

Sixth Annual Conference on Carbon Capture & Sequestration

Regulatory/Oversight Programs

Incorporating Carbon Dioxide Transport, Injection and Storage into the U.S. GHG Inventory

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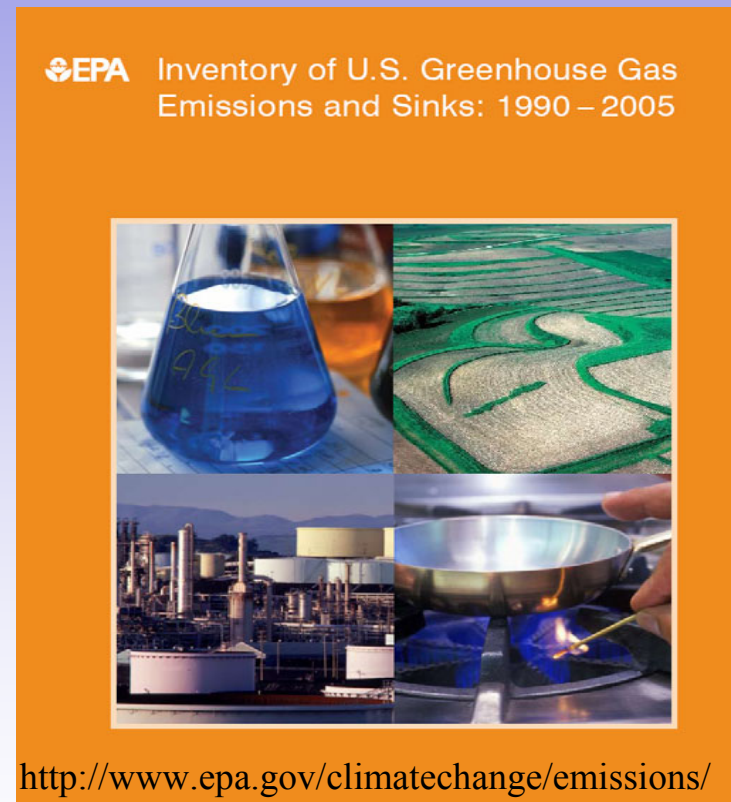
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Overview

- **Overview of the *Inventory of U.S. GHG Emissions and Sinks***
- **How carbon capture and storage is accounted for in most recent *Inventory***
- **New international reporting guidelines on carbon dioxide capture, transport, injection and geological storage**
- **Proposed process for incorporating carbon dioxide capture and storage in future inventory submissions**

Overview of the U.S. GHG Inventory

- Under the United Nations Framework Convention on Climate Change countries have an obligation to:
“...Develop, periodically update, publish and make available...national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol...”
- The U.S. has submitted an annual inventory since 1995- most recent submission April 2007.
- Includes anthropogenic emissions
 - CO₂, CH₄, N₂O, SF₆, PFC's and HFC's
- Covers six sectors
 - Energy; Industrial Processes; Solvents and Product Use; Agriculture; Land Use, Land Use Change and Forestry; and Waste
- Developed in accordance with Guidelines from the Intergovernmental Panel on Climate Change (IPCC)

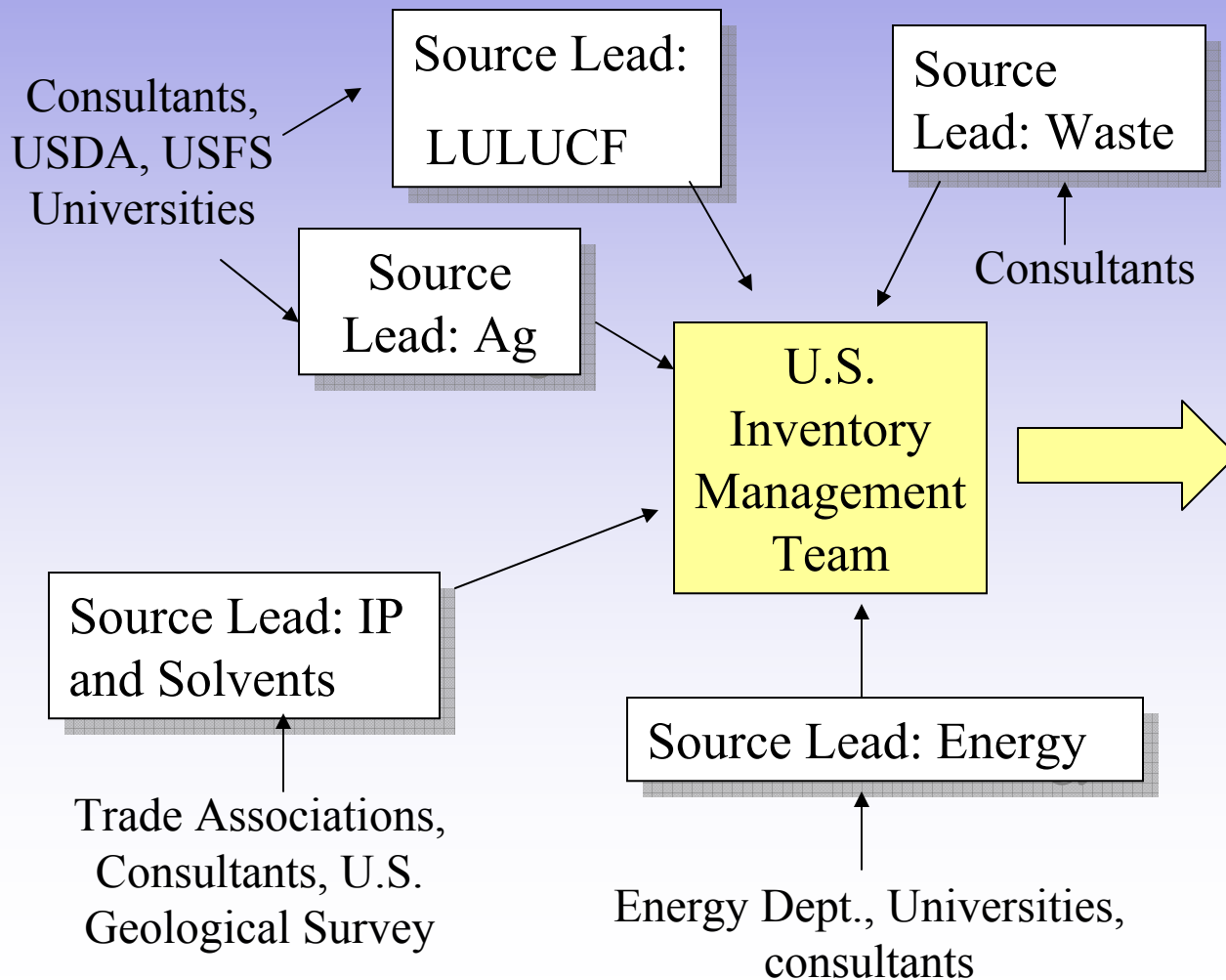


IPCC Guidelines

- The Intergovernmental Panel on Climate Change (IPCC) develops international reporting guidelines
 - First step in 1995
 - Revised 1996 IPCC Guidelines
 - 2000 Good Practice Guidance and Uncertainty Management in National GHG Inventories (good practice guidance for Land Use, Land Use Change and Forestry in 2003)
 - 2006 IPCC Guidelines for National GHG Inventories
- Countries follow the IPCC Guidelines in developing national Inventories for submission to the UNFCCC
- Combustion-related emissions reported separately from process and fugitive emissions.
- Different “tiered” methodologies presented
- The 2006 Guidelines reflect “state of the art”
 - Updated emissions factors
 - Updated methodologies to reflect the latest science
 - New sources (including CO₂ capture, transport, injection and storage)
 - New gases

U.S. National System for Inventory Development

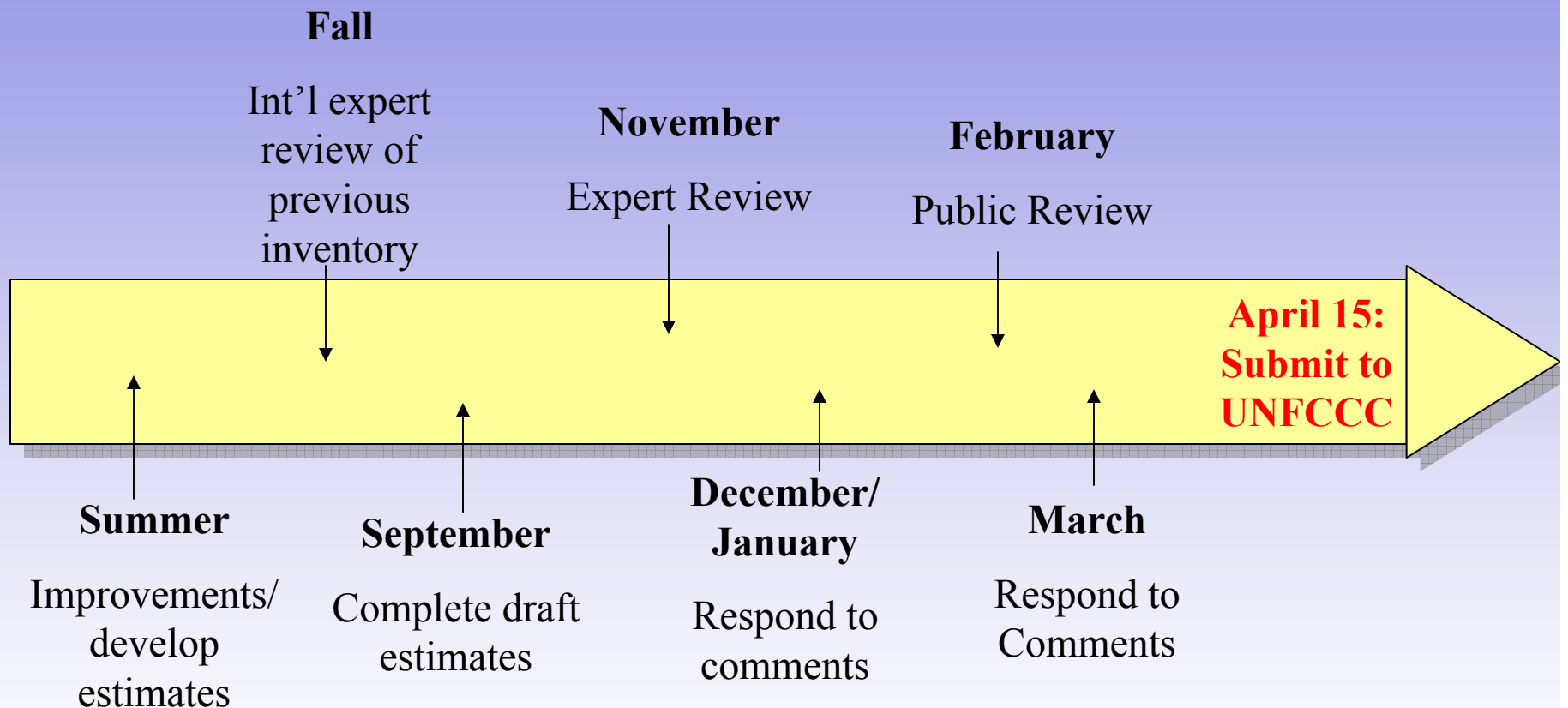
- Interagency effort led by EPA
- Other agency involvement includes EIA, DOE, USDA, Dept. of State, USGS, DOD, DOT, BTS and Forest Service



Management Team (in EPA)

- ◆ Assemble Estimates
- ◆ General QA/QC
- ◆ Cross-Cutting Analyses
- ◆ Conduct peer and public reviews
- ◆ Archive Inventory

Timeline for Inventory Development



How CCS Chain Addressed in 2007 Inventory Submission

- Do not directly report emissions from CO₂ capture, transport, injection and storage.
- Current inventory assumptions:
 - Natural CO₂ used for EOR remains sequestered;
 - Natural CO₂ used for non-EOR applications is emitted; and
 - CO₂ emitted from gas processing and ammonia plants assumed to be emitted regardless of application.
- Include a text box discussing the methodological change introduced by 2006 IPCC Guidelines.
 - Values are not reflected in the national inventory totals.

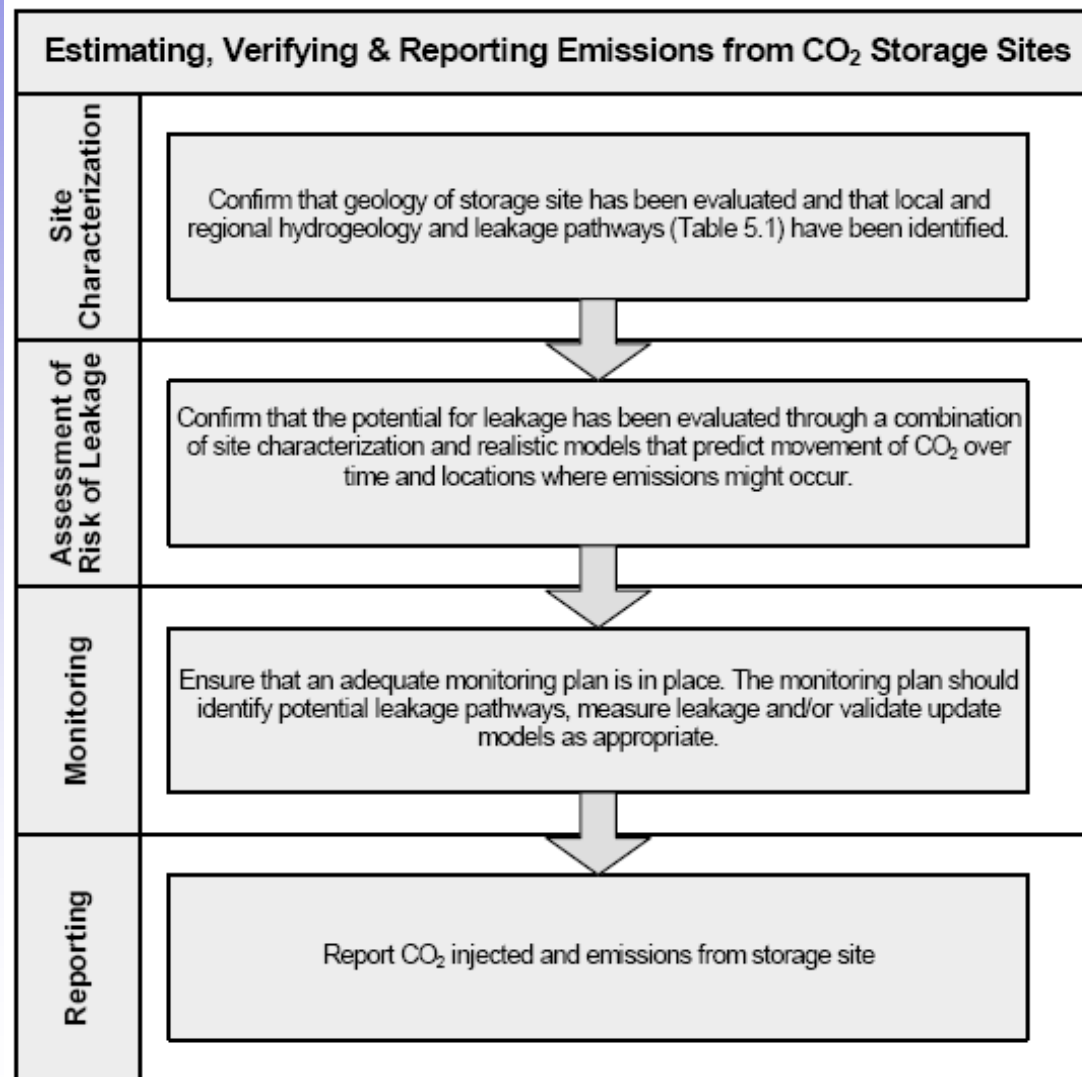
2006 IPCC Guidelines

- CO₂ transport, injection and geological storage included as a source for the first time
 - Does not address ocean storage or conversion of CO₂ to carbonates.
- *“It is good practice for inventory compilers to ensure that the CCS system is handled in a complete and consistent manner across the entire energy sector”*
 - Capture should be accounted for where it occurs (e.g., gas processing, ammonia, cement plants)
 - Fugitive emissions from transport, injection and storage are accounted for as separate sources
 - Stationary/mobile combustion associated with capture through storage activities are accounted for, but separately.
 - Combustion-related emissions addressed elsewhere in Guidelines; current effort focuses on fugitive emissions.

2006 Guidelines: Methods for Estimating Emissions from Transport, Injection & Storage

Transport	Injection	Storage								
<p>Tier 1: Apply default emission factor to pipeline length.</p> <table border="1" data-bbox="172 792 810 954"> <thead> <tr> <th>Low</th> <th>Med</th> <th>High</th> <th>Units</th> </tr> </thead> <tbody> <tr> <td>0.00014</td> <td>0.0014</td> <td>0.014</td> <td>Gg/y/km</td> </tr> </tbody> </table>	Low	Med	High	Units	0.00014	0.0014	0.014	Gg/y/km		
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0.00014	0.0014	0.014	Gg/y/km							
<p>Tier 3: Leakage obtained from data on number and type of equipment and equipment-specific emission factors.</p>	<p>Tier 3: Amount of CO₂ injected is monitored at wellhead/ monitoring of surface facilities.</p>	<p>Tier 3: Site-specific assessment of potential emission pathways.</p>								

Estimating CO₂ (and CH₄) Emissions from Storage



Source: 2006 IPCC Guidelines (Vol 1, Chpt 5)

Reporting & Documentation in 2006 Guidelines

Prior to start of storage project

- Methods/results of site characterization
- Methods/results of modeling
- Description of monitoring program
- Relevant background information
- Year CO₂ storage began/will begin
- Proposed sources of CO₂
- Infrastructure in whole CCS chain between source and storage

Annual Site Information

- Mass CO₂ injected in reporting year
- Mass CO₂ stored in reporting year
- Cumulative CO₂ stored at site
- Source of CO₂
- Infrastructure between source/storage
- Report on monitoring program, including any emissions
- Report on any adjustment of/forward modeling necessary
- Results of 3rd party verification of the monitoring program and methods.

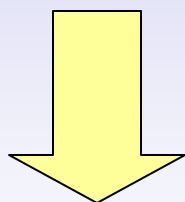
Cross-border

Country A: Reports capture, emissions from transport and any temporary storage, quantity CO₂ exported.

Country B: Quantity CO₂ imported, emissions from transport, temporary storage, injection and storage.

Data Gaps for Incorporating CCS in Inventory

- Data available on the quantity of CO₂ captured
- Preliminary data available to estimate CO₂ emission from transport
- Data not readily available to estimate emissions from capture, injection and storage



Work with stakeholders to enable the U.S. to fully reflect the storage of CO₂ in our National GHG Inventory

Proposed Process for Incorporating CCS into National GHG Inventory

Summer 2007	Distribute discussion paper to industry; solicit feedback
November 2007	Requested industry feedback on discussion draft
Early 2008	Host an inventory meeting based on content and comments on discussion paper; discuss methodologies, data gaps, compile any available data
Summer/Fall 2008	Develop preliminary estimates of CO ₂ emissions from capture, transport, injection and storage for inclusion in 2009 Inventory submission to UN.
April 15th, 2009	Submit Inventory to the UNFCCC with estimates
Beyond April 15th, 2009	Continue to work with stakeholders to improve/refine inventory estimates

Thank You

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