Waste Disposal and Climate Change

Meredith College: General Biology 105

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Presenter:
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Background

- What is a Regulation
- Clean Water Act
- Major Solid Waste Laws
- Subtitle D (of RCRA)
Background: What is a Regulation

- Begins with a Bill (legislation)
- If approved, this Bill becomes an Act
- Placed in the United States Code
- Regulations created to clarify the Code
- Published in the Code of Federal Regulations (CFR)
Background: **Clean Water Act**

- **Water Pollution Act of 1948**
  - 1st major U.S. Law to address water pollution

- **Clean Water Act (CWA) – 1972 Amendments**
  - Regulated pollutant discharge
  - Set wastewater standards
  - Made it unlawful to discharge pollutants
  - Funded sewage treatment plants
Background: Major Solid Waste Laws

- **Solid Waste Disposal Act of 1965**
  - 1st major federal solid waste law

- **Resource Recovery Act of 1970**
  - Emphasized reclaiming energy from solid waste

  - Also known as RCRA
  - 1st program for hazardous and non-hazardous waste
Non-Hazardous Solid Waste

- Encourages States to develop solid waste management plan
  - Promote recycling
  - Requires closing or upgrading all landfills
  - Establish minimum requirements for municipal solid waste landfills
The Modern Solid Waste Landfill

- What are the parts?
- Cross Section
- Pictures
The Modern Solid Waste Landfill: What are the parts?

- Liner System
- Leachate Collection System (LCS)
- Waste Cells
- Final Cover System
- Leachate Removal Piping
- Landfill Gas (LFG) Vents/Extraction Wells
The Modern Solid Waste Landfill: Cross Section
The Modern Solid Waste Landfill: Pictures

- Subgrade Preparation
- Compacted Clay Liner
- Compacted Clay Liner
- Geomembrane Liner
The Modern Solid Waste Landfill: Pictures

- Geomembrane Liner
- Protective Cover
- Leachate Collection Piping
- Leachate Pump Station
Subtitle D Regulations

- Groundwater
- Air Quality
40 CFR § 258.53: Groundwater Sampling and Analysis

- Provide consistent sampling and analysis
- Groundwater quality monitoring programs
40 CFR § 258.54: Groundwater Detection Monitoring Programs

- Routine sampling, analyses, and reporting
- If detections above allowable limits
  - Alternate source demonstration
  - Statistically significant increase (SSI) from error or natural variation
- Report and submit to the State
40 CFR § 258.55: Assessment Monitoring Program

Whenever a SSI has been detected
  • Samples initially for Appendix I parameters

Appendix II sampling is needed
40 CFR § 258.57: Selection of Corrective Action

Remedy

- Protective of human health and the environment
- Attains groundwater protection standard
- Controls the source(s) of releases that reduces or eliminates any further releases
40 CFR § 258.58: Implementation of the Corrective Action
40 CFR § 258.23: Controlling Explosive Gases

- Methane gas does not exceed 5% methane in facility structures
  - 5% is 25% of the lower explosive limit (LEL)
- Methane gas does not exceed the LEL at the property boundary
- Implement quarterly methane monitoring program
Figure 2-1: Production Phases of Typical Landfill Gas

Aerobic

Anaerobic

Phase I  Phase II  Phase III  Phase IV

Gas component (% by volume)

Note: Phase duration time varies with landfill conditions

Source: EPA 1997
Subtitle D Regulations

1970-1990

Explosion Hazards
- Control Gas Migration
- Construct Caps
- Passive Venting

*CH₄, CO₂, NMOC*

*N, O₂, NH₃, S, CO
Air Quality

- Air Quality Regulations
- Clean Air Act of 1970
- Amendments to Clean Air Act (1990)
- Title V Permits
- MACT Rules
- Additional Greenhouse Gas Rules
Air Quality: Air Quality Regulations

- 1993 – MSW Landfills New Source Performance Standards (NSPS) and Emission Guidelines
  - Subpart WWW/CC

- 2003 – National Emission Standards for Hazardous Air Pollutants (NESHAP)
  - Defines Maximum Achievable Control Technology (MACT) for MSW landfills
  - Subpart AAAA

- 2009 – Greenhouse Gas (GHG) Mandatory Reporting Rule
  - Subpart HH
National Ambient Air Quality Standards for pollutants
  - Lead, ozone, etc.

(New Source) Performance Standards

National Emission Standards
  - Hazardous air pollutants from industry sectors
US EPA approves the States to issue Title V Permits

NSPS and Emission Guidelines for MSW landfills

- *Regulate non-methane organic compounds (NMOC’s)*
Requirements of Title V Permittees

- NMOC emissions must be calculated
- Gas collection and control system (GCCS) is required
- New requirements for field measurements of GCCS system components.
- Annual compliance submitted to EPA
Air Quality

1990-2010

CH₄

CO₂

NMOC*

* N, O₂, NH₃, S, CO

Energy

- Voluntary Systems
- Carbon Credits
- GCCS Systems
- Surface Sweeps
Air Quality: Pictures

LFG Extraction Wells

LFG Well Drilling

LFG Passive Vent

LFG Piping
2003: Maximum Available Control Technology rules for MSW landfills

- Semi-annual reporting of system operations and monitoring
- Startup, Shutdown, Malfunction (SSM) plans required
  - Continuous flare flow rate & flame temperature monitoring
Air Quality: Additional Greenhouse Gas Rules

2009

› Greenhouse Gas Mandatory Reporting Rule (GHGMRR)
  • Report GHG emissions from landfills and other emitting sources

2010

› Greenhouse Gas Tailoring Rule
  • Permitting and control of CO2 and other GHG emissions from landfills
Air Quality

Emissions
- GHG Reporting
- Combustion Reporting

2010-Present

CH₄

CO₂

NMOC*

*N, O₂, NH₃, S, CO
Air Quality: Pictures

- LFG Flare
- Waste-to-Energy Facility
- LFG Remediation System
- Enclosed LFG Flare
What is the Impact on Landfills?

- Landfill design and operations are changed due to increased air quality regulations
- LFGCCS installed earlier
- Increased voluntary waste-to-energy projects
- Landfill areas capped/closed sooner
- Increased landfill operations difficulties
- Increase cost of air quality monitoring and reporting
- Decreased surface emissions
What Can We Do?

- **Waste**
  - Consumer-initiatives
  - Composting
  - Recycle/Re-Use/Re-Purpose

- **Energy**
  - Control Energy Use