Applicability of Phase 1 Study Findings to SDA, NDA, and WTF

Exhumation Working Group

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AGENDA

- ✓ Recap of EXWG Phase I Studies
- ✓ Task 3.3: Consolidated Report – Applicability of EXWG Findings to SDA, NDA, and WTF
  - ➢ Scope of Processes Addressed
  - ➢ Process-Specific Findings and Conclusions
  - ➢ Conclusions and Implications

Recap of EXWG Phase 1 Studies

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Study	Task	Objective
Study 1	1.1	Comparison of Published Inventories
	1.2	Update Waste Inventories to 2020 and Future Years
	1.3	Application to Selective Removal Scenarios
	TASK 1.3 REPORT JUST POSTED TO WEBSITE: TO BE PRESENTED	
Study 2	2.1	Planning and Modeling in Support of Field Studies
	2.2.a	Boring Program to Correlate Results with Inventories
	2.2.b	Geophysical Prove-Out Study
	TASK 2.2.B REPORT JUST POSTED TO WEBSITE	
Study 3	3.1	Review of Projects at Seven Targeted Sites
	3.2	Review of Other Projects for Targeted Features
	3.3	Findings w/ Application to NDA, SDA, WTF
	PRESENTATION EMPHASIS: PARTIAL FINDINGS OF TASK 3.3	

Task 1.3: Application of Inventories To Selective Exhumation Scenarios

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Example of SDA Results: Percent of Targeted Radionuclides Removed

SDA Volume	Cs-137 Activity	I-129 Activity	Tc-99 Activity	C-14 Activity	GTCC Volume	Pu-238 Activity	U-234 Activity
10%	58.7%	60.6%	47.3%	29.2%	35.1%	53.2%	18.1%
20%	72.9%	74.2%	60.7%	44.6%	61.9%	84.3%	38.3%
30%	80.4%	81.1%	65.9%	63.0%	81.1%	89.6%	62.5%
40%	84.7%	85.1%	69.2%	79.2%	94.4%	92.8%	77.8%
50%	90.6%	91.1%	78.6%	86.5%	99.1%	97.2%	87.5%

SDA Trench Segments to Exhume to Remove All Long-Term Radionuclides

Trench Segment Distance (feet)

	0-49	50-99	100-149	150-199	200-249	250-299	300-349	350-399	400-449	450-499	500-549	550-599	600-649	650-699
Trench 1	Remain	Remain	Ex: 50%	Remain	Remain	No Waste	Remain	Remain	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste
Trench 2	Ex: 20%	Remain	Remain	Remain	Remain	Remain	Ex: 50%	Remain	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste
Trench 3	Ex: 40%	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Ex: 50%	Ex: 20%	Remain
Trench 4	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 10%	Ex: 50%	Ex: 20%	Ex: 10%	Remain	Ex: 30%	Ex: 30%
Trench 5	Ex: 10%	Remain	Ex: 50%	Remain	Ex: 50%	Ex: 20%	Ex: 30%	Ex: 20%	Ex: 20%	Remain	Remain	Remain	No Waste	No Waste
Trench 7	Ex: 50%	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste	No Waste
Trench 8	Ex: 20%	Ex: 40%	Ex: 30%	Ex: 20%	Ex: 30%	Ex: 30%	Ex: 40%	Ex: 40%	Ex: 20%	Remain	Ex: 50%	No Waste	No Waste	No Waste
Trench 9	Remain	Ex: 10%	Ex: 40%	Ex: 10%	Ex: 30%	Ex: 20%	Ex: 20%	Ex: 30%	Ex: 50%	Ex: 30%	Remain	Remain	No Waste	No Waste
Trench 10	Ex: 30%	Ex: 30%	Ex: 20%	Ex: 40%	Ex: 40%	Ex: 20%	Remain	Ex: 50%	Remain	Ex: 40%	Remain	Remain	No Waste	No Waste
Trench 11	Ex: 30%	Ex: 10%	Ex: 40%	Ex: 40%	Ex: 30%	Remain	Remain	Remain	Ex: 40%	Ex: 50%	Ex: 50%	Remain	No Waste	No Waste
Trench 12	Ex: 40%	Remain	Remain	Remain	Remain	Ex: 10%	Ex: 30%	Ex: 20%	Remain	Ex: 50%	Remain	Remain	No Waste	No Waste
Trench 13	Ex: 20%	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Ex: 40%	Remain	Remain	Remain	Remain	No Waste
Trench 14	Remain	Remain	Remain	Remain	Remain	Remain	Ex: 40%	Remain	Remain	Ex: 50%	Remain	Remain	Remain	No Waste
Trench 6	SPH-01	SPH-02	SPH-03	SPH-04	SPH-05	SPH-06	SPH-07	SPH-08	SPH-09	SPH-10				
	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain	Remain				
	SPH-11	SPH-12	SPH-13	SPH-14	SPH-15	SPH-16	SPH-17	SPH-18	SPH-19					
	Remain	Ex: 50%	Ex: 50%	Remain	Remain	Remain	Remain	Remain	Remain					

Task 1.3: Application of Inventories: Example of Key Findings - SDA

- **Long-Lived Fission Products (I-129, Tc-99, C-14)**
  - Initially quite cost-effective – 50% removal of I-129 activity by removing only 5% of SDA waste volume (10:1 Efficiency)
  - Efficiency decreases as % increases – 90% removal of I-129 activity requires 28% of SDA volume (3:1 Efficiency)
  - Primarily exhumation of Trench 4, followed by 50-foot segments from Trench 9 and then Trenches 5, 2, and 3
  - Co-located Cs-137 would add to efficiency but require more shielding

Task 1.3: Application of Inventories; Example of Key Findings - SDA

- **Transuranic Waste**
  - Initially quite cost-effective – 50% removal of TRU activity by removing only 2.8% of SDA waste volume (18:1 Efficiency)
  - Efficiency decreases but remains high as % increases – 90% removal of TRU activity requires 7.1% of SDA volume (13:1 Efficiency)
  - Primarily exhumation of specific 50-foot segments from Trench 10, followed by segments from Trenches 11, 8, 9
  - Direct dose rates in these trench segments are generally <2.5 mrem/hr and less robust measures to protect workers would be required.

Task 1.3: Application of Inventories: Example of Key Findings - NDA

- NDA Deep Holes and Special Holes each contain about 50% of the NDA's activity, whereas NDA trenches contain <1% of activity.
- Fission products and TRU radionuclides have very similar profiles across the Deep Holes and Special Holes, except for activation products (Deep Holes only).
- Therefore, more appropriate to target total activity than a specific radionuclide.

Holes	Deep Holes			Special Holes		
	% Activity	% Volume	Efficiency	% Activity	% Volume	Efficiency
Top 10	45%	10%	4.5 : 1	63%	22%	2.9 : 1
Top 25	75%	25%	3.0 : 1	82%	33%	2.5 : 1
Top 50	90%	47%	<2 : 1	96%	57%	<2 : 1

- Decision may be driven by other factors – area, depth, technology, dose rate

Task 3.3: Consolidation of Findings: Application to West Valley

Purpose:

- Identify alternate exhumation approaches for the SDA, NDA, and WTF to those proposed in the 2010 FEIS that ensure worker and community safety.

Special Considerations:

- Need to consider implications of selective removal scenarios.
- Approaches focused on those used on precedent projects; SEIS not limited to these alternatives

Task 3.3: Consolidation of Findings Exhumation-Related Processes

Exhumation Approaches Evaluated

- **Leachate Treatment**
- Protective Measures (Exhumation Enclosures)
- **Waste Exhumation – SDA and NDA**
- Waste Processing
- Interim Waste Storage
- **High-Level Waste Tank Removal**

Note: **Bold** Entries Addressed in Presentation

Task 3.3: Consolidation of Findings Leachate Treatment (1 of 3)

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2010 FEIS Approach

- Description: Physical-chemical-biological treatment
- Advantages
  - Applicable for range of radionuclides and organic constituents
  - Design flexibility
- Disadvantages
  - Tritium not removed
  - Lack of flexibility to possible phased selective removal decisions in the future

Task 3.3: Consolidation of Findings Leachate Treatment (2 of 3)

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Option 1: Leachate Grouting

- Description: Stabilization/solidification of leachate in cement grout
- Advantages
  - Capability to bind tritium in grout mixture
  - Successfully applied at Maxey Flats
  - Low cost
- Disadvantages
  - Large volume of residual waste (grout) generated
  - Off-site disposal of grout likely to increase cost
  - Potential for leaching of contaminants from grout

Task 3.3: Consolidation of Findings Leachate Treatment (3 of 3)

Option 2: Leachate Evaporation

- Description: Controlled evaporation of leachate
- Advantages
  - Lowest cost option
  - Proven performance treating similar leachate at Maxey Flats
- Disadvantages
  - Tritium released to atmosphere
  - Concentrated waste stream requiring disposal

Task 3.3: Consolidation of Findings Trench Exhumation (1 of 3)

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2010 FEIS Approach: Remotely-Operated Crane

- Description: Excavation with remotely-operated crane system
- Advantages
  - Highest level of worker protection
  - Enables use within planned enclosure structures
- Disadvantages
  - Ability to exhume the full range of waste forms
  - Entry into trenches may still be required to facilitate removal

Task 3.3: Consolidation of Findings Trench Exhumation (2 of 3)

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Option 1: Manually Operated Equipment Within Trench

- Description: Manned shielded excavation equipment
- Advantages
  - Higher level of control and rate of production
  - Successful and safe application on precedent projects
  - Flexibility to match equipment to waste forms
- Disadvantages
  - Operator shielding may not provide adequate protection
  - Remote operation would still be necessary for some trenches

Task 3.3: Consolidation of Findings Trench Exhumation (3 of 3)

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Option 2: Manually Operated Equipment Outside of Trench

- Description: Manned excavation using long-reach excavators
- Advantages
  - Operator entry into trenches not required
- Disadvantages
  - Similar to Option 1

Task 3.3: Consolidation of Findings NDA Deep Hole Exhumation (1 of 2)

2010 FEIS Approach: Remotely-Operated Crane

- Description: Excavation using remotely-operated crane system
- Advantages
  - Highest level of worker protection
  - No depth restriction on operation of crane
- Disadvantages
  - Applicability to exhume waste from the Deep Holes

Task 3.3: Consolidation of Findings NDA Deep Hole Exhumation (2 of 2)

Option 1: Waste Grouting and Coring

- Description: Cement grouting of waste and removal by augering
- Advantages
  - Stabilizes waste and provides shielding prior to removal
  - Leachate provides in-situ water source; captured within grout
- Disadvantages
  - Size of Deep Holes will require different over-casing techniques
  - Volume of waste will approximately double

Task 3.3: Consolidation of Findings HLW Tank Removal (1 of 4)

2010 FEIS Approach: Roof Removal Within Robust Waste Processing Facility

- Description: Removal of tank roofs prior to removal of residual radionuclides
- Advantages
  - Operations within a single enclosure
  - Removal of the tank roofs provides access to tanks
- Disadvantages
  - High cost
  - Destroys integrity of tanks

Task 3.3: Consolidation of Findings HLW Tank Removal (2 of 4)

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Option 1: Removal of Waste Through the Risers

- Description: Removal of residual waste with an in-tank robotic system
- Advantages
  - Cover soil and roofs remain in place to provide shielding
  - Much lower cost enclosure structure
  - Maintains integrity of tanks; suitable for selective removal
  - Precedent applications at other sites
- Disadvantages
  - Technology development would be required
  - Technology limitations would likely prevent 100% waste removal
  - Requires certain high cost waste processing facilities

Task 3.3: Consolidation of Findings HLW Tank Removal (3 of 4)

Option 3: Full Grouting of Tanks Before Removal

- Description: Following tank grouting, segmentation using diamond wire or other specialty tool
- Advantages
  - Full removal
  - Provides shielding of tank contents
  - Eliminates need for FEIS-style Waste Processing Facility
  - After grouting, tanks could be left in place until decay reduces activity
- Disadvantages
  - Generates a large volume of waste
  - Potential exists for high levels of exposure

Task 3.3: Consolidation of Findings HLW Tank Removal (4 of 4)

Option 4: Filling of Tanks with Water Before Removal

- Description: Tanks and waste removal under water using specialized equipment
- Advantages
  - Water can control worker exposure rates
  - Eliminates need for FEIS-style Waste Processing Facility
- Disadvantages
  - Approach not proven on structures as large as HLW tanks
  - High potential for leakage from tanks/vaults into underlying soil
  - Radioactive water requires treatment
  - Requires certain high cost waste processing facilities

Task 3.3: Consolidation of Findings Application to West Valley

GENERAL CONCLUSIONS AND IMPLICATIONS

1. The FEIS Sitewide Removal Alternative approach represents the most robust, protective, and costly of the alternatives considered.

2. The alternative exhumation approaches identified are less costly; however, they are most applicable only to certain selective removal-scenarios.