

PERMIT PART 7

VADOSE ZONE MONITORING

HIGHLIGHTS

Introduction

This Part contains conditions to ensure the earliest possible detection of contaminant leakage from the Landfill and the Surface Impoundment. Permit Conditions include the location, design, construction, operation, and maintenance of the Vadose Zone Monitoring System (VZMS); the methodology for sampling and characterizing the fluids that may accumulate in the system; a methodology for distinguishing between leachates and non-leachates; monitoring frequency; laboratory analysis; and data reporting and recording requirements.

The Landfill and Surface Impoundment are referred to as "regulated units" in this Part. The VZMS consists of sumps located directly below both regulated units, and a total of eleven monitoring wells located immediately adjacent to the regulated units, six monitoring wells on the periphery of the facility, three suction lysimeters associated with the Surface Impoundment, and three neutron probe access tubes adjacent to the regulated units. The VZMS monitors the accumulation and migration of fluids below the ground surface and above the uppermost aquifer. Together with the Leachate Detection and Removal System (LDRS) and Leak Collection and Removal System (LCRS) sumps (see Permit Parts 5 and 6), the VZMS distinguishes between leachates originating within the regulated units and non-leachate fluids that may originate outside the units.

Regulatory Background

The New Mexico Hazardous Waste Act and Regulations under 20.4.1.500 NMAC (incorporating 40 CFR 264.90 through 264.99) and 20.4.1.900 NMAC (incorporating 40 CFR 270.32(b)(2)) require owners and operators of facilities that treat, store and dispose of hazardous waste to monitor the ground water of the uppermost aquifer for possible contaminant releases and to operate under the necessary permit conditions to be protective of human health and the environment. The Secretary has approved a waiver of the requirements for ground water monitoring at the facility in accordance with 20.4.1.500 (incorporating 40 CFR 264.90(b)(4)). In lieu of ground water monitoring, and as a part of a Final Order dated March 18, 2002, the Secretary is requiring vadose

Zone monitoring. The Secretary has determined that vadose zone monitoring is more appropriate, and more protective of health and the environment, than ground water monitoring at this Facility, given the depth to ground water and the distance that hazardous constituents would have to travel to contaminate ground water. The upper zone of ground water is approximately 700 feet beneath the Facility. The Ogallala Aquifer is a minimum of 3600 feet east of the Facility. Moreover, contaminant flow modeling, based on conservative assumptions, predicts that any contaminants released from the Facility would not reach ground water within 800 years. The vadose zone monitoring system is designed to detect contaminants released from the Facility long before they reach ground water. Once detected, any contamination in the vadose zone will be addressed under the corrective action conditions of this Permit, or under other authority. The bases for the ground water monitoring waiver are specified in greater detail in Permit Attachment H, *Ground Water Monitoring Request and Approval*.

A ground water monitoring waiver for the Facility has been approved by the Secretary for reasons specified at Permit Attachment H, *Ground Water Monitoring Waiver Request and Approval*, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.90(b)(4)). Those reasons include contaminant flow model predictions that conservatively demonstrate that fluids will not migrate from a Regulated Unit to either the first zone of saturation approximately 700 feet below the facility, or to saturation associated with the Ogallala Aquifer a minimum of 3600 feet east of the facility, within 800 years. It is pursuant to the above regulations, and as a condition of the waiver approval, that vadose zone monitoring is required in lieu of groundwater monitoring under this Permit.

Other Monitoring Requirements

Monitoring requirements for regulated units contained in this Part are in addition to the LDRS monitoring requirements specified at Permit Conditions 5.6.2 and 6.6.2.

Regulated Units

Regulated units are defined at 20.4.1.500 NMAC (incorporating 40 CFR 264.90(a)(2)) as those land-based units that receive hazardous wastes after July 26, 1982. The Facility has two regulated units, the Landfill and the Surface Impoundment. The Landfill is described at Permit Part 6, *Highlights*. The Landfill is a disposal unit where wastes will remain indefinitely and will therefore be subject to vadose zone

monitoring Permit Conditions established in this Part that will extend through the Post-Closure Care Period (see Permit Part 8).

Potential releases from the Landfill are anticipated to be in the form of liquids escaping through a breach in the liner system. Though no free liquids will be placed in the Landfill, fluids will enter the Landfill in the form of precipitation, which will invariably leach hazardous constituents and accumulate in the Landfill sumps. Engineered controls to address the accumulated fluids and to preclude a release outside the Landfill liner system include an LCRS and an LDRS. The LCRS and LDRS are not considered part of the VZMS, but LCRS and LDRS fluid samples are used to establish indicator parameters indicative of Landfill leachate against which VZMS sample analyses are compared to determine whether a release to the vadose zone has occurred.

The Surface Impoundment is described at Permit Part 5, *Highlights*. Although the Surface Impoundment is a treatment unit that will undergo clean closure, its associated vadose zone monitoring wells will continue to be monitored through the post-closure care period due to their proximity to the Landfill (see Permit Part 8). Potential releases from the Surface Impoundment are anticipated to be in the form of liquids escaping through a breach in the liner system. Fluids that escape through the primary liner will be detected and removed by the Surface Impoundment LDRS.

1.1 GENERAL REQUIREMENTS

1.1.1 Duty to Monitor

The Permittee shall conduct vadose zone monitoring in accordance with the requirements of this Permit Part and as specified at Permit Attachment I, *Vadose Zone Monitoring System Work Plan*, and as required by 20.4.1.500 (incorporating 40 CFR 264.91, 264.97, and 264.98)).

1.1.2 Duty to Initiate Corrective Action

If at any time a release, generally in the form of a leachate escaping through a liner system, is detected from a regulated unit through the release assessment required at Permit Condition 7.5, the Permittee shall notify the Secretary within 24 hours and shall initiate corrective action in accordance with Permit Part 9.

1.1.3 Duty to Remove Non-Leachates

If the VZMS contains non-leachate fluids as identified at Permit Condition 7.3.1, the Permittee shall identify and remove, where possible, both the source and the non-leachate fluids as required by 20.4.1.500 (incorporating 40 CFR 264.97(a)(2)). If removal is implemented, the Permittee shall report the progress of that removal to the Secretary monthly.

1.1.4 Duration of Monitoring

The Permittee shall conduct vadose zone monitoring through the active life, including the closure period, of both the Landfill and the Surface Impoundment, and through the post-closure care period of the Landfill, in accordance with this Permit Part as required by 20.4.1.500 (incorporating 40 CFR 264.90(c)).

1.2 VZMS LOCATION AND CONSTRUCTION

1.2.1 VZMS Construction and Locations

The VZMS shall consist of three vadose zone sumps, seventeen vadose zone monitoring wells, three neutron probe access tubes, and three suction lysimeters installed at locations and depths as required at Permit Conditions 7.2.1.a, 7.2.1.b, 7.2.1.c, 7.2.1.d, and 7.2.1.e; and as specified at Permit Attachment I, Section 2.0, *Vadose Zone Monitoring System Installation*. The vadose zone monitoring wells shall be capable of yielding fluid samples from the vadose zone below the Landfill and Surface Impoundment where fluids are likely to accumulate in the future. The Permittee shall construct and maintain these monitoring points to yield sufficient fluid samples that are representative of the various fluid sources, as required by 20.4.1.500 (incorporating 40 CFR 264.95(a) and 40 CFR 264.97(a)(2)). The vadose zone monitoring system shall be installed prior to the initial acceptance of waste at the Facility, in accordance with the schedule presented at Table 1-1, *Compliance Schedule*, of this Permit. See a map of the VZMS at Permit Attachment I, Figure 2.

1.2.1.a Deep Vadose Zone Monitoring Wells

The Permittee shall install and maintain a total of eleven deep vadose zone monitoring wells as required by 20.4.1.500 (incorporating 40 CFR 264.95(a) and 264.97(a)(2)).

Ten deep vadose zone wells capable of collecting representative samples of any fluid that may accumulate at or above the

stratigraphic boundary between the Upper and Lower Dockum stratigraphic units, and below the stratigraphic boundary between the alluvium and the Upper Dockum, shall be constructed. The specific location of six of the ten deep vadose zone monitoring wells is specified at Permit Attachment I, Section 2.2, *Vadose Zone Monitoring Wells*. These wells shall be installed at the locations specified as Nos. VZMW-D1, D2, D3, D4, D5, and D6 in Permit Attachment I, Figure 2, *Location of Sumps and Monitoring Wells*.

One deep monitoring well (VZMW-D9) shall be located within fifteen feet of borehole location WW-1. The purpose of this deep vadose zone monitoring well is to measure potential changes in fluid chemistry and water level for a location where shallow groundwater is currently known to exist.

Two of the ten deep vadose zone monitoring wells will be located northeast of the regulated units. One well will be located at the northeast corner of the facility boundary, and another one-half the distance from the northeast corner of the facility boundary to the northeast corner of the landfill on a line that intersects the two points. The purpose of these two wells is to identify the lateral extent of Upper Dockum saturation, and to monitor any possible contaminants that may potentially migrate toward the saturated zone.

Also, one of the ten deep vadose zone monitoring wells will be located west of the facility boundary within fifteen feet of borehole location PB-14. This well will measure changes in fluid chemistry and water level at a location where shallow groundwater is currently known to exist.

One deep vadose zone monitoring well shall be installed and operated to determine the presence and quality of groundwater within the Lower Dockum Unit above the lower sandstone formation (Santa Rosa Sandstone). This well shall be constructed at the southeast corner of the stormwater detention basin. This well shall be screened from fifty feet below the top of the Lower Dockum Unit, down to one hundred feet above the top of the Santa Rosa Sandstone. The well shall be properly constructed to prevent fluid migration and infiltration between different stratigraphic units or zones.

These wells shall be constructed as specified in Permit Attachment I, Section 2.2.2, *Vadose Zone Monitoring Well Construction*; and as required by 20.4.1.500 (incorporating 40 CFR 264.97(c)).

1.2.1.b Shallow Vadose Zone Monitoring Wells

The Permittee shall install and maintain a total of six shallow vadose zone monitoring wells that are capable of collecting a representative sample of fluids that may accumulate at or above the stratigraphic boundary between the alluvial material and the Upper Dockum stratigraphic units, and below the ground surface as required by 20.4.1.500 (incorporating 40 CFR 264.95(a) and 264.97(a)(2)). Four shallow vadose zone monitoring wells shall be constructed and operated in the alluvial sediments west of the waste management units and east of the Stormwater Detention Basin. These wells shall be constructed on a north-south line spaced at approximately 330-foot intervals. The purpose of these wells is to monitor the possible near surface migration of regulated fluids toward the western boundary of the facility.

One shallow vadose zone monitoring well shall be constructed and operated within fifteen feet of the deep vadose zone monitoring well located near borehole WW-1. A second shallow vadose zone monitoring well shall be constructed and operated within fifteen feet of the deep vadose zone monitoring well located near borehole PB-14. The purpose of the two monitoring wells is to monitor the accumulation of fluids in the alluvial materials.

1.2.1.c Vadose Zone Monitoring Sumps

The Permittee shall install three vadose zone monitoring sumps, two below the Surface Impoundment and one below the Landfill, that are capable of collecting a representative sample of any fluids that may accumulate below the Surface Impoundment and the Landfill, respectively, in accordance with Permit Conditions 5.2.1.e and 6.2.1.e.

Vadose Zone Sumps shall be designed and constructed in accordance with the following engineering design drawings contained at Permit Attachment L1, *Engineering Drawings*:

Drawing 15: Sump Plan View - Phase 1a

Drawing 16: Sump Cross-Sections - Phase 1a

Drawing 17: Typical Sump Detail Cross-Section

Drawing 18: Vadose, LDRS, LCRS Cross-Sections and Details

Drawing 28: Evaporation Pond Subgrade Contours - Phase 1

Drawing 29: Evaporation Pond Clay Liner Contours - Phase 1

Drawing 30: Evaporation Pond Cross-Sections

Drawing 32: Evaporation Pond LDRS and Vadose Plan
and Details

Drawing 39: Drum Handling Unit Sump Details
(sheet 1 and sheet 2)

Drawing 41: Truck Roll Off Area Drainage Surface
Contours (plan)

Drawing 43: Truck Roll Off Area Liner Details
(section and details)

Drawing 44: Truck Wash Layout and Details (sheet
1 and sheet 2)

1.2.1.d Neutron Probe Access Tubes

The Permittee shall install and maintain a total of three deep neutron probe access tubes capable of detecting a release from the regulated units migrating in the subsurface as unsaturated flow. The neutron probe access tubes shall also be constructed to enable collection of a representative sample of any fluid that may accumulate at or above the stratigraphic boundary between the Upper and Lower Dockum stratigraphic units, and below the stratigraphic boundary between the alluvium and the Upper Dockum. Installation of neutron probe access tubes designed to detect unsaturated flow partially fulfills the Final Order from the Secretary dated March 18, 2002, through his authority stipulated at 20.4.1.900 (incorporating 40 CFR 270.32(b)(2)).

One neutron probe access tube shall be located at the center of the north boundary of the Phase I Landfill. Another access tube shall be located at the center of the west boundary of the Phase IA Landfill. The third access tube shall be located at the northwest corner of the North Surface Impoundment. Suction

1.2.1.e Lysimeters

The Permittee shall install and maintain a total of three shallow suction lysimeters capable of detecting a release from the Surface Impoundment migrating in the subsurface as unsaturated flow. Installation of suction lysimeters designed to detect unsaturated flow partially fulfills the Final Order from the Secretary dated March 18, 2002, through his authority stipulated at 20.4.1.900 (incorporating 40 CFR 270.32(b)(2)).

The lysimeters shall be placed in vertical boreholes at a depth of five feet below the Surface Impoundment vadose zone monitoring sumps. The lysimeters shall be located at the surface a distance of fifteen feet away from VZMW 1, VZMW 2, and the neutron probe access tube at the northwest corner of the North Surface Impoundment.

1.2.2 Additional Vadose Zone Monitoring Points

If, after Permit issuance, the Secretary's or the Permittee's knowledge of subsurface conditions indicate that the VZMS Permit Conditions are insufficient to detect a release from a regulated unit, the Secretary may require the Permittee to install additional vadose zone monitoring points in accordance with Permit Condition 7.2.1. Such changes may include, but are not limited to, detection of fluid in previously dry locations, or the discovery of previously unknown permeable strata during Facility construction or operation. The Permittee shall initiate a Permit modification to incorporate required additional monitoring point(s), in accordance with 20.4.1.900 (incorporating 40 CFR 270.42).

1.2.3 Location of Replacement Wells

Should existing monitoring wells fail or otherwise cease to perform their intended function, replacement wells shall be installed as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.95(a) and 264.97(a)(2)). Replacement vadose zone monitoring wells shall be located within 15 feet of an original well.

1.2.4 Well Surveys

All vadose zone monitoring points shall be surveyed for both vertical and horizontal coordinates by a professional land surveyor registered in New Mexico. Horizontal coordinates shall be to plus or minus 0.1 foot with respect to the State Plane Coordinate System (NMSA 47-1-49 to 56) (Repl. Pamp. 1993) and a Facility benchmark. Vertical coordinates shall be to the top of the well casing (marked), the top of the concrete apron (marked), and the ground surface to plus or minus 0.01 foot with respect to mean sea level and a benchmark. This survey information shall be entered into and maintained in the Operating Record in accordance with Permit Condition 7.7.1.

1.2.5 Supervision of Construction

An experienced professional geologist or engineer shall supervise and document all VZMS construction.

1.2.6 Continuous Core

Well bores VZMW-1, VZMS-5, and VZMS-6, as identified in Permit Attachment I, Table 2, shall be drilled so as to provide continuous core so as to substantially be in accordance with 20.45.1.900 NMAC (incorporating 40 CFR 270.14(c)(2)). One deep borehole required in Permit Condition 7.2.1.a shall be continuously cored from 15 feet below the Upper/Lower Dockum contact to the total depth. The primary purpose of the coring is to evaluate the possible existence of paleofractures or faults beneath the facility. Should these well bores yield insufficient core to accurately determine the lithology and geologic structure of the locations, the Secretary may require additional attempts to obtain the required core from proximal locations. All geologic core shall be labeled as to depth, photographed, boxed, stored, and made available for inspection for the operating life of the Facility. Selected samples shall be sealed and stored for future inspection. These samples shall be considered part of the Operating Record and maintained in accordance with Permit Condition 7.7.1.

1.2.7 Compatibility of Well Construction Materials

The Permittee shall ensure that vadose zone fluids are not adversely affected by well construction materials, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(a)). A compatibility demonstration shall be provided within six months of well construction, provided that sufficient vadose zone fluids are available to perform said assessment.

1.2.8 Drilling Equipment Air Supply

Borings shall be drilled using air rotary drilling methods as specified at Permit Attachment I, Section 2.2.2, and the air supply shall be filtered or provided with an efficient separator to minimize the introduction of water or compressor oil into the well bore, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(a)).

1.2.9 Well Completion Logs

Well completion logs for each VZMS well shall include, in addition to those items listed at Permit Attachment I, Section 2.2.2.3, *Well Construction Information*, the following information:

- date(s) of drilling, completion, and any well development that may be necessary;

- explanation for any introduced water and a reference to its source and its chemical analysis;
- well location horizontal and vertical coordinates;
- total boring depth to within 0.1 foot with respect to ground surface, and well depth to within 0.01 foot with respect to top of casing (marked);
- boring and well casing(s) diameters;
- drilling and lithologic logs;
- well casing material specifications and size, and reference material certifications;
- well screen slot size and depth to both top and bottom of screen interval;
- casing and screen joint type;
- filter pack material source and grain size analysis;
- filter pack placement methodology;
- sealant material sources, types and mix design;
- surface seal design;
- reference to any non-anthropogenic fluids encountered during construction;
- well development procedures, should they be required, including equipment and methods used, total daily amounts of fluids removed, recovery rates, turbidity, and static fluid surface elevation measurements, if applicable;
- description of protective cap;

- detailed well construction drawing presenting depth of well construction material emplacement and well dimensions; and
- aquifer test results, including hydraulic conductivity, for any well containing groundwater at construction.

Well Completion Logs shall be entered into and maintained in the Operating Record in accordance with Permit Condition 7.7.1. The Well Completion Logs shall be submitted to the Secretary in the first Quarterly Report after completion of well construction, in accordance with Permit Condition 7.7.2.

1.2.10 Decontamination of Material Introduced into the Well Bore

All materials (except filter pack and sealants) introduced into the well bore shall be steam cleaned or washed with hot water and anionic detergent (e.g., Alconox or equivalent) and thoroughly rinsed with distilled water prior to introduction, unless the material is supplied from the manufacturer certified clean and has remained sealed in a protective wrapping, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(a)). Wash/ decontamination water shall be collected in 55-gallon drums, labeled, and stored on site for later disposal in accordance with applicable regulations.

1.2.11 Decontamination of Drilling Equipment

Drilling equipment shall be decontaminated as specified at Permit Attachment I, Section 2.2.3, *Decontamination*; and in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(a)).

1.3 INDICATOR PARAMETERS

The Permittee shall create and maintain a list of chemical constituents and other parameters for use in monitoring the VZMS as specified below and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(a)). Monitored constituents are hereafter referred to as indicator parameters. Permit Attachments U2, *Background Values for Non-Leachates*, and V, *Vadose Zone Monitoring Indicator Parameters*; shall be developed, against which VZMS sample analysis shall be compared to assess potential releases to the vadose zone, in accordance with Permit Condition 7.

Potential sources of vadose zone fluids include two major categories: leachates originating from within the regulated units and containing the contaminants of concern; and non-leachates that originate outside the regulated units which are generally considered to not be contaminated. The non-leachate chemical constituents will be combined with the chemicals measured in leachates to establish the complete list of indicator parameters.

1.3.1 Non-Leachate Fluids

The Permittee shall establish and maintain a list of indicator parameters and their "baseline" chemical concentrations for the following non-leachate fluids according to the procedures specified at Permit Attachment I, Section 3.0, *Baseline Liquid Characterization*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(a)):

- precipitation;
- consolidation water from prepared regulated unit subgrade or geosynthetic clay liner;
- Facility water supply; and
- Stormwater Detention Pond fluids.

Non-leachate fluids are anticipated to contain only major ions and metals, but shall also be analyzed for those parameters identified at Permit Attachment I, Table 1, *Baseline Chemical Analyses*, including sulfides and sulfates, radionuclides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), perchlorate, and total petroleum hydrocarbons (TPH). Non-leachate water samples from the four sources listed above and drill cuttings from three representative Dockum lithologies (i.e. mudstone, siltstone, and sandy siltstone) will be used in the Meteoric Water Mobility Procedure to determine non-leachate water quality (see Permit Attachment I, Appendix A, *Meteoric Water Mobility Procedure*). The result of this procedure and the non-leachate water quality analysis, as described at Attachment I, Section 3.0, shall be used to determine the non-leachate indicator parameter list at Permit Attachment V and the baseline chemical concentrations at Attachment U2.

A tolerance interval statistical procedure, as described at Permit Attachment Q, *Statistics for Release Determination*, shall

be used to determine statistically significant changes from non-leachate baseline concentrations, as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)).

1.3.1.a Time Frame for Establishing Non-leachate Fluid Indicator Parameter List and Baseline Concentrations

Both parameters on the indicator parameter list and their chemical constituent baseline concentrations for non-leachate fluids, excluding data acquired from Stormwater Detention Pond fluids, shall be established within three months of activating the Facility water supply and before acceptance of waste, in accordance with the procedures specified in Permit Attachment I, Section 3.0; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(a)).

Fluids in the Stormwater Detention Pond shall be measured annually for the constituents listed at 20.4.1.500 NMAC (incorporating 40 CFR 264, Appendix IX) and reported to the Secretary. A list of these constituents shall be maintained in both the Operating Record and at Permit Attachment V.

1.3.1.b Reporting - Baseline Values for Non-Leachate Fluids

The indicator parameter list and the baseline chemical concentration values for non-leachate fluids, tolerance intervals required at Permit Condition 7.3.1, and the computations necessary to determine these parameters, shall be submitted by the Permittee in a separate report to the Secretary for approval in accordance with Permit Condition 7.7.2.a; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(a)).

1.3.1.c Additional Non-Leachate Fluids

The Permittee shall establish and record a list of indicator parameters and their chemical constituent baseline for any new sources of non-leachate fluid in a manner consistent with the procedure identified in Permit Condition 7.3.1; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(a)).

1.3.2 Leachates

The Permittee shall establish indicator parameters for leachates generated at both the Landfill and the Surface Impoundment as specified below; and as required by 20.4.1.500 (incorporating 40 CFR 264.98(a)). These lists shall be maintained in both the

Operating Record and at Permit Attachment V. The leachate indicator parameters determined through monthly and biennial sampling shall be combined into a single leachate indicator parameter list maintained at Attachment V, which presents those parameters detected and which shall be updated as new indicator parameters are detected in subsequent sampling rounds. Parameters shall not be removed from the listing if subsequent sampling events do not detect a parameter present in previous sampling events.

1.3.2.a Monthly Sampling

The Permittee shall analyze both the Landfill and Surface Impoundment leachate (i.e., samples from the LCRS and LDRS) monthly, as specified at Permit Attachment F, *Waste Analysis Plan*, Section 4.5.6, *Waste Analysis Requirements for Waste Generated On-Site*, for the underlying hazardous constituents listed at the Table referenced at 20.4.1.800 NMAC (incorporating 40 CFR 268.40), for EPA Hazardous Waste Number F039 listed wastes (leachates); and as required by 20.4.1.500 (incorporating 40 CFR 264.98(a)). The results of these analyses shall be reported to the Secretary in the Quarterly Report, in accordance with Permit Conditions 2.12.2.b and 7.7.2.

1.3.2.b Biennial Sampling

The Permittee shall analyze both the Landfill and Surface Impoundment leachate biennially for the hazardous constituents referenced at 20.4.1.500 NMAC (incorporating 40 CFR 264, Appendix IX), as specified at Permit Attachment F, Section 4.5.6; and as required by 20.4.1.500 (incorporating 40 CFR 264.98(a)). The results of the test shall be reported to the Secretary in the Biennial Report and the samples shall be collected no sooner than 45 calendar days prior to the Biennial Report due date. Constituents previously undetected in the Appendix IX analysis shall be identified and reported. Constituents detected but not previously reported in accordance with Permit Condition 7.3.2.a and this Permit Condition shall also be reported.

1.4 MONITORING PROGRAM

The Permittee shall inspect and sample the VZMS at each monitoring point during the active life and closure period of the Facility, as specified at Permit Condition 7.1.4, and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98). The Permittee shall inspect and sample vadose zone monitoring wells 3, 4, 5, and 6 at the Landfill, and vadose zone monitoring wells

1 and 2 at the surface Impoundment during the post-closure care period of the Facility. The Permittee shall use the following techniques and procedures when inspecting and sampling the vadose zone monitoring points required under Permit Condition 7.2.1. This information shall be recorded and reported in accordance with Permit Condition 7.7. Investigation-derived waste (IDW) generated during monitoring shall be managed as specified at Permit Attachment F, Section 4.5.6.1, *Overview of Wastes Generated On-site*.

1.4.1 Requirement to Inspect

1.4.1.a Inspection Schedule for Vadose Zone Fluids

The Permittee shall inspect each VZMS sump daily and each VZMS well monthly for the presence of vadose zone fluids. Inspection of Landfill VZMS sumps and Landfill and Surface Impoundment wells shall occur semi-annually during the post-closure period, as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(d)).

1.4.1.b Inspection Schedule for Neutron Probe Access Tubes

The Permittee shall inspect each neutron probe access tube, plus Vadose Zone Monitoring Wells 1, 2 and 3, every six months. The Permittee shall probe the above inspection locations with a neutron geophysical logging tool calibrated to optimally distinguish between dry and partially saturated lithologies at the Facility. Baseline neutron logs shall be established in both open and cased holes for the above inspection locations. Subsequent inspections will produce logs that will be compared to the baselines. If a neutron log shows a 0.25 change over established baseline API readings over a two-foot interval anywhere in the column, the Permittee shall immediately inspect the appropriate monitoring point for the presence of vadose zone fluids. If a neutron log shows a 0.25 change over established baseline API readings over a two-foot interval within a depth range of five feet above or below the depth of the suction lysimeters, the Permittee shall immediately inspect the appropriate suction lysimeter for the presence of vadose zone fluids. If vadose zone fluids are detected during any of the above inspections, the Permittee shall implement Permit Condition 7.4.2.

1.4.1.c Inspection Due to Exceedance of the ALR

If the Action Leakage Rate (ALR) is exceeded, the Permittee shall inspect each VZMS monitoring point associated with the

impacted regulated unit immediately, and the Permittee shall increase the frequency of inspection of the monitoring wells from monthly to weekly at the impacted regulated unit; as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(d), 264.223, and 264.304). The inspection frequency shall remain weekly as long as the ALR continues to be exceeded.

1.4.2 Requirement to Sample

If fluids are detected in a VZMS monitoring well, sump, neutron probe access tube, or lysimeter upon the inspection required in Permit Condition 7.4.1., the Permittee shall collect a sample of vadose zone fluid monthly at each monitoring point containing fluid, as detailed at Attachment I, Sections 4.1 *Monitoring Frequency*, and 4.3, *Monitoring Method*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)). A sample shall be collected immediately when fluids are first detected at each monitoring point.

1.4.3 Fluid Elevation Measurement

The Permittee shall determine fluid elevation at each well and VZMS sump, referenced to mean sea level, each time fluid is detected, as specified at Permit Attachment I, Section 4.4, *Sample Collection*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(e)).

1.4.4 Fluid Purging

The Permittee shall evacuate fluids in the monitoring points to the surface, as specified at Permit Attachment I, Section 4.4; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.5 Decontamination

The Permittee shall ensure that reusable sampling equipment is decontaminated as specified at Permit Attachment I, Section 4.9, *Decontamination*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.6 Equipment Calibration

The Permittee shall ensure that field measuring instruments are calibrated as specified at Permit Attachment I, Section 4.8, *Field Equipment*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.7 Sample Containerization

The Permittee shall place fluid samples in containers as specified at Permit Attachment I, Section 4.4; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.8 Quality Assurance Samples

The Permittee shall assure sample quality as specified at Permit Attachment I, Section 4.6, *Quality Assurance Samples*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.9 Sample Preservation

The Permittee shall preserve samples as specified at Permit Attachment I, Section 4.5, *Sample Preservation and Transportation*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)).

1.4.10 Sampling Record

The Permittee shall ensure that sampling activities as specified at Permit Attachment I, Section 6.1, *Field Documentation*, are recorded in the Operating Record, in accordance with Permit Condition 7.7.1; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)). The sampling record shall include the Quarterly Well Inspection Logs (containing information required under Permit Condition 7.4.1) and Monitoring Field Logs (containing information required under Permit Conditions 7.4.2 through 7.4.9).

1.5 RELEASE ASSESSMENT

The Permittee shall conduct a release assessment on all fluid samples collected in accordance with Permit Condition 7.4.2 and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)) to determine whether fluids may have originated from within a regulated unit. If the data analysis specified at Permit Condition 7.5.1.a indicates that a release has occurred, the Permittee shall notify the Secretary within 24 hours of detection, as specified in Permit Attachment C (*Contingency Plan*), Section 6.5.3.2, and initiate the corrective action requirements of Permit Part 9, including the verification sampling requirements of Permit Condition 9.3.2. The fluid constituent concentrations indicative of a release shall be referred to as "action levels". The release assessment shall be performed using the following techniques and procedures:

1.5.1 VZMS Sample Analysis

The Permittee shall analyze VZMS samples in accordance with all conditions of this Permit Part for all indicator parameters specified at Permit Attachment V and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)). It is presumed that the number of VZMS analytes will increase as additional waste streams are placed into the regulated unit.

1.5.1.a Release Determination

The Permittee shall determine whether a VZMS release has occurred, as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)), by evaluating monitoring data for two criteria: 1) a significant change in non-leachate indicator parameter chemical concentrations, and 2) the detection of any leachate indicator parameters. The Permittee shall measure leachate constituents using the detection limits specified in Permit Condition 7.5.4.

The Permittee shall use trilinear diagrams to graphically determine any significant changes in the following non-leachate parameters: bicarbonate, chloride, dissolved major cations (Na, K, Mg, Ca, Fe), total dissolved solids (TDS), and sulfate. Trilinear diagrams will be compared after consecutive sampling events and over time. A tolerance interval statistical procedure, as described at Permit Attachment Q, shall be used to determine statistically significant changes in the following non-leachate parameters: dissolved and total metals (Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti, Zn) and radionuclides (gross alpha, gross beta, gamma emitters, total uranium, radium 226/228, radon). TDS, sulfates and all detected leachate indicator parameters shall be presented in a tabular format and will be compared after consecutive sampling events and over time.

The Permittee shall initiate corrective action under Permit Part 9 and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(g)) for any release defined as (a) any significant change in the shape of the trilinear diagram (i.e., a change in major ion ratio); (b) any statistically significant change in non-leachate dissolved or total metals or radionuclides; or (c) any detection of an anthropogenic hazardous constituent in VZMS samples.

1.5.1.b Analytical Methods

The Permittee shall utilize the appropriate analytical methods for baseline constituents as specified at Permit Attachment I, Table 1. Analytical methods for leachate constituents shall be

chosen from *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods* (EPA publication SW-846, most current edition).

1.5.2 Evaluation Frequency

The release assessment shall be conducted each time fluid samples are collected, in accordance with Permit Condition 7.4.2 and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(d)), at each monitoring point required under Permit Condition 7.2.1, and as specified at Permit Attachment I, Section 6.4, *Data Analysis*.

1.5.3 Evaluation Schedule

The Permittee shall perform the evaluations specified at Permit Condition 7.5.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)(2)), within 30 calendar days after completion of sampling. The 30-day evaluation period includes the time required to perform laboratory analysis. The Permittee may petition the Secretary in writing for an extension to the 30-day evaluation period. The reasons for extending the 30-day evaluation period shall be presented in the petition. The Secretary will approve or disapprove the extension petition in writing within ten calendar days of receipt of the petition.

1.5.4 Detection Limits

Analytical detection limits shall in all cases be below the most stringent of the following three criteria, as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)):

- applicable State or federal drinking water standards;
- the universal treatment standards (UTS) contained at 20.4.1.800 NMAC (incorporating 40 CFR 268, Subpart D); or
- the lowest detection limits specified at EPA publication SW-846, Third Edition, 1986.

1.5.5 Laboratory Quality Assurance/Quality Control

The Permittee shall ensure that waste analyses are performed using the laboratory quality assurance/quality control (QA/QC) measures specified at Permit Attachment I, Section 5.2,

Laboratory Quality Assurance/Quality Control; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)).

1.5.6 Data Validation

The Permittee shall ensure that all laboratory analytical data is presented in accordance with the most current version of EPA publication SW-846, Third Edition, documentation packages. Data validation shall be conducted as specified at Permit Attachment I, Section 5.3, *Data Review, Validation, and Verification Requirements*, and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(f)).

1.5.7 Data Reporting

The Permittee shall report the VZMS analytical data to the Secretary within 15 calendar days of sample evaluation schedule specified in Permit Condition 7.5.3. Data shall be reported in a form that is conducive to determining the presence of a release. The analytical information shall be presented as specified at Permit Condition 7.5.1.a and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.97(j) and 264.98(c)).

1.5.8 Alternate Indicator Parameters

The Permittee may propose to the Secretary an alternate list of indicator parameters that could be used to analyze vadose zone fluids and that shows contamination by leachates through a Permit modification pursuant to 20.4.1.900 (incorporating 40 CFR 270.42).

1.6 VZMS MAINTENANCE

The Permittee shall maintain the VZMS as specified at Permit Attachment N, *Operations and Maintenance Plan*, Sections 3.4.4, *Operation of Leachate Collection and Detection Systems*, and 3.5.4, *Operation of Leachate Detection and Vadose Zone Monitoring Systems*; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.96). A summary of operation and maintenance activities shall be reported to the Secretary in the Quarterly Report in accordance with Permit Conditions 2.12.2.b and 7.7.2.

1.7 RECORDKEEPING AND REPORTING

1.7.1 Recordkeeping

The Permittee shall enter, at a minimum, the following VZMS information into the Operating Record in accordance with Permit Condition 2.12.1; and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.98(c)):

- well survey information (Permit Condition 7.2.4);
- geologic core (Permit Condition 7.2.6);
- Well Completion and Lithologic Logs (Permit Condition 7.2.9);
- leachate chemistry (Permit Condition 7.3.2);
- Appendix IX analysis (Permit Condition 7.3.2.b);
- sampling activities (Permit Condition 7.4.2);
- fluid elevation measurements (Permit Condition 7.4.3);
- VZMS inspection reports (Permit Condition 7.4.1.a);
- VZMS analytical results (Permit Condition 7.5.1);
- sample collection and preservation (Permit Condition 7.4);
- data evaluation (Permit Condition 7.5); and
- non-leachate removal (Permit Condition 7.1.3).

1.7.2 Reporting

The Permittee shall report the following information to the Secretary, as specified at Permit Attachment I, Section 6.5, *Data Reporting*; and as required by 20.4.1.500 (incorporating 40 CFR 264.98(c)):

1.7.2.a First Quarterly Report

The following information shall be submitted in the first Quarterly Report:

- Well Completion and Lithologic Logs (Permit Condition 7.2.9);
- A list of indicator parameters for non-leachate fluids and associated computations (Permit Condition 7.3.1.b);
- A list of indicator parameter for initial leachates (Permit Condition 7.3.2) based on F-039 and the first Appendix IX analysis; and
- VZMS analytical results collected during the first quarter, and associated Well Inspection Logs and Monitoring Field Logs sampling information (Permit Conditions 7.4.1, 7.4.10, and 7.5.3).

1.7.2.b Quarterly Reports

The following information shall be submitted in all Quarterly Reports:

- leachate chemistry (Permit Condition 7.3.2.a);
- fluid elevation data for each well (Permit Condition 7.4.3);
- vadose zone system inspection reports (Permit Condition 7.4);
- vadose zone system analytical results (Permit Condition 7.5.1);
- sample collection and preservation procedures (Permit Conditions 7.4.3, 7.4.4, 7.4.5, 7.4.6, 7.4.7, 7.4.8, and 7.4.9);
- release assessment information in the form of a summary of the data reports (Permit Condition 7.5);

- operation and maintenance report (Permit Condition 7.6);
- non-leachate fluid removal summary (Permit Condition 7.1.3);
- Indicator Parameter List, including non-leachate parameters and leachate parameters, revisions to the list based on quarterly/biennial leachate sampling results, and evaluations used to derive this list (Permit Condition 7.3);
- monthly leachate sampling results for that quarter (Permit Condition 7.3.2.a); and
- summary of Appendix IX results included in the previous biennial sampling event (Permit Condition 7.3.2.b)

1.7.2.c Biennial Report

The following information shall be submitted in the Biennial Report required under Permit Condition 2.12.2.a:

- Appendix IX analysis (Permit Condition 7.3.2.b); and
- Indicator Parameter List modification based on Appendix IX analysis, and evaluations used to derive this list (Permit Condition 7.3)

1.7.2.d Special Reports

The following information shall be submitted in special reports:

- release information (Permit Condition 7.1.2);
- monthly reports as long as there are fluids in the VZMS; and
- non-leachate parameter list and computations necessary to determine non-leachate parameter list (Permit Condition 7.3.1.b)

1.7.3 VZMS Report Supervision

A professional geologist or engineer shall supervise all VZMS report preparation.

