



Mixed Waste Landfill Long-Term Monitoring & Maintenance Plan

Technical Information Monitoring, Inspection, and Reporting Requirements



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000





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 Year 2 – Quarterly Year 3 – Semiannual Year 4 – Semiannual Year 5 and subsequent years – Annual	17	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.	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. 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 Year 2 – Semiannual Year 3 – Semiannual Year 4 and subsequent years – Annual	17	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.	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 Year 2 – Semiannual 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. 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 Parameters/ 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. 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

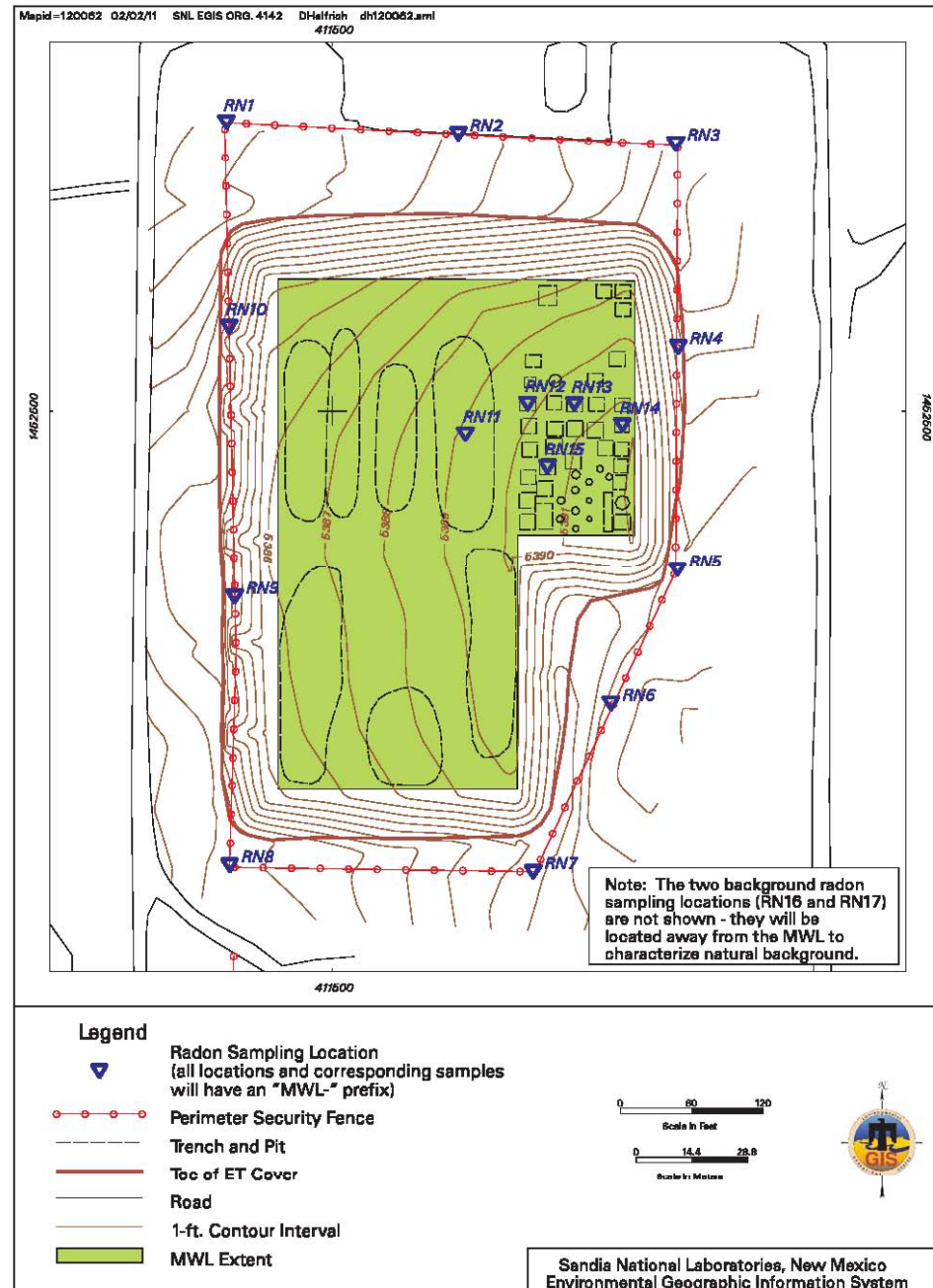
Monitoring Method

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 curies per liter of air)

Frequency

- First 2 years – Quarterly
- Years 3 & 4 – Semiannual
- Year 5 and beyond - Annual



SURFACE SOIL MONITORING

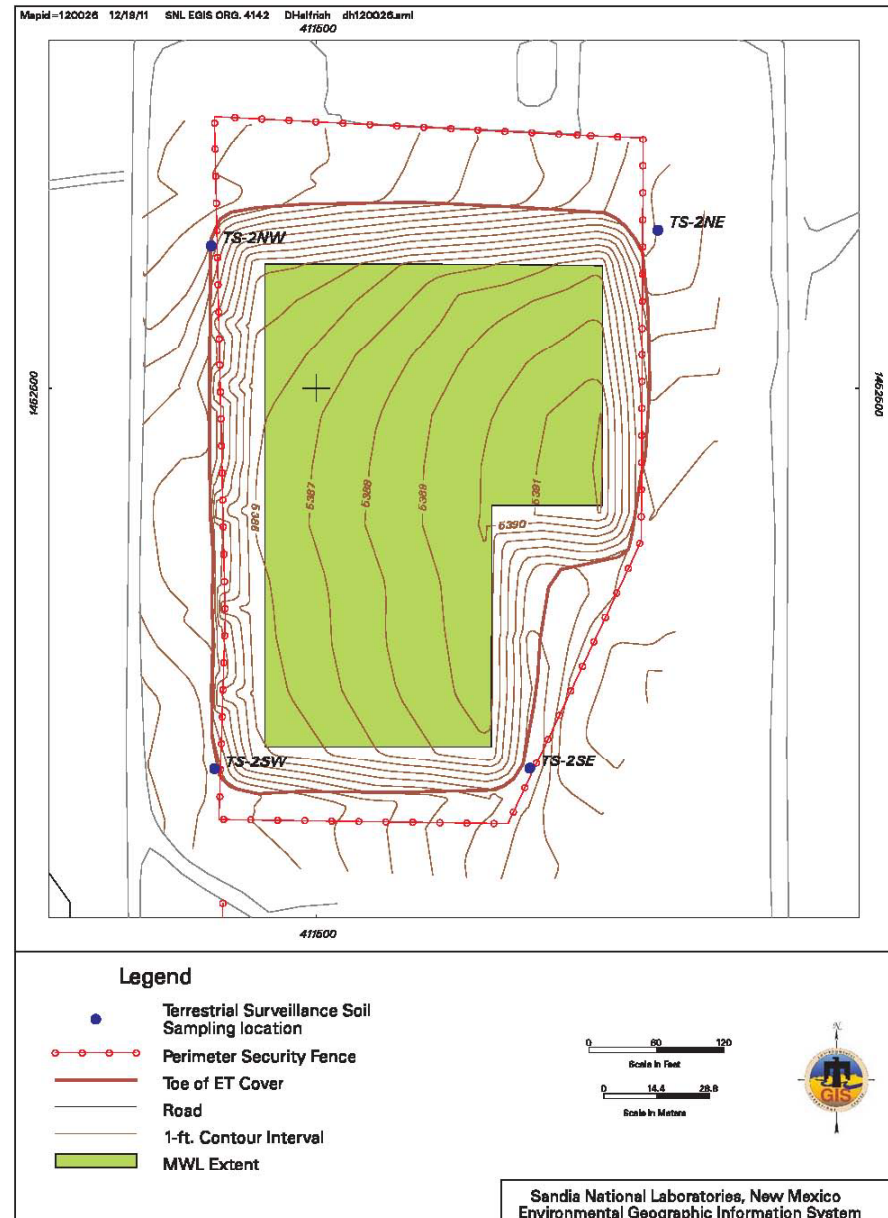
Tritium Sampling Locations

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

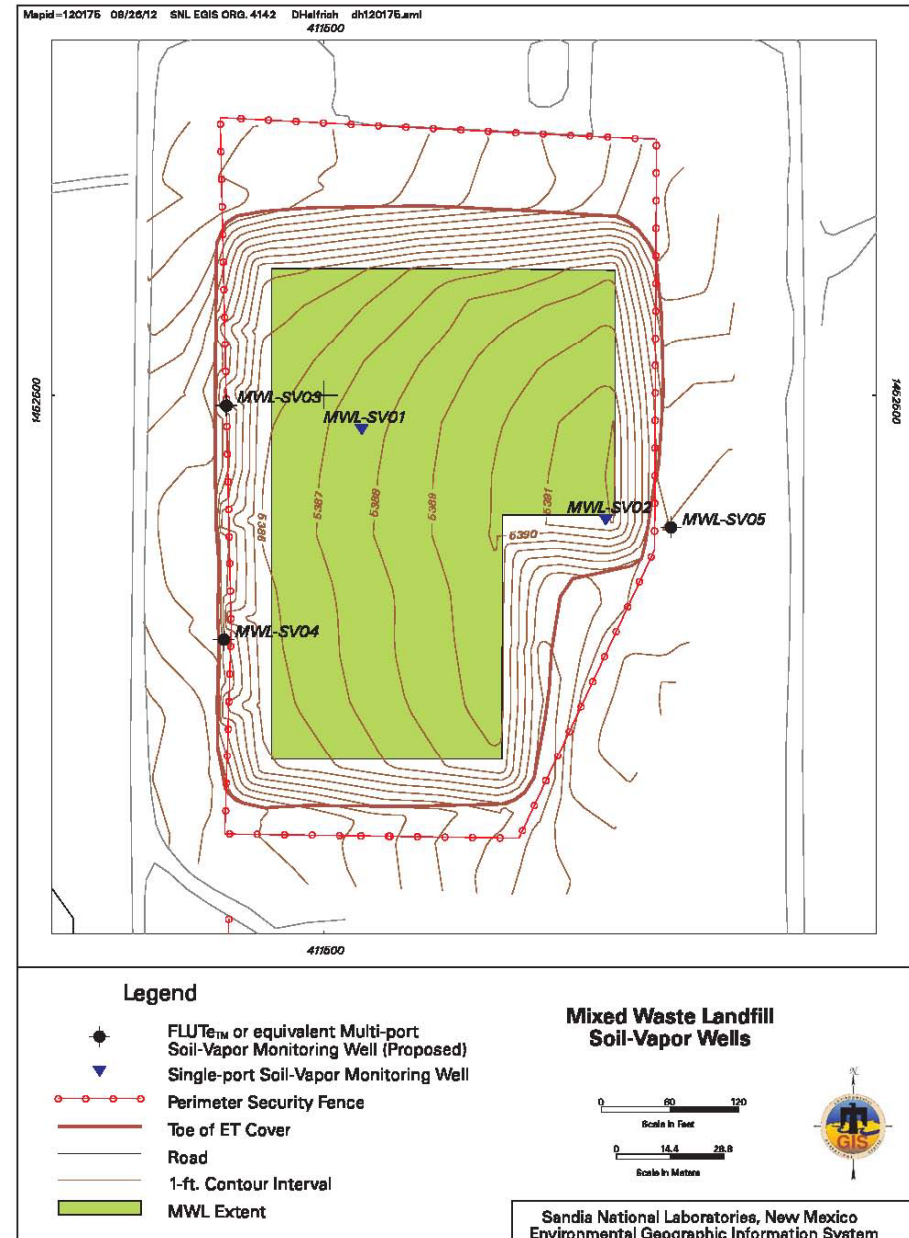
Volatile Organic Compounds (VOCs) in Soil-Vapor

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



Monitoring Method

- Frequency*

-
- Mapid=120171 09/20/12 SNL EGIS ORG. 4142 D\Helfrich dh120171.aml
- 411000 411500 412000
- 1463000 1462500 1462000
- MWL-MW6
- MWL-MW9
- MWL-MW8
- MWL-MW5
- MWL-MW7
- MWL-MW4
- MWL-BW2
- 4890 4885 4880 4875 4870 4865 4860 4855 4850 4845 4840 4835 4830 4825 4820 4815 4810 4805 4800 4795 4790 4785 4780 4775 4770 4765 4760 4755 4750 4745 4740 4735 4730 4725 4720 4715 4710 4705 4700 4695 4690 4685 4680 4675 4670 4665 4660 4655 4650 4645 4640 4635 4630 4625 4620 4615 4610 4605 4600 4595 4590 4585 4580 4575 4570 4565 4560 4555 4550 4545 4540 4535 4530 4525 4520 4515 4510 4505 4500 4495 4490 4485 4480 4475 4470 4465 4460 4455 4450 4445 4440 4435 4430 4425 4420 4415 4410 4405 4400 4395 4390 4385 4380 4375 4370 4365 4360 4355 4350 4345 4340 4335 4330 4325 4320 4315 4310 4305 4300 4295 4290 4285 4280 4275 4270 4265 4260 4255 4250 4245 4240 4235 4230 4225 4220 4215 4210 4205 4200 4195 4190 4185 4180 4175 4170 4165 4160 4155 4150 4145 4140 4135 4130 4125 4120 4115 4110 4105 4100 4095 4090 4085 4080 4075 4070 4065 4060 4055 4050 4045 4040 4035 4030 4025 4020 4015 4010 4005 4000 3995 3990 3985 3980 3975 3970 3965 3960 3955 3950 3945 3940 3935 3930 3925 3920 3915 3910 3905 3900 3895 3890 3885 3880 3875 3870 3865 3860 3855 3850 3845 3840 3835 3830 3825 3820 3815 3810 3805 3800 3795 3790 3785 3780 3775 3770 3765 3760 3755 3750 3745 3740 3735 3730 3725 3720 3715 3710 3705 3700 3695 3690 3685 3680 3675 3670 3665 3660 3655 3650 3645 3640 3635 3630 3625 3620 3615 3610 3605 3600 3595 3590 3585 3580 3575 3570 3565 3560 3555 3550 3545 3540 3535 3530 3525 3520 3515 3510 3505 3500 3495 3490 3485 3480 3475 3470 3465 3460 3455 3450 3445 3440 3435 3430 3425 3420 3415 3410 3405 3400 3395 3390 3385 3380 3375 3370 3365 3360 3355 3350 3345 3340 3335 3330 3325 3320 3315 3310 3305 3300 3295 3290 3285 3280 3275 3270 3265 3260 3255 3250 3245 3240 3235 3230 3225 3220 3215 3210 3205 3200 3195 3190 3185 3180 3175 3170 3165 3160 3155 3150 3145 3140 3135 3130 3125 3120 3115 3110 3105 3100 3095 3090 3085 3080 3075 3070 3065 3060 3055 3050 3045 3040 3035 3030 3025 3020 3015 3010 3005 3000 2995 2990 2985 2980 2975 2970 2965 2960 2955 2950 2945 2940 2935 2930 2925 2920 2915 2910 2905 2900 2895 2890 2885 2880 2875 2870 2865 2860 2855 2850 2845 2840 2835 2830 2825 2820 2815 2810 2805 2800 2795 2790 2785 2780 2775 2770 2765 2760 2755 2750 2745 2740 2735 2730 2725 2720 2715 2710 2705 2700 2695 2690 2685 2680 2675 2670 2665 2660 2655 2650 2645 2640 2635 2630 2625 2620 2615 2610 2605 2600 2595 2590 2585 2580 2575 2570 2565 2560 2555 2550 2545 2540 2535 2530 2525 2520 2515 2510 2505 2500 2495 2490 2485 2480 2475 2470 2465 2460 2455 2450 2445 2440 2435 2430 2425 2420 2415 2410 2405 2400 2395 2390 2385 2380 2375 2370 2365 2360 2355 2350 2345 2340 2335 2330 2325 2320 2315 2310 2305 2300 2295 2290 2285 2280 2275 2270 2265 2260 2255 2250 2245 2240 2235 2230 2225 2220 2215 2210 2205 2200 2195 2190 2185 2180 2175 2170 2165 2160 2155 2150 2145 2140 2135 2130 2125 2120 2115 2110 2105 2100 2095 2090 2085 2080 2075 2070 2065 2060 2055 2050 2045 2040 2035 2030 2025 2020 2015 2010 2005 2000 1995 1990 1985 1980 1975 1970 1965 1960 1955 1950 1945 1940 1935 1930 1925 1920 1915 1910 1905 1900 1895 1890 1885 1880 1875 1870 1865 1860 1855 1850 1845 1840 1835 1830 1825 1820 1815 1810 1805 1800 1795 1790 1785 1780 1775 1770 1765 1760 1755 1750 1745 1740 1735 1730 1725 1720 1715 1710 1705 1700 1695 1690 1685 1680 1675 1670 1665 1660 1655 1650 1645 1640 1635 1630 1625 1620 1615 1610 1605 1600 1595 1590 1585 1580 1575 1570 1565 1560 1555 1550 1545 1540 1535 1530 1525 1520 1515 1510 1505 1500 1495 1490 1485 1480 1475 1470 1465 1460 1455 1450 1445 1440 1435 1430 1425 1420 1415 1410 1405 1400 1395 1390 1385 1380 1375 1370 1365 1360 1355 1350 1345 1340 1335 1330 1325 1320 1315 1310 1305 1300 1295 1290 1285 1280 1275 1270 1265 1260 1255 1250 1245 1240 1235 1230 1225 1220 1215 1210 1205 1200 1195 1190 1185 1180 1175 1170 1165 1160 1155 1150 1145 1140 1135 1130 1125 1120 1115 1110 1105

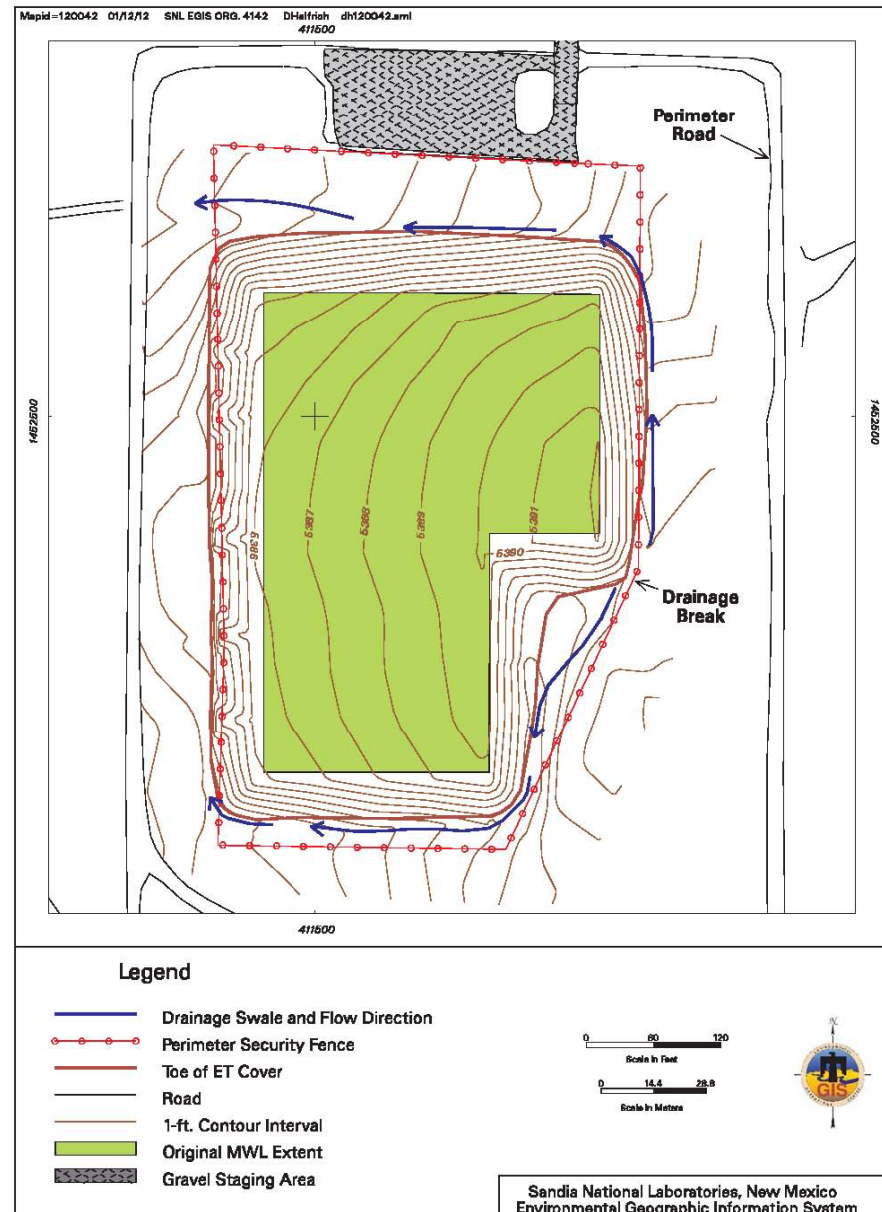
BIOTA - SURFACE SOIL & VEGETATION MONITORING

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. 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) TCE = 20 ppmv 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

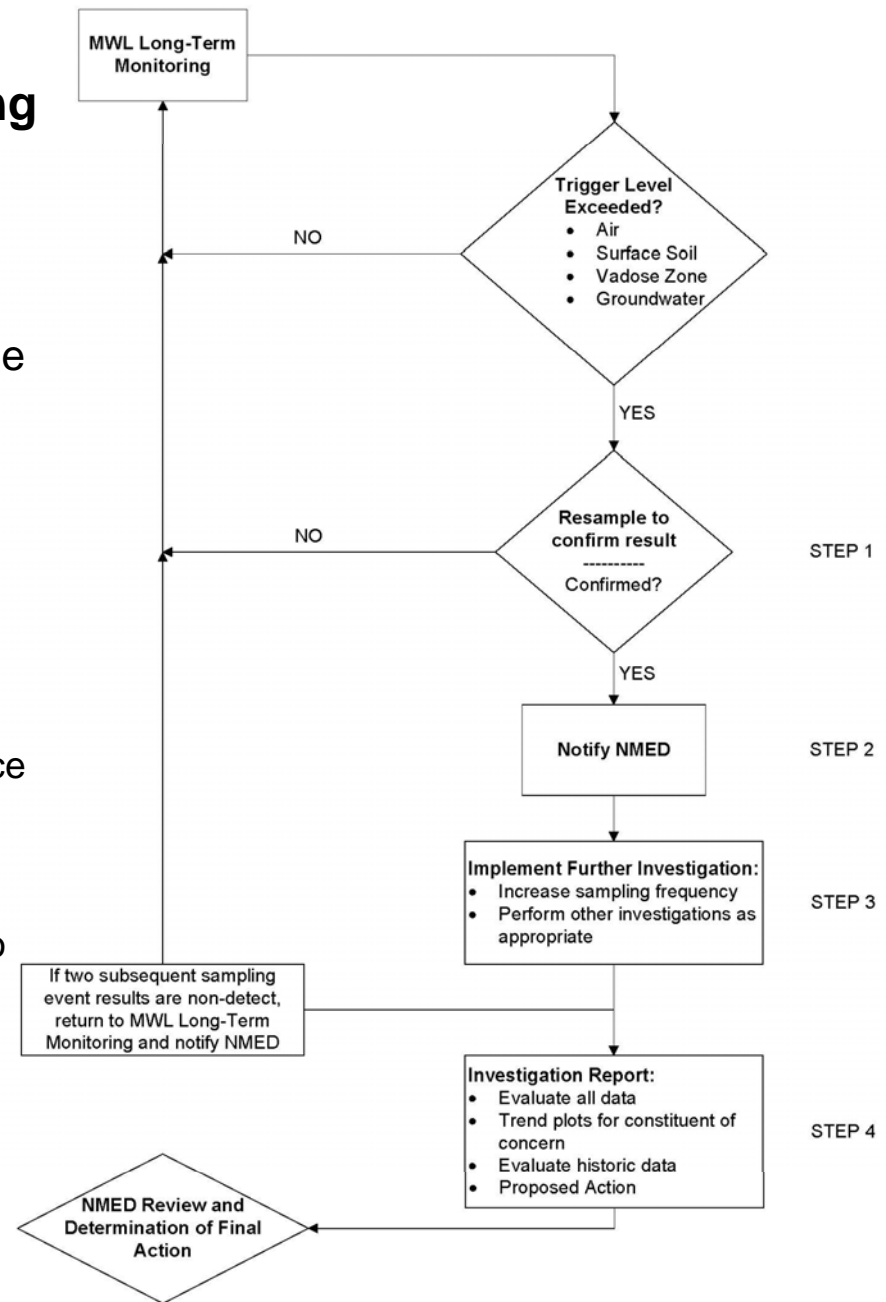
Component 1 – Multi-Media Monitoring Trigger Evaluation Process for the Mixed Waste Landfill

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 a 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 reseeded	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 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