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Final Implementation Strategy for Post Closure Inspection and Maintenance of the DOE/NNSA LASO Airport Landfill SWMU 73-001(a) and Debris Disposal Area SWMU 73-001(d), Los Alamos County Airport, New Mexico

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Prepared for:
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Abbreviations and Acronyms

ASR	After Significant Rainfall
BMP	Best Management Practices
DDA	Debris Disposal Area
DOE	U.S. Department of Energy
ENV-WQH	LANL Water Quality and Hydrology Group
EPA	U.S. Environmental Protection Agency
ft	feet
ft MSL	feet above mean sea level
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
LEL	Lower Explosive Limit
MatCon™	Modified Asphalt Technology for Waste Containment
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NRCS	National Resources Conservation Service
NPDES	National Pollutant Discharge Elimination System
PCMP	Post-Closure Care and Monitoring Plan
RCR	Remedy Completion Report
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
TRM	Turf Reinforced Mat
VCM	Voluntary Corrective Measure

1.0 Introduction

This document was prepared by CE2 Corporation at the request of the U.S. Department of Energy / National Nuclear Security Administration (DOE/NNSA) Los Alamos Site Office (LASO). The document presents a strategy for implementing the inspection and maintenance of storm-water related features at the Los Alamos County (LAC) Airport. In 2006, the DOE and Los Alamos National Laboratory (LANL) conducted a Voluntary Corrective Measure (VCM) that constructed a "Final Remedy" for Solid Waste Management Unit (SWMU) 73-001(a), the Airport Landfill, and nearby SWMU 73-001(d), the Debris Disposal Area (DDA). The Final Remedy primarily involved waste relocation, the installation of asphalt pavement, the construction of hangar pads, and reseeding activities.

2.0 Regulatory Background

This document incorporates the site-specific items discussed in the *Post-Closure Care and Monitoring Plan for the LASO TA-73 Airport Landfill* (PCMP) (North Wind Inc., 2006a) and the general items discussed in the lab-wide *Storm Water Pollution Prevention Plan (SWPPP) for SWMUs and AOCs* (LANL, 2005). The *Remedy Design Work Plan for the Los Alamos Site Office TA-73 Airport Landfill* (North Wind Inc., 2006c) presents an exhaustive listing of the National Pollutant Discharge Elimination System (NPDES) guidance that was used for developing the PCMP (North Wind Inc., 2006a). To date, no PCMP-compliant inspection findings or reports have been submitted to the New Mexico Environment Department (NMED).

Because the PCMP (North Wind Inc., 2006a) was written before the Final Remedy was constructed in late 2006 and early 2007, this document utilizes the as-built engineering drawings presented in the *Remedy Completion Report DOE-LASO TA-73 Airport Landfill SWMUs 73-001(a) and 73-001(d)* (RCR) (North Wind Inc. and Weston Solutions Inc. (2007). The *Storm Water Pollution Prevention Plan for the Los Alamos Site Office TA-73 Airport Landfill* (North Wind Inc., 2006b) specified the surface-water controls used during the Final Remedy construction activities, but the plan was not revised after the construction activities were completed.

Storm-water issues associated with aircraft and airport operations are addressed under a separate SWPPP (Kleinfelder, 2007). The LAC airport manager conducts annual inspections of the airport facilities and associated outfalls. His findings are reviewed by the NMED Surface Water Quality Bureau.

3.0 Land Use

The LAC Airport is situated on the eastern edge of the townsite of Los Alamos, New Mexico on a narrow mesa between State Road 502 and Pueblo Canyon (Figure 1). The LAC Airport was built in 1947 by the Atomic Energy Commission (predecessor to the DOE) to serve the transportation needs of the Los Alamos Scientific Laboratory (predecessor to LANL). The airport is currently owned and operated by the County of Los Alamos. The airport property was conveyed from DOE to the county in October 2008 and was formerly part of LANL Technical Area 73.

The airport is predominately used for general aviation purposes such as recreation and air taxi. An average of approximately 30 operations (takeoffs or landings) occur daily (Ploeger, 2009). The vast majority of operations involve single-engine propeller aircraft. Business jets and air-ambulance helicopters occasionally use the airport. For the last several years, DOE has infrequently used the airport.

The single runway, Runway 9/27, is 5,500 ft long. The airport facilities consist of a terminal building, a two-story storage building (formerly the landfill incinerator building), four rows of T-hangars, various taxiways, two parking aprons, a self-service fueling station, the Hot Pad, and a strip of older hangars on the west end of the airport. Prior to about 2000, the Hot Pad was used for the loading and unloading of sensitive LANL cargo. The Hot Pad is now occasionally used for aircraft parking and has six tie-down spots.

Pueblo Canyon trends along the north side of the airport and is undeveloped land. An unpaved road trends along the floor of the canyon. Road traffic typically consists of just a few vehicles per day. The new LAC waste-water treatment plant is located about 1.1 miles down the canyon from the Airport Landfill. The Bayo waste-water treatment plant is currently being demolished and is located approximately 1.4 miles down the canyon from the Airport Landfill.

The airport property and Pueblo Canyon are not located within the boundaries of the Santa Fe National Forest. The forested slope of Pueblo Canyon near the airport did not burn during the 2000 Cerro Grande fire.

4.0 Physiography

The airport is situated on one of the narrow mesas of the Pajarito Plateau that flank the eastern edge of the Jemez Mountains. The airport covers approximately 89 acres. Ground elevations range from approximately 7,170 ft above mean sea level (ft MSL) on the western end of the airport to approximately 7,050 ft MSL on the eastern end. The runway grade is approximately 1.5 degrees down to the east. The airport is bounded on the north and east by steep slopes of Pueblo Canyon. State Road 502 trends along the south side of the property. Single unit housing is located on the west side of the airport.

The Bandelier Tuff (consolidated volcanic ash) forms the resistant bedrock underlying the airport. The Hackroy soil series is developed from the tuff and is characterized as a well-drained sandy loam (NRCS 2008). The uppermost north-facing slope near the airport is steep and rocky with scattered scrub oaks, chamisa, bunch grasses, and junipers. Near the canyon floor, the slope lessens and the vegetation is dominated by ponderosa pines. The channel along the canyon floor is ephemeral and has stream flow only in response to heavy precipitation. The vertical relief from the airport paved area to the canyon floor is approximately 500 ft. The depth to groundwater at the airport is approximately 1,200 ft (North Wind Inc. 2006a). No water-supply wells are located on the airport property or nearby in Pueblo Canyon.

5.0 Climate

Los Alamos has a temperate mountain climate with four distinct seasons (LANL 1999). For the LANL meteorological station nearest the airport, the mean precipitation including snowmelt is approximately 18.7 inches per year (LANL, 2006). The peak months for precipitation are typically July and August, the "rainy season", when brief thunderstorms can produce intense rainfall and occasionally small hail. These two months are typically responsible for approximately one-third of the annual precipitation. Thunderstorms are common in the Los Alamos area with an average of 60 thunderstorms occurring per year (LANL, 1999).

6.0 Airport Landfill Background and History

Two inactive solid-waste disposal sites [the Airport Landfill, SWMU 73-001(a) and the DDA, SWMU 73-001(d)] are located at the airport (DOE 2005). The Airport Landfill was operated from 1943 to 1973 for the disposal of solid waste consisting of household trash from the townsite of Los Alamos and office trash from LANL. Prior to 1965, some of the waste was incinerated and subsequently buried in the Airport Landfill. Approximately 540,000 cubic yards of waste were disposed of in the Airport Landfill. The landfill contents primarily consist of municipal solid waste. However, the presence of non-municipal solid waste can not be ruled out for the Airport Landfill. Approximately 50,000 cubic yards of waste was relocated within the SWMU boundary during the 2006 construction activities; a single container of Freon-113 was uncovered and subsequently shipped off site (North Wind Inc. and Weston Solutions, 2007). No other hazardous materials or radioactive materials were discovered. Four empty gas cylinders were uncovered.

During 1984 to 1986, burnt debris from the western end of the Airport Landfill was excavated and re-buried in a pair of parallel trenches at the DDA. Approximately 126,000 cubic yards of burnt debris were disposed of at the DDA.

In late 2006 and early 2007, the Final Remedy landfill cover system was installed at the Airport Landfill (North Wind Inc. and Weston Solutions, 2007). After the waste relocation and regrading were conducted, the following features were installed for the Airport Landfill cover:

- approximately six acres of MatCon™ (Modified Asphalt Technology for Waste Containment) asphalt pavement,
- five concrete hangar pads within the MatCon™ pavement area,
- a landfill-gas collection system,
- two rock retaining walls,
- a concrete retaining wall,
- turf reinforcement mats (TRMs),
- revegetation of approximately four acres with native grasses, and
- a storm-water collection system consisting of five linear grated trenches, three gravel drainage channels, buried storm-sewer lines, drainage inlets, and an 18-inch diameter outfall pipe.

In early 2007, the Final Remedy for the DDA was constructed and consisted of regrading approximately five acres and adding topsoil as necessary to achieve a minimum cover thickness of one ft. The finished ground surface was hydroseeded and hydromulched (North Wind Inc. and Weston Solutions Inc., 2007).

7.0 Schedule of Inspection and Reporting Tasks

Table 1 summarizes the inspection tasks for the Airport Landfill and DDA as discussed in the PCMP (North Wind Inc. 2006a). The frequency, duration, end date, and proposed staff are listed for each task. LASO proposed the staff assignments.

Table 1. Schedule for the Inspection, Maintenance, and Reporting for the Airport Landfill and Debris Disposal Areas as specified in the PCMP (North Wind Inc., 2006a).

Inspection Task	Frequency	Duration	End date	Staff
Inspect MatCon™ pavement, concrete hangar pads, and seals (expansion joints)	Monthly	30 years after Final Remedy was constructed	2037	LANL ENV-WQH
Submit MatCon™ pavement inspections to MatCon™ subcontractor and the Final Remedy engineer*	Annually	5 years after Final Remedy was constructed	2012	LANL ENV-WQH
Conduct Annual Inspections	Annually, after spring thaw and before the green-up of grasses.	30 years after Final Remedy was constructed	2037	LANL ENV-WQH
Conduct Inspections following significant rainfall	Following significant rainfall (see Section 8.0)	30 years after Final Remedy was constructed	2037	LANL ENV-WQH
Measure landfill-gas concentrations	Quarterly for the first two years; possibly biannually for third year and thereafter discontinued	At least 3 years following construction of Final Remedy (see Table 2 for more details)	Maybe 2012	LANL ENV-WQH
Conduct corrective actions (ongoing maintenance)	Earliest opportunity and before end of calendar year	30 years after Final Remedy was constructed	2037	LANL ENV-WQH
Maintain Project File	Ongoing activity	30 years after Final Remedy was constructed	2037	LASO
Compile and submit Annual Report to NMED	Annually within 45 days of calendar year end (before February 14)	30 years after Final Remedy was constructed	2037	LASO

*The MatCon™ pavement subcontractor was the Wilder Construction Company of Everett, Washington. The Weston Solutions Inc. office in Albuquerque, New Mexico employed the Engineer of Record (North Wind Inc. and Weston Solutions Inc., 2007).

8.0 Inspection Tasks and Weather Considerations

The Inspection Checklist for the Airport Landfill and the DDA is presented in Appendix A. The inspection frequency for the various landfill components are either annual (A), quarterly (Q), biannual (B), monthly (M), or after significant rainfall (ASR). The PCMP (North Wind Inc., 2006a) and RCR (North Wind Inc. and Weston Solutions Inc., 2007) were used for compiling the components listed in the checklist. The Inspection Checklist (Appendix A) is SWMU specific and is more detailed that the Best Management Practices (BMP) Inspection and Maintenance Form presented in the lab-wide SWPPP (LANL, 2005).

While inspection of most landfill components can be conducted regardless of most weather conditions, the weather can affect three types of tasks and the corresponding field efforts need to be conducted accordingly.

[a] According to the frequencies listed in the Inspection Checklist, some field inspections shall be conducted following significant rainfall. A significant rainfall is defined as either a thunderstorm that produces more than half an inch of rain in less than one hour, or a precipitation event in which more than one inch of rain falls. Because thunderstorms in the rainy season tend to occur in clusters of a few days each, timely inspections can be beneficial if repairs are needed. Of course, field inspections should not be conducted while lightning is occurring in the vicinity. After the effects of several significant rainfalls are observed, professional judgment might be used to reduce the amount of ASR inspections.

[b] The measurement of landfill gas shall not be conducted when the weather is windy (wind speed greater than 10 knots) or the ground/pavement is damp, wet, or frozen. Calm or low wind speeds are ideal because wind can dissipate the landfill gas potentially resulting in anomalously low concentrations of methane. In addition, measurements should not be collected during, or for a few days after, precipitation because moisture in soil and concrete gaps can inhibit the migration of landfill gas. Wind speeds are typically lower in the morning. Weather information for the airport is continuously updated at phone number 662-8423.

[c] Ideally, inspections should not be conducted when snow cover is present. However, inspections during the winter shall not be skipped for an entire quarter because of snow cover.

9.0 Inspection Methodology

To ensure compliance with the PCMP (North Wind Inc., 2006a), the following methodology is mandated so that the inspections from event to event are conducted in a standardized approach. Thus, the various inspections will be directly comparable. For each landfill component in the Inspection Checklist (Appendix B), there are corresponding concerns. For example, cracking and subsidence (settling) are concerns for the concrete pads. The Inspection Checklist also provides a way to suggest and verify corrective actions. [Figures 2 and 3 can be printed at a useful scale (one inch equals 100 ft) on 11x17-inch paper by selecting "choose paper source by PDF page size".

The methodology for identifying and quantifying the concerns is discussed below. Common sense and the lab-wide SWPPP (LANL, 2005) shall be also be used. The locations of landfill components are shown on Figure 2. During field inspections, copies of the figure can be marked up to show the locations of various findings and corrective actions. The marked-up copies shall be attached to the Inspection Checklist.

9.1 MatCon™ Pavement Area and Hangar Pads

A walkover survey of the MatCon™ asphalt pavement and the five concrete hangar pads shall be conducted by first walking a transect along all four edges of each pad. A transect shall also be walked along the centerline of each hangar pad. Additional transects shall be walked along the southern and eastern parts of the asphalt pavement. The survey benchmark located at the northeast corner of each pad shall be inspected as well. Areas of cracking, subsidence, separation of expansion joints, and separation of the MatCon pavement from the hangar pads shall be noted. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in a logbook.

9.2 Vegetated (Seeded) Areas

A series of transects shall be walked across the vegetated areas that are located at the Airport Landfill and the DDA. Figure 2 shows a recommended series of 11 transects for the Airport Landfill. The vegetated areas located along the northern and eastern perimeters of the MatCon™ asphalt pavement are covered with TRMs (geosynthetic slope protection). The DDA was seeded by hydromulching and no TRMs are located there. A series of at least five parallel (east-west) transects are recommended for the DDA.

If areas of rills, subsidence, animal burrows, or barren spots are laterally extensive in the vegetated areas, the affected area(s) shall be described by quantifying the lateral extent of each area using a percentage system. For example, a useful description might state "rills cover 25% of Area X measuring 20 by 50 ft as shown on Figure Y." The depths, widths, and lengths of the rills can be documented using a range of values. Extensive rills should be discussed individually. Causes of rilling and other problems shall be noted also. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in the logbook.

9.3 Gravel Drainage Channels

A transect shall be walked along the entire length of each of the three gravel (rip rap) drainage channels. Areas of subsidence, erosion, vegetation, or sedimentation shall be noted and measured. An attempt should be made to identify and document the source(s) of the problem area. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in the logbook.

9.4 Retaining Walls

Transects shall be walked along the entire length of each retaining wall. A transect is needed for the upper edge and lower base for each of the three walls. The concrete retaining wall and two rock retaining (rock basket / gabion) walls are located on the northeast corner of the landfill cover. Areas of cracking, separation, rotation, erosion/sedimentation, or slumping shall be noted and an attempt shall be made to identify and document the source(s) of the problem area. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in the logbook.

9.5 Straw-Wattle Areas

A transect shall be walked across the two straw-wattle areas and the surrounding vicinity between the concrete retaining wall and the chain-link fence. Areas of rilling, subsidence, excessive erosion/sedimentation shall be noted. It is anticipated that additional storm-water controls such as semi-permanent wattles, hay bales, and silt fencing will be installed in late 2009. These controls may need to be replaced annually. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in the logbook.

9.6 Storm-Water Collection System

The storm-water collection system shall be inspected thoroughly. The visible components consist of six grated trenches, 13 drain inlets, a manhole lid, and the outfall pipe. The entire length of each grated trench shall be walked. Damaged or missing components shall be noted. Cracking, standing water, and excessive sedimentation shall also be noted. Inspecting the outfall pipe will require accessing the small gate in the chain-link fence and then walking eastward along the fence. Findings shall be noted on the Inspection Checklist and marked-up figures; lengthy discussions shall be noted in the logbook.

9.7 Landfill-Gas Monitoring

The monitoring of landfill gas will be conducted at various locations at the Airport Landfill: hangar pads, grated trenches, drainage inlets, and along the vegetated northern and eastern perimeters of the Airport Landfill. The landfill-gas monitoring will include the measurement of methane, oxygen, and carbon dioxide concentrations in air. No landfill-gas monitoring is required for the DDA because only burnt debris was buried there.

The required frequency of landfill-gas measurements at the Airport Landfill is listed in Table 2. Measurements shall be collected for at least three years. The duration of this measurement task is dependent on the measured concentrations with respect to the lower explosive limit (LEL) of methane.

Table 2. Frequency of Landfill-Gas Monitoring for the Airport Landfill as specified in the PCMP (North Wind Inc., 2006a).

Year	Frequency of Landfill-Gas Monitoring
One	• Quarterly
Two	• Quarterly
Three	• Biannually (twice during the year) if all methane concentrations from the previous two years were less than 25% of the LEL, or • Quarterly, if any methane concentrations collected during the previous two years were greater than 25% of the LEL
Four	• Discontinued if no methane concentrations for the three preceding years were greater than 25% of LEL • Quarterly if previous years had methane concentrations greater than 25% of the LEL
Outlying	• If any methane concentrations exceed 25% of the LEL, then quarterly monitoring will continue until methane concentrations meet the frequency listed for year three

If methane concentrations exceed either 25% of the LEL in any enclosed structure (such as inside a hangar), or 100% of the LEL at the northern edge of the landfill cap, immediate steps shall be taken to protect human health and the environment. These steps consist of notifying NMED immediately and installing an active (blower) gas collection system. More details for this scenario are discussed in Section 3.5.1 of the PCMP (North Wind Inc., 2006a).

Because the solid waste in the Airport Landfill is over 35 years old and probably has low moisture content, the methane concentrations are expected to be low. No post construction landfill-gas measurements have been collected to date. Table 3 shows the anticipated landfill-gas monitoring events. The two assumptions for Table 3 are that that monitoring will begin in the third quarter of 2009 and that the methane concentrations will be consistently less than 25% of the LEL at all monitoring locations for three years.

Table 3. Anticipated Landfill-Gas Monitoring Events for the Airport Landfill Assuming that all Methane Concentrations are less than 25% of the LEL.

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2009			Q	Q
2010	Q	Q	Q	Q
2011	Q	Q		B
2012		B		

Q = quarterly event, B = biannual event. Yellow cells depict Year One, green cells depict Year Two, brown cells depict Year Three.

Figure 3 shows the landfill-gas measurement locations at the Airport Landfill. Appendix B presents an accompanying Landfill Gas Monitoring Form. Because no figures were presented in the PCMP (North Wind Inc., 2006a), Figure 3 was created using the as-built engineering drawings presented in the RCR (North Wind Inc. and Weston Solutions Inc., 2007).

The selection of an appropriate field instrument and the use of proper measurement units are important. An example of an appropriate field instrument is the Landtec GEM 2000. This instrument is listed on NMED's landfill-gas measurement form example (NMED, 2008). The field instrument must be capable of measuring the concentrations of methane (CH_4), oxygen (O_2), and carbon dioxide (CO_2) in air. To be compliant with the PCMP (North Wind Inc. 2006a), the methane concentrations shall be measured and reported in percent (%) of the LEL, not in parts per million.

The PCMP (North Wind Inc., 2006a) specifies that "combustible gas levels shall be measured using an intrinsically safe combustible gas indicator with an output scale reading 0-100% LEL. The instrument shall be calibrated to a mixture of methane in air equal to 25% to 100% LEL." This means that methane is the sole combustible gas of concern at the Airport Landfill. However, the monitoring of volatile organic compounds with a separate instrument (meter) might be necessary if specified in a health and safety plan.

In February 2009, spinners (wind turbines) were observed to be missing from the six landfill-gas risers located along the northern perimeter of the Airport Landfill. The risers are currently equipped with either wind vanes or blind flanges. Spinners need to be installed at all six risers in accordance with as-built engineering drawing #2010AB in the RCR (North Wind Inc. and Weston Solutions Inc., 2007).

10.0 Modifications from the PCMP

As mentioned before, the PCMP (North Wind Inc., 2006a) and the RCR (North Wind Inc. and Weston Solutions Inc., 2007) were the primary source documents for preparation of this Implementation Strategy. Several topics were significantly modified, clarified, or added to this strategy document.

- The PCMP (North Wind Inc., 2006a) specified that a barren area needed to exceed 10,000 square ft before requiring corrective action. The value used in the Inspection Checklist (Appendix A) is a more reasonable 1,000 square ft.
- Landfill-gas monitoring locations are now defined to include the eastern perimeter of the Airport Landfill in addition to the northern perimeter locations specified in the PCMP (North Wind Inc., 2006a). Waste is buried in both areas.
- Because no buried utility conduits were constructed during the Final Remedy as envisioned in the PCMP (North Wind Inc., 2006a) no such locations are listed for monitoring.
- Drainage culverts were not constructed during the Final Remedy as envisioned in the PCMP (North Wind Inc., 2006a). The monitoring of drainage inlets is substituted for the culverts.

- The frequency for submittal of pavement inspections to the MatCon™ subcontractor and the Final Remedy engineer were not specified in the PCMP (North Wind Inc., 2006a). This task is assigned an annual frequency.

- The definition of significant rain was not specified in the PCMP (North Wind Inc., 2006a); a definition is discussed in Section 8.0.

- The staff proposed in Table 1 was suggested by LASO.

- Figures 1, 2, and 3 are presented below. No figures were presented in the PCMP (North Wind Inc., 2006a). Figure 1 is modified from the *Environmental Assessment* (DOE, 2005) and shows the general locations of both disposal sites. The RCR (North Wind Inc. and Weston Solutions Inc., 2007) did not contain engineering drawings for the DDA that depicted the extent of grading or hydromulching. Figure 2 was created using the as-built engineering drawings presented in the RCR (North Wind Inc. and Weston Solutions Inc., 2007) for the Airport Landfill. Figure 3 is based upon professional judgment and interpretation of the text presented in the PCMP (North Wind Inc., 2006a).

- The number of actual sample locations was not specified in the PCMP (North Wind Inc., 2006a). The measurement form presented in Appendix B lists 54 locations.

- Methane was the only landfill gas proposed for measuring in the PCMP (North Wind Inc., 2006a). The measurement form (derived from NMED, 2008) presented in Appendix B lists methane, oxygen, and carbon dioxide as the gases for measurement.

11.0 Annual Reporting

Inspection findings shall be summarized in Annual Reports that are submitted to NMED before February 14th of each year (Table 3). At a minimum, each Annual Report shall contain:

- Completed Checklist Inspection forms and marked-up figures,
- Documentation of corrective actions conducted,
- Copies of logbook pages,
- Digital photographs taken during inspections and during corrective-action work,
- Completed Landfill-Gas Measurement Forms,
- Other useful forms such as calibration logs for the landfill-gas instrument, and
- A discussion of the field activities.

12.0 References

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NRCS (2008), *Soil Survey of Sandoval County Area, New Mexico, Parts of Los Alamos, Sandoval, and Rio Arriba Counties*, Natural Resources Conservation Service, U.S. Department of Agriculture, March 2008.

Ploeger (2009), David Ploeger, Los Alamos County Airport manger, *personal communication* with John Copland, Senior Hydrogeologist, CE2 Corportation, 13 February 2009.

Figures

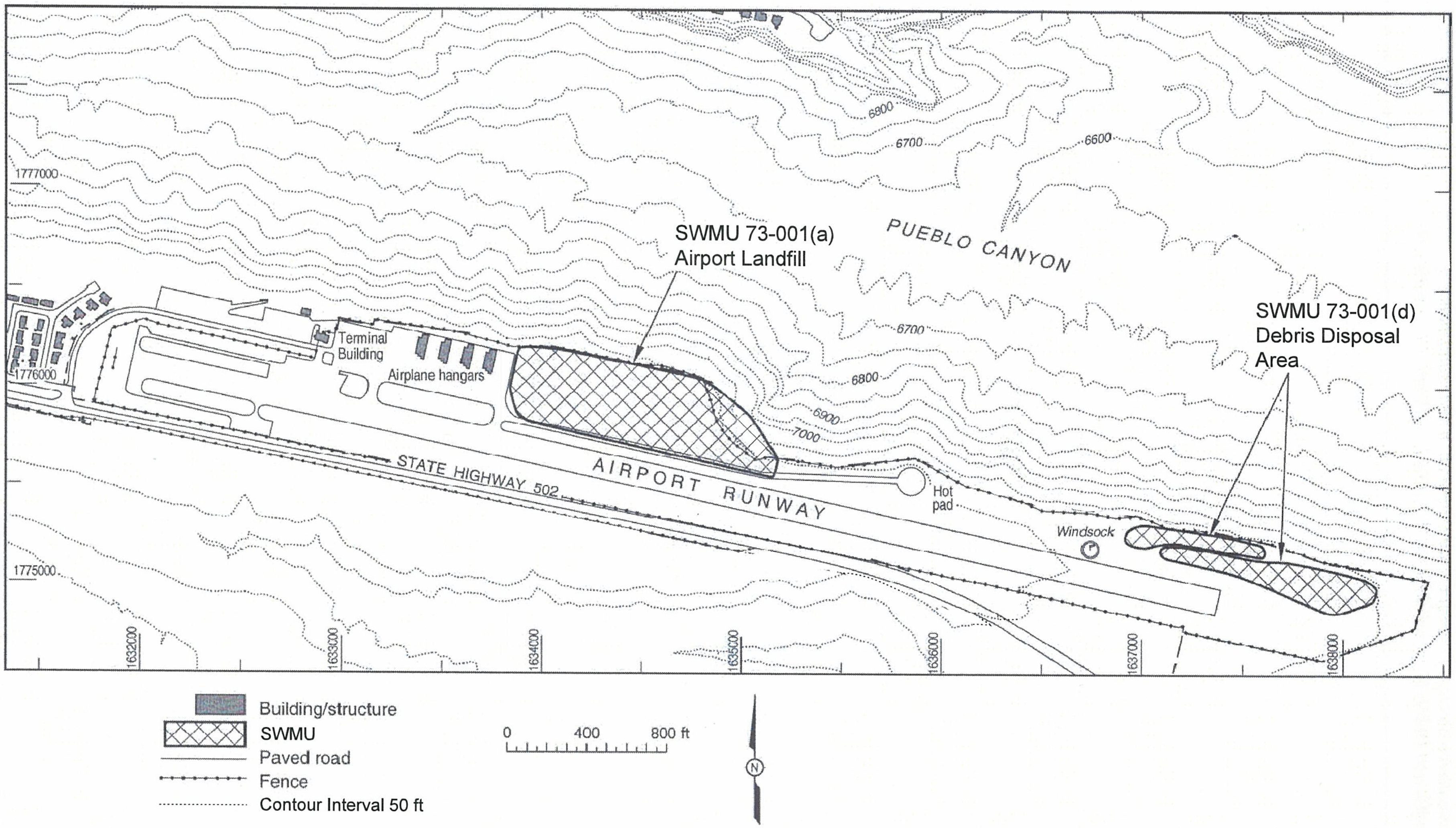

Figure 1. Locations of the Airport Landfill and Debris Disposal Area at the Los Alamos County Airport (Modified from North Wind Inc., 2006).

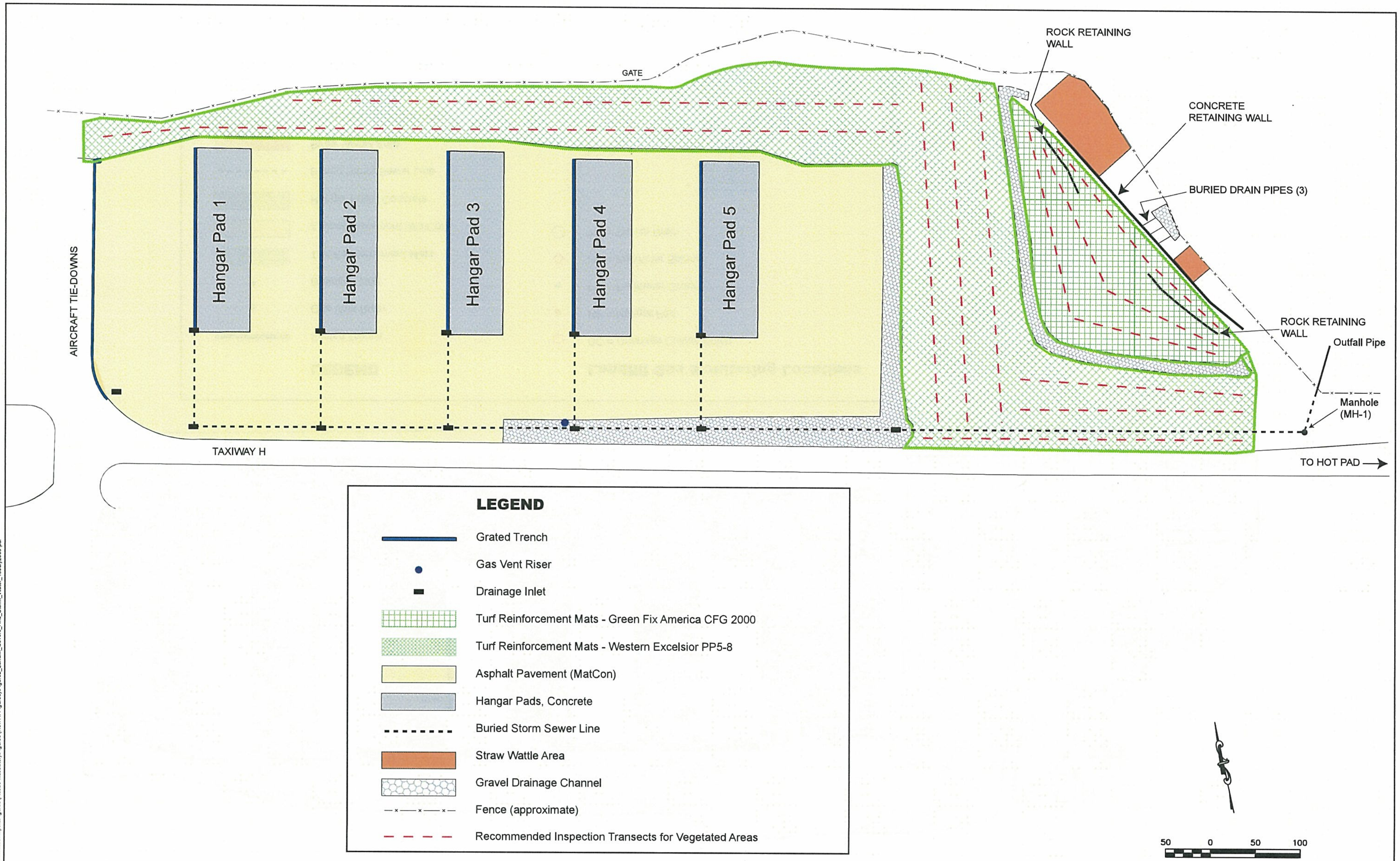

Figure 2. Landfill Cover And Storm Water Collection System at the Airport Landfill, SWMU 73-001(a)

S:\PROJECT\Los Alamos Airport\Figures (Adobe Illustrator)\Figures (New AI Figures)\Figure2_Landfill_Covers_And_Storm_Water_15July2009.pdf

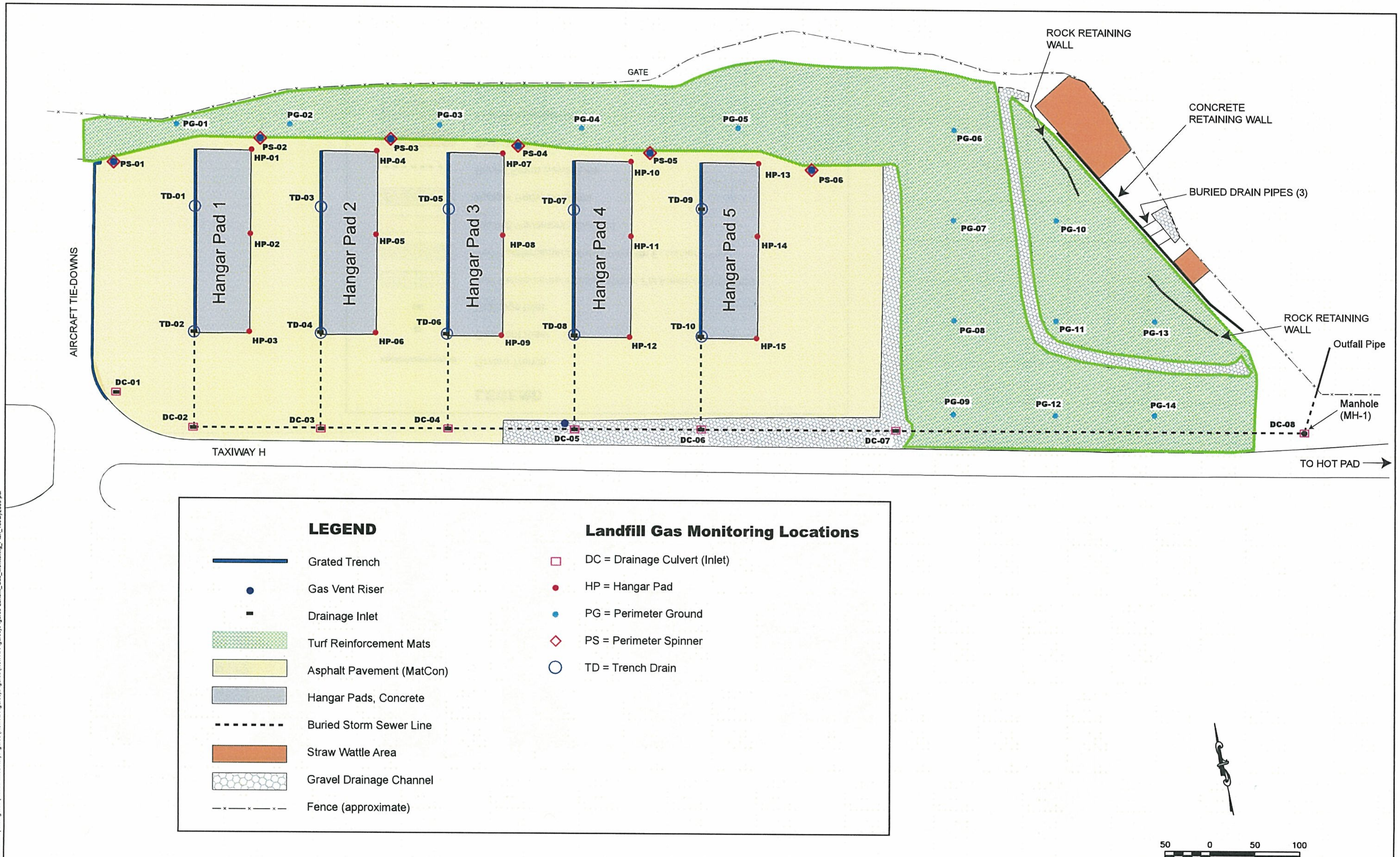

Figure 3. Landfill Gas Monitoring Locations at the Airport Landfill, SWMU 73-001(a)

Appendix A

Inspection Checklist for the Airport Landfill, SWMU 73-001(a) and Debris Disposal Area, SWMU 73-001(d)

Inspection Checklist for the Airport Landfill, SWMU 73-001(a) and Debris Disposal Area, SWMU 73-001(d)

Date: ________ Time: ________ Printed Name: ______________ Signature: ______________ Logbook ________ Figure(s) _______
Weather: temperature ____ wind ________ days since last rain ___, on ___________. Weather Data Source ____________________

Component: Concern(s)	Inspection Frequency*	Corrective Action Needed Yes/No?	Description of Corrective Action	Corrective Action Completed Yes/No? & Date
Airport Landfill				
MatCon Asphalt Pavement: cracks, gaps, spalling, subsidence	M			
Concrete Hangar Pads (5) and expansion joints: cracks, gaps, spalling, pop-outs, separation of pad from asphalt, subsidence	M			
Survey Benchmark on each hangar pad: accessible, attached to concrete pad	M			
Gas Collection System: Turbines (6) along northern edge of asphalt pavement and 1 stub-out on southern edge of asphalt pavement: debris, functional, accessible	A			
Measure landfill-gas concentrations using Landfill Gas Monitoring Form: any values greater than 25% of the methane LEL (lower explosive limit)?	Q or B			
Turf Reinforcement Mats: tears, animals burrows >4 inches deep, subsidence >1 ft, rills/cracks >4 inches deep, large vegetation (trees, shrubs, bushes, deep-rooting weeds)	A, ASR			
Gravel drainage channels (3): subsidence, erosion, clear of trash, soil, other blockages	A, ASR			
Seeded (hydromulched) Areas: barren areas >1,000 square feet, animals burrows >4 inches deep, subsidence >1 ft, rills/cracks >4 inches deep, large vegetation (trees, shrubs, bushes, deep-rooting weeds)	A, ASR			
Concrete Retaining Wall: cracks, bulges, separation, rotation, nearby erosion, spalling, pop-outs, drain pipes (3) open at gravel drainage channel	A, ASR			
Rock Retaining Walls (2): movement, separation, bulges, rotation, nearby erosion	A, ASR			

Component: Concern(s)	Inspection Frequency*	Corrective Action Needed Yes/No?	Description of Corrective Action	Corrective Action Completed Yes/No? & Date
Grated Trenches (6): cracks; clear of trash, soil, other blockages, draining properly, standing water, subsidence	A, ASR			
Drainage inlets (8): functional, grates not blocked by trash, soil, other material	A, ASR			
Evidence that pollutants (spills) have entered the storm-water system?	A, ASR			
Sediment washing off the site? If so, map the location[s] in logbook	A, ASR			
Outfall Pipe: secure, blockage, significant erosion, soil staining, manhole in place	A, ASR			
Straw-wattle areas between retaining walls and fence: wattles in place, erosion, rills	A, ASR			
Debris Disposal Area				
Seeded (hydromulched) Areas: animals burrows >4 inches deep, barren areas >1,000 square feet, subsidence >1 ft deep, rills/cracks >4 inches deep, large vegetation (trees, shrubs, bushes, deep-rooting weeds)	A, ASR			
Comments:				

Component locations are shown on Figure 2. Copies of this figure can be marked up to show concerns, findings, and corrective actions. These copies should be listed above in the comments section and stapled to this checklist.

*Inspection Frequency: A= annual, ASR = After Significant Rainfall, B = biannual (twice a year), M = Monthly, Q = quarterly.

Note: If an additional component(s) is installed for the Airport Landfill, the component(s) can be added in the blank row.

Appendix B

Landfill Gas Monitoring Form for the Airport Landfill

LANDFILL GAS MONITORING FORM

Landfill Name: Airport Landfill, SWMU 73-001(a) at the Los Alamos County Airport

Inspector Printed Name: ____________ Inspector Signature: __________

Date: _____ Barometric Pressure: _________ Temperature: _______

Weather conditions: ______ Wind Direction: ______ Wind Speed: __________

Date and amount of last precipitation (within last 48 hours): ______________________

Instrument: ________________Calibration method and date __________

Sample Location	Height (ft)	Time	CH_4 % LEL	O_2 %	CO_2 %
Hangar Pads: Samples will be collected on the east side of the pad along the expansion joint.* After a hangar is built, samples will be collected along the interior walls at 4 inches to 4 ft above pad.					
HP-01	2 inches above expansion joint*				
HP-02	2 inches above expansion joint*				
HP-03	2 inches above expansion joint*				
HP-04	2 inches above expansion joint*				
HP-05	2 inches above expansion joint*				
HP-06	2 inches above expansion joint*				
HP-07	2 inches above expansion joint*				
HP-08	2 inches above expansion joint*				
HP-09	2 inches above expansion joint*				
HP-10	2 inches above expansion joint*				
HP-11	2 inches above expansion joint*				
HP-12	2 inches above expansion joint*				
HP-13	2 inches above expansion joint*				
HP-14	2 inches above expansion joint*				
HP-15	2 inches above expansion joint*				

Trench drains (west side of each hangar pad)					
TD-01	4 inches below trench grate				
TD-02	4 inches below trench grate				
TD-03	4 inches below trench grate				
TD-04	4 inches below trench grate				
TD-05	4 inches below trench grate				
TD-06	4 inches below trench grate				
TD-07	4 inches below trench grate				
TD-08	4 inches below trench grate				
TD-09	4 inches below trench grate				
TD-10	4 inches below trench grate				
Drainage culverts (drainage inlets on the buried storm sewer lines)					
DC-01	4 inches below grate				
DC-02	4 inches below grate				
DC-03	4 inches below grate				
DC-04	4 inches below grate				
DC-05	4 inches below grate				
DC-06	4 inches below grate				
DC-07	4 inches below grate				
DC-08	4 inches below manhole lid				
Northern perimeter (ground and spinner [wind turbine] locations)					
PG-01	2 inches above ground surface				
PG-02	2 inches above ground surface				
PG-03	2 inches above ground surface				
PG-04	2 inches above ground surface				
PG-05	2 inches above ground surface				
PG-06	2 inches above ground surface				
PG-07	2 inches above ground surface				

PG-08	2 inches above ground surface				
PG-09	2 inches above ground surface				
PG-10	2 inches above ground surface				
PG-11	2 inches above ground surface				
PG-12	2 inches above ground surface				
PG-13	2 inches above ground surface				
PG-14	2 inches above ground surface				
PS-01	at spinner (4 ft above pavement)				
PS-02	at spinner (4 ft above pavement)				
PS-03	at spinner (4 ft above pavement)				
PS-04	at spinner (4 ft above pavement)				
PS-05	at spinner (4 ft above pavement)				
PS-06	at spinner (4 ft above pavement)				

Note:
Methane concentrations shall be measured in percent of the LEL. Other gases measured in %.
DC = Drainage Culvert (inlet)
HP = Hangar Pad
LEL = lower explosive limit
PG = Perimeter Ground
PS = Perimeter Spinner (wind turbine)
TD = Trench Drain
Methane = CH_4
Oxygen = O_2
Carbon dioxide = CO_2

Comments: ____

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Form modified from http://www.nmenv.state.nm.us/swb/documents/ExampleMethaneFORM10-10-08.doc.