

Attachment 19

Process Description

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D.6 Landfills

This Section provides information for the following active RCRA landfill units:

- Cell 14;
- Cell 15; and
- Cell 16

Closure plans for these units and for Trench 10, which is located adjacent to Trench 11, are described in Section I.

During 1999, ESII (previous owner) submitted a Class 3 modification requesting the use of alternate earthen final covers over Trenches 10 and 11. Conditional approval was granted by IDEQ pending successful performance of the design as determined from the evaluation of a test pad to be constructed concurrently with the alternative final covers. Construction on Trench 10, 11 and the test pad were completed during the year 2000. The 60-month (5-year) demonstration was completed in 2005. The final report, documenting successful completion of the demonstration period, was approved by IDEQ on April 12, 2006. Closure activities for Cell 5 were completed in 2005 and Closure Certification was received on February 6, 2006. Further information is provided in Section I, Closure and Post Closure Plan.

D.6.a List of Wastes

The approximate dimensions, permitted capacity (total volume), and remaining capacity for each of the active landfill units appear in Table D-3. Each of the landfill units are used to dispose of the wastes listed in USEI's Part A Form for landfill disposal in the form of bulk solids, containerized solids, treated or stabilized residues, and approved PCB and NORM waste materials.

D.6.b Liner System Exemption Requests

Not Applicable - USEI is not requesting any exemptions under 40 CFR §264.301(a) or (b) from the applicable liner system requirements contained in Subpart N - *Landfills* of 40 CFR Part 264.

D.6.c Liner System - General Items

Cell 5, Trenches 10 and 11, and Phase 1 of Cell 14 were all constructed prior to January 29, 1992. As such, the liner system design and operating requirements described under 40 CFR §264.301(c) do not apply to these units. These requirements do, however, apply to Phase 2 of Cell 14. However, as the liner systems of Phases 1 and 2 of Cell 14 are identical, Phase 1 does, in fact, comply with 40 CFR §264.301(c). Cell 5, Trenches 10 and 11, Cell 14, Cell 15, and Cell 16 must and do comply with the requirements described under 40 CFR §264.301(a).

The landfill unit construction, including excavation, geotextile placement, liner placement, flow zone materials, berm construction, roadway construction, drainage control construction, etc. are similar to the specifications provided in Appendix D.4.1. Final specifications packages and CQA methods and procedures were prepared as each unit was constructed. This information is available for review on-site.

D.6.c.(1) Liner System Description

D.6.c.(1)(a) Trenches 10 and 11 (Closed)

Trench 10 does not have a bottom synthetic liner. Trenches 10 and 11 are inactive and have been covered with an evaporative cap. The design for Landfill Trench 11, above-grade, appears on Drawing # PRMI-L01, -L02, -L03 and -L04. The general layout/location for Trenches 10 and 11 is shown on the Facility Site Plan, Figure D-1.

D.6.c.(1)(b) Cell 5 (Closed)

The design for Cell 5 is shown on Drawing #'s PRMI-L11, -L12, -L13, -L14, -L15, -L16, -L17, -L18, and -L19.

Cell 5, Phase 1, which comprises approximately the southern one-third of the Cell 5, was constructed in late 1984 and its base liner consists of the following, from bottom to top as shown on Drawing #'s PRMI-L15 and -L16:

- Liner foundation - Native subsoil;
- Support layer - The excavated foundation was fine-graded and compacted to provide a stable base;
- Secondary synthetic liner – 40 mil HDPE;
- Leak detection, collection, and removal zone – 12 in. of sand;
- Primary synthetic liner – 60 mil HDPE;
- Leachate collection and removal zone – 12 in. (minimum) of sand;
- Separation layer - Geotextile fabric; and
- Protective layer – six (6) in. of soil cover for protection.

In early 1986, prior to disposal of any wastes in Cell 5, an additional 60 mil HDPE primary liner and primary leachate collection and removal zone were constructed on top of the base of the Phase 1 area as shown on Drawing #'s PRMI-L15 and -L16. This new liner system consisted of the following components, from bottom to top:

- Bedding material - Site soils that passed the ¾ in. sieve placed in six (6) in. lifts and compacted to 90% of the Standard Proctor maximum dry density;
- New primary liner - 60 mil HDPE material;
- New protective layer - Geotextile fabric;
- New primary leachate collection and removal zone – 12 in. of sand;
- New separation layer - Geotextile fabric; and
- New cover soil layer – six (6) in. of compacted road mix.

The side slopes of Cell 5, Phase 1 were constructed of the following components, from bottom to top as shown on Drawing #'s PRMI-L15 and -L16:

- Support layer - Prepared native subsoil was excavated, fine-graded and compacted to provide a stable base;
- Bedding layer - Geotextile fabric;
- Secondary synthetic liner - 40 mil HDPE material;
- Leak detection, collection, and removal zone - Synthetic drainage net;
- Primary synthetic liner - 60 mil HDPE material;
- Primary leachate collection and removal zone - Synthetic drainage net; and

- Support/separation layer - Geotextile fabric.

The Phase 2 portion of Cell 5 was completed in November 1986 and consists of the following components, from bottom to top, which comprise the base of the Phase 2 portion of Cell 5 as shown on Drawing #'s PRMI-L17 and -L18:

- Liner foundation - Native subsoil;
- Support layer - The excavated foundation was fine-graded and compacted to provide a stable base;
- Compacted low permeability soil liner - 36 in. clay/soil liner;
- Secondary synthetic liner – 60 mil HDPE material;
- Leak detection, collection, and removal zone - 12 in. (minimum) of sand placed over a geotextile fabric which overlies a drainage net. A leachate collection pipe with a stone annulus was placed within the leachate collection zone and drains to a leachate removal sump;
- Primary synthetic liner - 80 mil HDPE material;
- Primary leachate collection and removal zone - 12 in. (minimum) of sand with a leachate collection pipe with a stone annulus placed within the leachate collection zone to drain to a leachate removal sump;
- Separation layer - Geotextile fabric; and
- Protective layer – six (6) in. of soil cover for protection.

The internal side slopes of Cell 5, Phase 2 were constructed of the following components, from bottom to top as shown on Drawing # PRMI-L17 and -L18:

- Support layer - Prepared native subsoil;
- Compacted low permeability soil liner - 36 in. clay/soil liner;
- Secondary synthetic liner - 60 mil HDPE;
- Leak detection, collection, and removal zone - Synthetic drainage net;
- Primary synthetic liner - 80 mil HDPE material;
- Primary leachate collection and removal zone - Synthetic drainage net; and
- Support/separation layer - Geotextile fabric.

D.6.c.(1)(c) Cell 14

The design for Landfill Cell 14 is shown on Drawing #'s PRMI-L21, -L22, -L23, -L24, -L25, -L26, -L27, -L28, and -L29. Cell 14 has an engineered leachate collection and removal system (LCRS) and leak detection, collection, and removal system (LDCRS) in the base of the disposal area consisting of the following, from bottom to top:

- Liner foundation - Native subsoil;
- Support layer - The excavated foundation was fine graded and compacted to provide a stable base;
- Compacted low permeability soil liner - 36 in. thick, compacted to develop a maximum permeability of 1×10^{-7} cm/sec at a minimum of 92% of the Standard Proctor maximum dry density;
- Secondary synthetic liner – 60 mil HDPE;
- Leak detection, collection, and removal zone - 12 in. of free draining granular material (minimum permeability of one (1) cm/sec) graded to drain to a leachate removal sump
- Support/separation layer - Geotextile fabric;
- Primary liner support layer – 12 in. (minimum) compacted low permeability soil at a minimum of 90% of the standard Proctor maximum dry density;
- Primary synthetic liner – 80 mil HDPE;

- Leachate collection and removal zone - A drainage net, geotextile fabric, and 12 in. (minimum) of free draining granular material (minimum permeability of 1×10^{-2} cm/sec) with a leachate collection pipe with a stone annulus placed within the leachate collection zone to drain to a leachate removal sump;
- Separation layer - Geotextile filter; and
- Protective layer – six (6) in. of soil cover for protection.

Cell 14 has excavated and fill constructed side slopes of approximately three (3) horizontal to one (1) vertical (3H:1V). The fill areas have 2.5H:1V exterior side slopes (berms/dikes). The engineered lining and LCRS and LDCRS along the side slopes and below the proposed grade consist of the following, from bottom to top:

- Support layer - Native subsoil;
- Compacted low permeability soil liner – three (3) ft. thick with 1×10^{-7} cm/sec maximum hydraulic conductivity;
- Secondary synthetic liner - 60 mil HDPE;
- Leak detection, collection, and removal zone - Synthetic drainage net;
- Primary synthetic liner - 80 mil HDPE;
- Leachate collection and removal zone - Synthetic drainage net; and
- Support/separation layer - Geotextile filter fabric.

D.6.c.(1)(d) Cell 15

The design for Landfill Cell 15, Phases I thru III is shown on Drawings 52-01-01, 52-01-02, 52-01-03, 52-01-04 and 52-01-05. Cell 15 will be excavated into the on-site soils, with a 36 in., low permeability, soil liner placed over the bottom of the excavated landfill. A 36 in. recompacted, low permeability soil, with 1×10^{-7} cm/sec hydraulic conductivity, has been specified for the composite secondary liner. Cell 15 will be lined with two, synthetic, high-density, polyethylene (HDPE) liner membranes. The base of the lined cells will have two, leachate collection zones. After filling, the cells will extend to a maximum of 80 feet above the existing grade. Cell 15 Engineering Report (Appendix D.3.1), Cell 15 Construction Quality Assurance Plan (Appendix D.3.2) and Cell 15 Design Specifications (Appendix D.3.3) provide additional details. Modifications to Cell 15 are outlined in the Landfill Engineering Report - Cell 15 Modifications, (Appendix D.3.1.a). The modifications include a lateral expansion of Phase IV and a vertical expansion of the waste limits with a revised cover design described in Appendices I-14 and I-15.

Cell 15 landfill areas will each have engineered lining and leachate collection systems in the base and side slopes of the disposal area consisting of the following, from bottom to top:

- Support layer – Native subsoil;
- Compacted low permeability soil liner – three (3) ft. thick with 1×10^{-7} cm/sec hydraulic conductivity;
- Secondary synthetic liner – HDPE material;
- Leak detection and collection zone – Geocomposite drain;
- Primary synthetic liner – HDPE material;
- Primary Leachate Collection Zone – Geocomposite drain; and
- Frost protection materials (30 inches thick)

D.6.c.(1)(e) Cell 16

The layout of Cell 16 is approximately 1,150 feet by 2,800 feet, as shown on the drawings in Appendices D.5.4 and D.5.10, located in Attachment 18. Cell 16 is being constructed in a phased manner, as described in the Engineering Report, contained in Appendix D.5.1, and the Engineering Report Addendum. All phases of Cell 16 will be excavated into native soils. The exterior and interior portions of the perimeter berm are sloped at 3H:1V. The interior portions of the perimeter berm have a typical height

of 25 feet. The floor of Subcells 16-1a and 16-2a have a typical grade of approximately 3.5%. The floor of Subcells 16-1b and 16-2b have a variable floor grade between 3.5% and 5.6%. Additional information on the grading of future phases of Cell 16 can be found in Appendix D.5.10. The Cell 16 liner system extends across the floor and interior sideslopes of the cell, which includes the following components from bottom to top;

- Native subgrade;
- Compacted clay liner (36 inches);
- LDCRS HDPE geomembrane;
- LDCRS geocomposite drain;
- LCRS HDPE geomembrane;
- LCRS geocomposite drain; and
- Frost protection material (30 inches)

The waste placed within Cell 16 will have a maximum thickness of approximately 140 feet.

D.6.c.(2) Liner Location Relative to High Water Table

Current separation distances of at least 100 ft. exist between the lowest points of the synthetic liners of Cells 5, 14, 15, and 16 respectively, and the uppermost aquifer beneath these liners. More details describing the geologic and hydrogeologic conditions at the facility are provided in Section E.

D.6.c.(3) Loads on Liner System

Based on laboratory tests and manufacturer's data (see in Appendix D.4.3), the primary HDPE liner can support uniform loads of 4,000 psi without tearing. This allowable loading greatly exceeds the maximum expected normal load at any of the landfill bases (i.e., contact pressure), which is estimated to be 120 psi in Cell 15 and 125 psi in Cell 16. The maximum contact pressure is based on the maximum depth landfill materials with an average in-place density of 125 pounds per cubic foot (pcf), as described in Appendices D.3.1 and D.5.1. The as-built survey records of Cell 15 (up through December 2009) indicate an average waste density of approximately 115 pcf. The loads considered for design of Cell 15 were subsequently modified from 135 pcf (previously assumed) to a more representative value of 125 pcf.

HDPE has superior tear resistance, compared to other common flexible membrane liners. Appendix D.6.4 provides information on the HDPE liners. Additional data on tear resistance (from an HDPE liner manufacturer) appear in Appendix D.4.3, page D.9-31.

Based on the soil characteristics of the site, bottom heave (uplift) and slope stability should not produce undue stresses on the liner. The impact of the applied landfill load on the soil liner, the geosynthetic liner, and the sub-grade soils is evaluated and presented in Appendix D.6.4. As described in this appendix, the liner system should accommodate any settlement/subsidence resulting from applied landfill load. As the calculated settlement/subsidence is relatively minor, this should not result in the application of excessive stresses on the liner system. In addition, internal pressure gradients (i.e., leachate head) are minimized because collected leachate is removed from the leachate collection sumps as needed. There will be no external pressure gradients on the liner systems from groundwater as the groundwater table is a minimum of 100 ft. below the liner systems.

The HDPE liner systems for Cells 5 and 14 were installed under the CQA programs described in Section D.6.g.(3) to assure the integrity of the material sheets and seam joints. Non-destructive testing was performed after installation of the liners. Liner installation specifications are presented in Appendix D.4.1. For each cell, the installation stresses created by installation equipment were minimized by covering the liner system with a specified minimum thickness of material prior to trafficking of equipment.

Installation stresses from the temperature fluctuations present during the liner installations for Cells 5 and 14 were minimal. The lining manufacturers do not have standards for allowing slack in the material to compensate for contraction of the material. It is a field judgment based on the liner installer's experience. The HDPE liners do not have "snare drum" effects during the winter months. In addition, HDPE has a minimum elongation of 500% before break as indicated in Appendix D.4.3.

Operational stresses on the primary liner are minimized by covering the primary liner with the LCRS materials and a minimum of six (6) in. of protective soil like material or waste. The engineered cover system over the primary liner also protects the HDPE from puncture from objects. The cover also distributes any point stresses on the flexible liner from foot or vehicle traffic.

On the side slopes, the liner is covered with the synthetic drainage net and geotextile filter. The initial layer of material placed over the drainage system is soil or waste of a soil like consistency that is free of sharp objects that could puncture the drainage net and liner. This initial layer of material serves as a further protective cover over the liner system.

D.6.c.(4) Liner System Coverage

The HDPE liner systems for Cells 5, 14, 15, and 16 cover the entire bottom surfaces and base side slopes of each unit and will be overlapped with the top (cap) liner during closure. Drawing # PRMI-L19, PRMI-L28 and PRMI-L29 show the lateral (horizontal) limits of the engineered liner systems for Cells 5 and 14. Drawing # 52-01-02 shows the lateral limits of the engineered liner system for Cell 15. The liner limits of Cell 16 are shown on Drawings 16-11-01 and 16-11-02 as found in Appendices D.5.4 and D.5.10. These limits are clearly visible in the field, and procedures described in Section D.6.t have been implemented to prevent filling outside these limits.

D.6.c.(5) Liner System Exposure Prevention

The liners for each cell are exposed to the general climatic conditions of the area for a short period of time during installation operations. During active disposal operations the bases of the liner systems are covered with a minimum of six (6) in. of protective soil-like material or waste while the internal landfill side slopes are covered with drainage net and geotextile filter fabric. However, because of the physical characteristics of the HDPE liners, these exposures should have no detrimental effect on the performance or integrity of the liner systems. The polymeric HDPE material withstands weathering very well. The HDPE liners can withstand temperature extremes and, because of its elastic qualities, installation stresses were minimal.

Sideslope leachate drainage uses ultraviolet-stabilized HDPE drainage nets. The drainage nets were anchored at the base of the disposal units by the base LCRS and LDCRS and at the top in the HDPE liner anchor trench. For Cell 5 and Phase 1 of Cell 14, the geotextile placed over the drainage net was placed in strips around the disposal cell shortly before waste placement. The geotextile was installed with a minimum two (2) ft. overlap at the seams, unless heat fused, in which case a minimum six (6) in. overlap was used. The geotextile is held in place primarily by the waste load. For Phase 2 of Cell 14, an ultraviolet-stabilized geotextile fabric was installed at the time of cell construction. The geotextile panels were sewn together, secured at the top of the slope in the liner anchor trench, and anchored in the protective cover layer at the base of the cell. Similar design criteria exists for Cells 15 and 16 as found in Appendices D.3.1 and D.5.1.

D.6.d Liner System – Foundation

D.6.d.(1) Foundation Description

The sub-grades for the current landfill disposal units were excavated into the native soils. Sub-grade (top of 36 in. clay liner) elevations for Cells 5 (Phase 2) and 14 are shown on Drawing # C565L-LT4 previously submitted. The perimeter embankments for these units are also shown on this drawing. The perimeter embankments for Trench 11 are shown on Drawing #530L-L02, which was also previously submitted. See Section D.6.c. (1)(d) for Cell 15 foundation design criteria. Cell 15 design is shown on Drawing #52-01-03. See Appendix D.5.1 for the Cell 16 foundation design.

D.6.d.(2) Subsurface Exploration Data

The facility is located south of the Snake River on a plateau approximately one (1) mile wide that rises about 150 ft. above the drainage area of Castle Creek, which is located about ½ mile to the west of the facility. Maximum surface relief across the site is approximately 90 ft., sloping from south (high) to the north (low) with a mean elevation of approximately 2570 ft. above mean sea level (MSL).

The soils beneath the site are part of the Bruneau Formation, which consists of moderately indurated sediments that may vary in composition within the boundaries of the site. Based on test boring information and subsurface investigations, the soils beneath the site gradually grade from a gravelly, silty sand to a clean, poorly-graded sand. Beneath the Bruneau Formation is the Glens Ferry Formation, a silty sand to a silt with clay interbeds, grading to a massive silty clay bed. The top of the gray massive silty clay bed is at elevation 2470 at the southern end of the property and slopes down to elevation 2370 at the northern end of the property, as shown in the boring logs and by laboratory testing of samples from borings D-1 and D-2 (see Appendix D.6.2).

During the various subsurface investigations conducted by Shannon and Wilson (1959), Northern Testing Laboratories (1981 & 1982), and CSI/CH2M Hill (1983 - 1985), bedrock was encountered in only one (1) boring. The log of this boring (see Appendix E.1) shows the initial rock encountered was blue shale at about 650 ft. below ground (approximate elevation 2000 MSL). Various strata of consolidated sediments were found below this shale until another gray shale was encountered about 1,940 ft. below ground surface (approximate elevation 720 MSL).

It is uncertain whether the blue shale described in the boring log is truly bedrock or whether it is a highly consolidated version of the blue clay found in more shallow borings. The subsurface investigations showed that the soils to a depth of over 400 ft. (elevation 2240 MSL) were dense consolidated sediments, with no evidence of subsidence. Based on the geological information, no limestone or solutionable material is present near the facility, making sinkhole potential minimal. Subsurface investigation and laboratory testing results are contained in Appendix D.6.2. A more thorough description of the geology at the facility is presented in Section E.

Groundwater is present beneath the site, with the surface of the groundwater varying from elevation 2395 MSL near the northwestern corner of the property, to elevation 2360 MSL near the southeastern corner of the property. Groundwater flow is to the east.

The low points of the bases of the landfill units (excluding sumps) vary from elevation 2520 MSL for Trench 11 to elevation 2535 MSL for Cell 14. Cell 15 Phase I construction report will include this information within the “as-built” drawings. Therefore, the bases of all current landfill units are established at least 130 ft. above the uppermost aquifer, and groundwater cannot encroach on the base of any of the landfill units. Further discussion on the site hydrogeology can be found in Section E.

The facility is not located in an area listed in Appendix VI of 40 CFR Part 264. Therefore, a demonstration of compliance with the seismic standard is not required. As described in the *Geotechnical Investigation, ESII Site B*, dated May 1998, as prepared by Geosystems Consultants, Inc. and included in Appendix D.4.8, the facility is located in an area of low to moderate earthquake risk.

The facility is located near the drainage divide separating Castle Creek from the Snake River. The facility lies about 200 ft. above the Snake River and is outside the 100 year flood plains for the Snake River and Castle Creek. The facility's drainage is presented in detail in the *Surface Water Management Plan* (see Appendix D.4.7).

D.6.d.(3) Laboratory Testing Data

From August 1958 to January 1959, soil borings were performed in the vicinity of the facility by Shannon and Wilson of Seattle, Washington, as described in their *Subsurface Investigations and Surveys - Special Site Studies - Site Number M2 - Mountain Home Air Force Base, Idaho* report dated February 9, 1959. A copy of this report is included in Appendix D.6.5. As described in that report, the following tests were performed on soil samples from the site:

- Classification and index tests - including grain-size curves, Atterberg limits, specific gravity determinations, in-place unit weights, natural water contents and pH determinations;
- Compaction tests - including modified AASHO compaction tests;
- Consolidation tests - including development of load-settlement, time-settlement and stress-settlement curves;
- Shear strength tests - including Q (unconsolidated-undrained or quick), Q_c (consolidated-undrained or consolidated-quick) and S (fully drained) triaxial tests, unconfined compression tests, the development of stress-strain relationships and Mohr strength envelopes;
- Capillary tests - to measure the height of capillary rise in the soils;
- Confined compression tests - indicating stress-strain relationships;
- Vibration tests - including a summary of the relationship between dynamic modulus of elasticity (E_d) and confining pressure; and
- Discussion of modulus of elasticity - including a discussion of the results of the triaxial, confined compression and vibration tests and the advantages and limitations of each test.

In November 1981, Northern Testing Laboratories conducted geotechnical investigations of the facility as described in their *Report of Geotechnical Investigations – ESII Hazardous Waste Disposal Site - Grandview, Idaho* (see Appendix D.6.2). Samples obtained during the field exploration were visually classified in accordance with the Unified Soils Classification System. Representative samples were tested for the following characteristics: grain-size distribution, Atterberg limits, natural moisture content, moisture-density relationship and permeability.

As described in the December 1983 *Subsurface Investigation of the ESII Site* report (see Appendix D.6.2) prepared by Conversion Systems, Inc. (CSI), the following laboratory geotechnical tests were performed by Intermountain Materials Consultants of Boise, Idaho, on soil samples collected in September 1983 from the facility: natural moisture content, grain size analysis, specific gravity, Atterberg limits, Proctor compaction, triaxial permeability and direct shear.

The boring logs from the Northern Testing Laboratories report of 1981, the CSI/CH₂M Hill report of 1983 and the Shannon and Wilson report of 1959, indicate the near surface soils underlying the site are dense, over consolidated, slightly indurated silty, gravelly sand deposits. These materials are all granular, unsaturated, and non-plastic.

The Standard Penetration Tests performed while progressing the borings drilled during these studies indicated that the in-place soils have minimum test values of 40 to 50 blow counts per foot. This correlates to a bearing capacity of at least eight (8) kips per square foot (ksf). In areas where higher

Standard Penetration Tests values were encountered, the associated bearing capacities increased to 10 to 12 ksf. The Shannon and Wilson report indicated the upper soils layer to be pre-consolidated to 20 ksf.

D.6.d.(4) Engineering Analyses

For Cell 14, the nominal depth of wastes from the base of the landfill units (which are excavated 20 ft. to 60 ft. into the ground) to the crest of the landfill, is 110 ft.. With an average waste density of 135 pcf, this equates to a gross normal load of 14.9 ksf and a maximum net loading of 12.2 ksf. The increased incremental load of the waste is the total load of the waste, minus the weight of excavated soil. The bearing capacity analysis performed for Cell 14 is presented in Appendix D.4.8, Section 4. Specific foundation analysis related to Cell 15 is contained in Appendix D.3.1.

Based on the Standard Penetration Tests, the sandy soils and the silts and clays underlying the sandy soils are dense to hard material. This, associated with the bearing capacity of the soils, indicates that soil compressibility will be minimal. As such, the calculated settlement/subsidence for the landfills is relatively minimal as detailed in Appendix D.4.8. Detailed discussions of soil conditions are presented in Appendix D.6.2.

Because the nearest groundwater table is greater than 100 ft. below the liner systems of Cells 5, 14, and 15, and 16, the potential for bottom heave caused by rising groundwater is negligible. Furthermore, since any collected leachate is removed from the leachate collection sumps, there are no excess hydrostatic pressures on the liner systems. Also, based on the composition of the wastes placed in the disposal units and of the underlying native soils, the potential for excess gas pressure on the liner system is minimal.

The near surface sandy soils have a compacted coefficient of permeability ranging from 1×10^{-2} to 5×10^{-4} cm/sec.

The Northern Testing Laboratories report states that excavated slopes for the landfill units of .5H:1V will have adequate stability. The laboratory testing and soils reports prepared for ESII by Northern Testing Laboratories and Intermountain Testing, Incorporated, and the data reported in the Shannon and Wilson Report, indicate that the surficial soils have an internal angle of friction ranging from 30° to 37°. The slope stability analysis, performed and presented in Appendices D.4.8 and D.5.10, located in Attachment 18, indicate that a 3H:1V slope in the excavated materials provides more than adequate stability. Slopes for the landfill units were excavated at only 3H:1V to facilitate liner placement. The slope of the excavated materials has been demonstrated in the field and laboratory to be stable. Existing and past landfill units have been excavated to almost vertical side slopes at depths up to 40 ft.

The compacted soil fill berms for the landfill units have an exterior side slope of 2½H:1V. Based on the Northern Testing Laboratories direct shear test results, these exterior slopes for the landfill units will have a sufficient safety factor, when compacted to 90% of Standard Proctor maximum dry density (ASTM D-698) at moisture contents less than the optimum moisture content. This is witnessed by the excavated and fill berm slopes in Cell 5, Phase 1, which were constructed to 1½H:1V and 2H:1V, respectively. The stability analysis performed on the steepest cut and fill slopes is presented in Appendix D.4.8.

Although very similar to the above engineering analyses, the Engineering Report and associated engineering analyses for landfill Cell 15 are found in Appendix D.3.1. The engineering report and analyses for Cell 16 are found in Appendices D.5.1 through D.5.10, located in Attachment 18.

D.6.e Liner Systems – Liners

D.6.e.(1) Synthetic Liners

The synthetic liners of Cell 14 are described in Section D.6.c.(1). The Cell 15 liner system is described in Appendix D.3.1. The HDPE liners installed in Phases 1 and 2 of Cell 5 were manufactured by National Seal Company, while those for Phases 1 and 2 of Cell 14 were manufactured by Gundle Lining Systems (now GSE).

Appendix D.4.8 includes an analysis of the anchor trenches for Cell 5 and 14; Appendix D.3.1 includes anchor details for Cell 15, and Appendix D.5.1 includes anchor details for Cell 16. Further details on the liner system are shown on the previously referenced drawings and discussed in the Sections that follow.

D.6.e.(1)(a) Synthetic Liner Compatibility Data

The synthetic liners are constructed of HDPE which is a crystalline polymer (thermoplastic) with a relatively high molecular weight and narrow molecular weight distribution. HDPE has no fillers or plasticizers, is resistant to a wide range of chemicals and biological attack, and acts as a nearly impermeable barrier to liquid flow. Appendix D.4.5 contains a Chemical Resistance Table for HDPE that can be used as a chemical compatibility guide to high concentrations of concentrated chemical substances and mixtures.

Exposure testing has shown that HDPE is resistant to hazardous waste leachate as described in *Lining of Waste Impoundment and Disposal Facilities* SW-870, EPA, March 1982. The manufacturer's data are included in Appendix D.4.5. Liner chemical compatibility testing data are included in Appendix D.4.4.

D.6.e.(1)(b) Synthetic Liner Strength

The basic mechanical and physical properties of HDPE can be summarized as follows:

- High tensile strength;
- Good elastic deformation;
- Good plastic deformation;
- Good relaxation properties;
- Good stress crack resistance; and
- Good resistance to aging.

To assure consistent mechanical properties, the manufacturer closely monitors the density of HDPE. Typical data on the physical properties of an HDPE liner from a major manufacturer are presented in Appendix D.4.3. The liners selected for Cells 5, 14, 15 and 16 have equivalent or better physical properties. Information on the actual liners installed in Cells 5, 14, 15, and 16 is contained in the CQA reports for these landfill units. These reports are bound separately because of their size, but copies can be made available to the IDEQ upon request.

For yield stress calculation purposes, a 60 mil liner was evaluated to depict worst case conditions. This evaluation of the HDPE liner demonstrated that stresses from dead and live loadings would not exceed the allowable stresses for the material during construction or maintenance activities. In addition, the chemical compatibility of the HDPE liners with facility landfill leachates and the effects of these leachates on liner strength are described in Appendix D.4.4. In general, the testing indicated landfill leachates did not have any adverse effects on the strength of the HDPE liners. Additional information describing HDPE liner chemical compatibility test data and chemical resistance tables are contained in Appendices D.4.4 and D.4.5.

The resin used for extrusion joining of sheets is HDPE and as a result, the seams have chemical and physical properties similar to those discussed for the liners and have excellent tensile strength.

A CQA program was implemented during construction of Cells 5 and 14 that included inspection and testing of the physical properties of the liner material and seams. Typical elements of this quality control testing program are similar to those described in Appendix D.4.2. Appendix D.3.2 provides a similar Construction Quality Assurance Plan for Cell 15. The Construction Quality Assurance Plan for Cell 16 is located in Appendix D.5.6.

The relative effects of radiation on HDPE liner system for types of wastes received are as follows:

The contact dose rate for a slab of depleted uranium is known to be 200 mrad/hr. This dose is due to the beta emissions of its two immediate progeny, thorium-234 and protactinium-234m. There are nine beta emitters in the decay chain of uranium-238. Over 99% of the dose the uranium and its progeny could deliver to the liner would be from beta emissions. The beta emissions from each of the progeny would deliver a dose of approximately 0.02 mrad/hr if it were in equilibrium with the parent nuclide, uranium-238, and at the concentration allowed by the WAC. The instantaneous dose rate to the liner would be 0.18 mrad/hr. The annual dose to the liner would be 1.67 rad. HDPE used as insulation for electrical wires is advertised to have a radiation resistance of $7E+6$ rads. This indicates a potential lifetime for the liner, based solely on dose, of 4.2 million years.

It is also worthy of note that 40 CFR 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, requires the same containment system for uranium mill tailings as are required for RCRA wastes. Uranium mill tailings contain from 25 to 100 times higher concentrations of all the beta emitting progeny of uranium-238 than the USEI's WAC allows for receipt at the facility.

D.6.e.(1)(c) Synthetic Liner Bedding

Prior to installation of the secondary liner for Phase 1 of Cell 5 or the 36 in. of low permeability soil for Phase 2 of Cell 5, and all of Cell 14, the native soil sub-base was compacted to a minimum of 90% of the Standard Proctor maximum dry density (as defined in ASTM D-698) to provide a stable sub-base for the liner systems. Compaction tests were performed by an independent testing laboratory to document that the required compaction was achieved. The fine-grained sandy soils provide a stable base and adequate bedding for the HDPE liner and the 36 in. of compacted low permeability soil. Stones or other objects that could potentially damage the liner were removed from the soil liner surface of the sub-base.

For all cells, the primary liners are protected from damage caused by drums, debris, or operating equipment by maintaining minimum distances from the liner and side slope LCRSs. The bases of the primary liners are protected from operating equipment (disposal operation) by the LCRSs and the six (6) in. protective cover. The operating equipment is not allowed to come within two (2) ft. of the side slope LCRSs during routine operations.

For protection of the primary liner systems, drums and other articles are kept a minimum of two (2) ft. away from the side slopes of the lined landfill units and a minimum of 18 in. above the base (primary) liner of the landfill units. Above grade, drums and other articles can be placed adjacent to the interior slope of the above-grade soil containment dikes, but no closer than two (2) ft. (vertically) from the top of the waste limits for each landfill unit. There is sufficient space to place bulk solid, stabilized waste or clean fill around the drums or articles.

Information regarding Cell 15 synthetic liner bedding, compaction results and protective cover are included in the Cell 15 construction reports. Appendix D.3.3 provides more detailed design specifications for Cell 15. Information regarding Cell 16 synthetic liner bedding, compaction results and protective cover are included in the Cell 16 construction reports. Appendices D.5.1 through D.5.10 provide more detailed design specifications for Cell 16.

D.6.e.(2) Soil Liners

As described previously, Phase 2 of Cell 5 and all of Cell 14, Cell 15 and Cell 16 have 36 in. compacted low permeability soil base liners located beneath the secondary HDPE liners. Only Phase 2 (Sub-cells 4, 5 and 6) of Cell 14 is required to have a soil liner. Phase 1 of Cell 14 and all of Cell 5 predates this requirement. The low permeability soil placed in the landfills was obtained from a nearby off-site source. During construction, the CQA manager monitored the inspection and field testing of the soil liners to document that they were compacted to a uniform density, achieved in-place permeability's of less than 1×10^{-7} cm/sec, were graded to a uniform surface, and were cleared of surface stones and other objects that could potentially damage the overlying HDPE liner. Appendix D.4.2 contains a similar CQA Plan. Soil liner material specifications similar to those used are described in Appendix D.4.1. CQA documentation, as described previously, is available on-site. The CQA plan for Cell 15 is found in Appendix D.3.2, and the CQA plan for Cell 16 is found in Appendix D.5.6.

D.6.f Liner System - Leachate Collection/Detection System

D.6.f.(1) Systems Operation and Design

Appendix D.3.1 Cell 15, Engineering Report, Section 6, and Appendices D.3.1.a and D.3.1.b provide design criteria for Cell 15 liner system and LCRSs and LDCRSs System. Details for these systems are found in Drawing #52-01-03. Leachate piping system is described in Section 6.9.3 of Cell 15 Engineering Report found in Appendix D.3.1 and Appendices D.3.1a and D.3.1.b.

Cells 5 and 14 have LCRSs and LDCRSs as described in Section D.6.c.(1). The synthetic liners on the bottom and side slopes are in contact with leachate that is moving through the LCRSs and LDCRSs. The bottoms of the cells are sloped so that leachate drains over the HDPE liners to the collection laterals.

The details for the LCRSs and LDCRSs are shown on Drawing #'s PRMI-L15, -L16, -L17, -L18, L24, -L25, -L26, -L28 and 14-17-R01. Leachate from the landfills is conveyed to collection pipes located on the base (primary liner). The collection pipes traverse the landfills and drain to collection sumps located within the landfills. The LDCRSs collect any liquid over the secondary liners and convey it to collection/removal sumps located within the landfills. For Cell 5 access to the LCRS sumps is via 48 in. diameter concrete risers. For Phase 1 of Cell 14, access to the LCRS sumps is via 12 in. diameter HDPE pipes located in the center of 48 in. diameter concrete risers. A description of the design is contained in Appendices D.8.1 and D.8.2. For Phase 2 of Cell 14, access to the LCRS sumps is via 24 in. diameter HDPE pipes located on the side slopes of the cell above the primary HDPE liner. For Cell 5 and Cell 14, access to the LDCRS sumps is via 12 in. diameter HDPE pipes located on the side slopes of the cells between the primary and secondary HDPE liners. This design precludes any penetrations at critical locations in the primary liner systems as the penetrations are located at the edges (rather than the bottoms) of the landfill cells.

The collection pipes for the LCRSs for all the Cell 5 and Cell 14 sub-cells are four (4) in. diameter (minimum) perforated HDPE pipes that have been placed within the 12 in. to 18 in. drainage zone on the base of the cells. As they are constructed of HDPE, these pipes are chemically compatible with the leachate in the landfills. The pipes have a six (6) in. annulus of stone, and the entire pipe/stone system has been wrapped with a geotextile which acts as a filter to minimize the transport of fine sediment into the pipe. .

The LCRS collection sumps for Cell 5 are constructed of 48 in. diameter pre-cast concrete riser sections set in a cast-in-place concrete base. The LCRS sumps for Subcells 14-1, 14-2, and 14-3 of Cell 14 are constructed of 48 in. diameter pre-cast concrete riser sections set in a cast-in-place concrete base, with 12 in. HDPE pipe located down the center of the original concrete riser. Gravel from ½" up to approximately 2" fills the annulus between the concrete riser and 12" HDPE pipe. The basis and

specifications for the change to the primary leachate risers are included in Appendices D.8.1 and D.8.2. The LDCRS collection sumps consist of 12 in. diameter HDPE riser pipes placed on the side slopes of the cells. Sumps have been located in low areas as indicated on Drawing # PRMI-L11 and PRMI-L22. For Phase 2 of Cell 14, both the LCRS and the LDCRS leachate collection sumps consist of HDPE riser pipes placed on the cell side slopes.

Drawing #'s PRMI-L16 and -L24 depict a cross-section of the liner system and collection sumps. As shown in this drawing, the LCRS collection manholes for Cell 5 and Phase 1 of Cell 14 have been constructed in sections as the cells are filled. When the fill reaches final grade, a manhole frame and cover will be provided. Drawing 14-17-R01 depicts the updated cross-section for Cell 14, Subcell 14-1, 14-2, and 14-3 risers, including 12 in. HDPE inner riser and gravel fill. The 12 in. LDCRS (and LCRS for Phase 2 of Cell 14) collection risers access the leak detection, LDCRS sumps and have been placed on the cell side slopes. The risers are provided with locking caps. The LCRS and LDCRS sumps are monitored in accordance with Section F and, if liquids are detected, the leachate management procedures described in the following sections are followed. Pumping shall commence if liquid is present in the leak detection sumps in Landfill Cells 5 and 14, at or above 18 in., as measured with the bubbler tube located at the bottom of the concrete thrust block. Pumping shall not cease until the level is below 18 in. (actual depth is < 12 in. due to the angle of the riser). Pumping will typically continue until the pumps lose full suction capability, due to the drop in the liquid level below the inlet of the pump. (NOTE: This 18 in. level, measured as described, correlates to a level of approximately six (6) in. or less from above the top of the concrete thrust block and below the top of the horizontal sump collection pipe.) The leachate volume removed will be recorded.

The leachate pumping criteria and procedures for Cell 15 are described in Appendix D.3.1, Section 7.1.3. The LCRS and LDCRS riser pipe details for Cell 15 are shown on Drawing 52-01-05. For each subcell the LCRS sump is located at an elevation 2 feet below the primary liner and the LDCRS sump is located at an elevation 3 feet below the secondary liner.

The LCRS and LDCRS sump and riser pipe details for Subcell 16-1a and 16-2a are shown on Drawings 16-11-06 and 16-11-07 in Appendix D.5.4. The LCRS and LDCRS sump and riser pipe details for Subcell 16-1b and 16-2b are shown on Drawing 16-11-06A in Appendix D.5.10. The LCRS sumps in each subcell of Cell 16 are equipped with two pumps for leachate removal, including a low flow pump which will be used during typical operating conditions and a high flow pump which should be operated in tandem during maximum leachate removal events. Criteria for Cell 16 leachate inspection and removal are described in Appendix D.5.1, Section 5.3.

For each landfill unit, leachate level measurements in the LDCRS are taken using the same methods used for the LCRS sumps. If liquid is found in an LDCRS sump, it is pumped dry to the extent practical. In no case is the height of liquid on the secondary liner to exceed 12 in. The leachate volume removed will be recorded. Removed leachate may be pumped to trucks, drums etc. or conveyed via hard pipe for treatment and subsequent disposal in the Evaporation Pond or other appropriate permitted unit.

A chronological record of LCRS and LDCRS pumping events, liquid levels before and after pumping, volume of liquid removed and liquid destination is maintained on-site. The LDCRS pumping data of active landfill disposal units are analyzed weekly using a four (4) week rolling average to determine the average daily leakage rate. Similarly, the pumping data of closed units will be analyzed quarterly using a four-month rolling average to determine the average daily leakage rate. The calculated leakage rates are compared to the various action leakage rates established in the RAP (see Section M). As described in the RAP, various leakage rates will trigger various levels of response action (such as repairing the primary liner system, modifying daily operating procedures, or notifying the IDEQ).

D.6.f.(2) Equivalent Capacity

As described in Section D.6.c.(1), the side slopes of Cells 5 and 14 utilize synthetic drainage nets in lieu of granular drainage layers. The net is a very permeable synthetic mesh of bonded HDPE strands that

allows migration of leachate along the slope to the base leachate collection system. Specifications for flow rate and transmissivity values, demonstrating the drainage net has a drainage capacity meeting or exceeding Minimum Technology Requirements (MTR) for drainage layers in landfills, are provided in Appendices D.4.1, Section 02236 for Cell 14, D.3.1.b, Section 02272 for Cell 15 and D.5.5, Section 02272 for Cell 16.

Cell 15 and Cell 16 utilize synthetic drainage nets within their entire containment systems. The equivalent capacity of each drainage net has been sized for these applications, based upon liner gradient, flow lengths, and flow volumes.

D.6.f.(3) Grading and Drainage

The bases of Cells 5, 14, 15 and 16 are sloped to drain toward the LCRS and LDCRS removal sumps at a minimum 1% slope for Cell 5 and a minimum 2% slope for Cells 14, 15 and 16. As such, the LCRS collection pipes are constructed at a minimum 1% slope for Cell 5 and 2% slope for Cell 14 leading to the LCRS collection sumps. The six (6) in. diameter HDPE pipes for Cells 14 and 15, and the 8 (eight) in. diameter HDPE pipes for Cell 16 are adequate for gravity drainage of collected leachate to the sumps.

LCRS drain components, including geocomposite drain panels and leachate collection pipes, are designed to limit the liquid head from exceeding one (1) ft. over the primary liner. Typical drain components also include drain rock aggregates, which facilitate liquid transfer between geocomposite drain layers and the leachate collection pipes. Details of the drain components are illustrated on Drawing PRMI-L24 (Cell 14), Drawing 52-01-03 (Cell 15), and Drawing 16-11-03 (Cell 16).

Individual performance of the drain components are evaluated in the respective landfill engineering reports (Appendices D.3.1, D.5.1, D.5.10). Drain components for Cell 14 are discussed in the Phase 2 CQA report, available on-site.

D.6.f.(4) Maximum Leachate Head

LCRS drain components, including geocomposite drain panels and leachate collection pipes, are designed to limit the depth of leachate from exceeding one (1) ft. over the primary liner, as discussed in the previous section.

Leachate depth for Landfill 15 is addressed in Section 6.9.2 of Appendix D.3.1; leachate depth for Landfill Cell 16 is addressed in Section 4.8 of Appendix D.5.1.

D.6.f.(5) Systems Compatibility

As stated previously, Cells 5 and 14 four (4) in. and six (6) in. diameter perforated collection pipes and fittings are constructed of HDPE, which is chemically resistant to the leachate. Additional information describing the chemical compatibility of the LCRS and LDCRS with the landfill leachate at the facility is provided in Appendices D.4.4, D.4.5, and D.6.3. Chemical compatibility of the LCRS and LDCRS associated with Cells 15 and 16 are also constructed with HDPE materials and are likewise compatible with waste materials.

D.6.f.(6) Systems Strength

A number of features have been integrated into the design of the LCRS and LDCRS components to withstand the loads and stresses at the landfills. The collection sumps have been graded to the lines and grades shown on the drawings and filled with coarse aggregate. The cast-in-place foundations for the LCRS collection manholes (Cell 5 and Phase 1 of Cell 14) and the LDCRS collection riser pipes were constructed of 3,000 psi concrete. Each LCRS collection manhole is constructed of 48 in. diameter pre-

cast concrete manhole sections conforming to ASTM C478. The secondary collection riser pipes are constructed of 12 in. diameter HDPE pipe, and the primary side slope risers for Cell 14, Phase 2 were constructed of 24 in. diameter HDPE pipe. Evaluation of the drainage layers for Cell 14, Phase 2, is presented in the Cell 14 Phase 2 CQA report, available on-site.

An evaluation of applicable system strength associated with Cell 15 is provided in Appendices D.3.1, D.3.1.a, and D.3.1.b. Further design details are found in Appendices D.3.2 and D.3.3, Construction Quality Assurance Plan and Cell 15 Design Specifications.

The evaluation of foundation loads, resulting settlement, and liner strains for Cell 16 are addressed in Appendices D.5.1 and D.5.10.

D.6.f.(7) Prevention of Clogging

The base and side slope LCRSs are covered with a layer of geotextile fabric allowing liquid flow through to the free-draining zone, but screening out particulate matter. The collection pipes have been covered with approximately six (6) in. of $\frac{3}{4}$ in. to two (2) in. coarse aggregate. This size aggregate will not enter and/or block the $\frac{3}{8}$ in. diameter pipe perforations. The pipes and stone annulus were also wrapped with a geotextile fabric to minimize the quantity of fines entering the pipes..

Similar information associated with Cells 15 and 16 is provided in their respective construction specifications.

D.6.g Liner System-Construction and Maintenance

D.6.g.(1) Material Specifications

Material specifications for the Cell 5 and 14 synthetic liners, soil liners, LCRSs and LDCRSs are included in Appendix D.4.1. Material specifications for Cell 15 are included in Appendix D.3.3. Material specifications for Cell 16 are located in Appendices D.5.1 and D.5.10.

D.6.g.(2) Construction Specifications

Construction specifications for the Cell 5 and 14 liner system foundations, soil liners, synthetic liners, LCRSs, and LDCRSs are included in Appendix D.4.1. Construction specifications for Cell 15 are included in Appendix D.3.3. Construction specifications for Cell 16 are located in Appendices D.5.1 and D.5.10.

D.6.g.(3) Construction Quality Assurance Program

CQA was provided for the “new” primary liner of Phase 1 of Cell 5 for the complete liner systems for Phase 2 of Cell 5 and all of Cell 14 in accordance with the USEPA’s *Minimum Technology Guidance on Double Liner Systems for Landfills and Surface Impoundments* (Draft, May 1985) CQA guidance. The initial liner system for Phase 1 of Cell 5 was constructed prior to release of the USEPA’s CQA guidance, however, CQA for this liner system was provided in accordance with CSI’s CQA requirements. Copies of the CQA reports for Cells 5 and 14 were previously provided to the IDEQ and are available for examination on-site.

A detailed CQA program has been developed for the construction of hazardous waste management unit components such as landfill liners and covers at the facility. This CQA program is based on selected

manufacturers' standard inspection and testing procedures and the USEPA's *Quality Assurance and Quality Control for Waste Containment Facilities* guidance document dated September 1993. An experienced, qualified CQA manager documents that hazardous waste management unit components are constructed according to the approved design specifications. The CQA manager or CQA field inspectors are present during construction and installation to monitor, and test the materials as needed. The CQA manager is responsible for the inspection and approval of all work.

Appendix D.4.2 contains the detailed CQA Plan for the construction, repair, and closure of any hazardous waste management units. The Cell 15 CQA Plan is found in Appendix D.3.2, Construction Quality Assurance Plan. The CQA Plan for Cell 16 is located in Appendix D.5.6.

D.6.g.(4) Maintenance Procedures for Leachate Collection/Detection Systems

The LDCRSs for each cell are inspected as described in Sections D.6.f and D.6.n and in Section F. As required, the necessary repairs to the affected landfill component(s) will be made. Because of the nature of the LDCRSs (i.e., in-place field systems), routine maintenance procedures will not be necessary. The only components of the LDCRSs that may require maintenance are the leachate pumps, which are maintained/repared as necessary.

D.6.g.(5) Liner Repairs During Operations

The following are procedures commonly used in the event of liner damage. Actual procedures will depend on the specific incidents.

Upon observation of damage to the liner system, landfilling operations in the vicinity of the damage is immediately ceased. An inspection to assess the damage is performed. The inspection procedures are as follows:

- Waste and soil is carefully removed a minimum of 24 in. beyond the damage in all directions, to provide a working area;
- If the damage is surrounded by saturated material, barriers, absorbents, and/or a vacuum truck is used to maintain the work area in a dry condition and to minimize leakage to the LDCRS or underlying base material;
- The LDCRS materials are cut and removed a minimum of 18 in. beyond the damage in all directions;
- The primary liner is cleaned and dried. If the primary liner was deformed but not penetrated, the damage is repaired as described below under temporary or permanent repairs. However, if the primary liner was penetrated, the liner is carefully cut and removed a minimum of 12 in. beyond the damage, in all directions to expose the LDCRS;
- The LDCRS materials are cut and removed a minimum of 12 in. beyond the damage in all directions to expose the secondary liner; and
- The secondary liner is cleaned and dried. If the secondary liner was deformed but not penetrated, the damage is repaired as described below under temporary or permanent repairs. However, if the secondary liner was penetrated, obvious contamination is removed and the underlying base materials sampled. Samples are analyzed for indicator parameters and the results compared with risk-based clean-up concentrations for these same parameters. Soils are considered clean as described in Section I.

Temporary repairs are made to provide containment until the permanent repairs can be completed. Temporary HDPE patches may be heat seamed over the damage, or held by duct tape or other appropriate materials to secure and seal the temporary patch.

Permanent repairs may be delayed because of the following conditions:

- Liner temperature is below 35° F;
- Precipitation or high humidity;
- High winds and/or dusty conditions;
- Qualified HDPE welder not available;
- Certifying engineer not available; and
- Results of soil sampling analysis not received (if secondary liner was penetrated).

All permanent repair work is performed only in the presence of the certifying engineer or inspector, using the following procedures:

- If sub-base soil was removed, it is replaced and compacted with similar materials;
- Prior to any welding repair activities, the person who is to perform the repair must make a satisfactory test weld. This test requires preparing and welding together two (2) pieces of HDPE material that are at least three (3) ft. long. Three one (1) in. wide samples are removed and tested in peel until failure. A passing test requires the sheet material to fail before the weld or to meet the tensiometer specification described in Appendix D.4.1;
- Deformations in the HDPE liner are repaired by roughening the damaged and surrounding area with sandpaper. A bead of extruded HDPE is then placed over the roughened area;
- Penetrations in the HDPE liner are patched with material of the same thickness and type as the damaged liner. The patch is cut to extend beyond the damaged area by at least four (4) in., and all corners are rounded. The liner surface and patch material are clean and dry. With the hot air gun and roller, the patch is heat seamed to the liner so the patch lies flat and without wrinkles. The surface to which the patch will be extrusion welded is roughened with sandpaper and the patch immediately welded. When the weld has cooled, a soap solution is applied to the seams, and the repair vacuum tested. Should a leak be detected, the defective weld will be roughened, re-welded, and retested. This procedure is continued until a leak free repair has been made;
- Drainage net may be reused. If required, additional net is placed over the repair to overlap underlying pieces a minimum of two (2) in. and secured with nylon cable ties;
- Geotextile fabric may be reused. If required, additional fabric is placed over the repair to overlap underlying pieces a minimum of four (4) in. and heat seamed together; and
- Granular materials and cover soils are replaced with similar materials and to the original thickness.

Upon completion and testing of the repair, the certifying engineer completes the certification repair form shown on Figure D-8.

The inspection, assessment, repair, and testing of the damaged liner system will be documented on the Liner System Repair Report form shown on Figure D-9. The repaired area may then be returned to service.

D.6.h Surface Water Management Plan

The main elements of the system include diversion and interceptor channels, diversion berms, pipe culverts, storm drain inlets (catch basins), the gravel-amended erosion protection layer of the Cell 14, Cell 15, and Cell 16 final ET cover systems, surface impoundments, including two (2) Collection Ponds (Nos. 1 and 3) and the Evaporation Pond. The constructed Surface Drainage System will be maintained to ensure proper functioning throughout the operating life of the facility.

D.6.i Control of Wind Dispersal

D.6.i.(1) Control of Wind Dispersal - Landfill

Within the landfill, to prevent wind dispersal, all bulk materials within the working face and other wastes susceptible to such dispersion are covered with soil, non-hazardous waste (solid), or an asphaltic emulsion, as necessary, before the close of business on the day of disposal. Dust suppressants (typically polymers) may also be used to assist in dust control. Such materials are applied by a water truck equipped with spray nozzles.

The EPA has provided numerous guidance documents that allow the use of non-hazardous liquids for dust suppression within landfills. These activities would be performed to meet USEI's general site conditions to control fugitive emissions found in the facility's air permit (e.g., opacity). Prior to the beneficial use of non-hazardous liquids within the landfill, the WPF will be reviewed with the DEQ for concurrence.

The utilization of non-hazardous liquids for dust control activities will be performed in a manner that prevents the accumulation of recoverable liquids (i.e., ponding) within the footprint of the landfill in question. USEI utilizes a spray bar that evenly distributes the liquid across the designated area. By spreading the liquid evenly it is possible to limit the accumulation of liquids during dust control activities. Also, dust control activities are conducted when weather conditions are conducive to this form of dust control (e.g, not raining, freezing, etc.).

D.6.i.(2) Control of Wind Dispersal – Landfill Haul Roads

Water and nonhazardous liquids or other forms of dust suppressants, such as polymers and magnesium chloride, may also be used for dust control on landfill haul roads. Prior to the beneficial use of non-hazardous liquids within the landfill, the WPF will be reviewed with the DEQ for concurrence. As described above (Section D.6.i.(1)), non-hazardous liquids will be applied under specific circumstances.

D.6.i.(3) Control of Wind Dispersal –Haul Roads- Outside of RCRA Landfill Units.

Water and/or other dust suppressants, such as polymers and magnesium chloride, may be used for dust control on non-landfill areas.

D.6.j Liquids in Landfills

D.6.j.(1) Bulk or Non-containerized Free Liquids

In accordance with 40 CFR §264.314, bulk or non-containerized liquid hazardous wastes or hazardous wastes containing free liquids are not disposed in the landfill units. The procedures to prevent bulk or non-containerized liquid hazardous waste or hazardous waste with free liquids from being placed in the landfill units are described in Section 8.6 of the WAP.

D.6.j.(2) Containers Holding Free Liquids

Containers with free liquids are not disposed in the landfill except as provided below [40 CFR §264.314(c)(1), (2), (3), or (4)]:

- The container is very small (e.g., ampule); or
- The container is designed to hold free liquids for use other than storage (e.g., battery); or
- It is a lab pack.

These containers are disposed in the landfill in a manner similar to containerized solid waste. For liquids in containers not meeting the above criteria, the free liquids are removed from the containers or the

liquids are stabilized before the container is placed in a landfill unit. If the liquid is removed from the container, then the container may be crushed.

D.6.j.(3) Restriction to Small Containers

Only small containers with liquids inside labpacks (e.g., ampules) are disposed in the landfill units.

D.6.j.(4) Non-Storage Containers

Non-storage containers may be landfilled provided they are designed to hold free liquids for use other than storage (e.g., battery, capacitor).

D.6.j.(5) Lab Packs

Lab packs (small containers of waste in over-packed containers) are placed in the landfill units in accordance with the requirements of 40 CFR §264.316. The following conditions are met before lab packs are landfilled:

- The wastes must be listed in Part A Permit Document or must be non-hazardous under RCRA regulations;
- The lab packs must be approved for acceptance in accordance with the WAP;
- The hazardous waste must be packaged in inside containers that:
 - Are securely sealed and not leaking,
 - Will not react with, be decomposed by or ignited by the contained waste, and
 - meet DOT specifications, if applicable;
- The inside containers must be over-packed in an open head DOT-specification metal shipping container of no more than 110 gallon capacity;
- Adequate absorbent material must be placed inside the over-pack to absorb the total liquid of all containers within the lab pack;
- The outside container must be full after packing with inside containers and absorbent material;
- The absorbent materials are not capable of reacting dangerously with, being decomposed by, or being ignited by the contents of the inside containers;
- Incompatible wastes must not be placed in the same outside container; and
- Reactive wastes, other than cyanide or sulfur-bearing wastes, must be treated or rendered non-reactive prior to packaging and acceptance by the facility.

D.6.k Containerized Wastes

Containers placed in the landfill disposal units are at least 90% full unless the following conditions are present:

- The container is very small, such as an ampule;
- The container is designed to hold free liquids for use other than storage (such as a battery or capacitor);
- The container is a lab pack as defined in 40 CFR §264.314; or
- The container contains micro-encapsulated debris without a lid/cover. The container may be filled to 90% with compatible non-hazardous bulk wastes, stabilized materials, or other native soils.

With the above exceptions, containers having free liquids are processed by decanting or by stabilizing the liquid portion of the waste in the container. All containers undergo a visual inspection prior to landfilling. Any containers that are less than 90% full require the addition of solid material so the volume is at least

90% full prior to landfilling. Containers not meeting the above criteria or not 90% full will be emptied and crushed, shredded, or similarly reduced in volume to the maximum practical extent before disposal.

Containers and articles placed in the landfill area are surrounded with compatible bulk wastes, stabilized material, inert waste, or soil. These surrounding materials are placed to fill void spaces between the containers. The locations of containers are recorded on a grid system for each landfill unit.

D.6.l Special Waste Management Plan for Landfills Containing Wastes F020, F021, F022, F023, F026 and F027

A Dioxins Waste Management Plan that has been approved by the IDEQ in a letter dated July 25, 1996, is used at the facility. This plan includes all of the information required under 40 CFR §264.317 and §270.21(j). This plan and a copy of the IDEQ approval letter are included in Appendix D.4.9.

D.6.m Action Leakage Rate

As Cell 5 and Cell 14, Phase 1 (sub-cells 1, 2 and 3) are not subject to the requirements of 40 CFR §§264.301(c) or (d), USEI is not required to have approved ALRs for the LDCRSs for these units. Only Cell 14, Phase 2 (sub-cells 4, 5 and 6), Cell 15 and Cell 16 are required to have approved ALRs for its LDCRS. However, as Cell 5, 14, 15, and 16 do have LDCRSs in place, the RAP does establish ALRs and response actions for these units. Section M provides the ALRs.

D.6.n Monitoring and Inspection

The active landfill area is monitored during working hours by facility personnel who routinely work within the landfill area and who continually monitor the construction, containment, and operational facets of the unit. These personnel are trained to report unusual problems to their supervisor. While the landfills are in operation, landfill inspections examine:

- Deterioration, malfunction or improper operation of run-on and run-off control systems;
- Presence of liquids in the LCRSs;
- Presence of liquids in the LDCRSs;
- Proper function of wind dispersal control systems;
- Condition of the liner;
- Areas having recently received intermediate cover;
- Areas having received final cover;
- Haul and access roads for accessibility and repairs of any damage from excessive run-off; and
- Lined areas not covered by waste and available for visual inspection.

If a problem is detected during these inspections, the inspector contacts the appropriate supervisor. The problem is then corrected in accordance with the site design, operation procedures, the permit, and applicable regulations of (40 CFR §§264.300 through 264.316).

Periodic inspections of landfill operations are also performed; items examined include:

- Monitoring wells;
- Dust conditions and control;
- Spillage on haul roads; and
- Safety and emergency response equipment.

Section F contains the frequency and details of the landfill inspection program. Post-closure inspection/monitoring of the LCRSs and LDCRSs and is described in Section I.

D.6.o Response Actions

The LDCRSs in Cells 5, 14, 15, and 16 are routinely inspected as described in Section F. In the event liquid requires removal, the following actions are taken:

- The liquid is removed using the following procedures:
 - Pump the zone dry to the extent practical;
 - Determine the volume of leachate removed;
 - Compare volume of liquid removed to the action leakage rates defined in the RAP; and
 - Initiate response actions as established in the RAP, if required.

Once removed the leachate is treated within the four (4) above ground Wastewater Tanks, described in Sections D.2 and managed as F039 on-site generated wastewater. The general wastewater treatment system operational outline is provided in Appendix D.2.5 of this Section.

D.6.p Surveying and Recordkeeping

Placed waste locations are routinely recorded in a computerized system that can produce a chart showing the location of specific waste in accordance with the requirements of 40 CFR §264.309.

An example is provided in Figure D-10 to show the location of waste placed in Cell 5, Lift C, Section B, Footage Marker 975; this waste location designation would be Cell 5C/B/975. Required records are maintained electronically and can be provided to the IDEQ and local land authorities upon request after final site closure as required under 40 CFR §264.119.

D.6.q Closure and Post-Closure Care

The landfill units will be removed from service in a sequential manner. Section I provides details on the closure procedures for the landfill units.

D.6.r Special Requirements for Ignitable or Reactive Waste

Hazardous wastes that are ignitable or reactive are not placed in the landfills, unless the provisions of IDAPA 58.01.05.008 (40 CFR §264.312(b) and 264.17) are met. Hazardous wastes exhibiting these characteristics are treated and rendered non-ignitable or non-reactive prior to land disposal. Waste acceptance and testing procedures to identify these wastes and to determine the adequacy of treatment are presented in the WAP.

D.6.s Special Requirements for Incompatible Wastes

Wastes and materials that are potentially incompatible according to the WAP are not placed in the same landfill cell unless in compliance with IDAPA 58.01.05.008 (40 CFR §264.17(c), 264.17(b) and 264.313). Procedures for compliance with those requirements include the placement of clean fill or non-reactive material between incompatible waste materials to prevent adverse reactions. Waste acceptance and testing procedures to determine the chemical compatibility of wastes to be landfilled are presented in the WAP.

D.6.t Landfill Operating Practice

D.6.t.(1) General Landfilling Procedures

The Cell Liner System (bottom and side slope) for Cell 5 and 14 were protected from waste transport vehicles and placement equipment, with 12 to 18 inches of leachate collection zone sand overlain with a six (6) inch-thick protective soil layer. The sideslope liner system is protected as the waste level rises. This was accomplished by overlaying the synthetic drainage net leachate collection system with a layer of geotextile, filter fabric and two (2) feet of soil or waste which has a soil-like consistency, which is free of sharp objects that could puncture the net or liner. Careful operating procedures, during placement of this material were used in order to prevent damage by operating equipment. Proper construction of this buffer is the key to protection of the liner system.

Each lift will be covered by the close of business on the day of disposal, with a minimum of four (4) inches of clean soil, asphaltic emulsion or equivalent as described in Section D.6.i.

For Cell 14, as waste placement operations approached the top of the below-grade liner system, clean soil perimeter dikes were constructed to provide for waste and runoff containment. These dikes were constructed in stages, varying in height from zero (0) to six (6) feet, with a top width of 10 feet, an exterior slope of three (3) horizontal to one (1) vertical, and an interior slope of 1.5 horizontal to one (1) vertical (see Figure D-11). Each lift of soil dike was compacted to 90% of the standard proctor density. Density tests were performed at the rate of 1 per 10,000 square feet of lift, to ensure the specified compaction was achieved.

USEI maintains stockpiles of clean native soils, which were excavated during construction of the Landfills. This material is used, as necessary, for cover, construction of the above-grade containments dikes, and to provide clean access roads. The clean soil is transported and applied using construction equipment and compacted with the hauling and spreading equipment, which readily achieves a minimum of 85% of the standard Proctor density. The permeability of the cover soil is adequate to promote drainage through the landfill.

The liner systems for Cell 15 and Cell 16 (bottom and side slopes) are protected from waste transport and placement equipment with a 30 inch layer of frost protection materials. The Cell 15 and Cell 16 design does not include the construction of perimeter dikes for runoff containment. Appendix D.3.1 (Section 7.0) provides more detailed landfilling procedures for Cell 15.

Tanks are disposed in the landfill units in accordance with the liner clearance restrictions for containers. The exact disposal location within the landfill is dependent on tank size, operations, and interference with run-off controls. Once the tank is positioned, it is crushed or filled to 90% of its volume, with solid structural material. Bulk solid non-hazardous waste, stabilized waste, or soil, are placed around the tank. The facility maintains stockpiles of clean soils. This material is used, as necessary, for cover, above-grade containment dikes, and access roads.

Extreme care will be taken while transporting and disposing of encapsulated material to avoid any rips and/or tears to the encapsulate material. The macro-encapsulated load will use cover or backfill material with specifications similar to the select waste that will be used to protect the landfill liner system during construction (See Cell 15 design, Appendix D.3.1). This select backfill will have a maximum particle size of three (3) inches and will be free of debris or any object that may damage the encapsulated material liner.

To help protect encapsulate, debris will be "wrapped" or "coated" in a way that minimizes the amount of encapsulate material that is not supported by the physical form of the debris (i.e., void between debris and encapsulate). Otherwise, the void will be filled with an appropriate filler material that will provide the support, if necessary. Depending on the shape of the debris it may be advantageous to use a loose wrap in certain areas to account for expected pressures from waste placement operations (i.e., weight of overburden). Debris comes in many shapes and sizes and as a result, a combination of these types of precautions may be necessary. The primary objective of these procedures is to avoid damage of encapsulate material resulting from the pressure generated by waste placement operations.

Once placed in the landfill and prior to backfill the liner of the encapsulated material will be inspected for conformance with 40 CFR §268.45. If defects are noted they will be repaired as necessary prior to backfilling.

D.6.t.(2) Transport Vehicle Unloading and Waste Placement Procedures

D.6.t.(2)(a) Bulk Solid or Stabilized Waste

Bulk solid or stabilized wastes are unloaded at the active face within the landfill units. Bulk wastes unloaded at the active area of the landfill units are spread along the working face with a bulldozer, loader or other appropriate compaction equipment.

D.6.t.(2)(b) Containerized Solid Waste and Articles

Containers are placed in the landfill units after verification that they contain no free liquids, unless the provisions of 40 CFR §264.314 are satisfied, and are at least 90% full. Containers may be placed in the landfill units either on their sides or vertically. Bulk solid waste or soil is backfilled over and around the containers to fill void spaces. Closed containers, articles (TSCA regulated wastes) and micro/macro-encapsulated wastes do not require daily cover for prevention of wind dispersion since there is no potential for wind dispersion.

For protection of the liner system, containers, drums and other articles are placed at least two (2) ft. from the side slope and a minimum of 18 in. above the base. Above grade, the drums, containers, and other articles may be placed adjacent to the interior slope of the above-grade soil containment dikes. Sufficient space to place bulk solid, stabilized waste, or fill around the drums or articles is provided prior to disposal.

D.6.t.(2)(c) Macro-Encapsulated Hazardous Waste Debris

All containers of macro-encapsulated hazardous debris are maintained a minimum of five (5) ft. from the centerline of collection pipes, as shown on Drawing #PRMI-L22 until at least five (5) ft. of material is between the containers and the pipes. The operator(s) confirm the appropriate placement of the boxes of macro-encapsulated hazardous debris through use of the length and width markers. The disposal coordinates are documented on the ICF. Macro-encapsulation is conducted as described in Section D.10.c.

D.6.t.(2)(d) Lift Sizes

During waste placement operations, lift sizes will range from zero (0) to six (6) feet. Larger debris or other non-hazardous material (e.g., non-hazardous debris) may exceed six (6) feet. Final lift size for debris like material will be dependent on the size of material.

D.11 Interim Processing Loads

Interim Processing loads are loads of treated waste awaiting results from post-treatment testing. The conditions for the management of interim processing of treated waste materials are as follows:

Treated waste awaiting post-treatment analysis is staged in rolloff containers in Container Storage Area 1 (CSA 1).

D.11.a Containment/Control

Treated material shall be capable of passing the paint filter test. All rolloff bins of treated waste awaiting analysis must be covered.

D.11.b Marking

Each batch placed shall be permanently marked (for the duration of interim processing) with the following minimum information:

- A. Date and Time Placed
- B. ICF Number(s) and/or Batch Number(s)
- C. Compatibility Group
- D. Approximate Weight
- E. Hazardous Waste Label

D.11.c Tracking

Each batch shall have all permit required information available and retrievable for identification while in interim processing (e.g., manifest, WSID, ICF, lab data, etc.).

D.11.d Reporting Requirements

All batches of waste treated for LDR requirements that are tested and fail to meet required treatment standards shall be maintained in the operating record. Reporting of treated loads failing to meet LDR requirements is no longer required since treated loads are no longer staged in Cell 14 while awaiting post treatment testing results, as they were in the past.

D.11.e Inspection

Inspections of CSA 1 and required conditions of staged waste containers are part of the daily inspection (Section F).

Table D-3 – Landfill Capacities

Cell/ Trench Designation	Approximate Dimensions (ft)	Approximate Total Capacity (yd³)	Approximate Remaining Capacity (yd³)
5	200 x 1,110	240,000	None
10	100 x 1,300	77,000	None
11	120 x 1,700	345,000	None
14	1,040 x 1,750	2,102,000	111,000
15	768 x 2,260	4,800,000	706,000
16	1,150 x 2,800	10,262,000	8,793,000

NOTE: All capacities include above-grade capacities. Remaining capacities are as of May 31, 2015.

Figure D-8 - Typical Certification of Liner System Repair Form

CERTIFICATION OF LINER SYSTEM REPAIR
FOR
US ECOLOGY IDAHO, INC.
GRAND VIEW, IDAHO

WASTE MANAGEMENT UNIT:
LOCATION OF REPAIR:

(TYPED OR PRINTED NAME OF QUALIFIED ENGINEER)

_____ HEREBY CERTIFY THAT BASED ON MY
OBSERVATIONS AND TESTING, THE REPAIR OF THE LINER SYSTEM MEETS THE DESIGN
SPECIFICATIONS APPROVED IN THE PART B PERMIT.

(SIGNATURE OF QUALIFIED ENGINEER AND DATE)

(SEAL)

Figure D-9 - Typical Liner System Repair Report Form

LINER SYSTEM REPAIR REPORT

I. INCIDENT

DATE: _____
WEATHER: _____
UNIT: _____
LOCATION: _____
EXTENT OF DAMAGE: _____

DID WASTE PENETRATE PRIMARY LINER? YES___ NO___
DID WASTE PENETRATE SECONDARY LINER? YES___ NO___

DESCRIBE TEMPORARY REPAIR: _____

REPORTED BY: _____

II. REPAIR

DATE: _____
WEATHER: _____
NAME OF WELDER: _____
TEST WELD: PASS_____ FAIL_____

DESCRIBE REPAIR: _____

TESTING OF REPAIR: _____

ATTACH COPY OF AS BUILT DRAWING INDICATING LOCATION OF REPAIR

REPAIR DOCUMENTED BY: _____

Figure D-10 - Waste Locator System

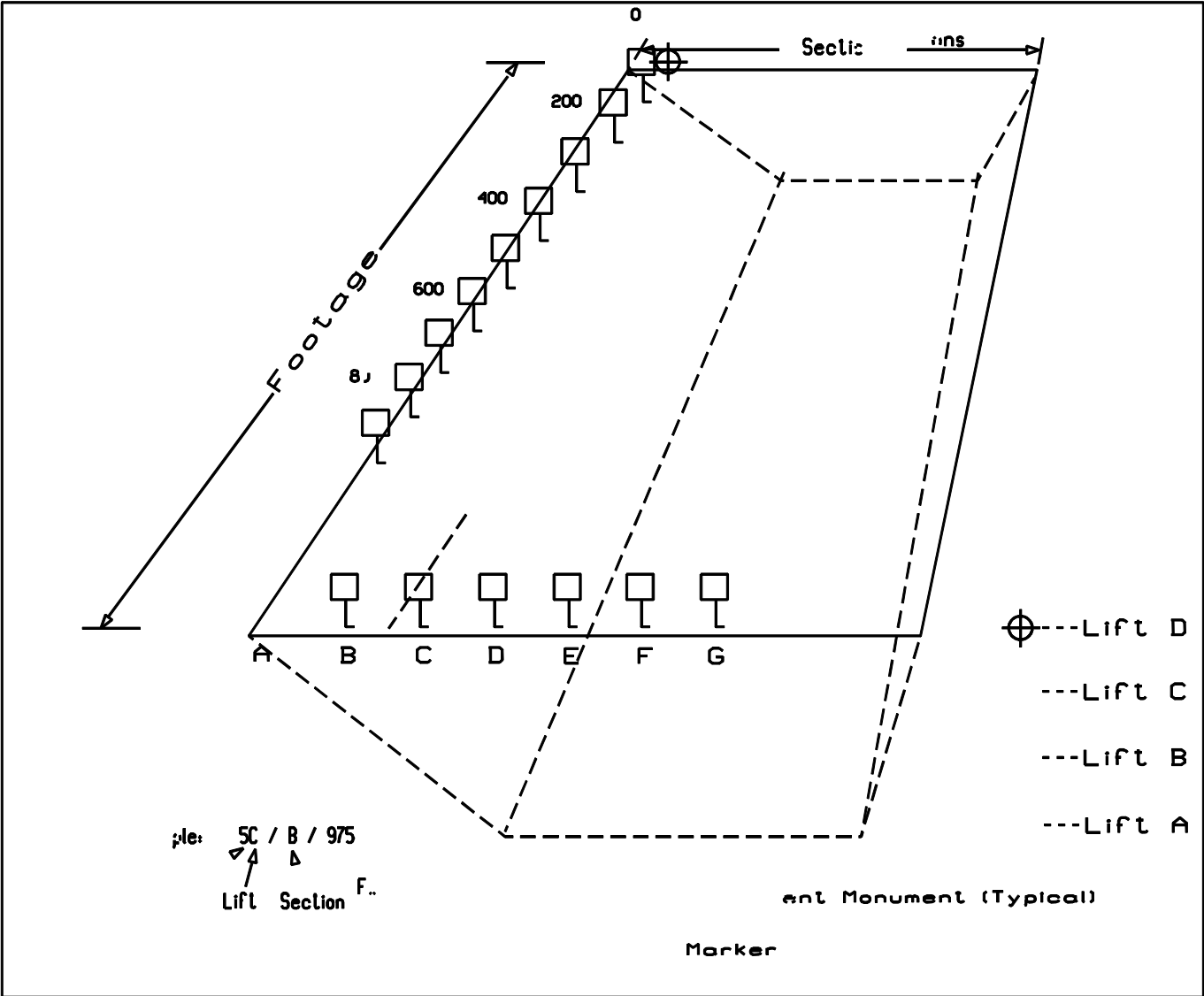
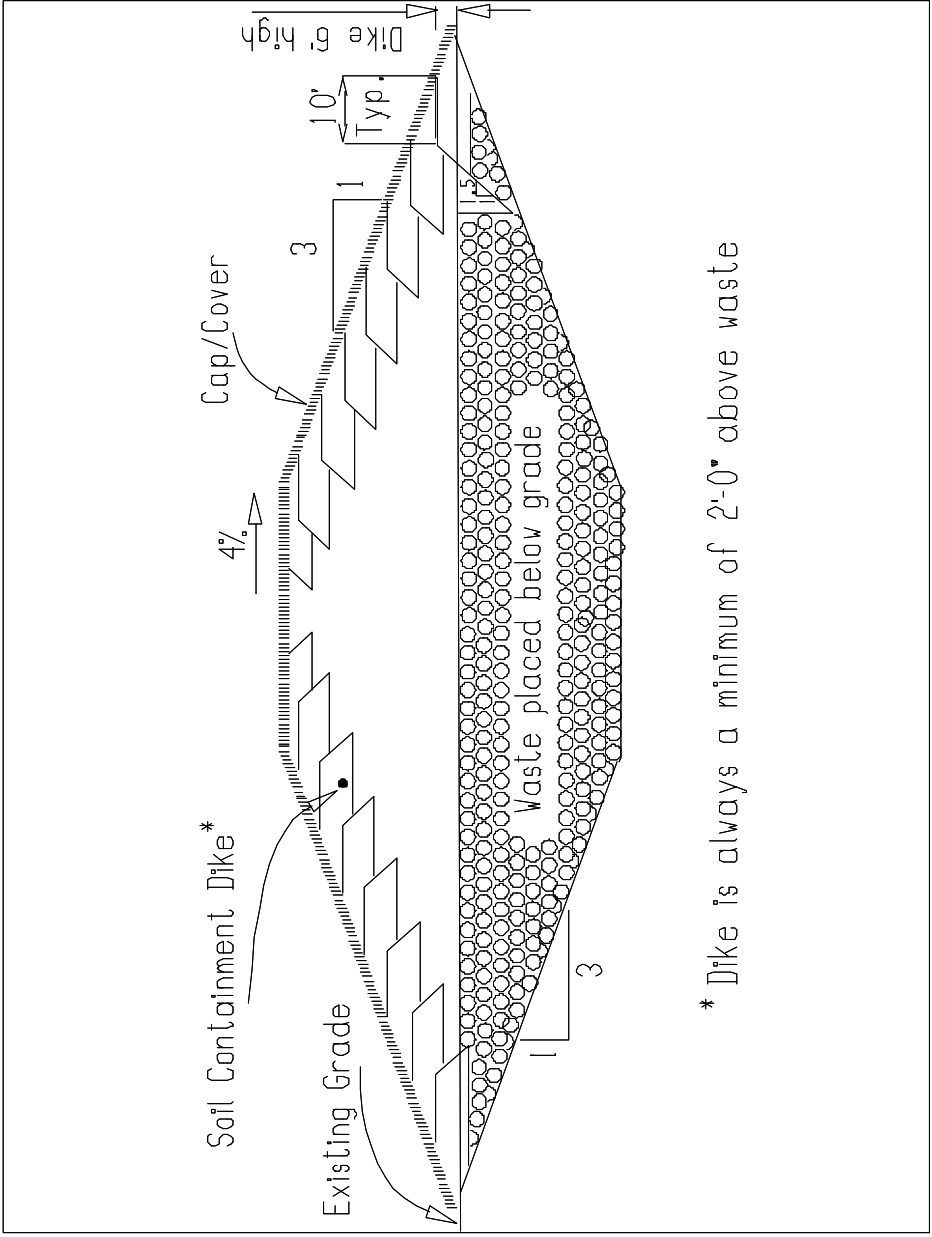


Figure D-11 - Typical Cross Section of Above-Grade Containment Dikes
Cell-14



Not To Scale