LANDFILL REPORT

US ECOLOGY NEVADA

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SECTION 11

LANDFILL REPORT

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SECTION 11

LANDFILL REPORT

11.1.0 Introduction

This report by US Ecology Nevada (USEN) complies with the requirements of 40 CFR Part 264, Subpart N (§§264.300 - 264.316) and 40 CFR §270.21, as adopted by the Nevada Division of Environmental Protection (NvDEP). The report describes the design features employed in the construction and operation of Trenches 11 and 12.

11.2.0 List of Hazardous Wastes

USEN accepts a wide variety of hazardous and non-hazardous wastes for disposal in its secure landfill trenches. The Part A Application identifies the U.S. Environmental Protection Agency (EPA) hazardous waste codes acceptable for disposal on-site.

Hazardous wastes[1] accepted for disposal on-site meet the applicable treatment standards of 40 CFR Part 268 Land Disposal Restrictions (LDR); or are amenable for treatment at the facility to achieve the required standards prior to disposal. The Waste Analysis Plan[2] describes the waste characterization procedures employed to ensure that waste streams accepted for landfill disposal comply with the requirements of 40 CFR Part 268.

11.3.0 Landfill Operating Procedures

11.3.1 Landfill Description

Both Trench 11 and Trench 12 are in active use at the USEN Facility. Landfill final covers are described in References 15.

Trench 11 has an approximate ground-surface footprint of 11.3 acres, and is located on the northeast side of the plant. It is about 26 feet from the north and south property boundaries and at least 10 feet west of closed Trench 10 and closed pre-Resource Conservation and Recovery Act hazardous waste disposal Trenches. Trench 11 was constructed to a maximum depth of ~75' below the original ground surface (bgs). The Trench 11 below-grade specification details were previously submitted in the Part B Application dated January 1993 (Reference 1). Placement of waste in the above-grade portion of Trench 11 began in 2000.

The above-grade portion of the Trench 11 has been developed in three (3) sequential phases, as indicated in the design plans included in the previously submitted document *Trench 11 Above-Grade*

1 Here-in-after "waste" or "wastes."

2 All analytical references or treatment methods referenced in this section are for informational purposes. Specific analytical references are found in the USEN Waste Analysis Plan. Specific treatment processes are described in the section where the treatment occurs (e.g.; Tank Report for Stabilization, Container Management Report for container management).

Disposal Facility Design and Construction Quality Assurance Plan, revised May 6, 1999 (Reference 2). Placement of waste in Trench 11 is nearly complete.

Trench 12 is designed with an approximate ground-surface footprint of about 8.4 acres, and is located about 150 feet north of the closed low-level radioactive waste disposal cells, about 20 feet from the north and west property boundaries, and about 50 feet west from Trench 11. The maximum depth of Trench 12 will be ~75 feet bgs. The above-grade portions of Trenches 11 and 12 will be joined across the narrow unexcavated ridge of natural ground that separates the subsurface portions of the trenches. The final covers of the two Trenches also will be joined together. Details for Trench 12 were previously submitted in various reports, including:

- *Trench 12 Design Report*, Volumes I and II, TRC Environmental, 03/96 (Reference 3), and
- *Response to Notice of Deficiency for the Trench 12 Design Report*, HMA Environmental, 12/96 (Reference 4).
- *Supplement – Landfill Report for Trench 12, October 2007 (Reference 14)*
- *Design Basis and Construction Specifications for Trenches 11 and 12 Final Covers, April 2008 (Reference 15)*

Joining the above-grade portions of Trench 11 and 12 will make efficient use of land area available for waste disposal, improve the performance of engineered environmental protection measures (i.e.; subsurface liners, final covers, and leachate and surface-water management features), and allow efficient waste disposal operations as those operations move from the Trench 11 area into Trench 12. USEN also will be able to progressively close the filled portions of the two trenches as the above-grade areas are filled. Closure procedures are described in detail in the Closure Plan.

11.3.2 Management of Containerized Waste

Waste containers intended for disposal are inspected to ensure they are > 90% full or crushed, shredded, or similarly reduced in volume to the maximum practical extent before burial in the landfill. Typically, empty containers are placed in the landfill and crushed by landfill equipment (e.g.; dozer, compactor). Also, poly containers may be physically cut or crushed and buried to reduce their volumes.

11.3.3 Procedures to Prevent Disposal of Bulk or Containerized Liquids

Incoming waste shipments are subject to inspection and verification sampling and analysis to ensure the absence of free liquids. The presence of free liquids in a waste shipment is evaluated by visual inspection for free standing liquids or by using the Paint Filter Liquids Test (PFLT), as described in the WAP. Free liquids present in containerized shipments may be absorbed with a non-biodegradable absorbent (e.g.;

cement kiln dust, clay). Absence of free liquids will be confirmed prior to disposal using visual inspections or the PFLT.

Absorbed bulk liquid hazardous waste is not accepted for direct disposal. Solidified liquid waste may be accepted if the generator provides data demonstrating the liquid portion of the waste was chemically transformed into a solid.

Bulk or containerized shipments arriving at the facility containing free-standing liquids may be stabilized using appropriate stabilization reagents as described in the WAP.

11.3.4 Exceptions to Containerized Liquid Disposal Prohibition

Provisions are made in the regulations (40 CFR §§264.314) to allow for the disposal of containerized liquids on specific situations. These situations are:

- The container is a lab pack;
- The container is very small, such as an ampule; or
- The container is a non-storage type container, designed to hold free liquids (e.g., capacitors, batteries).

11.3.4.1 Lab Packs

Lab packs may be accepted for disposal at USEN after evaluation of the lab pack inventory to ensure it complies with these guidelines as established in 40 CFR §264.316:

(a) Hazardous waste must be packaged in non-leaking inside containers. The inside containers must be of a design and constructed of material that will not react dangerously with, be decomposed by, or be ignited by the contained waste. Inside containers must be tightly and securely sealed. The inside containers must be of the size and type specified in the DOT hazardous materials regulations (49 CFR Parts 173, 178, & 179), if those regulations specify a particular inside container for the waste;

(b) The inside containers must be overpacked in an open head DOT-specification metal shipping container (49 CFR Parts 178 & 179) of no more than 416-liter (110 gallon) capacity and surrounded by, at a minimum, a sufficient quantity of sorbent material, determined to be nonbioderadable in accordance with 40 CFR §264.314(e), to completely sorb all of the liquid contents of the inside containers. The metal outer container must be full after it has been packed with inside containers and sorbent material;

(c) The sorbent material used must not be capable of reacting dangerously with, being decomposed by, or being ignited by the contents of the inside containers, in accordance with 40 CFR §264.17(b);

(d) Incompatible wastes, as defined in 40 CFR §260.10, must not be placed in the same outer container;

(e) Reactive wastes, other than cyanide- or sulfide-bearing waste as defined in 40 CFR §261.23(a)(5), must be treated or rendered non-reactive prior to packaging in accordance with paragraphs (a) through (d) of this section. Cyanide- and sulfide-bearing reactive waste may be packed in accordance with paragraphs (a) through (d) of this section without first being treated or rendered non-reactive; and

(f) Such disposal is in compliance with the requirements of 40 CFR Part 268.

11.3.4.2 Small Containers

USEN considers small ampules to be similar to lab waste, and requires that they be packaged in the same manner. If all the ampules contain the same waste (e.g., quality control samples) and all other guidelines are observed, a drum inventory sheet is not required.

11.3.4.3 Non-Storage Containers

Non-storage containers (e.g.; capacitors, batteries) may be accepted for disposal without meeting the over-pack criteria established for lab waste, provided that the containers are in good condition.

11.3.5 Special Requirements for Ignitable or Reactive Wastes

Ignitable or reactive wastes will not be placed in the landfill, unless the waste has been processed to remove the ignitability or reactivity characteristic (in accordance with 40 CFR §261.23), and the wastes meet all applicable requirements and treatment standards under 40 CFR Part 268. In accordance to 40 CFR §264.313 incompatible wastes and materials must not be placed in the same landfill cell unless 40 CFR §264.17(b) is complied with. When ignitable or reactive waste treatment is required, USEN takes precautions such as small batch treatment to prevent violent reactions and/or generation of extreme heat, toxic mists, fumes or gases.

11.3.6 Special Requirements for RCRA Debris

RCRA debris typically is treated by an alternate treatment method of encapsulation. Microencapsulation typically occurs in other permitted units (e.g.; tank systems), but it is often preferable to perform macroencapsulation in the landfill to maintain the integrity of the outer barrier. When performed in the landfill, the debris is staged on an acceptable outer encapsulant (e.g.; polyethylene, HDPE) and wrapped or the debris, especially large debris, may be staged and encapsulated in place (e.g.; liquid clay, pozzolonic materials) to reduce contaminant leachability.

11.3.7 Special Requirements for Management of F020, F021, F022, F023, F026, F027 Wastes

Regulated dioxin-containing wastes may be disposed of on-site when the LDR treatment standards are met. Compliance with LDR requirements ensures that disposal of such waste will be protective of human health and the environment. In addition, USEN provides geologic and climatic conditions that are exceptional for the safe disposal of these and other waste streams. The extremely low rainfall, high evaporation rates, facility location in a desert area (isolated from population sources), waste characterization and handling procedures, and facility design and operation minimize the potential for migration of these wastes through the soil, or volatilization into the atmosphere.

11.3.8 Special Requirements for Interim Processing Loads

Interim processing loads are loads of treated waste awaiting results from post-treatment testing. These loads may be staged within the lined area of Trench 12, provided that the treated waste is not placed on or adjacent to final cover. Up to 10 batches of waste may be placed at any one time. Treated waste awaiting test results are contained and controlled in the following manner:

- Wastes shall be placed in segregated piles, physically separated and distinguishable from other waste placed into the landfill.
- Wastes shall be placed in bulk in individual piles above an impermeable membrane. The impermeable membrane shall be at least 6 mil PVC, PPE or High Density Polyethylene and shall be placed within a lined area of the Trench.
- No free liquids shall be present as determined through visual inspection or a paint filter test,
- Wastes shall be protected from wind erosion and dispersal by topping with an anchored impermeable membrane or covering with a spray-on asphaltic emulsion. The spray-on emulsion may be applied at the end of the working day. Other covers providing equal protection may also be used.
- Interim processing loads will be moved within ten days of placement, either by disposal following successful confirmation testing or by retrieval for additional treatment or containerized storage.

Each waste pile shall be accompanied by the following information:

- Date and time of placement
- Unique waste batch identification
- Compatibility Group
- Approximate weight
- Hazardous waste label

Information accompanying treated waste shall be placed within a weatherproof container directly placed within the interim processing load. (Weatherproof containers are customarily metal "rockets" holding information within an enclosed tube which is affixed to a long rod that is placed within the waste pile.)

Compliance with the conditions stated above shall be verified during weekly landfill inspections.

11.3.9 Surveying and Record Keeping Procedures

USEN maintains records of waste locations within the Trench using a grid coordinate system established in reference to elevation and horizontal benchmarks. Irregularly-shaped loads and bulk loads will be defined by the grid block that most completely captures the load, noting that waste is moved by non-precise equipment such as bulldozers and can cross several grids. Shipments containing more than one waste stream of compatible waste may be buried and located in the same area, but need to be identified. Waste location information will be recorded in the Operating Record.

11.3.10 Wind Dispersal Control

To control wind dispersal of particulates during landfilling operations, USEN evaluates candidate waste streams during the waste stream evaluation process (as described in the WAP) to determine the waste stream's potential to generate excessive fugitive off-site particulate emissions during unloading. Specified packaging and handling arrangements contain the dust during unloading and disposal. If the potential for off-site fugitive particulate emissions is excessive, USEN will use place the roll-off box near the active face, use a liquid spray or take other measures to reduce fugitive particulate emissions. Wind dispersal potential is routinely reduced by using liquids to suppress dust, by daily cover and by spray foam. Non-hazardous, Non-RCRA and Leachate generated from Trenches 11 and 12 maybe used for the purpose of dust suppression. Leachate generated within Trenches 11 or 12 can only be used for dust suppression in the landfill from which it was generated (i.e. leachate generated from Trench 12 must be used in Trench 12 only). An EPA memo dated 5/23/96 authorizing the use of landfill leachate for dust suppression is included in Attachment D.

11.3.11 Run-On/Run-Off Control

The facility is located on a rise in the desert terrain formed by an alluvial fan. This rise extends up-valley (north and west) from the facility about 4.1 miles, forming a drainage area of 1.7 mi^2. Drainage of the remainder of the desert and surrounding mountains flows into the normally dry Amargosa River channel and natural drainage swales in the desert, and would not impact the facility during a 100-year storm event.

Run-on control for the 1.7 mi^2 drainage area is provided by a trapezoidal ditch (identified in design drawings as Ditch #1), north of the facility, which diverts the major portion of the drainage area to natural swales west of the facility. Smaller triangular ditches, (identified in drawings as Ditches #2 & #3), along the northern and eastern boundaries of the facility, divert the remainder of the drainage area around the facility. These drawings were previously submitted in Reference 5.

The run-on control ditches were designed to handle precipitation resulting from a 25-year, 24-hour design storm. A description of the procedures and assumptions employed in the design of the diversion ditches was previously submitted and incorporated herein as Reference 5.

The run-on control ditches are inspected annually to ensure that the design capacity is maintained. Necessary maintenance activities will be conducted to ensure that the system's capacity is not reduced by accumulated debris or obstructions.

11.3.12 Run-off Control

With the run-on control measures in place at the facility, the only water expected to come in contact with the waste in the disposal unit is direct rainfall. No run-off is expected from the disposal unit since precipitation within the Trench is evaporated naturally or collected by the unit's leachate collection and removal system.

Precipitation that falls outside of the above-grade berms is captured by the run-on control system and prevented from contacting waste.

11.4.0 Liners and Leachate Collection System Description

11.4.1 Liner Components Description

Trenches 11 and 12 employ liner and leachate collection systems equivalent to the Hazardous and Solid Waste Amendments (HSWA) of 1984 as Minimum Technological Requirements (MTR) to prevent the migration of hazardous wastes from land disposal units to groundwater and the surrounding environment. The Trench 11 liner system design meets the MTR performance standards and incorporates several liner design features tailored to site-specific arid environment conditions, and offering a level of protection equal or superior to the MTR requirements. The demonstration of USEN's liner system equivalency to the MTR liner system design was previously submitted with the original permit application. The specifications described in Reference 1 present the Trench 11 liner system design, which met the MTR requirements.

The design features of the Trench 12 liner and leachate collection system are similar to those of Trench 11 and also exceed the performance standards required of the MTR liner systems. The design features for Trench 12 were previously submitted in References 3, 4 and 14 and are included herein by reference.

The flexible membrane liner (FML)/Composite double liner system for both Trenches 11 and 12 is depicted in the design drawings included in previously submitted references (References 1 and 3), and incorporated herein by reference. The liner system is comprised of the following elements (described from top to the bottom).

Trench 11:

- Soil to isolate other components of the liner system from waste deposited in the Trench. The soil consists of 12" of cover material in the bottom and 6" in the sidewalls;
- Primary leachate collection/removal system consisting of a geotextile ($\geq$4 oz/ft^2) over a drainage geonet layer that slopes to collection sumps;
- Top synthetic liner consisting of 80-mil high-density polyethylene (HDPE);

- Leak detection/collection/removal system comprised of HDPE geonet which slopes to collection sumps;
- 100-mil HDPE liner which constitutes the upper layer of the composite bottom liner;
- Compacted clay liner consisting of a 6" thick layer of compacted, low permeability clay (select soil mixed with bentonite) placed at the Trench bottom and sidewall benches (this component has a hydraulic conductivity of $\leq 1 \times 10^{-7}$ cm/sec);
- 40-mil-thick HDPE liner placed at the bottom of Trench 11; and
- 4- or 6-ounce geotextile filter layer for further protection to overlying liner components during system installation.

Trench 12:

- Clean soil and/or select waste to protect the underlying liner components from heavy equipment or operations that could damage the liner. No large or angular elements, debris or drums are to be placed in this layer;
- Small particle size (i.e., sand or gravel) clean soil and/or select waste to protect the underlying liner components from heavy equipment or operations that could damage the liner. No large or angular elements, debris or drums are to be placed in this layer. The soil consists of 12" of material in the bottom and 6" in the sidewalls;
- Primary leachate collection/removal system consisting of a drainage geocomposite layer that slopes to collection sumps over a geotextile ($\geq$7.5 ounces/ft^2);
- Top synthetic liner consisting of 100-mil HDPE, textured on both sides;
- Leak detection/collection/removal system comprised of a drainage geocomposite over an HDPE geonet which slopes to collection sumps;
- 80-mil HDPE liner, textured on both sides, which constitutes the upper layer of the composite bottom liner;
- Geosynthetic Clay Layer (GCL), consisting of granulated bentonite sandwiched between two (2) geotextiles placed at the Trench bottom and sidewall benches (this component has a hydraulic conductivity of $\leq 1 \times 10^{-8}$ cm/sec); and
- Prepared fine-grained soil subgrade, 9" thick on Trench floor (this component has a hydraulic conductivity of $\leq 1 \times 10^{-5}$ cm/sec), with up to 36" of prepared subgrade beneath sumps.

<u>Synthetic Liners</u>

The synthetic liners installed in Trench 11 and Trench 12 are made of HDPE materials manufactured specifically for liquid containment. Manufacturer's resistance and strength data, as well as EPA SW-846 Method 9090 laboratory data for leachate, indicate that HDPE materials are resistant to a wide range of chemicals likely to be disposed at the facility. Method 9090 data demonstrating that the properties of the HDPE liner are not impacted by exposure to the waste and waste leachate were previously submitted and are included in Reference 6. These data correspond to testing conducted at a company-owned facility in

Texas, but are representative of the conditions at the USEN Facility in that the type of wastes managed by both facilities is similar.

Soil Liners

The soil component of Trench 11 liner system consists of a 6" thick layer of compacted, low permeability clay mixed with bentonite. The soil material employed was select soil from site stockpiles or excavations, from which all unsuitable materials such as trash, organic material, large rocks and particles were removed to allow the soil to pass a ⅜" sieve. Bentonite was combined with the soil in proportions that allow the liner system to be self-healing without causing excessive swelling (generally a minimum 12% dry weight bentonite contents).

Trench 12 uses a combination of compacted soil and a GCL element on the Trench floor. On side slopes, only the GCL will be used. The compacted soil layer is fine-grained soil screened from native materials and has a hydraulic conductivity specification of $\leq 1 \times 10^{-5}$ cm/sec. This material is used on the Trench floor and beneath leachate collection sumps.

11.4.2 Leachate Collection System

Trench 11

The Trench 11 double liner system incorporates a primary and a secondary leachate collection and removal system (LCRS). The primary LCRS is located above the primary liner, and is designed to collect and allow removal of liquids within the Trench. The secondary system is located between the two (2) liners, and its main function is to provide detection and removal of any leakage through the top liner.

The system was designed so that the south part of the Trench is served by one pair of collection sumps (Sump C1 for the collection system and D1 for the detection system), while the north part of the Trench is served by another pair of sumps (Sumps C4 and D4). By dividing the collection areas, the capacity requirements of the drain, the distance to the sump, and the contact time for leachate were minimized. The Trench's benches were also provided with sumps: C2/D2 and C3/D3. Sump C2 was closed in 1991 while retrofitting the sump risers.

The primary collection and transport mechanism of the LCRS is a HDPE drainage geonet layer covered by a geotextile (to prevent clogging), draining at a 2% slope to gravel-filled sumps. The HDPE drainage net (typically Tensar DN-3 geonet) has a transmissivity of 2 gpm/minute/linear foot/unit gradient or 7×10^{-7} m^2/sec, which is greater than the required 3×10^{-5} m^2/sec provided by 1' of sand with a permeability of 1×10^{-2} cm/sec. US Ecology tested the performance of the geonet under imposed loads, and confirmed that the lower transmissivity expected to result from intrusion of the overlying geotextile under applied loadings was significantly greater than the minimum requirement. Testing results were presented in the previous Part B renewal, in Section 5.4.2 of the Landfill Report, and are not duplicated here.

The drainage net flows to a trapezoidal gravel-filled sump sloped at 1% to a low point where a pipe riser will facilitate leachate monitoring and/or removal. Concrete-grade gravel in the ½" to ⅜" size range was employed. The drain was completely surrounded by a geotextile layer with a minimum thickness of 100 mils, folded in areas adjacent to the liner where the gravel was found to be extremely angular.

Ten-inch HDPE diameter pipes with a standard dimensional ratio (SDR) of 17 were initially installed as risers. This provided a wall thickness of 0.632", an appropriate thickness to withstand the forces applied during Trench operation. The riser pipe was extended in 5' to 10' increments as the level of waste in the Trench increased, using prefabricated sections that were flanged and bolted (or otherwise connected) together.

The design of the Trench's leachate collection and detection system is illustrated on the design plans that were previously submitted and are included herein by reference.

Obstruction of Trench 11 risers required rehabilitation during the fall of 1991. All risers, with the exception of C4 and D4, were retrofitted by placing a steel pipe inside the HDPE pipe. The risers are extended as necessary to accommodate the above-grade waste disposal of Trench 11.

The level of liquid in the LCRS sumps is monitored weekly, and the presence and level of liquids is recorded in a log (an example log is provided in Appendix B). Measurement of the liquid level is performed by lowering a water measurement tape down the riser until the presence of liquid is indicated, such as by a sound or light. The level is determined by subtracting the difference between the known depth to bottom of the sump riser, and the tape measurement.

As described in the Response Action Plan (RAP), Appendix B, pumping is initiated when 18" (vertical) of liquid is measured in the sump. This avoids backup of liquids into the drainage layer. If liquid is detected at $\geq$ 18", the sump will be pumped until the liquid level is < 18". The total amount of liquid removed is recorded on the log.

Every time the volume of leachate in the sumps reaches pumping levels, USEN evaluates the detection for potential exceedence of the Action Leakage Rates (ALRs) specified in the RAP. A detailed description of the procedures to be followed in the event of an ALR exceedence is contained in the RAP.

Trench 12

The Trench 12 LDS consists of a double-side geocomposite (GSE Fabrinet 300-mil geonet sandwiched between two 8 ounce/yd^2 geotextiles) and a 60-mil underlying HDPE flexible membrane liner atop a geosynthetic clay liner. Three (3) sumps are also installed in the LDS to collect liquids draining from discrete portions of the leak detection layer in the Trench 12 cell floor and sidewalls. 40 CFR §264.301(c)(4) requires the facility to collect and remove pumpable liquids found in the LDS sumps to minimize the head on the bottom liner. "Pumpable liquids" are defined in this plan as liquid that can be reasonably pumped out of the sump based on sump dimensions and pump operating levels for automated pump systems.

Pumps located within a perforated riser pipe in the LDS are used to remove pumpable liquids at each sump. USEN monitors LDS sumps weekly and removes pumpable liquids.

The selected LDS Pump type will not operate (i.e., cannot pump liquid) if there is less than 0.6 feet of fluid above the base of the pump. The operating controls for LDS Pumps will be set so that pumping will begin when the fluid level above the base of the pump is approximately 2.0 feet. At this fluid level, the fluid being pumped will be fully contained with the limits of the LDS/LCRS Sumps. The LDS Pump capacity as established in this RAP and fluid head levels equivalent to 1.0 feet of head above the Lowest Point of the Trench Bottom Liner should never be exceeded.

All leachate sumps (LCRS and LDS) in Trench 12 are monitored weekly. The results of this monitoring (depth of leachate in the sump, volume of leachate removed if pumping is required, and pumping time) are recorded in the sump monitoring log maintained for each sump.

If liquid is detected in an LDS sump above the pump operating level, the sump will be pumped within 24 hours to remove pumpable liquids. If liquid is detected in an LCRS sump with a depth of 1.75 feet or greater in the LCRS riser, the sump will be pumped within 24 hours to remove pumpable liquids.

11.4.3 Liner System Location Relative to High Water Table

As discussed in the Groundwater Monitoring Plan, included in this Renewal Permit Application, the water table in the vicinity of Trenches 11 and 12 is located approximately 285 feet to 310 feet bgs. Groundwater elevations recorded since 1988 do not indicate any significant variations over time. The distance between the water table and the liner system is expected to be over 200 feet at all times.

11.4.4 Liner System Exposure Protection

The primary synthetic liner in Trench 11 is protected from wind or sunlight exposure by a sacrificial 100-mil geotextile placed permanently on top of the primary liner. This geotextile is inspected periodically until it is completely covered, and repaired or replaced as necessary.

The Trench 12 design uses a sacrificial 40-mil HDPE layer as protection for the primary liner. This HDPE will be inspected periodically, and repaired or replaced as necessary until it is completely covered.

11.4.5 Loads on Liner System

The liner system is subjected to loads from both static and dynamic sources during construction, installation, and over the life of the facility. The following static loads are anticipated on-site:

- Self-weight during installation
- Anchor trench capacity
- Vertical load of fill and cap

The following dynamic loads also are expected:

- Uplift pressures from wind loads
- Thermal expansion and contraction of liner
- Equipment traffic
- Post-closure settlement of the cap

Analyses of each of these loads on the Trench 11 liners and the cover design were performed for the construction of Trench 11, and results have been previously presented. The analyses demonstrated that the construction design of the Trench was well within the material limits. These calculations are included herein by reference, and can be found in detail in the 1993 Part B Application Landfill Report, Appendix K "Design Calculation for Loads," included herein by reference (Reference 7).

Similar analyses were performed for the Trench 12 design. Although the design was approved, minor modification to the design and improvements in materials may slightly alter some of the calculations. However, as with Trench 11, the design employed conservatively estimated material properties, and the changes are not expected to affect the performance of the construction design.

11.4.6 Liner System Foundation

Since 1961, extensive investigations of the subsurface soils have been conducted at the USEN Facility. Detailed discussion of the foundation materials is provided in the following documents, most of which have been previously submitted to the NDEP.

- *Site Characterization Low-Level Radioactive Waste Disposal Facility*, Beatty, Nevada, US Ecology, Inc., 1987.
- *Environmental Pathways Analysis and DOSE Model for Low-Level Radioactive Waste Management Facility, Beatty, Nevada*, US Ecology, Inc., 1989.
- *Exploratory Boring and Monitoring Well Installation Program at the US Ecology RCRA Facility in Beatty, Nevada*, The Mark Group, Report No. 88-2107, 1989.
- *Drilling, Sampling and Installation of Two Monitoring Wells at the US Ecology, Inc., Beatty, Nevada Facility, Rad Site*, Geraghty and Miller, Inc., Report No. NV01201, 1990.
- *Drilling and Installation of Six Monitoring Wells at the US Ecology, Inc., Beatty, Nevada Facility Chemical Site*, Geraghty and Miller, Inc., Report No. NV01203, 1991.
- *Completion Report Vadose Zone Monitoring Well 500 and 501, Beatty, Nevada*, IT Corporation, Report No. 244266, 1991.
- *License Renewal Application for Low-Level Radioactive Waste Management Facility*, Beatty, Nevada, US Ecology, 1992.

- *Sediment Properties and Water Movement Through Shallow Unsaturated Alluvium at an Arid Site for Disposal of Low-Level Radioactive Waste near Beatty, Nye County, Nevada*, U.S. Geological Survey, Water Resources Investigations Report 92-4032, 1992.
- *Geotechnical Investigation for Trench 12 at the US Ecology Hazardous Waste Management Facility, Beatty, Nevada*, Grant Environmental, 1994.

The following sections provide a summary of the results of these subsurface investigations.

11.4.6.1 Geologic Setting

The USEN Facility is located in the Amargosa Desert basin. The basin was formed by normal block faulting, which displaced the surrounding rock strata upward relative to the crustal block underlying the valley. This tectonic process and subsequent erosion created the current topography, which is characteristic of the entire basin and range province. Subsequent erosion of the uplifted areas has filled the basin with sedimentary deposits, which reach a maximum depth of approximately 1,000' near the center of the basin.

11.4.6.2 Type of Bedrock

Sedimentary, metamorphic and igneous rocks make up the fault block mountain ranges to the north, east and west of the Amargosa basin. Similar rock formations also underlie the unconsolidated sediments found on the valley floor. The sedimentary and metamorphic strata contained in these formations are Precambrian and Paleozoic in age while the igneous rocks formed during the Tertiary period.

11.4.6.3 Type of Subsurface Soils

The subsurface soils are primarily alluvial in origin, having formed during the Tertiary and Quaternary periods from sediments deposited in alluvial fans, debris flows, streambeds, dunes, and lake or marsh beds. As a result of the varied depositional mechanisms, the subsurface soils exhibit a wide range or shapes, sizes and mineralogical origins.

The alluvial fan deposits extend into the basin from each side to form bajadas or broad fan-shaped plains. Near the center of the basin, intermittent prehistoric lakes or marshes are indicated by extensive deposits of subsurface clays and silts. These fine-grained deposits typically interfinger with the surrounding alluvial fan deposits. Playa or dry lake bed deposits are also found in the central basin area. Fluvial and aeolian depositional processes have typically dominated since the end of the Pleistocene and at other times between periods of lake bed or playa deposition.

11.4.6.4 Depth of Subsurface Soils

Recent subsurface soil investigations have extended to depths > 650' bgs. These borings were generally advanced specifically for the installation of monitoring wells within the unconsolidated alluvial sediments. A rotary drill exploration boring in July 1962, completed at the site water well may have penetrated bedrock. The following table summarizes the visual observations of the drill cuttings made by Vincent P. Gianella.

Summary of Gianella Log		
Predominant Material	**Thickness (feet)**	**Depth to Bottom (feet)**
Silt	22	22
Fine to Coarse Gravel with Boulders	80	102
Boulders with Clay	15	117
Small Gravel with Clay	30	147
Boulders with Clay	14	161
Orange to Brown Clay	45	206
Clayey Gravel with Boulders	59	265
Brown, Yellow and White Clay with Gravel	61	326
Boulders with Clay	14	340
White and Brown Clay with Boulders	95	435
Boulders with Clay	132	567
Gray Metamorphic Rock	8	575

More recent investigations have encountered soil formations to depths of 650'.

11.4.6.5 Hydrogeologic Conditions

Extensive hydrogeologic investigations have been conducted at USEN since 1988 to better define the physical properties and the hydraulic and hydrologic characteristics of the soil deposits. Following is a summary of the results of these previous investigations. Detailed discussions of the site hydrogeology are contained in the following documents previously submitted to NvDEP.

- *Exploratory Boring and Monitoring Well Installation Program at the US Ecology RCRA Facility in Beatty, Nevada*, The Mark Group, Report No. 88-2107, April 1989.
- *Drilling, Sampling and Installation of Two Monitoring Wells at the US Ecology, Inc., Beatty, Nevada Facility Rad Site*, Geraghty and Miller, Inc., Report No. NV01201, 1990.
- *Drilling and Installation of Six Monitoring Wells at the US Ecology, Inc., Beatty, Nevada Facility Chemical Site*, Geraghty and Miller, Inc., Report No. NV 01203, 1991.
- *Beatty RCRA Facility Investigation Report*, US Ecology, April 1992.

Recent investigations have identified alluvial deposits to a depth of ~300 feet to 350 feet, composed primarily of gravelly sands with poorly-sorted gravel or sand deposits in discontinuous intervals. The alluvial deposits are generally underlain by 50 feet to 150 feet of silt, clay and indurated deposits that act as a barrier to the downward flow of water. An upper saturated zone occurs near the contact between the overlying alluvial deposits and the underlying silt, clay and indurated deposits. A second aquifer has been identified in the sandy gravel formation that underlies the silt and clay deposits. The sandy gravel deposits generally become coarser with depth.

The depth to top of the saturation, as measured from the ground surface, is approximately 285' on the north side of the site and greater than 360 feet at the southwest corner of the low-level radioactive waste (LLRW) site. The interbedded clays and silts encountered beneath the saturated zone effectively separate the upper saturated zone from the lower aquifer located in the sandy gravel formation. The lower confined aquifer is located at depths below 380'. Thickness of the lower aquifer is estimated to be >250 feet on the southern side of the site. The piezometric level measured in the lower aquifer indicates a confined condition.

No significant changes in the piezometric level of the water table on-site have been observed since the monitoring program was initiated and has remained about 250 feet below the bottom of Trench 11 (75 feet bgs). The depth of Trench 12 is not affected by the water table elevation.

11.4.6.6 Description of Foundation Soils

Sampling of the foundation soils was conducted by Converse Consultants in 1984 (Reference 8, previously submitted). Further sampling and testing of the foundation soils was performed by Law Engineering (Law) in 1980 (Reference 9) and 1981 (Reference 10), Mark Group in 1989 (Reference 11), Geraghty and Miller in 1991 (Reference 12), and Grant Environmental in 1994 (Reference 13). The following sections are a summary of the information contained in the reports.

The foundation soils at the facility consist primarily of extensive deposits of sand, gravelly sand and sandy gravel. These alluvial deposits generally extend from the ground surface down to depths of about 300'. In accordance with the Unified Soil Classification System (USCS), the foundation soil has been classified primarily as SM (Silty Sand), SP (Poorly Graded Sand) and SW (Well-Graded Sand). In localized zones, SC (Clayey Sands), GC (Clayey Gravels), and GW (Well-Graded Gravels) have been identified. Thickness of the individual beds within the foundation soil range from a minimum of 1 foot or less than 20 feet.

A. **Index Properties of Foundation Soil**

The grain-size analyses (ASTM D-422) indicate the foundation soils contain between 0% and 19% soil fines (minus #200 sieve) with more than half of the samples generally displaying fines between 4% and 14%. The sand-sized particles (minus #4 sieve, plus #200 sieve) ranged between 10% and 84%. In general, the percentage of sand-sized particles displayed a gradual decrease with depth. The percentage of gravel-size particles (plus #4 sieve) ranged widely from 12% to 90% with three-fourth of the values in the range of 20% to 60%. In most instances the samples displayed a gradual increase in gravel content with depth.

Atterberg limits tests (ASTM D-4318) were not performed on samples obtained from the foundation soils. In general, these samples were granular and had < 20% fines (minus #200 sieve) with most samples exhibiting < 12% fines.

A mineralogic evaluation using petrographic microscopy and x-ray rate diffraction indicate the foundation soils consist primarily of volcanic rock fragments with various amounts of basalt, quartz and feldspar. Locally, the soil may also contain minor amounts of calcite and claystone fragments. Claystone and agglomerates of clay and calcite were also observed. The results of the x-ray diffraction techniques indicated the fine-grained portion of the foundation soils consist primarily of montmorillonite (35% to 40%), quartz (20% to 25%), sanidine (20% to 30%), illite (trace to 15%), cristobalite (0% to 10%), and kaolinite (trace).

The foundation soil wet bulk density (ASTM D-2937), determined by the Mark Group, Inc., ranged from a minimum of 90.0 pounds per cubic foot (pcf) to a maximum of 124.2 pcf. The average wet bulk density was 108 pcf. The dry bulk density ranged from 83.7 pcf to 112.9 pcf, with an average value of 91 pcf. Consistently higher bulk density values were determined from the samples obtained by Geraghty and Miller. For this study, wet bulk density values ranged from 105.2 pcf to 128.9 pcf for an average value of 118.5 pcf. The dry bulk density for the same samples ranged from a minimum of 82.3 pcf to a maximum of 119.8 pcf, for an average value of 110.4 pcf.

The moisture content (ASTM D-2216) of the foundation soil was generally between the ranges of 6% to 10% by weight for the granular samples taken above the saturated zone. As expected, fine-grained samples from below the saturated zone generally exhibited moisture contents >30%.

B. **Engineering Properties of Foundation Soil**

Standard Penetration Tests (SPT) were performed by Law in 1980-81 during installation of Observation Wells #101 - 107. The "N-value" (blow-counts/ft) of sampler penetration for the samples of the foundation soil ranged from 16 for a sample obtained near the surface in the non-cemented material to sampler refusal at most other locations. N-values as high as 200 blows for 2" penetration were recorded at two (2) sample locations. N-values of this magnitude are indicative of very dense coarse-grained soils or large gravels.

Unconfined compression strength tests (ASTM D-2166) were performed on block samples from the sidewalls of Trenchs 10 and 22 with values ranged from 77 psi to 175 psi, with an average of 130 psi. Strengths in excess of 55 psi are generally considered indicative of hard fine-grained soils.

Field infiltration tests were performed on five (5) different type samples from USEN. The sample types included the undisturbed desert surface, the bottom of Trench 10, dry uncontrolled compacted fill, moistened controlled compacted fill and the well-cemented layer located at a depth of 6 to 8 feet below the surface. The field infiltration rates ranged from 3.5×10^{-5} cm/s corresponding to a sample from the well-compacted layer to 1.3×10^{-3} cm/s for a sample tested on the undisturbed desert surface. At the bottom of Trench 10, field infiltration rates of 6.1×10^{-4} cm/s were recorded.

Laboratory falling head permeability tests were performed on samples representing the undisturbed desert surface, the bottom of Trench 10, dry uncontrolled compacted fill, and moistened controlled compacted fill. The laboratory permeability values ranged from 3.1×10^{-5} cm/s for the samples of dry uncontrolled compacted fill to 3×10^{-3} cm/s for the undisturbed sample obtained from the desert surface. Samples obtained from the bottom of Trench 10 yielded values of 1.3×10^{-5} cm/s and 5.2×10^{-4} cm/s.

Compressibility of the foundation soil was not determined directly, however, the compressibility of the foundation soil should be minimal because of the coarse texture, consistency and degree of cementation exhibited by the soil. The classification test results indicate the foundation soils are primarily comprised of coarse-grained soils, while the SPT results indicate the foundation soils are very dense. These two (2) factors tend to minimize the compressibility of foundation soils and any compression or settlement that does occur should occur readily upon application of the load.

11.4.6.7 Bearing Elevation of Waste Trench

The foundation of Trenches 11 and 12 consists of extensive deposits of alluvial soils comprised primarily of sand, gravelly sand and gravel. Results of previous investigations indicate the upper layer of the alluvial deposits extend to ~ 300' beneath the ground surface. The below ground depth of the waste Trenches is ~ 80', which indicates that the bearing elevation of the waste Trenches will be well within the extensive alluvial deposits, and well above the groundwater level.

11.4.6.8 Engineering Analysis

Settlement of the foundation system should be minimal because of the granular texture and very dense consistency of the foundation soil. Because of the granular consistency, any potential settlement should occur upon application of the load. Since the majority of the waste Trench will be located below-grade, the majority of the vertical load applied to the foundation soil should be compensated by the soil removed during construction of the Trench.

Similar to the previous discussion concerning settlement, the foundation soil will exhibit a relatively high bearing capacity. The granular texture of the soil, coupled with the very dense consistency, will greatly minimize the potential for a bearing capacity failure.

Law performed a stability analysis for proposed steep side slopes of disposal trenches in 1981. Law concluded that an adequate factor of safety ($FS \geq 1.5$) would be provided in 90' deep trenches with 60% side slopes. The analysis was performed using conservative values for cohesion (cementation). Using a more realistic evaluation of cementation, Law further concluded that a factor of safety of $\geq$2.0 could be achieved.

The Trench 11 slope configuration consists primarily of 25 foot high ½:1 (63.5°) slopes with 15 foot horizontal benches. The resultant average Trench 11 side slopes, considering the benches, is about 45%. A slope stability analysis, previously submitted, was performed utilizing the REAME (Rotational Equilibrium Analysis of Multi-Layered Embankment) program developed by Y.H. Huang at the University of Kentucky. The analysis employed the soil strength parameters recommended by Law in their August 13, 1981 report and indicated a safety factor of 2.45 could be achieved using the parameters recommended by Law.

The slope stability analysis (Reference 13, previously submitted) of the below-grade portion of Trench 12 examines the sidewalls as continuous slopes, without benches. The analysis, performed in a similar fashion to the analyses of Trench 11, used the PCSTABL program and indicated the safety factor for the different slope orientations (north, south, east and west) ranged from 1.74 to 2.51 using the soil parameters recommended by Grant Environmental.

Excess external hydrostatic pressure is not a concern because of the granular texture of the foundation soil and the significant depth to the zone of saturation. The granular alluvial deposits comprising the foundation soil are generally free-draining and should not allow the buildup of excess hydrostatic pressures. The zone of saturation exceeds 200' below the bottom of the waste Trenchs.

The build-up of gas pressure beneath the waste Trench is unlikely because of the granular consistency of the soil and the high permeability of the formation. U.S. Geological Survey (USGS) data indicate that soil gas pressure within the Beatty foundation soil fluctuates with changes in the barometric pressure at the surface. With increasing depth, the pressure fluctuations are dampened but still indicate an interconnection to the ground surface.

USEN is located in the Basin and Range Province in Zone 3, an area of active seismicity. Between September 4, 1868, and August 4, 1992, a total of 23,764 seismic events were recorded by the USGS National Earthquake Information Center, within a 200 kilometer radius of the site. An event with an estimated magnitude of 8.0 (Richter Scale) occurred in 1872 about 78 miles west of the site in the Owens Valley of California. Recent earthquakes of unrecorded magnitude occurred in 1964 and 1968 within 1.2 miles and 6.2 miles of the site, respectively.

Several seismic events occurred during a 2-week period in the summer of 1992. The largest event during that time period was a magnitude 5.5 seismic event (Richter Scale) that occurred 22 miles west of the site on June 29, 1992. Although damage was reported near the epicenter, no damage was observed on-site during this event or during the half dozen smaller events that occurred over the following days.

Although USEN is located in an active seismic region, the probability of a seismic event occurring with sufficient magnitude to cause damage to waste Trenches is remote. However, as required by applicable regulations, slope stability analyses consider possible seismic events.

Localized subsidence of the natural ground surface because of internal erosion or solution activity has not been observed within the vicinity of USEN. The lack of appreciable precipitation and near surface groundwater flow coupled with the granular texture of the soil has greatly reduced the potential for internal erosion or piping, which could lead to surface subsidence.

11.4.7 Constructions and Maintenance

Material and construction specifications for all components of Trench 11 liner system are provided in the "Specifications for Trench 11 report included as Reference 1. Trench 12 specifications are essentially identical to those for Trench 11, and are included in References 3 and 4. A listing of the specific information requirements addressed by the specifications is provided below.

- Preparation of the liner system foundation, including a description of the procedures to be followed in preparing the supporting areas for the liner system;
- Procedures for installation of the soil components of the liner system;
- Procedures for installation of synthetic liner, including:
  - The inspection of synthetic liner bed for material which could puncture the liner, and removal of such material; the synthetic liner placement, and procedures for protection of the liner system before and during placement of material on top.
  - Techniques to bond liner seams are described.
  - Procedures for protection of the liner before and during placement of material on top of the liner are described.
  - Protection of the liner during operations is accomplished by restricting the minimum traffic loads imposed on the synthetic liner and leachate collection system until sufficient cover has been placed. To prevent mechanical damage or displacement of the liner, at least 1 foot of cover is placed prior to loading by tracked vehicles, and 6 inches prior to loading by wheel vehicles.
- Installation of leachate collection and detection systems, including the drainage layer, piping, and filter layers;
- Quality Control program; and
- Liner Repair Methods.

11.5.0 Above-Grade Design

The configuration of the above-grade disposal structure was designed to accomplish the following:

- Allow waste within the above-grade structure to remain within the boundaries of Trench 11;
- Allow stable, maintenance-free slopes; and
- Allow construction using conventional earthwork equipment.

Lateral migration of potential contaminants to the surface is prevented by a compacted earth embankment constructed around the Trench perimeter. As indicated in design drawings, the berm is covered on the top and outer slope with a synthetic liner. The structure design incorporates a permanent outer slope of three horizontal to one vertical (3H:1V), and an inside slope of 1.25:1. The structure will have a crest width of 16' (the minimum width which can be constructed conveniently with normal earthwork equipment), and heights between about 18' and 30'. Temporary ramps will be constructed along the outside of the northern and southern embankment sections to provide safe one-way traffic flow, and access to all facilities.

An engineering analysis (Reference 2) demonstrating stability of the above-grade embankment slope was previously submitted in the "Trench 11 Above-Grade Disposal Facility Design and Construction Quality Assurance Plan", prepared by AquAeTer, Inc, and revised May 6, 1999.

Above-grade berms are constructed of on-site sand and gravels compacted to at least 95% Standard Proctor Density. Laboratory and field studies conducted by Converse and Associates (Reference 8, previously submitted) demonstrated that this minimum specification will be easily achieved with site soils. Converse studies determined maximum dry density of site compacted fill within the range of 122 to 128.5 pcf, and in-place dry densities of natural materials below loose surficial layers in the 122 to 129 pcf range.

The above-grade design for Trench 12 (References 3 & 4, previously submitted) incorporates the slope stability analyses.

Both Trench 11 and Trench 12 above grade designs incorporate alternative covers approved by the NvDEP in 2009.

11.5.1 Foundation Design

The northern and southern compacted fill berms of Trench 11 are constructed over below-grade wastes, and the remaining compacted fill berms (e.g., the eastern and western berms) are constructed over natural ground. Where the berm foundation consists of buried waste materials, these materials typically consist of about 50% to 60% buried waste and 40% to 50% sand and gravel backfill. Post-construction settlement or subsidence is not expected to be a significant problem for the berms founded on waste for the following reasons:

1. Waste materials beneath the above-grade facility are predominantly solid wastes;
2. The sand and gravel backfill is dry and tends to flow between containers, thus decreasing void space in the fill;
3. Most settlement will occur before the above-grade berms are constructed; and
4. Unlike clay soils, sands and gravels do not settle appreciably after initial placement and loading.

Settlement also is not expected to be a concern for berms founded on natural ground (e.g.; west & east berms). However, slope stability analyses indicate the loose sand layer that forms the natural surface material might affect the berm & final cover outer slope stability on the west side. In this area, the loose sand was removed, except where the trench liner already is present, and replaced with a compacted soil fill. The loose sand layer is not a concern for the east side berm and final cover that overlap the existing covers of Trench 10 and the Trenches 1 to 9 area. Differential settlement is not a concern since no berms founded partially on waste and partially on natural ground are included in the design.

The design for Trench 12 incorporates the foundation design for the above-grade berms. Above-grade berms founded on waste on the north and west sides of Trench 12 will be low (typically, <10' high) and, as such, subject to relatively little settlement. The higher berms intended for use on the south side of the Trench will be founded on native materials, and, as for similar Trench 11 above-grade berms founded on native soil, subject to minimal settlement. No above-grade berms are planned for the east side of Trench 12 where above-grade waste disposal will be continuous with above-grade waste disposal in Trench 11.

11.6.0 References

1. *Part B Application*, 01/93, Section IV.D, Landfill Report, with Appendices A through Q.
2. *Trench 11 Above-Grade Disposal Facility Design and Construction Quality Assurance Plan*, revised 05/06/99.
3. *Trench 12 Design Report*, Volumes I and II, TRC Environmental, 03/96.
4. *Response to Notice of Deficiency for the Trench 12 Design Report*, HMA Environmental, 12/96.
5. *Part B Application*, 01/93, Section IV.D, Landfill Report, Appendices C and D.
6. *Part B Application*, 01/93, Section IV.D, Landfill Report, Appendix F, "Method 9090 Compatibility Data."
7. *Part B Application*, 01/93, Section IV.D, Landfill Report, Appendix K "Design Calculations for Loads."
8. Converse Consultants, Inc., 1984, *Field and Laboratory Testing of Soils at the Beatty Site, 84-3163-01, Beatty Disposal Site, Nevada*, prepared for US Ecology.
9. Law Engineering Testing Company, 1980, *Trench Stability Analyses*, NECO, Inc. Beatty, Nevada Facility.
10. Law Engineering Testing Company, 1981, *Geotechnical Studies, Deep Trench Stability Analyses*, US Ecology, Inc. Beatty, Nevada Facility.
11. Mark Group, 1989, *Exploratory Boring and Monitoring Well Installation Program, US Ecology RCRA Facility, Beatty, Nevada,* 2 volumes, prepared for US Ecology.
12. Geraghty and Miller, Inc., 1991, *Drilling and Installation of Six Monitoring Wells at the US Ecology, Inc., Beatty, Nevada Facility Chemical Site.*
13. Grant Environmental, 1994, *Geotechnical Investigation for Trench 12 at the US Ecology Hazardous Waste Management Facility, Beatty, Nevada.*
14. AquAeTer, October 2007 Supplement – Landfill Report for Trench 12

15 AquAeTer, April 2008, Design Basis and Construction Specifications for Trenches 11 and 12 Final Covers,

Appendix 11-A

Leachate Monitoring and Recording Log

Trench 12 C1 Leachate Sump Monitoring Log

Date	Depth to Bottom	Depth to Water	Gallons Pumped	Pumping Time	Initials	Review Initials	Comments
	85.6						
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Notes:

Trench 12 D1 Leachate Sump Monitoring Log

	Depth to Bottom	Depth to Water	Gallons Pumped	Pumping Time	Initials	Review Initials	Comments
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Appendix 11-B

Response Action Plan Trench 11

RESPONSE ACTION PLAN

LEAK DETECTION SYSTEM

TRENCH 11

US ECOLOGY NEVADA

OCTOBER 2009

SECTION 11-A

RESPONSE ACTION PLAN
TRENCH 11

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RESPONSE ACTION PLAN

11.1.0 Introduction

The U.S. Environmental Protection Agency (EPA) promulgated rules on January 29, 1992, mandating the preparation of Response Action Plans (RAP) for new hazardous waste landfill units which commence construction after January 29, 1992, or expansion of existing units after July 29, 1992 (57 FR 3462). At the US Ecology Nevada (USEN) Facility, Trench 11 is a regulated unit under this rule.

This RAP was developed to meet the requirements of 40 CFR §264.304 and to provide predetermined, site-specific actions that will detect leaks at the earliest practical time complemented by early follow-up actions that effectively minimize migration of hazardous substances from Trench 11.

11.2.0 Action Leakage Rate

The Action Leakage Rate (ALR) is the leakage rate that requires implementation of a response action to prevent hazardous constituent migration out of the unit. The regulations specify that a leakage rate be established for each leak detection sump in a regulated unit. The ALR for an individual sump may be based on an approach similar to the EPA proposed definition for rapid and extremely large leakage rate as provided in the January 29, 1992 rule. The calculation of the ALR is based on the maximum design leakage rate that the unit's leak detection system can remove without the fluid head on the bottom liner exceeding one foot. The EPA did not propose a standard ALR for regulated units. Regulated facilities may use the formula proposed by the EPA in the January 29, 1992 Final Rule to determine ALRs or justify higher ALRs through the use of different models, formulas, or demonstrating the exceedence of minimum technology standards.

In this submission, the ALR has been calculated for each individual detection sump located in Trench 11 based on the maximum flow that the leak detection system can deliver and remove (see Table 1).

Table 1 - ALR Determination

Sump No.	Total Flow (gal/day)	Pump Capacity (gal/day)	ALR* (gal/acre/day)
1D	211	12,960	70
2D	211	12,960	104
3D	211	12,960	84
4D	211	12,960	44

*The total flow is limited by the capacity of the sump collection trench to 211 gal/day. The ALRs were all calculated based on that flow. See Attachment A for ALR calculations.

11.2.1 Trench 11 ALRs

The leak detection system in Trench 11 consists of a geonet drainage layer on the cell floor and sidewalls. The geonet drains to a gravel-filled collection sump. A pump located within a perforated riser pipe is used for liquid removal.

11.2.2 Function of ALR

The ALRs established in this document will serve as a trigger for response actions for Trench 11. US Ecology will contact the Nevada Division of Environmental Protection (NvDEP) within seven days after confirmation of an exceedence of the ALR. Measured rates of leakage less than the ALR will be addressed by the collection and removal of pumpable liquids from the detection sump to minimize head on the bottom liner. Pumping will follow the facility pumping schedule outlined below. All amounts of leachate pumped from the leak detection system will be documented in the facility operating record.

11.2.3 Trench 11 Collection Sump Action Levels

The collection system in Trench 11 consists of three (3) sumps draining the primary liner on the cell floor and sidewalls. The trench is constructed so that the liner drains to a gravel-filled collection sump. A pump located within a perforated riser pipe is used for liquid removal. The sumps are constructed such that water levels of at least 1.75 feet are required to actuate the pumps. The following levels are an indication of 1 foot of hydraulic head exists on the collection liner (see Table 2).

Table 2 - Collection Sump Levels

Sump No.	Total Water Level (feet)
1C	1.75
2C	Closed
3C	3.9
4C	4.0

11.2.4 Function of the Collection Sump Action Levels

The collection sump action levels established in this document will serve as response actions for Trench 11. Should water levels in the collection sumps reach the listed values, actions will be undertaken by the facility to remove water from the sumps.

11.3.0 Leachate Removal

The purpose of the leachate collection and removal system (LCRS) is to remove pumpable liquids from the primary liner system, thereby minimizing the possibility of leachate escaping the primary liner into the leak detection system. To assure pumpable liquids are removed from this primary system, USEN will monitor the LCRS sumps and ensure that liquids are removed such the head on the primary liner does not exceed 1 foot.

40 CFR §264.301 (c)(4) requires the facility to collect and remove pumpable liquids found in the leak detection system sumps to minimize the head on the bottom liner. "Pumpable liquids" are defined as any amount of liquid that can be reasonably pumped out of the sump based on sump dimensions, pump operating levels for automated pump systems, and the goal of minimizing the head in the sump and backup of liquids (from the sump and drainage tile or pipes) into the drainage layer. The distance from the bottom of the leak detection sump in Trench 11 to the top of the primary liner is approximately 3.25 feet. The leak detection sump pumps require approximately 1.75 feet of head to operate properly. The pump operating level for the leak detection sumps in Trench 11 has therefore been established at

1.75 feet. This will avoid backup of liquids into the drainage layer, minimize the head on the bottom liner, and allow the pump to function properly.

11.4.0 Sump Monitoring

1. All leachate sumps (LCRS and detection) in Trench 11 will be monitored at least weekly during the active life of the trench. The results of this monitoring (depth of leachate in the sump and volume of leachate removed if pumping is required) will be recorded in the sump monitoring log maintained for each sump.

   a. If liquid is detected in a leak detection sump with a depth of 1.75 feet (pump operating level) or greater, the sump will be pumped, within 24 hours, until evacuated or liquid removal is no longer possible or is below the 1.75 feet pump operating level. The volume of leachate pumped will be recorded on the sump monitoring log for that sump.

   b. If liquid is detected in a LCRS sump with a depth of 1.75 feet or greater, the sump will be pumped, within 24 hours, until evacuated or liquid removal is no longer possible. The volume of leachate pumped will be recorded in the sump monitoring log for that sump.

2. If liquid is pumped from a LCRS or leak detection sump, the frequency of monitoring that sump will be increased to daily (daily is defined for this RAP as each day that the facility is open for operation – normally Monday through Friday, excluding weekends and holidays), until the liquid level in the sump is maintained below 1.75 feet in depth for two (2) consecutive days. If the leachate measurement in a sump is 2.5 feet or greater; the sump monitoring frequency will be increased to daily including Saturday, Sunday and holidays, until the liquid level in that sump is maintained below 2.5 feet for two (2) consecutive days. At that time, monitoring will be reduced to operational days only (Monday through Friday).

3. During the post-closure period (which begins after the final cover is installed), the leachate sumps will be routinely monitored on a monthly basis (see NOTE). If the leachate level in a LCRS or leak detection sump stays below the pump operating level (1.75 feet) for two (2) consecutive months, the leachate in that sump will be monitored on at least a quarterly basis. If the leachate level in a LCRS or leak detection sump stays below the pump operating level (1.75 feet) for two (2) consecutive quarters, the leachate level in that sump will be monitored on at least a semi-annual basis.

   If at any time during the post-closure period the pump operating level is exceeded in a leak detection sump monitored on a quarterly or semi-annual basis, that sump will return to monitoring on a monthly basis until the liquid level in the sump again stays below the pump operating level for two (2) consecutive months/quarters before relaxing the frequency of monitoring.

   Note: If at any time during the post-closure period, if the leachate levels noted above are exceeded in a sump that is being monitored on a monthly basis, that sump will return to monitoring as outlined for monitoring during the active life of the trench (as outlined above). This monitoring frequency will continue until the liquid level in the sump again stays below the 1.75 feet level for two (2) consecutive days/weeks before relaxing the frequency of monitoring.

11.5.0 Determination of LCRS or Leak Detection Issues

ALR Exceedence

An ALR exceedence is suspected to have occurred when the volume of liquid pumped from any leak detection pump exceeds 211 gal/day over a 7-day period. Facility personnel will report to the Facility Manager[1] should this volume be pumped from any leak detection monitoring well in one 24 hour period. The volume of leachate pumped from each detection sump in the leak detection system will be recorded in the facility operating record.

The average leakage rate, in gallons per acre per day (GAPD), based on site operations that pump leachate each day of the week, is calculated as follows.

$$GPAD = \frac{[\text{Sum of pumped volumes for the last 7 days}]}{[\text{acreage served by sump}]}$$

11.6.0 Repairs to Liner System During Operation

If during routine operations the liner is damaged and requires repairs, the facility will initiate repairs according to recommended procedures by the High Density Polyethylene (HDPE) liner manufacturers. All inspection reports showing damage and subsequent repairs shall be documented in the facility operating record. All repairs will be made in accordance with the Trench 11 specifications and construction quality assurance program to ensure that repairs meet design criteria. Repairs shall be completed to the extent practicable within 20 working days after their discovery.

11.7.0 RESPONSE EVALUATION

If the 211 gal/day limit is exceeded in the detection sumps, facility personnel will notify the Facility Manager immediately. The Facility Manager will review the sump monitoring log and determine through calculation if the ALR has been exceeded. Should it be determined an ALR exceedence has occurred, the facility will follow the procedure listed below.

11.8.0 Response Action Plan for Leakage Greater Than ALR

Upon confirmation of ALR exceedence, the following actions will be initiated.

1. Notify NDEP in writing within seven (7) days of determining that the ALR has been exceeded.

---

1 All references to the Facility Manager will include his/her designee and are herein-after referred to collectively as the "Facility Manager."

2. Submit a preliminary written assessment to NDEP within 14 days of the determination. This report will document the amount of liquids removed from the leak detection sump; likely sources of the liquids; possible location, size and cause of any leaks; and short-term actions taken and planned.

3. Assess the source or liquids and amounts of the liquids by source.

4. Conduct a fingerprint, hazardous constituent or other analysis to identify the sources of liquids and possible locations of any leaks, and the hazard and mobility of the liquid.

5. Assess the seriousness of the leak in terms of potential for escaping into the environment.

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

7. 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.

8. Determine if any other short-term and long-term actions need to be taken to mitigate or stop any leaks.

9. Within 30 days after the initial notification to NDEP that the action leakage rate has been exceeded, submit a report to NDEP containing the information and determinations specified in items 3 through 8 above.

10. Thereafter, submit monthly reports to NDEP as long as the flow rate in the leak detection systems exceeds the action leakage rate summarizing the results of any remedial actions taken and actions planned.

Appendix 11- A

ALR Calculations

AMERICAN ECOLOGY
PROJECT: BEATTY ORDER RESPONSE
ALR CALCULATIONS

COVER SHEET PAGE 1
CALCULATION NO. NV161002
BY: ____________
CHECKED: LB
DATE: OCTOBER 10, 1995
Rev. December 5, 1995

I. SCOPE

The Order for the facility dated August 7, 1995, requires that the leak detection system (LDS) for Cell 11 be reevaluated and the action leakage rates (ALRs) adjusted, if necessary. The Order also required that the test performed on the geonet at 8,000 lb/ft^2 overburden pressure, and referenced in the current Response Action Plan (RAP) for the facility, be repeated at an overburden of 10,000 lb/ft^2.

II. ALR DETERMINATION

The following calculations, Calculation No. NV161002, Sheet Nos. 1-9, evaluate the ability of the LDS to transmit flow. The calculations, not including this cover sheet, will be included as an attachment to the RAP.

Preferential flow for the majority of the cell floor is to the LDS sump trench because of cell geometry. A small area of the floor flows directly to the sump. The sump trench was determined to be a limiting factor in transmitting flow to the sump. Once the geonet at the sump is flowing full, additional flow will be transmitted across the cell floor, although at a lower gradient. Because flow is transmitted across the entire cell floor, the sump perimeter becomes the limiting factor in the system. The maximum flow that the system can remove is determined by the maximum flow that can be transmitted at the sump perimeter and removed through the riser pipe and pump. At the maximum flow rate that the system can deliver, converted to an ALR, the geonet in the cell will flow full, or partially full, and fluid head will not increase with time (mound).

The riser pipe perforations were evaluated and determined to be adequate for transmitting the system flow. In addition, the smallest pump used in the LDS system is a two inch pump. The current pump being used has a maximum flow rate of nine gallons per minute, which is greater than the maximum flow that the system can deliver. A specification sheet for the current pump is included in Attachment 1.

Based on the above evaluation, the ALRs for Cell 11 are:

DESIGNATION	ALR (GAL/AC/DAY)
Sump D1	70
Sump D2	104
Sump D3	187
Sump D4	98

III. JUSTIFICATION OF ASSUMPTIONS

A. GEONET TRANSMISSIVITY

The test performed on the geonet and referenced in the RAP was not repeated. The specific material that was tested in 1989 is no longer manufactured. A replacement product is available; however, the manufacturing technique is different and the new product might yield greater flow characteristics than the old material according to the manufacturer. For this reason, historical data on geonet products, general transmissivity data, construction specifications and cell construction quality assurance (CQA) reports were used to quantify a transmissivity value.

The transmissivity value used in the LDS evaluation calculations is the 4 x 10^{-4} m^2/sec. This is the transmissivity required in the Specifications for Cell 11 Construction included in the Permit Application on file with the Nevada Department of Environmental Protection. The original specifications did not specify a corresponding overburden value for the transmissivity requirement. In the CQA Report for Cell 11, Phase I, Second Half, a revised specification sheet was included with the manufacturer's certification statements requiring a transmissivity of 4x10^{-4} cm/sec under a loading of 12,000 lb/ft^2 (see Attachment 2). An Engineering Revision Authorization was probably prepared to add this requirement, however, the original document has not been located.

The CQA reports for Cell 11 were reviewed and information concerning the geonet products used in each stage of construction were reviewed. The reports contained the following data.

<u>Cell 11, Phase I, First Half (See Attachment 3)</u>
Report Title: Geosynthetic and Natural Component Materials Quality Assurance Services, First Half of Trench 11, Phase I, Beatty Facility
Prepared By: Golder Associates, Inc.,
Product: Tensar NS1410(DN4-HD)
Transmissivity Certified by Manufacturer: 1x10^{-3} ft^2/sec at 10,000 lb/ft^2
Gradient of 1

<u>Cell 11, Phase I, Second Half (See Attachment 4)</u>
Report Title: Final Report to US Ecology, Inc. Construction Quality Assurance Observation and Testing Report, Trench 11, Phase I, Second Half, Beatty, Nevada, Quality Control Documents
Prepared By: Golder Associates, Inc.
Product: Tensar NS130590 (DN3)
Transmissivity Certified by Manufacturer: 2.82 gal/min/lf (5.8x10^{-4} m^2/sec) at 12,000 lb/ft^2 normal pressure
Gradient of 1

<u>Cell 11, Phase II (See Attachment 5)</u>
Report Title: US Ecology, Inc. Trench 11, Phase II, Quality Assurance Construction Report
Prepared By: Woodward-Clyde Consultants
Product: Tensar NS130592
Transmissivity Certified by Manufacturer: 0.3x10^{-3} ft^2/sec (2.7x10^{-5} m^2/sec) at 20,000 lb/ft^2
Gradient of 1

<u>Cell 11, Phase III (See Attachment 6)</u>
Report Title: Construction Quality Assurance Final Report, Trench 11, Phase 3 Construction
Prepared By: Vector Engineering, Inc.
Product: Gundle Gundnet
Transmissivity Certified by Manufacturer: 2 gal/min/ft (minimum) (4x10^{-4} m^2/sec)
11.41 gal/min/ft (2.4x10^{-3} m^2/sec) at 10,000 lb/ft^2
Gradient of 0.25

The transmissivity values stated above are for varying values of normal pressure (10,000 lb/ft^2 to 20,000 lb/ft^2) and for varying test conditions. The test conditions, or boundary conditions, when stated on manufacturer specification sheets are two aluminum plates. A comparison of current transmissivity test results for Tensar products with a boundary condition of two plates, and a boundary condition of two HDPE sheets, shows the values to be almost identical. The graphed test results are included in Attachment 7. These graphs also show a trend of increasing transmissivity with decreasing gradient. The geonet manufacturer stated that the referenced trend can be extrapolated to continue to increase with continued decreasing gradients.

Historical graphs of transmissivity data were found in the reference material for the Liner Waiver Request contained in Volume IV(A), Section 3-13 of the current permit application on file with the NDEP. These graphs are included in Attachment 8. Graph A shows that at high pressures (20,000 lb/ft^2), the transmissivity of the geonet material decreased with decreasing gradient. Graph B shows the transmissivity to increase with reduced gradients at pressures between 1000 lb/ft^2 and 5000 lb/ft^2, remain unchanged at a pressure of 15,000 lb/ft^2 and decrease at a pressure of 20,000 lb/ft^2. The transmissivity values reported at 10,000 lb/ft^2 to 15,000 lb/ft^2 and a gradient of 0.25 to one were assumed to be valid for lower gradients.

Values for transmissivity, for ALR determination, were not taken directly from the historical graphs in Attachment 7 because the tests were conducted under the conditions of soil, geotextile, geonet, geomembrane. This scenario will yield a lower transmissivity value than a test condition of geonet between HDPE materials. Graphs included in Attachment 9 of the same products tested under the two different boundary conditions show the referenced decrease in transmissivity.

The graph of transmissivity performed by the Geosynthetic Research Institute (GRI) and included in the current RAP was discounted. This graph depicts a linear relationship of transmissivity versus gradient. No other data, either current or historical, documents this type of relationship. In addition, no test procedures were included with the data. Manufacturer's specification sheets, dated about the same time as the GRI test, reference the use of a draft test method from ASTM for transmissivity determination. These specification sheets are included in the CQA documents referenced previously. In addition, the test was performed with a geotextile and sand as one boundary, which is not the working condition of the geonet in the LDS. In general, the data from the test procedure included in the current RAP did not correlate with any other located documentation and was discounted.

B. <u>GRAVEL TRANSMISSIVITY</u>

The gravel for Cell 11 construction was required to have a size range of between 1-1/2 inch to 3/8 inch. The specification is included in Attachment 10. For calculation purposes, the gravel was assumed to have a hydraulic conductivity of 4.5 cm/sec. This is a reasonable assumption based on generalized published data. In addition, similar gravel was used in construction at another American Ecology facility. The gradation curves and hydraulic conductivity test results for this gravel are included in Attachment 10 to substantiate the referenced assumption.

American Ecology

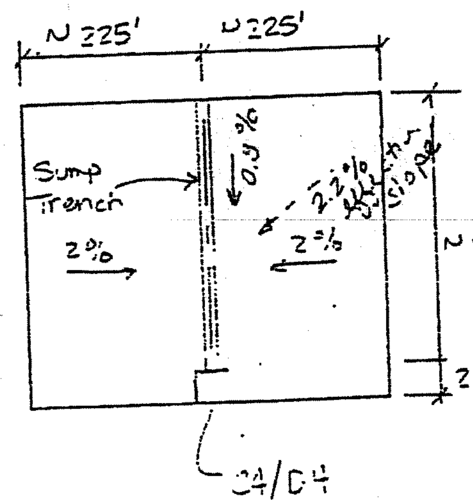
SHEET NO. 1 OF 9
CALC. NO. NV161002
DATE 10/7/95
COMPUTED BY GBA / GBA Rev. 1
CHECKED BY LR LR Rev. 1 | REV 1 REV 2 REV 3

PROJECT Beatty Order Response
SUBJECT ALR Calculation

- Calculate ALR for Cell 11 Detection Sumps
- Use maximum flow rate that the system can deliver. Consider all limiting factors/ System components

SUMP C4/D4

→ Consider Sump C4/D4 because they serve the largest flow area



Sump Trench Slope = 1%

Floor Slope (@ trench) = 0.2%

Area to D4 (by CADD) = 4.767 Ac = 207,651 ft^2

A (by scaling drwg) = (450')(440' - 23') = 208,350 ft^2

~440' → Use CADD Area in calcs. requiring total area because more accurate

23' (including sideslope) (S. side consists of sideslope + partial waste slope; 5' = side of sump only)

- Geonet transmissivity = specified transmissivity = 4×10^{-4} m^2/sec

- Area Contributing to side of sump trench
(440')(225') = 99,000 ft^2 × 2 = 198,000 ft^2

American Ecology

SHEET NO. 2 OF 9
CALC. NO. NV1161002
DATE 10/7/95
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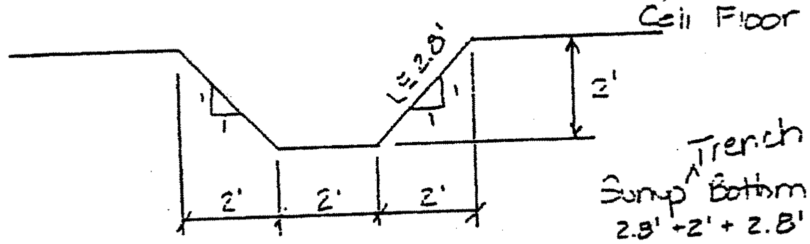
REV 1 REV 2 REV 3

PROJECT Beatty Order Response
SUBJECT FLR Calculation

Sump Trench Dimensions (Ref Cell 11 Drawing NV87C50024-6)



Sump Trench Bottom Length
2.8' + 2' + 2.8' = 7.6 ft.

Area of Flow in Trench: $2(\frac{1}{2})(2')(2') + (2')(2') = 8 ft^2$

Total area contributing to Sump D4: 4.762 Ac. = 207,433 ft^2
(Ref Cell 11 RAP Area D4 CADD)

Area Contributing at sides of sump
(23')(225') = 5175 ft^2 (each side)

American Ecology

SHEET NO. 3 OF 9
CALC. NO. NV161002
DATE 10/7/95
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REV 1 REV 2 REV 3

PROJECT Beatty Order Response
SUBJECT ALR Calculation

- Because entire leak detection system is geonet, except for sump area, the limiting component will probably be the largest flow area served by a limited geonet section. This will be at the sump trench which serves the majority of the cell floor.

Q_g transmitted by geonet = KiA

$K = \frac{T}{t}$ $t = 0.2"\left(\frac{1 ft}{12"}\right) = 0.017 ft.$

$T = 4\times10^{-4} m^2/sec \left(\frac{10.78 ft^2}{m^2}\right) = 0.00431 ft^2/sec$

$= 0.259 ft^2/min.$

$K = \frac{0.259 ft^2/min}{t = 0.017 ft} = 15.2 ft/min$

Q_{cell} into sump trench (Max)

$Q = (15.2 ft/min)(0.02)[(2)(440')(0.017')]$

$Q = 4.55 ft^3/min$

Q through sump trench (Max)

$Q_t = (15.2 ft/min)(0.01)[(0.017')(7.6 ft)]$

Perimeter Length of Trench Sump (See pg. 2)

$Q_t = 0.02 ft^3/min$

→ The sump trench is limiting as anticipated

American Ecology

SHEET NO. 4 OF 9
CALC. NO. NV16:002
DATE 10/10/95
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PROJECT Beatty
SUBJECT ALR CALC

- Determine flow at sides of sump, ("Q_1")
  (Sides of LDS geonet tie to gravel at top of gravel)

Detection Sump intercept length (See Sht. 9)

$Q_{1\ max} = k\,i\,A$

$= (15.2\ ft/min)(0.02)[(2)(5')(0.017')]$

$= 0.052\ ft^3/min$

- Because the flow is restricted by the sump trench, flows will be transmitted over floor area also ("Q_2")

Under this scenario, the geonet at the perimeter of the sump will govern. The flattest floor slope of the sump will also govern for the flow from area sloping to sump trench

$Q = k\,i\,A$
where A = area of geonet at sump perimeter that intercepts floor flow that slopes to sump trench. Intercepts sump at bottom and side slopes of LCS Gravel ≅ 4.2' + 2.5' + 2.5' = 9.2 (See Sht 9/10)

$Q_2 = (15.2\ ft/min)(0.008)[(9.2')(0.017')]$

$= 0.019\ ft^3/min$

Flow from sidewall + flow from cell floor that equalizes due to drainage area will contribute @ sidewall intercept w/ sump @ top of LCS gravel

conservative, assumes floor will govern

$Q = (15.2\ ft/min)(0.008)[(7.5')(0.017')] = 0.016\ ft^3/min$

$Q_{TOTAL} = Q_2(\text{FRONT}) + Q_1(\text{SIDES}) + Q_3(\text{SIDEWALL})$

$= 0.019\ ft^3/min + 0.052\ ft^3/min + 0.016\ ft^3/min$

$= 0.087\ ft^3/min$

* See Attached Dwg NV-161-CON-001, 002 for sump configuration
Also Eg. Dwg. NV 8705002411 for sump configuration.

American Ecology

SHEET NO. 5 OF 9
CALC. NO. NY161002
DATE 10-19-95
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REV 1 REV 2 REV 3

PROJECT Beatty Order
SUBJECT ALR Calculation

- Check flow through gravel

Use $K = 4.5$ cm/sec

$4.5 \text{ cm/sec} \times \frac{\text{in}}{2.54 \text{ cm}} \times \frac{\text{ft}}{12 \text{ in}} = 0.148 \text{ ft/sec}$

$= 8.86 \text{ ft/min.}$

For the 1' of gravel in sump area, use gradient corresponding to flattest contributing slope to define flow through gravel (max)

$Q = KiA$

$Q = (8.86 \text{ ft/min})(0.003)[(1 \text{ ft})(4.2' + 25' + 25') + (2)(5') + (7.5')]$

(intercepts floor, floor, bottom, side) (floor from slope) (sidewall)

$Q = 1.89 \text{ ft}^3/\text{min}$ > contributing flow ($0.027 \text{ ft}^3/\text{min}$) O.K.

- Check flow through riser perforations

1/2" holes / 4 holes per row (Ref. Drwg. NY87050024-6)

Use orifice equation

$Q = CA\sqrt{2gh}$

C = orifice coeff. = 0.61 for sharp edges

A = area = $\pi (0.5''/2)^2$

$= 0.196 \text{ in}^2 = 1.36 \times 10^{-3} \text{ ft}^2$

h = head = 1 ft

$Q = (0.61)(1.36 \times 10^{-3} \text{ ft}^2)\sqrt{(2)(32.2 \text{ ft/sec}^2)(1 \text{ ft})}$

$Q = 0.0067 \text{ ft}^3/\text{sec}$ per hole

$= 0.402 \text{ ft}^3/\text{min/hole}$ > total flow O.K.

Because sumps have been determined to be the limiting factor in the LCS system, and C3/D3 have same design as C4/D4, the ALRs for these sumps should be calculated in the same manner.

The ALR shall not be greater than the flow that the system can deliver

Flow that system can deliver = 0.087 ft³/min
0.087 ft³/min × 60min/hr × 24hr/day × 7.48gal/ft³ = 937 gal/day

937 gal/day ÷ 4.762 Ac = 197 gal/ac·day

Applying a SF. of 2

197 gal/ac·day ÷ 2 = 98 gal/ac·day

An ALR of 98 gal/ac/day for sump D4

based on the maximum that the system can deliver. Because the sump perimeter and sump trench are the limiting components of the system, zones in these areas will be flowing full (max) under these conditions, while some floor areas will have only partial or no flux.

For D3, Area = 2.502 Ac

ALR (with SF=2) = 937 gal/day ÷ 2.502Ac ÷ 2
= 187 gal/ac·day

BENCH SUMP

The maximum flow in the LDS for the bench sumps will similar to the flows for the floor sumps. However, the bench slopes are less than the floor slopes.

Use minimum bench slope for evaluation

Min. Slope = 0.56 %

$Q = K i A$

Perimeter Length = (4.3'+25'+25' - 2(5')-7.5') — same as floor sump

= 26.7 L.F.

$Q = (15.2\ ft/min)(0.0056)(0.017')(26.7')$

$= 0.039\ ft^3/min \left(\frac{7.48\ gal}{ft^3}\right)\left(\frac{60 min}{hr}\right)\left(\frac{24\ hr}{day}\right)$

= 420 gal/day for bench sumps

Area served by D1 = 2.987 Ac
Area served by D2 = 2.025 Ac

Sump D1: ALR = 420 gal/day ÷ 2.987 Ac ÷ 2
= 70 gal/acre/day

Sump D2: ALR = 420 gal/day ÷ 2.025 Ac ÷ 2
= 104 gal/ac/day

Appendix 11-C

Response Action Plan Trench 12

RESPONSE ACTION PLAN

LEAK DETECTION SYSTEM

TRENCH 12

US ECOLOGY NEVADA

OCTOBER 2009

Revised May 2011

RESPONSE ACTION PLAN
TRENCH 12
TABLE OF CONTENTS

RESPONSE ACTION PLAN

TRENCH 12

1. Introduction

The U.S. Environmental Protection Agency (USEPA) promulgated rules on January 29, 1992, requiring Response Action Plans (RAP) for new hazardous waste landfill units which commence construction after January 29, 1992, or which expand existing units after July 29, 1992 (57 FR 3462). At the US Ecology Nevada (USEN) Facility, Trench 12 is a new hazardous waste landfill unit that is regulated under this rule. This RAP meets the requirements of 40 CFR §264.304 and identifies actions to be taken if an action leakage rate has been exceeded.

2. Leachate Collection and Removal System

The primary leachate collection and removal system (LCRS) minimizes the possibility of leachate migrating through the primary liner into the underlying Leak Detection System (LDS). The primary LCRS in Trench 12 consists of a double-sided geocomposite (GSE Fabrinet 300-mil geonet sandwiched between two 8 ounce/yd^2 geotextiles) and an underlying 80-mil HDPE flexible membrane liner. (See Appendix A, Figure 1.)

Upon completion of all phases of construction, three (3) sumps will collect liquids draining from discrete portions of the Trench 12 cell floor and sidewalls. At the time of submittal, phase I construction is completed and one detection sump and one collection sump have been constructed in Trench 12. 40 CFR §264.301(c)(2) requires the facility to collect and remove leachate from the landfill during the active life and post-closure care period. Pumps located within a perforated riser pipe in the LCRS are used to remove liquids at each sump. USEN monitors LCRS sumps weekly and removes accumulating leachate to ensure that the head on the primary liner does not exceed 1.0 foot.

3. Leak Detection System (LDS)

The Trench 12 LDS consists of a double-side geocomposite (GSE Fabrinet 300-mil geonet sandwiched between two 8 ounce/yd^2 geotextiles) and a 60-mil underlying HDPE flexible membrane liner atop a geosynthetic clay liner. Upon completion of all phases of construction, three (3) sumps will be installed in the LDS to collect liquids draining from discrete portions of the leak detection layer in the Trench 12 cell floor and sidewalls. 40 CFR §264.301(c)(4) requires the facility to collect and remove pumpable liquids found in the LDS sumps to minimize the head on the bottom liner. "Pumpable liquids" are defined in this plan as liquid that can be reasonably pumped out of the sump based on sump dimensions and pump operating levels for automated pump systems.

Pumps located within a perforated riser pipe in the LDS are used to remove pumpable liquids at each sump. USEN monitors LDS sumps weekly and removes pumpable liquids.

Figure 1 shows the basic configuration of Trench 12 LDS/LCRS Sumps, and identifies the limits of the Sumps and the limits of the Trench Bottom Liner. The vertical distance from the bottom of the LDS Sumps to the lowest point of the trench bottom liner is approximately 2.25 feet. Figure 1 also shows a schematic of 1.0 foot of leachate on the Trench Bottom Liner. The LDS Pump will be positioned in each LDS Sump such that the base of the pump is approximately 2.25 feet below the lowest point of the trench bottom liner. The selected LDS pump type will not operate (i.e., cannot pump liquid) if there is less than 0.6 feet of fluid above the base of the pump. The operating controls for LDS Pumps will be set so that pumping will begin when the fluid level above the base of the pump is approximately 2.0 feet. At this fluid level, the fluid being pumped will be fully contained with the limits of the LDS/LCRS Sumps. The LDS Pump capacity as established in this RAP and fluid head levels equivalent to 1.0 feet of head above the lowest point of the trench bottom liner should never be exceeded.

4. Action Leakage Rate

The Action Leakage Rate (ALR) is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid level on the bottom liner exceeding one (1) foot. This plan establishes an ALR for each of the three LDS sumps in Trench 12. (See Appendix A.)

The ALR for each sump is based on an approach similar to the USEPA-proposed definition for "rapid and extremely large leakage rate" as provided in the January 29, 1992 rule. In this plan, the ALR is based on the maximum flow that the LDS can deliver to the sumps as shown in Table 1.

Table 1. ALR Determination

Sump	Total Flow* (gal/day)	Pump Capacity** (gal/day)	Sump Area (acres)	ALR*** (gal/acre/day)
12A	910	2,160	4.45	204
12B	910	2,160	3.45	147
12C	910	2,160	3.26	279

* Inflow capacity of geocomposite component of LDS system.
** Maximum capacity of the IH125 pump at 80 feet is 1.5 gal/min.
*** The ALR is calculated based on the collection flow capacity of the LDS sump.

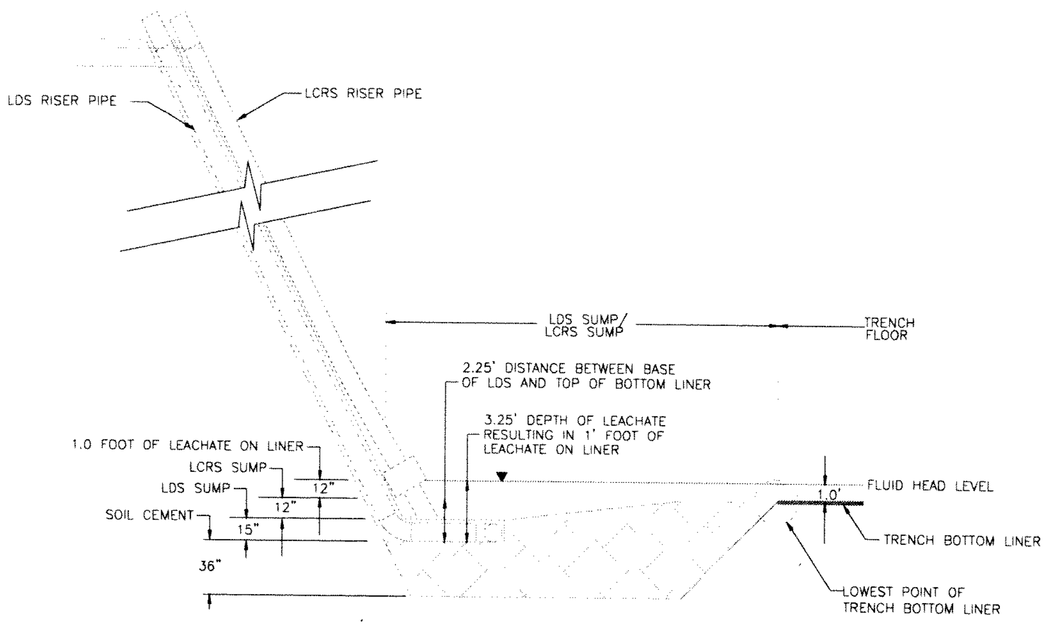
5. Sump Monitoring

All leachate sumps (LCRS and LDS) in Trench 12 are monitored weekly. The results of this monitoring (depth of leachate in the sump, volume of leachate removed if pumping is required, and pumping time) are recorded in the sump monitoring log maintained for each sump.

If liquid is detected in an LDS sump above the pump operating level, the sump will be pumped within 24 hours to remove pumpable liquids. If liquid is detected in an LCRS sump with a depth of 1.75 feet or greater in the LCRS riser, the sump will be pumped within 24 hours to remove pumpable liquids.

During the post-closure period, after the final cover is installed, leachate collection sumps and leak detection sumps will be monitored monthly.

Figure 1 Typical Sump Layout



TYPICAL LONGITUDINAL SECTION
OF SUMPS AND RISERS

6. Determining When the ALR Is Exceeded and Response Actions

If the volume of liquid pumped from any LDS sump exceeds 910 gal/day, facility personnel will report this information to the Facility Manager.[1]

[1] All references to the Facility Manager will include his/her designee and are herein-after referred to collectively as the "Facility Manager."

The Facility Manager will institute daily monitoring for five working days to determine whether average removal volumes indicate that practical daily total flow limits are being exceeded for an individual sump. Five-day average flow rates will then be used to calculate Action Leakage Rates to determine whether ALR values in Table 1 are being exceeded.

If the Facility Manager determines that the flow rate into the LDS exceeds the ALR for an individual sump, the Facility Manager will follow the steps outlined below:

1. Notify NDEP and EPA Region IX in writing within seven (7) days of determining that the ALR has been exceeded.

2. Submit a preliminary written assessment to NDEP within 14 days of the determination. This report will document the amount of liquids removed from the leak detection sump; likely sources of the liquids; possible location, size and cause of any leaks; and short-term actions taken and planned.

3. Assess the source or liquids and amounts of the liquids by source.

4. Conduct a fingerprint, hazardous constituent or other analysis to identify the sources of liquids and possible locations of any leaks, and the hazard and mobility of the liquid.

5. Assess the seriousness of the leak in terms of potential for escaping into the environment.

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

7. 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.

8. Determine if any other short-term and long-term actions need to be taken to mitigate or stop any leaks.

9. Within 30 days after the initial notification to NDEP that the action leakage rate has been exceeded, submit a report to NDEP containing the information and determinations specified in items 3 through 8 above.

10. Thereafter, submit monthly reports to NDEP as long as the flow rate in the leak detection systems exceeds the action leakage rate summarizing the results of any remedial actions taken and actions planned.

7. Leachate Management

Leachate generated from leachate collection systems (LDS and LCRS) in Trench 12 will be used for dust control within the lined cell (from which the leachate originated). During early operations in Trench 12, there will be less opportunity to use collected liquids from leachate collection systems for dust control when there is little waste disposed in Trench 12. Excess liquids, not used for dust control and removed from the active cell will require appropriate disposal as a hazardous liquid. The appropriate disposal of the hazardous liquid will need to be accomplished within appropriate time limitations.

Appendix A

ALR Calculations

AquAeTer *optimizing environmental resources - water; air; earth*

CALCULATION SUMMARY SHEET

PROJECT NUMBER: 073133.05

PROJECT NAME: USEN – Trench 12 Response Action Plan

DATE: May 20, 2008

CALCULATION NUMBER: ____________ Revision: 0

CALCULATION TITLE: ALR Calculation

DESCRIPTION OF CALCULATION:

Calculation to determine Action Leakage Rate in the LDS

REFERENCES USED: Number of Reference Pages Attached: ______

1. GSE Geotextile Information
2. Designing with Geosynthetics, Koerner, 1998
3. Calculation in 10/8/2007 Supplement to Landfill Report for Trench 12 Attachment 3, "LDS Flow Capacity and Pump Sizing"

REVIEW COMMENTS:

CALCULATION MADE BY: CAB DATE: 5/20/2008

CALCULATION CHECKED BY: SLW DATE: 6/18/2008

CALCULATION REVISED BY: CAB DATE: 6/18/2008

CALCULATION REVIEWED BY: SLW DATE: 6/18/2008

Purpose of Calculation

Evaluation of the ability of the leak detection system (LDS) for Trench 12 to transmit flow and evaluation of the action leakage rate (ALR). The evaluation of ALR is required in the Response Action Plan (RAP). For this calculation the conservative assumption is made that the primary liner system leaks and pumping of the LDS is required.

Method

- The LDS flow to a typical Trench 12 sump was calculated.
- The ALR for Trench 12 LDS sumps was calculated

Analysis

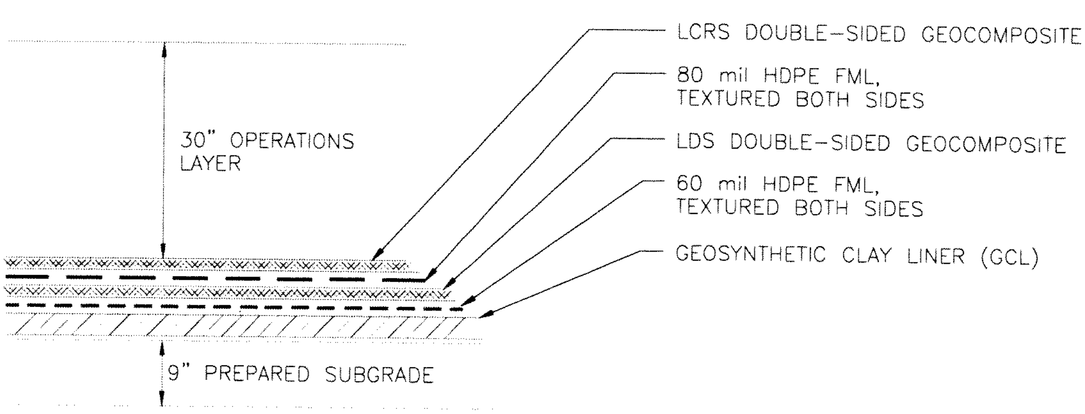
Applicable Regulations

The regulatory definition of the ALR is, "the maximum design flow rate 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 in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the LDS, and proposed response actions. The ALR must consider decreases in the flow capacity of the system over time resulting from siltation and clogging, rib layover and creep of synthetic components of the system, overburden pressures, etc.

Geometry

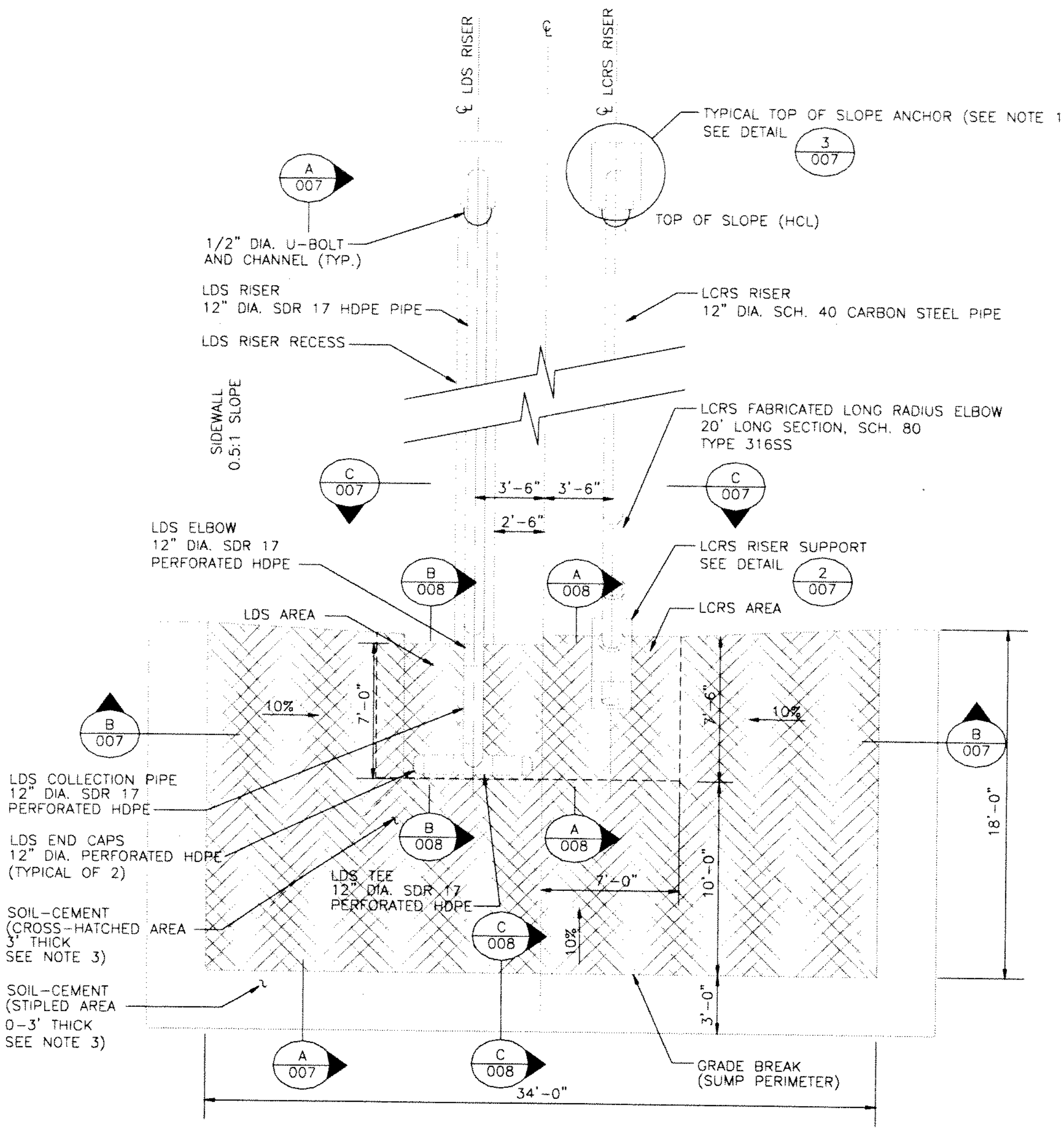
The typical bottom liner is shown below. Both the LCRS and LDS double-sided geocomposites are have a 300-mil geonet component.

Figure 1. Typical Trench Bottom Configuration



There are three sumps in the Trench 12 design. The typical geometry is shown below.

Figure 2. Typical Sump Layout



Flow Capacities

The following flow elements are used in the LDS.

- Double sided geocomposite (GSE Fabrinet 300-mil geonet sandwiched between two 8 ounce/yd^2 geotextiles).

- Gravel (screened site materials with at least 95% falling within the size range between 1.0 and 3.0 inches and not more than 5% passing the #4 sieve) used in the sump only.

The double sided geocomposite is used in the slope liner LDS as well as in the bottom liner as shown in Figure 1. Therefore, flow within in the LDS will be controlled by the minimum bottom slope.

Flow within the geocomposite is calculated using Darcy's Equation (which assumes laminar flow within the net).

$q = \Theta_{eff} * i$

Where

q = flow per unit width

Θ_{eff} = effective transmissivity

i = hydraulic gradient

Effective transmissivity for the geocomposite is calculated by applying several safety factors to the published transmissivity value. The following formula is used for that calculation.

$\Theta_{eff} = \frac{\Theta}{(FS_{CR} \times FS_{IN} \times FS_{CC} \times FS_{BC})}$ Where:

FS_{CR} = the factor of safety for creep deformation of the drainage core itself and/or intrusion of the adjacent geotextile into the drainage core space

FS_{IN} = the factor of safety for elastic deformation of the adjacent geotextile intruding into the drainage core space

FS_{CC} = the factor of safety for chemical clogging and/or precipitation of chemicals onto the geotextile or within the drainage core space

FS_{BC} = the factor of safety for biological clogging of the geotextile or within the drainage core space

The following table shows the unit flow capacity for the 300-mil trench bottom geocomposite based on the applicable transmissivity, or hydraulic conductivities, hydraulic gradients, and safety factors.

Flow Element	Θ	FS_{CR}	FS_{IN}	FS_{CC}	FS_{BC}	Θ_{eff}	i	q	q
Units	gal/min/ft	NA	NA	NA	NA	gal/min/ft	NA	gal/min/ft	gal/day/ft
GSE Fabrinet UF 8 ounce/yd^2	4.35	1.4	1.5	1.5	1.5	0.92	**0.01**	0.0092	13
GSE Fabrinet UF	4.35	1.4	1.5	1.5	1.5	0.92	**0.1**	0.0921	133

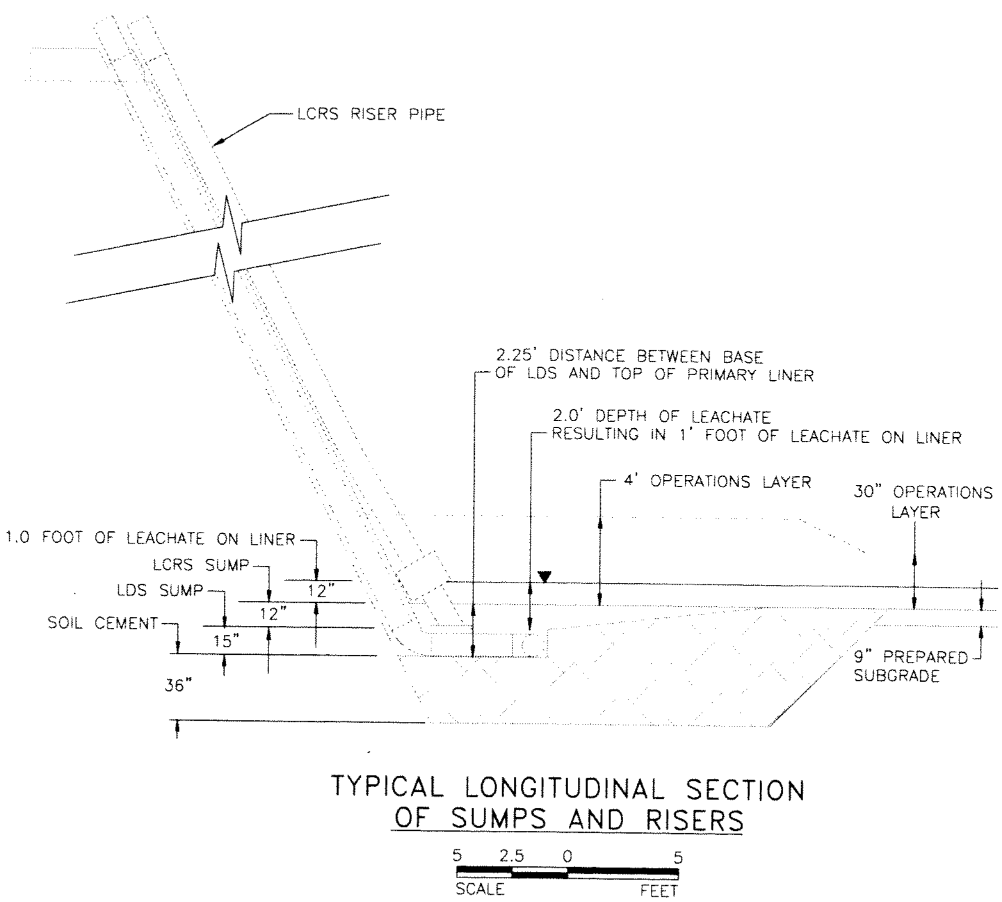
8 ounce/yd^2										

Transmissivity values are provided by the manufacturer as included in the references. Safety factors are taken from the literature (Koerner 1998). Flow capacities are shown at hydraulic gradients of 1 percent and 10 percent for the nominal cell bottom slope and the minimum sump slope, respectively. Since the gravel is used only within the sump boundaries around the riser pipes, flow capacities are calculated for the geocomposite only.

Controlling Section

Preferential flow for the cell floor is to the LDS sumps of each Phase (12A, 12B, and 12C). Because flow is transmitted tot the sump from across the entire cell floor, the sump perimeter was determined to be the limiting factor in transmitting flow to the sump for removal. The maximum flow that the system can remove is determined by the maximum flow that can be transmitted at the sump perimeter and removed through the riser pipe and pump. At the maximum flow rate that the system can deliver, converted to an ALR, the geocomposite will flow full, or partially full, and fluid head will not increase (mound) with time.

Figure 3. Typical Sump (Longitudinal Section)



TYPICAL LONGITUDINAL SECTION
OF SUMPS AND RISERS

As shown in the typical sump layout figures (Figures 2 and 3), there are two potentially controlling sections:

1) the 7'x 7' LDS perimeter at 15" thick; and

2) the perimeter at the grade break between the 1 and 10 percent slopes.

To determine the controlling section, the flow at each section was determined as:

Total Flow = Flow at section * Section Length (perimeter).

Total Flow at 7'x 7' LDS perimeter = 133 gal/day/ft * (7'+7'+7') = 2,793 gal/day

Total Flow at 1 to 10% grade break = 13 gal/day/ft * (18'+34'+18') = 910 gal/day

Therefore, the controlling section is located at the grade break from 1 percent to 10 percent surround each of the three sumps. The grade break has a 70 feet long perimeter Contribution to flow from the fourth side (against the trench sidewall) is ignored.

Total flow capacity for each cell contributing to each sump (including floor and sidewalls) and total area for each cell are shown in the table below and are used to calculate the ALR.

The smallest pump that has been used in the LDS system of Trench 11 is a two-inch pump. That pump has a maximum flow rate of nine gallons per minute, which is greater than the maximum flow that the Trench 12 system can deliver. The same pump or equivalent is anticipated for use in Trench 12 LDS sumps. A specification sheet for the pump is included.

Sump	Total Flow Capacity Through GSE Fabrinet UF (at i = 0.01) (gal/day)	Pump Capacity (gallons/day)	Trench Area Served by Sump (acres)	ALR (gal/acre/day)
12A	910	2,160	4.45	204
12B	910	2,160	3.45	264
12C	910	2,160	3.26	279

<u>Result</u>

Sumps 12A, 12B, and 12C of Trench 12 all have the same design. The only difference between the three sumps is the size of the area draining to the sumps. Sump 12A has the largest drainage area at 4.45 acres.

The Iron Horse IH125 Extended-Duty Piston Pump or equivalent is acceptable for use in Trench 12 LDS sumps.

Flow through the 300-mil GSE Fabrinet UF (or equivalent) at 1 percent up to the perimeter of the sump (at the grade break) is the controlling section for ALR determination. The total flow at each of the three sumps at this controlling section is 910 gallons per day. This results in the lowest ALR occurring in Cell 12A at 204 gallons per acre-day. Flow from any of the three sumps exceeding 910 gallons per day might result in fluid head rising on the bottom liner. Determination of exceedence of the 910 gallons per day flow will result in the implementation of a response action.

Flow through the 300-mil GSE Fabrinet UF at 10 percent gradient up to the perimeter of the 7' x 7' area around the LDS pipe and pump is sufficient, and does not result in accumulation of water on the LDS liner.

AquAeTer

optimizing environmental resources - water; air; earth

CALCULATION SUMMARY SHEET

PROJECT NUMBER: 103247

PROJECT NAME: USEN T12/PH2 Construction QC and Certification

DATE: March 28, 2011

CALCULATION NUMBER: (not assigned) Revision: Update 2008 ALR calculation

CALCULATION TITLE: Determine Sump 12B ALR for 220 mil Geocomposite

DESCRIPTION OF CALCULATION:

Revision of ALR determination for Trench 12, Phase 12B LDS geocomposite

REFERENCES USED: Number of Reference Pages Attached: 8

1. August 2008 Response Action Plan, LDS for Trench 12 (5/20/08 ALR Calculation)
2. Skaps TN220-2-6 delivered material specs.
4. Drawing NV12-11-021, As built topography of Phase 12B cell floor
3. Geosynthetics Research Institute Standard GC8

REVIEW COMMENTS:

CALCULATION MADE BY: SLW DATE: 28 March 2011

CALCULATION CHECKED BY: CAB DATE: 28 March 2011

CALCULATION REVISED BY: DATE:

CALCULATION REVIEWED BY: SLW DATE: 28 March 2011

Purpose of Calculation

Determine flow carrying capacity of a 220-mil double-sided geocomposite (TN220-2-6) in the LDS portion of the liner system on the floor of Trench 12- Phase 12B for the purpose of revising the Action Leakage Rate (ALR) for the Phase 12B sump. Revision of the ALR is required because TN220-2-6 geocomposite was used in the construction of Sump 12B instead of the 300-mil geocomposite that was intended (per approved design) to be used.

Method

Determine the flow carrying capacity of the 220 mil geocomposite by the same method used in the similar calculation made for the Trench 12 Response Action Plan (2008). The revised calculation uses the same safety factors (i.e., capacity reduction factors) that were used in the 2008 calculation rather than the less conservative capacity reduction factors that are recommended by GRI in GC8. These factors, though more conservative than recommended by GRI are used for consistency with previous Trench 12 LDS calculations.

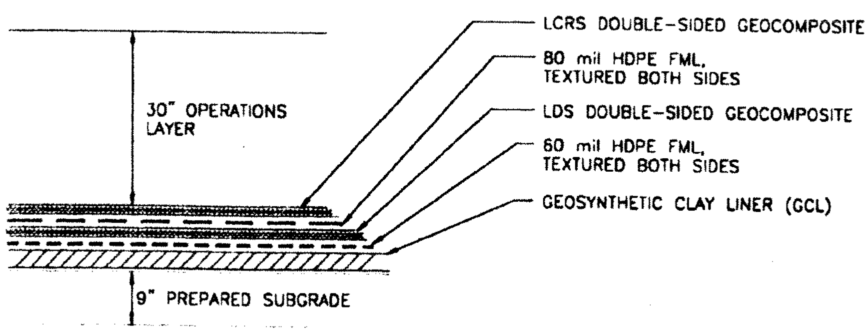
Analysis

USEPA guidance on Action Leakage Rates for Leak Detection Systems (EPA 530-R-92-004, 1992) defines the ALR as the "maximum design flow rate that the leak detection system can remove without the fluid head on the bottom liner exceeding one foot." As such, the ALR is the flow the drainage media (in this case, a 220-mil geocomposite) can convey as free flow under the influence of gravity at the actual slope (gradient) of the installed geocomposite. The calculation considers no head build-up, thus gradient is the only driving force causing the liquid flow. Flow constriction, such as narrowing of the flow pathway width near the sump entrance, becomes the controlling factor in ALR determination.

Flow Geometry

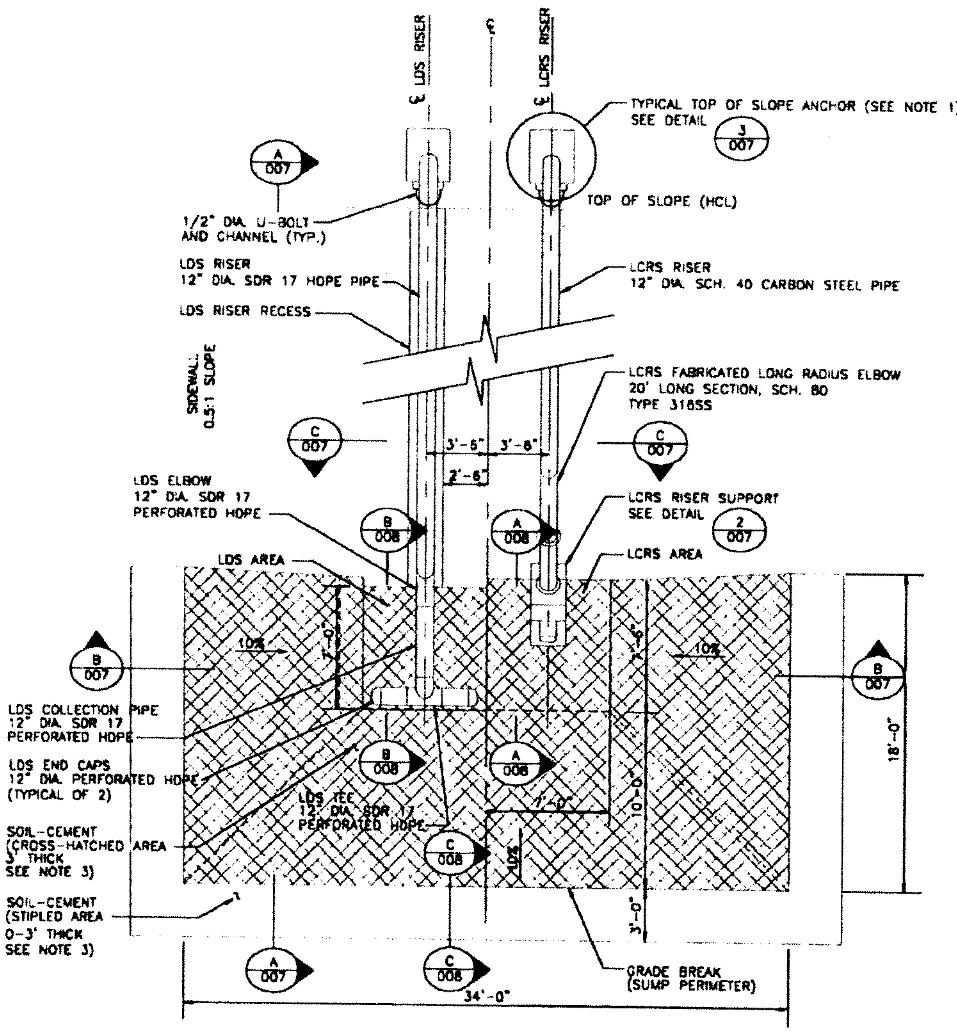
The typical bottom liner is shown below.

Figure 1. Typical Trench Bottom Configuration



For Phase 12B, the LDS double-sided geocomposite is the 220-mil thick Skaps TN220-2-6 geocomposite. This material type differs from the 300-mil geocomposite specified for the LDS liner NDEP-approved Trench 12 design and, as such, is intended to apply only to the Phase 12B area and Sump 12B.

Figure 2. Typical Sump Layout



Flow Capacities

The following flow determination apply to the geocomposite component LDS part of the Phase 12B liner system.

- Double sided geocomposite (Skaps Transnet TN220-2-6).

The 220-mil double sided geocomposite is used in the LDS sideslope liner as well as in the LDS bottom liner. A single, continuous layer of geocomposite is used. Therefore, flow within in the LDS is controlled by the slope of the landfill cell bottom and the geometry of the sump entry.

The flow carrying capacity of the geocomposite is assumed to be equal to test values for material used in Phase 12B construction, as reported by the manufacturer at the time of installation. The geometric mean of those actual values is:

$\theta_{manufacturer}$ $= [2.85 \times 10^{-4} * 2.86 \times 10^{-4} * 2.98 \times 10^{-4}]^{-1/3}$ in m^2/sec

$= 2.90 \times 10^{-4}\ m^2/sec$

In actual use as a landfill liner system component, the capacity of the material can decrease over time in response to textile intrusion (IN), creep (CR), chemical (CC), and biological (BC) factors. Although the most conservative application of these factors likely applies only at a point in time late in the life of the landfill, to make the calculation of flow carrying capacity appropriately conservative, these factors are considered (as shown below) to reduce the manufacturer's determination of material property from the outset of landfill operation.

$\theta_{eff} = [\theta_{manufacturer}] \div [FS_{IN} * FS_{CR} * FS_{CC} * FS_{BC}]$

The following table shows the determination of unit flow capacity for the geocomposite based on the mean transmissivity and safety factors.

Flow Element	$\theta_{manufacturer}$	FS_{IN}	FS_{CR}	FS_{CC}	FS_{BC}	θ_{eff}
Units	m^2/s	NA	NA	NA	NA	m^2/s
TransNet 220-2-6	2.90×10^{-4}	1.5	1.4	1.5	1.5	6.14×10^{-5}

Considering the reduced transmissivity of the material, flow within the geocomposite is calculated using Darcy's Law (which assumes laminar flow). GC8 is included as a reference for the formula that is used below.

$q_{actual} = \theta_{eff} * i$

Where

q_{actual} = flow per unit width of material, based on effective material transmissivity

θ_{eff} = effective transmissivity, based on actual transmissivity reported by manufacturer

i = hydraulic gradient

Flow within the material is controlled by effective transmissivity (Θ_{eff}) and the actual (as-built) slope of the LDS floor liner. In the Trench 12B floor area, the average slope of the trench floor subbasins that potentially direct leakage to Sump 12B, as taken from Drawing NV12-11-021, is 1.7% in the area outside (above) the Outer Sump entry. The average slope is 10% in the area between the Outer Sump entry and the Main Sump entry. The determination of flow potential (q_{actual}) per unit width of flow path in each area of the sump entry is determined below.

Flow Element	Θ_{eff}	i	q_{actual}	q_{actual}
	m^2/s	NA	$m^3/s/m$	gal/day/ft
TransNet 220-2-6	6.14×10^{-5}	0.017	1.04×10^{-6}	7.26
	6.14×10^{-5}	0.1	6.14×10^{-6}	42.72

Conversion: $1.0\ m^3/s/m = 1.0\ m^2/s = 6.9569 \times 10^6$ gpd/ft

These values of q_{actual} are applied to the length of the controlling geocomposite section at each of the Sump 12B entries (Outer Sump and Main LDS Sump) to determine the total daily flow and daily flow per contributing area (in acres). These values are considered to determine the ALR for Sump 12B.

The total sidewall and floor area of the Phase 12B landfill cell, 3.45 acres, is considered in these calculations.

<u>Controlling Section at **Outer Sump entry**</u>

This calculation focuses on the flow restriction (controlling cross-section) at the perimeter of the grade break between the main landfill cell floor (1.7% average slope) and the interior slope of the Outer Sump area (10%). The Outer Sump has a perimeter of 70 feet at the grade break between the cell floor and the sump. This dimension does not include the sump side that is against the sidewall because little flow is contributed from the sidewall, the sidewall slope is steep (increasing flow), and a double-thickness of geocomposite is installed at the sidewall/floor transition. The table below shows the value that would become the ALR if the TN220-2-6 geocomposite layer at the Inner Sump Entry is the controlling geocomposite section.

Sump	q_{actual}	**Width of Controlling Section**	**ALR**	**ALR**
12B	**gal/day/ft**	**Feet**	**gallons/day**	**gpd/acre**
	7.26	70	508.2	147.3

<u>Controlling Section at **Main Sump Entry**</u>

Within the 7'x7' Main LDS Sump area immediately surrounding the LDS riser pipe, the perimeter is 21 feet (not including the sump side that is against the sidewall) as shown in the typical sump layout figure. The table below shows the value that would become the ALR if the

TN220-2-6 geocomposite layer at the Main LDS Sump Entry is the controlling geocomposite section.

Sump	q_{actual}	**Width of Controlling Section**	**ALR**	**ALR**
12B	**gal/day/ft**	**Feet**	**gallons/day**	**gpd/acre**
	42.72	21	897.1	260.0

Verification Calculation Result

This calculation determines Sump 12B ALR value (as total daily flow to the sump and total daily flow in gallons per contributing acre (gpd/ac) for Trench 12, Phase 12B. The ALR at the Outer Sump Entry is 147.3 gpd/ac and the ALR at the Main Sump Entry is 260 gpd/ac. The lower value, 147.3 gpd/ac, becomes the ALR for the Phase 12B area. As indicated, this ALR is equivalent to a total daily flow to Sump 12B of approximately 508 gallons.

Actions that would be required in the event of LDS sump flows exceeding the 508 gallons per day ALR value are provided in the approved Trench 12 Response Action Plan. This modified ALR is applicable only to Sump 12B and replaces the Sump 12B value included in the 2008 RAP. ALRs for Sumps 12A and 12C are not changed by this calculation.

Appendix B

Pump Specification Sheet

LEADERS IN ENVIRONMENTAL COMPLIANCE PRODUCTS

IRON HORSE

Extended-Duty Piston Pumps

For Remediation and Landfill Pumping

IRON HORSE™

The first piston pump durable enough to carry the QED name

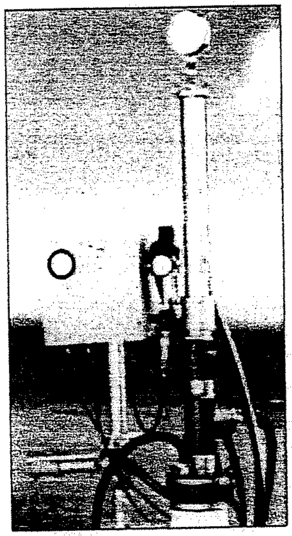
QED

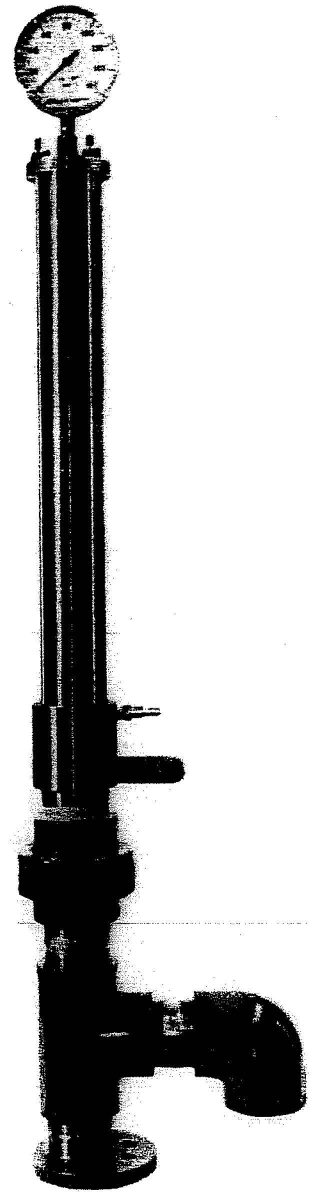
Environmental Systems

A division of Severn Trent Laboratories, Inc.

IRON HORSE Extended-Duty Piston Pumps Built for

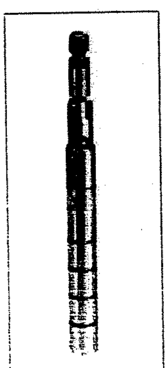
IRON HORSE Extended-Duty Piston Pumps are built for durability based on QED's 20 years of engineering experience in landfill pumping. IRON HORSE pumps are designed to provide dependable pumping in applications that benefit from the special capabilities of piston pumps, such as slant wells, sites requiring no drive air with the pumped fluids, deeper wells, and drawdown to extremely low levels.





IRON HORSE pumps are air-powered and use a reciprocating air cylinder at the wellhead to drive a piston down in the well, connected by a flexible fiberglass rod. Each piston stroke lifts a known amount of liquid and provides positive suction at the inlet. Piston pumps can be installed in wells and risers at any angle, including horizontal.

Unlike older piston pump designs used in landfills and remediation sites, IRON HORSE pumps are designed from the start for durability and serviceability to greatly reduce maintenance frequency and costs. In comparative testing, IRON HORSE has demonstrated critical component life many times that of older piston pump designs. IRON HORSE'S simplicity and strength advantages are visible even from first appearances. QED's extensive engineering experience and resources have delivered the first piston pump good enough to carry our name.



What makes IRON HORSE piston pumps more durable?

IRON HORSE pump's durability advantage is based on better engineering solutions to the challenges of landfill and remediation pumping. Examples of important IRON HORSE pump durability features include:

- Heavy-duty, stainless steel construction used for key components subject to wear, such as the piston and check valves.
- Rugged, oil well type, all-stainless steel piston
- Ultra-hard metal surfaces and special seal materials for longer service, as used in concrete pumps and industrial slurry equipment
- Serviceable driver air cylinder components to avoid having to replace the entire unit when it wears out.
- Serviceable stainless steel check valves downwell, instead of throwaway plastic type.
- Simpler, more reliable built-in air cylinder controls, similar to those used on jackhammers, rather than weather-exposed valves and tubing circuits.

Durability, Backed by the Leaders in Air-Powered Landfill Pumping

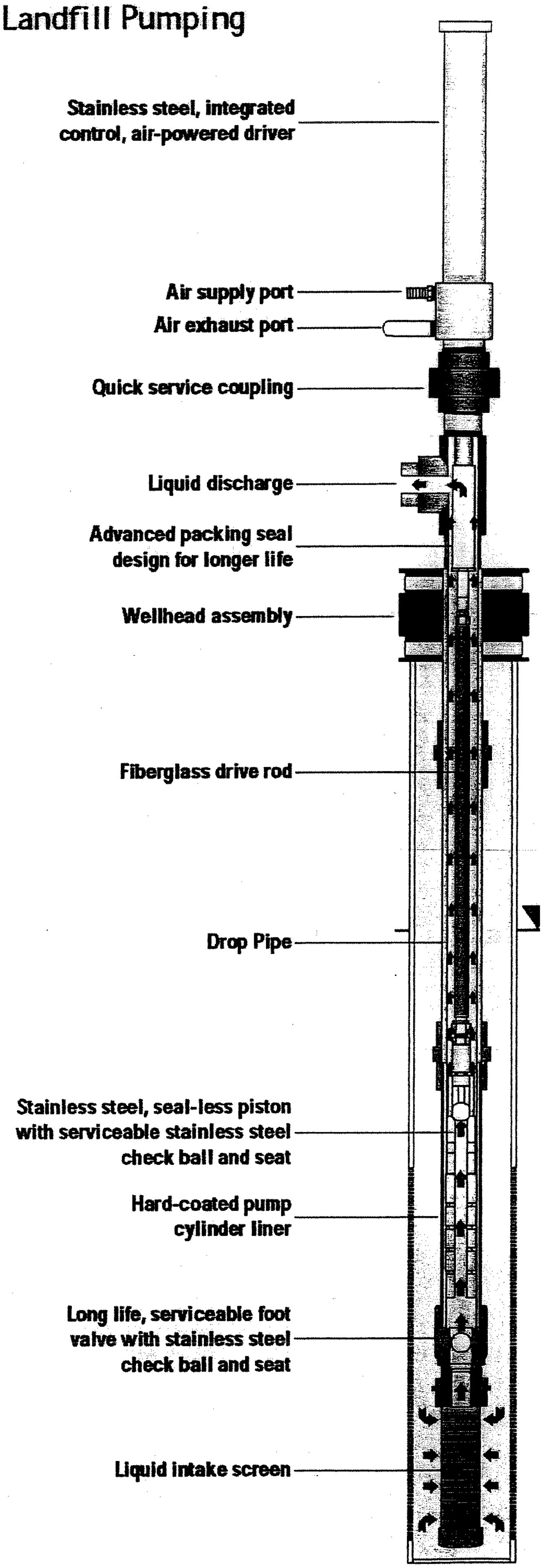
How it Works

The IRON HORSE pump has four major components:

- A reciprocating air cylinder at the wellhead.
- A liquid pumping piston and cylinder at the bottom of the well.
- A fiberglass rod connecting the air cylinder to the downwell piston.
- A downwell drop pipe which provides the flow conduit from the downhole pump to the wellhead.

The air cylinder is connected via a flexible, one-piece fiberglass rod to the liquid pump piston. The piston reciprocates within a specially designed stainless steel cylinder located at the bottom of the drop pipe.

Supplying compressed air to the air cylinder starts it reciprocating – automatically. The reciprocating action is controlled by heavy-duty, jackhammer type controls built into the cylinder itself. The recommended level control is referenced to pressure and vacuum in the well, and provides accurate and reliable pump shutoff when the desired level is reached.



Advantages

- Extended duty between service compared to other piston pump designs
- Simple driver with reliable, built-in reciprocation mechanism
- Seal-less, stainless steel pump piston
- Serviceable check valves and drive cylinder
- Extreme low drawn-down capability
- Isolates driver air from pumped liquid
- Slant-well and horizontal applications

IRON HORSE Extended-Duty Piston Pump Specifications

IH 125 System (1-1/4" Drop Pipe)

Max Flow Rate: 2 gpm (7.5 lpm)
Approximate Pump Volume/Cycle: 0.045 gal (.170 L)
Max. Cycle Rate: 40 cpm
Max. Depth: 400 ft. (121.9 m)
Consult factory for depths greater than 400 ft.
Min. Liquid Pumping Level Above Bottom:
Standard Screen 12 in. (30.5 cm)
Short Screen 6 in. (15.2 cm)
Max. Air Pressure: 120 psi (8.4 kg/cm2)
Air Usage: See chart below
Min. Well Casing Inside Diameter: 4" (10.2 cm)

Model IHD - Driver Assembly:
Weight: 22 lbs. (9.97 kg)
Length: 50 in. (1.27 m) without gauge
Max. Diameter: 4 in. (10.2 cm)
Drive Piston Diameter: 2 in. (5.08 cm)

Wellhead Assembly
QED offers 4", 5", 6" or 8" wellhead caps and flanges required to support and operate the system.

Model IH125 - Downwell Pump Assembly (Piston, Cylinder, Foot-Valve, Screen)

Piston:
Weight: 1.5 lbs. (.68 kg)
Length: 11 in. (27.9 cm)
Diameter: 1.06 in. (2.69 cm)

Pump Cylinder Assembly:
Weight: 5 lbs. (2.27 kg)
Length: 58 in. (1.47 m)
Outside: Diameter 2.25 in. (5.72 cm)

Model 39538 Drive Rod:
1/2 in. (1.27 cm) diameter, 3/8 in. (.952 cm) pultruded epoxy and glass fiber with protected anti-abrasion coating

Drop Pipe, not supplied by QED: 1 1/4 in. (3.175 cm) CPVC, Schedule 80, 10 ft. (3.04 m) sections, threaded connectors

Model 39573 Pneumatic Bubbler Level Control:
(References to well-head vacuum)
Weight: 14 lbs. (6.35 kg)
Size: 12 in. (30.4 cm) high x 15 in. (38.1 cm) wide x 6 in. (15.2 in.) deep, (Complete, with regulator, mounting brackets and connection fittings)

IH 200 System (2" Drop Pipe)

Max Flow Rate: 5 gpm (18.9 lpm)
Approximate Pump Volume/Cycle: 0.120 gal (.454 L)
Max. Cycle Rate: 40 cpm
Max. Depth: 180 ft. (54.8 m)
Consult factory for depths greater than 180 ft.
Min. Liquid Pumping Level Above Bottom:
Standard Screen 18 in. (45.7 cm)
Short Screen 6 in. (15.2 cm)
Max. Air Pressure: 120 psi (8.4 kg/cm2)
Air Usage: See chart below
Min. Well Casing Inside Diameter: 5" (12.7 cm)

Model IHD - Driver Assembly:
Weight: 22 lbs. (9.97 kg)
Length: 50 in. (1.27 m) without gauge
Max. Diameter: 4 in. (10.2 cm)
Drive Piston Diameter: 2 in. (5.08 cm)

Wellhead Assembly
QED offers 5", 6" or 8" wellhead caps and flanges required to support and operate the system.

Model IH200 - Downwell Pump Assembly (Piston, Cylinder, Foot-Valve, Screen)

Piston:
Weight: 6.5 lbs. (2.94 kg)
Length: 18 inches (45.7 cm)
Diameter: 1.75 in. (4.44 cm)

Pump Cylinder Assembly:
Weight: 8.5 lbs. (3.85 kg)
Length: 64 in. (1.62 m)
Outside Diameter: 3.35 in. (8.51 cm)

Model 39538 Drive Rod:
1/2 in. (1.27 cm) diameter, 3/8 in. (.952 cm) pultruded epoxy and glass fiber with protected anti-abrasion coating

Drop Pipe, not supplied by QED: 2 in. (5.08 cm) CPVC, Schedule 80, 10 ft. (3.04 m) sections, threaded connectors

Model 39573 Pneumatic Bubbler Level Control:
(References to well-head vacuum)
Weight: 14 lbs. (6.35 kg)
Size: 12 in. (30.4 cm) high x 15 in. (38.1 cm) wide x 6 in. (15.2 in.) deep, (Complete, with regulator, mounting brackets and connecton fittings).

Materials of Construction

Above-Ground Pump Driver Materials:
Driver Assembly: Stainless Steel / Aluminum
Stuffing Box: Stainless Steel
Wellhead Assembly: Nylon, CPVC, Stainless Steel

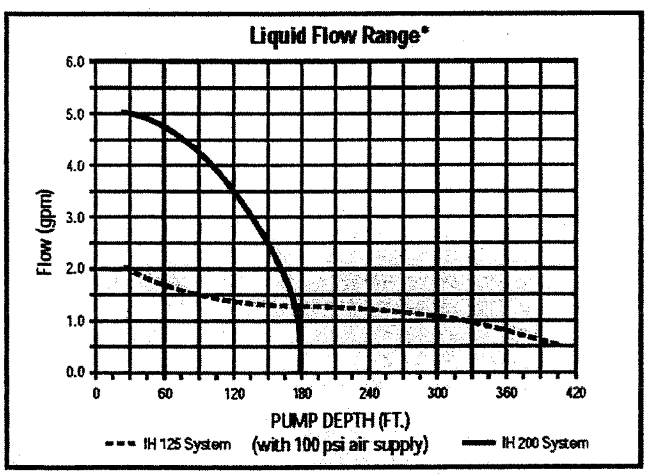
Down-Well Pump Materials:
Drive Rod: Fiberglass
Pump Piston: Stainless Steel
Pump Piston Seal: Labyrinth Seal (seal-less)
Pump Piston Check Ball & Seat: Stainless Steel
Pump Housing Assembly: Stainless Steel / CPVC
Foot-Valve (Check Ball & Seat): Stainless Steel
Intake Screen: CPVC or Stainless Steel

Hose & Tubing Options:
Pump Air Supply: 3/8 in. (.952 cm) ID Rubber Air Hose
Liquid Discharge:
1-in. (2.54 cm) ID Nylon Tube or Rubber Hose
Level Control Bubbler Tube:
1/4 in. (.635 cm) OD Black Nylon
Level Control Reference Tube:
5/16 in. (.793 cm) Black Nylon

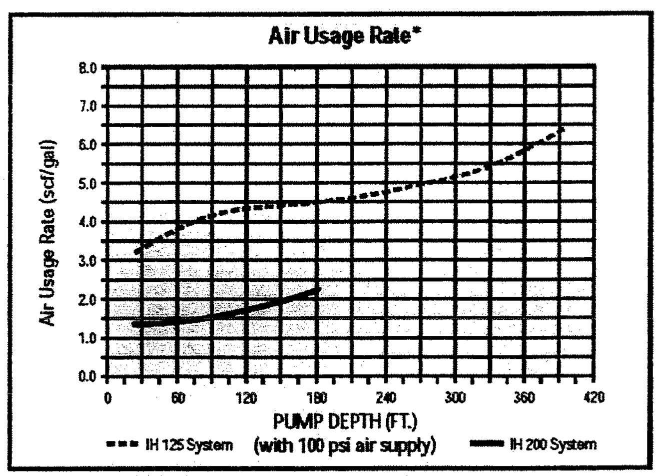
Application Temperature Range: Max: 180° F (82.2 C)
Downhole Min: -20° F (-28.9 C) Surface

Warranty:
Limited (1) one-year warranty for parts and labor on all system components. Warranty begins on delivery date.

IRON HORSE™
Patent Pending



*consult factory for depths greater than 400ft.



*consult factory for depths greater than 400ft.

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Appendix 11 – D

EPA Memo for Leachate as Dust Suppression

SEND TO: CHAD & STEVE B. JOE & DOUG ~~Dave~~ SIMON & JIM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 23 1996

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: The Proposal by USPCI to use Hazardous Waste Leachate for Dust Suppression at a Landfill

FROM: Matthew Hale, Director
Permits and State Programs Division (5303W)
Office of Solid Waste

TO: Steve Gilrein, Associate Director for RCRA
Hazardous Waste Management Division (6PD-O)

We have carefully considered the proposal by USPCI to use hazardous waste leachate for dust suppression at its Lone Mountain landfill in Oklahoma. We believe that the proposal, as USPCI and the Region VI staff have described it, is environmentally sound when properly managed under RCRA permitting conditions. To meet the permit requirements for dust suppression, USPCI currently purchases potable water and then disposes of the leachate off site through deep well injection. By using the leachate, a valuable resource would be saved and the relatively costly disposal of a low-level hazardous waste would not be necessary.

The proposal raises two legal issues. First, Section 3004(l) of RCRA forbids the use of hazardous waste for dust suppression or road treatment. Second, removing the leachate from the unit, storing the liquid in another unit, and then applying the leachate on the landfill could arguably make it subject to the Land Disposal Restrictions (LDRs).

As to the issue of the land disposal restrictions, USPCI could likely avoid possible liability by pumping the leachate from the sumps and keeping it within the landfill rather than first placing the waste in a separate unit. To accomplish this, the leachate might be pumped directly from the sumps to dedicated spray trucks or towed containers in the landfill. The leachate would not leave the unit and applying the leachate (i.e., moving the leachate within the unit) would not be considered placement into a land disposal unit. Furthermore, since placement in a land disposal unit would not be involved, the ban on placing hazardous liquids in landfills would not apply.

In addition, we believe it is reasonable to take the position that the use of leachate in this way would not constitute a violation of Section 3004(l) because the legislative

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history of Section 3004(l) only discusses the use of hazardous waste for road treatment. Clearly, Congress's concern was the uncontrolled release of hazardous liquids to the environment, not the reapplication of leachate into the lined landfill from which it was originally derived. As long as the leachate is being returned to the landfill where it originated, we do not believe it is being "used for dust suppression" in the sense prohibited by Section 3004(l).

Oklahoma, of course, is authorized for the relevant RCRA provisions under discussion. Therefore, the State would have the final say in interpreting the applicability of the RCRA land disposal restrictions and Section 3004(l) to USPCI's proposal, and could make a more stringent interpretation. We believe, however, that under a reasonable interpretation of the provisions, USPCI would be allowed to carry out its proposal.

Thank you for the opportunity to assist you. If you have any questions, please contact David Eberly of my staff on 703-308-8645.

cc: David Vogler, Region VI
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