# Mixed Waste Landfill
# Long-Term Monitoring & Maintenance Plan

## Technical Information

## Monitoring, Inspection, and Reporting Requirements

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# 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 (LTMMP) 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

| Sampling Media | Monitoring Parameters | Monitoring Frequency | Number of Samples Per Event | Purpose | Monitoring Method |
|---|---|---|---|---|---|
| **Air** | Radon | Year 1 – Quarterly<br>Year 2 – Quarterly<br>Year 3 – Semiannual<br>Year 4 – Semiannual<br>Year 5 and subsequent years – Annual | 17 | Determine if sealed radium -226 sources remain intact in the disposal area.<br>Two previous studies show radon-222 emissions from the MWL are consistent with background values. | 17 Track-etch detectors placed around the perimeter and on the MWL. Samples are time-weighted average for a 3-month period. |
| **Surface Soil** | Tritium | Annual | 4 | Determine if a significant release of tritium occurs from the disposal area.<br>Monitoring has been conducted since 1985 and tritium values have been steadily decreasing over time. | One soil sample collected from each corner (4) of the MWL ET Cover. Moisture is extracted and analyzed for tritium. |
| **Vadose Zone** | VOCs in soil vapor | Year 1 – Semiannual<br>Year 2 – Semiannual<br>Year 3 – Semiannual<br>Year 4 and subsequent years – Annual | 17 | Determine VOC soil-vapor concentrations in the subsurface above the water table and monitor over time.<br>Two previous studies show VOC soil-vapor concentrations are very low to a depth of 50 feet below ground surface. | 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. |
| **Vadose Zone** | Moisture content underneath the ET Cover | Year 1 – Semiannual<br>Year 2 – Semiannual<br>Year 3 and subsequent years – Annual | 171 | Determine soil-moisture content underneath the ET Cover over time to evaluate moisture infiltration through the ET Cover.<br>Baseline data collected prior to ET Cover installation. | 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). |

# Component 1 – Multi-Media Monitoring

## Summary of Long-Term Monitoring Parameters, Frequencies, and Methods
## Mixed Waste Landfill, Sandia National Laboratories, New Mexico

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

# AIR MONITORING
## Radon Sampling Locations

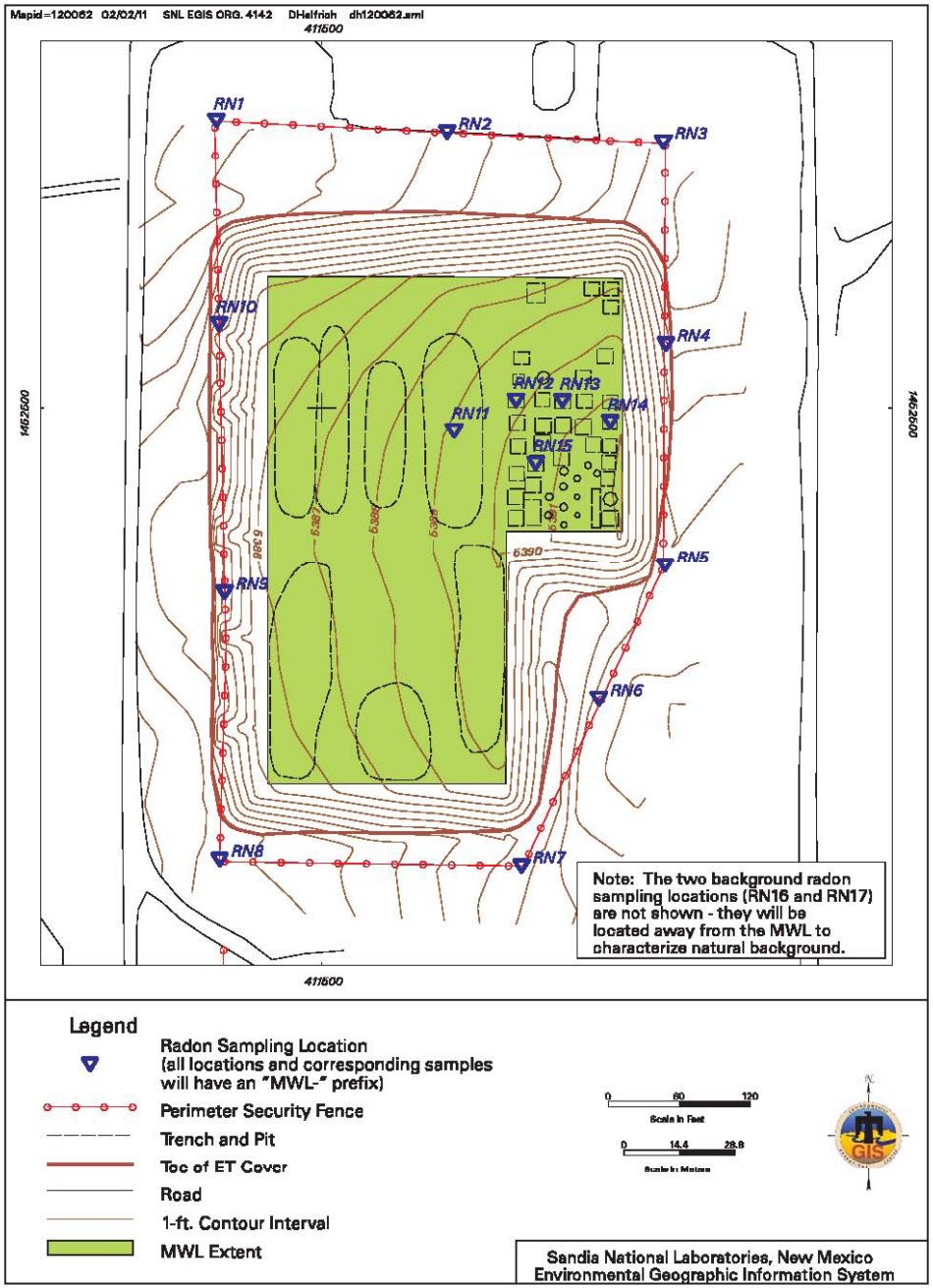
*Monitoring Method*

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



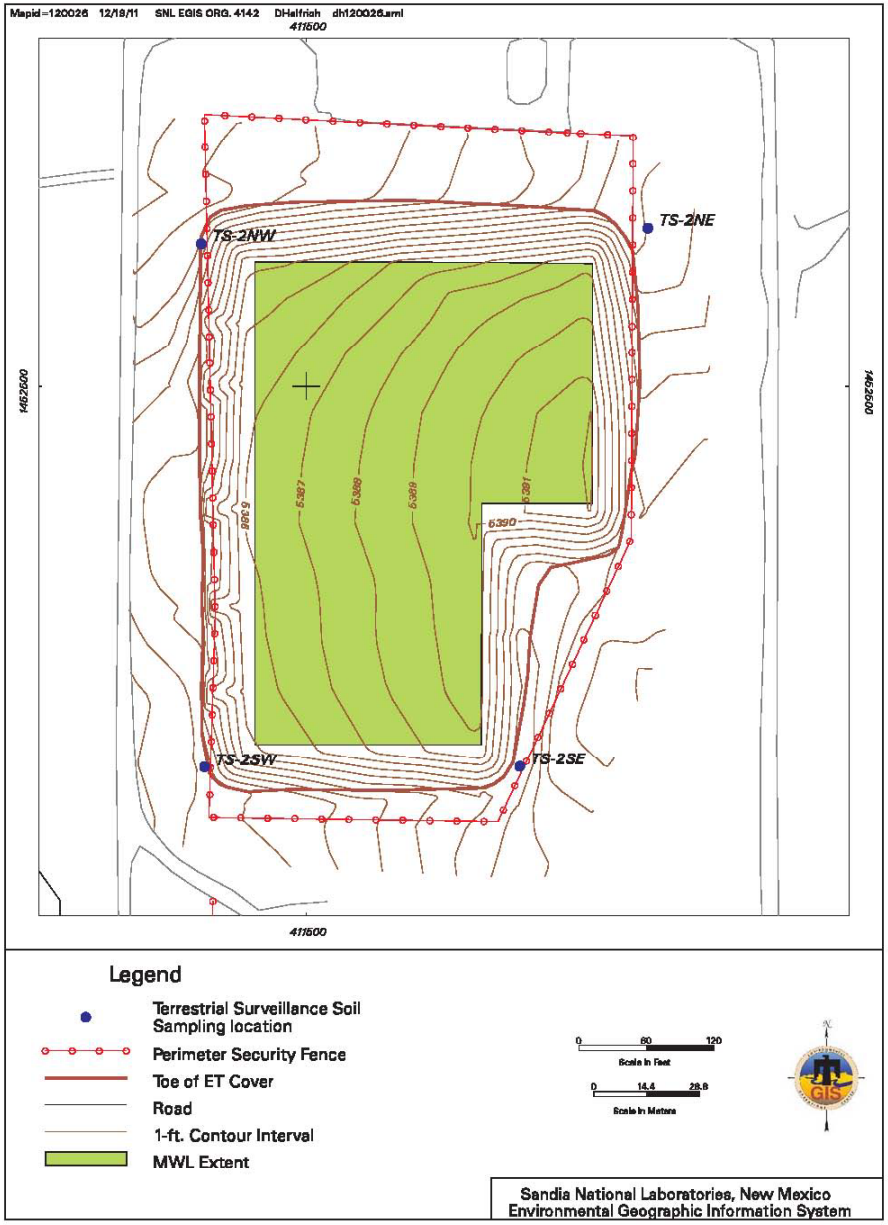
# SURFACE SOIL MONITORING
## Tritium Sampling Locations

*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



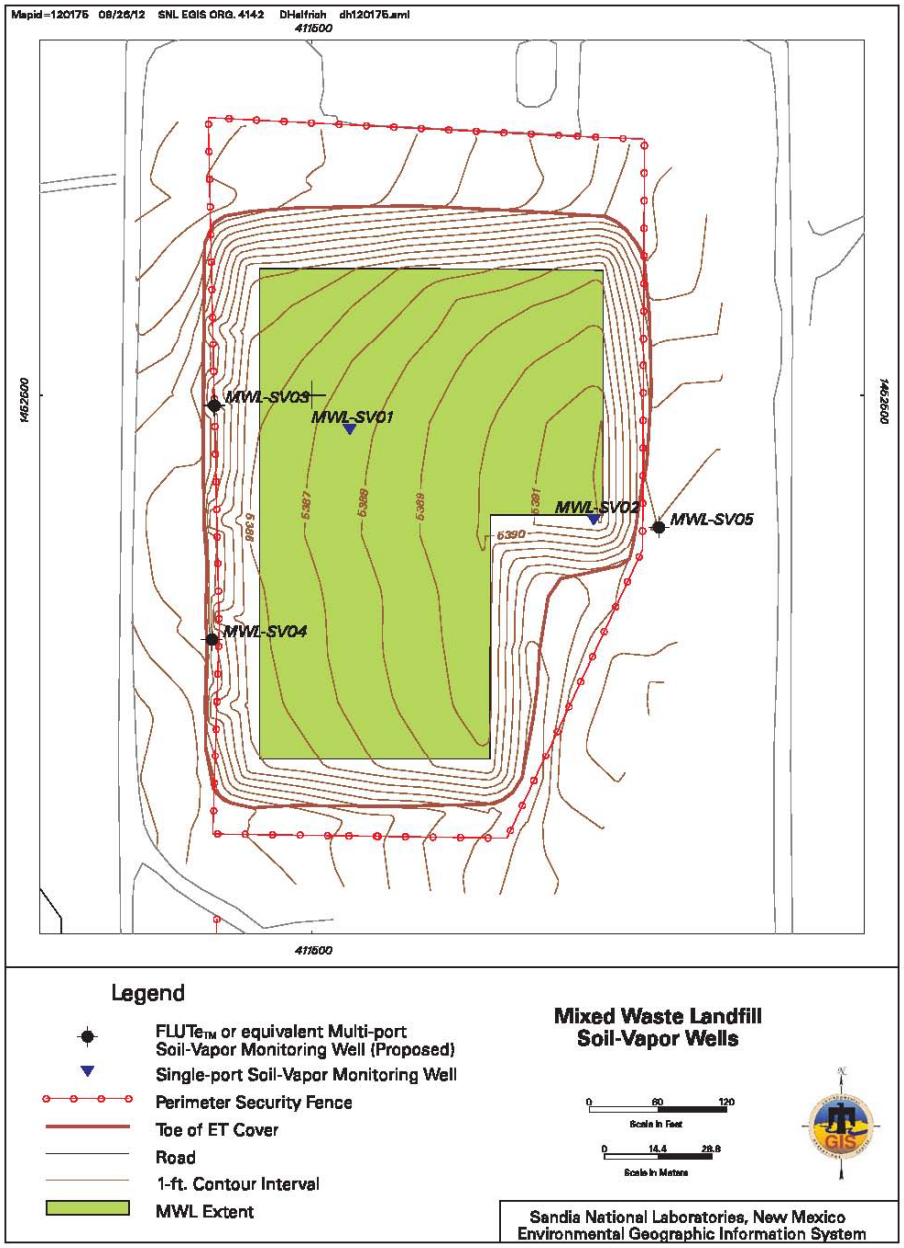
# VADOSE ZONE MONITORING
## Volatile Organic Compounds (VOCs) in Soil-Vapor

*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



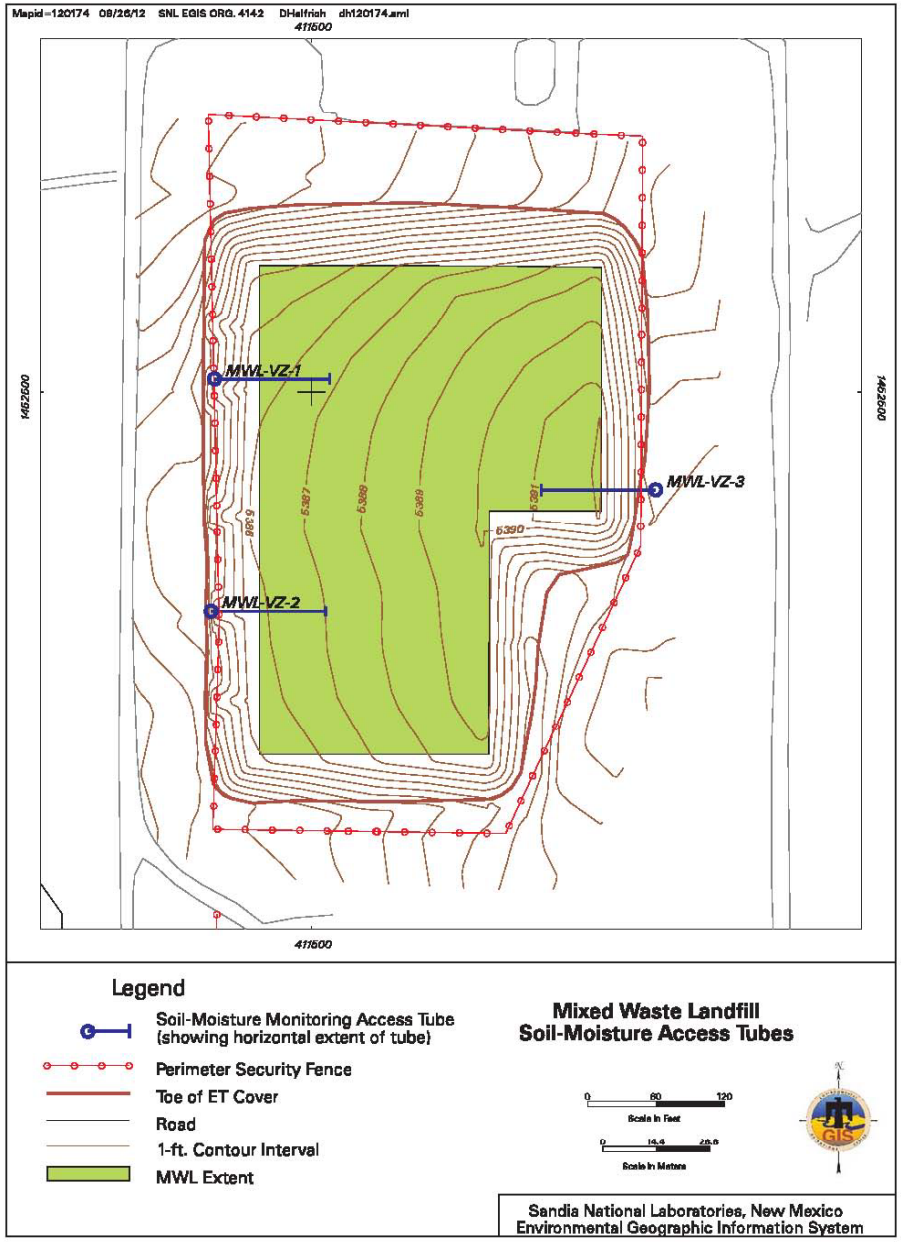
# VADOSE ZONE MONITORING
## Soil Moisture

*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



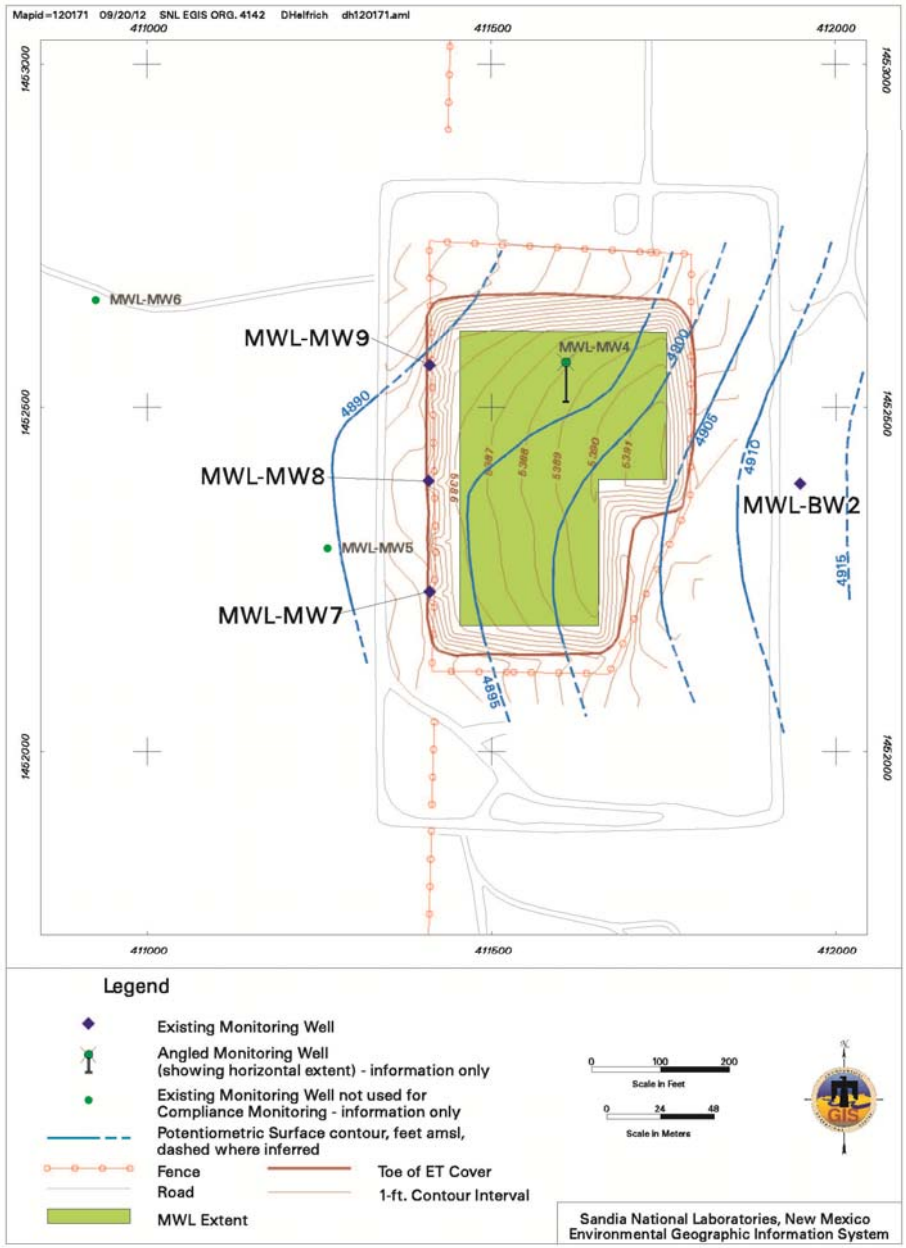
# GROUNDWATER MONITORING

*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

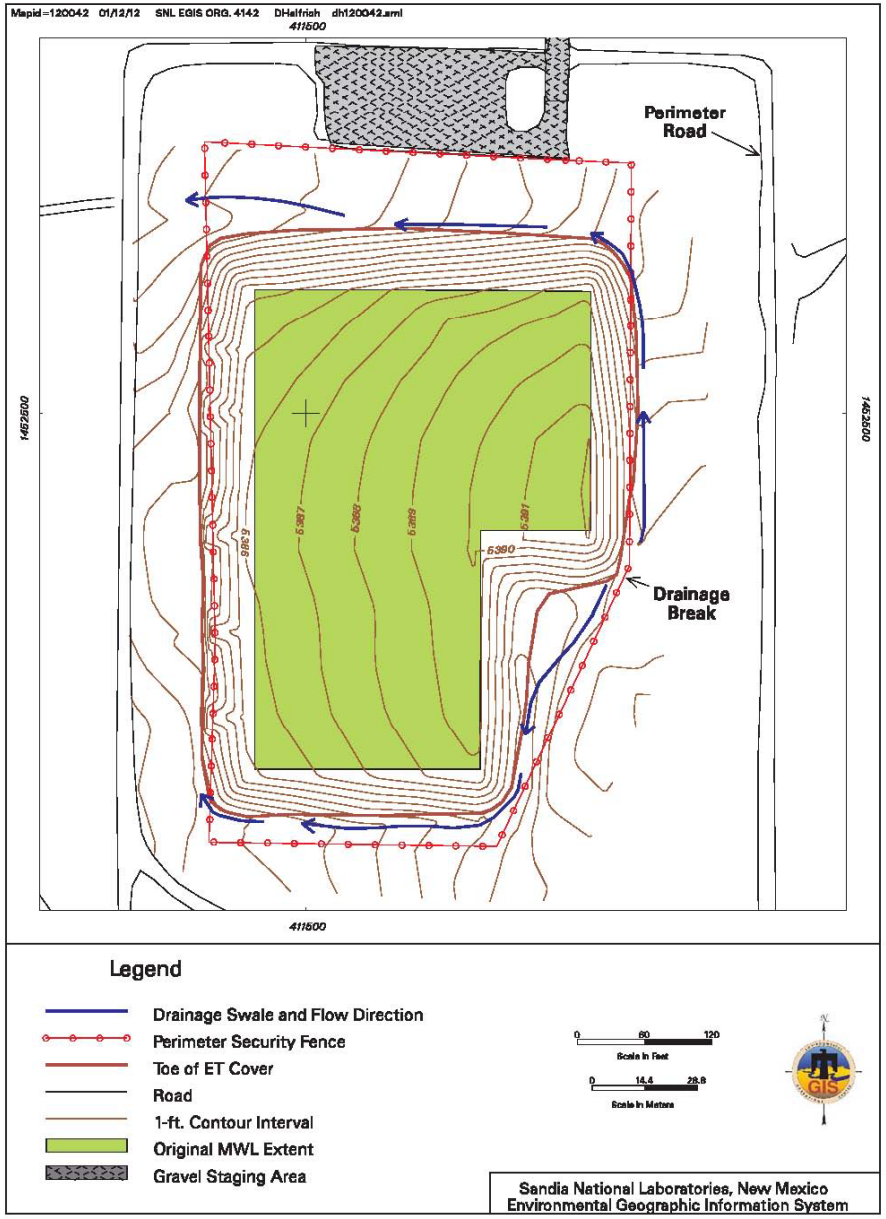
*Monitoring Method*

- 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

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

## Component 1 – Multi-Media Monitoring

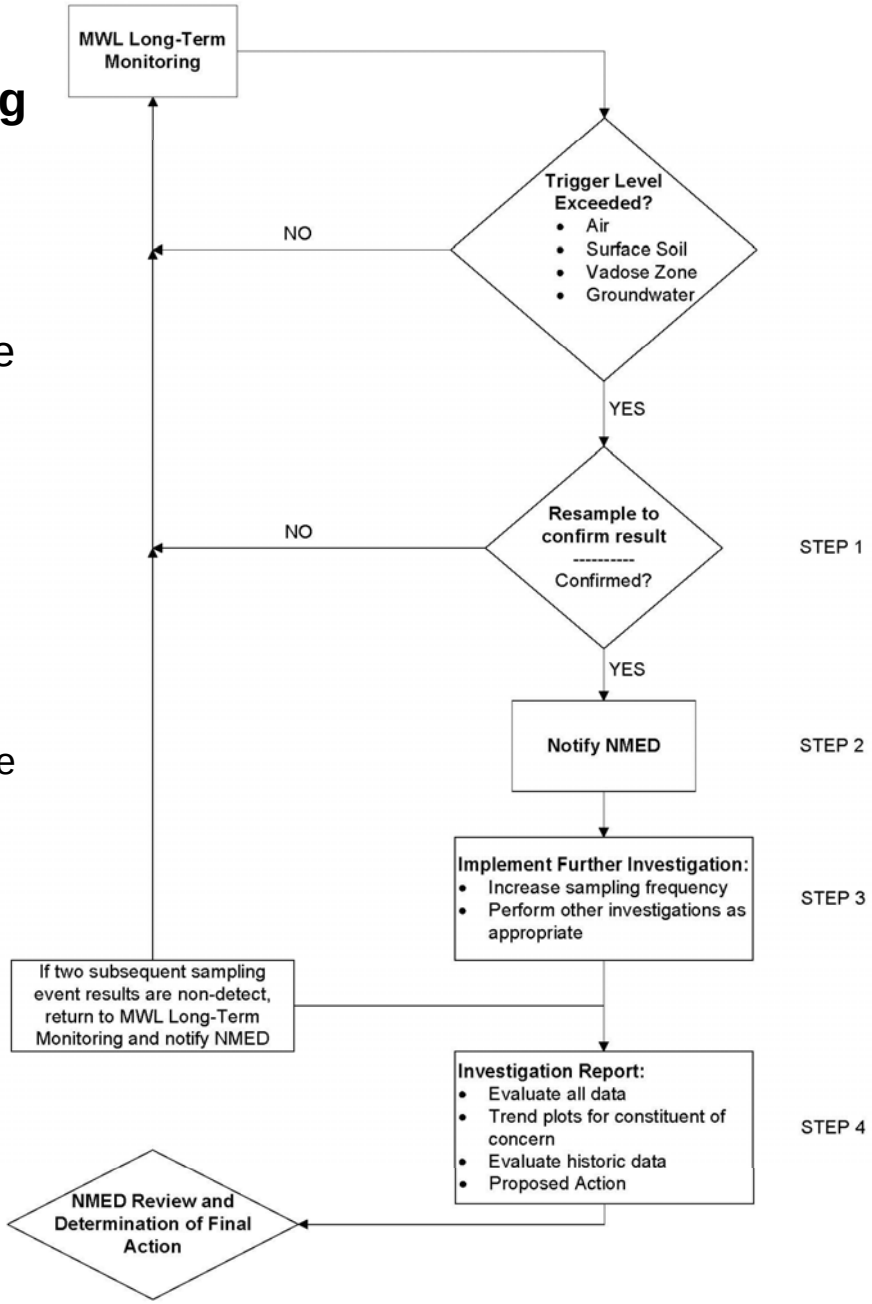
## Trigger Evaluation Process for the Mixed Waste Landfill

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

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

# Component 2 – Inspection, Maintenance, and Repair

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

## Mixed Waste Landfill, Sandia National Laboratories, New Mexico

| MWL System to be Inspected | Inspection Parameters | Inspection Frequency | Maintenance Implementation | Maintenance/ Repair Frequency |
|---|---|---|---|---|
| **Soil-Vapor Monitoring Wells, Soil-Moisture Monitoring Access Tubes, and Groundwater Monitoring Wells** | Concrete pads, stanchions, and protective casings | Groundwater and Vadose Zone Network Components: Field technician to inspect at same frequency/time that monitoring occurs | Maintain, clean, repair, replace, re-label, as appropriate | Within 60 days of discovery of needed repairs. |
| | Well cover caps and Swagelok® (or equivalent) dust caps | | | |
| | Monitoring wells and soil-vapor sampling port labels | | | |
| | Locks | | | |
| | Sampling pumps and tubing<br>Neutron probe and cable system | | | |
| **Fence** | Presence of wind-blown plants and debris | Quarterly by a field technician | Remove wind-blown plants and debris | Within 60 days of discovery of needed repairs. |
| | Condition of fence wires, posts, gates, gate locks, warning signs, and survey monuments in the local area | | Repair broken wire sections and posts, repair/oil gates, clean/replace locks, repair/replace warning signs, clear dirt/debris from monuments | |

# 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