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14-16 April 2009, Baltimore, Maryland

Sectoral Guidance for Consistent and Accurate Greenhouse Gas Emission Assessments

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API Greenhouse Gas (GHG) Working Group

MISSION

Develop a set of voluntary guidelines and tools for the oil and natural gas industry to account for, calculate and report GHG emissions

- Established a decade ago
- Collaborated with global and regional oil and natural gas industry associations
- Focused on publishing publicly available documents and tools

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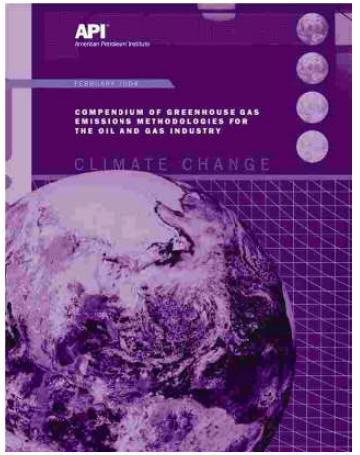
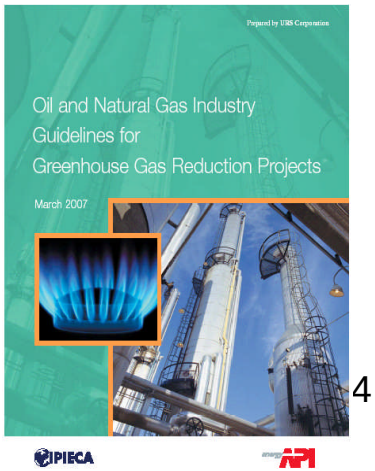
Greenhouse Gas Inventory Evolution

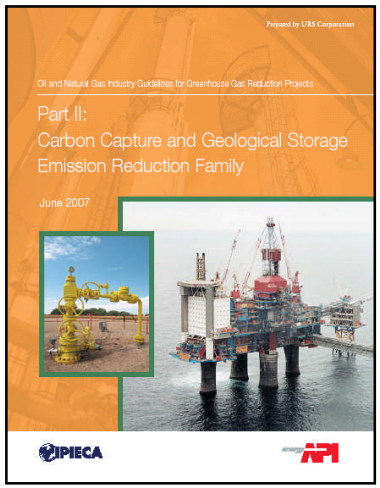
- Industry Trends
  - Moving from internal inventory development to external Carbon disclosure reports
  - Ongoing refinements of methods to improve accuracy and completeness
- Regulatory Trends
  - Movement towards stricter voluntary reporting
  - Emerging mandatory reporting programs to support policy development
- Increased stakeholder interest

New and Updated Guidelines

- API Methodology Compendium Version 3.0
  - Compilation of GHG estimation methodologies for the Oil & Gas Industry
- Uncertainty Document
  - Technical considerations and calculation methods
- GHG Project Guidelines
  - A series of guidelines for GHG emission reduction projects







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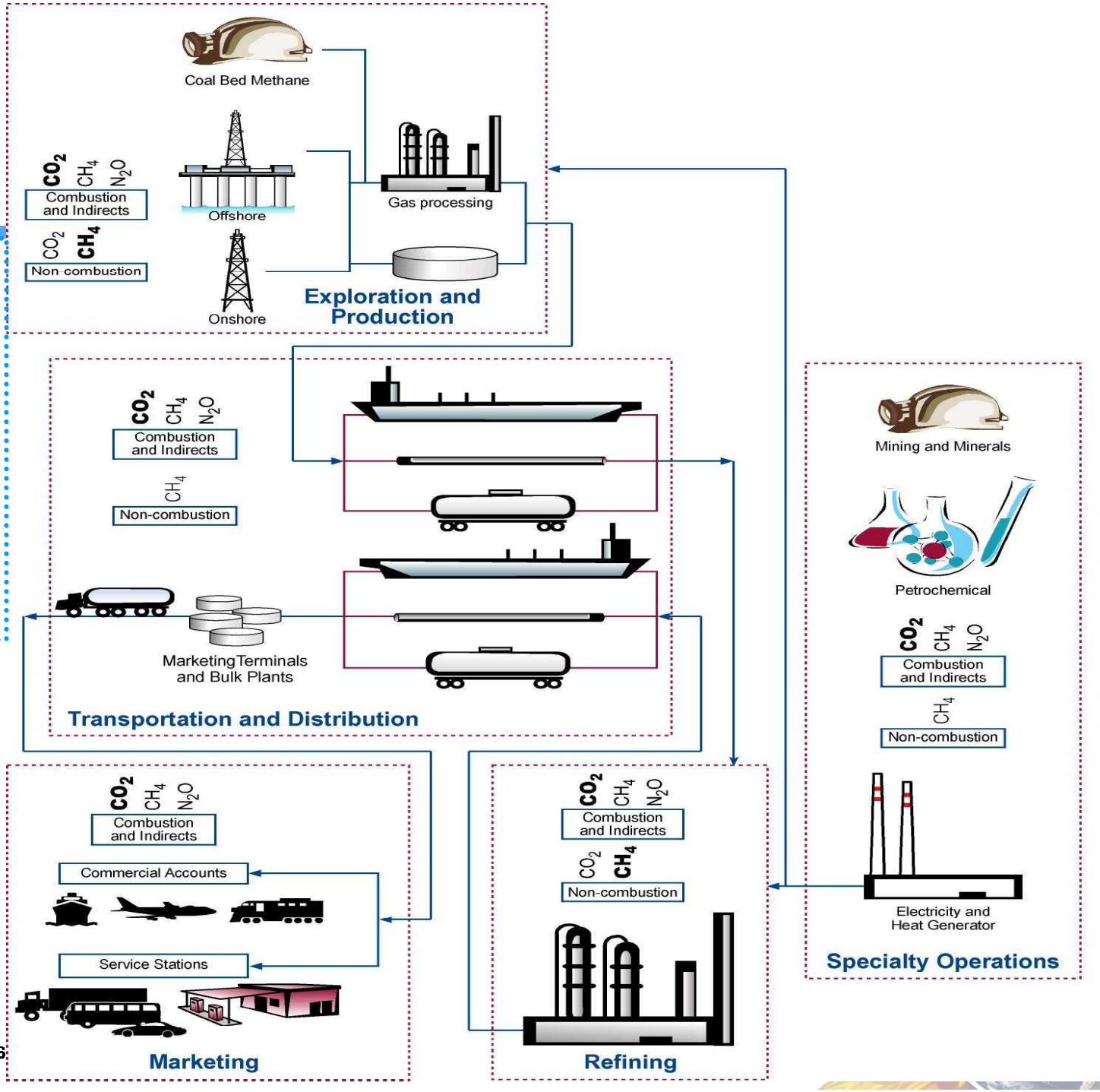
API Methodology Compendium

Oil & Natural Gas Greenhouse Gas Inventories

- Key questions:
  - Which company facilities and emission sources are to be included?
  - How will the inventory account, if at all, for indirect emissions from operations outside the company's facilities but created in support of its operations?
  - What methods are available to calculate GHG emissions from a wide variety of sources?
- Overarching Goal:
  - Reliable, efficient and cost-effective industry-endorsed methods for estimating and reporting GHG emissions.

Oil and Natural Gas Industry Schematic of GHG Emissions



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Establishing a GHG Inventory

- Categories of emissions sources:
  - **Combustion:** stationary sources and portable devices;
  - **Vents:** both normal venting from processing, storage, and product loading or off-loading as well as emergency releases;
  - **Fugitives:** unintentional leakages from piping components and seals as well as wastewater and other waste handling
- Special challenges
  - Complexity of facility designs and operations
  - Heavy reliance on self-generated fuels
  - Integrated systems on a continental level
  - Resources needed for data collection

Compendium Organization

Section 1 - Introduction

Section 2 – Industry Description

Section 3 – Technical Considerations

Section 4 – Combustion Devices

Section 5 – Process and Vented Emissions

Section 6 – Fugitive Emissions

Section 7 – Indirect Emissions

Section 8 – Emission Inventory Examples

Compendium Organization

Appendix A – Additional Combustion Calculation Approaches

Appendix B – Additional Vented Calculation Approaches

Appendix C - Additional Fugitive Calculation Approaches

Appendix D – Supporting Material for Indirect Emission Factors

Appendix E – Other Background Information

Appendix F – Summary of Refinery Fugitive Emissions Study

Key Compendium Revisions

- Decision trees revamped to address materiality, data availability, and accuracy;
- Emission factors updated to reflect changes in referenced documents;
- Emission calculation approaches expanded:
  - Dehydration, acid gas removal, tank flashing, pneumatic devices, H2 plants, catalytic cracking units, asphalt blowing, and wastewater treatment;
- Inventory uncertainty considerations introduced to reflect concepts from the Uncertainty Document;
- Referenced uncertainty ranges recalculated to reflect 95% confidence intervals;
- Case studies updated.

Uncertainty Document

Rationale for Developing the Uncertainty Document

- Provide companion document for API Compendium and Industry Guidelines
- Improve GHG Assessments
- Enhance confidence of attaining compliance
- Focus data collection resources
- Assess applicability of existing emission factors
- Simplify statistical calculation approach

About the Uncertainty Document

- Technical considerations for uncertainty analysis at the facility and entity level
- Sources of GHG inventory uncertainty
- Role of industry practices and standards
- Approaches for calculating uncertainty
- Methods for error propagation
- Example applications for Oil & Natural Gas inventories

Uncertainty Document Organization

Section 1 - Introduction

Section 2 – Sources of Uncertainty

Section 3 – Overview of Measurement Practices

Section 4 – Statistical Calculation Methods

Section 5 – Calculation Examples

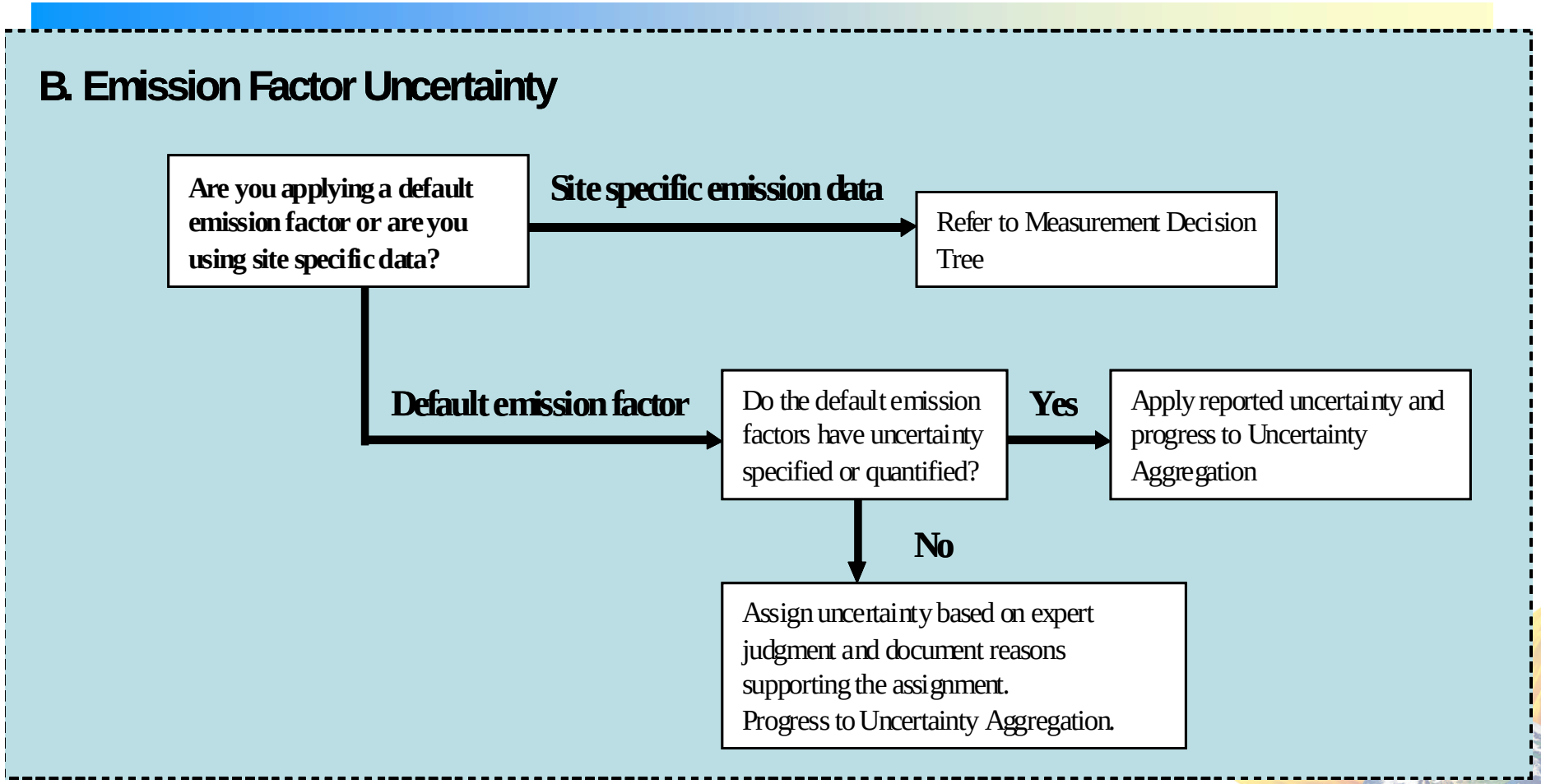
Appendices

- **A** – Glossary of Statistical and GHG Inventory Terms
- **B** – Flow Meters Inspection & Maintenance
- **C** – Measurement Methods Summaries
- **D** – Units Conversion
- **E** – Calculation details for example inventory

Quantifying Uncertainty

- General Steps
  - Determine the uncertainty for measured data;
  - Determine the uncertainty for emission factors data;
  - Aggregate uncertainties.
- Statistical calculation methods provided with guidance to applicability
- Decision trees used to help navigate
- Pertinent examples embedded in text

Example:
Use of Decision Trees



Use of Uncertainty Analysis

- Uncertainty analysis is a tool to assess the confidence range for reported GHG emissions
- The analysis is usually a blend of statistical calculations aided by expert judgment
- It is an excellent tool for
  - Understanding the main contributors to errors
  - Enable targeting large contributing sources for more intense data collection
  - Devising strategies to improve GHG inventories

GHG Projects Guidelines

Accounting for GHG Reductions

- Guiding principle:
  - Reported information should provide a faithful, true, and fair account of the reductions achieved;
- For existing operations
  - Historical activity levels and operating practices, often provide the most realistic baseline scenario;
- For new operations
  - Objective and credible prediction of what would have happened in the absence of the project;
- Methods used for estimating and monitoring project reductions should be fit for purpose

Project Guidelines Organizations

Section 1 - Introduction

Section 2 – GHG Reduction Project Concepts and Principles

Section 3 - Policy Considerations

Section 4 - Overview of GHG Project Families

Section 5 - Cogeneration Project Family

Appendices

- **A-1** - Summary of GHG Project-Based Emission Reduction Registries
- **A-2** - Summary of GHG Project-Based Emission Reduction Inventories
- **B-1** - Cogeneration Project Case Studies
- **B-2** - Baseline Methodologies for Grid-displacement Reduction Projects

GHG Reduction Calculation Steps

- Baseline Considerations
  - Plausible situations or conditions that would have occurred in the absence of the GHG reduction project
- CHP Projects Characteristics
  - Net change in GHG emissions from the imported energy streams in the baseline scenario relative to the emission sources created by the project
- GHG Emission Reduction Calculations
  - Difference between baseline emissions and GHG reduction project emissions for a given time period, typically on a recurring annual basis

Example:

GHG Reduction via Cogeneration

- **Scenario 1**: New Cogeneration Unit
  - A facility CHP system consisting of NG fired combustion and steam turbines;
  - The fuel source used may replace or displace more carbon intensive fuel sources used off-site.
- **Scenario 2**: Increased on-site energy use
  - The CHP system provides an improvement to overall energy efficiency as compared to the separate generation of electricity and steam
  - Previously imported energy is replaced with on-site generation and excess electricity is exported to grid.

GHG Reduction from CHP Scenarios

		ANNUAL CO_2-E (Tonnes/year)	
		CASE # 1	**CASE # 2**
BASELINE SCENARIO	*Electricity Equivalent Emissions*	162,315	161,959
	Electricity Grid Displacement	801,496	406,103
	Steam Equivalent Emissions	153,678	353,802
	Total Baseline Emissions	**1,117,489**	**921,864**
CHP PROJECT	***Total Direct Emissions***	840,773	463,373
NET GHG EMISSION REDUCTIONS		**276,716**	**458,491**

Next Steps

- Version 3.0 of API Compendium is in last stages of technical review
  - Expect to be released by May 2009
- Companion Uncertainty Document undergoing industry experts review
  - To be released as a Pilot Version by June 2009
  - Stay open for comments and 'road-testing' for one year
- GHG Reduction Projects Guidelines on Flaring is being reviewed
  - Expect to be published by May/June 2009

Summary

- Decade-long effort by the Oil & Natural Gas industry resulted in credible and consistent methodology guidelines
- The revised API Compendium - in conjunction with the Uncertainty Document - are now at the forefront of emission estimation methods
- The Project Guidelines provide a consistent framework for assessing the GHG emission reductions projects
- The Oil & Natural Gas industry will continue outreach, dissemination, and development of additional relevant guidelines

Thanks for your attention

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