

Technologies and Management Practices for Reducing Greenhouse Gas Emissions from Landfills

CIWMB Workshop
February 26, 2008
Sacramento, CA

Outline of Presentation

- Introduction
- Technical Advisory Group
- Literature Review
- Summary of Technologies and BMPs
- Screening for Site-Specific BMPs
- Metrics for Assessment of GHG Reductions

Introduction

- **Background on Climate Change**
- **Objectives of Project**
- **Project Team**
 - **CIWMB Staff**
 - **Lead Contractor: SCS Engineers**
 - **Integrated Waste Management Consulting, LLC**
 - **Pacific Waste Consulting Group, Inc.**
 - **GC Environmental, Inc.**

Technical Advisory Group

- **Regulatory Agency:** Renaldo Crooks; CARB
- **Environmental Community:** Scott Smithline; Californians Against Waste
- **Academia:** Jean Bogner; University of Illinois
- **Large Public Landfill Owner:** Tim Israel; Sacramento County
- **Small Public Landfill Owner:** Mary Pitto; Rural Counties ESJPA

Technical Advisory Group (cont.)

- Private Landfill Owner: Chuck White; Waste Management, Inc.
- Randy Masukawa; Power Management, Inc.
- Rich Haughey; Shaw Environment and Infrastructure, Inc.
- Ramin Yazdani; Yolo County
- Jim Bier; Ameresco, Inc.

Literature Review

- Sources: Proceedings from Industry Conferences, Regulatory Documents, Technical Journals, Textbooks, etc.
- Focus on Practical, Real-World Solutions
- Actual Experience of Experts More Important than Literature Sources
- Literature Critical for Research in Biocovers

Technologies and BMPs

- **LFG BMPs**
 - Design-Related BMPs
 - BMPs for Gas Mover Equipment and Vacuum Control
 - BMPs for LFG Control Systems
 - BMPs for Enhanced LFG O&M
 - General LFG BMPs
 - Enhanced Monitoring, Modeling, and Testing BMPs

Technologies and BMPs (cont.)

- **Landfill BMPs**
 - Design-Related BMPs
 - BMPs for Landfill Cover Systems
 - BMPs for Landfill Operations
 - BMPs for Enhanced Landfills
- **Other Solid Waste Management Strategies**

Technologies and BMPs (cont.)

- **Description of BMP**
 - Schematics or photos where relevant
- **Feasibility**
- **Implementation Recommendations**
- **Relative Cost**
 - Low, medium, or high
- **Relative GHG Emissions Reduction Potential**
 - Low, medium, or high

LFG BMPs

- **Design-Related for LFG Wellfield**
 - Use of Horizontal Collectors
 - Use of Surface Collectors
 - Tighter Spacing of Vertical LFG Wells
 - Mixed Horizontal/Vertical Systems
 - Connection to LCRS Layer
 - Deep, Multi-Depth Vertical Wells
 - Maximize Borehole Size and Well Diameters

LFG BMPs (cont.)

- **Design-Related for LFG Wellfield (cont.)**
 - **Enhanced Seals on LFG Wells/Boreholes**
 - **Dewatering of Gas Wells**
 - **BMPs for LFG Piping Systems**
 - **Maximize Pipe Sizes**
 - **Install Piping on Native Soil**
 - **Increased Pipe Slopes**
 - **Above Grade Piping**

LFG BMPs (cont.)

- Design-Related for LFG Wellfield (cont.)
 - BMPs for LFG Piping Systems (cont.)
 - Looped Piping Systems
 - Pipe Specifications
 - Adequate Condensate Systems
 - Barometric Control of LFG System
 - Redundant Flare Station Equipment
 - Maximize Capacity of Gas Mover Equipment

LFG BMPs (cont.)

- **BMPs for LFG Control Equipment**
 - Redundant Flare Station Equipment
 - Maximize Capacity of Control Equipment
 - Implement LFG Recovery Projects
- **BMPs for Enhanced O&M**
- **General LFG BMPs**
 - Early Installation of LFG Systems
 - LFG Master Planning

LFG BMPs (cont.)

- **Enhanced Monitoring, Modeling and Testing BMPs**
 - **Enhanced Surface Emissions Monitoring**
 - **Enhanced Gas Migration Monitoring**
 - **Improved Modeling and Testing for LFG Design**
 - **LFG Generation Modeling—various methods**
 - **Finite Element Analysis**

LFG BMPs (cont.)

- **Enhanced Monitoring, Modeling and Testing BMPs (cont.)**
 - **Improved Modeling and Testing for LFG Design (cont.)**
 - Pneumatic Methods for Gas Production Measurement
 - Pore-pressure Penetrometer (PPT)
 - LFG Pump Tests
 - Use of Actual Waste Characterization Data in LFG Models

Landfill BMPs

- Cover LCRS Layer
- Blockage of Permeable Layer Within Landfill
- Designing for Closure/Post-Closure
- Promote Deeper Landfills
- Designing Covers for LFG Collection
- Limit Delays on Final Cover Systems
- Limit or Remove Intermediate Cover Systems

Landfill BMPs (cont.)

- **BMPs for Landfill Operations**
- **BMPs for Enhanced Landfills**
 - **Leachate Recirculation**
 - **Bioreactor Landfills**
 - **Biocover Systems**

Biocover Systems

- Improved Methane Oxidation over Soil Covers
- Additional Beneficial Use of Organic Waste
- Biocover, Biofilter, and Biocell Concepts
- Replacement for Intermediate Cover Systems
- Possible Use as Component of Final Cover System
- Not an ADC
- Compost is Most Suitable Material

Other Solid Waste Management Strategies

- **Composting**
- **Any Other Organic Waste Diversion/Recycling Program**
- **Anaerobic Digestion**
- **Bale Waste Prior to Disposal**
- **Dedicated Organic Waste Cells**

Screening Process for Site-Specific BMPs

- **Assessing Technical Feasibility**
- **Evaluating Implementability**
- **Estimating Cost**
- **Estimating GHG Reduction Benefit**
- **Prioritization and Ranking**
- **Final Selection**
- **Action Plan**

Metrics for Assessment of GHG Emissions Reductions

- **Performance Criteria**
 - Additional LFG Collected
 - Surface Emissions Reductions
 - Amount of Diverted Organic Waste
- **Measurement Techniques**
 - Gas Flow and Methane Measurement
 - Enhanced SEM Program
 - Scale House Records
- **Tracking of Progress**

Concluding Thoughts

- Summary
- Questions or Comments
- Next Steps