Welcome to DES & to Today’s Workshop
“Landfills: Things You Never Knew You Needed To Know”
WHY THIS WORKSHOP?

Landfills

• Tie together the concepts you learned in Basic Training and other CPD
• Create an understanding of how landfills function and why monitoring and maintenance is so important
TODAY’S AGENDA

• Introduction: History and Design of Landfills
• Activity
  • Building a Landfill
  • Debrief
• Post-Closure Monitoring & Maintenance
• Take Away
LANDFILLS: HISTORY & DESIGN

JAIMIE COLBY, PE
PERMIT ENGINEER
NHDES – WASTE MANAGEMENT DIVISION
Prior to 1960s:
- Open dumps
- Burn dumps
HISTORY: EARLY LEGISLATION

Federal legislation in 1960s-70s
- Clean Air Act
- Solid Waste Act

New Hampshire changes
- 1969-1972 NH Solid Waste Laws & Regulations
- 1981 Solid Waste Management Act (currently RSA 149-M)
HISTORY: THE RULES

1982 – SW Rules Adopted

1987 – NHDES established

1991 – Major updates relative to Landfills, SWOT added

1995 – NH becomes an approved state under RCRA Subtitle D
HISTORY: THE RULES

1997 – Pre-1981 Landfills and Interim Closure Status

2003 – “Brady Bill” passed, becomes law RSA 149-M:9(XIII)

2014 – Readopted w/amendments

Danville, NH Tire Fire of 1989
HISTORY: THE RULES

WHY DOES IT MATTER?

Concord Municipal Landfill (then)

Concord Municipal Landfill (now)
LANDFILL DESIGN: THE BASICS

- Landfill Gas
- Cap
- Waste
- Gas Probe
- Leachate
- Liner
- Groundwater Well
LINED LANDFILLS

- Waste
- Sand
- Sand
- Clay
- Subgrade

- Geomembrane (Primary)
- Geomembrane (Secondary)
- Leachate Pipes
SUBGRADE THROUGH SECONDARY GEOMEMBRANE
Sand & Primary Geomembrane
SAND & WASTE

Waste
Sand
Sand
Clay
Subgrade
LINED LANDFILLS

- Subgrade
- Clay
- Sand
- Geomembrane
- Leachate Collection
- Geomembrane
- Leachate Collection
- Sand
- Waste
Unlined Landfills
LANDFILL DESIGN: THE BASICS

Dumps and older landfills are “unlined”
LANDFILL CAP

- Loam & Seed
- Drainage Sand
- Sand
- Soil
- Waste

- Geomembrane
- Landfill Gas Collection
Sand

Soil

Waste
GEOMEMBRANE

Sand
Soil
Waste
DRAINAGE

SAND
Loam & Seed

- Loam
- Sand
- Sand
- Soil
- Waste
LANDFILL GAS: VENTS
LANDFILL GAS: EXTRACTION WELLS
LANDFILL CAP ➔ COVER

- Loam & Seed
- Drainage Sand
- Sand
- Soil
- Waste

- Geomembrane
- Landfill Gas Collection
- Landfill Gas Collection
LANDFILL COVER

Topsoil & Grass

Soil

Waste
“Brady Bill” Landfills

RSA 149-M:9(XIII)
LANDFILL DESIGN:

IT’S A CONTAINMENT SYSTEM

Diagram showing the components of a landfill system:
- **LFG**: Landfill Gas
- **Cap**: Covering layer
- **Leachate**: Contaminant leaching
- **Waste**: Landfill material
- **GWP Well**: Gas collection well
- **Gas Probe**: Monitoring device for gas emissions

Diagram details:
- LFG: Landfill Gas
- Cap: Covering layer
- Leachate: Contaminant leaching
- Waste: Landfill material
- Gas Probe: Monitoring device for gas emissions
- GWP Well: Gas collection well

Diagram showing containment system components:
- LFG (Landfill Gas)
- Cap (Covering layer)
- Leachate (Contaminant leaching)
- Waste (Landfill material)
- Gas Probe: Monitoring device for gas emissions
- GWP Well: Gas collection well
LANDFILLS: HISTORY & DESIGN

Second Chance Shop
All items sold AS IS,
unless prior arrangements
have been made!

Jaime Colby, PE
 Permit Engineer
 NHDES – Waste Management Division
 Phone: (603) 271-5185
 Email: jaime.colby@des.nh.gov
**Activity: Landfill in a Bottle**

1. Fill about 2” with gravel
2. Fill about 2” sponge pieces (waste)
3. Fill about 1” with sand
4. If you have it, add plastic cap or clay layer (about ½”)
5. Add coffee filter and topsoil (about ½”)

---

1. Fill about 2” with gravel
2. Fill about 2” sponge pieces (waste)
3. Fill about 1” with sand
4. If you have it, add plastic cap or clay layer (about ½”)
5. Add coffee filter and topsoil (about ½”)

---

[Image of a bottle with layers of gravel, sponge, sand, and topsoil.]
BREAK!
Activity: Landfill in a Bottle

Debrief

U.S. Forest Service sign at Reyes Creek Campground in the Los Padres National Forest, California.
“During the post-closure period, the permittee shall have specific obligations to regularly inspect, monitor and maintain the facility in conformance with the solid waste rules based on the provisions of a post-closure inspection, monitoring and maintenance plan...”

Env-Sw 807.05(b)
Landfill Post-Closure Requirements

• **Inspect, monitor, and repair** any damage

• Achieve the “performance standards” in the NH Solid Waste Rules:
  – Stop generating leachate,
  – Stop generating decomposition gases like methane,
  – Achieve maximum settlement,
  – Remove harmful impacts to air and water, and
  – Remove threat to human health and the environment.
# Landfill Post-Closure Inspection Report

## A. Site Information

<table>
<thead>
<tr>
<th>Site Information</th>
<th>B. Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Name:</td>
<td>Permittee Name:</td>
</tr>
<tr>
<td>Address:</td>
<td>Address:</td>
</tr>
<tr>
<td>Date Waste Receipt Stopped:</td>
<td>Phone #:</td>
</tr>
<tr>
<td>Closure Date:</td>
<td>Contact Person:</td>
</tr>
<tr>
<td>Cap Design:</td>
<td></td>
</tr>
<tr>
<td>Soil:</td>
<td></td>
</tr>
<tr>
<td>Paper Fiber:</td>
<td></td>
</tr>
<tr>
<td>Geomembrane:</td>
<td></td>
</tr>
<tr>
<td>LLDPE:</td>
<td></td>
</tr>
<tr>
<td>HDPE:</td>
<td>Other: describe:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permit #</th>
<th>Inspected by:</th>
<th>Date:</th>
</tr>
</thead>
</table>

## B. Contact Information

<table>
<thead>
<tr>
<th>Permittee Name:</th>
<th>Address:</th>
<th>Phone #:</th>
<th>Contact Person:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## C. Funding

Is the Facility owner receiving funding from the State for closure of the landfill [Grant Program, etc.]?

- [ ] Yes
- [ ] No

If yes, provide the funding source.

## D. Enforcement

Is the Facility under any enforcement action?

- [ ] Yes
- [ ] No

If yes, check the appropriate box:

- Notice of Finding
- Letter of Deficiency
- Administrative Order
- Administrative Fine
- Other:

If yes, provide status of enforcement.

## E. Other Features

If damage is present, indicate if damage is Minor or Major then use Section H to provide additional information as necessary.

- (Minor damage = no immediate repair needed, but should be repaired or watched during the year)
- (Major damage = requires immediate repair and submittal of a work scope to conduct repair)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>No</th>
<th>NA</th>
<th>Minor</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Adequate access</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Access control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Access road(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Retention basin(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Drainage system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Culverts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Under-the-cap drain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) All gas probes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) Landfill odors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Revised April 2006**
Elements of Inspection Reports

A) Site info
B) Contact Info
C) Funding
D) Enforcement
E) Off-Cap Features
F) Cap Features
G) Reporting Requirements
H) Comments & Recommendations

http://des.nh.gov/organization/divisions/waste/swmb/css/categories/forms.htm
Post-Closure Inspections

• Protect the closure system from damage:
  - Fencing, signage,
  - Landfill slopes,
  - Vegetation,
  - Drainage system,
  - Gas management system, and
  - Groundwater and gas monitoring wells.
Fencing & Signage
Slopes
Vegetation
Gas Management System

Gas Vent

Extraction System

Flare

Gas Probe
Landfill Gas Rule Requirements

• As Landfill wastes breakdown they can create decomposition gases. Some of which are harmful and/or dangerous.

• Landfill gases must be controlled to prevent hazards to human health and safety, and the environment.
Gas Monitoring

- Pure Gas
- Rich
- Explosive
- Lean

- Methane by Volume:
  - 0% to 5%: Lean
  - 5% to 15%: Explosive
  - 15% to 100%: Rich

- Air:
  - 0% to 100%: Lean

- LEL (Lower Explosive Limit):
  - 0% LEL for Lean
  - 100% LEL for Rich

- Limits:
  - Limit at Property Line: 50% of LEL
  - Limit in a Structure: 25% of LEL
Landfill Gas Rule Requirements

• Methane concentrations must not exceed 25% of the LEL in structures on or off-site.
• Methane concentrations must not exceed 50% of the LEL in the soil at the property line.
Monitoring Wells
Groundwater Management Permit

Places monitoring requirements on:

- Sampling frequency,
- Number of wells sampled,
- Compounds being analyzed for, and
- Reporting frequency.
Other Important Features to Monitor

- Is settlement even or are there depressions or standing water?
- Are there leachate breakouts?
- Is there damage from burrowing animals?
Activities - Landfill Use
Activities - Landfill Use
WHAT’S THE ISSUE?
WHAT’S THE ISSUE?
WHAT’S THE ISSUE?
WHAT'S THE ISSUE?
Why Does Post-Closure Monitoring Matter?

- Landfills are basically “containment systems” for waste.
- The waste contained in landfills can be a mix of household, business, mining, agricultural, and industrial wastes.
- Without periodic inspections, monitoring, and routine maintenance we can’t assume these containment systems will continue to function adequately forever.
Why Does Post-Closure Monitoring Matter?
Why Does Post-Closure Monitoring Matter?

Sources of Drinking Water in New Hampshire

- Surface Water Supplies: 40%
- Public Groundwater Supplies: 20%
- Private Groundwater Supplies: 40%
Landfill Post-Closure Summary

- Follow your landfill’s Post-Closure Plan.
- Include the Landfill Post-Closure Inspection Report as part of your annual reporting.
- Contact DES prior to using the landfill for other purposes.
- Inspect, monitor, repair, and report any damage to the landfill system.

Don’t let a small problem become a BIG PROBLEM!!!
Contact Information

James O’Rourke, PG
New Hampshire Department of Environmental Services
603-271-2909
James.O’Rourke@des.nh.gov