WELCOME!

Welcome to DES & to Today’s Workshop “Groundwater Basics, Landfill Monitoring & Case Histories”
WHY ARE YOU HERE?

- Required by law and NH Solid Waste Rules.
- Build your resume & accumulate professional development hours.
• From where do NH’s citizens get their water?
  • 60% rely on a well
  • 25% rely on surface waters
  • 15% use both
DESKTOP MATERIALS & DISPLAYS

• Agenda
• Evaluation
• BMP Manual
TODAY’S AGENDA

• Groundwater Basics
• Break and Demonstration
• MSW Unlined Landfill Case Study
• Landfill Monitoring Requirements
• SWOT Rule Changes
Groundwater Basics

February 24, 2015

Paul Rydel, PG
New Hampshire Department of Environmental Services
Typical Solid Waste Transfer Station w/ Closed Unlined Landfill
Groundwater Monitoring Well
Definitions

**Groundwater** = water which occurs below the land surface (*saturated zone*).

**Vadose Zone** = zone between the land surface and the groundwater surface or water table (*unsaturated zone*).

**Geology** – study of the earth.

**Hydrogeology** – geology specific to water resources.

**Aquifer** – geologic material or unit (soil or bedrock) that yields groundwater to wells in usable quantities.
Drilling to Install Monitoring Well
Monitoring Well Details

- Monitoring Well
- Bentonite Seal
- Vadose Zone
- Backfill
- Gravel Pack
- Well Screen
- Aquifer
- Bedrock
Capillary Fringe
Sources of Drinking Water in New Hampshire

- Surface Water Supplies: 40%
- Public Groundwater Supplies: 20%
- Private Groundwater Supplies: 40%
WATER CYCLE

Condensation

Evaporation from Oceans, Lakes & Streams

Transpiration from Plants

Precipitation

Groundwater

Surface Runoff
History of Solid Waste Disposal
Sanitary Landfill
Unlined Landfill
Lined Landfill
Groundwater Contamination
Unlined Landfill Monitoring
Unlined Landfill Monitoring
Groundwater Contaminants

- Volatile organic compounds (VOCs) – petroleum products (benzene, toluene, naphthalene, etc.) and solvents (PCE, TCE) – about 65 compounds;
- Metals (arsenic, iron, manganese, etc.);
- Chloride, nitrate, sulfate.
- Drinking water standards (*safe levels*) established for most common groundwater contaminants
Concentration Units

• Typical concentration units are parts-per-million or parts-per-billion;

• 60 seconds x 60 minutes x 24 hours = 86,400 seconds in one day – 1,000,000 seconds / 86,400 seconds per day = 11.57 days
Case Study – Groundwater Monitoring at a Closed Unlined Landfill Site
<table>
<thead>
<tr>
<th></th>
<th>MW-1</th>
<th>MW-4S</th>
<th>Private well</th>
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<tbody>
<tr>
<td>Chloride</td>
<td>2.2</td>
<td>112</td>
<td>8.6</td>
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<tr>
<td>Iron</td>
<td>0.25</td>
<td>13.8</td>
<td>0.47</td>
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<tr>
<td>Manganese</td>
<td>0.078</td>
<td>4.0</td>
<td>&lt; 0.005</td>
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<tr>
<td>Arsenic</td>
<td>0.007</td>
<td>0.016</td>
<td>0.024</td>
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Contact Information

Paul Rydel, PG
New Hampshire Department of Environmental Services

603-271-3116
Paul.Rydel@des.nh.gov
Methane Basics and Monitoring -
A Closed Landfill Case Study

Douglas Kemp
Waste Management Specialist
NHDES - Waste Management Division
Landfill Gas

• Composed of mostly methane and carbon dioxide, and hundreds of other gases
• Composition changes over time from mostly carbon dioxide to methane
• Methane forms from bacteria in the landfill
• Landfills can generate methane for decades
Methane Gas

- Is explosive between 5% to 15% of the total volume of air [LEL = Lower explosive Limit & UEL = Upper Explosive Limit]
- Can migrate horizontally via void spaces in soils
- New Hampton landfill
Rule Requirements

• Landfill gases must be controlled to prevent hazards to human health and safety, and property
• Methane conc. must not exceed 25% of the LEL in structures on or off-site
• Methane conc. must not exceed 50% of the LEL in the soil at the property line
Methane % vs LEL %

- To convert from LEL % to methane % - divide the LEL value by 20
- To convert methane % to LEL % - multiply the methane value by 20
- 100% LEL = 5% methane

<table>
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<tr>
<th>SITE ID</th>
<th>DATE</th>
<th>% LEL</th>
<th>% METHANE</th>
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<tbody>
<tr>
<td>TGV-1</td>
<td>6/21/2012</td>
<td>96</td>
<td>4.8</td>
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<td>TGV-2</td>
<td>6/21/2012</td>
<td>220</td>
<td>11.0</td>
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<td>TGV-3</td>
<td>6/21/2012</td>
<td>280</td>
<td>14.0</td>
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<tr>
<td>TGV-4</td>
<td>6/21/2012</td>
<td>720</td>
<td>36.0</td>
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<tr>
<td>TGV-5</td>
<td>6/21/2012</td>
<td>54</td>
<td>2.7</td>
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<td>TGV-6</td>
<td>6/21/2012</td>
<td>454</td>
<td>22.7</td>
</tr>
<tr>
<td>TGV-7</td>
<td>6/21/2012</td>
<td>128</td>
<td>6.4</td>
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Closed Landfill Cross Section
Typical Landfill Gas Vents
Landfill Gas Monitoring

- Soil gas monitoring
- Ambient air monitoring
- Monitoring inside buildings
Drilling Equipment
Constructing Gas Monitoring Well
Typical Gas Monitoring Wells
Methane Monitoring In Buildings
Gas Monitoring Equipment

Monitoring equipment can directly measure methane gas or present its readings as a percentage of the Lower Explosive Level [LEL]
Methane Migration Case Study
Closed Hampton Landfill

- Approximately 32 acres in total area
- Located in a suburban area
- Stopped accepting waste in 1995
- Capped during 1996 with plastic sheeting [LLDPE]
- Closure costs >$6 million
- Methane was detected >100% LEL in 3 gas wells
- HFD detected >100% LEL at a pipe penetration
- The homeowners were relocated out of the home
Methane Survey

- The Town conducted a landfill gas survey in 1997, installing 26 temporary gas monitoring wells.
- Methane >100% LEL was detected at varying depths in 13 of the 26 soil gas wells sampled in March 1997.
- DES approved a trench design on Dec. 19, 1997.
- The trench was completed in 1998.
- HFD continued to monitor the home.
Migration Cut-Off Trench

- Roughly 530 feet long
- Maximum depth of 20 feet
- Excavated to the water table
- Lined with geomembrane & geo-fabric
- Backfilled with crushed stone
- Installed a horizontal, perforated PVC pipe
- Installed 7 PVC Vents every 75 feet
Trench Construction
Results

• Elevated levels of methane continue to be detected in the trench vents
• Low to No methane has been detected in the gas monitoring probes between the trench and adjacent homes
• The home was sold to new owners
Questions?
Operating Lined Landfills

- Landfill designs follow engineered standards.
- DES staff conduct routine inspections.
- Owners are required to:
  - conduct inspections,
  - monitor air, water, and waste disposal capacity,
  - submit routine reports to DES,
  - submit incident reports and repair any damage.
Closed Unlined Landfills

- Closure designs follow engineered standards.
- Remain a potential threat.
- Roughly 130 landfills have been closed since 1985.
- Vast majority are municipal unlined landfills.
- Closure costs exceeded $1,000,000.
- Post-Closure costs could reach $500,000.
Unlined Landfill Closure Process

- The closure process could take 2 plus years
- Hydrogeology study
- Submittal of cap design concept
- Submittal of cap design and post-closure plans
- Cap construction
- Submittal of Record Drawings
- Post-closure monitoring and maintenance period
- The post-closure period is performance driven
Can You Spot the Landfill?
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 methane,
  – Achieve maximum settlement,
  – Remove harmful impacts to air and water,
  – Remove threat to human health and the environment.
Post-Closure Inspections

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

Post-Closure Summary

– If one or more of the performance standards is **not** met, must continue to monitor
– If one or more of the performance standards is met, submit a **permit modification** to change a post-closure requirements
– To alter the report submittal frequency or other Rule requirement, submit a **waiver** request
– Contact DES prior to using the landfill site for other purposes
Questions?
SOLID WASTE FACILITY OPERATOR WORKSHOP

SWOT Rule Revisions
Effective July 1, 2014
Establishes two types of operators:

1. **Principal operator**
   - Attend basic training and pass the exam.
   - May be in supervisory/management position.
2. Assistant operator

- Attend basic training, but do **not** take/pass the exam.
- Must work under supervision of principal operator.
OPERATOR QUALIFICATIONS

- No more minimum education/experience requirements.
- Employers determine who is competent, not DES.
TRANSITION FROM LEVEL TO STEP

- Attendant in Training → Assistant Operator
- Level 1 → Principal Operator, Step 1
- Level 2 → Principal Operator, Step 2
- Level 3 → Principal Operator, Step 3
- Level 4 → Principal Operator, Step 4
To recognize those individuals who have 20 years of continuous certification, we have designated them as Senior Principal Operators.
STEPS

• Recognition for continuing professional development.

• Awarded automatically with renewal.

• Step increases with hours of accrued training starting July 1, 2014.
## PRINCIPAL OPERATOR STEPS

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<th>Step</th>
<th>Hours of Accumulated Continuing Professional Development</th>
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<tr>
<td>1</td>
<td>2.5 total</td>
</tr>
<tr>
<td>2</td>
<td>12.5 total</td>
</tr>
<tr>
<td>3</td>
<td>25 total</td>
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<tr>
<td>4</td>
<td>37.5 total</td>
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<tr>
<td>Senior</td>
<td>50 total</td>
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Assistant Operators advance in steps according to years of certification.

<table>
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<th>Years Certified</th>
<th>Step</th>
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<tr>
<td>One to 4 total</td>
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<tr>
<td>5 to 9 total</td>
<td>2</td>
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<tr>
<td>10 to 14 total</td>
<td>3</td>
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<tr>
<td>15 or more total</td>
<td>4</td>
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PROFESSIONAL DEVELOPMENT

• “Continuing Professional Development” means professional or technical instruction that imparts information and instruction relevant to waste management and solid waste facility operations to individuals who have already attended basic training.
• 2.5 hour minimum for annual renewal for **ALL** designations.

• Must be completed in the 12 months in-between expiration dates before you are considered late.
PROFESSIONAL DEVELOPMENT

- Repeated courses do not qualify for certification renewal or step increases.
- In-house and third party training count, provided the topic is waste-related.
- If you aren’t sure if the training you want to take will count, call and ask us before you go.
GRACE PERIOD

• There is a 90-day grace period for renewal applications

• A $25 late fee will be assessed if your complete renewal application is received within 90 days after your certification expiration date
BEYOND THE GRACE PERIOD

• If you miss the grace period, you must start over.
  • Come back to Basic Training; and
  • Take the test again
The operator’s signature shall certify:

- the information is true, complete and not misleading;
- the operator understands s/he is subject to penalties of law for false swearing; and
- the operator understands s/he is required to comply with RSA 149-M and SW Rules.