



U.S. DEPARTMENT OF
ENERGY

Waste Disposal Alternatives Educational Session

U.S. Department of Energy
Paducah CAB

October 18, 2012



EM *Environmental Management*

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

Introduction/Purpose

- **Provide a background of the Waste Disposal Alternatives Project**
- **Explain how CERCLA will be used to make cleanup decisions**
- **Summarize current CERCLA schedule and progress**
- **Discuss individual topics of stakeholder importance**
- **Establish a path forward to meet project (DOE and CAB) needs**

History of Paducah Gaseous Diffusion Plant

- Construction of PGDP began in 1951
- Initiated Operation in 1952
- Managed by DOE and predecessor agencies until 1993
- USEC leases and operates plant today
- The PGDP is located on federally owned property; DOE is the site landlord



C-300 Central Operations Building during 1950's construction

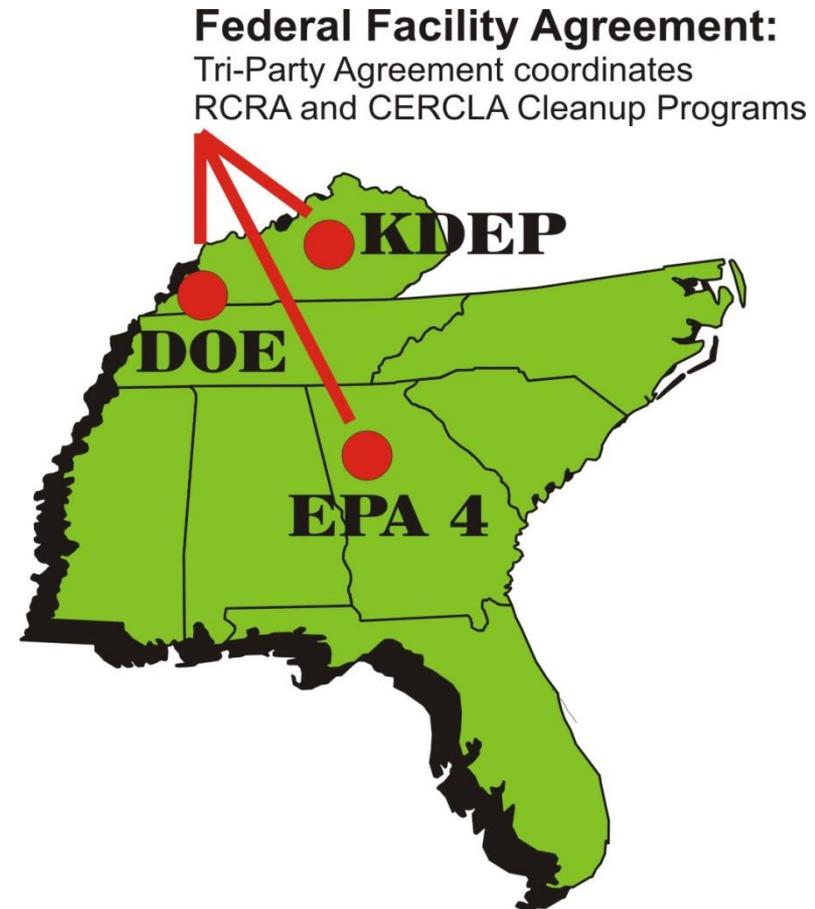
Significance of Plant Size

- Federal Site Acreage: 3,556
- Plant Site Acreage: Approximately 750
- Number of Buildings: over 500
- Process Buildings: 4
- Process Building Acreage Under Roof: 74 acres (*once 2nd largest structure under roof in the world*)



PGDP Regulatory

- Past operational practices led to current environmental challenges
- PGDP was placed on CERCLA's National Priorities Listing (NPL) in 1994
- Kentucky Natural Resources and Environmental Protection Cabinet, EPA, and DOE signed the CERCLA Federal Facility Agreement in 1998
- The Federal Facility Agreement is the binding agreement that oversees the cleanup of PGDP



DOE EM Waste Disposal Background

- 1996 *Paths to Closure* document centered on a detailed management approach to achieve cleanup of the 53 remaining sites to be closed
- 2001 *Top to Bottom* report was a programmatic review of the EM program that found that DOE needed to improve performance:
 - ✓ Centralized a core mission of EM to provide safe cleanup and closure
 - ✓ EM cleanup and closure should be run like a business
- Due to the waste characteristics and volumes associated with the decontamination and decommissioning of the site within the complex, a risk based approach to waste disposal should be considered

Paducah WDA Background

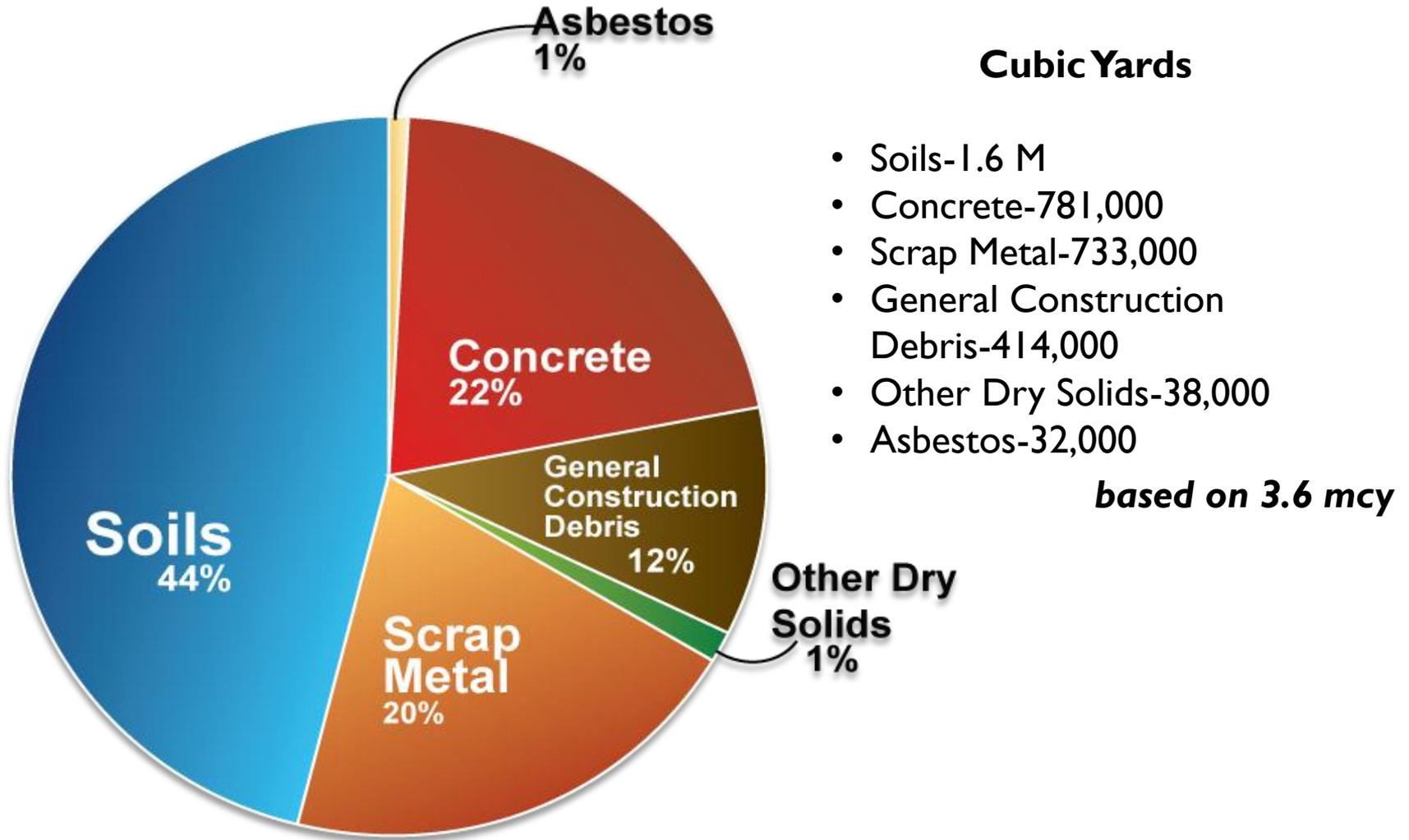
Approximately 3.6 million cubic yards (mcy) of waste is expected to be generated from D&D of the facilities and from final environmental remediation of soils

- Over 500 buildings and facilities
- ~3.1 mcy D&D construction debris
- Additional 500,000 cy of remediated soils

DOE is responsible for D&D and cleanup of the site, including waste management of soils and D&D material generated from the cleanup of PGDP



Projected Waste Types for Disposal



WDA CERCLA Project



WDA Scope Summary and Approach

- Identify CERCLA projects and their waste volumes
- Identify and develop waste disposal alternatives
- Evaluate and compare each waste disposal alternative
- Reach a CERCLA waste disposal Record of Decision

What is CERCLA?

Comprehensive **E**nvironmental **R**esponse, **C**ompensation, and **L**iability **A**ct (CERCLA) is the federal authority to deal with threats to human health and the environment from hazardous substances or waste sites

- CERCLA was designed to clean up hazardous waste sites not covered by other federal regulations
- Increased importance of permanent remedies and the use of treatment technologies
- Incorporated other state and federal regulations
- Increased state involvement in the process
- Increased focus on human health
- Encouraged greater citizen participation in decision making

CERCLA is commonly referred to as the Superfund

CERCLA Process at PGDP

CERCLA states DOE is required to enter into an agreement with the Regulators for remedy selection (e.g. Proposed Plan, Record of Decision)

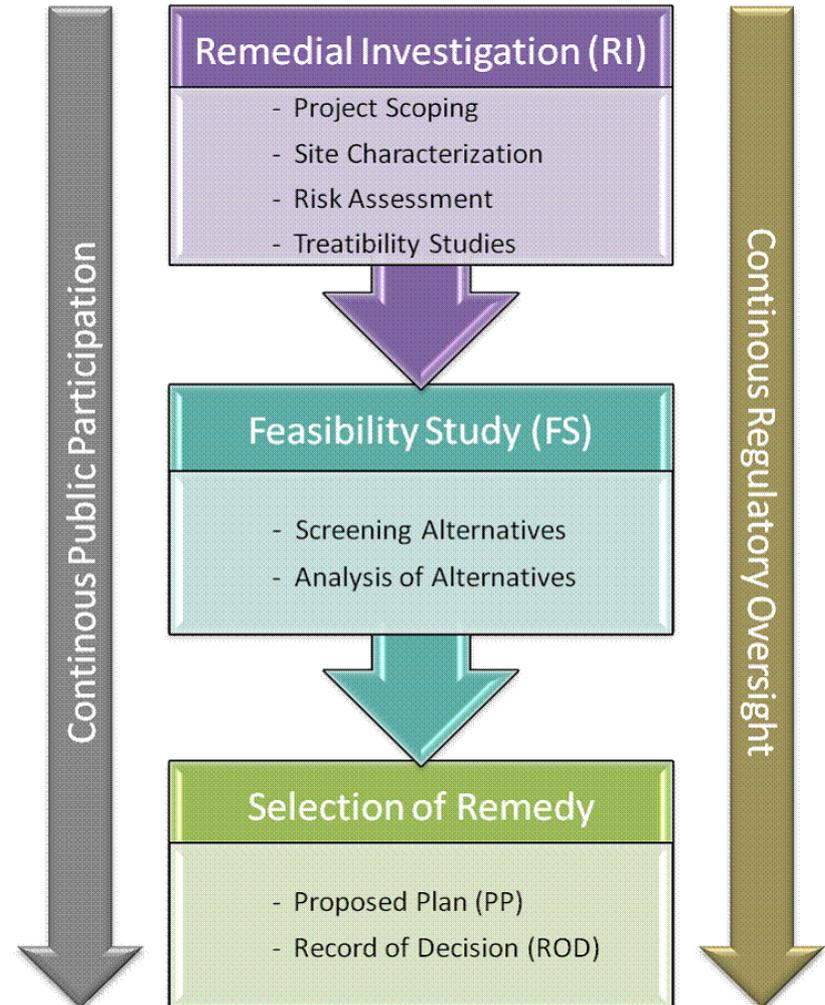
Under the FFA, DOE has agreed to provide KDEP and EPA enhanced involvement that includes review and concurrence throughout the CERCLA process.

Examples include:

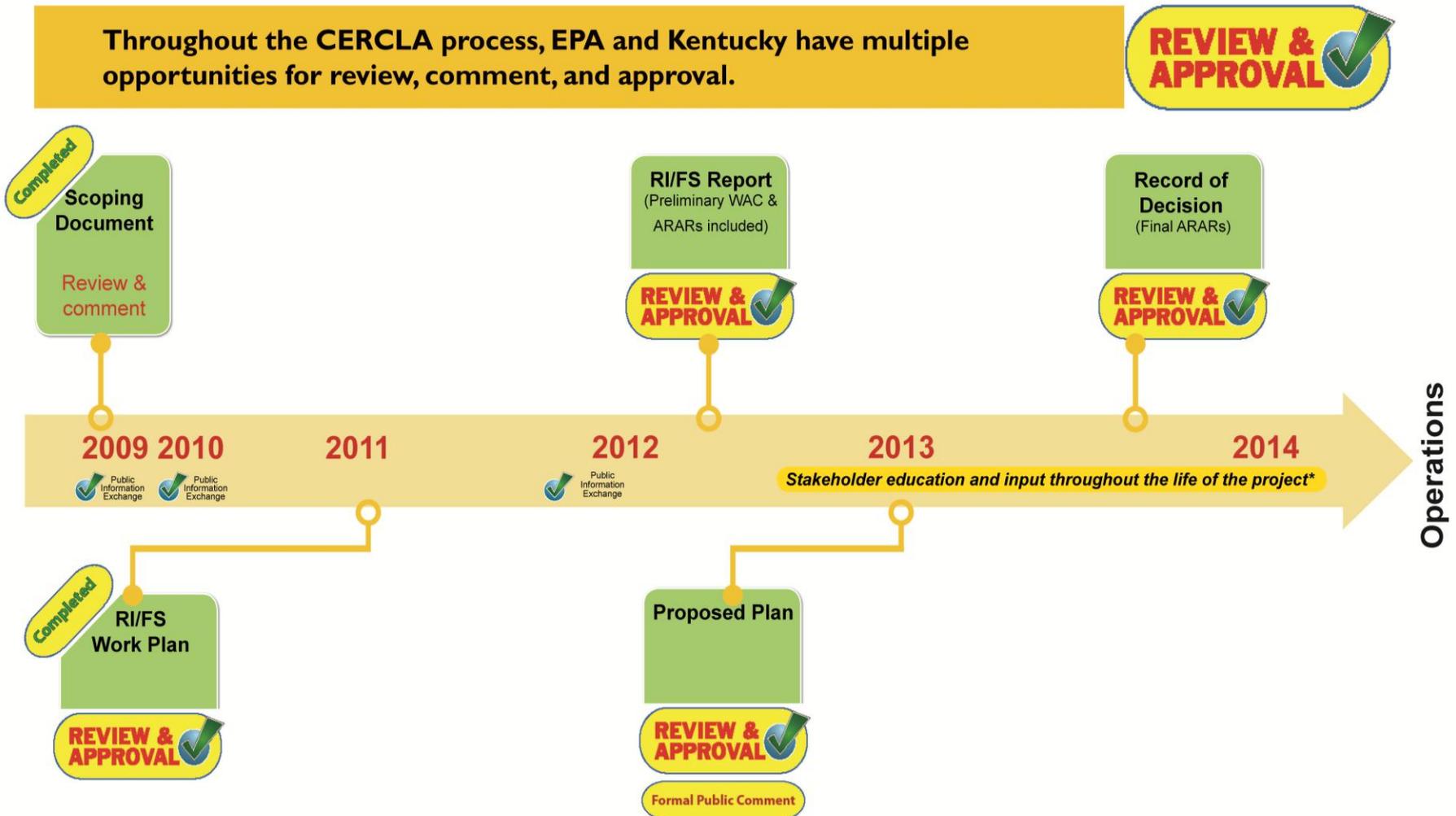
- RI/FS Work Plan
- RI/FS Report
- Proposed Plan
- Record of Decision

A complete record of the review and approval process conducted by KDEP and EPA is available to the public for review in the Administrative Record file.

CERCLA Decision Process



Current WDA Project Schedule



*If necessary, dependent on final Record of Decision

CERCLA Decision Process for Waste Disposal Alternatives

Alternatives to be evaluated:

Off-site alternative—The continuation of current off-site disposal practices for waste disposal

On-site alternative—The disposal of waste in a new waste disposal facility that would be constructed on property currently owned by DOE

No action alternative —Current practice of waste disposal would continue on a project-by-project basis

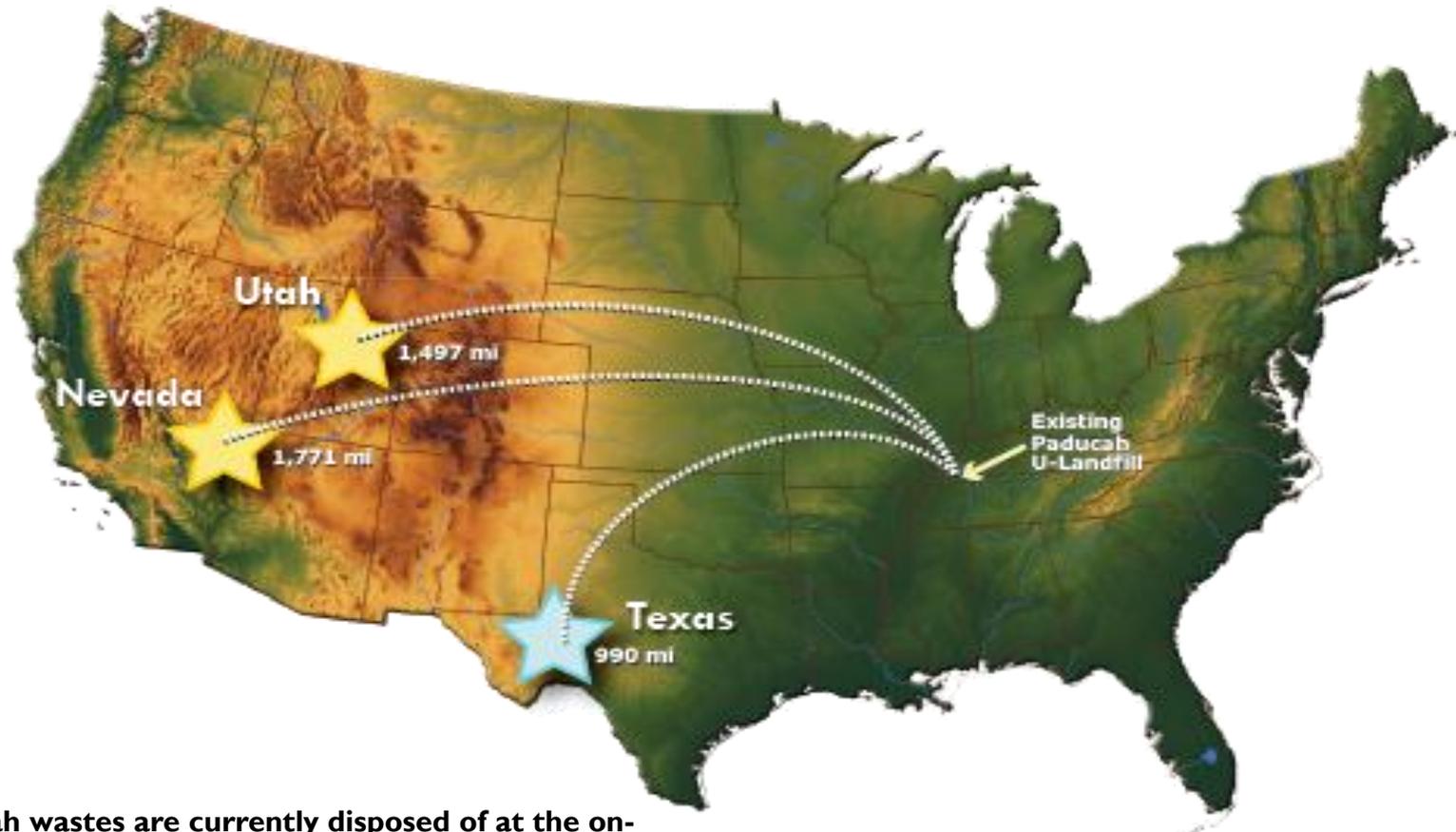
All scenarios assume the C-746-U Landfill will continue operation

For all scenarios, some portion of the waste is assumed to be disposed of in an off-site facility



Current Waste Disposal Facilities

Locations of Currently Permitted Waste Facilities



Paducah wastes are currently disposed of at the on-site C-746-U Landfill and Utah and Nevada disposal sites. Potential future options include the Andrews, TX, disposal facility and an on-site CERCLA cell.

Alternative Challenges

Off-site challenges

- **D&D cleanup schedule**
- **State equity**
- **Transportation risks**
- **Cost**

On-site challenges

- **Long-term stewardship**
- **Future use**
- **Conceptual/Seismic Design**
- **Waste Acceptance Criteria (WAC)**

Additional topics presented by the CAB include these: U-Landfill capacity, recycling, and WKWMA

D&D Cleanup Schedule

- Unexpected regulatory shutdown of off-site facilities could cause site domino effect, impacting resources and causing project delays
- Higher off-site transportation costs result in less funding available for D&D
- Nevada National Security Site (formerly NTS) is scheduled for site closure in 2027
- *EnergySolutions* is scheduled to close before Paducah D&D is scheduled to be complete

State Equity

- Both Nevada and Utah have expressed continued concerns over waste disposal
- Continued growth creates community anxiety related to transportation routes



Long-Term Stewardship

The FFA and CERCLA impose ongoing responsibilities at the site related to the following:

- Future transfers
- Ongoing obligations
- CERCLA Five-Year Reviews ensure remedy still is effective
- Land Use Control Implementation Plans

DOE created the Office of Legacy Management to transition sites to post-closure activities



DOE and the federal government cannot walk away from the Paducah Site

Long-Term Stewardship

DOE Order 450.1

An environmental compliance audit and review program that identifies compliance deficiencies and root causes of non-compliance.

Clearly articulated roles and responsibilities at all appropriate levels to ensure accountability for less than desired environmental performance.

Activity	Fernald—Closed	Weldon—Closed	Oak Ridge—Post Closure	Hanford—ERDF Post Closure	Paducah—TBD
Site Maintenance	Legacy Management - EM	Legacy Management - EM	TDEC*	Legacy Management – EM	Using current models, during cleanup activities, site maintenance would be performed by DOE on-site cleanup contractor. Post closure activities would be assumed by EM Office of Legacy Management
Emergency Event	Legacy Management - EM	Legacy Management - EM	Legacy Management - EM	Legacy Management – EM	
Monitoring	Legacy Management - EM (Stoller)	Legacy Management - EM (Stoller)	TDEC*	Legacy Management – EM	
Reporting	Annually	Quarterly/Annually	Quarterly*	TBD	
Cell Ownership	DOE/Federal Government				

*Postclosure activities will be assumed by the Tennessee Department of Environment and Conservation through a perpetual care trust fund established under state law.

Future Use

What is the impact of an on-site landfill impact future development of the site?

DOE has experience in working with local communities to enhance the post closure environment

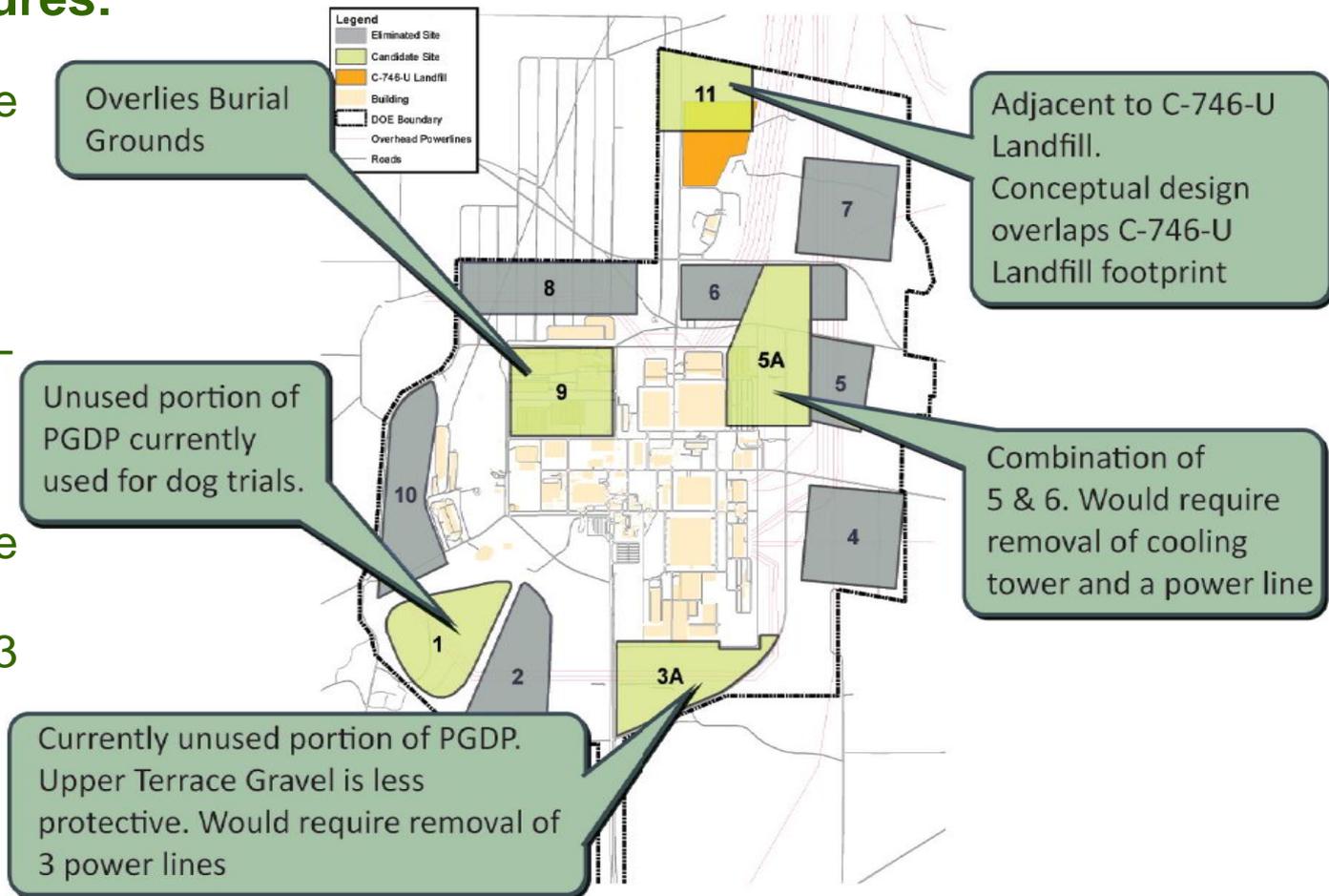
Waste disposal facility aesthetics and site selection options can be maximized to provide for limited impact on future use opportunities



Siting

Based on high end waste volume assumptions (~3.6 million), the current conceptual design has the following features:

- Maximum waste disposal footprint—29 acres
- Total waste disposal facility—87 acres (post closure)
- Maximum waste disposal facility height—up to 113 ft (includes liner, waste, and cap)



CAB Topics

Raising the Authorized Limits of the U Landfill—What impact would raising the authorized limits of the currently operating C-746-U Landfill have on the project decision?

Assuming all currently permitted phases of the U-Landfill are constructed, the design capacity could accommodate approximately 1.2 mcy of waste. In the most likely scenario of the draft WDA RI/FS Report, 1 mcy of CERCLA waste will be disposed of at the U Landfill.

The most likely scenario projects 2.6 mcy of waste to be placed in a potential on-site waste disposal facility. If the additional 200,000 cy of waste noted above was placed in the U Landfill, the remaining waste that would go to the waste disposal facility exceeds the break-even volume of 300,000 cy. The break-even volume is the volume where on-site disposal becomes more cost effective than shipping waste off-site.

Bottom line—the U Landfill essentially will be used to the maximum capacity. The cost considerations already take this into account.

CAB Topics

Recycling—What is DOE's position on recycling and how does it impact the amount of waste generated?

DOE Paducah supports recycling efforts and will perform recycling activities within funding and regulatory constraints.

Impact to WKWMA—Will location of a potential on-site waste disposal facility cause impacts to WKWMA?

Input from WKWMA is being considered as a part of the siting process. DOE will work with WKWMA and Paducah Economic Development to mitigate any impact that a potential on-site cell might create.

CERCLA Decision Topics—Transportation Risks

- Statistics from a DOE transportation handbook were used to calculate how many fatalities and injuries could occur based on how many miles were traveled
- Other transportation issues include incidents with waste packaging and profiling



<i>Trucks to Commercial or DOE Facility</i>		<i>Rail Cars to Commercial Facility</i>	
<i>Off-site/No Action</i>	<i>On-site</i>	<i>Off-site/No Action</i>	<i>On-site</i>
10,000 shipments	—	30,000 rail cars	1,600 rail cars

CERCLA Decision Process—Cost

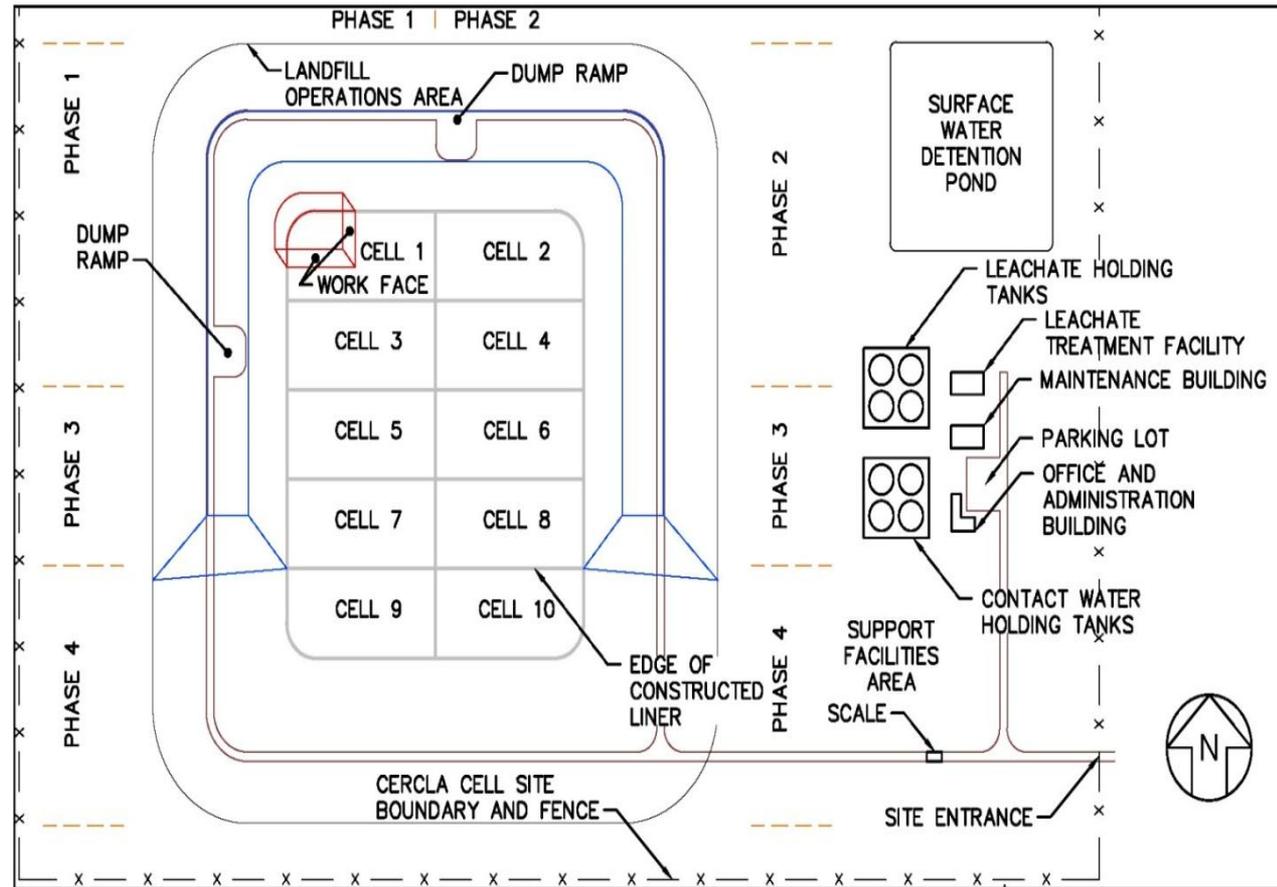
For the No Action, On-site, and Off-site disposal actions, the following costs are addressed:

- Direct and indirect costs—expenditures required to initiate and perform a remedial action, including characterization, design, and construction.
- Waste disposal operation costs include (1) cost of containers, long distance transportation, and fees paid to off-site disposal facilities; (2) waste and handling placement, facility maintenance, and monitoring during on-site operations
- Surveillance and Maintenance are long-term costs that would occur after closure of an on-site facility

Conceptual Design

A conceptual design has been developed at the appropriate level to support that an on-site disposal facility is feasible

- Seismic
- Environmental protectiveness (cap and liners)
- Leachate collection, detection, and treatment
- Surface water controls

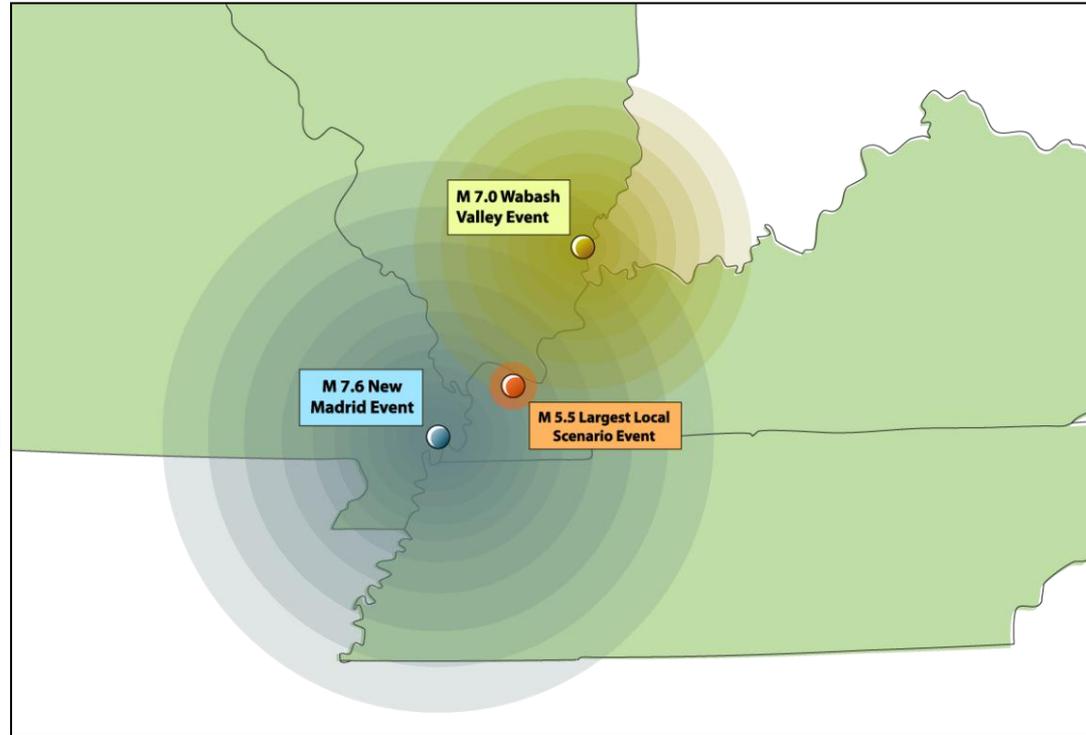


In the event of an on-site disposal decision, a detailed design would be developed by DOE and approved by Kentucky and EPA before construction begins

Conceptual Design

The site seismicity and site geologic conditions are documented in eight site-specific studies, referenced in the RI/FS

The potential waste disposal facility would be designed to resist the critical maximum credible earthquake (MCE) event, Magnitude 7.6, predicted at the New Madrid Fault



Seismic analyses completed in 2012 for the C-746-U Landfill at PGDP, provide confidence that an on-site waste disposal facility can be designed to resist the MCE in this area

Potential WDF Design and WAC

If selected, an on-site cell design

- Would meet RCRA Subtitle C design criteria and DOE 435.1 performance standards
- Would be a highly regulated state-of-the-art design
- Would accept only DOE's PGDP FFA material, including D&D

If selected, WAC

- Would be protective of human health and the environment
- Would be developed with regulatory approval

Basis for Preliminary WAC

- The preliminary WAC development determines the level of protection necessary where someone could be exposed in the future
- Fate and transport modeling is developed based on the landfill design, waste characteristics, and environmental characteristics
- Waste profiles used to develop contaminant profiles for the PGDP D&D and BGOU waste came from Oak Ridge GDP data because of the design, process, and historical operation similarities between the PGDP and the former K-25 (Oak Ridge) GDP
- Waste profiles were used to support the preliminary WAC that “actually” were disposed of in EMWMF

Preliminary WAC Development

Calculate Preliminary WAC

- Take the groundwater concentration at each point of assessment and compare that to the appropriate risk-based exposure values
- Increase or decrease the concentration of each contaminant in the waste and repeat the process until either the contaminant is at a theoretical maximum or the appropriate risk-based exposure values at each point of assessment are satisfied
- The preliminary WAC for each contaminant is the lowest of the concentrations derived for the three points of assessment
- Contaminant concentrations in groundwater change over time as contaminants migrate, t peak concentrations from 0 to 1,600 years are used

Summary

- Assumes on-site child resident within an area designated for DOE industrial use
- Assumption of on-site child resident groundwater user implies protectiveness outside of DOE property
- Assumes the most contaminated groundwater is used at each point of compliance
- No credit for man-made liner components after year 600

Past CAB Recommendations

Recommendation 05-02

The CAB recommended that DOE review and update, as needed, the waste projections for the site remediation and plant decommissioning activities to achieve a sufficient level of precision to support investigation of disposal options.

DOE agreed with the recommendation and submitted for review the waste generation forecast for 2006-2019 to the CAB.

Recommendation 08-03

The CAB recommended a series of public involvement activities for the WDO project.

DOE agreed with the recommendation and has implemented subelements since 2008.

Recommendation 08-05

The CAB recommended that DOE develop and implement a public education program, with suggestions of what should be included.

DOE agreed with the recommendation and has implemented the subelements since 2008.

Recommendation 08-07 The CAB recommended that DOE develop a program to segregate material.

DOE agreed with the recommendation, with limitations, and has implemented subelements since 2008.

Recommendation 10-06 Order to adequately address stakeholder concerns and issues during the siting study of a potential CERCLA cell, the PGDP CAB recommends that DOE give appropriate weighting and consideration to "non-technical" factors, such as, but not limited to:

DOE agreed in principle with the recommendation and applied the factors in accordance with the CERCLA process.

Stakeholder Involvement/Community Outreach

November 2008—Public Information Session

May 2009—Public Information Session

June 2009—Regulators visit Oak Ridge Waste Cell

October 2009 —Paducah CAB visits Oak Ridge Cell, TDEC, and ORSSAB

December 2009—Public Information Session

April 2010—PUPAU visits OR Waste Cell, TDEC, and Mayors

June 2010—Public Information Session

January 2011—Public Information Session

November 2011—Paducah CAB visits Fernald site

June 2008—October 2012
Paducah CAB multiple subcommittee meetings on Waste Cell Decision Process

June 2007—October 2012
Monthly FFA meetings



Additional educational sessions

Tour of identified sites at Paducah

Dry run of CAB/DOE-sponsored public workshop

CAB/DOE-sponsored public workshop

Backup Slides

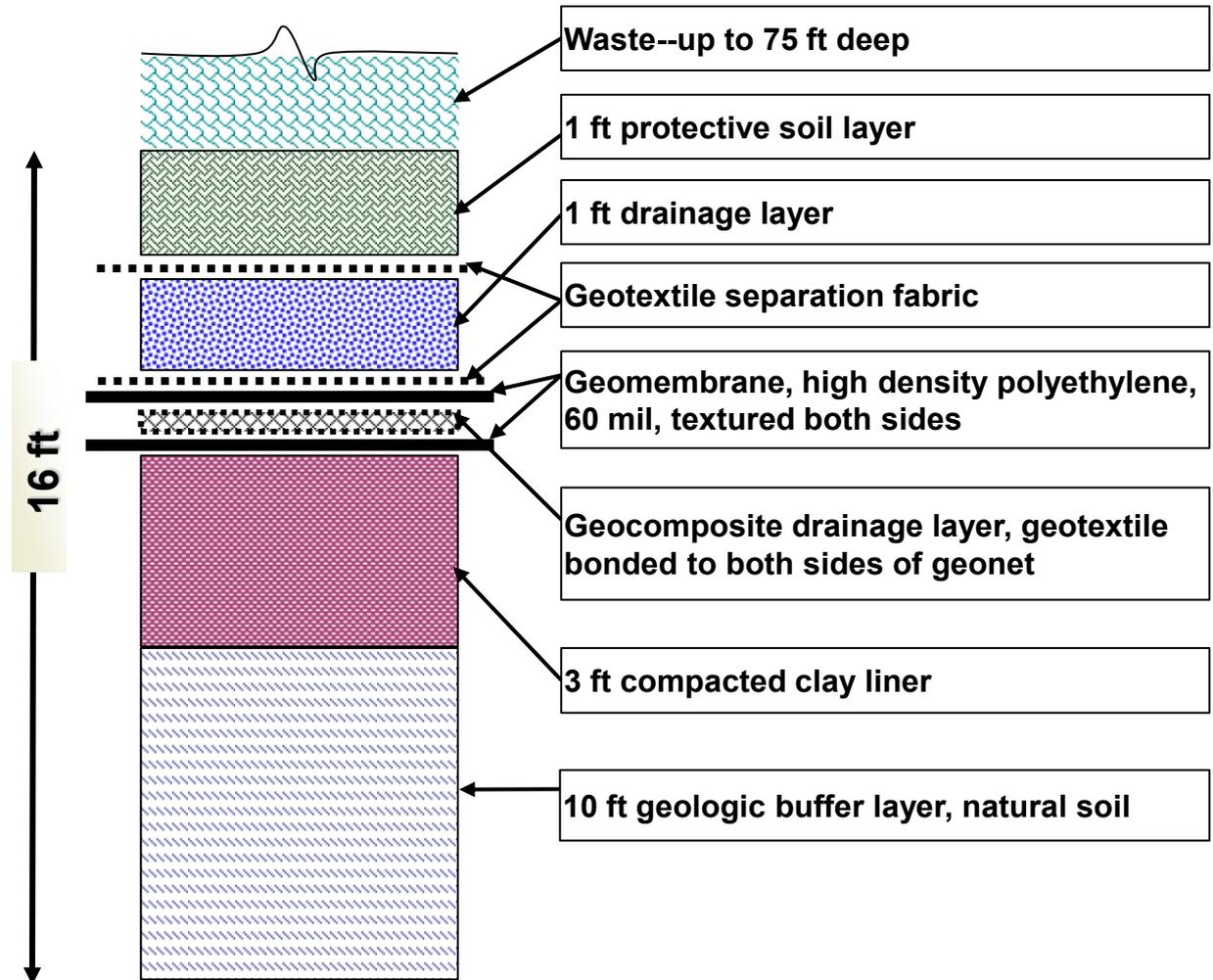
Preliminary WAC versus Final WAC

- The preliminary WAC is developed using assumptions to guide a go/no-go decision
 - ✓ A preliminary WAC is developed, often with limited site-specific information to evaluate the feasibility of an on-site waste disposal facility
 - Provides a basis for determining the adequacy of the landfill design
 - Allows evaluation of changes to the design
 - Provides a determination of approximate volume of waste acceptable for disposal
 - Allows cost breakpoint evaluation to determine if an on-site waste disposal facility is economically viable
- The final WAC also requires regulator acceptance and becomes the determiner for all waste acceptance
 - ✓ A final WAC refines the preliminary WAC to take the final design into account
 - ✓ A final WAC is only developed if an on-site waste disposal facility is the selected remedy

A Cap and Liner System Would Be Constructed to Maintain Waste Stability

LINER SYSTEM DESIGN

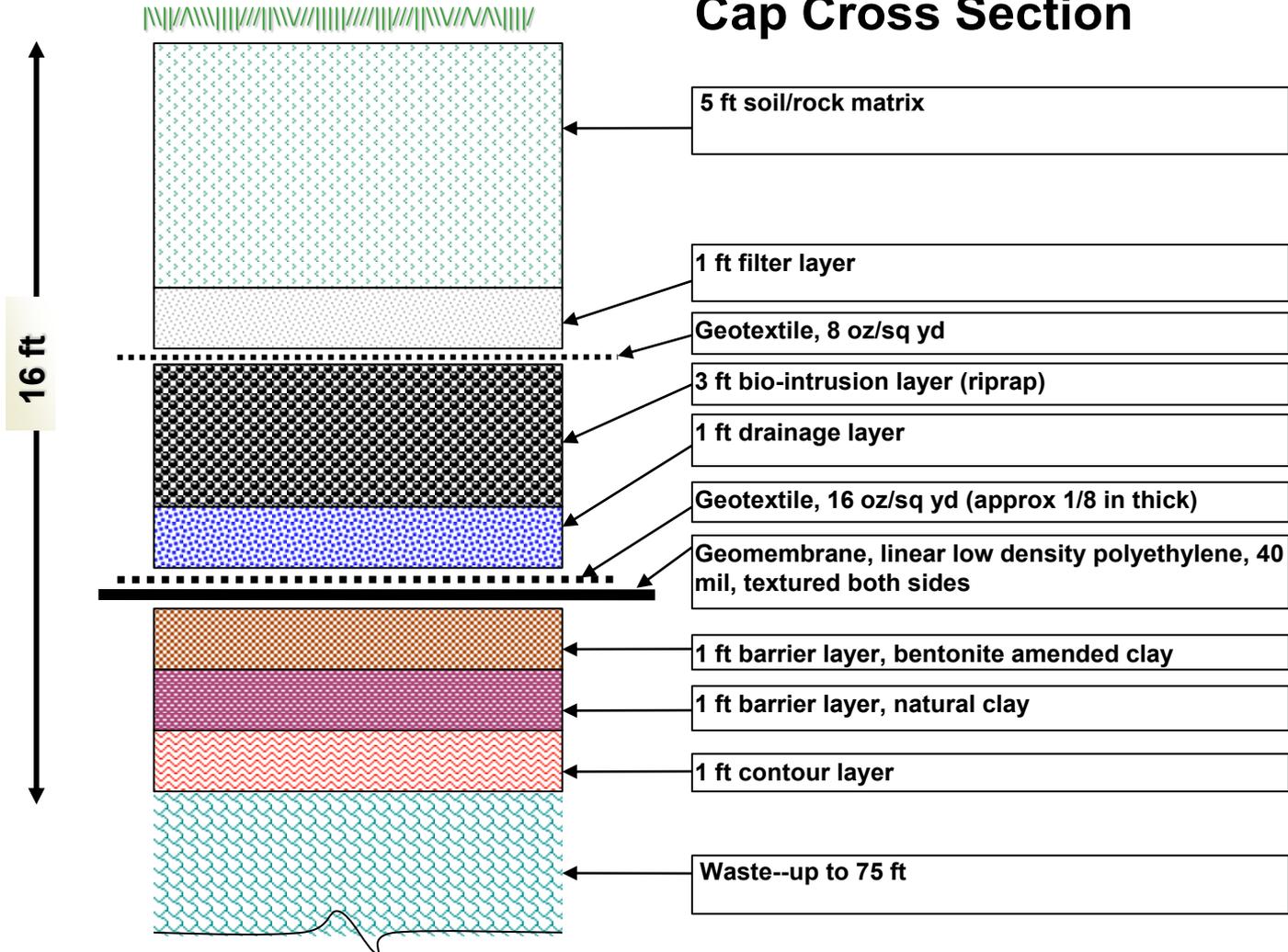
Design would include a double-liner of both low-permeability materials and impermeable synthetic liner



A Cap and Liner System Would Be Constructed to Maintain Waste Stability

COVER SYSTEM DESIGN

Cap Cross Section



What about Classified Waste?

- A small portion of the waste will be classified from a security perspective
- Classified material that may be placed in a potential on-site facility poses no greater risk than other waste disposed of in the facility
- PGDP currently has classified waste on-site
- Classified waste is not determined by level or type of contamination
- Fundamental radiological and chemical characteristics of classified waste will be made public
- Nuances that are not publicly available will be made available, under provisions in the FFA, to appropriately cleared personnel on a need-to-know basis
- Designated state personnel will be provided clearances as long as they meet AEA requirements
- Other sites successfully manage classified material

An On-site Cell Can Be Designed to Blend with the Local Environment

Conceptual Design

- *Schematic Site Plan indicating generic components of a disposal facility*
- *Typical cross sections indicating the geological buffer, cell base liner system, operational cell internal drainage control, long-term and permanent cover system high*
- *Water Management Summary indicating the water control measures implemented during the operation of a disposal facility*
- *Scaled drawings indicating proposed location on PGDP property, plan view of area, footprint of the facility at full capacity, contours and elevations of the earthfill dike, and support facility locations*

Typical 30% design submittals include

This is the best point in the Contract Document development phase to check on design development efforts, make corrections to the design development documents, and incorporate project criteria changes.

- *An updated, detailed cost estimate*
- *Elevations*
- *Building sections*
- *Structural, mechanical, plumbing, communication, and electrical plans with details*
- *Site and landscaping plans*
- *All the analyses and discussions that were part of the Conceptual design submittal*
- *Specifications in rough draft*
- *Updated design analysis*
- *Check status of any required waivers or exemptions (DDESB, design criteria, etc.)*

Equipment layouts with necessary clearances and utility support also should be shown at this stage of design

Typical 60% design submittals include

At this stage, all basic design decisions should have been made, and design development is in full progress.

- *An updated, detailed cost estimate*
- *Any changes necessary to comply with the 30% design review comments*
- *Complete plans and specifications*
- *Final design analysis*
- *Check status of any required waivers or exemptions (DDESB, design criteria, etc.)*

Typical 90% design submittals include

- *An updated, detailed cost estimate*
- *Any changes necessary to comply with the Preliminary Design review comments*
- *Complete plans and specifications*
- *Final design analysis*
- *Check status of any required waivers or exemptions (DDESB, design criteria, etc.)*

Remedial Action Objectives

- Prevent releases of CERCLA waste from a disposal cell that result in contaminant concentrations that exceed a maximum contaminant level (MCL) or background concentration at the point of compliance.
- Prevent exposure by a human receptor to contaminants in or migrating from CERCLA waste that results in a cumulative human health risk in excess of lifetime cancer risk (ELCR) greater than the EPA risk range of 1×10^{-4} to 1×10^{-6} or hazard index (HI) greater than 1 (within 0 to 1,600 years). When groundwater modeling predicts that a single contaminant will be present in groundwater at a point of exposure at the waste facility boundary or DOE property boundary, the MCL for the chemical will be used as a protective value consistent with EPA guidance (EPA 1991).

Preliminary WAC Development

Receptor, Exposure Pathway, and Point of Assessment

- Residential child
- Groundwater use (including consumption)
- Assessment locations
 - ✓ Edge of waste
 - ✓ Waste Disposal Facility Boundary (about 100 meters from the edge of waste)
 - ✓ DOE property boundary or surface water feature

Risk-Based Values

- Edge of waste—greater of MCLs or background concentrations
- Waste Disposal Facility Boundary
 - ✓ Cumulative cancer risk <1 in 10,000 and HI < 1 for the first 1,600 years
 - ✓ Cumulative cancer risk <1 in 10,000 and HI < 3 for the first 1,600 years
- DOE property boundary or surface water feature
 - ✓ Cumulative cancer risk < 1 in 1,000,000 and HI <1 for the first 1,600 years
 - ✓ Cumulative cancer risk < 1 in 100,000 and HI <3 after 1,600 years
- Establish Risk Goals (EOW is individual criteria, downgradient are cumulative criteria)
 - ✓ Cancer risk <1 in 10,000 and health index <3 after 1,600 years
- Radiological criteria are based upon dose and cancer risk
 - ✓ Determined from MCLs based on allowable beta and gamma dose

Preliminary WAC development

Models

HELP Model

- Estimates infiltration of precipitation to the landfill that can leach contaminants from the waste
- Considers evapotranspiration, runoff, drainage, and infiltration
- Cap and liner geosynthetics and clay layers are assumed to degrade over time
- HELP often overestimates infiltration

DUST-MS Model

- Estimates contaminants leaching from the waste and migration through the waste and to the groundwater
- 100% of projected waste is considered homogeneous soil, overestimating leached concentrations

MODFLOW Model

- Estimates groundwater movement from the waste disposal facility to the receptor

AT123D Model

- Estimates contaminant transport in groundwater using output from DUST-MS and MODFLOW

Preliminary WAC Development

