of any GHG Inventory. All the worksheets listed in this Protocol are part of an integrated workbook system that allows automatic correction in all the cells of the respective spreadsheets and summary tables. Automatic cell correction reduces errors when the baseline is adjusted or a new emissions factor is used. It also facilitates transparency and verification.

The protected workbook for the GHG inventory needs a log for entries so all corrections and adjustments performed in the original inventory and baseline are recorded and can be traced, verified and assessed in the future. The section 5.5, entitled, “Change of Custody of Base Year Emission Adjustments,” provides more detailed

information about the chain of custody that must be implemented and the role of the workbook design on it.

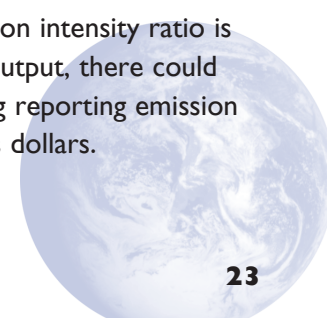
**7.5 - DATA SOURCES AND TYPES.** The majority of the data collected in the GHG inventory is generated by activity data consisting mostly of the purchased quantities of fuels and the use of published emission factors. These are very reliable sources of information since they are totally incorporated in internal accounting procedures. Practically all the direct GHG emissions are estimated in this matter. Likewise, for most the indirect GHG emissions, purchased quantities of electricity, heat or steam, and the use of recognized emission factors comprised and equally reliable and accurate approach.

In addition to the activity data that makes possible the quantification in these two scope levels of categories, the amount of biomass fuel combusted is also closely scrutinized. Purchased biomass generates an activity data based on purchasing receipts and invoices. Internally generated biomass that is combusted is also recorded closely since it becomes an important factor in the combustion efficiency performance of the power center.

There are specific process calculations to derive the GHG emissions from certain process sources such as the lime kiln, the tail gas of chemical plants, the fugitive emissions from wastewater treatment plants and the landfills. The quantification of the product carbon pool annual contributions, according to production and type of product, is a specific GP development, now shared with the rest of the industry. The appendices of the Protocol explain these estimations in detail.

**7.6 - DATA TO COLLECT ON PRODUCTION OUTPUT AND SALES.**

Although the preferred emission intensity ratio is based on unit of production output, there could still be circumstances justifying reporting emission efficiency ratio, based on sales dollars.



### 7.6.1 - PRODUCT CATEGORIES

**(PRODUCT LINES / TYPES).** Product lines and types in TAB III, pages one and two may need adjustments to incorporate Dixie and other specific product lines in the European operations. Quality production data is essential to ensure the intensity ratios are accurate and meaningful. Therefore, caution should be used when aggregating products that are not similar. For example, aggregation in

the gypsum category may be unacceptable due to the diversity of products and the differences in processing and energy used to produce them.

### 7.6.2- SALES BY PRODUCT LINES/TYPES IN 2000.

Sales will be adjusted according to the defined product lines and types. European and Canadian operations' sales will be expressed in U.S. dollars. The use of this information is optional for the inventory report.

## 8- INVENTORY QUALITY — UNCERTAINTY

Using several different approaches, the company has minimized systemic and inherent uncertainties in the inventory. Activity data is the basic quantification tool. The company relies almost entirely on the information gathered by the business units through their normal accounting and cost control procedures. Internal and external auditors consistently audit this fundamental and reliable information. In that fashion, approximately 90 percent of the energy data is derived from the invoices paid in fuels and electricity. The rest of the data is from self-generated fuels that are subject also to intense scrutiny and accuracy because they are important elements of the facility cost controls. Likewise, the GP Protocol provides detailed guidance in a manner that minimizes improvisations in the calculations. Since carbon dioxide is the most prominent GHG for consideration in this inventory, the reporting accuracy of emissions factors for the remaining GHG emissions is not as critical.

For the sake of completeness, the Working Group incorporated GHG emissions from wastewater treatment systems and landfills into the inventory. Although improvements need to be made regarding the accuracy of allocating carbon dioxide emissions

either as direct or neutral, for the purposes of this Protocol, we have considered all carbon dioxide emissions as neutral and the methane emissions as direct emissions.

The inventory incorporates non-manufacturing facilities such as warehouses, offices and other buildings, as well as GHG emissions related to the company's own transportation fleet (Unisource and Building Products Distribution) into the direct emissions category.

The *actual direct and indirect contribution to emissions* is likely to be well within five percent of the reported scope level total<sup>8</sup>, which indicates a high certainty in the inventory results as a whole. Likewise, on an item-by-item basis, the Working Group does not expect any specific item to differ by more than 5 percent of the reported total. Such items include landfill and wastewater treatment fugitive emissions for that category or scope level.

For *biomass neutral emissions*, values provided at the industry level need improvement. Likewise, biomass emissions from the lime kiln, as explained in the worksheets and in the Appendix 2 of this Protocol, are estimated on kiln production

<sup>8</sup>The gross estimation is based on the fact that GP emissions are mostly carbon dioxide from combustion of recognized fuels for which very accurate conversion to GHG factors are available. These conversions are within three percent of the true value. Thus, five percent is a realistic estimation, considering none of the other components such as methane from landfills, etc., amount to more than six percent of the total for a significant scope level and that the precision of the methods is approximately 10 to 15 percent.

averages rather than actual production for the base year. Precipitated calcium carbonate assumptions are relevant as a whole, but not for a specific mill. There also is the question on the factors available to transform biomass energy into GHG emissions. Energy data, however, is solid.

The category or scope level for product carbon pool removals is based on extremely accurate production data and model reliability. To establish a level of uncertainty, however, the model reliability would require more consensus and investigation, based on the accepted U.S. GHG Inventory Report to the U.N.'s FCCC.

**QUANTIFICATION UNCERTAINTY FOR LEVELS 1 AND 2.** Some combined uncertainties can be quantified for elements in Levels 1 and 2. *The uncertainty about GHG emissions from fossil fuels and electricity is for the most part managed with great care because of good records on invoices for fuels and electricity.* The uncertainty for these emissions could be partitioned into two components- uncertainty on the measurement of the activity (energy data gathering) (U1), and uncertainty in the transformation factors (U2).

Considering a +/- range of three percent for each, the combined “c” uncertainty in these estimations (mostly Level 1 and Level 2) are:

$$c = (3^2 + 3^2)^{0.5}$$

$$= +/- 4.2426 \%$$

Thus, in this example, the value for combined uncertainty is applicable to direct and indirect GHG emissions from fuel and electricity purchases.

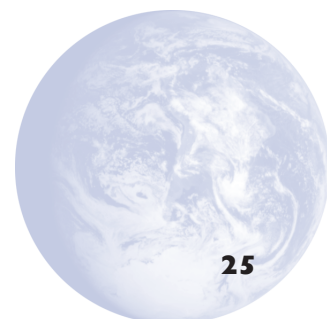
The exception to this combined uncertainty estimation would be the emissions from landfills and wastewater, which represent a smaller fraction of the total biomass C neutral emissions. Still, the transformation factor uncertainty is higher. An effort to incorporate this uncertainty into *the total combined uncertainty for biomass neutral emission reporting* could yield a confidence interval for the entire Level 3 of:

$$C_{de} = +/- \text{sqrt} [(0.042 \times 17473)^2 + (997 \times 0.30)^2] / 18470$$

$$= +/- 4.29\%.$$

The 17473 and 997 figures are the CO<sub>2</sub> emissions from biomass burning, and the fugitive from wastewater and landfills facilities respectively, and 18470 is their total.

At this point, any attempts to further estimate uncertainty for other Level 3 and Level 4 components would be unreliable.



## 9- VALIDATION AND VERIFICATION

The terms listed in the previous section are subject to interpretation as they are applied to projects or programs. For the sake of clarity, the Work Group considers the process of determining the criteria for the inventory Protocol and the inventory itself as validation. In addition, the principles and procedures for performing an inventory must have been effectively implemented. Finally, the data in the inventory must contain proper measures for verification.

*Verification* is the element of the validation that confirms the accuracy and validity of data, its sources and estimates. According to this interpretation, a validation statement cannot be made without verification, but verification in certain cases could be performed outside the umbrella of validation.

**THIRD-PARTY VERIFICATION.** Third-party verification is not a requirement of the GP Protocol; however, all necessary material is available if it is needed. The Working Group reviewed the provisions in Chapter 10 of the revised edition of WRI/WBCSD's, "The Greenhouse Gas Protocol" to determine the criteria for third-party verification of

the final report. The group is confident the Protocol adheres to those recommendations and that a verification/validation could be performed expeditiously and effectively.

In preparing for validation/verification, the company will prepare and issue a Request for Proposal (RFP) preferable to three reputable verifiers. All details, including objectives and references will be provided to facilitate receiving comparable bids.

Under certain circumstances, GP might convene a "review panel" composed of stakeholders, and facilitated by a professional third-party verifier, rather than a professional third-party by itself. Using a review panel is an effective tool for reviewing the Protocol and the base year emission GHG inventory report.

Regardless of the final approach on verification, this Protocol requires the verifying party to provide clear recommendations about improvements and corrections to the procedures of the Protocol in order to improve the accuracy and transparency in subsequent inventory reports.

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## 10- COMPATIBILITY OF THIS INVENTORY PROTOCOL WITH OTHERS

In the opinion of the Working Group, the approach and terms in this Protocol are compatible with the revised edition of WRI/WBCSD protocol of March 2004. WRI/WBCSD inventory protocol efforts, as well as the EIA's reporting requirements per section 1605 (b) of the Energy Policy Act of 1992. Likewise, the present work of NCASI with the international group of pulp and paper associations for "Calculating Tools" (drafted March 2002) on GHG Inventories for a mill is under consideration and does not conflict with any

specific element of the GP Protocol. The corporation anticipates that the data collected will be compatible with reporting requirements in the foreseeable future with minimum adjustments. Finally, the company participates in the developing efforts at the ISO TC 207 level on the ISO 14064 standard which has provided an opportunity for inputting the corporation's views as well as receiving timely new information, ideas or procedures.

## 11- REPORTING

Reporting the results and significant conclusions from the GHG Inventory will follow the customary corporate reporting format. Because of the size and diversity of GP operations and facilities, summary tables will be provided to give executive managers a quick overview of the results in the way that interests them most ± in terms of the production units for which they are responsible.

Subsequent GHG inventory reports should always refer to the base year emissions inventory in order to project the proper and unbiased situation of the corporation regarding progress on climate change

efforts. Permissible adjustments to the base year emissions inventory must be reported in detail and with entire transparency.

If the report is intended for or could potentially reach external audiences, it should be written in a way that is clear to readers not necessarily familiar with internal terms or situations. In the opinion of the Working Group, the reporting, content and format of the GP's inventories meet the intent and most of the content of Chapter 9 of the revised edition of the WRI/WBCSD protocol.

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## 12- AREAS OF FUTURE IMPROVEMENT

During the conducting of our GHG inventories and the revision of the 2002 Protocol, the Working Group identified several informational and procedural areas that the company, the forest products industry and its professional associations need to investigate further, including:

- Better estimations on biomass lime kiln emissions through:
  - accurate kiln product production for the year;
  - accurate information on precipitated calcium carbonate utilization of lime kilns emissions by mill, etc.
- How to apportion biomass emissions from lime kilns in mills with different product lines, reflecting both production rates and process issues;
- How to develop more reliable GHG emissions factors for spent liquor and biomass fuels;
- Update on the model parameters of the product carbon pool removals and their level of uncertainty with more recent data. The production rate element of the model is extremely reliable and verifiable.
- Expand the knowledge and tools for practical “registries” that include both forest and product carbon sinks.
- At the company level complete the linkage of the ITS and CAPMOD systems and training on new forms identifying energy savings elements of capital projects.
- Updating the factors used in estimating the prevented or avoided emissions due to recycling of fiber.



## GLOSSARY OF TERMS

**Avoided or Prevented Emissions.** The GHG emissions that would occur if not for a specific directed action, like a demand side management project, the operation of non-GHG emitting electric generation, or recycling.

**Base Year Emissions / Removals.** The formula providing an historic performance datum for comparing emissions and removals over time.

**Base Year (entity).** For the purposes of this Protocol, a datum against which to measure GHG emissions and removals over time, usually annual emissions / removals in a selected base period of time.

**Baseline (project).** A reference point for what emissions would have been without the intervention of the GHG project.

**Biomass.** Total dry weight of all living organisms that can be supported at each trophic level in a food chain. Also, materials that are biological in origin, including organic material (both living and dead) from above and below ground, for example, trees, crops, grasses, tree litter, roots and animals and animal waste.

**Biomass Neutral Carbon Dioxide.** The carbon dioxide emissions from the oxidation (combustion) of biomass materials and that are part of the close loop natural carbon cycle. These emissions are differentiated from fossil CO<sub>2</sub> GHG emissions.

**Boundaries.** A line drawn to encompass the emissions sources and sinks to be evaluated in an entity or project level report. GHG accounting and reporting boundaries can have several dimensions, i.e. organizational, operational, geographic, sectoral, business unit, and other.

**CO<sub>2</sub> Equivalent.** The universal unit of measurement used to evaluate the impacts of releasing (or avoiding the release of) different GHG based on global warming potential.

**Product Carbon Pool Removal.** Annualized corrections to carbon dioxide that are counted as emissions from wood harvesting, but are still stored in biogenic products in use.

**Certification.** The assurance by an independent party that entity or project emissions and removals have been validated and verified according to the requirements of the standard.

**Close Loop Natural Carbon Cycle.** The process by which biogenic materials, upon oxidation, return to the atmosphere as carbon dioxide that was originally removed from the atmosphere by photosynthesis.

**Cogeneration.** The generation of two forms of energy such as heat and electricity from the same process with the purpose of utilizing or selling simultaneously.

**De Minimis (entity).** The GHG emissions from one or more sources that when summed, equal less than a predetermined level for a specific category or scope level (i.e. direct emissions, indirect emissions, etc.).

**Direct GHG Emissions.** The GHG emissions from sources that are owned or controlled by the entity or project.

**Emissions.** The intentional and unintentional release of GHGs into the atmosphere through a point source or fugitive.

**Emissions Factor.** A factor or calculation relating activity data (e.g. tons of fuel consumed, tons of product produced) and the associated GHG emissions or removals.

**Emissions Reduction.** The decrease in the release of GHG as a result of activities that reduce, remove, capture, or avoid GHG releases.

**Entity.** A legally constituted business organization, governmental body and/or non-profit organization that owns or controls sources, areas or projects from where GHG are emitted, carbon sinks created, and that purchases or sells project credits and offsets.

**Global Warming Potential.** The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gas without directly calculating the changes in atmospheric concentrations. Calculated as the ratio of the radiative forcing from the emission of the GHG to that of carbon dioxide over a period of time.

**Greenhouse Gases (GHG).** Any gas that absorbs infrared radiation in the atmosphere. GHG include but are not limited to carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), perfluorinated carbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>), and halogenated fluorocarbons (HCFCs). Other GHG such as water vapor, ozone, etc. could be added, as more information on them is available.

**Indirect GHG Emissions.** Emissions that are a consequence of the activities of the reporting entity, but occur from sources owned or controlled by another entity. Examples are imports of electricity and steam, outsourcing, etc.

**Inherent Uncertainty.** A difference due to random error or fluctuations between a measurement and its true value. Inherent uncertainty depends on the calculation methodology used, and the measurement of activity/emissions data.

**Intensity Ratios.** Normalized GHG emissions per unit of activity or unit of value.

**Inventory.** The structured gathering of energy and production information, emissions measurements and transforming them into the relevant GHG emission accounting, reductions, removals, avoidance, and emission intensity data.

GHG inventory will also reflect transactions of units sold or purchased.

**Leakage.** The net change of anthropogenic GHG emissions which occur outside the project boundary and that are measurable and attributable to the project activity.

**Management Control.** The ability to govern the operating policies of the entity, facility or project.

**Material.** Any emission of GHG that is not de minimis in quantity.

**Offsets.** An emission reduction achieved by undertaking a GHG reduction project outside the operational control of the entity.

**Organic Growth / Decline.** Increases or decreases in GHG emissions because of changes in production output, product mix, plant closures and the opening of new plants.

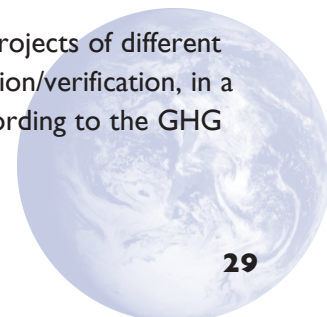
**Outsourcing.** The contracting of activities to other entities.

**Pool (carbon).** Carbon reservoirs and conditions that take-in and store carbon (i.e. carbon sequestered), thus serving to offset GHG emissions. Forest, seas and wood products are typical carbon pools.

**Project.** A discrete or continuous directed action or change in operational procedure that results in a reduction of GHG emission or increase in removal. It must be a differentiated effort with the specific purpose of climate change improvements. It should be of sufficient size to justify the reporting, accounting and validation efforts.

**Reductions.** Any control project, operational or management actions, process changes, etc. that discernably decreases the releases of GHG.

**Registry.** The recording of projects of different categories after proper validation/verification, in a long-term depository and according to the GHG Inventory Protocol.



**Removals.** Reduction of atmospheric GHG through an uptake and storage of carbon by sequestration and creation of carbon sinks by positive carbon stock changes, harvested wood product systems, landfills, injection projects, etc.

**Uncertainty.** The likely difference between a reported value and a real value.

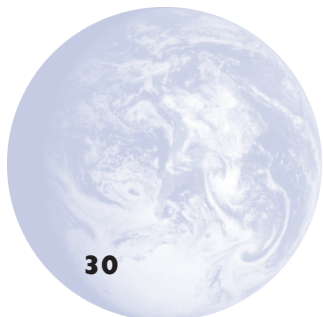
**Systemic Uncertainty.** The result of subjective choices in the calculation methodology such as simplifying assumptions and improper selection of emission factors.

**Validation (entity).** The process of evaluation of entities' GHG inventory (GHG categories or levels), guidance or protocol, baseline and GHG data management systems.

**Validation (project).** The process of evaluation of a project design and the monitoring and verification plan put forward by a project developer to ensure that project performance is adequately monitored.

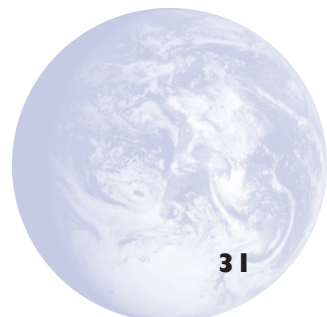
**Verification (entity).** The periodic review and post determination of the monitored emissions and removals quantities as reported in the inventory.

**Verification (project).** The periodic review and post determination of the monitored reductions or removals quantities during the life of the project.



# Appendix I

**Methodology and Procedures to be used for  
Estimating CO<sub>2</sub> Removals as the Result of  
Remaining C in End Product Pools.**



## Background Terminology

**CARBON SEQUESTRATION.** The uptake and storage of Carbon. The removal of carbon from the atmosphere. Trees and plants absorb atmospheric CO<sub>2</sub>. Carbon is stored in carbon sinks or pools (i.e. forests).

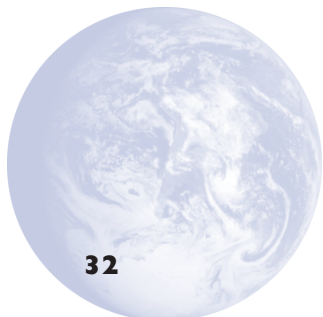
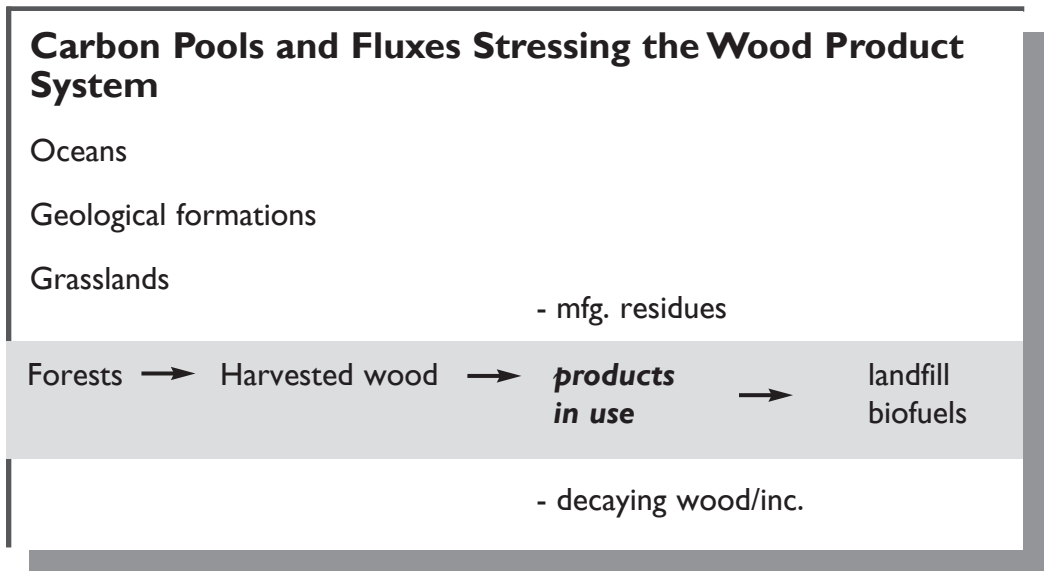
**CARBON POOLS.**

Reservoirs of Carbon.

**CARBON FLUX.** Rate of exchange of carbon between pools (i.e. forest to harvested wood, to products in use, to landfills).

**REMOVALS.** The term reflects the removal, by sequestration, of CO<sub>2</sub> from the atmosphere. In the “balance sheet” of anthropogenic GHG emissions, removals are the credits that counter the emissions (the debit).

**SINK.** Any process, activity, or mechanism removing a GHG.



## Concept and Justification

As explained in the text of the Protocol, accounting for product carbon pool removals is simply the correction or adjustment to the accounting practice that “books” all harvested biomass volumes (or weights) as emissions for the year in question. This correction recognizes the indispensable role of the manufacturing of forest products in making possible a product carbon pool. The Intergovernmental Panel on Climate Change (IPCC) provides several options for estimating carbon stock changes or fluxes from Land Use Changes and Forestry (LUCF). These options are:

- using annual land change statistics on LUCF to derive total carbon flux values, or
- using carbon stock estimates derived from periodic surveys of natural forests. The U.S. uses option two for its estimates.

In addition, IPCC also provides two options for accounting of the harvested wood.

**Option 1.** All harvested wood replaces products that decay in the year of the inventory because the amount of carbon in harvested wood would equal the amount of carbon emissions from the production in the inventory year.

**Option 2.** Accounting is based on a variable rate of decay for manufactured forest products in use according to its disposition, e.g. product pool, landfill, etc. Again, the United States uses option two, which is the variable rate of decay, according to methods from Skog and Nicholson (1996) and Heath (1996).

**GENERAL.** According to Article Five of the Framework Convention on Climate Change (UNFCCC), signatories are obliged to submit annual GHG inventories for the country as a whole. The Environmental Protection Agency (EPA) submits the information for the U.S. Since

1996, the United States’ report on GHG inventories has included the annual removals from both forest carbon sink and product carbon sink, including landfills.

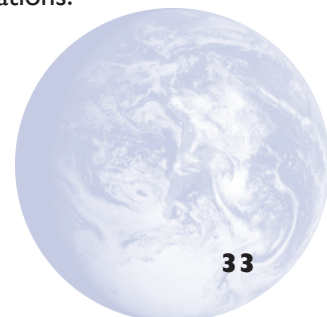
In the UNFCCC, “sink” is defined as, “any process, activity or mechanism that removes a GHG.” This definition fits squarely in the results of the manufacturing process that yields biogenic products, such as those produced by Georgia-Pacific.

The GHG inventories report the amount of pools and the analysis of both forest carbon pool and product pool trends. They indicate the increasing importance of the product carbon pool component of the “removals.” As forest carbon pools decrease for varied reasons (e.g. increasing areas set aside and not included), the product carbon pool increases as part of general population increases and quality of life.

### **THE US NATIONAL GHG INVENTORY METHODOLOGY AS THE BASIS FOR OUR METHOD.**

Conceptually, the methodology used to calculate the US national GHG emissions net is applicable to countries for both carbon stock changes and product carbon sinks removals estimations. The fundamentals of the concept are applicable to corporations with some changes. In the corporate estimation, two major elements are important: 1) the annual product production data; and 2) the calculation methodology.

As indicated on the following page, the US GHG Inventory is able to track down the forest carbon fluxes all the way to the estimation of the carbon sinks from the manufactured forest product in use based on national data since the early 1900’s. The approach is lacking for corporations.



**The Method of Calculation in the US GHG Inventory justifies the product carbon pool.** For example, the US 1990-2000 GHG Inventory report, for 2000, GHG emissions as

Gross Emissions	7,001.2 Teragrams CO <sub>2eq</sub>
Net Emissions	6,098.7 Teragrams CO <sub>2eq</sub>
Sinks	902.5 Teragrams CO <sub>2eq</sub>

**How Are Pools Distributed?** The 902.5 Tg CO<sub>2eq</sub> emission is broken down as:

<b>Forest carbon Flux</b>	<b>770.0</b>
Agricultural Soils	67.4
Urban Trees	58.7
Landfilled yard trimmings	6.4

*Our interest is on the **Forest Carbon Fluxes - 770***

**Disaggregating the Forest C Flux -770 Tg**

**A) Forest Carbon Stock (546.3) Tg CO<sub>2eq</sub>**

Trees	447.3
Understory	14.7
Forest floor	29.3 (an emission)
Down Dead wood	58.7
Forest soils	55

**B) Harvested Wood C Stocks (223.7)**

Wood products	66
Landfilled wood	157.7

*(data for 2000, from US GHG Inventory)*

**The above “tracking” of the C fluxes in the US GHG Inventory report is evidence that it is feasible to quantify the C exchanges between pools down to the carbon in the products in use.**

**Methodology in National Accounting of C Stock Changes in Wood Products**

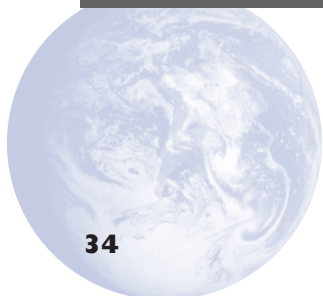
Carbon is tracked from forests through products and end uses, to landfills and emission by decay and burning.

- From Forest to harvested roundwood
- From roundwood to primary products and residues
- From primary products to end-use products and disposal

Use of equation from Row & Phelps to estimate fraction of C remaining in end use for each year after after mfg. It predicts half-life for carbon in each end use. Half life is the time after which half the carbon placed in use is not longer in use.

After retirement from wood-in use pools, bioproducts are recycled, landfilled, burned w & w/o energy, or let decay

The Method of Skog & Nicholson (Forest Product Journal, July/August 1998, p. 75-83)



## The Method of Calculation in the US GHG Inventory

Typically the carbon stock calculations in a company’s forest management operations are explained elsewhere and generally follow the results of merchantable wood accounting with additional extrapolations to total biomass. In most cases, carbon soil changes are considered minimal in conventional forest management practices. If changes in land use are involved, specific considerations may be needed. Harvested wood is considered an emission source of GHG.

Some specific considerations for product carbon pool removals calculations include:

Considering only end-use products. Primary production cannot be included since the transformation from raw material to finished products occurs rapidly. For example, in the case of containerboard that is used to make corrugated packaging, only corrugated packaging production should be included. Estimations for forest products deposited in landfills are not justifiable to the company and are not part of the inventory estimations for category or Scope Level 4. When the discarded product arrives at the landfill, the chain of property has been broken more than once. Proper accounting and justification as an owned “removal” for the company would be elusive at the very least. Therefore, the landfill carbon pool is properly included in the national GHG inventory.

**Characterization Model for Estimating Remaining Carbon in Product Pools.**<sup>9</sup> To estimate the amount of carbon equivalent that can be considered remaining in storage in product sinks, the retirement rate of the forest products and carbon should be estimated according to the functionality of the product. Row and Phelps (USDA) have developed a characterization

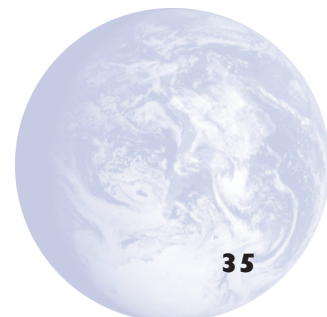
model that uses a 3-segmented curve to estimate the proportion (%) of wood products remaining in the end-use pool. It is based on the half-life average and the functional use of the specific product. The Internal Revenue Service (IRS) of the U.S Department of Treasury generates half-life estimates for a variety of products according to functional categories such as single-family building, multi-family building, etc. Logically, different kinds of wood products can be classified into one given functional category. This model is reflected in the U.S. Annual Inventory of GHG, an official report to the United Nations Climate Change Framework Convention.

The time a wood product remains in use (T) is determined largely as a function of the average useful life (L) and the proportion (P) of that product remaining in the pool at a selected time. The selected T of 100 years exceeds the higher half-life average value of 67 years. The selection also reflects the 100-year horizon selected for the GWP factors. In this manner, the indicator results from the two impact categories will be expressed as C-equivalent and in the same time horizon. T and P are expressed as:

$$T = f(L, P) \quad P = 0.5 / [1 + 2(\ln T - \ln L)]$$

**REFINING THE CHARACTERIZATION MODEL AND FACTORS FOR THE PRODUCT POOLS.** The USDA Forest Service developed an equation to account for recycling that extends the useful half-life of the C stored in a particular product end-use pool and increases the remaining fraction.

<sup>9</sup>Excerpted from ISO 14047-TR-2002.



The equation below illustrates the extended half-life, where **L**= Revised expected half-life, **H** =the original half-life and **R**= the proportion the product is being recycled into the same product category.

$$L = H / (1 - R)$$

The benefits of recycling/reuse in estimating product carbon pool removes can be represented in other ways. Galeano<sup>10</sup> describes different procedures of forest product allocation based on the “number of uses”, a concept transferred into the ISO 14041 standard for allocation practices.

### **NATIONAL INVENTORY APPROACHES NOT ENTIRELY SUITABLE FOR ENTITY QUANTIFICATION.**

Albeit the U.S. GHG Inventory implicitly reaffirms the appropriateness of including the product carbon pool in an entity inventory, it does not provide complete methodology for its quantification by entities. The U.S. GHG Inventory follows closely the recommendation of the Intergovernmental Panel on Climate Change (IPCC) Tier 2’s suggestion to estimate the carbon stock changes in the product carbon pool.<sup>11</sup>

It estimates stock changes by netting annual additions to stocks-in-use against annual losses occurring in that year. Additions to the stocks of carbon in the pool result from data on production or consumption for the year in question. Losses are estimated in different ways. For national inventories, IPCC suggests a first order decay equation that estimates losses from the current carbon pool. Additions and losses, year-by-year, since 1900 or a relatively distant date then estimates the current carbon pool. This is of course completely impractical for entities, which are not expected to have available, such types of information.

In the referenced example of ISO 14047, Georgia-Pacific proposed a suitable approach in which current year additions to stocks in product-in-use are netted against the future losses from current year additions. Thus, the approach estimates the amount of carbon in the year’s production of the entity that is expected to remain in use at the end of the selected 100 years. The current year additions are simply the production quantities of the entity or manufacturing facility for the current year. Future losses from current additions (and consequently the remaining in use quantity) are obtained using the three-segments curve equation of Row and Phelps. This approach is eminently practical as accurate or more accurate than foreseeable straightforward use of the national inventory approach.

### **THE SPREADSHEET GPCARB.™**

Georgia-Pacific has developed a practical tool that permits a company or manufacturing facility to quantify its annual contribution to the product carbon pool according to its annual production and the type of product (e.g. timber, plywood, etc.) and functionality (residential, commercial, etc.).

The Excel spreadsheet provides complete information on the values used in the Row and Phelps functions allows for specific values for the product dimensions and half-lives. It is available, free of charge, from Georgia-Pacific.

In 2004, the industry via its main association, the American Forest and Paper Association (AF&PA) adopted GPCARB™ (under the generic name of “100-year model”) as the calculating tool in its reporting of product carbon sequestration to the DOE for the VISION program.

<sup>10</sup> Galeano, S.F. Ch. 35, “Life Cycle Assessment of Product Systems” in “ Industrial Environmental Control”, 3rd Edition, edited by A.M. Springer (2000).

<sup>11</sup> Intergovernmental Panel on Climate Change (IPCC). 1997c. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (Volume 3). IPCC National Greenhouse Gas Inventory Program. <http://www.ipcc-nggip.iges.or.jp/public/gl/invs6.htm> (20 Nov. 2001)

## Steps in the GP Calculating Method for Annual Carbon Removal from the Forest Product Pool

- 1- Identify end products of the company (not primary products readily converted into end prod.)
- 2- Express production in terms of tons (for both paper and wood products)
- 3- Convert tons of end products to tons Carbon
- 4- Allocate quantities of C in end products into functional categories
- 5- Apply fractions of C remaining after 100 yrs, to above (Row & Phelps)

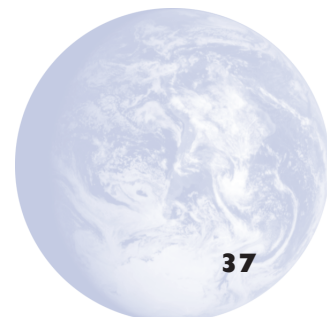
### Identify end products of the company (not primary products).

**Examples:**

- Industrial Wood Products: MDF, particle board, hardboard, Structural Panels; I-beams, OSB, Plywood
- Lumber
- Gypsum paperboard
- Corrugated packaging
- Tissue & Towel
- Printing paper; communications, copier, etc.

*No market pulp/containerboard/ parent rolls production included*

**STEP 1**



**STEP 2**

**Express production in terms of tons (for both paper and wood products).**

**Examples**

Hardboard	850,000	MSF x factor =	260,000 tons
Lumber	2,500,000	MBF x factor =	3,300,000 tons
Packaging	2,900,000	tons x factor =	2,900,000 tons

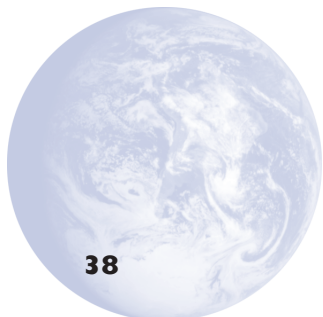
There are available conversion factors for all different wood products from MSF, MBF, MLF, etc. to tons

**STEP 3**

**Convert tons production to tons Carbon**

**Examples**

Lumber	Wood, 50%	C content, 44%
Printing paper	80%	44%
Packaging	90%	44%



**STEP 4**

**Allocate quantities of C in end products into functional categories.**

**Examples**

<i>Categories</i>	<i>% in Category</i>	<i>MM tons C</i>
<b>WOOD PRODUCTS</b>		
I family residence	40	0.66
multi-family residence	30	0.49
Upkeep/improvement	20	0.33
non-residential	10	0.16

**STEP 5**

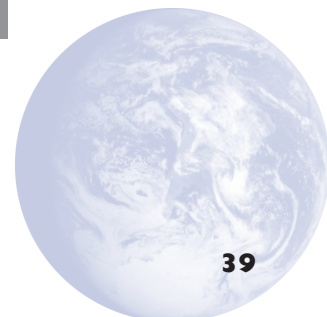
**Apply fractions of C remaining after 100 years, to above (Row & Phelps) and obtain removals sought. Original work (1990) comprised 12 functional categories. Used a 3-segmented curve function to represent the retirement of each product category according to its half-life. From it, R&P developed remaining fractions after certain No. of years, up to 100, for each functional category\*.**

**Examples**

<i>Category &amp; Product</i>	<i>MM tons C</i>	<i>Fraction Remaining</i>	<i>Removal MMtons C</i>
Lumber in I fam. Residence	0.60	0.34	0.204
Printing Paper	1.80	0.05	0.09

(\* See also table and graph at end of this Appendix)

As indicated in Step 5, the amount of annual C removal from the product carbon pool to be reported as a category in the GP GHG Inventory is given in the right-hand side column.



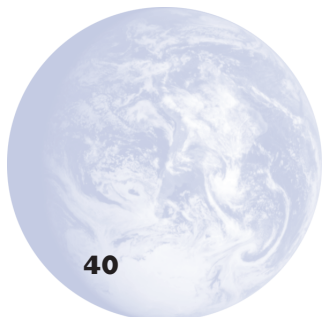
### **Note: Reflecting Recycling Benefits**

Row & Phelps suggested extending the original half-life (HL) of the product by incorporating the recycle rate (RR) for a given product.

$$\text{HL ext.} = \text{HL orig.} / (1 - \text{R.R.})$$

There are other ways such as number of uses, etc. that can be used to reflect this ONE aspect of recycling.

ANOTHER aspect of the recycling benefits would be to estimate the increase C sequestration (increase in forest C sink) by extending the carbon storage benefit of the equivalent growth of the tree not harvested because of recycling.

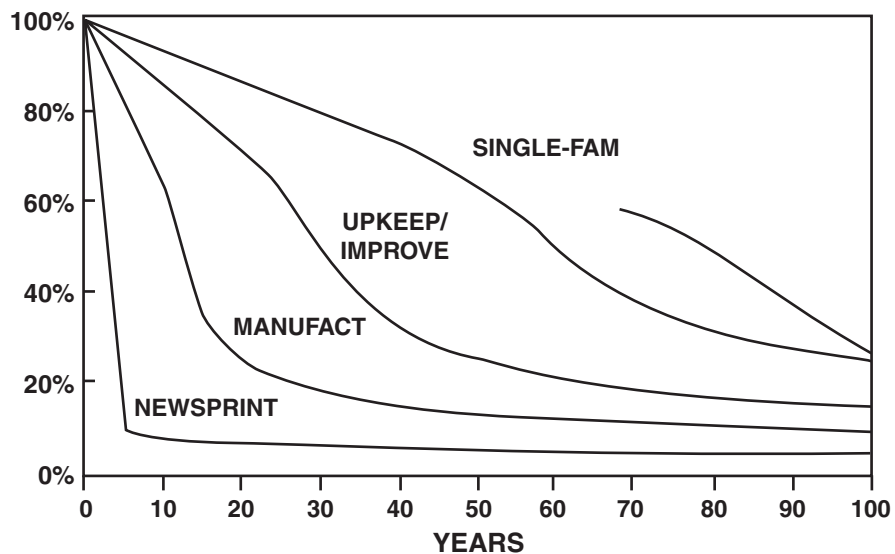


**Carbon Release From Wood-in-use Pools Over Time**

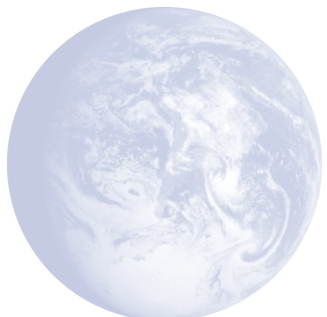
Period ending in year	Metric tons of carbon											
	I-family	Housing Multi-	Mobil	Maint. & Repair	Non-res building	Manu- ftrs	Ship- ping	Other uses	News- print	Print/ write	Tissue papers	Pack- aging
5	0.095	0.021	0.043	0.123	0.027	0.133	0.109	0.142	0.766	1.024	0.711	0.698
10	0.095	0.021	0.044	0.123	0.027	0.135	0.141	0.142	0.033	1.244	0.024	0.027
15	0.095	0.021	0.076	0.123	0.027	0.235	0.030	0.142	0.012	0.249	0.009	0.010
20	0.095	0.021	0.036	0.115	0.027	0.112	0.012	0.133	0.007	0.101	0.005	0.006
25	0.095	0.021	0.015	0.136	0.027	0.047	0.007	0.157	0.004	0.057	0.003	0.004
30	0.095	0.019	0.009	0.185	0.027	0.027	0.004	0.213	0.003	0.037	0.003	0.003
35	0.086	0.022	0.006	0.257	0.027	0.017	0.003	0.297	0.002	0.027	0.002	0.002
40	0.093	0.026	0.004	0.181	0.024	0.012	0.002	0.209	0.002	0.016	0.002	0.002
45	0.108	0.032	0.003	0.109	0.027	0.009	0.002	0.126	0.002	0.013	0.001	0.001
50	0.127	0.040	0.002	0.073	0.031	0.007	0.001	0.085	0.001	0.011	0.001	0.001
55	0.152	0.044	0.002	0.053	0.036	0.006	0.001	0.061	0.001	0.009	0.001	0.001
60	0.186	0.031	0.002	0.040	0.042	0.005	0.001	0.046	0.001	0.008	0.001	0.001
65	0.207	0.022	0.001	0.032	0.050	0.004	0.001	0.036	0.001	0.007	0.001	0.001
70	0.152	0.016	0.001	0.026	0.060	0.003	0.001	0.030	0.001	0.006	0.001	0.001
75	0.112	0.013	0.001	0.021	0.052	0.003	0.001	0.024	0.001	0.006	0.001	0.001
80	0.086	0.010	0.001	0.018	0.038	0.002	0.001	0.021	0.001	0.005	0.001	0.001
85	0.069	0.008	0.001	0.015	0.030	0.002	0.001	0.018	0.001	0.005	0.000	0.000
90	0.056	0.007	0.001	0.013	0.024	0.002	0.000	0.015	0.001	0.004	0.000	0.000
95	0.047	0.006	0.001	0.012	0.019	0.002	0.000	0.013	0.000	0.004	0.000	0.000
100	0.039	0.005	0.001	0.010	0.016	0.001	0.000	0.012	0.000	0.004	0.000	0.000
Total	2.089	0.405	0.248	1.664	0.637	0.766	0.320	1.924	0.840	2.854	0.768	0.761
Remain	0.715	0.111	0.027	0.310	0.257	0.085	0.027	0.369	0.046	0.239	0.040	0.041
% Remain of Total	34	27	11	18.6	40	11	8	19	5	8	5	5

*From Row and Phelps, "Determining the Flows and Disposition of Carbon in Timber Harvest and Wood-in-use," August 5-11, 1990, Montreal, Canada*

**Carbon Remaining in Selected Wood-in-use Pools**



*From Row and Phelps, August 5-11, 1990, 19th World Congress IUFRO, Montreal, Canada*

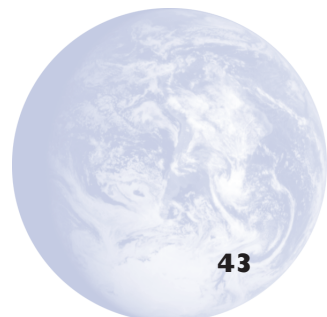


# Appendix 2

## Selection and Estimation of Specific Conversion Factors

(to GHG CO<sub>2eq.</sub>)

(Using 2000 data in some instances)



# I - Chemical Division, Tail Gases CO<sub>2</sub> Emissions

Estimates from Thermal Destruction FA and Resin Units - Division.  
 (Example for the Estimation of the Factor.)

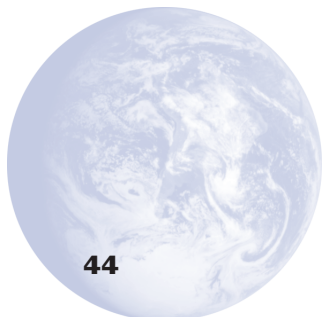
Components in Emission		Heat released	
FA and Resin Group		BTU/hr	
- Carbon Monoxide	197.487 lb-mol/hr	197.487 lb-mol/hr CO <sub>2</sub>	24,046,453
- Dimethyl ether	19.749	39.498	11,288,101
- Methanol	4.937	4.937	1,435,369
- Formaldehyde	1.975	1.975	447,593
- Methyl Formate	0.107	0.214	77,766
	Total	244.111	Total 37,295,282
Resin Group			
- Phenol	0.056	0.336	72,243
- Formaldehyde	0.280	0.280	63,512
- Dimethyl ether	0.112	0.224	64,070
- Methanol	0.280	0.280	83,568
- Thiethylamine	0.006	0.036	9,844
	Total	1.156	Total 293,236
	Total	245.267	

**Released BTU /yr** FA& Resin Group -  $8400 \times (37,295.282) = 313.280$  billion BTU

Resin Group -  $8400 \times (293,236) = 2.46$  billion BTU

Annual GHG Emission CO<sub>2</sub> =  $245.267 \times 44 \times 8,400$   
 = 90,650,683#s or **45,325 tons CO<sub>2eq.</sub> factor,**  
**46,325 tons CO<sub>2eq.</sub> / 315.74 billion BTU = 146.72**

The value of this factor or ratio depends on the type and number of facilities included in the inventory and it is important that the factor be developed for the specific inventory and not be considered a final, constant value. The proper factor will be used in the “swing” worksheet to maintain the integrity of the design workbook.



## 2- Distribution Centers - Electrical Consumption

### ESTIMATES BASED ON COVERED SURFACE AND OUTDOOR LIGHTING.

The included worksheet provides for a total of 11.175 million sq. ft. of covered area (warehousing) and 9.06 million sq. ft. of useable outdoor space (parking, etc.).

Assuming year-round lighting in the warehouse at 1.0W/sq. ft., electrical consumption is:

$$11.175.961 \times 1. \times 8,760 \times 1/1000 = 97, 901. 420 \text{ Kwh indoors}$$

Assuming 12 hrs /day average of lighting and with 1600 W per 5,000 sq. ft, electrical consumption is:

$$9,062,125 \times 1600/5000 \times 4380 \times 1/1000 = 12,701,475 \text{ Kwh, outside}$$

**Total 110,602,895 Kwh /yr**

### 2A - PAPER DISTRIBUTION CENTERS.

Electricity consumption at paper distribution centers is approximately 60 percent that of building products centers.

Procedure — 110,602,895 Kwh /yr divided into 110 centers = 1.05 MM Kwh per building products facility

$$60 \text{ percent of } 1.05 = 0.630000 \text{ MM Kwh per facility}$$

Total Paper distribution Units in the USA

	283 x 0.63 = 220 MM Kwh
Canada	27 locations at 0.63 = 17.01
Mexico	22 locations at 0.63 = 13.86

---

## 3- Indirect Contributions to GHG Emissions - Imported Steam

Estimates Based on Same Regional Approach as for Electricity In estimating carbon dioxide and methane emissions indirectly associated with electricity consumption, GP refined the conversion factors to reflect the diversity of its operations across North America. The information is provided in the Department of Energy’s (DOE) reporting instructions per EIA’s March 2001, “Updated State Level GHG Emission Factors for Electricity Generation” (Also appearing in API’s GHG Estimation Methodologies, April 2001 Table 4-30).

The same emission factors were applied for imported steam on the assumption that, unless the imported steam comes from a bio-fuel boiler, the fuel mix will be the same as the estimated EIA factors. For example:

For Halsey, OR mill, pulp production, GP purchased 91.7 billion BTU’s in 2000. Per the company’s classification of states, the region is nine

and the regional factor is 0.432 CO<sub>2eq.</sub> per Kwh. These figures take into consideration the efficiencies as provided by the NCASI “ Calculating Tools” document, allocating 0.80 for steam and 0.35 for electricity. Thus,

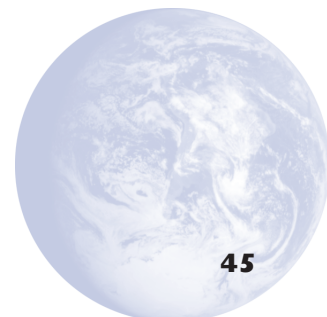
If Kwh equals 3,413 BTUs, CO<sub>2</sub> per BTU in purchased steam will be:

$$1/3413 \times 0.35 / 0.80 = 1.28 \text{ E-4}$$

and for Halsey,

$$1.28 \text{ E-4} \times 0.432 \times 91.7 \text{ billion BTU} = 0.507 \times 10\text{E}+7 \text{ \#s CO}_{2\text{eq.}}$$

$$= 2,450 \text{ tons tons CO}_{2\text{eq.}}$$



## 4 - Net Zero for Carbon Dioxide from Biomass Oxidation

**JUSTIFICATION IS BASED ON CLIMATE CHANGE ACCOUNTING PRACTICES AND SCIENTIFIC REASONS.** The advent of the Framework Convention on Climate Change formalized the recognition of carbon sequestration as a balancing element that to a certain extent, in quantity and time, would balance the increase in GHG emissions. This recognition, known as removals in the lexicon of the Framework Convention and the Kyoto Protocol, provides for the consideration of net-zero or no contribution of CO<sub>2</sub> emissions from biomass oxidation to the global warming GHGs. Although recognized officially by different domestic and international agencies, the GP CCTF would like to succinctly advance two powerful justifications.

**ACCOUNTING.** The United States and Canada use a recognized accounting practice that also is included in the IPCC methodology to calculate carbon stocks. Accordingly, all harvested biomass is booked as an emission in a given year. Biomass products or fuels are the result of a harvesting action. Thus, emissions of C from the oxidation (combustion) of biomass materials must not be counted again.

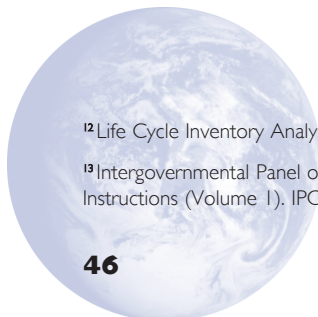
**SCIENTIFIC CONSIDERATIONS.** With the help of solar light energy, photosynthesis sequesters atmospheric carbon dioxide, converts it initially to glucose and later into more complex organic elements. This process creates the biomass in a tree that continues sequestering atmospheric CO<sub>2</sub> as long as it grows. For example, when biomass fuel is burned, it emits the oxidized form of the complex organic elements previously formed from sequestered atmospheric carbon dioxide. In this carbon dioxide sub-cycle, the biomass absorbs the atmospheric carbon dioxide and emits it into the atmosphere later as carbon dioxide, maintaining the cycle as long as biomass growth takes place<sup>12</sup>.

The net-zero character of the biomass oxidation has been recognized by many agencies, some of which are referenced in this Protocol<sup>13</sup>.

The GHG Protocol considers only the CO<sub>2</sub> emissions from biomass oxidation to be subject to the net-zero qualifier. Both methane and nitrous oxides are considered direct emissions.

<sup>12</sup>Life Cycle Inventory Analysis- User's Guide. The International Working Group. Page 2-18 et al. TAPPI Press, 1998.

<sup>13</sup>Intergovernmental Panel on Climate Change (IPCC). 1997a. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions (Volume I). IPCC National Greenhouse Gas Inventory Program. <http://www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm> (26 Nov. 2001).



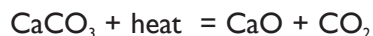
## 5 - Emissions from Lime Kilns in the Pulping Recovery System

Considerations for Fossil Fuel and Biomass Oxidation Emissions.

**DIRECT EMISSIONS.** All direct emissions from burning fossil fuels in the lime kiln are already accounted for in the inventory since the total amount of fuels used in the pulp mill are inventoried in the energy database. This information should be recorded in the first set of workbook worksheets dealing with purchased fuels, gas or oil. The other source, calcination, is analyzed as:

**BIOMASS NEUTRAL EMISSIONS.** Both the nature of the emissions and their quantity will be analyzed in:

**Nature. Causticizing** is a fundamental process in the chemical recovery system of the pulping process, whereby residual inorganic chemicals are recovered and modified to obtain the original pulping chemicals. The basic reaction is represented by the conventional equation:

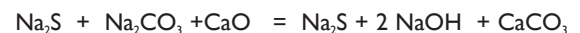


In typical cement kilns, the CO<sub>2</sub> is considered a direct emission since the limestone was extracted (mined) from a carbon sink; however, this is not the case in the pulp mill lime kiln. Although the fundamental equation is accurate, the nature of the CaCO<sub>3</sub> is different. In the 1970s, Galeano's (15) pioneering work on the thermodynamics in the recovery furnace of the pulp mill indicated the calcium carbonates' nature going into the kiln.

The pulping (cooking) liquor is basically sodium hydroxide and sodium sulfide (NaOH and Na<sub>2</sub>S, respectively). After cooking, the spent liquor (black liquor in the Kraft process) contains lignins and other organics from the separation of the wood fibers, etc. It also contains the inorganic chemicals

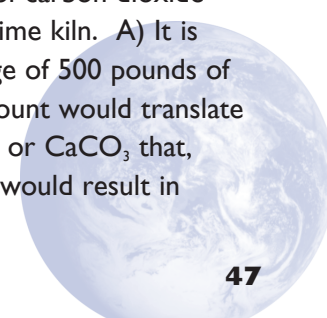
that need to be recovered to regenerate the cooking liquor. It is important to remember that the sole source of carbon is from the biomass itself. No other carbon input has taken place in the cooking and subsequent recovery process at the recovery furnace, where the black liquor is fired after being concentrated in evaporators. The recovery furnace is operated in reduced conditions at its bottom and the resulting "smelt" is comprised of sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>) and sodium sulfide (Na<sub>2</sub>S). The smelt is dissolved in a smelt tank, clarified and becomes green liquor. In Kraft containerboard mills, manufacturing liners and medium, the "cross-recovery" practice utilizes the green liquor as a pulping agent for the production of hardwood pulp medium.

The green liquor is causticized with lime to regenerate the missing NaOH needed as the other cooking liquor agent. The reaction is:



The carbon in the sodium carbonate is the carbon in the wood material subject to the cooking process and later to the oxidation/reduction processes in the recovery furnace. The calcium carbonate from this reaction is precipitated, washed, dewatered and then fired in the lime kiln to produce the lime (CaO) and release carbon dioxide. The carbon dioxide is from the carbon in the biomass wood and consequently is a net-zero GHG emission. The GP Protocol calls for reporting it at Scope Level 3, jointly with the biomass fuel fired in the boilers or otherwise oxidized.

**QUANTITY.** Two sources of carbon dioxide emissions are possible in the lime kiln. A) It is possible to consider an average of 500 pounds of lime per ton of pulp. That amount would translate into 900 pounds of limestone, or CaCO<sub>3</sub> that, when burned in the lime kiln, would result in



approximately 400 pounds of carbon dioxide. Of these 400 pounds, 380 pounds originate from the neutral biomass and 20 pounds are from make-up mined limestone or direct emissions. This is an estimate of the conventional make-up limestone used in the process, and can be refined mill by mill.

Fossil fuels also are used to fire the kiln. As indicated earlier, the amount is already reflected in the inventoried emissions based on fossil fuel receipts.

The Protocol’s suggested procedure can be explained with an exercise. These numbers may or may not be the same as those that appear in the final Inventory.

**TONNAGE.** As an example, data provided by the engineering department indicates that the TPG kiln discharge is 1212.5 TPD, based on the kiln’s total annual production. At 350 operating days, 424,375 tons of kiln product is produced. The biomass carbon dioxide emissions are linked to kiln production and not to the fuel used to fire the kilns. A typical factor of 0.76, CO<sub>2</sub> to CaO, is used with a 95% CaO purity.

The carbon dioxide emissions are estimated as:

Biomass neutral	424,375	x	0.76x0.95	=	306,399 tons
Direct emissions	424,375	x	0.76x0.05	=	16,126 tons

GP has not been able to obtain exact quantities of precipitated calcium carbonate, PCC, manufactured from the carbon dioxide emissions of the kilns at these mills. In the absence of specific data on PCC the following assumption can be made.

Considering the national levels of recovery, this study assumed that 20 percent is recovered and thus not emitted as carbon dioxide of either nature: biomass or direct. (More precise estimates will be used when proper information is obtained),

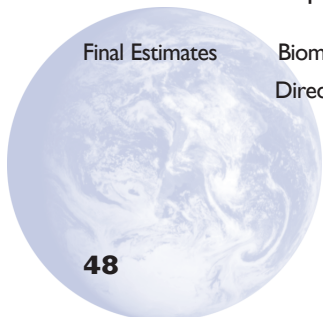
Final Estimates	Biomass Neutral	245,000 tons CO <sub>2eq</sub>
	Direct Emissions	12,901 tons CO <sub>2eq</sub>

**SUGGESTED PROCEDURES FOR WORKSHEET CALCULATION OF FACTORS FOR BIOMASS CO<sub>2</sub> EMISSION ALLOCATION.**

All worksheets in the workbook should be linked so that if a change is made in the value of one cell, all other cells in related worksheets will be changed automatically. The structure of the workbook advances from energy consumption in billion BTUs to its transformation into GHG emissions. The integrity of the system will be broken if the emissions are not related to billion BTUs, regardless of the fact that these biomass emissions are not the result of any type of fuel use (but rather a result of a process).

Consequently, the workbook designer may create a “dummy” “billion BTU” value that, when multiplied by a factor, will yield the GHG emissions from a specific mill. The following procedure is suggested to link kiln production output to the biomass carbon dioxide emissions, and to determine different kiln operating rates:

The annual production per mill is then multiplied by 0.76 times 0.80 since only 80 percent of the total is considered emissions according to the estimated use of precipitated carbon carbonate (if no better information is available). The dummy billion BTU value will be exactly the same number as the corrected tons of CO<sub>2</sub> generated in the preceding step. A factor of 1.0 will multiply each of these values to generate the biomass GHG emission using the dummy billion BTU.



**APPORTION FOR KRAFT MILLS WITH COMBINED PRODUCTION.** The earlier procedure allows taking the biomass GHG emission value per mill. In addition, the lime kiln biomass emissions estimates must be apportioned at the location level whenever the mill manufactures more than one product. The biomass neutral emissions are an integral part of the unit process that serves different product lines and, as such, should be reflected in the ratio indicators. Accurately apportioning these values could become a project in itself, therefore, the first inventories can be simplified. However, because GP mills do produce many different products, the company should strive to accurately report the results.

For example, in a containerboard facility with cross-recovery for the medium production, how much of the biomass emissions from the lime kiln are attributed to the liner and how much to the medium? In this case, apportioning by production rates is crude. Based on production rates of different products produced at the same mill, a simplified apportionment method is suggested, which in the case of containerboard mills with cross-recovery, is based on both production and process factors.

Two examples provide an approach for these estimations:

**Multiple production - Four products -**

*Estimated lime kiln biomass carbon dioxide allocated to mill-170,000 tons/yr*

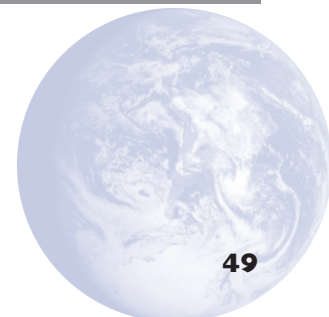
	Production/yr	Production Ratio	
Production of printing paper	195,070 tons	0.22	37,400 tons CO <sub>2</sub>
Foodboard	215,858	0.25	42,500 tons CO <sub>2</sub>
Tissue	216,700	0.24	40,800
Towel	256,761	0.29	49,300
	884, 389	1.00	170,000

**Multiple Production - Two products - Containerboard and Medium**

*Estimated lime kiln biomass carbon dioxide allocated to mill-209,000 tons/yr*

		Production Ratio	Process Ratio*	Final	
Production of Liner	861,997	0.77	0.90	0.83	173,470 tpy
Medium	254,135	0.23	0.10	0.17	35,530
	1,116,132	1.00			209,000

(\* In this specific case, the pulp for the medium is not Kraft pulp as for the liner but uses chemicals of the "green liquor" of the chemical recovery process.)



## 6- Emissions from Landfills and Wastewater Treatment Systems

Fugitive Emissions from Landfills (methane) and mixed aerated lagoons (CO<sub>2</sub> and CH<sub>4</sub>).

**LANDFILLS.** Pages 33 and 34 of NCASI’s, “Calculating Tools for Estimating GHG from P&P Mills,” provide the equation and coefficients for the calculations of methane. The landfills include those owned and operated by GP at operations such as plywood plants, pulp and paper mills, gypsum plants, etc., and total 34 distinct facilities. These methane emissions will be reported as direct emissions. The biomass neutral concept applies only to the carbon dioxide.

**AERATED LAGOONS.** Eighteen (18) treatment systems will be analyzed and the estimates made according to three major references listed in the worksheets. As with landfills, the methane emissions will be reported as direct emissions. The carbon dioxide emissions from these facilities are not considered direct emissions since they are from biomass grown from a cellulosic source. It is the microorganism growth that removes organic pollution due to the wastes from biomass processing (pulp fibers, liquors spills, etc.).

## 7- Avoided Emissions and Additional CO<sub>2</sub> Sequestration from Recycling

The Protocol recognizes the beneficial consequences of the recycling activities of Georgia-Pacific by providing for the quantification and reporting of two distinct contributions under the scope level of “Other Categories.” Georgia-Pacific recognizes that it is “pushing the envelope” on this matter and it is not providing this reporting element at the same status as the other scope levels, 1 to 4. We consider that the life cycle inventory studies conducted by the EPA<sup>14</sup>, with input from peers, is a valid reference to initiate the dialogue about these entries. Two types of contributions could be used in the report of the GHG Inventory.

a) Avoided emissions from landfills. For this contribution, the calculation is straightforward and simplified to one type of paper in this manner. From Exhibit 8-10 of the referenced source, we take the values for three types of

waste paper, for the national average in landfills as in 2000, and average them.

Office paper	-2.52
Old corrugated cartons	-1.12
Mixed papers, broad	-1.22

Ave = - 1.59 MTCO<sub>2</sub>E/ton of reclaimed waste paper

This factor will be applied to the quantity of recovered waste paper recycled at GP facilities and not to the amount recovered by our subsidiary Harmon Inc. of New York.

b) Additional CO<sub>2</sub> Sequestered. The study by EPA, and general understanding on the matter, indicates that for each ton of reclaimed waste paper, in the average, there is an incremental carbon sequestration in the forest of 0.73 metric ton of carbon equivalent, MTCE or

<sup>14</sup> “Solid Waste Management and Greenhouse Gasses - A Life Cycle Assessment of Emissions and Sinks,” U.S. EPA, 2nd Edition, EPA 532 R-02-006, May 2002



2.69 MTCO<sub>2</sub>E. It is understood, and so stated in the EPA report, that this fraction would change as the mix of the wastepaper stream changes and the recycling rates increases.

additional sequestration, the company can only use the quantity recycled in its facilities. Claiming the entire recovered quantity would create double-counting.

As in the allocation for the contribution of recycling in landfills, for this contribution in

## 8- Selection of Conversion Factors

**8.1- ADJUSTMENTS TO ELECTRIC GRIDS-NORTH AMERICA AND EUROPE.** For North American operations, GP used the same carbon dioxide and methane factors as EIA’s March 2001, “Updated State Level GHG Emission Factors for Electricity Generation.” Information about nitrous oxides is generally not recognized, and reported values appear to be insignificant.

- EPA AP-42 uses 195 pounds of carbon dioxide per million BTU (HHV).

For the purposes of this document, the Working Group used the average of the last two values **or 208 # CO<sub>2</sub>eq./ MM BTU.**

The European data also was adjusted according to the 1999 EUROGRID information provided by the International Energy Agency (2000). This information applies only to carbon dioxide. Consequently, European facilities reported no indirect contribution of methane to the GHG emissions entry level.

The conversion values for spent liquor (black liquor) are very difficult to obtain in a recognized way. Finland uses a value of 110 metric tons carbon dioxide per Terajoule, and in Sweden, the value is 108 as reported in NCASI’s “Calculating Tools” document. This document uses an average value of **109 metric tons of carbon dioxide per terajoule or 253 #CO<sub>2</sub> / MM BTU.**

**8.2- FACTORS FOR BIOMASS AND SPENT LIQUORS (BLACK LIQUOR).** GP used NCASI-recommended values for biomass fuel. Here are some of the available values:

- IPCC uses 109.6 metric tons carbon dioxide per Terajoule (TJ) LHV;
- EIA uses 222 pounds of carbon dioxide per million BTU (HHV);

