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## Landfill Gas Carbon Credits – Impacts for Landfill Owners

APWA Congress  
Columbus, OH  
September 14, 2009

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## Agenda

- Overview of GHG markets
- GHG Credit Development Process
- Review of Voluntary Markets
- Risk Management
- State, Regional, and Federal Initiatives

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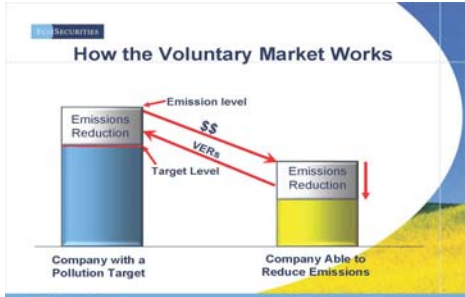
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## GHG Markets, How Do They Work?



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## GHG Market Project-Level Description of Existing Project



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## Who is Buying?

- Corporations, Businesses, & Institutions
  - Growing consumer demand for environmentally responsible companies
  - Offer new carbon neutral products and services
  - Competitive Positioning/Market Value for "green" organizations
  - Environmental Stewardship/Corporate responsibility
  - Compliance/Economic Risk Mitigation
  - Universities (280 have pledged carbon neutrality)
- Speculators

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## Who is Buying (cont.)

- Individuals (through retail GHG providers)
  - TerraPass: Purchased offsets and RECs from LFGE projects at
    - CrossRoads LF, ME
    - Bavarian LF, KY
    - Tontitown LF, AR
    - Catawba Co. LF, NC
  - CarbonFund: Purchased offsets from LFGE at
    - New Bedford LF, MA
    - North Country LF, NH
  - Atmosclear: Purchased offsets from LFGE project at
    - Des Plains LF, Illinois

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## What are GHG Buyers Looking For?

- Renewable energy projects are highest priced project types
- Landfill gas projects continue to be highly valued
  - 2008 Average Price = \$8.20
- Lowest value projects in 2008:
  - Industrial gas
  - Soil sequestration
  - Geological sequestration



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## What are GHG Buyers Looking For? (cont.)

- Must own green attributes of LFG (or at least GHG credits)
- Landfills with at least 1,000,000 tons of waste in place and sufficient depth (> 35 ft.)
- Landfills with recently installed GCCS which require low capital cost and have GHG credits ready for sale

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## Current Pricing and Market Status

- Methane prices up in general
  - Mar/Apr 09 = \$6.20
  - (up from \$5.10 Jan/Feb 08)

- CCX has minimal current value
  - \$0.35 on August 10, 2009



- Credit prices most dependent upon which protocol used
  - Gold Standard has highest value (few in US)
  - Followed by CAR
  - VCS
  - CCX

\* New Carbon Finance, VCI Index Mar/Apr 2009

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## GHG Credit Pricing

- 2008 average price for voluntary market was \$8.20/tonne of CO<sub>2</sub>e (volume weighted)
- Buyer determines value
- LFG currently a small, but growing, percentage of total credit "supply"
  - 16% in OTC markets
  - 7% in CCX
- Other project types can diminish value
  - Volume of low-value industrial gas projects
  - Infusion of large amounts of credits from coal-mine methane projects

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## GHG Credit Quality Impacts the Price

- High quality projects would be new, voluntary, located in a compliance market area, and clearly additional.
- Buyers also like "charismatic" projects that promote sustainability (e.g., reforestation, renewable energy)
- Value dependent upon protocol
  - e.g., Gold Standard, CAR, VCS



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## Who are the Deal Makers?

- Asset Developers – develop projects to sell VERs to other players or final buyer
- Originators – purchasers of credits, but no interest in significant equity investment
- Retailers – also own portfolios and sell smaller amounts to individuals, institutions, or organizations, may provide equity

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## Who are the Deal Makers? (cont.)

- Brokers – Assist in transacting the sale of VERS into the marketplace (matchmaking for a fee)

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## Examples of Carbon Asset Developers

- BlueSource
- EcoSecurities
- Element Markets
- Environmental Credit Corporation
- GE/AES GHG Services
- SCC Americas

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## What GHG Markets Exist?

- Voluntary Markets
  - Currently where most of the activity occurs
    - 123.4 Million Tonnes in 2008
  - Chicago Climate Exchange (CCX)
    - 69.2 Million Tonnes in 2008
  - Over the Counter (OTC)
    - 54 Million Tonnes in 2008
  - Auction/RFP process
- Compliance Markets
  - California AB32
  - Regional Greenhouse Gas Initiative (RGGI)
    - Regional cap-and-trade program in ten Northeast and Mid-Atlantic states
  - Federal cap and trade legislation



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## Voluntary Markets or Mechanisms

- **Chicago Climate Exchange (CCX)**
  - Contractually binding, multi-sectoral integrated GHG emissions reductions registry and trading system
- **Over the Counter (OTC) Approach**
  - Various Project participants and protocols (e.g., CAR, VCS, ISO) that are generally grouped together
- **Auction/Request for Proposal Approach**



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## U.S. Compliance Markets

- **Regional Greenhouse Gas Initiative**
  - Northeast states
- **Waxman-Markey Bill**
  - Proposes establishment of cap-and-trade program
  - Could result in increased regulation of landfills under expanded NSPS
    - Potential negative impact on landfills participating in GHG projects
    - Pay attention as this is only the House bill

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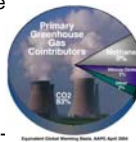
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## Why Interest in Landfills?

- Methane has a global warming potential 21-25 times that of CO<sub>2</sub>
- Destruction of methane easily verifiable
- Technology already exists for LFG collection and control
- Landfills are the second largest human-related source of methane in 2007
  - 23% of total generation



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GHG Credit Development Process

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GHG Credit Development Process

- Determination of applicable protocol or standard
- Development of Project Application or Design Document
- Validation of Project
- Generation and Quantification of Credits
- Verification of Credits
- Registration/Transaction

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Protocols and Standards Establish...

- Eligibility
- Monitoring
- Recordkeeping
- Calculations and Quantification
- Consideration of overall emission impact of project (in some cases)
- Reporting

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## GHG Protocols/Standards

- Climate Action Reserve (CAR)
- Chicago Climate Exchange (CCX)
- EPA Climate Leaders
- Gold Standard
- Regional Greenhouse Gas Initiative (RGGI)
- Voluntary Carbon Standard 2007 (VCS)

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## Which Landfills Can Participate in GHG Markets?

- Project must be “additional”
  - Beyond business as usual
    - Would not have happened without revenue provided by participation in the GHG market.
  - Not required by federal, state, or local law, statute, or other regulatory framework

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## Which Landfills Can Participate in GHG Markets? (cont.)

- GCCS must be “voluntary” from a regulatory standpoint
  - LFG collection and control must not be required by NSPS/EG/NESHAP
  - Early installation in advance of 2/5 year installation requirements (not under CAR)
  - No state or local requirements for collection and control
  - No consent orders in place

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## Which Landfills Can Participate in GHG Markets (cont.)

- Project Eligibility Dates

- 1/1/99 CCX
- 1/1/01 CAR
  - If registered by 11/17/09
  - After 11/17/09, must register within 6 months of startup
- 12/20/05 RGGI
  - Must register within 6 months of startup
- VCS
  - Must validate within 2 years of startup
- GHGS
  - Recent project startups

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## Project Application / Design Documents

- Overall Project Scope
- Project Eligibility
- Project Boundaries and Baselines
- Monitoring Plan
- Recordkeeping
- Quantification
- QA/QC Procedures and Data Management
- *Similar to a Permit Application*

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## Validation

- Project Design Document reviewed by GHG Program or Third-Party
  - Is the project eligible?
  - Adequate supporting documentation?
  - Correct M/R/R procedures?
  - All project aspects considered per applicable protocol / standard?
- Establishes that GHG reductions from project are valid
- *Not required under CAR*

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## GHG Credit Quantification And Project Operation

- Monitoring of LFG flow rate
- Monitoring of LFG methane content
- Temperature, pressure
- Control device operation
- Overall energy use (if applicable)
- Calculations
- Regular calibration of measurement devices
- Recordkeeping activities

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## Measurement of Methane Content

- Continuous or periodic LFG sampling
  - Periodic
    - GEM-500
    - GEM-2000
  - Continuous
    - GC
    - Infrared



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## Measurement of LFG Flow Rate

- On-line measurement of eligible LFG flow rate before control device
  - SWANA manual of practice for landfill gas operations and maintenance
  - Orifice plate
  - Mass flow meter
  - ASTM methods

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## Control System Efficiency and Operation

- Default Methane Destruction Efficiency
  - Open Flares (50% - 100%)
  - Enclosed Flares (90% - 100%)
  - Other combustion devices (98% - 100%)
  - Injection into NG Pipeline (98% - 100%)
- Monitor control device operation and operating parameters
  - to ensure continuous destruction of methane

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## Calculations

- GHG Credit (metric ton of CO<sub>2</sub>e)
  - LFG flow \* methane % \* STP adjustment \* destruction efficiency \* global warming potential \* conversion constants
- Other considerations
  - Electrical Use
  - Methane Oxidation
  - Baseline Emission Reductions



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## Gross Revenue Calculation

- 100 scfm average flow ~ 10,000 tonnes per year of CO<sub>2</sub>e
- Assume \$4.00/tonne CO<sub>2</sub>e
- 100 scfm ~ \$40,000/year gross revenue potential

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## Verification

- Third-Party review of GHG credits
- Confirms GHG project meets protocol requirements
- Review and approval of GHG credit quantification
- Project has appropriate supporting documentation
- Appropriate QA/QC procedures taken and documented

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## Registration and Transaction

- Verified GHG credits are the asset
- GHG credits are given unique identifier if registered
  - Some GHG buyers may not require registration
- GHG credits are accepted by buyer
- Landfill/project developer receives revenue

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## Market Participation Options

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## General Approach

- Voluntary, unregulated, without contractual obligation to reduce emissions
- Private transaction between buyer and seller
- Currently no standard methodology, verification, or registration process (but coming)
- Buyer beware marketplace
  - *Caveat carbo emptor*

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## Participation in the Voluntary Market

- Auction/RFP
- Bi-lateral or Over the Counter (OTC)
- Chicago Climate Exchange (CCX)

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## Auction / RFP Process

- Landfill or Project Developer accumulates verified GHG credits
- Open Auction, or RFP, used to generate market for GHG credits
- Sold to the highest bidder
- Rights to future years can also be sold "forward"
- Can include reserve on credit price
- Think e-bay©

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## Pros/Cons of Auction/RFP Process

- Advantages
  - GHG credit price determined through competitive bidding
  - Potentially higher pricing for credits
  - Retains ownership of credits until sale completed
  - Greater flexibility
- Disadvantages
  - Responsible for project investment and operating costs
  - Responsible for GHG credit development process (e.g., validation, verification, etc)
  - Revenue subject to market conditions at time of sale

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## Bi-Lateral / OTC Process

- Carbon Asset Developers
  - Entities that develop, invest, acquire, aggregate, and sell or "use" GHG credits (Investment Projects)
  - Established buyers in queue
- Originators
  - Purchase GHG credits from GHG projects which require little or no investment (Origination Projects)
  - Can provide long-term offers at agreed upon pricing structures
  - Established buyers in queue
- Brokers
  - Bring buyers and sellers together
  - No significant investment

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## Equity Sources

- Financial Institutions and brokerage firms
  - Morgan Stanley, Cantor Fitzgerald, JP Morgan
- Other large investors (often energy market participants) – GE AES, First Reserve
- Hedge Funds
- Private Equity

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## The Process

- Gas rights agreement executed
- Project design, permitting, construction
- Validation
- Operation and Quantification
- Verification
- Registration
- Sales
- Royalty payments
  - Fixed
  - Variable based on sales price and revenue sharing agreements



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## Pros/Cons of the OTC Approach

- Advantages
  - Potentially higher pricing for GHG credits
  - No requirements of seller to reduce GHG emissions
  - Can sell GHG credits forward
  - May provide project investment
- Disadvantages
  - No definitive market index
  - Confidential contract negotiation process
  - Public entities may require RFP to participate



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## Chicago Climate Exchange - CCX

- Integrated GHG emissions registry and trading system
- Its members make a voluntary but legally binding commitment to reduce GHG emissions
- Trades Carbon Financial Instruments (CFI)
  - Currently trading at ~ \$0.20 / tonne of CO<sub>2</sub>e (9/11/09)



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## Pros/Cons of CCX

- Advantages
  - Transparent transaction process
  - On-line electronic transactions
  - Older GHG credit "vintages" still have robust value compared to current vintages
  - Relatively lenient protocol requirements
- Disadvantages
  - May require a contractual obligation to reduce GHG emissions
  - Credits treated more like a commodity, may result in lower revenue since credits are not identified to a specific project type
  - Landfill/Project Developer responsible for investment and operating costs
  - Cannot sell forward
  - Future revenue subject to market value



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## What Should You Do?

- Determine if you have an eligible landfill GHG project
- Conduct gap analysis of existing project
- Determine which protocol best fits your project
- Understand your options
  - Get assistance, if needed
- Take action!

*"A good plan, violently executed now, is better than a perfect plan next week."*

General George S. Patton



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## Risk Management for Operating Projects

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## Objective

- To assist participants in understanding the technical requirements under the leading voluntary greenhouse gas (GHG) emission reduction program
- To minimize delivery risk of GHG credits from a landfill project

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## GHG Credit Delivery Risk?

- For An Eligible Project
  - \$\$ = Verifiable Data
- Verifications periodically (project specific)
- Data Collected Continuously / Periodically
- How Are You Managing Your Data?



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## Risk Management

- Understand Applicable GHG Protocol
- Develop Site-Specific Monitoring Plan
- Implement and Update Monitoring Plan
- Prepare Periodic GHG Reduction Summary Reports

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## Project Monitoring Plan

- What is it?
  - Written documentation outlining the monitoring and reporting under a particular GHG Protocol
    - Includes data acquisition, recordkeeping, instrument calibration, and QA/QC
- Why should I develop?
  - Because you have to under some protocols
  - To serve as a guide for GHG project operations
- Why should I follow?
  - To minimize delivery risk of GHG credits

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## What Should Be In Your Monitoring Plan?

- Description of monitored parameters, data collection frequency, and records to be kept
- Documentation of system components, installation dates, initial calibration certificates
- Documentation of monitoring system components, installation dates, O&M procedures, initial calibration certificates
- QA procedures
  - Calibration
  - Data management
- Procedure for annual evaluation of regulatory status

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## What Should Be In Your Monitoring Plan? (cont.)

- Site-specific program and guidance
  - Who's Doing What, and When, and How
- Set up task tables and reminders
  - Periodic monitoring tasks
  - QA tasks
  - Periodic data review

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## Typically Monitored Parameters

- LFG Flow Rate
- Methane Content
  - Periodic
  - Continuous
- Control Device Operation
- Energy Consumption
  - Metering system
  - Electric/propane billing

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## Recordkeeping

- Retain all data used to quantify the GHG emissions reductions
- Collect, review and maintain data
  - Automated digital data acquisition and storage system
  - Automated systems preferred over manual, handwritten, or analog data requiring interpretation/transcribing
- Data must be verifiable
- Document maintenance and Q/A activities on monitoring equipment

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## Recordkeeping

- How and Where are the Data Stored?
- Automated Alarms
- Data Back Up Procedures
- Data Review Procedures



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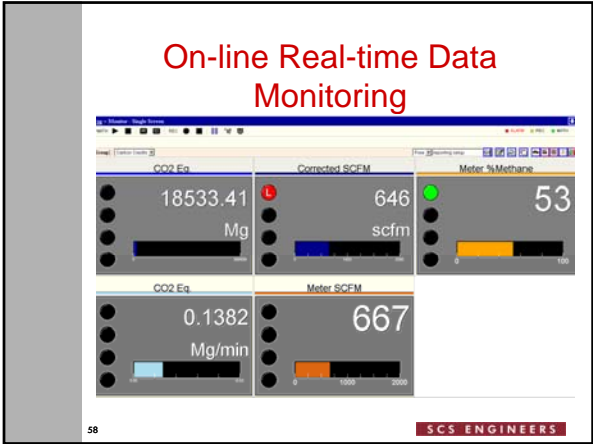
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- ### Quality Assurance Activities
- Monitoring Systems
  - Data Management
  - Overall Project
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- ### QA Activities – Monitoring System
- Monitoring System (flowmeter, methane monitoring device, thermocouples, pressure gages)
    - Periodic inspection/calibration/verification
    - Document QA activities
    - Consider redundancies - e.g. dual flow meters with staggered calibration schedules
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## Flowmeter QA Program

- Gather manufacturer's documentation
  - Initial calibration data
  - Recommended maintenance and verification/calibration activities
- Follow manufacturer's maintenance and verification/calibration recommendations
  - Work with manufacturer to develop QA program
- Conduct quarterly maintenance and verification of accuracy (CAR requirement)
  - Use third party
  - Typical accuracy of +/- 5% required by most protocols
  - If failure of accuracy verification occurs, have factory recalibrate

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## Methane Monitor QA Program

- Gather manufacturer's documentation
  - Initial calibration data
  - Maintenance and verification/calibration activities
- Follow manufacturer's maintenance verification/calibration recommendations
- Conduct daily / periodic maintenance and verification of accuracy
  - GEM's (6-month factory calibration, and before each use)
  - Continuous monitors to be calibrated quarterly (CAR)

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## Quality Assurance Activities – Data & Recordkeeping

- Data & Recordkeeping
  - Review collected data, ensuring that it can be verified
    - Provide for "sanity check" of data to identify issues
  - System algorithms to identify data outside expected range
  - Alarms to alert project team (text message, voice message, e-mails)
  - Back up data
  - Automate processes
    - Focus on minimizing risk of transcription errors
  - Keep all records, better to have too many than not enough. You can't sell what you can't document

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## Project QA Program

- Periodic review of collected data
  - Don't wait until just before verification
- Adhere to monitoring plan
- Consider GHG Summary Reports
  - Summarize GHG reductions for reporting period
  - Provide all appropriate back information for verifier
- Commit proper resources to stay on top of GHG project activities

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## Conclusions

- “Value” being sold is accurate, verifiable data that can quantify the amount of methane destructed
- Treat data like “green gold”
  - Review, store and back-up data carefully
- Keep all records and document activities related to project eligibility, development, and QA activities
- You can't sell what you can't document!

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## Regulatory Initiatives

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## State Initiatives

- California AB-32
  - Summary of Goals
  - Early Action Measures Affecting Waste Industry
  - Landfill Early Action Measure
  - Scoping Plan
  - Cap and Trade Program
- Florida GHG Executive Orders
- Bay Area AQMD
  - Fees for GHG Emissions
- Various Other State Programs; generally focused on inventories

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## Regional Initiatives

- RGGI
- WCI
- Midwestern Regional GHG Reduction Accord

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## Federal GHG Action

- Recent ANPR
- Endangerment Findings
- Legislative Activities
  - Waxman-Markley
  - Lieberman-Warner (S.2191)
  - Bingaman-Specter (S.1766)
  - Lieberman-McCain (S.280)

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## Federal Action Impacts on Landfills

- Direct Regulation of Landfill Emissions?
  - NSPS Revisit (AB 32 as example ?)
- Allowance for Landfills as Offset Providers?
- Offset Price Impacts
  - Method and Implementation of GHG Credit Allocation?
  - Limits for Offset Use for Compliance?
  - Ability to Use International Offsets?
  - Fate of Pre-compliance Offsets?
  - Safety Valve for Offset Costs?

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## GHG Inventory Requirements

- The Climate Registry (voluntary)
  - North American Emissions
  - Includes all Kyoto Gases
  - Steps to Joining and Obligations
  - How Landfills are treated
- Federal Mandatory Reporting
- California AB 32 Mandatory Reporting
- Other States Moving Forward With Inventory Requirements
  - Part of annual inventories
  - Separate rulemakings

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## Draft Federal Mandatory Reporting Rule

- Federal Register April 10, 2009
- 25,000 MTCO<sub>2</sub>E trigger levels
- Annual reports first submitted in 2001 for 2010 emissions
- Solid waste facilities affected by either landfill or stationary combustion categories
- Landfills
  - Methane and CO<sub>2</sub> from LFG
  - Other combustion emissions
  - Biogenic separate
  - Two methods required: typical LFG generation model and SWICS-like method

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