Response Action Plan
For Landfill L-14

For

Chemical Waste Management of the Northwest
Arlington Facility
17629 Cedar Springs Lane
Arlington, Oregon 97812

Revision 2
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EXECUTIVE SUMMARY

This Response Action Plan for Landfill L-14 (RAP) has been prepared for the Chemical Waste Management of the Northwest, Inc. (CWMNW) Arlington Facility in accordance with Title 40, Code of Federal Regulations (40 CFR) Part 264 Subpart N, Oregon Administrative Rule (OAR) 340-104, and United States Environmental Protection Agency (EPA) guidelines as outlined in the double liner and leak detection rules for hazardous waste and disposal units (FR 57, January 29, 1992). This RAP addresses: (1) the requirements of CFR Part 264.301; (2) identification and quantification of potential sources of liquids within the Leak Detection System (LDS) on a cell-specific basis; (3) the criteria to be used to detect, evaluate, and respond to liquids in the LDS; (4) the proposed response actions which may be triggered by detection of liquids within the LDS; and (5) the reporting procedures to state and federal agencies.

The rates of flow into the LDS from potential sources of liquids have been evaluated following a series of conservative assumptions. Because a geosynthetic clay liner (GCL) is a component of the primary lining system and a drainage geocomposite is designed for the LDS, no internal sources for liquid generation are considered in this RAP (as compared to compacted soil liners and granular drainage layers which were more common when the leak detection rules were published). All potential liquids sources in this analysis are external to the lining system.

Based on the definition in the final leak detection rule (also 40 CFR Part 264.302), an Action Leakage Rate (ALR) of 11,410 gallons/day was calculated. This is considered to be an unreasonably high flow rate. The primary motive behind the selection of the LDS drainage geocomposite was to provide a drainage system that would have satisfactory structural performance under the anticipated overburden pressures of the landfilled waste. If the maximum drainage capacity of the LDS is adopted as the ALR, then during the active life of the landfill cells, a leak condition that requires an action may never be triggered regardless of the severity of the leakage. Also, the use of the flow capacity of the LDS drainage geocomposite would result in a significant overdesign of the LDS collection sump and the leachate pumping system.

Considering the large disparity between the cell-specific liquid leakage rates into the LDS (as estimated in Section 3.3.6 of this RAP) and the flow capacity of the LDS drainage geocomposite, a more reasonable flow rate is proposed for the ALR. The ALR flow rate is based on the minimum required transmissivity of $3x10^{-5}$ m^2/sec in the drainage geocomposite of the LDS per 40 CFR Part 264.301. Based on this transmissivity, the Action Leakage Rate (ALR) is calculated to be approximately 438 gallons/day.

Section 5.0 of this RAP details a series of actions that will be taken in the event the leak rates into the LDS exceed the ALR. These actions include EPA and Oregon Department of Environmental Quality (DEQ) requirements and an additional set of measures that CWMNW will implement if the leak rates beyond the ALR are observed in the leak detection system.

1.0 INTRODUCTION

1.1 General

The owners or operators of landfill units subject to Resource Conservation and Recovery Act (RCRA) Subtitle C (Title 40, Code of Federal Regulations [40 CFR] Part 264.3018 or (d)) regulations must have an approved Response Action Plan (RAP) before receipt of waste at the landfill facility. 40 CFR Part 264.301, also adopted by the Oregon Administrative Code (OAR 340-100-002), requires that the leachate collection system between the liners and immediately above the bottom composite liner functions as a leachate collection and removal system as well as a leak detection system (LDS).

A RAP describes the criteria used to address liquids which accumulate in the LDS. Details of the definition of the "Action Leakage Rate" (ALR) which trigger a response on the part of the owner/operator to address such accumulations are given in 40 CFR Part 264.302.

In the final leak detection rule the EPA (1992) has adopted a single level of action identified by the Action Leakage Rate which triggers regulatory response in the event of significant releases of landfill liquids into the LDS. By its definition, the ALR is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner exceeding one foot. The ALR must include an adequate safety margin to allow for uncertainties including design and construction of the landfill, waste and leachate characteristics, and proposed response actions.

This RAP for Landfill L-14 at the CWMNW Arlington Facility has been prepared in accordance with 40 CFR Part 264 Subpart N, OAR 340-104, and EPA guidelines as outlined in the double liner and leak detection rules for hazardous waste and disposal units (FR 57, January 29, 1992). This RAP addresses: (1) the requirements of Part 264.301; (2) identification and quantification of potential sources of liquids within the LDS on a cell-specific basis; (3) the criteria to be used to detect, evaluate, and respond to liquids in LDS; (4) the proposed response actions which may be triggered by detection of liquids within LDS, and (5) the reporting procedures to state and federal agencies.

1.2 Project Location

The CWMNW Arlington Facility is located in Gilliam County, Oregon. Landfills L-12, L-13, and L-14 (Cell No. 1 through 3) are currently in operation.

Landfill L-14 has been designed with five cells, and will have a total capacity of approximately $6.3x10^6$ cubic yards. The design of L-14 meets or exceeds the requirements detailed in 40 CFR Part 264.301, OAR 340-104, and guidelines for landfill construction as described in *Minimum Technology Guidance on Double Liner Systems for Landfill and Surface Impoundment Design, Construction and Operation* - EPA 530SW85014.

1.3 Waste Characterization

Landfill units at the Arlington Facility are designed for permanent disposal of bulk solid hazardous wastes, containerized wastes free of liquids, and stabilized wastes. A complete description of wastes which are not accepted at the Arlington Facility is presented in Part A (Attachment 3) of the Permit Renewal Application.

2.0 LANDFILL DEVELOPMENT

2.1 General

Landfill L-14 is divided into five cells for development and operational purposes. Details of the design and construction of each Landfill at the facility can be found in Standalone Document 14 – Design and Ops Plan. Three inter-cell berms in the north-south direction and one intercell berm in the east west direction divide the base area into five cells. The primary and secondary leachate collection and detection systems have been designed to be hydraulically independent. Details of the primary and secondary leachate collection and detection system can be found in Standalone Document 14 – Design and Ops Plan

Liquids collected in the primary and secondary collection sumps will be removed by pumps placed within large diameter riser pipes that extend from the ground surface down the sideslope to each sump.

The landfill base grades (i.e., top of protective layer) vary between 934 feet MSL and 954 feet MSL which vary from 35 feet above to 80 feet below the existing grade. The maximum top of landfill elevation is approximately 1,150 feet. The maximum depth of waste in the landfill is approximately 208 feet.

2.2 Description of Landfill Lining System

The lining system components of Landfill L-14 have been designed in accordance with 40 CFR Part 264 Subpart N 264.301 and the details are included in Standalone Document 14 – Design and Ops Plan.

2.2.1 Base Liner System

The base liner system incorporates separate primary and secondary composite lining systems as described in Standalone Document 14 – Design and Ops Plan.

2.2.2 Leachate Leak Detection Systems

Each of the five cells of Landfill L-14 are constructed with a primary leachate collection system (LCS) and a secondary LDS as described in Standalone Document 14 – Design and Ops Plan.

Leachate flow between cells will be prevented by means of separation/ intercell berms built into the base liner and leachate collection system. Separation of the cells will also be ensured in the design of primary and secondary leachate collection systems. Both the primary and the secondary leachate collection systems will have separate sumps where leachate collection, pumping, and leak detection functions will be performed by means of sideslope risers. A typical section through the primary and secondary sumps can be found in the facility's *Landfill Design Drawings* document.

Complete design analyses for the LCS and the LDS are provided in the following document previously submitted to the DEQ:

Hydrogeologic Investigation and Engineering Design Report for Landfill L-14, Arlington, Oregon, prepared for Chemical Waste Management of the Northwest, Inc., by Rust Environment and Infrastructure Inc., dated February, 1998.

2.2.3 Tertiary Sump Monitoring System

In addition to the primary and secondary lining systems, a tertiary detection monitoring system has been designed directly beneath the LDS sump to monitor any releases into the environment. Inside the LCS and LDS sumps, the leachate heads will reach measurable levels during landfill operations, increasing the probability of liner leakage at these locations. The tertiary sump monitoring system will be capable of detecting releases through the LDS sump as well as enable sampling of the liquids collected for purposes of chemical analyses.

2.3 Description of the LDS

Subtitle C Part 264.301 (c)(3)(ii) allows the use of a geosynthetic drainage composite within the LDS with a transmissivity equal to or greater than $3x10^{-5}$ meters squared per second (m^2/sec). The secondary leachate collection layer was designed using a geonet/geotextile drainage composite meeting this requirement. More information on the geocomposite is included in Standalone Document 14 – Design and Ops Plan. .

2.4 Leachate Management

Fluids from landfill operations (leachate) are intercepted by the primary leachate collection and removal system (LCRS), and collected in the sumps. The LDS is designed to effectively intercept liquids which may have migrated through the primary lining system. Fluids intercepted by the LDS are also channeled to discrete sumps from which they are removed.

3.0 POTENTIAL SOURCES OF LIQUIDS IN LDS

3.1 General

The potential sources of liquids that may be collected within the secondary leachate detection/collection system can be broadly categorized as: (1) construction-related, (2) internal; and (3) external sources.

This section addresses: (1) the potential sources of liquids inside the secondary leachate detection/collection system; and (2) quantification of the liquids due to each potential source.

3.2 Potential Sources of Liquid

3.2.1 Construction-Related Liquids

Liquids generated during installation of the lining system components and before placement of the waste inside each cell will be classified as construction-related liquids.

These liquids generally occur as a result of: (1) direct precipitation onto the secondary geomembrane and secondary drainage layer prior to installation of the primary lining system; (2) permeation and localized leakage (through flaws in the primary lining system) of water that enters the primary drainage layer during construction; and (3) permeation of water from direct precipitation onto the primary drainage layer that occurs after the drainage layer is placed.

Water collected in the secondary collection sump as a result of direct precipitation (item 1 listed above) is not considered a part of the liquid quantity to be used as the basis for the ALR. Leakage as a result of Item 2 above should take place relatively rapidly before the start of waste placement operations, and therefore it will be considered as construction-related. Additional leak quantities due to direct precipitation (Item 3 above) during this period will also be considered construction-related. Any leakage that results from direct precipitation after the start of waste placement operations will be considered as due to external sources.

3.2.2 Internal Sources

Internal sources of liquids in the secondary detection/collection system sump typically consist of: (1) compression of the soil component of the primary lining system; and (2) compression of the secondary drainage layer material. Compression water from the primary lining system drains into the secondary detection/collection system.

Regarding item (1) above, the soil component of the primary lining system is a GCL. The air-dry moisture content of the bentonite in GCL's is low enough not to release any moisture under subsequent waste loading. Regarding item (2) above, the secondary drainage material is a geocomposite which has no internal moisture content so will not release water due as overburden increases. Therefore, no measurable amounts of liquids in the secondary detection/collection system are anticipated from internal sources.

3.2.3 External Sources

External liquid sources inside the secondary detection/collection system consist of: (1) leakage of leachate and initial water within the primary drainage layer through the primary geomembrane/GCL system; (2) compression water from the secondary soil/bentonite liner leaking into the secondary collection system through pinholes or larger-size construction related flaws through the secondary geomembrane; and (3) seepage of groundwater and/or other liquids through the secondary lining system if an inward gradient condition exists.

The uppermost groundwater-bearing zone beneath Landfill L-14 is the Selah aquifer at a depth of approximately 75 to 95 feet from the base of the secondary soil liner component. Therefore, no migration of liquids into the secondary collection system is anticipated as a result of inward seepage of groundwater unless perched groundwater above the base grades is encountered.

3.3 Quantification of Liquids

The quantities of liquids from external sources were estimated based on the assumptions listed below:

Specific to the protective soil layer material above the primary leachate collection geocomposite:

- The lining system construction will take place during periods with very little precipitation.

- The protective soil layer material will have an areal averaged hydraulic conductivity greater than $1x10^{-3}$ cm/sec.

- The protective soil layer will be placed rapidly so that it can be assumed to cover the entire base area of the cell (or, portion of the cell).

Specific to the cells:

- The maximum length of drainage to the primary and secondary collection sumps is approximately 810 feet.

- Base slope of the cell is a minimum of 1 percent at the time of construction in conformance with 40 CFR264.301(c)(3)(i).

Specific to the lining system:

- Secondary soil/bentonite liner in Cells 1 through 3 can drain only in the downward direction as it consolidates under increasing waste loading unless there are pinholes in the overlying lining system.

The following paragraphs address the quantification of the leakage into the secondary detection system from external sources.

3.3.1 Leakage through Holes in the Primary Geomembrane

The calculations in Appendix A of this RAP show that the leachate removal capacity of the primary leachate collection system exceeds the annual precipitation. This result indicates that even if the drainage layer received direct precipitation throughout the year, the hydraulic head build-up above the primary base geomembrane would be negligible. Therefore, the potential for leakage through any flaws in the primary geomembrane is very small.

For a conservative estimate of the leakage rate through the primary liner system on the floor of each cell, a hydraulic head of 12 inches was assumed in the drainage layer and protective soil overlying the primary geomembrane. In the calculations, the methodology devised by Giroud and Bonaparte (1989) was employed to estimate the leakage.

The 60-mil HDPE geomembrane was assumed to be in good contact with the underlying GCL and to have four one-square-centimeter holes per acre. The result obtained is approximately 0.057 gallons per day (gpd) per 1 cm^2 hole in the geomembrane, or 0.228 gallons per day per acre of lined area.

On the sideslopes, the hydraulic head of the leachate above the primary geomembrane will be insignificantly small. The geocomposite drainage capacity on the sideslopes will be much larger than the transmissivity required to drain the leachate impinging upon the slopes. However, as a conservative value, the leakage rate estimated above was assumed to also occur through holes within the primary sideslope liner system.

Within the primary leachate collection sump areas, a hydraulic head of three feet was used in the leakage rate estimates. However, because two layers of GCL are installed in the sumps, one GCL layer beneath the sump was assumed to remain intact. The leakage rate in this case was found to be approximately 0.38 gpd/hole. Two holes were assumed per sump, in addition to the four holes per acre assumed in the remainder of the base liner.

3.3.2 Leakage Through an Assumed Tear Within the Primary Geomembrane and GCL

In this scenario a 12-inch long and 0.25-inch wide tear along a geomembrane seam was assumed. It was also assumed that the tear continues through the GCL. By the nature of the bentonite material used in their manufacture, GCL's are generally self-sealing. However, this characteristic of the bentonite was neglected in the analysis for increased conservatism.

The leakage rate in this scenario is controlled by the hydraulic conductivity of the protective layer soil rather than the size of the tear and the hydraulic head over it. Due to the high assumed hydraulic conductivity, the assumed tear will result in a higher leak rate. A leakage rate of about 12.1 gpd per tear was calculated assuming a hydraulic head of 12 inches above the tear. One tear was assumed per cell.

Within the primary leachate collection sump areas, a hydraulic head of three feet was used to calculate the leakage rates. Similar to leak rate estimates through holes discussed above, one of the GCL layers beneath the leachate collection sump was assumed to remain intact. The leakage rate for this case was found to be approximately 7.35 gpd/tear with one tear per sump assumed in addition to the tear assumed in the floor of the each cell.

3.3.3 Leakage of Consolidation Water Through the Secondary Geomembrane Flaws

Consolidation time for the 3-foot thick soil/bentonite liner in Cells 1 through 3 was estimated from the consolidation tests performed as part of the design of Landfill L-12 (Golder Associates, 1993).

The compacted soil/bentonite liner will be less than fully saturated immediately after construction. Also, there is no identifiable groundwater condition that could cause the liner to become saturated during filling of the landfill or after closure. Therefore, significant excess pore pressures that develop in response to loading of the low-permeability saturated soil materials are not likely to occur within the soil/bentonite liner.

The calculations indicate that the liner consolidates almost completely within a period of one week after each load increment is applied. Since the upper surface of the liner is in contact with the geomembrane, the single-drainage condition into the in-situ soils was considered in this evaluation. The height of waste was assumed to reach the original ground surface elevation (average of approximately 1,000 feet) within a period of about 5 years in five increments. Soil liner consolidation will progress as the waste load on it increases gradually. To conservatively estimate the liquid generation rate as a result of soil liner consolidation, the overburden pressure obtained with the first increment was used in consolidation water calculations.

The daily average flow into the LDS was calculated as approximately 0.026 gpd per 1 cm^2 hole in the secondary liner system. The number of holes per acre was assumed to be four, identical to the assumption for the primary geomembrane. The calculations are provided in Appendix A of this RAP.

Tears were also assumed in the secondary liner system. The leakage rate due to these is approximately 0.5 gpd, assuming one tear per cell, the same as the assumption for the primary geomembrane. Appendix A of this RAP contains the relevant calculations.

3.3.4 Permeation through Intact Primary Geomembrane

Intact HDPE geomembrane is capable of transmitting water only in the form of water vapor in response to vapor pressure gradients. An equivalent hydraulic conductivity value of $2x10^{-13}$ cm/sec and a hydraulic head of 1-foot were used in estimating the permeation rate through the intact geomembrane. This value is approximately 0.037 gpd/acre. Such small amounts of water permeating the primary HDPE geomembrane will be largely absorbed by the GCL. If the absorption capacity of the GCL under the waste overburden pressure is exceeded, the permeation liquid may be released into the LDS in very small quantities. To be conservative, the absorptive capacity of the GCL was ignored in the calculations.

3.3.5 Permeation through Intact Secondary Geomembrane

Due to the presence of the soil/bentonite liner below the secondary HDPE geomembrane in Cells 1 through 3, some permeation of soil/bentonite liner pore water through the overlying secondary geomembrane may take place under hydraulic or vapor pressure gradients as the soil liner consolidates under waste loading. The rate of liquid transfer for this condition was estimated to be approximately 0.0075 gpd/acre.

3.3.6 Summary of Leakage Rates

Table 3-1 summarizes leakage rates from different sources as estimated in this section.

TABLE 3-1

LEAKAGE RATES FROM DIFFERENT SOURCES

Leakage Mechanism	Leakage Rate
Permeation through intact primary geomembrane	0.037 gpd/acre
Leakage through primary geomembrane flaws (1-foot head): • 1 cm^2 hole 12-inch long tear (GCL also torn)	0.057 gpd/hole 12.1 gpd/tear
Leakage through primary geomembrane flaws at sump locations (3-foot head): 1 cm^2 hole 12-inch long tear (GCL intact)	0.38 gpd/hole 7.35 gpd/tear
Permeation through intact secondary geomembrane	0.0075 gpd/acre
Consolidation water through secondary geomembrane flaws (Cells 1 through 3: 1 cm^2 hole 12-inch long tear	0.026 gpd/hole 0.50 gpd/tear

Table 3-2 is a summary of the total leakage rates for each cell in Landfill L-14 based on the base liner and sideslope liner areas.

TABLE 3-2

CONSERVATIVE ESTIMATE OF CELL-SPECIFIC LEAKAGE RATES INTO LDS

Cell	**Total Area (acres)**	**Total Leak Rate (gpd)**
1	6.5	23.2
2	4.1	22.3
3	4.0	22.2
4	8.4	22.6
5	12.6	23.4

As indicated in the calculations, the cell-specific leakage rates shown in the table are based on very conservative assumptions. The actual leakage rates should be significantly lower than those shown.

4.0 LIQUID REMOVAL CAPACITY OF THE LDS

4.1 General

The minimum transmissivity of the geocomposite drainage layers for the LDS has been specified as $3x10^{-5}$ m^2/sec in the final leak detection rule. This is interpreted as the long-term value which is obtained after the application of several safety factors to account for potential long-term performance degradation. Some of these factors are related to the long-term filtration performance of the geotextile component and some to the long-term structural performance of the geonet. As discussed in Section 4.2 below, these factors have been included in the analysis of the long-term performance of the LDS.

4.2 LDS Design Considerations

Table 4-1 summarizes the safety factors used in the evaluation of the long-term performance of the geonet/geotextile drainage composite. The documentation for the selection of each safety factor value is provided in Appendix A of this RAP.

TABLE 4-1

DRAINAGE GEOCOMPOSITE PARTIAL REDUCTION FACTORS

Performance Factor	Assigned Safety Factor
Out-of-plane creep (geonet)	2.0
Void intrusion (geonet)	1.2
Soil clogging (geotextile)	1.0
Chemical clogging (geotextile)	1.5
Biological clogging (geotextile)	1.2
Overall Reduction Factor (Product of all above factors)	4.32

The geotextile-related factors listed in Table 4-1 do not necessarily affect the long-term transmissivity of the geonet. However, they force a decrease in the flow rate of liquid into the geonet, and therefore, indirectly affect the flow capacity of the drainage geocomposite.

The initial transmissivity value for the drainage geocomposite selected for the LDS was obtained from a transmissivity vs. normal stress chart published by the manufacturer. The maximum design waste thickness was used to calculate the design normal stress. This published transmissivity value, in part, includes the effect of the creep of the HDPE due to sustained loading. An additional creep factor of safety of 2.0 was applied to the transmissivity value obtained from the chart as shown in Table 4-1.

By combining the partial safety factors listed above, the long-term transmissivity of the drainage geocomposite was obtained as $7.8x10^{-4}$ m^2/sec.

The flow capacity of the drainage layer is calculated as approximately 11,410 gpd. This accounts for the configuration of the secondary collection trench along the southern edge of the Cells 1 through 3, and along the northern edge of Cell 5, which intercepts flow from portions of each cell. This value is nearly three orders of magnitude larger than the estimated total flow of liquids into the LDS.

4.3 Leak Detection Time

Based on the capability of the composite secondary leachate detection/collection systems to detect extremely small flows regardless of the time scale involved in the arrival of such flows to the LDS sumps, the final leak detection rule requires that the LDS "be capable of detecting … leaks … at the earliest practicable time."

In Landfill L-14, the slowest calculated leachate flow path is along the base of Cell 1. This path consists of approximately 180 feet along the sideslope (3H:1V west-east direction), 480 feet along the base (1.0 & 1.5 percent slope in the north-south direction), and 90 feet along the south toe collection trench (0.7 percent slope), for a total of 750 feet. The leak detection time for this path is estimated to be approximately one day.

4.4 Action Leakage Rate

In its final leak detection rule, the EPA has adopted a single level of leak detection (ALR), which is defined similarly to the Rapid and Large Leak (RLL) in the proposed rule (EPA, 1992). By its definition, the ALR is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner exceeding 1-foot. This description applies largely to the LDS's that have a 12-inch thick granular drainage layer. For the geocomposite drainage layers, an equivalent condition would be the full flow within the drainage layer that has the same transmissivity as a 12-inch thick granular layer with a hydraulic conductivity not less than 1×10^{-2} cm/sec.

Although based on the definition in the final leak detection rule (also 40 CFR Part 264.302), an ALR value based on the flow rate of 11,410 gallons/day (see Section 4.2 of this RAP) is considered to be unreasonably high as this flow rate greatly exceeds the average daily precipitation at the facility. The primary motive behind the selection of the LDS drainage geocomposite was to provide a drainage system that would have satisfactory structural performance under the calculated overburden pressures. The drainage capacity of the selected LDS drainage geocomposite exceeds, by a large margin, the calculated potential leakage rate into the LDS.

Therefore, if the maximum drainage capacity of the LDS is adopted as the ALR, then during the active life of a cell a leak condition that requires an action will likely never be triggered regardless of the severity of the leakage. Also, the use of the flow capacity of the LDS drainage geocomposite would result in a significant overdesign of the LDS collection sump and the leachate pumping system.

Considering the large disparity between the cell-specific liquid leakage rates into the LDS (as estimated in Section 3.3.6 of this RAP) and the flow capacity of the LDS drainage geocomposite, a more reasonable flow rate is proposed for the ALR. The ALR flow rate is based on the minimum required transmissivity of $3x10^{-5}$ m^2/sec in the drainage geocomposite of the LDS per 40 CFR Part 264.301.

Based on this transmissivity and the cell floor width and slope, the maximum drainage capacities of the LDS and thus ALRs are as follows.
TABLE 4-2

CELL SPECIFIC ACTION LEAKAGE RATES (ALRs)

Cell	Cell Floor Width (ft)	Mininum Cell Floor Slope (%)	Max Drainage Capacity (gpd)
1	210	1.0	438
2	214	1.0	447
3	214	1.5	670
4	120*	1.5	501
5	120*	1.5	501
*Due to the herringbone configurations of Cells 4 and 5 the perimeter length of the sump was used instead of the cell width.			

It should be noted that, the ALR values proposed in the table above include a safety factor which greatly exceeds the recommended minimum value of two that is published in the final leak detection rule. This safety factor was calculated by multiplying the partial safety factors listed in Table 4-1.

The use of these action leakage rates enables the owner/operator to take action before large releases into the LDS begin to occur.

4.5 Verification of LDS Sump Capacity

The LDS sump in each cell was designed to be approximately 3 feet deep. The depth of the toe trench on both sides of the sump (in cells that include a toe trench) will be approximately 1-foot at the point of connection to the sump. In order to prevent liquid accumulation inside the toe trench, the liquid head within the LDS sump will not be allowed to exceed 2 feet. The liquid capacity of the LDS sump has been calculated assuming that the hydraulic head will be limited to a minimum of 1-foot and a maximum of 2 feet.

The existing LDS sumps for cells 1 to 3 have a capacity of approximately 474 gallons. Based on the proposed LDS sump design for Cells 4 & 5, the liquid capacity of the LDS sumps is approximately 1,600 gallons. In this analysis, a porosity of 40 percent was used for the granular material within the sump and the storage volume of the sump riser was ignored. The LDS sump dimensions can be found in the facility's *Landfill Design Drawings* document.

The ALR's of 438 to 670 gallons/day/sump are relatively small flow rates. A wide range of commonly available pumps have the capacity to handle these flow rates. Based on the available LDS sump volume, a pump will need to operate approximately once per day for a period of only about 1.5 to 2.5 hours to stay ahead of the proposed ALR.

5.0 RESPONSE ACTION

5.1 General

This section details response actions for possible excursions from the cell-specific ALR's for Landfill L-14 Cells 1 through 5. A summary of the monitoring to be performed is also included.

5.2 Monitoring of the Primary Leachate Collection Sumps

During the active life of Landfill L-14, all primary leachate collection system sumps will be inspected in accordance with the facility's *Inspection Plan*, and the accumulated leachate in these sumps will be pumped at a frequency determined by the liquid accumulation rate, sump size, and the characteristics of the leachate pumps installed in each sump. Frequent removal of the leachate from the primary leachate collection system will minimize the hydraulic gradients that increase the potential for leakage into the LDS.

5.3 LDS Monitoring

During the active life of Landfill L-14, all L-14 LDS sumps will be inspected for liquid accumulation in accordance with the facility's *Inspection Plan*. Liquids accumulating within the LDS sumps will be removed to the extent possible by the leachate removal system. This will minimize the hydraulic head on the secondary containment system, also minimizing the potential for leakage through the secondary geomembrane and the soil liner. The maximum liquid level within the sumps will be 2 feet. This will prevent the liquids from backing into portions of the leachate collection trench along the southern edge of the cells. The liquid level within the sump will be at least 1 foot below the lowest point of the LDS drainage geocomposite blanket on the cell floor.

During the active life of Landfill L-14, as well as during final closure, liquid will be pumped from each LDS sump at least once per week, recorded, and compared to previous volumes. After final closure, the amount of liquid removed from each LDS sump will be recorded at least monthly. The monitoring frequency may be decreased to quarterly or semi-annually after closure in accordance with the requirements outlined in 40 CFR Part 264.303(c)(2). The volume of liquid removed over the time since last evacuation (end of pumping to end of pumping) will be averaged to determine if the ALR has been exceeded.

If it is determined that the ALR's have been exceeded, the following responses will be initiated until such time as the accumulations are determined to be within the cell's/sump's acceptable operating limits. The agencies have authority, upon determining the existence of a significant threat to human health and the environment, to require additional response actions.

5.4 Response Action Plan

For flow rates below the ALR, routine monitoring will continue.

Flow rates that equal or exceed the proposed ALR will require the implementation of a set of actions as described in Section 5.5 below. Pumping rates out of the LDS sumps greater than the ALR are indicative of flows into the LDS greater than expected due to one or more of the mechanisms described in Section 3.0.

5.5 EPA and DEQ Requirements

In the event of exceedance of the cell-specific ALR value in a cell, CWMNW will, per the minimum specifications detailed in 40 CFR Part 264.304(b)(c), and 340 OAR 104, take the following actions:

1. Notify the Department in writing of exceedance within 7 days of the determination, and indicate that the response action plan will be implemented.

2. Submit a preliminary written assessment to the Department within 14 days of the determination, describing the amount and likely sources of liquids, possible location, size, and cause of any leaks and short-term actions taken and planned.

3. Determine to the extent practicable, the location, size, and cause of any leak.

4. Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed.

5. Determine other short-term and long-term actions to mitigate or stop any leaks.

6. Within 30 days after the notification that the ALR has been exceeded, submit to the Department the results of the analysis specified in Steps 3, 4, and 5 (above) and the results of actions taken and planned.

   Monthly thereafter, as long as the flow rate in the LDS exceeds the ALR, submit to the Department a report summarizing the results of remedial actions taken and actions planned.

7. To make the leak and/or remediation determinations in Steps 3, 4, and 5 (above), the owner/operator must:

i. Assess the source(s) of liquids and amounts of liquids by source;

ii. Conduct a fingerprint, hazardous constituent, or other analysis of liquids in the LDS to identify the source of liquids and possible location of any leaks, and the hazard and the mobility of the liquid; and

iii. Assess the seriousness of any leaks in terms of potential for escaping into the environment; or document why such assessments are not necessary.

5.6 Additional Requirements

In addition to the above requirements, CWMNW will also include the following actions in response to an exceedance of the ALR for the LDS sump:

1. In the event that leakage greater than the ALR is detected in any secondary leachate collection system sump, CWMNW will sample and analyze the liquid to determine whether it is derived from hazardous waste. CWMNW will determine the parameters for analysis, based on their knowledge of the wastes placed in the unit. Result of the analysis will be maintained in the operating record.

2. If the flow remains above the ALR for two consecutive one-week monitoring periods, CWMNW will provide written notification to the Department, and implement the following actions:

i. Increase pumping frequency as necessary for both LCRS and LDS sumps until flows are reduced below the ALR;

ii. Remove all standing water from within the landfill including from within temporary retention basin(s);

iii. Inspect the exposed sideslope liner, if any, repair any damage or defects, and document the location and extent of liner damage;

iv. Examine the primary liner 5 feet on either side of the damage and from the elevation of the damage to the top elevation of the waste and repair any observed damage;

v. Cease placement of waste within 15 feet of the sideslope liner until a leak has been located, other appropriate actions have been taken, or flow to the secondary sumps has decreased below the ALR; and

vi. Verify that the waste surface is sloping away from the landfill sideslopes. If necessary, regrade the waste or place soil to achieve a minimum one percent slope away from the landfill side.

3. If flow continues to exceed the ALR for an additional one week monitoring period, CWMNW will inspect and investigate alternative sources of liquids.

4. If the leak cannot be located or the flow continues to exceed the ALR after both the protective cover and primary liners have been repaired as necessary, CWMNW will prepare a written report describing actions taken to date and proposed future responses, and submit it to the Department within 60 days of the completion date of the report.

6.0 TERTIARY SUMP MONITORING PROGRAM

A tertiary sump is constructed beneath each primary and secondary sump. The tertiary sump system effectively represents an "engineered vadose zone", protected from the true in-situ vadose zone materials by a tertiary liner system. The tertiary sump will be constructed in accordance with the requirements of Standalone Document 14 – Design and Ops Plan.

6.1 Objective of Tertiary Sump Monitoring Program

The primary purpose of the tertiary sump is to detect leaks in the LDS sump. Additionally, the tertiary sump monitoring program is intended to provide data to help identify the nature of the Landfill L-14 long-term detection monitoring program that will eventually replace the interim monitoring program. The tertiary sump monitoring program is designed to provide the following information: (1) whether any liquid is present in the tertiary sumps; (2) the rate of liquid accumulation in the tertiary sump; and (3) the chemistry of liquid that might accumulate in the sump.

6.2 Tertiary Sump Monitoring Frequency

Monitoring will be implemented at a given tertiary sump once waste placement begins in the cell that is monitored by the sump. A monthly tertiary sump monitoring schedule will be adequate to detect the presence of liquid. In the event that liquid is detected in the tertiary sump, liquid removal will occur, and subsequent monitoring and liquid removal will be performed weekly as long as liquids continue to be detected in the sump. Pumping will be performed with a dedicated low-flow pump, such as a bladder pump (or equivalent). Pumping will occur only if the liquid head is sufficient to operate the pump. The volume of liquid removed will be recorded. If liquid is detected but the volume is insufficient to activate the pump, this will be noted.

6.3 Tertiary Sump Volume and Chemical Measurements

During each monitoring event, a device for measuring the presence of liquid will be used to evaluate water volumes. Evidence of surface contamination or discoloration, the condition of the riser, and the integrity of the locking cap will be recorded and maintained as part of the permanent monitoring record at the site. If no liquid is present in the tertiary sumps, this will be noted along with the date and time of the observation.

Liquid samples will be collected quarterly, if a sufficient quantity of liquid is present to allow for sampling, from the tertiary sump and analyzed for the chemical indicator parameters listed in the Table 6.1 below. In addition, field indicator parameters (pH, SC, and temperature) will also be measured in the secondary and tertiary sumps. If a sufficient quantity of liquid is present to allow for sampling, one sample will be collected from both the secondary and tertiary sumps in order to evaluate whether there has been a potential release. Based on the analytical results, additional tertiary sump samples may be collected. If volatile organic compounds are detected in the tertiary sump samples, the secondary sump will be immediately sampled and analyzed for the constituents listed in Table 6.1. Weekly measurements of volume and field indicator parameters will continue as long as liquid is observed in the tertiary sumps.

TABLE 6-1

TERTIARY SUMP PARAMETERS

Volatile Organic Compounds [Method 8260B]	
General Inorganics:	Common Anions/Cations
	Calcium
	Magnesium
	Sodium
	Potassium
	Nitrate
	Bicarbonate
	Carbonate (when pH greater than 8.0)
	Sulfate
	Chloride
Indicator Parameters:	
	Dissolved Iron
	Dissolved Manganese

6.4 Sump Sampling, Laboratory Analysis Procedures, and Reporting

Samples will be collected from the secondary and tertiary sump using the dedicated low-flow pumps installed in the sumps for liquid removal. The use of a low-flow pump for sampling is generally considered better for collecting samples that require analysis for volatile organic compounds (VOCs) because a low-flow pump tends to induce less sample volatilization than other types of samplers (e.g., high pressure-vacuum lysimeters).

Samples for chemical analysis will be collected according to the procedures specified in the *Manual for Groundwater Sampling* (see Appendix 1 of the *Groundwater Monitoring Plan*), with the exception that no purging of the sumps will be performed prior to sample collection due to the anticipated slow recharge rates. Samples will be handled and sent to the laboratory using strict chain-of-custody procedures, as described in the *Manual for Groundwater Sampling*.

Quality assurance / quality control (QA/QC) procedures used in the field and in the laboratory will also follow the procedures outlined in the *Manual for Groundwater Sampling*. Equipment blanks will not be required since a dedicated low-flow pump will be used to collect the samples.

An annual data report and summary will be submitted to the Department each year for the tertiary sump monitoring program. This information will be contained in the second semiannual groundwater monitoring report for the facility, which is usually submitted during December of each year.

7.0 REFERENCES

40 CFR 1993 (Updated as of September 30, 1993).

FR Vol. 57, (1992) Environmental Protection Agency - Liners and Leak Detection Systems for Hazardous Waste Land Disposal Units.

Giroud, J.P., and Bonaparte, R (1989) *Leakage Through Liners Constructed with Geomembranes - Part I. Geomembrane Liners*, Geotextiles and Geomembranes, V.8, pp.27-67.

Giroud, J.P., and Bonaparte, R (1989) *Leakage Through Liners Constructed with Geomembranes - Part II. Composite Liners*, Geotextiles and Geomembranes, V.8, pp.71-111.

Golder Associates, Inc. (1993) Consolidation Test - ASTM D2435 and Consolidation Test Summary", prepared for CWMNW - Arlington, Fill Unit L-12.

Office of Solid Waste, EPA (1985) Minimum Technology Guidance on Double Liner Systems for Landfill and Surface Impoundment Design, Construction and Operation -EPA 530SW85014.

Office of Solid Waste, EPA (1992) Action Leakage Rates for Leak Detection Systems" (Supplemental Background Document for the Final Double Liners and Leak Detection Systems Rule for Hazardous Waste Landfills, Waste Piles, and Surface Impoundments) EPA 530-R-92-004.

Oregon Administrative Rules, Chapter 340 - Department of Environmental Quality.

RUST E&I (1995) Response Action Plan - Landfill Unit L-12 - Arlington Facility.

APPENDIX A

CALCULATIONS

	Detection Time Estimates Chemical Waste Management of the Northwest L-14 Expansion	
		Made by: DW Checked: ED Revision: TBD Date: May 2013

Objective

Estimate the detection time of a leak into the secondary LCRS that occurs at the hydraulically most distant point with a cell from the cell's sump.

Method

Use Darcy's equation to estimate the travel times along each subsection of the theoretical flow path and sum the sectional travel times to estimate the total travel time.

Assumptions

Geocomposite transmissivity = $1.4 \times 10^{-3} m^2/sec$. This value is only used to calculate the equivalent hydraulic conductivity with the apparent thickness under normal loading. Only the creep and void intrusion partial factors of safety are applied because localized chemical and biological clogging will not significantly affect the flow path.

Due to the high porosity of the geocomposite the porosity is assumed to be 1. This assumption results in longer detection time estimates since it will under-estimate the flow velocity.

The average normal stress on the geocomposite is approximately 14,000 psf. This assumes that the landfill is at final grade.

Calculations - Cell 1

Subsection of Flow Path		A	B	C	D	Total
Flowline Length	ft	180	280	200	90	750
Gradient		0.333	0.01	0.015	0.007	
Geocomposite Transmissivity	m^2/sec	1.40E-03	1.40E-03	1.40E-03	1.40E-03	
Geocomposite Thickness	inch	0.240	0.240	0.240	0.240	
	m	0.0061	0.0061	0.0061	0.0061	
Equivalent Hydraulic Conductivity	m/sec	0.230	0.230	0.230	0.230	
Flow Velocity	m/sec	0.0765	0.0023	0.0034	0.0016	
	ft/sec	0.2509	0.0075	0.0113	0.0053	
Sectional Travel Time	sec	717	37,161	17,696	17,064	
	hours	0.20	10.32	4.92	4.74	
Total Travel Time	hours					20.2
	days					**0.8**

Results

The calculations demonstrate that leakage into the secondary LCRS at the hydraulically most distant point from the Cell 1 sump will be detected in one day or less. Other locations within Cell 4 & 5 will be detected in shorter times. Flow paths in Cells 2 through 5 are faster than the design condition in Cell 1, so leakage in the secondary LCRS of those cells will be detected in less than one day.

	Detection Time Estimates Chemical Waste Management of the Northwest L-14 Expansion		
		Made by:	DW
		Checked:	ED
		Revision:	TBD
		Date:	May 2013

Objective

Estimate the detection time of a leak into the secondary LCRS that occurs at the hydraulically most distant point with a cell from the cell's sump.

Method

Use Darcy's equation to estimate the travel times along each subsection of the theoretical flow path and sum the sectional travel times to estimate the total travel time.

Assumptions

Geocomposite transmissivity = $1.4x10^{-3} m^2/sec$. This value is only used to calculate the equivalent hydraulic conductivity with the apparent thickness under normal loading. Only the creep and void intrusion partial factors of safety are applied because localized chemical and biological clogging will not significantly affect the flow path.

Due to the high porosity of the geocomposite the porosity is assumed to be 1. This assumption results in longer detection time estimates since it will under-estimate the flow velocity.

The average normal stress on the geocomposite is approximately 14,000 psf. This assumes that the landfill is at final

Calculations - Cell 4

Subsection of Flow Path		A	B	C	Total
Flowline Length	ft	240	190	380	810
Gradient		0.333	0.02	0.015	
Geocomposite Transmissivity	m^2/sec	1.40E-03	1.40E-03	1.40E-03	
Geocomposite Thickness	inch	0.240	0.240	0.240	
	m	0.0061	0.0061	0.0061	
Equivalent Hydraulic Conductivity	m/sec	0.230	0.230	0.230	
Flow Velocity	m/sec	0.0765	0.0046	0.0034	
	ft/sec	0.2509	0.0151	0.0113	
Sectional Travel Time	sec	957	12,608	33,622	
	hours	0.27	3.50	9.34	
Total Travel Time	hours				13.1
	days				**0.5**

Results

See Cell 1 Calculations

	Detection Time Estimates Chemical Waste Management of the Northwest L-14 Expansion	Made by:	DW
		Checked:	ED
		Revision:	TBD
		Date:	May 2013

Objective
Estimate the detection time of a leak into the secondary LCRS that occurs at the hydraulically most distant point with a cell from the cell's sump.

Method
Use Darcy's equation to estimate the travel times along each subsection of the theoretical flow path and sum the sectional travel times to estimate the total travel time.

Assumptions
Geocomposite transmissivity = $1.4x10^{-3}m^2/sec$. This value is only used to calculate the equivalent hydraulic conductivity with the apparent thickness under normal loading. Only the creep and void intrusion partial factors of safety are applied because localized chemical and biological clogging will not significantly affect the flow path.

Due to the high porosity of the geocomposite the porosity is assumed to be 1. This assumption results in longer detection time estimates since it will under-estimate the flow velocity.

The average normal stress on the geocomposite is approximately 14,000 psf. This assumes that the landfill is at final

Calculations - Cell 5

Subsection of Flow Path		A	B	C	Total
Flowline Length	ft	210	430	105	745
Gradient		0.333	0.02	0.2	
Geocomposite Transmissivity	m^2/sec	1.40E-03	1.40E-03	1.40E-03	
Geocomposite Thickness	inch	0.240	0.240	0.240	
	m	0.0061	0.0061	0.0061	
Equivalent Hydraulic Conductivity	m/sec	0.230	0.230	0.230	
Flow Velocity	m/sec	0.0765	0.0046	0.0459	
	ft/sec	0.2509	0.0151	0.1507	
Sectional Travel Time	sec	837	28,535	697	
	hours	0.23	7.93	0.19	
Total Travel Time	hours				8.4
	days				**0.3**

Results
See Cell 1 Calculations