Burial Grounds Operable Unit Feasibility Study – D1

CAB Subcommittee Briefing

May 27, 2010

Scope

- Primary source area control action - disposed waste materials
- Secondary source area control action – DNAPL sources originating from disposed waste material

BGOU Source Areas

- SWMU 2 — C-749 Uranium Burial Ground (Potential DNAPL Source)
- SWMU 3 — C-404 Low-Level Radioactive Waste Burial Ground
- SWMU 4 — C-747 Contaminated Burial Yard and C-748-B Burial Area (Probable DNAPL Source)
- SWMU 5 — C-746-F Burial Yard
- SWMU 6 — C-747-B Burial Ground
- SWMUs 7 and 30 — C-747-A Burial Ground and Burn Area (SWMU 7 Potential DNAPL Source)
- SWMU 145 — Area P (residential/inert borrow area) and old North-South Diversion Ditch disposal trench (the area for SWMU 145 includes that beneath SWMUs 9 and10)

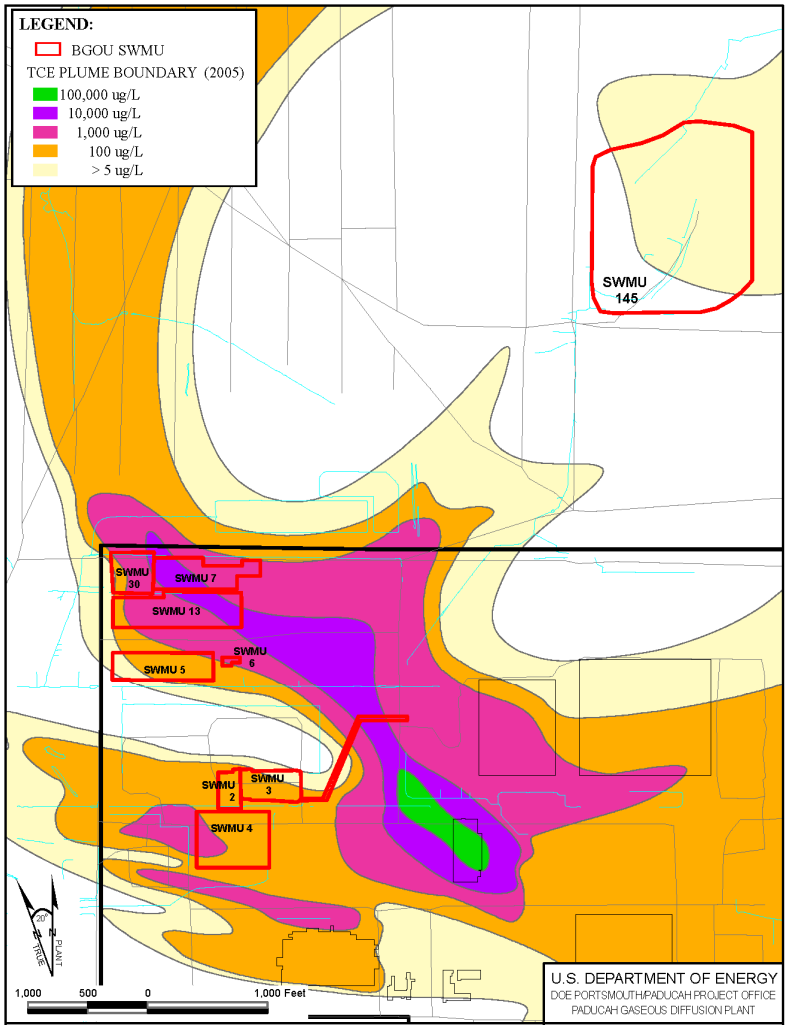
Areas that are Part of BGOU but not Addressed in RI or FS:

- SWMUs 9 and10 — Require No Further Action per SMP
- SWMU 12 — Any buried material under SWMU 12 is part of SWMU 7
- SWMU 13 — Planned evaluation results will be reported in SER

Solving Cleanup Challenges Through Risk Reduction

Location of BGOU SWMUs

Note: SWMUs 9, 10, and 12 not shown



BGOU Feasibility Study Organization

- 1.0 INTRODUCTION
- 2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES
- 3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES
- 4.0 DETAILED AND COMPARATIVE ANALYSES OF ALTERNATIVES
- 5.0 SWMU 2
- 6.0 SWMU 3
- 7.0 SWMU 4
- 8.0 SWMU 5
- 9.0 SWMU 6
- 10.0 SWMU 7
- 11.0 SWMU 30
- 12.0 SWMU 145
- 13.0 REFERENCES

BGOU Feasibility Study Organization (cont'd.)

- APPENDIX A: COMPARISON OF SOIL CONCENTRATIONS TO REMEDIATION GOALS BY SADA LAYER
- APPENDIX B: MODELING RESULTS
- APPENDIX C: DEVELOPMENT OF PRELIMINARY SOIL REMEDIATION GOALS AND APPROPRIATE LOWER-BOUND REMEDIATION GOALS FOR SOIL AT INDIVIDUAL SOLID WASTE MANAGEMENT UNITS
- APPENDIX D: EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS
- APPENDIX E: COST ESTIMATES
- APPENDIX F: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT TABLES
- APPENDIX G: GROUPING BGOU SWMUs TO ESTABLISH WASTE MANAGEMENT AREAS
- APPENDIX H: SWMU 3 RCRA POSTCLOSURE PERMIT CONDITIONS SUMMARY
- APPENDIX I: RISK ASSESSMENT FOR C-404 (SWMU 3) DISCHARGE DITCH

Section 1 Overview

- Background information
- Summary and conclusions from RI Report
- Section 1.4.1 – Uncertainties identified in the Remedial Investigation Report and the BGOU FS Scoping Meetings
- Table 1.15 – Features and attributes of alternatives that address uncertainties identified in RI Report and Scoping Meetings
- Section 1.4.2 – Metals comparison to background determine primary COCs for developing and evaluating alternatives.

Comparison of Data to Background to Select Primary COCs

- Data for commonly occurring radioactive and inorganic elements compared to PGDP site range of background concentrations and to No Action Levels
- Some elements were determined to not warrant remedial action for one or more of the following reasons:
  - All detected concentrations are within the range of background
  - 100% of the detected concentrations are below the NAL
  - Detected in less than 5% of the total samples
  - No detected concentrations exceed the background maximum
- RG development and alternative screening focused on the following primary radioactive /inorganic COCs: U (metal), U-234, U-235, U-238, Np-237, and Tc-99
- Common elements in soil have similar physical/chemical characteristics and properties as radionuclides and are remediated by the same technologies.

Section 2 Overview

- Remedial action objectives
- Development of remediation goals
- Basis for technology identification and screening
- Land use controls
- Identification and screening of technology types and process options
  - Tables 2.4 and D.1 – Results of technology screening
  - Tables 2.5 and D.2 – Technologies retained for potential alternative development in the BGOU FS

Section 2 Overview (continued)

Remedial Action Objectives

1. Contribute to protection of current and future off-site residential receptors from exposure to contaminated groundwater by reducing/controlling sources of groundwater contamination;
2. Protect industrial or outdoor workers (*formerly referred to as excavation workers*) from exposure to waste and contaminated soils; and
3. Treat or remove principal threat wastes wherever practicable, consistent with 40 *CFR* § 300.430 (a)(1)(iii)(A).

These general RAOs were developed for evaluation of technologies and development of Remedial Process Options. Site specific RAOs, which are subsets of general RAOs, were developed for each SWMU based on Scoping Meeting summaries.

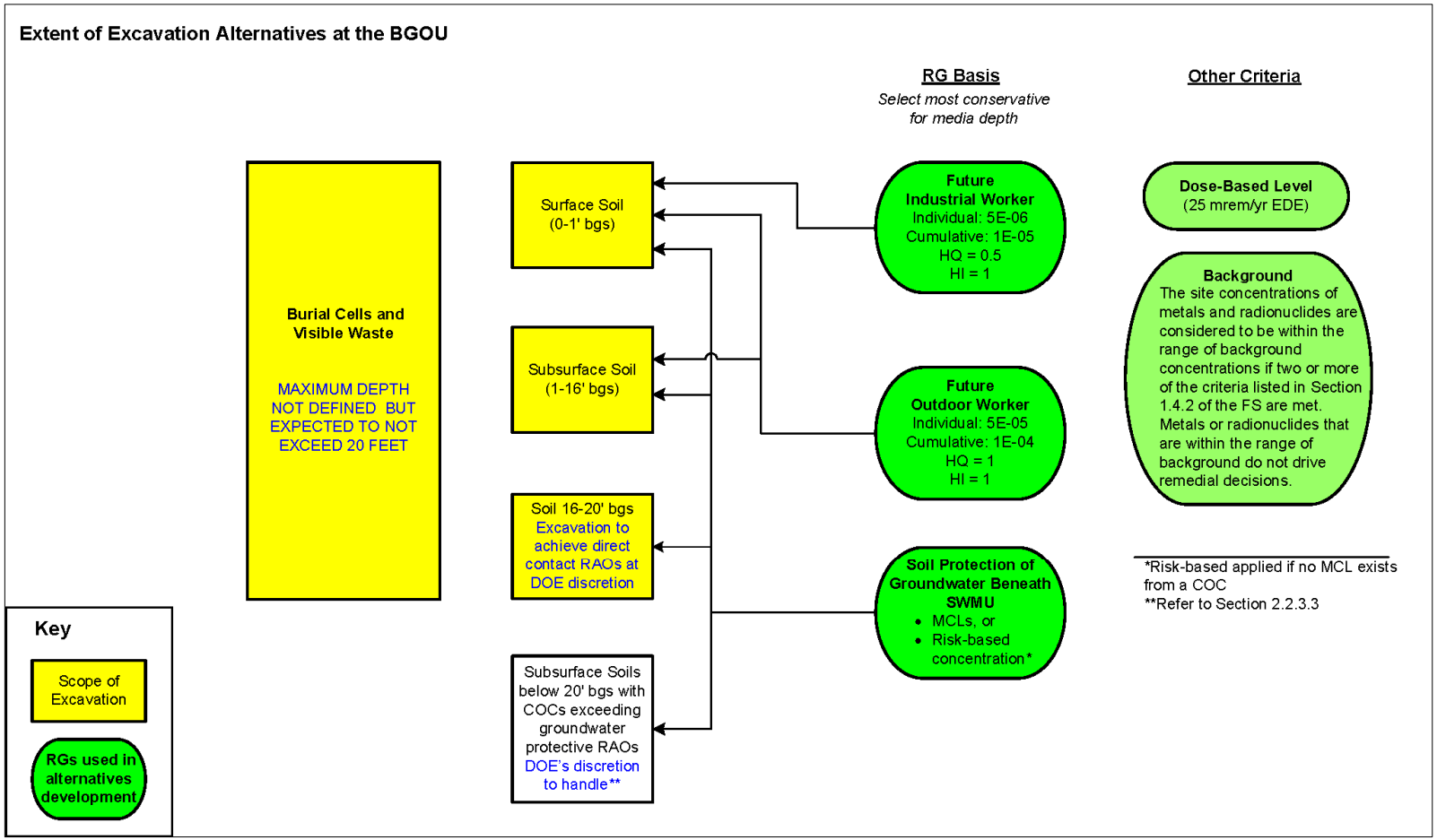
Section 2 Overview (continued)

Soil RG Development

- One set of direct contact surface soil RGs for all SWMUs;
- One set of direct contact subsurface soil RGs for all SWMUs;
- Each COC RG corresponds to ELCR=5E-06 and HI=0.5 (surface soil) or ELCR=5E-05 and HI=1 (subsurface soil) per negotiation with EPA and KDEP during 2009 scoping meetings.
- SWMU-specific GW protective RGs back calculated to meet MCL concentrations beneath individual SWMUs (i.e., soil concentrations that will allow MCLs to be met in the RGA beneath the SWMU).
- Lower of direct contact vs. GW protective chosen as Preliminary RG for surface and subsurface (so long as greater than background)
- Application of RGs for excavation alternative shown in Figure 2.3.

Preliminary RGs developed for screening and evaluating alternatives.

Extent of Excavation Alternatives at the BGOU



Section 2 Overview (continued)

Land Use Controls

Apply only to those units where waste left in place or residual contamination after active remediation precludes unrestricted use.

- E/PP Program

PGDP is a federal facility with restricted access by the general public. These existing access controls are being maintained outside of the requirements of CERCLA because of the nature and security needs of the facility.

Technology Screening

- Technology screening applied relatively broad criteria for retention of emerging or unproven (at PGDP) technologies for future consideration as RPOs and inclusion in remedial alternatives.
- Jet grouting and permeation grouting are retained as technologies for subsurface horizontal barriers.

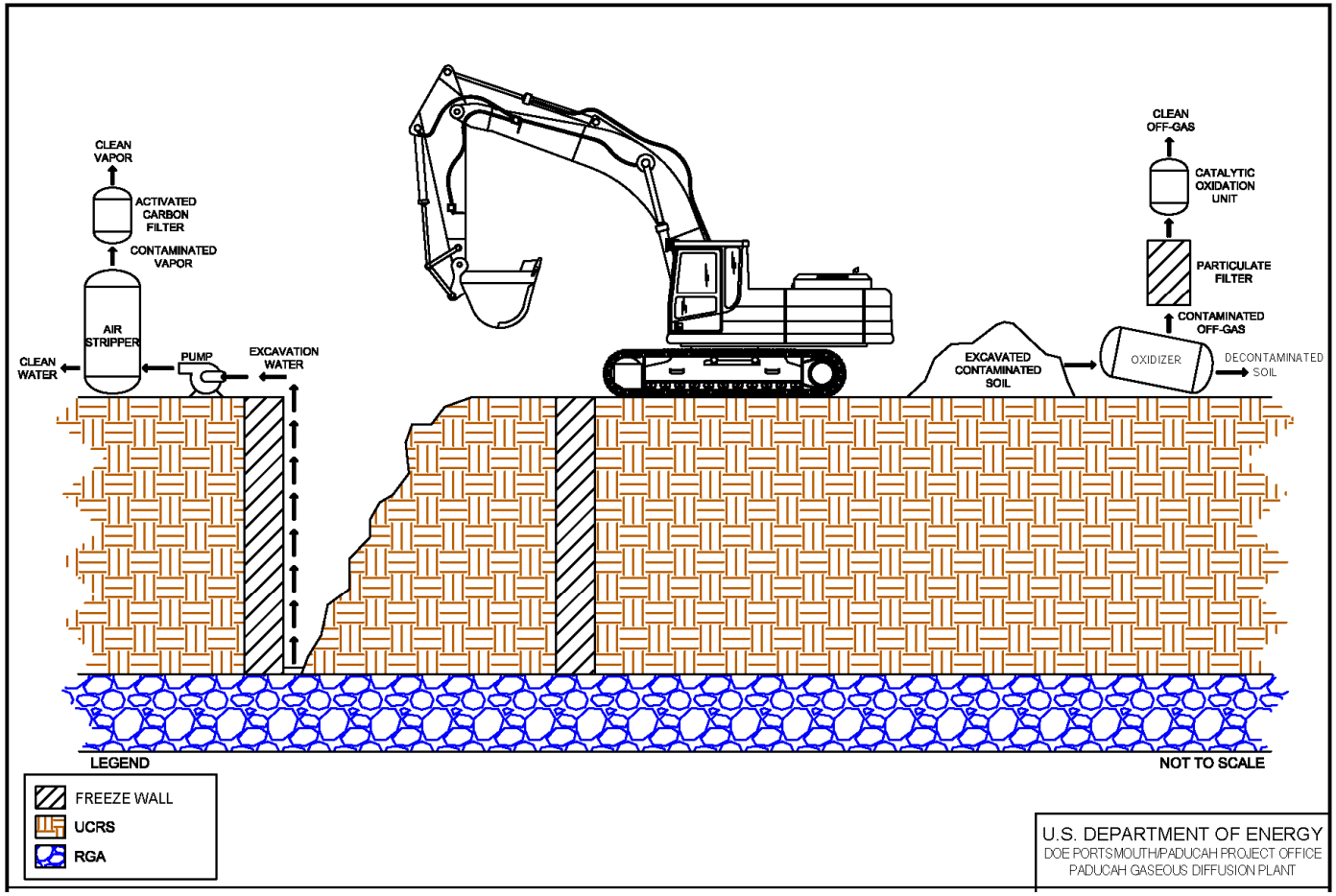
Section 3 Overview

- Developed 8 remedial action alternatives (in addition to No Action) for remediation of the BGOU SWMUs.
- Alternatives have been made broad (i.e., *in situ* DNAPL source treatment rather than *in situ* thermal source treatment.)
- ERH is a representative *in situ* DNAPL source treatment technology for evaluation and cost estimating. Other *in situ* DNAPL source treatment options are retained for possible future consideration.
- Chemical oxidation is a representative *ex situ* DNAPL source treatment technology for evaluation and cost estimating. Other *ex situ* DNAPL source treatment options are retained for possible future consideration.
- Volumes for *in situ* DNAPL source treatment estimated in Section 14.1.4.
- Volumes for *ex situ* DNAPL source treatment estimated in Table 3.2.

Section 3 Overview (continued)

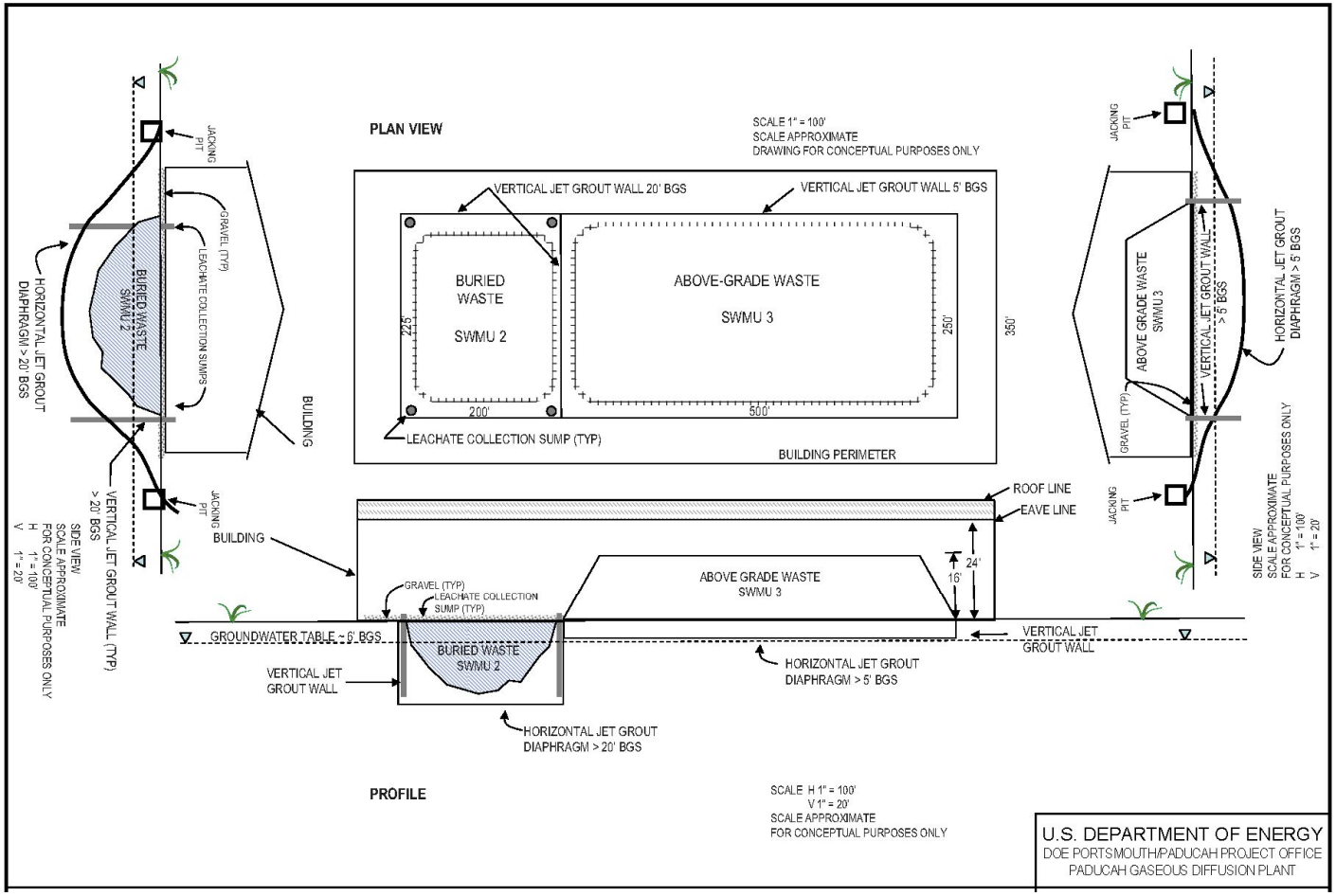
- Developed Alternative 8 for SWMUs 2, 4 and 7: excavation combined with *ex situ* DNAPL source treatment. Representative technology is oxidation based on Portsmouth project. Assume decontaminated DNAPL soils returned to excavation.
- Developed Alternative 9 for SWMUs 2 and 3: *in situ* containment and long-term monitoring. Evaluated primarily for combined SWMU 2/3 remedial action (Appendix G).
- Degradation curves for TCE at SWMUs 2, 4 and 7 included in Appendix B to address uncertainty about nature and extent of TCE DNAPL. Highest observed TCE concentrations degrade to concentration protective of MCL in GW in < 100 years after completion of active remediation.
- Infiltration reduction analysis for mobile COCs at each SWMU presented in Appendix B to address uncertainty about actual concentrations of buried wastes. Demonstrates that concentrations greater than maximum observed concentrations of COCs can be contained with cover or cap that provides reasonable reductions in infiltration.

Schematic View of *Ex situ* DNAPL Source Treatment



Solving Cleanup Challenges Through Risk Reduction

In situ Containment SWMUs 2 and 3 Combined



Alternative Formulation for PGDP BGOU Source Areas

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
No Action	**Limited Action**	**Soil Cover and Long-Term Monitoring**	**Soil Cover combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring**	**RCRA Cover with Hydraulic Isolation and Long-Term Monitoring**	**Excavation and Disposal[1]**	**Excavation and Disposal combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring**	**Excavation and Disposal combined with *Ex situ* DNAPL Source Treatment and Long-Term Monitoring**	***In situ* Containment and Long-Term Monitoring**
	Long-term groundwater monitoring Land use controls	Soil cover Long-term groundwater monitoring Land use controls	Partial excavation to remove debris, rubble, or metallic waste that could interfere with the installation or operation of the *in situ* DNAPL source treatment system, if necessary. *In situ* DNAPL source treatment Process monitoring Postremediation sampling Soil cover Long-term groundwater monitoring Land use controls	Vertical subsurface hydraulic isolation barrier RCRA cover Long-term groundwater monitoring Land use controls	Sheet pilings to shore excavation Excavation Treat or dispose of residual groundwater, as indicated by sampling Postremediation and WAC sampling and analysis Physical/chemical waste treatment Transportation to disposal facility Backfill with clean soil	Sheet pilings to shore excavation Excavation Treat or dispose of residual groundwater, as indicated by sampling Postremediation and WAC sampling and analysis Physical/chemical waste treatment Transportation to disposal facility Backfill with clean soil *In situ* source treatment for DNAPL Process monitoring Postremediation sampling Long-term groundwater monitoring	Sheet pilings to shore excavation Excavation Treat or dispose of residual groundwater, as indicated by sampling Postremediation and WAC sampling and analysis Physical/chemical waste treatment Transportation to disposal facility Backfill with clean soil Vertical barrier to protect deep excavation Deep excavation of DNAPL source area *Ex situ* source treatment for DNAPL Process monitoring WAC sampling of treated soil Postremediation sampling Backfill with clean, decontaminated soil Long-term groundwater monitoring	Construct subsurface horizontal barrier Construct subsurface vertical barrier Construct structure Long-term groundwater monitoring Land use controls.

BGOU SWMU Remedial Action Alternative Summary

Alternative	1	2	3	4	5	6	7	8	9
Alternative Description	**No Action**	**Limited Action**	**Soil Cover and Long-Term Monitoring[a]**	**Soil Cover combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring**	**RCRA Cover with Hydraulic Isolation and Long-Term Monitoring**	**Excavation and Disposal**	**Excavation and Disposal combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring[b]**	**Excavation and Disposal combined with *Ex situ* DNAPL Source Treatment and Long-Term Monitoring[c]**	***In situ* Containment and Long-Term Monitoring**
SWMU No.									
2	X				X		X	X	X
3[d]	X[e]	X[f]				X[g]			X
4[h]	X						X	X	
5	X		X			X[i]			
6	X	X							
7	X			X[j]			X	X	
30	X		X			X			
145	X		X			X[k]			

X-Indicates an alternative that was analyzed in detail for a particular SWMU.
[a] A soil cover was evaluated for those SWMUs where surface contact with the waste management unit is to be prevented and infiltration resulting from precipitation does not appear to pose any threat to human health or groundwater.
[b] *In situ* treatment is evaluated as a contingency alternative at SWMUs 2 and 7 if DNAPL is present upon completion of the excavation.
[c] *Ex situ* treatment is evaluated as a contingency alternative at SWMUs 2 and 7 if DNAPL is present upon completion of the excavation.
[d] SWMU 3 is a closed RCRA landfill lined with compacted soil, covered with a RCRA Subtitle C cap, equipped with a leachate collection system and managed under a RCRA postclosure permit.
[e] No action would be taken at SWMU 3 under the CERCLA program, but it would continue to be managed under the RCRA program.
[f] This alternative is for long-term monitoring based on results of the demonstration required under 40 *CFR* § 294.90(f)(1) and (2), but performed under the CERCLA program.
[g] SWMU 3 was evaluated for excavation of the documented waste disposal volume. No further action is required for the ditch at SWMU 3 under the BGOU.
[h] DNAPL at SWMU 4 is assumed to extend to sufficient depth to be present in both the UCRS and RGA.
[i] Metal melting is evaluated as a supplementary technology to excavation at SWMU 5 for metal recovery/recycle.
[j] A soil cover combined with *in situ* source treatment was evaluated for SWMU 7 where radioactive/inorganic contamination is limited to the surface. *In situ* treatment was evaluated to remediate DNAPL reported potentially to be present at SWMU 7.
[k] Excavation at SWMU 145 will be limited to course of the former North-South Diversion Ditch. Soil cover will be placed over uncovered portions, if necessary.

Sections 5 through 12: Alternative Screening and Analysis for Each Individual SWMU

- ❑ SWMU History and Background
- ❑ Screening of Alternatives
- ❑ Detailed Analysis of Alternatives
- ❑ Comparative Analysis of Alternatives
- ❑ Table X.1 – Source Area Alternative Screening Summary
- ❑ Table X.2 – Summary of Comparative Analysis of Source Area Alternatives
- ❑ Table X.3 – Remedial Alternatives Cost Summary

Appendix G – Waste Management Areas

- WMA A – SWMUs 2, 3 and 4.
- WMA B – SWMUs 5, 6, 7 and 30.
- SWMU 145

- Cost benefits of grouping result primarily from efficiency gains and reduction in redundancy.
- Implementation of Alternative 9 for combined SWMUs 2 /3 to establish a fully contained and isolated unit evaluated in Appendix G.
- If DNAPL not present or present at limited depth at SWMU 2, Alternative 9 meets CERCLA criteria for combined SWMUs 2/3 at substantially reduced cost compared to other alternatives analyzed.

Solving Cleanup Challenges Through Risk Reduction

Summary of Detailed Analysis of Alternatives for the SWMUs

KEY
○ Unfavorable Score
◉ Moderate Score
● Favorable Score

Evaluation Criteria	Overall protection of human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, or volume through treatment	Short-term effectiveness	Implementability	Cost
SWMU 2							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 5—RCRA Cover with Hydraulic Isolation and Long-Term Monitoring	◉	●	◉	◉	●	●	◉
Alternative 7—Excavation and Disposal Combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	◉[1]	◉[2]	○[3]
Alternative 8—Excavation and Disposal Combined with *Ex situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	○[1]	○[2]	○[3]
Alternative 9—*In situ* Containment and Long-Term Monitoring	◉	●	●	◉	◉	◉	◉
SWMU 3							
Alternative 1—No Action	◉	●	◉	◉	●	●	●
Alternative 2—Limited Action	◉	●	◉	◉	●	◉	●
Alternative 6—Excavation and Disposal	●	●	●	●	◉[1]	◉[2]	○[3]
Alternative 9—*In situ* Containment and Long-Term Monitoring	◉	●	●	◉	◉	◉	◉

Evaluation Criteria	Overall protection of human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, or volume through treatment	Short-term effectiveness	Implementability	Cost
SWMU 4							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 7—Excavation and Disposal Combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	◉[1]	◉[2]	○[3]
Alternative 8—Excavation and Disposal Combined with *Ex situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	○[1]	○[2]	○[3]
SWMU 5							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 3—Soil Cover and Long-Term Monitoring	●	●	●	◉	●	●	●
Alternative 6—Excavation and Disposal (with Metal Recovery/ Recycle)	●	●	●	●	○[4]	◉[2]	○[5]
SWMU 6							
Alternative 1—No Action	●		◉	○	●	●	●
Alternative 2—Limited Action	●	●	●	○	●	●	◉
SWMU 7							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 4—Soil Cover with *In situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	◉	●	◉
Alternative 7—Excavation and Disposal Combined with *In situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	◉[1]	◉[2]	○[3]
Alternative 8—Excavation and Disposal Combined with *Ex situ* DNAPL Source Treatment and Long-Term Monitoring	●	●	●	●	○[1]	○[2]	○[3]

Evaluation of Alternatives for the SWMUs

Evaluation Criteria	Overall protection of human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, or volume through treatment	Short-term effectiveness	Implementability	Cost
SWMU 30							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 3—Soil Cover and Long-Term Monitoring	●	●	●	◉	●	●	●
Alternative 6—Excavation and Disposal	●	●	●	●	◉[1]	◉[2]	○[3]
SWMU 145							
Alternative 1—No Action	○		○	○	●	●	●
Alternative 3—Soil Cover and Long-Term Monitoring	◉	●	◉	◉	●	●	◉
Alternative 6—Excavation and Disposal (NSDD) with Soil Cover and Long-Term Monitoring	●	●	●	●	◉	●	○

Notes:
[1] More favorable score for disposal of waste at the WDF due to cost savings.
[2] WDF is being evaluated as part of the waste disposal option project, and a ROD has not been issued.
[3] Moderate for disposal of waste at the WDF.
[4] Lower if metal melter is constructed at PGDP.
[5] If metal is recovered, recovery cost would be added to excavation and disposal costs, but other criteria would not be affected by either metal recovery or disposal.