SANDIA NATIONAL LABORATORIES
MIXED WASTE LANDFILL
LONG-TERM MONITORING & MAINTENANCE PLAN

New Mexico Environment Department

October 16, 2012
Background Information

- MWL occupies 2.6 acres in Technical Area III at Sandia (SNL)
  - 5 miles SE of Albuquerque International Sunport
  - 4 miles south of SNL's central facilities
- Operated 1959 to 1988, low-level radioactive and mixed waste
- Groundwater monitoring began 1990
- Final Order May 2005 – install cover (with biointrusion barrier) and conduct monitoring
- Vegetative Cover (i.e., evapotranspirative [ET] Cover) installed 2009
Location of Kirtland Air Force Base, SNL Technical Areas, and the Mixed Waste Landfill
Location of the MWL Within Technical Area III
Current Conditions

- Cover 4.1 acres (with side slopes), 4 engineered layers (barriers) above original ground surface
- Surface water diverted around Cover and to west, as with surrounding land
- Security fence surrounds cover, locked gates at north and south ends of fence
Profile of MWL Cover

- Main layers thicker (more protective) than design specifications
- Total thickness ~5.4 feet, not including Subgrade
Site Map

Site Features
- Cover
- Site Drainage
- Security Fence
- Perimeter Road
- North Staging Area

Green area is Cover surface over original 2.6 acre boundary
View to west showing MWL Cover
Regulatory Background

Corrective Measures Study (CMS) Report with recommended final remedy submitted May 2003

Public Hearing on CMS December 2004

NMED Final Order issued May 2005 (and Permit Modification):

- Cover (with biointrusion barrier) and monitoring design/construction specifications, fate and transport model
- Corrective Measures Implementation (CMI) Plan:
  - CMI Report: as-built construction of Cover
  - CMI Report: Long-Term Monitoring and Maintenance Plan (LTMP)
  - Long-Term Monitoring and Maintenance Plan
  - Long-Term Reevaluation Reports

CMI Plan submitted November 2005, approved December 2008
Regulatory Background

- Cover installed 2009
- CMI Report submitted January 2010, approved October 14, 2011
  - Public meeting December 14, 2010
  - 90-day comment period November 2010 – February 2011
- LTMMP submitted March 2012
  - 60-day comment period ongoing September 14 - November 13, 2012
  - Public meeting October 16, 2012 (this meeting)
What's Next

- Approve LTMP after consideration of public comment
- SNL will submit for the MWL Permit Modification
- Request for Corrective Action Complete with Controls
- LTMP documents the controls
- Further opportunity for public comment on MWL
- Annual reports and 5-year reevaluations
- Further opportunity for public comment on MWL
NMED Contact Information

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- LTMMP found at:
Mixed Waste Landfill
Long-Term Monitoring & Maintenance Plan

Technical Information
Monitoring, Inspection, and Reporting Requirements
Mixed Waste Landfill
Long-Term Monitoring & Maintenance Plan

The objective of the proposed long-term monitoring program documented in the Long-Term Monitoring and Maintenance Plan (LTMMMP) is to ensure that the final remedy and site conditions remain protective of human health and the environment.

Components

1. Multi-Media Monitoring (with Trigger Levels)
2. Inspection, Maintenance, and Repair
3. Reporting
## Component 1 – Multi-Media Monitoring
### Summary of Long-Term Monitoring Parameters, Frequencies, and Methods
Mixed Waste Landfill, Sandia National Laboratories, New Mexico

<table>
<thead>
<tr>
<th>Sampling Media</th>
<th>Monitoring Parameters</th>
<th>Monitoring Frequency</th>
<th>Number of Samples Per Event</th>
<th>Purpose</th>
<th>Monitoring Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air</strong></td>
<td>Radon</td>
<td>Year 1 – Quarterly</td>
<td>17</td>
<td>Determine if sealed radium-226 sources remain intact in the disposal area. Two previous studies show radon-222 emissions from the MWL are consistent with background values.</td>
<td>17 Track-etch detectors placed around the perimeter and on the MWL. Samples are time-weighted average for a 3-month period.</td>
</tr>
<tr>
<td><strong>Surface Soil</strong></td>
<td>Tritium</td>
<td>Annual</td>
<td>4</td>
<td>Determine if a significant release of tritium occurs from the disposal area. Monitoring has been conducted since 1985 and tritium values have been steadily decreasing over time.</td>
<td>One soil sample collected from each corner (4) of the MWL ET Cover. Moisture is extracted and analyzed for tritium.</td>
</tr>
<tr>
<td><strong>Vadose Zone</strong></td>
<td>VOCs in soil vapor</td>
<td>Year 1 – Semiannual</td>
<td>17</td>
<td>Determine VOC soil-vapor concentrations in the subsurface above the water table and monitor over time. Two previous studies show VOC soil-vapor concentrations are very low to a depth of 50 feet below ground surface.</td>
<td>Sampling and analysis for 50 VOCs at 17 locations to provide a complete profile of VOC soil-vapor concentrations in the subsurface above the water table.</td>
</tr>
<tr>
<td><strong>Vadose Zone</strong></td>
<td>Moisture content underneath the ET Cover</td>
<td>Year 1 – Semiannual</td>
<td>171</td>
<td>Determine soil-moisture content underneath the ET Cover over time to evaluate moisture infiltration through the ET Cover. Baseline data collected prior to ET Cover installation.</td>
<td>Soil-moisture monitoring using a neutron probe. Measurements obtained at 1-ft increments from 4 ft to 25 ft bgs, then 5-ft increments to total depth in the 3 soil-moisture monitoring access tubes (~200 linear ft).</td>
</tr>
</tbody>
</table>
## Component 1 – Multi-Media Monitoring

Summary of Long-Term Monitoring Parameters, Frequencies, and Methods

Mixed Waste Landfill, Sandia National Laboratories, New Mexico

<table>
<thead>
<tr>
<th>Sampling Media</th>
<th>Monitoring Parameters/ Constituents of Concern</th>
<th>Monitoring Frequency</th>
<th>Number of Samples Per Event</th>
<th>Purpose</th>
<th>Monitoring Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater</td>
<td>VOCs, metals (uranium, cadmium, radon, tritium, radon, gamma-emitting radionuclides (short list), and gross alpha/beta activity</td>
<td>Semiannual</td>
<td>4</td>
<td>Determine groundwater concentrations over time to evaluate potential impacts from the MWL and other sources. Groundwater monitoring has been performed at MWL since 1990 and provides over 20 years of data indicating the MWL has not impacted groundwater.</td>
<td>Sampling and analysis of the MWL compliance groundwater monitoring well network: MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9.</td>
</tr>
<tr>
<td>Biota - Surface Soil</td>
<td>RCRA Metals plus Cu, Ni, V, Zn, Co, and Be; and gamma-emitting radionuclides (short list)</td>
<td>Annual</td>
<td>Up to 4 (2 each, if they exist)</td>
<td>Determine surface soil concentrations in the vicinity of features indicative of animal activity (burrows and/or ant hills) to evaluate contaminant transport through biological activity.</td>
<td>Sampling and analysis of surface soil at animal burrow and/or ant hill features identified during routine cover inspections.</td>
</tr>
<tr>
<td>Biota - Cover Vegetation</td>
<td>Gamma-emitting radionuclides (short list) in vegetation</td>
<td>Annual</td>
<td>Up to 2 if they exist</td>
<td>Determine radionuclide activity of vegetation that have root systems that could potentially reach the disposal area to evaluate contaminant transport through vegetation.</td>
<td>Sampling and analysis of potentially deep-rooted vegetation, including the plant and root system.</td>
</tr>
</tbody>
</table>
AIR MONITORING
Radon Sampling Locations

Monitoring Method
17 radon gas alpha-track detectors
• 10 detectors on perimeter fence
• 5 detectors on ET Cover over disposal areas with radium-226 sources
• 2 detectors at background locations, away from site
• Detectors provide time-weighted average (pico curries per liter of air)

Frequency
• First 2 years – Quarterly
• Years 3 & 4 – Semiannual
• Year 5 and beyond - Annual
SURFACE SOIL MONITORING
Tritium Sampling Locations

Monitoring Method
- Monitoring for tritium since 1985
- One sample collected from each corner of the MWL ET Cover (4 total)
- Moisture is extracted and analyzed for tritium using liquid scintillation

Frequency
- Annual
VADOSE ZONE MONITORING
Volatile Organic Compounds (VOCs) in Soil-Vapor

Monitoring Method
• 17 samples collected from 3 multiport wells and 2 single-port wells (5 total monitoring wells)
• All samples analyzed for 50 VOCs per EPA Method TO-15 or equivalent

Frequency
• Semiannual for first 3 years, then Annual
VADOSE ZONE MONITORING
 Soil Moisture

Monitoring Method
- 171 measurements from 3 access tubes
- Measurements made using a calibrated neutron probe/gauge
  - 1-foot increments from 4 to 25 feet below ground surface
  - 5-foot increments to total depth (~200 linear feet)
- Soil moisture values in percent by volume

Frequency
- Semiannual for first 2 years, then Annual
GROUNDWATER MONITORING

Monitoring Method
- One sample collected from each of the 4 compliance groundwater monitoring wells
- Analyses include VOCs, metals, tritium, radon, gamma-emitting radionuclides (short list), and gross alpha/beta activity via EPA Methods

Frequency
- Semiannual
BIOTA - SURFACE SOIL & VEGETATION MONITORING

Monitoring Method

- **Surface soil**: Up to 4 samples from animal burrows and ant hills (2 each) as identified during cover inspections

- **Vegetation**: Up to 2 samples of potentially deep-rooted plants overlying disposal area, as identified during cover inspections

Frequency

- **Annual**
## Component 1 – Multi-Media Monitoring

Summary of Long-Term Monitoring Parameters with Trigger Levels
Mixed Waste Landfill, Sandia National Laboratories, New Mexico

<table>
<thead>
<tr>
<th>Sampling Media</th>
<th>Monitoring Parameter</th>
<th>Trigger Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Radon</td>
<td>4 pCi/L</td>
</tr>
<tr>
<td>Surface Soil</td>
<td>Tritium</td>
<td>20,000 pCi/L in soil moisture</td>
</tr>
<tr>
<td>Surface Soil - Biota Monitoring</td>
<td>Metals</td>
<td>NMED Industrial/Occupational Soil Screening Levels.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Listed in Table 5.2.2-1 of the MWL Long-Term Monitoring and Maintenance Plan</td>
</tr>
<tr>
<td>Vadose Zone</td>
<td>VOCs in soil vapor</td>
<td>PCE = 20 pmv (parts per million - volume)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCE = 20 ppmv</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total VOCs = 25 ppmv</td>
</tr>
<tr>
<td>Vadose Zone</td>
<td>Moisture content in underlying vadose zone</td>
<td>Average 23% volumetric soil moisture content</td>
</tr>
<tr>
<td>Groundwater</td>
<td>VOCs, metals, and radiological parameters</td>
<td>All groundwater trigger levels listed in Table 5.2.4-1 of the MWL Long-Term Monitoring and Maintenance Plan</td>
</tr>
</tbody>
</table>
Component 1 – Multi-Media Monitoring
Trigger Evaluation Process for the Mixed Waste Landfill

The trigger evaluation process is designed to ensure the protection of human health and the environment, while allowing adequate data collection to eliminate field sampling and/or laboratory error and identify short-term exceedances that do not reflect long-term trends.

Steps 1 & 2 require resampling to confirm exceedance, and notification to NMED if exceedance confirmed

Steps 3 & 4 require further investigation and reporting. Investigation Report must be submitted to NMED within 1 year of exceedance notification

NMED will review the investigation report and determine final actions to be implemented.
Component 2
Site Inspection, Maintenance & Repair Activities

- Site inspections and related repair & maintenance activities will be performed on an quarterly basis

- Soil-vapor monitoring wells, soil-moisture monitoring access tubes, groundwater monitoring wells, and related monitoring equipment will be inspected, repaired, and maintained at the frequency that the monitoring occurs

- All inspection and maintenance/repair parameters are presented in Table 4.6-1 of the MWL Long-Term Monitoring and Maintenance Plan
## Component 2 – Inspection, Maintenance, and Repair

### Long-Term Inspection, Maintenance, and Repair Schedule

Mixed Waste Landfill, Sandia National Laboratories, New Mexico

<table>
<thead>
<tr>
<th>MWL System to be Inspected</th>
<th>Inspection Parameters</th>
<th>Inspection Frequency</th>
<th>Maintenance Implementation</th>
<th>Maintenance/Repair Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ET Cover Surface</strong></td>
<td>Vegetation Inventory</td>
<td>Quarterly until vegetation is established, annually thereafter by a staff biologist</td>
<td>Soil augmentations and/or reseeding</td>
<td>Within 60 days of discovery of needed repairs. Reseeding repairs may be delayed to await appropriate growing season.</td>
</tr>
<tr>
<td></td>
<td>Contiguous areas of no vegetation &gt;200 square feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Animal intrusion burrows in excess of 4 inches in diameter</td>
<td></td>
<td>Repair cover system damage that exceeds prescribed limits</td>
<td></td>
</tr>
<tr>
<td><strong>ET Cover Surface</strong></td>
<td>Settlement of cover surface in excess of 6 inches</td>
<td>Quarterly by a field technician</td>
<td></td>
<td>Within 60 days of discovery of needed repairs. Reseeding repairs may be delayed to await appropriate growing season.</td>
</tr>
<tr>
<td></td>
<td>Erosion of cover soil in excess of 6 inches deep</td>
<td></td>
<td>Repair cover system damage that exceeds prescribed limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ponding of water on the ET Cover surface in excess of 100 square feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Animal intrusion burrows in excess of 4 inches in diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contiguous areas of no vegetation &gt;200 square feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surface-Water Drainage Features</strong></td>
<td>Channel or sidewall erosion in excess of 6 inches deep</td>
<td>Quarterly by a field technician</td>
<td>Repair erosion that exceeds prescribed limits</td>
<td>Within 60 days of discovery of needed repairs.</td>
</tr>
<tr>
<td></td>
<td>Accumulations of sediment in excess of 6 inches deep or debris that blocks more than 1/3 of the channel width</td>
<td></td>
<td>Remove sediment and debris that exceed prescribed limits</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Within 60 days of discovery of needed repairs.
- Reseeding repairs may be delayed to await appropriate growing season.
Component 2 – Inspection, Maintenance, and Repair
Long-Term Inspection, Maintenance, and Repair Schedule
Mixed Waste Landfill, Sandia National Laboratories, New Mexico

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<th>Maintenance/ Repair Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil-Vapor Monitoring Wells, Soil-Moisture Monitoring Access Tubes, and Groundwater Monitoring Wells</td>
<td>Concrete pads, stanchions, and protective casings</td>
<td>Groundwater and Vadose Zone Network Components: Field technician to inspect at same frequency/time that monitoring occurs</td>
<td>Maintain, clean, repair, replace, re-label, as appropriate</td>
<td>Within 60 days of discovery of needed repairs.</td>
</tr>
<tr>
<td></td>
<td>Well cover caps and Swagelok® (or equivalent) dust caps</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Monitoring wells and soil-vapor sampling port labels</td>
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</tr>
<tr>
<td></td>
<td>Locks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sampling pumps and tubing Neutron probe and cable system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fence</td>
<td>Presence of wind-blown plants and debris</td>
<td>Quarterly by a field technician</td>
<td>Remove wind-blown plants and debris</td>
<td>Within 60 days of discovery of needed repairs.</td>
</tr>
<tr>
<td></td>
<td>Condition of fence wires, posts, gates, gate locks, warning signs, and survey monuments in the local area</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Component 3
Long-Term Reporting Requirements

• Annual Reports will be submitted to NMED to document all monitoring and inspection activities/results conducted during the previous year
  • Proposed annual period is April 1 – March 31
  • Annual Reports due to NMED by June 30 of each year
  • All monitoring results will be reported, evaluated, and compared to trigger levels
  • All inspection, maintenance, and repair activities presented
  • Reports will evaluate site conditions and the effectiveness of the final remedy
Mixed Waste Landfill
Long-Term Monitoring & Maintenance Plan

Conclusions

• Long-term multi-media monitoring program to be conducted to ensure MWL site conditions remain protective of human health and the environment

• Routine, quarterly inspection, maintenance, and repair of physical controls (i.e., ET Cover, Surface-Water Drainage, and Security Fence)

• Annual Reporting to NMED documenting all activities and presenting all monitoring results