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USACE / NAVFAC / AFCEC **UFGS-02 66 13 (February 2025)**

Preparing Activity: USACE **Superseding**
UFGS-02 66 13 (February 2021)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2026
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SELECT FILL AND TOPSOIL FOR LANDFILL COVER

02/25

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SECTION 02 66 13

SELECT FILL AND TOPSOIL FOR LANDFILL COVER
02/25

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NOTE: This guide specification covers the requirements for select fill and topsoil layers for landfill cover systems. Select fill is the term used to describe soil layers (other than low permeability clay barrier layers placed above a gas collection layer) placed directly on geosynthetic materials.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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PART 1 GENERAL

1.1 UNIT PRICES

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NOTE: These paragraphs should be edited based on whether the contract will use a single job price or unit prices. If there is a separate Measurement and Payment section, edited versions of these paragraphs should be inserted in that section.

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Base measurement and payment for "select fill" and "topsoil" on the

respective unit prices for each cubic meter cubic yard of "select fill" and "topsoil" in place. Include the cost for development of borrow sources, cost of materials, excavation, hauling, equipment, placement, testing, and other work required to construct the "select fill" or "topsoil" layers in the unit cost.

1.2 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D698	(2012; R 2021) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2216	(2019) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2487	(2017; R 2025) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification

	System)
ASTM D2488	(2017; E 2018) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D2974	(2020; E 2020) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4972	(2018) Standard Test Methods for pH of Soils
ASTM D6913/D6913M	(2017) Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E329	(2025b) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)	
ISO/IEC 17025	(2017) General Requirements for the Competence of Testing and Calibration Laboratories
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)	
EPA 505-B-04-900A	(2005) Intergovernmental Data Quality Task Force - Uniform Federal Policy for Quality Assurance Project Plans: Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP Manual
EPA SW-846	(Third Edition; Update VII) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods
UFP-QAPP WKSTS	(2012) Intergovernmental Data Quality Task Force - Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets

1.3 SYSTEM DESCRIPTION

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NOTE: Describe other components of the cover system and reference specification Sections that contain the requirements for these components. Other

specification sections that may be included in a landfill cover project are: 02 56 13.13 GEOMEMBRANE WASTE CONTAINMENT, 02 56 13.19 GEOSYNTHETIC CLAY LINER WASTE CONTAINMENT, 02 66 13 SELECT FILL AND TOPSOIL FOR LANDFILL COVER, and 02 66 16 TEST FILL.

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Construct a landfill cover consisting of [_____] mm [_____] inch thick layer of compacted select fill covered by a [_____] mm [_____] inch thick layer of topsoil.

[1.4 PRE-INSTALLATION MEETING

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NOTE: Delete this paragraph if a separate specification section is developed for the entire project to cover pre-installation meetings and other administrative requirements. Test(DJB)

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Conduct a pre-installation meeting at the jobsite[at least five business days prior to the start of earthwork operations on the project][_____]. The pre-installation meeting is to be arranged by the Contractor and is to follow the written pre-installation meeting agenda submitted prior to the meeting. The purpose of this meeting is to review the requirements of this specification and the associated plans. The following individuals must be in attendance at this meeting: Contractor's Project Manager and Project Superintendent, earthwork subcontractor's Project Manager and Site Foreman, Contractor's Geotechnical Engineer and Testing Agency, Government Geotechnical Engineer and Civil Engineer, and Government Construction Manager and Engineering Technician.

Record pre-installation meeting minutes and publish via email within 48 hours to all attendees. The minutes must be re-published within 48 hours via email pending any subsequent comments from the attendees.

]1.5 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the

District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Pre-Installation Meeting Agenda

Pre-Installation Meeting Minutes; G, [_____]

Materials Handling Plan; G [_____]

Borrow Source Assessment Report; G, [_____]

SD-04 Samples

Select Fill

Topsoil

SD-06 Test Reports

Water Supply Analysis

Select Fill and Topsoil Material Tests

Moisture Content and Density Tests of In-Place Select Fill

Geotechnical Evaluation Report; G, [_____]

SD-07 Certificates

Qualifications; G, [_____]

Certificate Of Subgrade Acceptance; G, [_____]

1.6 QUALITY CONTROL

1.6.1 Regulatory Requirements

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NOTE: Regulatory requirements will be location specific and may include local ordinances and State

regulatory requirements. At a minimum, an approved Soil Erosion and Sediment Control Plan will be required by the local Soil Conservation District.

For sites addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), administrative permit requirements for on-site activities are not required, though the substantive requirements may need to be met. The permits or permit equivalents may include those addressing air emissions, water discharge, stormwater pollution prevention, and possibly others. Permitting requirements known to have substantive requirements should be listed here. If permit requirements are covered in other specifications, such as 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, delete this section.

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Obtain all State and Local [permits][permit equivalents] required to perform the work.

1.6.2 Qualifications

1.6.2.1 Geotechnical Engineer

Provide a Professional Geotechnical Engineer licensed in the[applicable jurisdiction][state that work is being performed] to provide inspection of the select fill layer and topsoil layer throughout construction. The Geotechnical Engineer must have [five][_____] years of experience in design, construction, Quality [Assurance][Control], or certification of [landfill][dump] liners or covers. The Geotechnical Engineer is responsible for performing pre-construction, periodic during construction, and final at completion of construction site visits to inspect and [approve][certify] that the select fill and topsoil layers meet specifications. The Geotechnical Engineer is responsible for preparing and updating the Materials Handling Plan and Borrow Source Assessment Report as construction progresses to reflect changing conditions and submit updated plans if necessary. Submit a [monthly][_____] Geotechnical Evaluation Report, informing the Contractor and Contracting Officer of the status of the plans and an accounting of the Contractor's adherence to the plans addressing any present or potential problems. The Contractor is responsible for arranging meetings with the Geotechnical Engineer and Contracting Officer throughout the contract duration.

1.6.2.2 Qualified Technician

Provide a Qualified Technician to inspect, monitor, sample, and perform field testing. The technician qualifications need to be one of the following: a current National Institute for Certification in Engineering Technologies (NICET) Level II minimum certification in Construction Materials Testing Soils; Professional Civil or Geotechnical Engineer with minimum [two][_____] years of experience in design, construction, Quality [Assurance][Control], or certification of [landfill][dump] liners or caps.

1.6.2.3 Lab Validation

Perform testing by an accredited commercial testing laboratory meeting the

requirements listed below. Items a. through c. apply to testing laboratories used for soil geotechnical testing (all tests other than chemical contamination tests). Item d. applies to testing laboratories used for chemical contamination tests. Submit testing laboratory validation for the testing to be performed. Do not permit work requiring testing until the Contracting Officer approves use of the testing laboratory.

a. Comply with applicable requirements of ASTM E329

b. Testing laboratory must be licensed to operate in the State of [_____]. Third party laboratory testing must be conducted by a laboratory either validated by the USACE Materials Testing Center or have an AASHTO Materials Reference Laboratory (AMRL) certification for the required tests.

c. Testing equipment used by laboratory must be calibrated at maximum intervals of twelve months by devices of accuracy traceable to one of the following: NIST Standard Reference Materials, ISO/IEC 17025, certified by state or local bureau.

d. Perform the testing in paragraph CHEMICAL CONTAMINATION TESTING by a DoD Environmental Laboratory Accreditation Program (DoD ELAP) accredited commercial testing laboratory meeting the requirements of[Section 01 45 00 QUALITY CONTROL][_____] and approved by the Contracting Officer. Submit testing laboratory validation for the testing to be performed. Do not permit work requiring testing until the Contracting Officer approves use of the testing laboratory.

1.7 DELIVERY, STORAGE, AND HANDLING

1.7.1 Delivery

Deliver select fill and topsoil to the site in trucks that meet all local, state, and federal transportation regulations[and have added containment of material in the form of a fabric cover to prevent spillage].

1.7.2 Storage

Store select fill and topsoil in stockpiles. Keep stockpiles separate and in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations. Protect stockpiles from contamination from unsuitable materials, including but not limited to soils not meeting the definition of Select Fill or Topsoil defined in this specification, volunteer vegetation growth, or windblow waste [material][debris], which may destroy the quality and fitness of the select fill and topsoil materials. If the Contractor fails to protect the stockpiles, and any select fill or topsoil material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources. Unsatisfactory materials include materials which do not comply with the requirements for satisfactory materials in this section, and also include man-made fills, trash, refuse, backfills from previous construction, roots, and other organic matter or frozen material. Do not place stockpiles on prepared subgrade, any select fill lifts, or topsoil lifts. Place a[geotextile][geocomposite][_____] beneath stockpiles and between stockpiles of dissimilar material to keep materials separated. Provide stormwater sediment and erosion controls in accordance with[Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS][_____]. Do not allow water to

pond in the stockpile areas.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Environmental Requirements

Do not install the select fill or topsoil when temperatures are below freezing or during precipitation events. Any relaxation of this requirement must be approved by the Contracting Officer.

1.8.2 Existing Conditions

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NOTE: Existing conditions are site specific and are generally shown on the plans and provided in design or investigation documents prepared for the site. If there are specific conditions the Contractor should be made aware of that are contained in plans or documents provided, describe here.

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The existing site conditions are presented[in Appendix [_____]][on the plans]. Immediately notify the Contracting Officer if there are discrepancies between the existing site conditions as presented and field conditions discovered during execution.

PART 2 PRODUCTS

2.1 EQUIPMENT

Use equipment to place the select fill and topsoil layers as described in the approved Materials Handling Plan. The ground pressure of the equipment must be no greater than [49][_____] kPa [7][_____] psi. Do not operate equipment by accelerating or braking suddenly, turning sharply, or traveling at speeds exceeding 8 km per hour 5.0 miles per hour.

2.2 MATERIALS

2.2.1 Select Fill

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NOTE: The default maximum allowable particle size is 25 mm 1 inch. The maximum particle size should be reduced to 13 mm 0.5 inches in the select fill layer to prevent puncturing of the geomembrane if the select fill layer is placed directly on top of a geomembrane. Manufacturers should be consulted for recommendations on select fill maximum allowable particle size when select fill is placed on top of other geosynthetics.

Selection of suitable select fill should be based on the type and availability of soils at or close to the site. The designer must verify that these soils will not clog underlying drainage layers. The soil types listed in Table 1 are generally acceptable for use as select fill.

Sands must be analyzed to ensure they are internally

stable. A soil is internally stable if it is self-filtering (i.e., the fine particles do not move through the pores of the coarser fraction). Federal Highway Administration Publication No. FHWA-HI-95-038 describes procedures for determining the clogging potential and internal stability of soil.

The Design Engineer must also ensure the select fill is compatible with the underlying filter. For landfill applications, the filter is typically a geotextile. Filter design is based on a comparison of the grain size distribution (ASTM D7928) of the select fill and the apparent opening size (AOS) of the underlying geotextile. Geotextile filter design procedures are outlined in Federal Highway Administration Publication No. FHWA-HI-95-038.

Criteria for Atterberg limits are sometimes included in Table 1 to control the properties of the select fill.

Hydraulic conductivity criteria may also need to be added to Table 1 for the select fill soil. The hydraulic conductivity of the select fill layer controls the rate at which precipitation infiltrates into the underlying drainage layer.

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Provide select fill in compliance with the criteria listed in Table 1 and free of debris, frozen materials, angular rocks, roots, and organics. Submit a minimum of 23 kg 50 pounds of select fill from each proposed borrow source to the Government at least [15][_____] business days prior to placement; this material is for possible Government Quality Assurance testing and not the Quality Control testing required by the Contractor.

2.2.2 Topsoil

Provide topsoil consisting of natural, friable soil that is representative of soils in the vicinity which produce heavy growths of crops, grass, or other vegetation and is reasonably free from underlying subsoil, clay lumps, objectionable weeds, litter, brush, matted roots, toxic substances, or any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations as determined by the Geotechnical Engineer, Qualified Technician [, or Government Quality Assurance Representative]. Submit a minimum of 2 kg 5 pounds of topsoil from each proposed borrow source to the Government at least [15][_____] business days prior to placement; this material is for possible Government Quality Assurance testing and not the Quality Control testing required by the Contractor. Also, provide topsoil complying with the criteria listed in Table 1.

TABLE 1 - REQUIRED PHYSICAL PROPERTIES OF SELECT FILL AND TOPSOIL		
PROPERTY	TEST VALUE	TEST METHOD
Select Fill		
Soil classification	Lean clay (CL) Clayey sand (SC) Clayey gravel (GC) [_____]	ASTM D2487
Percent Passing 0.075-um (No. 200 sieve)	[_____]	ASTM D1140
Maximum Liquid Limit	[50][_____]	ASTM D4318
Plastic Limit	[_____]	ASTM D4318
Plastic Index	[_____]	ASTM D4318
Max. particle size	[25][_____] mm [1.0][_____] inch	ASTM D6913/D6913M
In Contact with Geomembrane Max. particle size	[13][_____] mm [1/2][_____] inch	ASTM D6913/D6913M
Topsoil		
Max. particle size	[25][_____] mm [1.0][_____] inch	ASTM D6913/D6913M
Soil Classification	[_____]	ASTM D2487
pH	[5-7] [_____]	ASTM D4972
Organic content (percent)	[5-20] [_____]	ASTM D2974

2.2.3 Water

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NOTE: Two options are provided. The first option is to only allow the Contractor to use potable water. The second option allows the Contractor to use non-potable water, but includes a testing requirement to limit the chance that the Contractor supplies a water that could introduce contaminants into the select fill or topsoil layers. The first option is simpler, but could lead to higher project costs if the volume of water needed is significant and/or potable water sources are not readily available. When specifying the criterion to be met for water, the Designer should consider if there are other standards which are more appropriate for the specific project (e.g. state groundwater cleanup

criteria).

****

Supply water used to increase moisture content of the select fill and topsoil layers for the sake of compaction during installation. Maintain an accurate record of water usage.[Use only potable water from a regulated public water system.][If non-potable water is to be used, provide water that does not contain oils, acids, salts, alkalis, organic matter, solids or other substances at concentrations that could be detrimental. Also characterize non-potable water prior to its use by collecting a sample from the water source and analyzing according to Table 2. Submit a Water Supply Analysis demonstrating that water meets requirements.

TABLE 2 - MOISTURE CONDITIONING AND DUST CONTROL WATER CRITERIA		
ANALYTICAL METHOD NUMBER (From EPA SW-846; use current version)	ANALYSIS TYPE	CRITERIA TO BE MET
6010 [and 7470A]	Metals [and Mercury]	[Less than Maximum Contaminant Level (MCL)] [_____]
8260	Volatile Organics	
8270	Semi-volatile Organics	
8082	PCBs	
1633	PFAS	
8081	Pesticides	
Within each Analytical Method, only analyze for analytes which have an [MCL][_____].		

]

2.3 TESTS, INSPECTION, AND VERIFICATIONS

2.3.1 Select Fill

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NOTE: Shear strength testing is often required for landfill covers and liners which contain geosynthetics. Testing should be conducted on all potential slip interfaces. Criteria for shear strength testing (also referred to as interface friction testing)are described in Section 02 56 13.13 GEOMEMBRANE WASTE CONTAINMENT or Section 02 56 13.19 GEOSYNTHETIC CLAY LINER WASTE CONTAINMENT.

If hydraulic conductivity of the select fill layer needs to be specified based on the design, requirements from Section 02 56 13.16 CLAY WASTE CONTAINMENT can be incorporated into this section.

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Use[test pits][borings] placed in a grid pattern to characterize each proposed borrow source. Extend the[test pits][borings] to the full depth of the proposed borrow source. Perform visual classification as

described in ASTM D2488 over the full depth of each[test pit][boring] by the[Geotechnical Engineer described in paragraph GEOTECHNICAL ENGINEER][Qualified Technician described in paragraph QUALIFIED TECHNICIAN]. Group soils into "principal types" based on visual classification.

2.3.1.1 Classification Testing

Perform borrow source assessment tests on each principal type and combination of materials proposed for use in the select fill layer to ensure compliance with specified requirements. Perform one set of borrow assessment tests for each [400][_____] cubic meters [500][_____] cubic yards of each soil type and borrow source proposed for use; test for the select fill properties listed in Table 1. Perform at least three borrow assessment tests for each soil type and borrow source. Based on borrow source assessment testing, classify soils in accordance with ASTM D2487.

2.3.1.2 Moisture-Density (Compaction) Testing

Test a representative sample from each principal type and combination of borrow materials to establish compaction curves using ASTM D698. Perform one compaction test for each [400][_____] cubic meters [500][_____] cubic yards of each borrow source proposed. Perform at least three compaction tests for each soil type and borrow source. Use a minimum of [five][_____] points to develop each compaction curve. During construction, conform to the following requirements for placement of select fill:

a. Minimum allowable dry density less than [90][_____] percent of maximum dry density is not acceptable.

b. The allowable moisture content range must be [+/-3][_____] percent of optimum.

2.3.2 Topsoil

Test representative samples of each principal type and combination of topsoil materials. Perform one set of tests for each [400][_____] cubic meters [500][_____] cubic yards of each borrow source proposed; test for the topsoil properties listed in Table 1. Perform at least three sets of tests for each borrow source. Based on borrow source assessment testing, classify soils in accordance with ASTM D2487.

2.3.3 Chemical Contamination Testing

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NOTE: This section includes a requirement to prepare a UFP-QAPP to define chemical contamination testing. Alternatively, this section may reference a separate specification section in the project requiring preparation of a UFP-QAPP. If that is the case, ensure that UFP-QAPP requirements from this section are appropriately incorporated into the separate specification section.

Suggested chemical analyses, sampling frequency, sample collection methods, and chemical concentration screening level standards are included as optional requirements to be considered in the UFP-QAPP. The Designer can include more specific

requirements in the list of UFP-QAPP elements to be addressed. Individual states where work is being completed may have requirements that should also be considered.

The Designer should take care that requirements are not too strict for what is considered "clean" soils. Natural and anthropogenic background concentrations of chemicals should be considered in addition to health-based screening levels defined by regulatory agencies. The Designer may wish to use alternative methods instead of conducting project-specific specific chemical contamination testing; alternative methods could include using previously approved borrow sources where chemical contamination testing has already been conducted or using borrow sources where chemical contamination is not suspected based on knowledge of land use, etc .

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2.3.3.1 Uniform Federal Policy Quality Assurance Project Plan

Prepare a Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) in accordance with the requirements set forth in EPA 505-B-04-900A and using the UFP-QAPP WKSTS. Submit the UFP-QAPP within [30][_____] calendar days after notice to proceed. Do not perform chemical contamination testing until the UFP-QAPP is approved. Prepare[draft for Government review][draft-final for[regulatory][_____] review] and final versions of the UFP-QAPP. Allow [30][_____] calendar days for[Government] review[and [30][_____] calendar days for regulatory review]. Allow [45][_____] calendar days for comment resolution following each review and preparing the next version of the document. Tailor the content to the requirements of the project and the site conditions. The UFP-QAPP must specifically address the following elements:

a. Chemical analyses: Specify the chemicals to be analyzed in each sample.[At minimum the following analyses must be included:[target compound list volatile organic compounds][target compound list semi-volatile organic compounds][target analyte list metals][pesticides/polychlorinated biphenyls][_____].]

b. Acceptable chemical concentrations for the select fill and topsoil layer soils.[At minimum the following standards must be considered:[U.S. Environmental Protection Agency Regional Screening Levels][state-specific screening levels defined at [_____]][background chemical concentrations defined at [_____].]]

c. Chemical contamination sampling frequency. Assume a minimum sampling frequency of one sample for every [2,000][_____] cubic meters [2,500][_____] cubic yards of select fill and topsoil brought on site. Consider other sampling frequency requirements such as state regulations or guidance.

d. Sample collection method (e.g. discrete grabs, composites, incremental samples).

e. Borrow source chemical contamination acceptance criteria, indicating how sample results will be compared to acceptable chemical

concentrations to determine if the borrow source is acceptable (e.g. each sample must meet acceptable concentrations, average of samples must meet acceptable concentrations).

2.3.3.2 Chemical Contamination Sampling and Analysis

Sample and analyze each principal type and combination of select fill and topsoil from each proposed borrow source for chemical contamination in accordance with [the UFP-QAPP][_____]. Any deviations to sampling frequency, number of samples, or sample collection methods must be[established in the approved[UFP-QAPP][_____]][approved by the Contracting Officer].

2.3.4 Borrow Source Assessment Report

Submit a Borrow Source Assessment Report at least [15][_____] business days prior to select fill and topsoil placement. Do not place select fill or topsoil until the Borrow Source Assessment Report is approved. Include the following in the report:

a. Location of each borrow source.

b. Plan view and estimated quantity of borrow available.

c. Locations and logs of subsurface explorations.

d. Laboratory test results.

e. Chemical testing data demonstrating that select fill and topsoil is acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Select Fill Layer Subgrade

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NOTE: Subgrade for the select fill layer should consist of a geosynthetic. The following paragraph includes a requirement for completing a Certificate of Subgrade Acceptance; this activity ensures that soils are not placed over a geosynthetic that has not been fully inspected, tested, and determined to meet requirements.

****

Each day during placement of the select fill layer, the Qualified Technician[and Government QA representative] must inspect the subgrade geosynthetic to verify it is acceptable for placement of the select fill layer. Submit a Certificate of Subgrade Acceptance each day that the select fill layer is placed. Examine the subgrade for compliance with the items in the list below:

a. A project-qualified land surveyor has verified the lines and grades of the subgrade meet project design.

b. All construction quality control and construction quality assurance of the underlying geosynthetics has been completed and results have been

accepted by the Contracting Officer.

c. The subgrade is free of irregularities, protrusions, loose soil, and abrupt changes in grade.

d. All tools, equipment, and temporary covers have been removed from the geosynthetic.

3.1.2 Topsoil Subgrade

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NOTE: Subgrade for the topsoil layer will either be select fill or common fill. If subgrade is not suitable to install the topsoil layer, require the subgrade to be reworked in accordance with the Specification Section that addresses subgrade preparation. The Certificate of Subgrade Acceptance is provided as an optional requirement for the topsoil layer as it is deemed less essential than for the select fill layer. Requiring this submittal creates more work for the Contractor's Quality Control program and Government's Quality Assurance activity; however it provides a checkpoint to verify that QA/QC testing has been performed on the subgrade or previously installed select fill lifts, limiting the chance for re-work.

****

Inspect the topsoil layer subgrade to verify it is acceptable for placement of the topsoil layer. The subgrade must be free of vegetation and ruts and must not be wet or frozen. If subgrade is not suitable to place the topsoil layer, rework subgrade in accordance with this section.[Submit a Certificate of Subgrade Acceptance completed by the Qualified Technician[and Government QA representative] each day that topsoil layer is placed.]

3.2 INSTALLATION

3.2.1 Materials Handling Plan

Submit a Materials Handling Plan at least [15][_____] business days prior to select fill or topsoil layer placement. Do not place select fill or topsoil until the Materials Handling Plan is approved. Include the following in the plan: processing and placement of the select fill or topsoil; type, model number, weight and critical dimensions of equipment to be used for soil processing and compaction.

3.2.2 Select Fill Placement

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A temporary haul roads is required to allow access for large construction equipment during select fill placement. The haul roads are typically a minimum of 1 m 3 feet in thickness and are constructed using select fill.

A test fill should be required when needed to demonstrate placement technique or to determine cover or liner stability. Section 02 66 16 TEST

FILL can be edited and included in the specification package if a test fill will need to be constructed.

****

Do not operate equipment directly on the top surface of geosynthetics without permission from the Contracting Officer. Push select fill out over geosynthetics in an upward tumbling motion so that wrinkles in geosynthetics do not fold over. Do not drop soil directly onto geosynthetics from a height greater than 915 mm[_____] 3 feet[_____]. On slopes, place select fill from the bottom of the slope upward.

3.2.2.1 Initial Lift of Select Fill Placed Over Geosynthetics

The first lift of soil placed over geosynthetics must be a minimum of [305][380][_____] mm [12][15][_____] inches in loose thickness. Use equipment with ground pressures less than [49][_____] kPa [7][_____] psi to place and traffic compact the first lift of select fill. Traffic compaction consists of a minimum of six one-way passes over all areas. Rubber-tire haul trucks can only operate over a geosynthetic if a haul road of minimum thickness 1 meter 3 feet is provided.

3.2.2.2 Subsequent Lifts of Select Fill

****

NOTE: Maximum loose lift thickness should be no greater than 200 mm 8 inches if a density criteria will be applied to the lift. The criteria for minimum number of passes can be omitted if the Contractor must meet a density criteria.

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Do not provide a lift thickness of each subsequent lift greater than [205][305][_____] mm [8][12][_____] inches. Allow full scale placement and compaction equipment on areas underlain by geosynthetics after the[first][second] loose lift of soil has been placed. Rubber-tire haul trucks can only operate over a geosynthetic if a haul road of minimum thickness 1 meter 3 feet is provided.[Compaction consists of a minimum of six passes over all areas.]

3.2.3 Topsoil Placement

Place topsoil and evenly spread to a final compacted thickness as specified in paragraph SYSTEM DESCRIPTION. Traffic compact topsoil using approved placement equipment. On slopes, place topsoil from the bottom of the slope upward.

3.2.4 Construction Tolerances

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NOTE: The U.S. Environmental Protection Agency document, EPA/600/R-93/182 Quality Assurance and Quality Control for Waste Containment Facilities discourages the use of grade stakes which penetrate the select fill layer to control lift thickness. Grade stakes can potentially damage underlying geosynthetic materials.

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Provide finished surfaces that are uniformly graded and free from

depressions, mounds, or windrows. Top surfaces of the select fill layer and topsoil layer greater than [76][_____] mm [3][_____] inches above the lines and grades shown on the drawings are prohibited. No minus tolerance will be permitted. Do not drive rigid grade stakes into the select fill layer to control placement.

3.3 FIELD QUALITY CONTROL

3.3.1 Select Fill and Topsoil Material Tests

During construction of the select fill layer, take representative samples for testing at the frequencies listed in Table 3[from the borrow source prior to placement][from stockpiled material prior to placement]. Test results must comply with the requirements listed in Part 2 PRODUCTS or the material will be rejected for use. Submit test results as specified.

TABLE 3 - SELECT FILL AND TOPSOIL MATERIAL TESTING FREQUENCIES

PROPERTY	FREQUENCY	TEST METHOD
Select Fill		
Grain size analysis	[1,500] [_____] cubic meters[2,000][_____] cubic yards	ASTM D6913/D6913M
Liquid Limit, Plastic Limit, Plastic Index	[1,500][_____] cubic meters[2,000][_____] cubic yards	ASTM D4318
Compaction (Note 1)	[4,000][_____] cubic meters[5,200][_____] cubic yards	ASTM D698
Topsoil		
Grain size analysis for maximum particle size	[1,500][_____] cubic meters[2,000][_____] cubic yards	ASTM D6913/D6913M
pH	[1,500][_____] cubic meters[2,000][_____] cubic yards	ASTM D4972
Organic content	[1,500][_____] cubic meters[2,000][_____] cubic yards	ASTM D2974

TABLE 3 - SELECT FILL AND TOPSOIL MATERIAL TESTING FREQUENCIES		
PROPERTY	FREQUENCY	TEST METHOD
Note 1: Compare compaction test results with the results obtained during the borrow source assessment. When there are significant differences, adjustments to the acceptable moisture content or density ranges must be proposed by the Contractor for approval.		

3.3.2 Moisture Content and Density Tests of In-Place Select Fill

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NOTE: Test results using ASTM D6938 may show a significant amount of scatter in some situations. ASTM D4643 (microwave method) can be used as an alternative to ASTM D6938 for quick determinations of moisture content.

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Perform moisture content and density tests for select fill in-place, in a grid pattern staggered for successive lifts, so that sampling points are not at the same location in each lift. Perform moisture content and density tests in accordance with Table 4. Submit test results as specified.

TABLE 4 - MOISTURE CONTENT AND DENSITY TESTS OF IN-PLACE SELECT FILL		
PROPERTY	FREQUENCY PER LIFT	TEST METHOD
Nuclear moisture content	[925][____] square meters [7,000][____] square feet Minimum of three tests per day.	ASTM D6938
Standard moisture content	One for every 20 nuclear tests; minimum one test per day.	ASTM D2216
Nuclear density	[650][_____] square meters [7,000][_____] square feet Minimum of three tests per day.	ASTM D6938
Standard density	One for every 20 nuclear tests, minimum one test per day.	ASTM D1556/D1556M or ASTM D2167

3.3.2.1 Test Frequencies and Locations

Perform nuclear density and moisture content tests at locations that are representative of moisture and compaction based on visual observations during placement of the lift. Perform standard tests at locations which are underneath the nuclear gauge or as close as possible to the locations of the nuclear tests being checked.

3.3.2.2 Nuclear Density and Moisture Content Tests

Take nuclear density readings in the direct transmission mode. When ASTM D6938 is used, check and adjust the calibration curves using only the sand cone method as described in ASTM D1556/D1556M. ASTM D6938 results in a wet unit weight of soil and when using this method, use ASTM D6938 to determine the moisture content of the soil. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; make the calibration checks of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

3.3.2.3 Test Results

Compare field moisture content and density test results to the compaction curve for the appropriate material type being tested. If test results are not within the acceptable range for moisture content or density, as described in subparagraph Moisture-Density (Compaction) Testing, repair the lift of soil out to the limits defined by the Qualified Technician based on visual observation, process monitoring, and additional nuclear testing. Retest the area as directed. Document repairs to the select fill layer including location and volume of soil affected, corrective action taken, and results of retests.

3.3.3 Government Quality Assurance Testing

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NOTE: Quality assurance (QA) testing and inspections should be performed on all landfill construction as the liability is long term and cost due to failure is significant. Factors to consider include whether the Government has access to a laboratory that can analyze quality assurance samples in a timely manner to not delay the project execution. If conducting quality assurance testing, a separate third-party quality assurance contract should be considered based on the qualifications of the Government QA personnel and the size and importance of the project.

Use of quality assurance testing data also needs to be considered. A relatively straightforward data use is to compare quality assurance sample results to the project performance requirements, and failing result would be treated the same way as a failing Contractor test result. A more complicated data use is to compare results from quality assurance samples and contractor quality control samples for the purpose of determining if there is meaningful disagreement between the results. In this case, procedures would need to be developed for determining when there is a meaningful disagreement between quality assurance and quality control sample results; corrective actions for when a meaningful disagreement was identified would also need to be developed. The process of defining procedures for identifying and correcting meaningful differences should be documented in a project-specific CQA Plan

or Quality Assurance Project Plan and referenced in this specification; the process is likely too complex to be adequately defined in this specification.

Two options are provided for defining Government Quality Assurance. The first option is to defer details of the Government QA to a separate CQA Plan. The CQA Plan would need to be developed and provided to the Contractor with the project specifications. This option would be preferred for large, complex projects where the clay barrier is one component of a larger waste containment system. A second, simpler option is provided to define Government QA testing frequency.

The Government's QA personnel should visit off-site borrow sources to assure that soils identified in the Borrow Source Assessment Report are being utilized and no water is being added.

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[Work will be monitored and tested in accordance with the requirements of the CQA Plan. Be aware of all monitoring and testing activities defined in the CQA Plan and account for these activities in the construction schedule. Quality Assurance testing and monitoring does not relieve the contractor of the responsibility to complete the quality control testing and monitoring defined in this specification section.

][[Provide][The Contracting Officer will provide] duplicate quality assurance samples to the Government's quality assurance laboratory at a frequency of one set of samples per [10][_____] sets of quality control tests performed. Quality assurance samples will be tested for the same parameters as the parent quality control sample. A failed quality assurance test will require the same corrective actions defined in this section as a failed Contractor quality control test. The Contracting Officer may require additional quality assurance tests as a result of failed quality assurance or quality control tests. Account for Government quality assurance testing in the construction schedule. Quality Assurance testing and monitoring does not relieve the contractor of the responsibility to complete the quality control testing and monitoring defined in this specification section.
]

3.4 PROTECTION

Protect newly placed select fill and topsoil from traffic, erosion, and settlements that may occur. Prevent damage by ineffective drainage or traffic by heavy equipment. Do not stockpile material on finished surfaces. Repair or reestablish damaged areas to specified requirements.

3.4.1 Damage

Repair erosion rills or other damage that occurs and re-establish grades. Document repairs to the select fill layer or topsoil layer including location and volume of soil affected, corrective action taken, and results of retests.

3.4.2 Stockpiles

Storage or stockpiling of material on the completed surface of the select fill or topsoil layers will not be permitted.

-- End of Section --