ENVIRONMENTAL
MONITORING AT LANDFILLS

George Schuman
Permit Section Manager, Solid Waste Bureau
New Mexico Environment Department

September 7, 2017
Environmental Monitoring at Landfills

- SWB considers three activities to be environmental monitoring at landfills:
  - Groundwater monitoring
  - Landfill gas monitoring
  - Leachate monitoring
- These monitoring activities are required by the NM Solid Waste Rules, 20.9.2 through 20.9.10 NMAC
Groundwater Monitoring at Permitted Landfills

- Required at municipal and special waste landfills (20.9.9.8.A NMAC), not required at C&D landfills, scrap tire monofills, and asbestos waste monofills (20.9.9.8.B NMAC)

- GW monitoring performed in accordance with approved Groundwater Monitoring System Plan/Groundwater Monitoring Plan

- Three GW sampling phases:
  - Detection monitoring
  - Assessment monitoring
  - Corrective measures
Groundwater Monitoring at Permitted Landfills

- Detection monitoring:
  - Semi-annual sampling
  - Specified list of constituents to be tested for per 20.9.9.20.A and C NMAC ("Subsection A and C")

- Possible amendments to detection monitoring program:
  - Alternate parameter list (reduction in number of constituents to be tested for) after background concentrations approved (20.9.9.11.A(1) and (2) NMAC)
  - Annual sampling frequency after first year (20.9.9.11.A(3) NMAC)
Groundwater Monitoring at Permitted Landfills

- Assessment monitoring:
  - Required if constituent concentration exceeds 50% of the “groundwater protection standard” (i.e., drinking water MCL or NMWQCC GW standard)
  - GW sampling for expanded list of constituents per 20.9.9.20.B NMAC (“Subsection B”)
  - Subsection B detections: added to detection monitoring constituents list
  - Exit assessment monitoring and return to detection monitoring when all constituents are less than 50% of groundwater protection standards
Corrective measures:

- Required if constituent concentration exceeds 100% of the groundwater protection standard
- Assessment of Corrective Measures: determination of nature and extent of GW contamination; evaluation of potential remedies
- Public meeting following completion of Assessment of Corrective Measures
Groundwater Monitoring at Permitted Landfills

- Corrective measures:
  - Submission of proposed remedy
  - Public hearing on proposed remedy
  - Hearing outcome = selection of remedy
  - Remedy implementation
  - Exit corrective measures when all constituents are less than 100% of groundwater protection standards
Requirements vary depending upon date of closure

Category 1 landfills:

- Closed between 4/11/1974 and 5/14/1989
- Subject to 1974 NM Solid Waste Management Regulations, which did not address GW monitoring

However…GW monitoring and assessment may be required by NMED Ground Water Quality Bureau pursuant to NMWQCC Regulations
Groundwater Monitoring at Closed Landfills

- (Closed) Category 2 landfills:
  - Stopped receiving waste between 5/14/1989 and 10/9/1993
  - GW monitoring per Part 9 of current Solid Waste Rules, but GW sampling constituents limited to those approved in the Closure/Post Closure Plan (20.9.9.8.A(3) NMAC)
Groundwater Monitoring at Closed Landfills

- (Closed) Category 3 landfills:
  - Began operations before 10/9/1993 and continued to operate after this date, but now closed
  - GW monitoring per Part 9 of current Solid Waste Rules and must perform GW monitoring per approved Groundwater Monitoring System/Groundwater Monitoring Plan (20.9.9.8.A(2) NMAC)
Groundwater Monitoring at Closed Landfills

- Important note for closed Category 2 and 3 landfills:
  - Closure/Post-Closure Care Plans approved under regulations preceding the 2007 Solid Waste Rules remain in effect until they are suspended, revoked, or otherwise modified (20.9.2.21.A NMAC)
  - GW monitoring subject to requirements of approved Closure/Post-Closure Care Plans, may not be required
Landfill Gas Monitoring at Permitted Landfills

- Municipal landfills, special waste landfills, and monofills (20.9.5.9.B and C NMAC):
  - Monitoring frequency: **Quarterly**
  - Methane concentration must not exceed 100% lower explosive limit (LEL) at facility boundary
  - Methane concentration must not exceed 25% LEL inside facility structures
Landfill Gas Monitoring at Permitted Landfills

- Municipal landfills, special waste landfills, and monofills (20.9.5.9.B and C NMAC):
  - If regulatory limits are exceeded, must:
    - Take immediate steps to ensure protection of public health, welfare, and environment
    - Develop and implement and approved remediation plan within 60 days of detection
Landfill Gas Monitoring at Permitted Landfills

- Reduced monitoring frequency may be approved if:
  - Waste receipts less than 20 tons per day, annual average (no operating LFs meet this threshold) or
  - Monofill (asbestos waste or scrap tires)
Landfill Gas Monitoring at Permitted Landfills

- C&D debris landfills (20.9.5.10.C NMAC):
  - Methane concentration must not exceed 100% lower explosive limit (LEL) at facility boundary
  - Methane concentration must not exceed 25% LEL inside facility structures
  - **But:** Monitoring frequency is not specified by Solid Waste Rules
  - Monitoring frequency: As approved by solid waste facility permit
Landfill Gas Monitoring at Closed Landfills

- Municipal landfills, special waste landfills, and monofills (20.9.6.9.A(3)(h)(ii) NMAC):
  - Implement a methane monitoring plan meeting requirements for operating LFs:
    - Quarterly monitoring
    - Methane must not exceed 100% LEL at facility boundary
    - Methane must not exceed 25% LEL inside facility structures
Landfill Gas Monitoring at Closed Landfills

- Reduced monitoring frequency at most closed landfills:
  - Waste receipts usually less than 20 tons per day for closed LFs
  - Semi-annual to annual monitoring frequency typically approved by SWB
Leachate Monitoring at Permitted Landfills

- Disposal cells must be constructed with leachate collection systems (20.9.4.15 NMAC)

- Leachate collection system design and construction requirements (20.9.4.15.A and B NMAC):
  - Maintain less than one-foot depth of leachate on liner
  - Maintain a minimum 2% slope throughout system
  - Materials must withstand chemical attack from waste and leachate
  - Materials must withstand damage from load and stresses due to overlying waste
Leachate Monitoring at Permitted Landfills

- Leachate management plan is required (20.9.4.15.C NMAC):
  - Means of leachate analysis
  - Treatment method, if necessary
  - Disposal methods
Leachate Monitoring at Permitted Landfills

- Leachate measurement is required (20.9.5.9.K NMAC):
  - Measure leachate head on liner
  - Quarterly records of leachate generation and treatment
Leachate Monitoring at Permitted Landfills

- Leachate disposal is typically accomplished by:
  - Evaporation in lined impoundments
  - Spraying onto waste at working face to aid compaction (recirculation)
  - Spraying over lined cells for dust control
Leachate Monitoring at Closed Landfills

- Not required as closed landfills lack leachate collection systems
- One exception: Smith Lake Landfill
  - Operated from 1992 to 1995
  - Lined landfill
  - Leachate gravity drains to evaporation pond
Issue: Landfill Gas Generation at Closed Landfills

- Most closed LFs show little or no methane in shallow subsurface at facility boundary
- However, several closed LFs have problems with methane generation
- Common factor: water infiltration into waste mass
Issue: Landfill Gas Generation at Closed Landfills

- Old Silver City Landfill
  - LEL exceedances at numerous LF gas monitoring probes
  - Excessive erosion of final cover
Issue: Landfill Gas Generation at Closed Landfills

Final cover erosion

Final cover erosion
Issue: Landfill Gas Generation at Closed Landfills

- Old Silver City Landfill
  - Repairs to final cover and storm water control improvements made late 2011-early 2012
  - Result: Methane concentrations have dropped substantially, typically only one monitoring location shows LEL exceedance (probe installed into waste)
  - Additional benefit: Construction of baseball and soccer fields over portion of closed landfill (synthetic turf)
Issue: Landfill Gas Generation at Closed Landfills

- South Broadway Landfill
  - Closed in 1989
  - 25-year post-closure care period in accordance with 1989 Solid Waste Management Regulations
  - Between 1996 and 2002: Water tank constructed adjacent to landfill
  - 2004: Approval granted for construction of road across landfill to provide additional access to concert venue (currently Isleta Amphitheater) on adjacent parcel
Issue: Landfill Gas Generation at Closed Landfills

Northern portion of South Broadway LF - Image date: April 2017
Issue: Landfill Gas Generation at Closed Landfills

- South Broadway Landfill
  - January 2015: SWB staff conducted post-closure care inspection
    - Evidence of water flowing from water tank across closed disposal cells in vicinity of access road
    - Found high levels of methane in shallow subsurface adjacent to access road
    - Area adjacent to access road used for concert parking and related activities
Issue: Landfill Gas Generation at Closed Landfills

Image date: November 2012

Approx. area of elevated subsurface methane (red)

Parking area (blue)
Issue: Landfill Gas Generation at Closed Landfills

- South Broadway Landfill
  - Response:
    - Locked gates installed at each end of access road (road use restricted to event staff only)
    - Signs and fencing along access road to prohibit parking
    - Cease discharges from water tank onto closed disposal cell
Issue: Leachate Monitoring at Permitted Landfills

- Varying volumes of leachate reported by landfills of comparable size and operation
  - Several landfills: 150,000 to 200,000 gallons of leachate pumped per year
  - Other landfills: Zero to a few thousand gallons of leachate pumped per year

- Reasons:
  - Lack of correct information on leachate riser construction, and/or
  - Compromised leachate collection systems
Issue: Leachate Monitoring at Permitted Landfills

- Sand Point Landfill
  - 1995-2010:
    - 3,000 gallons pumped in 1998
    - 13,000 gallons pumped in 2002
    - Zero gallons pumped in other years
  - Required evaluation of leachate collection system during permit renewal process (2013-2014)
  - Video inspection conducted in August 2014
Issue: Leachate Monitoring at Permitted Landfills

- Sand Point Landfill
  - Video inspection findings:
    - Riser length, Cells 1/2 = 114 feet
    - Leachate level, Cells 1/2 = 86 feet
    - Leachate head on liner, Cells 1/2 = approximately 4 feet
    - Riser length, Cells 3/4 = 63 feet
    - Leachate level, Cells 3/4 = 12 feet
    - Leachate head on liner, Cells 3/4 = approximately 9.5 feet
  - Regulatory limit: No more than 1 foot of leachate head on liner
Issue: Leachate Monitoring at Permitted Landfills

Leachate in riser for Cells 1/2 riser
Issue: Leachate Monitoring at Permitted Landfills

Bottom of riser/sump depth, Cells 1/2
Smaller diameter pipe in riser for Cells 1/2 at approx. 18 feet
Issue: Leachate Monitoring at Permitted Landfills

Leachate in riser for Cells 3/4 riser
Issue: Leachate Monitoring at Permitted Landfills

Near bottom of riser, Cells 3/4
Issue: Leachate Monitoring at Permitted Landfills

Bottom of riser/sump depth, Cells 3/4
Issue: Leachate Monitoring at Permitted Landfills

- Sand Point Landfill
  - Leachate monitoring protocol at time of video inspection:
    - Seven 10-foot sections of threaded PVC well casing (2-inch diameter) used to measure depth to leachate
    - Portable pump with 20-foot hose
  - Insufficient length of well casing to measure leachate in Cells 1/2
  - Pump hose too short to maintain leachate at one foot of head in either system
Issue: Leachate Monitoring at Permitted Landfills

- Sand Point Landfill
  - Landfill operators did not have the necessary as-built information to monitor leachate effectively
  - Response:
    - Construct new headwalls at leachate risers
    - Dedicated pumps with pressure transducers, control panels
    - As-built information posted on control panels
    - Occasional manual measurements
    - Pumped 814,000 gallons (Nov. 2013-April 2015)
Issue: Leachate Monitoring at Permitted Landfills

New headwall, Cells 1/2
Issue: Leachate Monitoring at Permitted Landfills

New pump control panel, Cells 1/2
Issue: Leachate Monitoring at Permitted Landfills

- Otero-Greentree Regional Landfill
  - 2004-2014:
    - Cells 1-4: No leachate reported
    - Required evaluation of leachate collection system during permit renewal process
    - Inspection conducted with plumbing rodder in June 2014, subsequent video inspection
Issue: Leachate Monitoring at Permitted Landfills

- Otero-Greentree Regional Landfill
  - Inspection findings:
    - Cell 1: Obstruction at 84 feet, unable to advance rodder; subsequent video inspection showed sediment blockage
    - Cell 2: Obstruction at 40 feet; subsequent video inspection revealed riser collapse at approximately 30 feet
    - Cell 3: Leachate present at about 88 feet, calculated to be approximately 0.7 feet of leachate head on liner
    - Cell 4: Leachate present at about 70 feet, calculated to be approximately 5.7 feet of leachate head on liner
Issue: Leachate Monitoring at Permitted Landfills

Cell 1 riser filled with sediment
Issue: Leachate Monitoring at Permitted Landfills

Pipe separation or collapse, Cell 2 riser
Issue: Leachate Monitoring at Permitted Landfills

- Otero-Greentree Regional Landfill
  - Response:
    - ✓ Early final closure of Cells 1 and 2 after issuance of renewed permit
    - ✓ On-going monitoring of Cells 3 and 4 with accurate as-built information obtained from video inspection
    - ✓ Pumped 135,000 gallons (2014-June 2017)
    - ✓ Weekly leachate pumping continues (still more than 1 foot of head on liner)
Final Plug for Video Inspection of Leachate Collection Systems

- Strange objects might be lurking in leachate collection systems...
Final Plug for Video Inspection of Leachate Collection Systems

Appears to be some type of object in the riser pipe
Final Plug for Video Inspection of Leachate Collection Systems
Final Plug for Video Inspection of Leachate Collection Systems

Basketball floating in leachate
Another object in riser pipe?

Final Plug for Video Inspection of Leachate Collection Systems
Plastic bottle floating in leachate