

# REDOX Complex Environmental Cost Estimate

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
under Contract DE-AC06-08RL14788



**P.O. Box 1600  
Richland, Washington 99352**

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CH2M HILL Plateau Remediation Company

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**APPROVED**

*By Lana Perry at 1:31 pm, Nov 28, 2016*

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Release Approval

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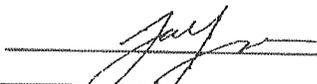
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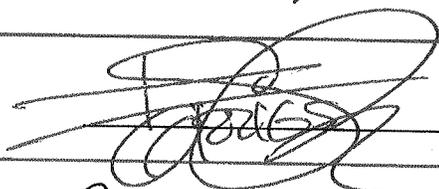
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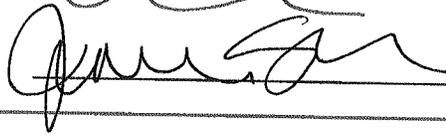
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## Terms

CHPRC	CH2M HILL Plateau Remediation Company
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
D&D	decontamination and decommissioning
demo prep	demolition preparation
DOE	U.S. Department of Energy
ECE	environmental cost estimate
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FY	fiscal year
G&A	general and administrative
HHE	human health and the environment
HSSA	Hanford Site Stabilization Agreement
IC	institutional control
MDBI	mobilization/demobilization and bonding and insurance
O&M	operations and maintenance
OH&P	overhead and profit
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
REDOX	Reduction-Oxidation
S&M	surveillance and maintenance
TRACE	Tool for Response Action Cost Estimating
TSS	technical support service
USACE	U.S. Army Corps of Engineers

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## 1 Introduction

This environmental cost estimate (ECE) was prepared to support the evaluation of removal action alternatives as documented in DOE/RL-2016-16, *Engineering Evaluation/Cost Analysis for the REDOX Complex* (hereafter referred to as the Reduction-Oxidation [REDOX] Complex Engineering Evaluation/Cost Analysis [EE/CA]).

Cost estimates for each building/structure summarized in this ECE have been prepared to support the selection of the removal action alternative. The cost estimates reflect specific removal action alternative approaches, scope assumptions, and exclusions, as well as cost estimating methodologies. Input parameters and related calculations used in the development of this cost estimate are provided in ECF-200W15-0132, *Cost Estimate Inputs for Engineering Evaluation/Cost Analysis for the REDOX Complex*. The cost estimate reflects specific removal action alternative approaches, scope assumptions and exclusions, as well as cost-estimating methodologies. The cost estimates have an expected range of accuracy described in Chapter 11.

## 2 Purpose of Estimate

This ECE provides costs needed to support the REDOX Complex EE/CA (DOE/RL-2016-16). It provides an overview of removal action specific cost inputs, methodology, and results. This ECE also documents the references that provide scope and information used to prepare these estimates. The purpose of this ECE is to accomplish the following objectives:

- Describe the methodology applied in performing the cost estimates.
- Describe the general and removal action-specific assumptions and inputs applied to the cost estimates.
- Summarize the removal action alternative cost estimates.

This ECE also documents the references that provide scope and information used to prepare these estimates.

This ECE has been prepared for guidance in project evaluation from the information available at the time of the estimate. The final cost of the project will depend on final design, selected scope of work, actual labor and material costs, competitive market conditions, implementation schedule, and other variable factors, and as a result, the final project costs will vary from the estimate presented here. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

## 3 General Project Description

The REDOX Complex EE/CA (DOE/RL-2016-16) identifies the removal action alternatives and evaluates them against the following criteria: removal action objectives, effectiveness, implementability, and estimated cost. The Environmental Protection Agency (EPA) is the lead regulatory agency for this action. The U.S. Department of Energy (DOE) is voluntarily seeking EPA review and concurrence in this removal action to help ensure consistency with ongoing or subsequent related remedial actions. Removal actions taken pursuant to the REDOX Complex EE/CA will be conducted in compliance with DOE et al., 2012, *Hanford Federal Facility Agreement and Consent Order Public Involvement Plan*, public participation requirements established in 40 CFR 300.415(n), “Community Relations in Removal Actions,” and any applicable DOE policies. The REDOX Complex EE/CA (DOE/RL-2016-16) will undergo a 30-day public comment period. After the public comment period, a written response to

significant comments will be provided in accordance with 40 CFR 300.820(a), “Administrative Record File for a Removal Action.” After consideration of the comments received from the public, DOE will confer with EPA regarding the issuance of the action memorandum. The action memorandum will identify the selected alternative, whether the one recommended here or one of the other alternatives.

The 202S Building was constructed in 1950. The REDOX Complex, which is inclusive of the 202S Building and surrounding support buildings, was designed to separate uranium, plutonium, and neptunium as individual product streams from associated fission products in the irradiated fuel. The 202S building is a large, multi-story, concrete structure with reinforced concrete walls. The 202S building contains a central canyon process area, a cavernous space that includes process cells used to separate fission products from irradiated fuel elements. The canyon process area is serviced via five gallery levels located to the north and south of the central canyon process area.

Deactivation activities included the flushing of vessel system loops and tanks. All flushed vessels were emptied to a minimum heel and associated piping was drained. Other deactivation activities included removing process liquids from the plant, shutting off utilities to the building, and consolidating ventilation systems. Deactivation was completed in 1998 and the complex has been under surveillance and maintenance (S&M) since that time. A general cross section of the 202S Building is shown in Figure 1.

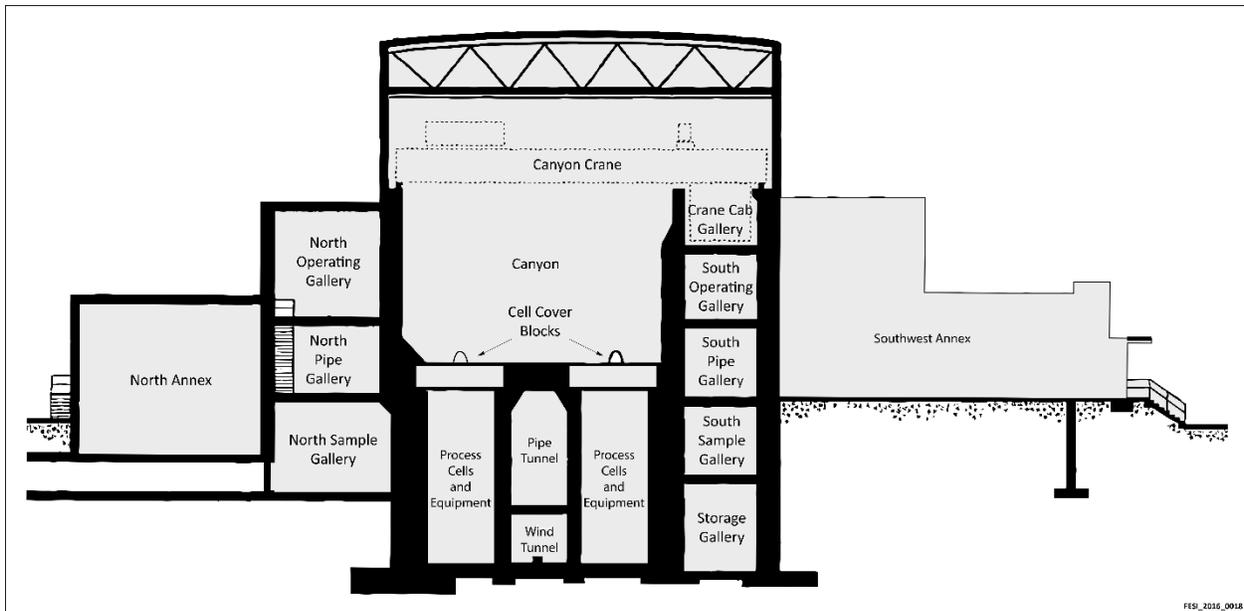


Figure 1. 202S Cross Section

Table 1 lists all structures evaluated under the REDOX Complex EE/CA (DOE/RL-2016-16), and Figure 2 provides a plan view of the layout of the evaluated structures.

Table 1. Evaluated Structures Within the REDOX Complex

Structure ID	Building/Structure Name
202S	REDOX (including Canyon, Silo, and Annex)
276-S-141 276-S-142	276S Hexone Storage Area Tanks
293-S	Nitric Acid and Iodine Recovery Building



Figure 2. Layout of Evaluated Structures Within the REDOX Complex

#### 4 Scope of Work

This cost estimate for the REDOX Complex EE/CA (DOE/RL-2016-16) was developed in accordance with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, and CH2M HILL Plateau Remediation Company (CHPRC) cost estimating procedures found in PRC-PRO-EP-40282, *Cost Estimating Procedure for Response Action Decision-Making and Work Plans*.

Quantities used in the creation of this estimate were based on the following documents:

- CP-59374, *Canyon Risk Mitigation Plan*
- ECF-200W-15-0132, *Cost Estimate Inputs for Engineering Evaluation/Cost Analysis for the REDOX Complex*
- HNF-13830, *Reduction-Oxidation (REDOX) Facility Documented Safety Analysis*
- Various Hanford Site drawings

Removal action alternatives were developed for all buildings/structures evaluated within the REDOX Complex EE/CA (DOE/RL-2016-16). These buildings/structures include the 202S Building and the 293S Building. The alternatives include specific actions to occur within each structure. Each successive alternative includes all of the structure-specific actions involved in the previous alternative, with the addition of new actions for various structures, as outlined in each alternative subsection.

Each alternative, with the exception of Alternative 1, includes the following types of actions: S&M hazard abatement, demo prep, demolition and/or grouting. Waste generated from these actions will be treated and/or disposed. The following subsections describe these action categories.

***Surveillance and Maintenance.*** S&M activities will be performed in accordance with the most current S&M Plan (e.g., DOE/RL-98-19, *Surveillance and Maintenance Plan for the 202-S Reduction Oxidation (REDOX) Facility*) on a routine and nonroutine basis. Routine S&M activities ensure that structural and passive confinement integrity is maintained, and may include access control, periodic monitoring for potential radiological contamination and other hazards, cold weather protection, maintenance, annual roof inspections, identification and minor repair of friable asbestos, and general visual inspections. Nonroutine activities include major responses to undesirable observations (e.g., a leak in one area spreading radiological contamination to another area). Major maintenance and other facility life extension operations, such as roof maintenance, would be performed to ensure the structures remain in a safe condition and that the ongoing deterioration process is minimized to control the potential for accidental release of radioactive materials and hazardous substances. The S&M Plan will be revised to reflect the current facility conditions and identify appropriate surveillance requirements as needed.

The objective of S&M is to ensure adequate containment of any contaminants left in place, provide physical safety and security controls, and maintain the facility in a manner that will minimize risk of release and subsequent exposure to human health and the environment (HHE). In accordance with these objectives, some areas within the scope of this EE/CA are not accessed during the S&M phase according to the current S&M Plan.

***Hazard Abatement.*** Hazard abatement differs from S&M in that it allows for a proactive response to mitigate or reduce risk before a “major response” would be required. Hazard abatement activities may range from stabilization to complete removal of equipment and waste, as needed, to mitigate hazards. Identification of areas that will receive hazard abatement will be based on S&M activities and observations. This EE/CA assumes that modifications to the 291S Ventilation System will be needed to support the removal activities at the REDOX Complex. An engineering evaluation of the ventilation system will be performed prior to initiation of the removal activity, if needed.

***Demolition Preparation.*** Demo prep may include activities such as general housekeeping and removal of equipment and waste. Decontamination, fixing/stabilization of contamination, and isolation of systems may be performed. Interior portions of the building may be removed, as practical and necessary to support future access for final disposition activities. Overhead utilities and adjacent concrete and asphalt may be removed, as needed. Fluids will be drained from piping and equipment. Piping entering or exiting a structure may be plugged, blocked, or grouted to prevent potential release pathways to the environment, as appropriate. These activities will be managed in accordance with procedures that address removing, handling, and disposing of these materials in a manner that protects the safety of employees and the general public, minimizes spills and releases to the environment, and meets regulatory requirements.

***Demolition.*** Demolition is preceded by hazard abatement and demo prep activities, including the removal of hazardous substances, as necessary, from within and around buildings and structures; decontamination, fixing contamination, and isolation of systems; removal of equipment; and plugging of piping or drains entering or exiting belowgrade buildings and structures. Demolition of buildings and structures includes

removal of abovegrade structures. Belowgrade structural components, such as basements, will be left intact (with penetrations secured or blanked) and backfilled or grouted as appropriate. If warranted, belowgrade structures and/or related equipment may be removed to facilitate other removal action activities surrounding the area, or as deemed necessary by DOE Richland Operations Office (RL), to support overall cleanup goals and priorities. The area will be stabilized (for example, backfill, contour, and vegetate) as necessary and appropriate.

**Grouting.** Grouting of structures will be performed as appropriate to reduce the mobility, solubility, and/or toxicity of the grouted waste and to support final disposition. Structures and systems, including piping, utility systems, and structural steel, may be abandoned in place and grouted. In addition, residual radioactive materials in all areas receiving grout would remain in place and would be managed in accordance with the current Hanford Sitewide Institutional Controls Plan (e.g. DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*). Void spaces would be grouted as necessary and/or backfilled as appropriate and practicable. Fill material such as controlled density fill or grout may be installed to stabilize the material, provide shielding, and facilitate demolition and/or future removal or remedial actions.

#### 4.1 Alternative 1 – No Action

The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)* requires the “No Action” alternative as a baseline for comparison with other removal action alternatives. Under the No Action alternative, it is assumed that 202S, 276S, and 293S would be abandoned without any further action. No legal restrictions, institutional controls, or active measures are applied to 202S, 276S, and 293S in this alternative. S&M activities would be discontinued, no additional facility stabilization would be performed, and degradation would continue indefinitely. Initial risks to HHE of the No Action alternative would be minimal, and barring an unusual event, contaminants are assumed to remain confined within the structures. Risks over time are expected to increase, as deterioration progresses and structural integrity is compromised. The possibility of a chemical and/or radiological contamination spread would increase due to lack of monitoring and controls. Physical hazards associated with partial structural collapse would also be anticipated.

Although Alternative 1 would not have an associated implementation cost under this analysis, it is understood that taking No Action would ultimately result in a substantial cost in the future. Alternative 1 is not consistent with DOE obligations under federal law to protect HHE; therefore, this alternative cannot be considered viable and is not considered further in this EE/CA. This alternative is used as a baseline for comparison only.

#### 4.2 Alternative 2 – Continued S&M/Hazard Abatement 202S/Demo Prep Silo Service Area/Demolition 276S/Demo and Grouting 293S

Alternative 2 would involve the following:

- Continued S&M of REDOX Complex structures
- Hazard abatement of the 202S Galleries
- Demolition preparation (demo prep) of the 202S Silo Service Area
- Demolition of the 276S Hexone Storage Tanks and the 293S Building
- Grouting of belowgrade areas of the 293S Building

The removal activities for Alternative 2 are summarized in Figure 3.

Under Alternative 2, S&M activities would continue for the entire REDOX Complex. Hazard abatement would take place in high-priority areas in the 202S Canyon. In addition, the Silo Service Area would undergo demo prep, and the 276S Hexone Storage Tanks (276-S-141 and 276-S-142) and the 293S Building would undergo demolition. The scope of each removal activity is described in the following subsections. Figure 3 provides a general overview of the removal activities that would be implemented under Alternative 2 throughout the REDOX Complex.

#### 4.2.1 Surveillance and Maintenance

Under Alternative 2, S&M activities for the REDOX Complex would be performed for 25 years. S&M efforts are expected to increase over time in areas where no additional removal actions will take place due to continued degradation of structures and components. No facility life-cycle upgrades will be performed.

#### 4.2.2 Hazard Abatement

Under Alternative 2, the 202S Galleries would undergo hazard abatement. At a minimum, high-risk areas that will receive hazard abatement include the North Sample Gallery, including the Plutonium Loadout Hood; the South Operating Gallery; the South Sample Gallery, the South Pipe Gallery; and the Storage Gallery. The Canyon Deck and areas below the cover blocks will not be included in hazard abatement activities.

#### 4.2.3 Demolition Preparation

Under Alternative 2, demo prep would occur in the Silo Service Area. This would include levels one through five, seven, and eight. Level six, which includes the crane and crane cover blocks, is not considered in the cost estimate for this activity. Demo prep will not occur in the Silo Tower Shaft and the Column Laydown Trench.

#### 4.2.4 Demolition

Alternative 2 includes demolition of the 276S Hexone Storage Tanks and the 293S Building. Demo prep activities will be performed at these structures prior to starting demolition work, as necessary.

The 276S Hexone Storage Tanks, associated pumps, piping, and the soil beneath the pumps will be clean closed per the existing *Resource Conservation and Recovery Act of 1976 (RCRA) closure plan (DOE/RL-2009-112, Hexone Storage and Treatment Facility Closure Plan)*. The tanks will be clean closed by removal and disposal. If possible, the tanks will be removed intact and transferred to the Environmental Restoration Disposal Facility (ERDF). If, due to the weight of the tanks or field conditions, intact disposal is not feasible, the tanks will be demolished on site and the debris will be placed in a double-lined roll-off container and transported to a cell at ERDF for disposal. The removal area soil will be sampled in accordance with an approved sampling and analysis plan to verify achievement of clean closure standards.

At the 293S Building, all above- and belowgrade process equipment and tanks will be removed. The building would be demolished to slab-on-grade in order to minimize infiltration of precipitation to underlying soils.

#### 4.2.5 Grouting

Following demolition and removal of the abovegrade structure and equipment, belowgrade areas of the 293S Building will be grouted.

#### 4.3 Alternative 3 – Continued S&M/Hazard Abatement 202S/Demo Prep Silo Service Area/Demolition 276S/Demo and Grouting 293S/Demo Prep Annex and Abovegrade 202S

The primary elements of Alternative 3 (in italics) are as follows, which include all activities in Alternative 2:

- Continued S&M of REDOX Complex structures (Alternative 2)
- Hazard abatement of the 202S Canyon Galleries (Alternative 2)
- Demo prep of the 202S Silo Service Area (Alternative 2)
- Demolition of the 276S Hexone Storage Tanks and the 293S Building (Alternative 2)
- Grouting of belowgrade areas of the 293S Building (Alternative 2)
- *Demo prep of 202S Annex and abovegrade areas of the 202S Canyon*

The removal activities for Alternative 3 are summarized in Figure 4. This alternative includes all activities included in Alternative 2 with the addition of demo prep in the Annex and abovegrade areas of the 202S Canyon. Prior to the demo prep of the Annex, some hazard abatement activities may be performed, if necessary.

#### 4.4 Alternative 4 – Continued S&M/Hazard Abatement 202S/Demo Prep Silo Service Area/Demolition 276S/Demo and Grouting 293S/Demo Prep Annex and Abovegrade /Demolition Annex

The primary elements of Alternative 4 (in italics) are as follows, which include all activities in Alternative 3.

- Continued S&M of the REDOX Complex (Alternative 2)
- Hazard abatement of the 202S Canyon Galleries (Alternative 2)
- Demo prep of the 202S Silo Service Area (Alternative 2)
- Demolition of the 276S Hexone Storage Tanks and the 293S Building (Alternative 2)
- Grouting of belowgrade areas of the 293S Building (Alternative 2)
- Demo prep of 202S Annex and abovegrade areas of the 202S Canyon (Alternative 3)
- *Demolition of the 202S Annex*

The removal activities for Alternative 4 are summarized in Figure 5. This alternative includes all activities included in Alternative 3 with the addition of demolition of the 202S Annex. Currently, the North and East Annex are service support areas. Demo prep will take place prior to all demolition activities. The Annex would be demolished down to ground level and the basement level would be brought back to grade with fill material. Following demolition, any access points to the remaining canyon portion will be isolated or sealed as appropriate.



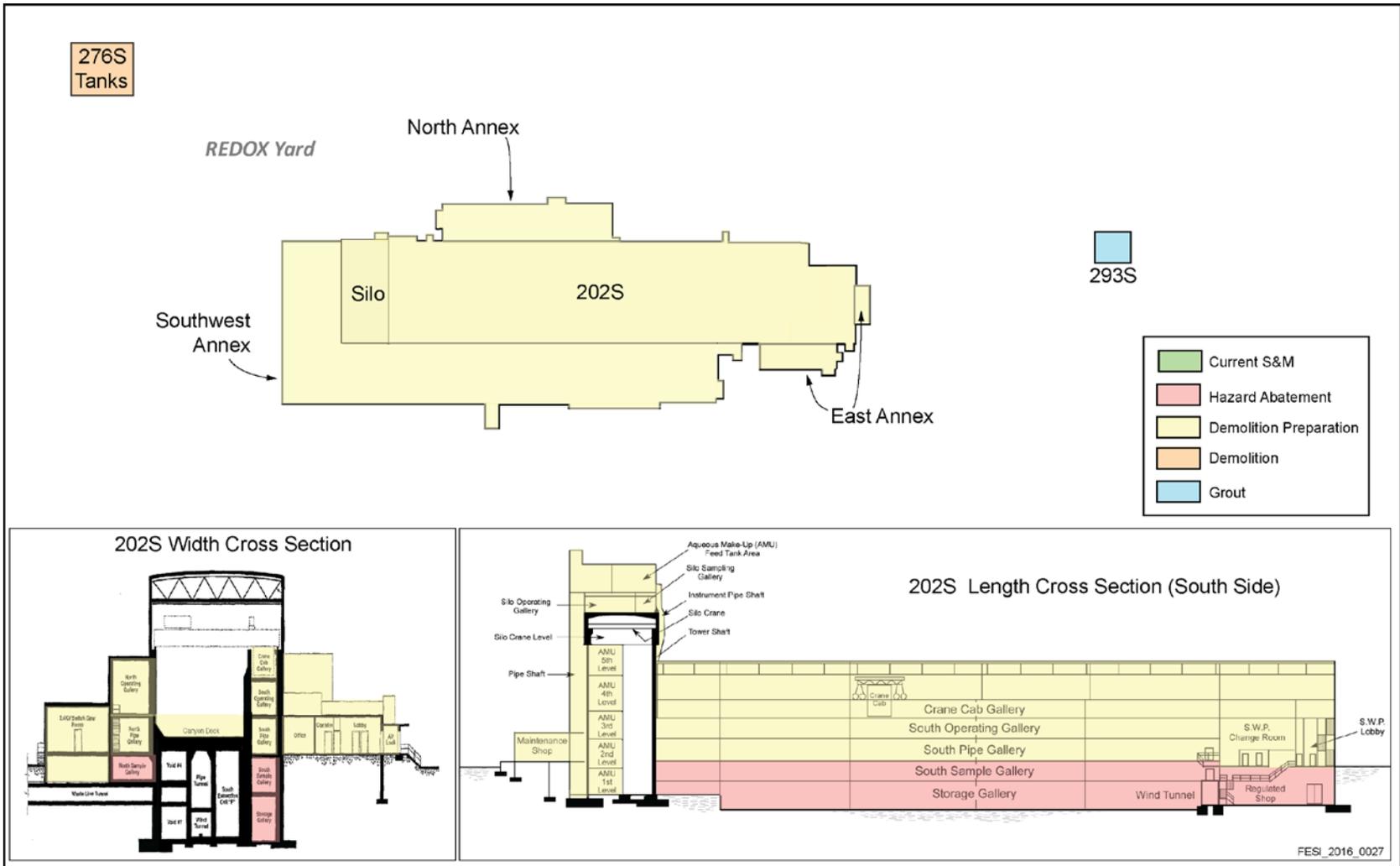


Figure 4. Alternative 3 Summary of Activities

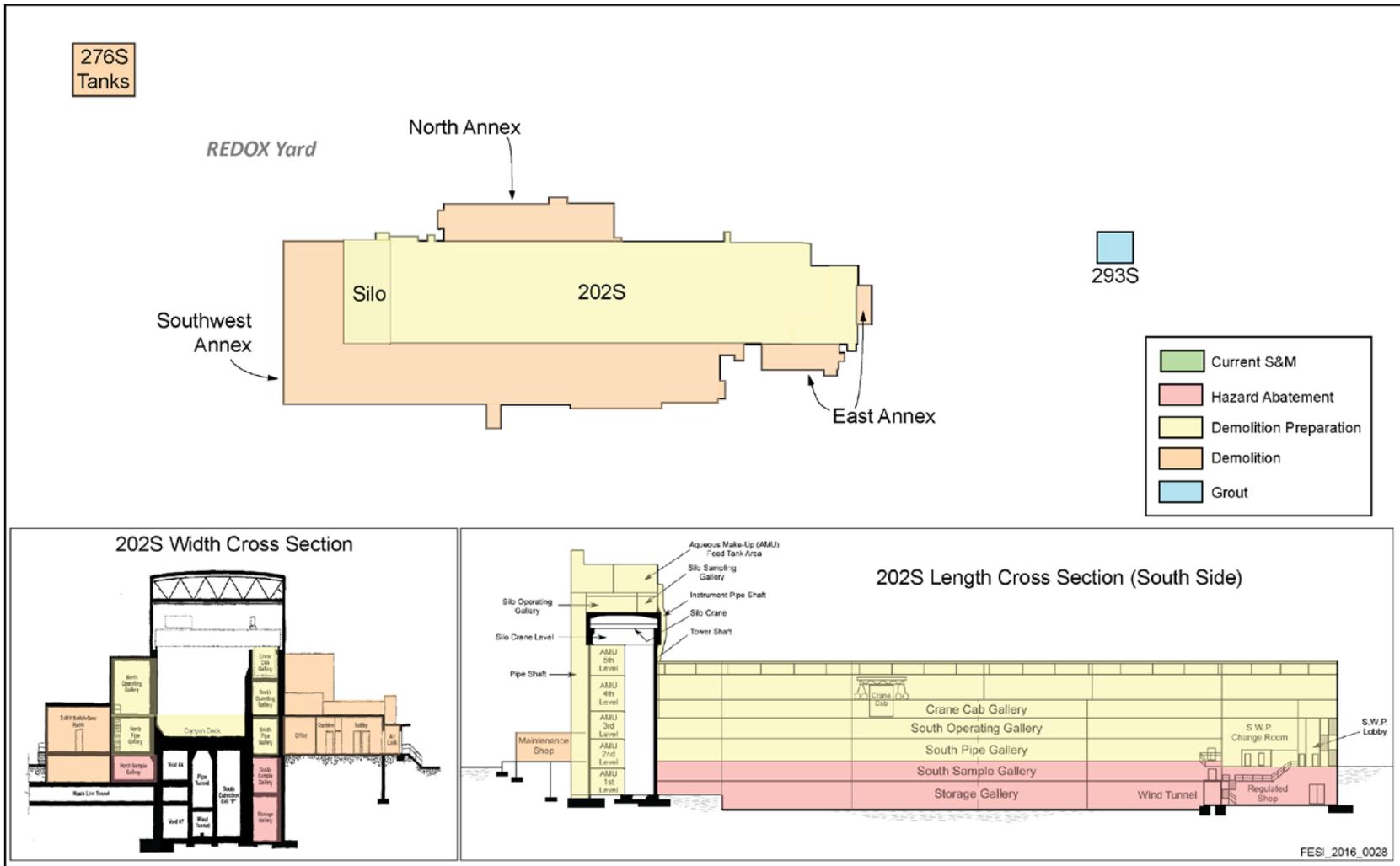


Figure 5. Alternative 4 Summary of Activities

## 5 Major Assumptions

This chapter describes the general and specific cost assumptions used in the estimate.

### 5.1 General Assumptions and Inputs

General assumptions include direct cost factors, indirect cost factors, and other general pricing assumptions.

- Markups are included for mobilization/demobilization and bonding and insurance (MDBI), overhead and profit (OH&P), taxes, contingencies, and general and administrative (G&A) (see Chapters 7 and 8).
- Markups for project management, removal action design costs, and construction management are included (see Chapter 9).
- The project will have a duration of 25 years.

### 5.2 Specific Assumptions

Specific assumptions are broken out into the following categories: site preparation, labor, waste disposal, waste treatment, sampling and analysis, grouting, O&M costs, and other.

#### 5.2.1 Site Preparation

Site preparation will be conducted prior to removal action activities. Site preparation assumptions include the following:

- Site prep allowance for securing the site, power connections, set up of work zones and equipment and waste areas, and set up of temporary facilities and utilities (includes 3 months of planning for initial activities)
- Modifications to the ventilation system are assumed to be necessary in order to conduct removal action activities inside the galleries.
- Modifications to the existing life safety documentation (fire hazards analysis, documented safety analysis) following completion of facility updates are required prior to initiating removal action activities.

#### 5.2.2 Labor

Labor costs and duration assumptions include the following:

- The cost and time necessary for mockups. A mockup is a simulation exercise for workers to practice a hazardous activity in a controlled environment prior to attempting the actual activity. Mockup costs include labor, equipment, and materials.
- Appendix A, Table A-10 provides the duration of each labor activity for all alternatives.
- The interior specialized crew is based on actual crew data from Plutonium Finishing Plant cleanup work. This crew is assumed to complete all hazard abatement and demo prep activities. This crew rate includes 20 full-time equivalents, materials, taxes and licenses, and G&A. Appendix A, Table A-11 provides a breakdown on worker types and hours.

- A decontamination and decommissioning (D&D) crew includes equipment costs (70 percent labor, 30 percent equipment). This crew is assumed to conduct all demolition and grouting activities. Appendix A, Table A-12 provides a breakdown on worker types and hours.
- Labor activities are to be conducted sequentially, with only one crew working at any given time. Crews will be focused on a single cleanup activity until work is complete or a change in conditions warrants redeployment.
- Current Radiological Controls practices will continue for the duration of the project.
- An average of 19 work days per month are assumed.

### 5.2.3 Waste Disposal

Calculations for equipment volumes and weights for disposal are discussed in ECF-200W15-0132. Waste disposal assumptions include the following:

- Hazard abatement activities will remove 50 percent of equipment from designated areas.
- Demo prep activities will remove 100 percent of equipment from designated areas.
- All contaminated wastes meeting acceptance criteria are to be disposed of at ERDF as low-level waste/mixed low-level waste.
- The average load to ERDF is 13 tons.
- No removable equipment is assumed in the Crane Cab Gallery.
- The canyon crane will not be operated. Any equipment requiring the canyon crane for removal will remain on the canyon deck.
- Sorting of waste prior to disposal will not be necessary.
- Any equipment remaining in the 202S Building following hazard abatement and demo prep activities will be left in place and will not be consolidated into belowgrade areas of the canyon.

### 5.2.4 Waste Treatment

Waste treatment cost breakdown is described in Appendix A, Table A-13, and contains the following assumptions:

- ERDF containers hold 13 tons of debris.
- Treatment for each ERDF container requires 4 hours to complete.
- 10 percent of waste will require treatment prior to ERDF disposal.

### 5.2.5 Waste Transportation

Transportation of waste contains the following assumptions:

- Total drive time from REDOX to ERDF is 0.1 hours ( $2 \text{ mi} \div 20 \text{ mi/hr} = 0.1 \text{ hr}$ ).
- Distance to ERDF ( $\times 2$  for return trip) is 2 mi.
- Average speed is 20 mi/hr
- Two teamsters are required for transportation of waste to ERDF.
- Average wait time is 0.5 hours.

### 5.2.6 Sampling and Analysis

Sampling and analysis assumptions include the following:

- An initial characterization campaign will occur prior to major work within the 202S Building. The characterization campaign will require approximately 350 samples. Appendix A, Table A-14 provides a breakdown of this characterization sampling campaign.
- Confirmatory sampling following removal action activities will not be taken until initiation of the final remedial action.
- An allowance for sampling waste prior to transport to ERDF is included for all waste disposal activities.

### 5.2.7 Grouting

Grouting assumptions include the following:

- Costs associated with grouting activities were taken from the cost estimate for U Canyon grouting.

### 5.2.8 O&M Costs

O&M cost assumptions include the following:

- The cost of the S&M program for the REDOX Complex is assumed to be the same as the cost for the fiscal year (FY) 2013. This rate is assumed to remain constant for the entirety of the project duration (25 years).
- Personnel support facilities will be necessary for the entire duration of the project (25 years). Support facilities will consist of two single-wide trailers, two double-wide trailers, and one restroom trailer.
- Additional hazard abatement activities are assumed necessary throughout the 25-year project duration as new hazards are identified.
- At the conclusion of the 25-year project duration, a final on-scene coordinator report will be completed to summarize the activities completed.

### 5.2.9 Other Specific Assumptions

Other specific assumptions include the following:

- Air monitoring is assumed to occur during each removal action activity. The duration of air monitoring will be matched to the duration of labor activities for each removal action.
- Calculations for room volumes, equipment volumes and weights, and void space volumes for grouting activities are discussed in ECF-200W15-0132. These measurements were used as inputs for waste disposal and grouting activity costs.
- On-scene coordinator reports will be issued following the completion of key removal actions, including the following:
  - Demolition of the 276S Hexone Storage Tanks
  - Cleanout of the Silo Service Areas
  - Removal of the Plutonium Loadout Hood
  - Demolition of the 293-S Building
- Assumed durations for actions in each area are provided in Appendix A, Table A-10.

- A final on-scene coordinator report has been allocated for at the completion of all proposed removal action activities.

## 6 Exclusions

This chapter identifies scope items and costs that have not been included in the estimates for any of the alternatives. The following items have been excluded from the estimate:

- Escalation – Separate escalation has not been included in these calculations. The costs are all based on FY 2016 costs.
- Institutional Controls (ICs) – Costs for CERCLA programmatic ICs are not included in this estimate.
- Significant amounts of contaminants/contaminated materials not previously identified are not included.
- Waste material size reduction beyond the minimum needed to handle and transport to ERDF.
- Costs associated with final remedial decision. All removal action activities were designed to prepare REDOX Complex for final disposition. As of May 2016, a final remedial decision has yet to be made for the 202S Building. Current duration estimates for removal action activities do not span the entire 25-year project duration. Following completion of removal action activities, activities associated with final remedial activities may occur, but are not included in this cost estimate.
- Facilities located within the REDOX Canyon Complex that have been evaluated under a separate EE/CA are not included.

## 7 Markups

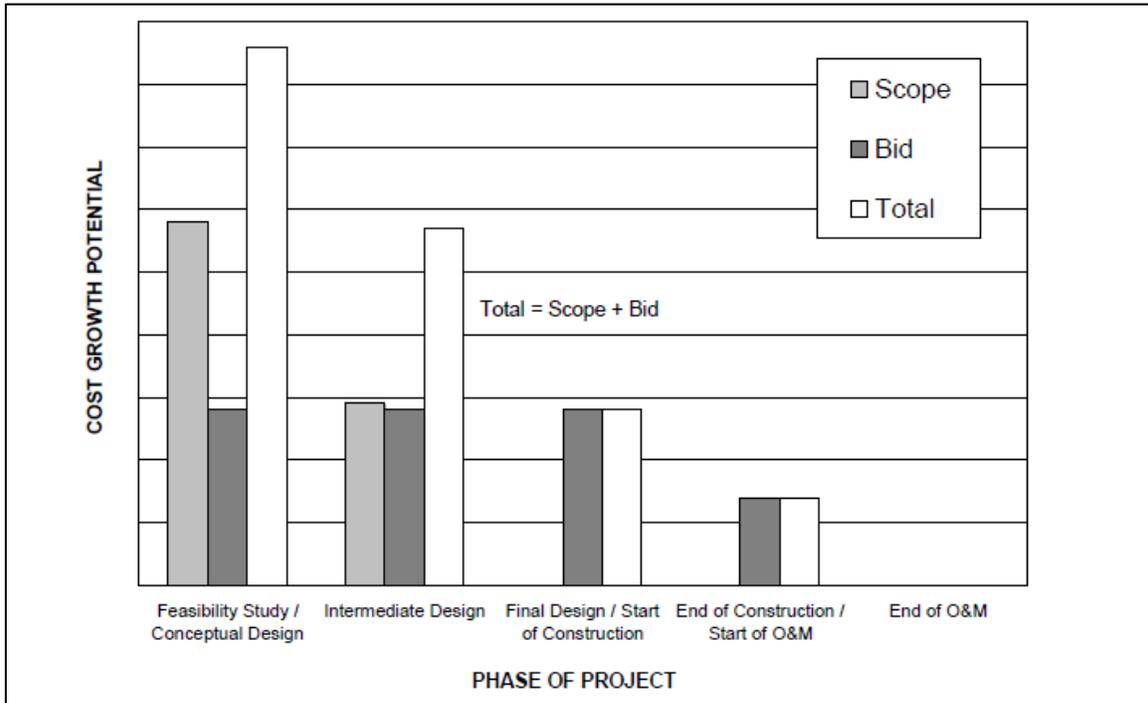
The following markups are used in the cost estimates for each alternative and applied in the following order (see Appendix A cost tables for delineation of subtotals and summation of markups):

- MDBI – A 10 percent markup is applied to capital cost subtotal costs to cover contractor MDBI.
- OH&P – A 15 percent markup is applied to the capital cost subtotal with taxes for contractor overhead, and a 10 percent markup is applied to the capital cost subtotal for contractor profit.
- Taxes – An 8.6 percent Washington State tax is applied to equipment, materials, subcontractors, and other direct costs (with the exception of laboratory services and quoted costs from subcontractors). Sales tax is assumed to be included in costs based on previous systems and components used in this estimate.
- Contingency – An overall 45 percent capital cost contingency was applied (25 percent capital scope contingency plus 20 percent capital bid contingency).
- CHPRC G&A Fee – A 20 percent G&A is applied to the subtotal capital cost including contingencies.

## 8 Contingencies

Contingency is factored into a cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate from the available data at the time the estimate is prepared. It is used to reduce the risk of possible cost overruns. The two main types of contingency are scope and bid. Scope contingency covers unknown costs due to scope changes that may occur during

design. Bid contingency covers unknown costs associated with constructing and implementing a given project scope. Figure 7 shows how the bid and scope contingencies typically change as a project progresses through stages of design and implementation. Figure 7 also shows the relationship between scope, bid, and total contingencies. In addition to scope and bid contingencies for capital costs, there is also an O&M contingency. The total O&M contingency has been estimated to be 50 percent for all alternatives.



Source: EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, Exhibit 5-5.

Figure 7. Relationship of Scope, Bid, and Total Capital Cost Contingency

## 8.1 Scope Contingency

Scope contingency represents project risks associated with an incomplete design. This type of contingency represents costs, unforeseeable at the time of estimate preparation, that are likely to become known as the remedial design proceeds (Figure 7). For this reason, scope contingency is sometimes referred to as “design” contingency, which is the term commonly used by the U.S. Army Corps of Engineers (USACE). In general, scope contingency should decrease as design progresses and should be 0 percent at the 100 percent design stage.

At the early stages of remedial design (e.g., feasibility study, which represents 0 to 10 percent design completion), concepts are not typically developed enough to identify all project components or quantities. Contributing factors include limited experience with certain technologies, potential requirements due to regulatory or policy changes, and inaccuracies in defining quantities or characteristics. Scope contingency would be expected to be higher for newer or emerging remedial technologies than for more well-documented systems. For these reasons, scope contingency may vary between alternatives. A low percentage for scope contingency indicates an opinion that the project scope will undergo minimal change during design. A high percentage indicates an opinion that the project scope may change considerably between the feasibility study and final design.

The scope contingency for this estimate has been set at 25 percent for all of the alternatives.

## 8.2 Bid Contingency

Bid contingency represents costs, unforeseeable at the time of estimate preparation, that are likely to become known as the remedial action construction or O&M proceeds (Figure 7). For this reason, bid contingency is sometimes referred to as “construction” contingency, which is the term commonly used by the USACE.

Bid contingency accounts for changes that occur after the construction contract is awarded. This contingency represents a reserve for quantity overruns, modifications, change orders, and/or claims during construction. Considerations include the technological, geotechnical, and other unknowns applicable to the construction phase. Examples include changes due to adverse weather, material or supply shortages, or new regulations.”

The range for bid contingency is typically from 10 to 20 percent. The bid contingency for this estimate has been set at 20 percent for all of the alternatives.

## 8.3 O&M Contingencies

O&M contingencies are applied to individual annual and periodic O&M cost line items. Since O&M scope is generally less defined than capital scope associated with a specific alternative design, and since O&M has variability in frequency, duration, activity level, and response to changes as O&M progresses, O&M cost contingencies are typically at least as high and often greater than capital cost contingencies. A total O&M contingency of 50 percent was used for each annual and periodic O&M cost line item for each alternative.

# 9 Project Management, Removal Design, Construction Management, and Technical Support Services

Project management, remedial design, and construction management capital costs are estimated using factors based on EPA 540-R-00-002. These factors are provided in Table 2.

Table 2. Percentages for Professional/Technical Services Capital Costs

Capital Cost Element	<\$100K (%)	\$100K-\$500K (%)	\$500K-\$2M (%)	\$2M-\$10M (%)	>\$10M (%)
Project Management	10	8	6	5	5
Remedial Design	20	15	12	8	6
Construction Management	15	10	8	6	6

Source: EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, Exhibit 5-8.

Because each alternative has an estimated cost greater than \$10 million, the following percentages were used in these estimates:

- Project management: 5 percent
- Remedial design: 6 percent
- Construction management: 6 percent

Technical support services (TSSs) include project management, technical coordination, and onsite logistics and support to implement O&M activities. The TSS markup is applied to individual annual and periodic O&M cost line items with the TSS percentage varying based on the line item subtotal cost as shown in Table 3. The line item subtotal costs corresponding to the Table 3 cost ranges include MDBI, OH&P, Washington State sales tax, and O&M contingency.

Table 3. Percentages for Technical Support Services for O&M Costs

O&M Cost Element	<\$100K (%)	\$100K-\$500K (%)	\$500K-\$2M (%)	\$2M-\$10M (%)	>\$10M (%)
Technical support services	45	33	26	19	17

Note: Percentages are the sum of the project management, remedial design and construction management vales found in Table 2.

Since the individual annual and periodic O&M line item subtotals in the alternatives range from <\$100,000 to \$2M - \$10M, the TSS markup percentages for the line items in the alternatives range from 45 percent to 19 percent. The Appendix A tables for annual O&M markups and periodic O&M markups for each alternative list composite average TSS markup percentages.

## 10 Present Worth

The estimate includes present worth calculations for work performed in outyears based on EPA 540-R-00-002.

The costs are presented as present worth values. The present worth value method establishes a common baseline for evaluating costs that occur during different time periods, thus allowing for direct cost comparisons between different alternatives. The present worth value represents the dollars that would need to be set aside today, at the defined real discount rate, to ensure that funds would be available in the future as they are needed to perform the response action alternative.

Present worth costs were estimated using the real discount rate published in Appendix C of OMB Circular No. A-94, 2015, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.” Based on this guidance and durations of 25 years for all alternatives, a real discount rate of 1.38 percent was used in the cost estimate present value calculations for these alternatives.

## 11 Estimate Classification

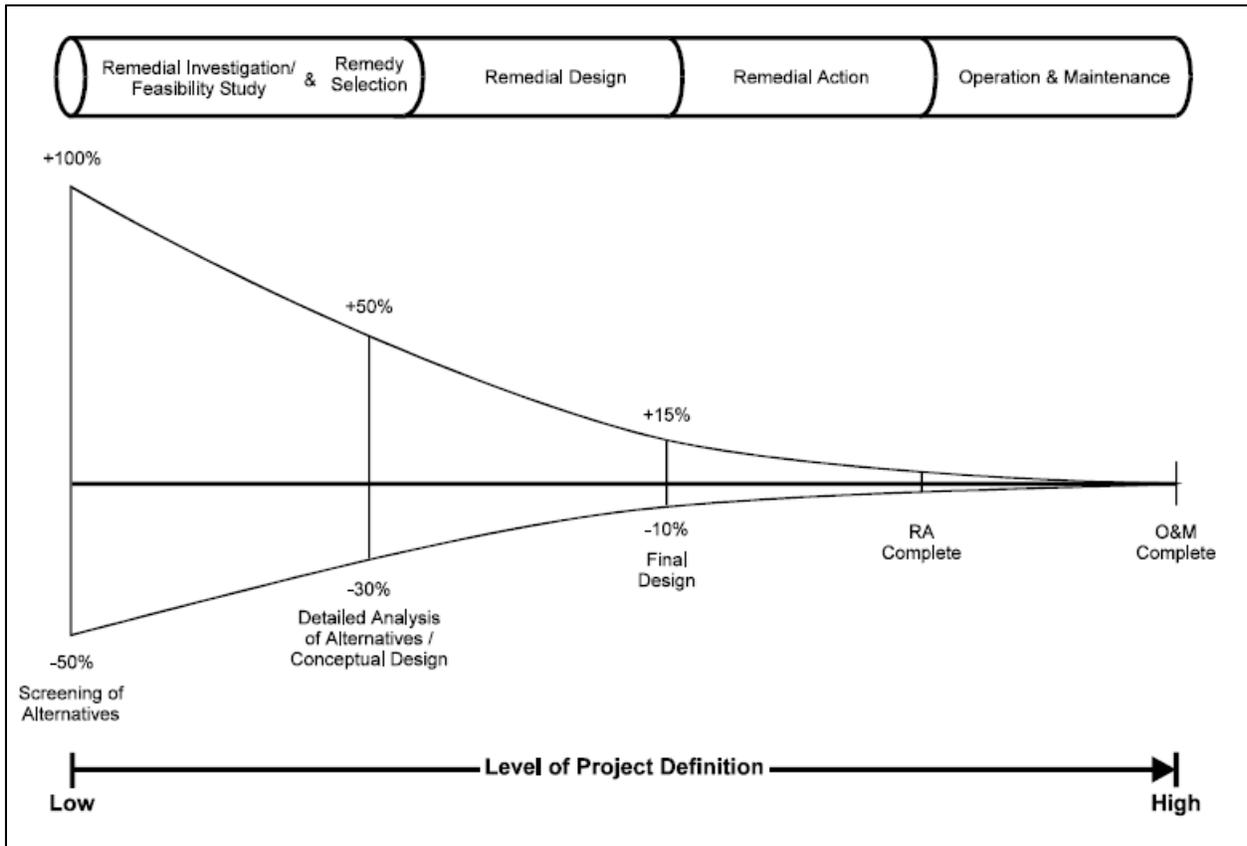
The expected accuracy range of the cost estimate at this stage is approximately +50 percent, -30 percent. This accuracy range is consistent with EPA 540-R-00-002 for the level of project definition available at this time.

The expected accuracy range is an indication of the degree to which the final cost outcome for a given project could vary from the estimated cost. Accuracy is traditionally expressed as a +/- percentage range around the point estimate after application of contingency, with a stated level of confidence that the actual cost outcome would fall within this range (+/- measures are a useful simplification, given that actual cost outcomes have different frequency distributions for different types of projects). Typically, this results in a 90 percent confidence that the actual cost will fall within the bounds of the low and high ranges.

The accuracy range of an estimate is dependent upon a number of characteristics of the estimate input information and the estimating process. The extent and the maturity of the input information as measured by percentage completion (and related to level of project definition) is an important determinant of

accuracy. However, there are factors besides the available input information that also greatly affect estimate accuracy measures. Primary among these are the state of technology in the project and the quality of reference cost-estimating data.

The accuracy of any given estimate is not fixed or determined by its classification category. Significant variations in accuracy from estimate to estimate are possible if any of the determinants of accuracy such as maturity of technology selected, quality of reference cost data, quality of the estimating process, and skill and knowledge of the estimator, vary. Accuracy is also not necessarily determined by the estimating methodology used or the effort expended. Estimate accuracy must be evaluated on an estimate-by-estimate basis, usually in conjunction with some form of risk analysis process. Figure 8 shows an example of the expected level of accuracy for a remedial action, which is similar to the removal actions this cost estimate supports.



Source: EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, Exhibit 2-3.

Figure 8. Expected Cost Estimate Accuracy

## 12 Cost Resources

This chapter describes the various resources used in the development of the cost estimate. Appendix A, Tables A-15 and A-16 provide unit costs and associated sources for items included in the cost estimate. Sources listed in the Appendix A tables include historical and other costs.

Historical costs include actual costs or estimated costs from past Hanford Site projects. Other costs are sourced from CHPRC project management, rate information gathered from subject matter experts, and estimator buildup utilizing information gathered from historical sources or other sources.

Labor unit prices reflect a burden rate, including workers' compensation, unemployment taxes, fringe benefits, and medical insurance (2015 rates).

The cost estimate was generated using the most recent version of the Tools for Response Action Cost Estimating (TRACE) workbook (V4, Rev. 0) in Microsoft® Excel®. Additional information on this workbook may be found in TRACE V4 (ECF-HANFORD-16-0003 through ECF-HANFORD-16-0012; see Chapter 18 for complete reference citations).

### 13 Estimate Methodology

The cost estimate for the REDOX Complex EE/CA (DOE/RL-2016-16) was developed in accordance with EPA 540-R-00-002 and contractor cost-estimating procedures. The TRACE V4 cost estimating workbook in conjunction with historical cost data and estimated allowances were used to develop the cost estimate for each of the removal action alternatives. Assumed project scope items were itemized and unit costs were applied as shown in Appendix A, Tables A-1 through A-9. Where available, costs for major systems were based on existing systems costs at the Hanford Site. Percentage allowances and lump sums were applied for some of the cost items based on Hanford Site and environmental project experience.

This cost estimate has been prepared for guidance in project evaluation from the information available at the time of the estimate. The final cost of the project will depend on final design, selected scope of work, actual labor and material costs, competitive market conditions, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimate presented in this document. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

### 14 Sensitivity Analysis

Sensitivity analysis for this cost estimate was not performed. The following factors might cause the estimate to change significantly:

- Levels of contamination
- Newly discovered hazardous conditions
- Availability of workers
- Less favorable working conditions and/or increased monitoring requirements that would significantly increase the impact of working in health and safety protection and/or increase the health, safety, monitoring, and regulatory requirements

Because of these factors:

- The remedy selection process must consider differences in response action cost uncertainties/cost risks in addition to response action-specific cost estimates and ranges.
- Funding needs must be carefully reviewed before making specific financial decisions or establishing final budgets.

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## 15 Labor Costs

Appendix A presents labor and crew costs used in these estimates. For this estimate, labor needs were developed through discussions with CHPRC project management. As a high-level estimate, in-depth work planning and crew development was not conducted. Labor needs were grouped into two work crew categories: interior specialized and general D&D.

Following the development of these two work crew categories, past estimates and actual costs from Hanford Site projects were studied.

The interior specialized work crew was identified for all interior cleanout work of contaminated structures. For this estimate, actual crew data from recent work conducted within the Plutonium Finishing Plant were evaluated. The average monthly cost and labor breakdown for a single full-time crew was calculated and can be found in Appendix A, Table A-11.

The general D&D labor category was selected for all facility demolition activities. The labor breakdown and monthly cost for this crew type were extracted from past cost estimates and can be found in Appendix A, Table A-12.

## 16 Sales Tax

Washington State sales tax has been applied to all materials and equipment purchases at 8.6 percent and is included in the markups discussed in Chapter 7.

Future cost escalation is not calculated in this estimate. All costs are presented in 2016 dollars.

## 17 Cost Summary

Table 4 presents overall capital, annual, periodic, total nondiscounted, and total discounted (present value) costs for the REDOX Complex.

Table 4. Summary of Costs

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
<b>Total Capital Cost</b>		\$0	\$104.1 M	\$135.2 M	\$140.0 M
<b>Total Annual Cost</b>		\$0	\$29.0 M	\$29.0 M	\$29.0 M
<b>Total Periodic Cost</b>		\$0	\$27.5 M	\$27.5 M	\$27.5 M
<b>Total Nondiscounted Cost</b>		\$0	\$160.6 M	\$191.7 M	\$196.5 M
<b>Total Present Value Cost (Discounted)</b>		\$0	\$148.1 M	\$176.5 M	\$180.7 M
<b>Total Present Value Cost Range</b>	-30%	\$0	\$103.7 M	\$123.5 M	\$126.5 M
	+50%	\$0	\$222.1 M	\$264.7 M	\$271.0 M

Notes: Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost Estimates are order-of-magnitude with an expected accuracy range of +50%/-30%

Cost estimate summary tables and associated quantity tables are presented in Appendix A.

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## Appendix A

### Capital and O&M Cost Estimate

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## Terms

CHPRC	CH2M HILL Plateau Remediation Company
D&D	decontamination and decommissioning
DSA	documented safety analysis
EA	each
ECY	each cubic yard
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ERQA	Environmental Remediation/Quality Assurance
FHA	fire hazards analysis
FTE	full-time equivalent
FY	fiscal year
G&A	general and administrative
LLW	low-level waste
LS	lump sum
MDBI	mobilize/demobilize/bonding and insurance
MLLW	mixed low-level waste
MO	month
NCO	nuclear chemical operator
O&M	operations and maintenance
PM	project manager
Pu	plutonium
REDOX	Reduction-Oxidation
S&M	surveillance and maintenance
TRACE V4	Tool for Response Action Cost Estimating Version 4
TRU	transuranic
WBS	work breakdown structure
YR	year

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## A1 Introduction

Tables A-1 through A-9 are from the Tool for Response Action Cost Estimating Version 4 (TRACE V4) cost estimate workbook for the Reduction-Oxidation (REDOX) Complex, with formatting modifications and the addition of overall alternative-specific composite average technical support services allowances for annual and periodic operations and maintenance (O&M) costs (TRACE V4 varies this allowance by line item). Additional information on this workbook may be found in TRACE V4 (ECF-HANFORD-16-0003 through ECF-HANFORD-16-0012; see Section A6 for complete reference citations). The TRACE V4 capital cost estimate and O&M cost estimate tables include the following:

1. Site: A site integer is user-assigned corresponding to each Site Name, allowing TRACE V4 to subtotal costs for sites within each alternative.
2. Site Name: User-assigned site name within each alternative.
3. WBS Top Tier: Highest level work breakdown structure (WBS) groupings that TRACE V4 can use to create WBS specific cost subtotals. WBS groupings are user-assigned and associated with each capital and O&M cost line item.
4. Description: User enters cost descriptions in TRACE V4 capital unit cost and O&M unit cost worksheets. The unit costs are linked with specific unit cost line item numbers already present in the TRACE V4 workbook in the worksheet rows where the unit cost descriptions and other information are entered. The user then selects unit costs on the alternative specific capital cost estimate and O&M cost estimate worksheets from pulldown lists and the unit cost number and description are automatically displayed in the Capital and O&M Cost Estimate Description columns.
5. Quantity: User-entered or linked quantity for the line item activity.
6. Unit: Unit associated with the cost line item quantity and unit cost.
7. Unit Cost: TRACE V4 automatically populates the unit cost column on the capital and O&M cost estimate worksheets based on the cost item selected by the user in the Description column.
8. Subtotal: TRACE V4 automatically calculates line item cost subtotals as the product of the specific line item quantity and unit cost.
9. Source: TRACE V4 displays source groupings as RACER, HISTORICAL, or OTHER on the capital and O&M cost estimate worksheets. Additional unit cost source information is noted in the TRACE V4 capital unit cost and O&M unit cost worksheets.
10. Start Year: User-entered year relative to the alternative base year (0 = base year, 1 = 1 year after base year, etc.) when the line item activity starts. TRACE V4 uses the Start Year, End Year, and Interval to associate each capital and O&M cost line item with a specific year or years when the activity occurs. TRACE V4 then uses year-specific discount factors to multiply by each cost in each specific year of occurrence to sum and calculate present value costs.
11. End Year: User-entered year relative to the base year when the line item activity ends.
12. Interval: User-entered interval in years between occurrences of the line item activity.
13. Notes: User-supplied notes.

Tables A-1 through A-9 also show line item specific markups for capital and O&M costs and successive cost subtotals as the markups are applied in TRACE V4.

Tables A-15 and A-16 are the TRACE V4 capital unit cost summary and O&M unit cost summary worksheets that show the cost line item numbers, descriptions, unit costs, and unit cost source information and notes. All REDOX Complex capital cost and O&M cost worksheets pull unit cost information from these sheets based on drop-down lists specific the capital and O&M unit costs from the capital and O&M unit cost summary worksheets.

## **A2 Alternative 2**

The Alternative 2 costs are divided into capital cost line items, presented in Table A-1, and O&M cost items, listed in Table A-2.

### **A2.1 Capital Cost Estimate for Alternative 2**

The capital cost line items include all activities that would occur under the Alternative 2 removal action as described in DOE/RL-2016-16, *Engineering Evaluation/Cost Analysis for the REDOX Complex* (hereafter referred to as the REDOX Complex EE/CA). Table A-1 also includes a summary of all markups, taxes, and contingencies applied to Alternative 2 capital costs.

### **A2.2 O&M Cost Estimate for Alternative 2**

The O&M cost line items include all annual and periodic costs to occur under the Alternative 2 removal action as described in the REDOX Complex EE/CA (DOE/RL-2016-16). Table A-2 also includes a summary of all markups, taxes, and contingencies applied to Alternative 2 annual and periodic costs.

Alternative 2			
Location:	REDOX Complex	Base Year:	2017
Phase:	EE/CA	Date:	9/6/2016
Description:	Current S&M with Hazard Abatement of 202S Canyon Galleries, Demolition Preparation of Silo Service Areas, Demolition of 293S Abovegrade Structure and Grouting of Belowgrade Structure, Demolition of 276S Hexone Storage Tanks		

Table A-1. Alternative 2 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
Capital Costs												
1	REDOX Complex	Mob/Demob; Temp. Utilities and Facilities	01 Site Preparation	1	LS	\$1,500,000	\$1,500,000	OTHER	0	0	1	Secure site; Power connections; Set up Work Zones and Equipment & Waste Areas; Set up temporary facilities and utilities.
1	REDOX Complex	Facility Modification or Upgrade	60 Ventilation System Modification	1	LS	\$10,000,000	\$10,000,000	OTHER	0	0	1	Budget allowance for bringing ventilation system into compliance for proposed work activities
1	REDOX Complex	Facility Modification or Upgrade	62 Life Safety Updates	1	LS	\$1,500,000	\$1,500,000	OTHER	0	0	1	Updates to facility to bring into compliance with life safety requirements of DSA and FHA documents
1	REDOX Complex	Document Preparation	1051 DSA / FHA Review and Update	1	EA	\$100,000	\$100,000	OTHER	0	0	1	Updates to life safety documentation in response to facility modifications
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	650 Characterization Sampling	350	EA	\$5,000	\$1,750,000	OTHER	0	0	1	Characterization sampling campaign throughout REDOX Canyon Building to identify contaminants of concern and associated concentrations prior to hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	0	0	1	Characterization sampling campaign labor
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	12	MO	\$20,000	\$240,000	OTHER	0	3	1	Site air monitoring during characterization sampling and hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	OTHER	4	4	1	Site air monitoring during characterization sampling and hazard abatement activities
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	0	0	1	Allowance for sampling of debris from Gallery Hazard Abatement activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	1	MO	\$300,000	\$300,000	HISTORICAL	0	0	1	Hazard Abatement Labor, Storage Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	1	Ton	\$69.70	\$69.70	OTHER	0	0	1	Storage Gallery Hazard Abatement waste disposal assumed LLW/MLLW
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	0	1	1	Hazard Abatement Labor, Sample Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	76	Ton	\$69.70	\$5,297	OTHER	1	1	1	Sample Galleries Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the sum quantity of waste from North and South Sample Galleries

Table A-1. Alternative 2 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	1	1	1	Hazard Abatement Labor, South Operating Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	44	Ton	\$69.70	\$3,067	OTHER	1	1	1	South Operating Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the quantity of waste from South Operating Gallery
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	2	2	1	Hazard Abatement Labor, South Pipe Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	50	Ton	\$69.70	\$3,485	OTHER	2	2	1	South Pipe Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to quantity of waste from South Pipe Gallery
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	17	Ton	\$11.28	\$192	OTHER	2	2	1	ERDF cost for treatment/stabilization of waste generated from Hazard Abatement activities within REDOX Galleries. (10% of total waste)
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	2	2	1	Allowance for sampling of debris from Silo Demo Prep activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	12	MO	\$300,000	\$3,600,000	HISTORICAL	2	2	1	Demo Prep Labor, Silo Service Area (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	723	Ton	\$69.70	\$50,393	OTHER	2	2	1	Demo Prep waste disposal, Silo Service Area (includes pipe and elevator shafts). Assumed LLW/MLLW
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	72	Ton	\$11.28	\$812	OTHER	2	2	1	ERDF cost for treatment/stabilization of waste from Silo. Assumed 10% of total waste requires treatment.
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Closure report following cleanout of Silo Service Areas
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	3	3	1	Demo Prep Labor, Pu Load-Out Hood (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	810 ERDF WF	162	CM	\$1,962.82	\$317,977	OTHER	3	3	1	Storage cost for Pu Load-Out Hood TRU waste, not including treatment
2	202-S	Treatment and Disposal	850 TRU Waste Treatment / Repackaging	162	CM	\$38,000	\$6,156,000	OTHER	3	3	1	Treatment Cost for TRU waste
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Closure report following removal of Pu Load-Out Hood
3	276-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Allowance for design and planning of tank removal
3	276-S	Treatment and Disposal	811 ERDF WG	6242	Ton	\$69.70	\$435,067	OTHER	3	3	1	Soil Disposal
3	276-S	Monitoring, Testing, Sampling and Analysis	659 ERDF Disposal Soil Cost (\$/Sample)	481	EA	\$497	\$239,057	HISTORICAL	3	3	1	Sampling of each load of soil prior to disposal in ERDF. Assuming average load of 13 tons each.
3	276-S	Mob/Demob; Temp. Utilities and Facilities	817 ERDF Waste Treatment	624	Ton	\$11.28	\$7,039	OTHER	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
3	276-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	OTHER	3	3	1	Soil Excavation Labor
3	276-S	Treatment and Disposal	811 ERDF WG	493	Ton	\$69.70	\$34,362	OTHER	3	3	1	Disposal of debris from tanks 276-S-141 and 276-S-142 and all associated piping and equipment. Assumed LLW/MLLW.

Table A-1. Alternative 2 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
3	276-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	3	3	1	Allowance for sampling of debris from 276-S Tank Removal prior to disposal in ERDF
3	276-S	Treatment and Disposal	817 ERDF Waste Treatment	49	Ton	\$11.28	\$553	OTHER	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
3	276-S	Demolition and Removal	803 Work Crew, General D&D	6	MO	\$190,000	\$1,140,000	OTHER	3	3	1	Tank Demo Labor
3	276-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Closeout Report - 276-S
4	293-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Allowance for design and planning of building removal
4	293-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	4	4	1	Allowance for sampling of debris from 293-S demo activities prior to disposal in ERDF
4	293-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	4	4	1	Labor to complete demolition and removal of Nitric Acid Absorber, Radioactive Iodine Scrubber, piping and equipment
4	293-S	Treatment and Disposal	811 ERDF WG	114	Ton	\$69.70	\$7,946	OTHER	4	4	1	Disposal of debris from 293-S interior cleanout. Includes piping and equipment, Absorber, Scrubber, ventilation equipment, and acid storage tank. Waste assumed LLW/MLLW.
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	11	Ton	\$11.28	\$124	OTHER	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	OTHER	4	4	1	Labor cost for demolition of above grade structure
4	293-S	Treatment and Disposal	811 ERDF WG	175	Ton	\$69.70	\$12,198	OTHER	4	4	1	Disposal of structural debris from above grade areas. Includes concrete structure, SWP and Control rooms and ventilation equipment pad. waste assumed LLW/MLLW
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	18	Ton	\$11.28	\$203	OTHER	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	0.5	MO	\$190,000	\$95,000	OTHER	4	4	1	Labor for grout pour in below grade spaces of 293-S
4	293-S	Grout Activities	1063 Grout Material	452	ECY	\$120	\$54,240	HISTORICAL	4	4	1	Grout material cost for below grade portions of structure
4	293-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Closeout Report - 293-S
1	REDOX Complex	Treatment and Disposal	819 ERDF Waste Transportation	610	Load	\$60.05	\$36,631	OTHER	4	4	1	Transportation cost for all LLW/MLLW waste generated during hazard abatement activities, demo prep of 202-S Silo Service Areas, and demolition of 293-S. Assumed waste disposal at ERDF

<b>Annual Capital Cost Markups</b>			
<b>Subtotal with MDBI</b>		<b>\$40,688,683</b>	
Contractors Overhead	15%	\$4,123,302	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$2,748,868	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$47,560,853</b>	
Washington State Sales Tax	8.60%	\$578,060	Applied to 30% of Subtotal with Subcontractor OH&P, excluding lines items designated as 100% labor
<b>Subtotal with Sales Tax</b>		<b>\$48,138,913</b>	
Scope Contingency	25%	\$12,034,728	As per EPA 540-R-00-002, Exhibit 5-7
Bid Contingency	20%	\$9,627,783	
<b>Subtotal with Contingency</b>		<b>\$69,801,424</b>	
Project Management	5%	\$3,490,071	As per EPA 540-R-00-002, Exhibit 5-8
Remedial Design	6%	\$4,188,085	As per EPA 540-R-00-002, Exhibit 5-8
Construction Management	6%	\$4,188,085	As per EPA 540-R-00-002, Exhibit 5-8
<b>Subtotal</b>		<b>\$81,667,666</b>	
CHPRC G&A	20%	\$16,333,533	CHPRC FY 2016 Rates-Multipliers
<b>Cost Per Year</b>		<b>\$98,001,200</b>	<b>Total Annual Capital Costs</b>
<b>Total Nondiscounted</b>		<b>\$104,099,524</b>	<b>Total Nondiscounted Value of Capital Cost</b>
<b>Total Present Value</b>		<b>\$100,879,817</b>	<b>Total Present Value of Capital Costs</b>

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

Table A-2. Alternative 2 Operations and Maintenance Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
<b>Annual O&amp;M Costs</b>												
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1102 Bathroom Trailer	1	YR	\$30,000	\$30,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Annual Surveillance	800 Surveillance and Maintenance Program	1	YR	\$277,000	\$277,000	Historical	0	25	1	Annual facility surveillance activities
<b>Periodic O&amp;M Costs</b>												
1	REDOX Complex	Hazard Abatement	1104 Hazard Abatement Allowance	1	EA	\$1,500,000	\$1,500,000	Other	0	25	5	Periodic hazard abatement allowance to mitigate hazards discovered during work activities
1	REDOX Complex	Document Preparation	954 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	Other	25	25	1	Final on-scene coordinator report following all removal action activities

<b>Annual O&amp;M Cost Markups</b>			
<b>Subtotal with MDBI</b>		<b>\$371,800</b>	
Contractors Overhead	15%	\$55,770	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$37,180	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$464,750</b>	
Washington State Sales Tax	8.60%	\$8,933	Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.
<b>Subtotal with Sales Tax</b>		<b>\$473,683</b>	
O&M Contingency	50%	\$236,842	
<b>Subtotal with Contingency</b>		<b>\$710,525</b>	
Technical Support Services	30.75%	\$218,509	Percentage for Technical Support Services varies for each line item and ranges from 26% to 45%. Percentage presented is weighted average for all annual O&M items.
<b>Subtotal</b>		<b>\$929,034</b>	
CHPRC G&A	20%	\$185,807	CHPRC FY 2016 Rates-Multipliers
<b>Cost Per Year</b>		<b>\$1,114,841</b>	<b>Total Annual O&amp;M Costs</b>
<b>Total Nondiscounted</b>		<b>\$28,985,856</b>	<b>Total Nondiscounted Value of Annual O&amp;M Costs</b>
<b>Total Present Value</b>		<b>\$24,217,107</b>	<b>Total Present Value of Annual O&amp;M Costs</b>

Periodic O&M Cost Markups			
<b>Subtotal with MDBI</b>		<b>\$9,949,780</b>	
Contractors Overhead	15%	\$1,492,467	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$994,978	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$12,437,226</b>	
Washington State Sales Tax	8.60%	\$320,880	Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.
<b>Subtotal with Sales Tax</b>		<b>\$12,758,106</b>	
O&M Contingency	50%	\$6,379,053	
<b>Subtotal with Contingency</b>		<b>\$19,137,159</b>	
Technical Support Services	19.88%	\$3,803,512	Percentage for Technical Support Services varies for each line item and ranges from 19% to 33%. Percentage presented is weighted average for all periodic O&M items.
<b>Subtotal</b>		<b>\$22,940,672</b>	
CHPRC DD/G&A	20%	\$4,588,132	CHPRC FY 2016 Rates-Multipliers
<b>Total Nondiscounted</b>		<b>\$27,528,805</b>	<b>Total Nondiscounted Value of Periodic O&amp;M Costs</b>
<b>Total Present Value</b>		<b>\$22,989,592</b>	<b>Total Present Value of Periodic O&amp;M Costs</b>

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

## A2.3 Total Present Value Cost Estimate for Alternative 2

Total present values for all capital costs and annual and periodic O&M costs for Alternative 2 are presented in Table A-3. This summary table provides the total present value for all costs associated with Alternative 2 as well as the -30/+50% expected accuracy range for this alternative.

Table A-3. Alternative 2 Total Present Value

<b>Capital Costs</b>	\$100.9 M	Total Present Value of Capital Costs
<b>Annual O&amp;M Costs</b>	\$24.2 M	Total Present Value of Annual O&M Activities
<b>Periodic O&amp;M Costs</b>	\$23.0 M	Total Present Value of Periodic O&M Activities
<b>Alternative 2 Total Present Value</b>	\$148.1 M	Total Present Value of Alternative 2
<b>Expected Accuracy Range for Total Present Value is -30% to +50%</b>		
<b>-30%</b>	\$103.7 M	
<b>+50%</b>	\$222.1 M	

Note: Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

## A3 Alternative 3

The capital cost line items for Alternative 3 are presented in Table A-4 and the O&M line items for Alternative 3 are presented in Table A-5.

### A3.1 Capital Cost Estimate for Alternative 3

The capital cost line items include all activities to occur under the Alternative 3 removal action as described in the REDOX Complex EE/CA (DOE/RL-2016-16). Table A-4 also includes a summary of all markups, taxes, and contingencies applied to Alternative 3 capital costs.

### A3.2 O&M Cost Estimate for Alternative 3

The O&M line items include all annual and periodic costs to occur under the Alternative 3 removal action as described in the REDOX Complex EE/CA (DOE/RL-2016-16). Table A-5 also includes a summary of all markups, taxes, and contingencies applied to Alternative 3 annual and periodic costs.

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Alternative 3			
Location:	REDOX Complex	Base Year:	2017
Phase:	EE/CA	Date:	9/6/2016
Description:	Alternative 2 plus Demolition Preparation of Annex and Abovegrade Areas in 202S		

Table A-4. Alternative 3 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
<b>Capital Costs</b>												
1	REDOX Complex	Mob/Demob; Temp. Utilities and Facilities	01 Site Preparation	1	LS	\$1,500,000	\$1,500,000	OTHER	0	0	1	Secure site; Power connections; Set up Work Zones and Equipment & Waste Areas; Set up temporary facilities and utilities.
1	REDOX Complex	Facility Modification or Upgrade	60 Ventilation System Modification	1	LS	\$10,000,000	\$10,000,000	OTHER	0	0	1	Budget allowance for bringing ventilation system into compliance for proposed work activities
1	REDOX Complex	Facility Modification or Upgrade	62 Life Safety Updates	1	LS	\$1,500,000	\$1,500,000	OTHER	0	0	1	Updates to facility to bring into compliance with life safety requirements of DSA and FHA documents
1	REDOX Complex	Document Preparation	1051 DSA / FHA Review and Update	1	EA	\$100,000	\$100,000	OTHER	0	0	1	Updates to life safety documentation in response to facility modifications
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	650 Characterization Sampling	350	EA	\$5,000	\$1,750,000	OTHER	0	0	1	Characterization sampling campaign throughout REDOX Canyon Building to identify contaminants of concern and associated concentrations prior to hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	0	0	1	Characterization sampling campaign labor
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	12	MO	\$20,000	\$240,000	OTHER	0	3	1	Site air monitoring during characterization sampling and hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	OTHER	4	4	1	Site air monitoring during characterization sampling and hazard abatement activities
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	0	0	1	Allowance for sampling of debris from Gallery Hazard Abatement activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	1	MO	\$300,000	\$300,000	HISTORICAL	0	0	1	Hazard Abatement Labor, Storage Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	1	Ton	\$69.70	\$69.70	OTHER	0	0	1	Storage Gallery Hazard Abatement waste disposal assumed LLW/MLLW
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	0	1	1	Hazard Abatement Labor, Sample Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	76	Ton	\$69.70	\$5,297	OTHER	1	1	1	Sample Galleries Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the sum quantity of waste from North and South Sample Galleries
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	1	1	1	Hazard Abatement Labor, South Operating Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	44	Ton	\$69.70	\$3,067	OTHER	1	1	1	South Operating Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the quantity of waste from South Operating Gallery

Table A-4. Alternative 3 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	2	2	1	Hazard Abatement Labor, South Pipe Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	50	Ton	\$69.70	\$3,485	OTHER	2	2	1	South Pipe Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to quantity of waste from South Pipe Gallery
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	17	Ton	\$11.28	\$192	OTHER	2	2	1	ERDF cost for treatment/stabilization of waste generated from Hazard Abatement activities within REDOX Galleries. (10% of total waste)
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	2	2	1	Allowance for sampling of debris from Silo Demo Prep activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	12	MO	\$300,000	\$3,600,000	HISTORICAL	2	2	1	Demo Prep Labor, Silo Service Area (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	723	Ton	\$69.70	\$50,393	OTHER	2	2	1	Demo Prep waste disposal, Silo Service Area (includes pipe and elevator shafts). Assumed LLW/MLLW
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	72	Ton	\$11.28	\$812	OTHER	2	2	1	ERDF cost for treatment/stabilization of waste from Silo. Assumed 10% of total waste requires treatment.
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Closure report following cleanout of Silo Service Areas
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	3	3	1	Demo Prep Labor, Pu Load-Out Hood (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	810 ERDF WF	162	CM	\$1,962.82	\$317,977	OTHER	3	3	1	Storage cost for Pu Load-Out Hood TRU waste, not including treatment
2	202-S	Treatment and Disposal	850 TRU Waste Treatment / Repackaging	162	CM	\$38,000	\$6,156,000	OTHER	3	3	1	Treatment Cost for TRU waste
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Closure report following removal of Pu Load-Out Hood
3	276-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	OTHER	3	3	1	Allowance for design and planning of tank removal
3	276-S	Treatment and Disposal	811 ERDF WG	6242	Ton	\$69.70	\$435,067	OTHER	3	3	1	Soil Disposal
3	276-S	Monitoring, Testing, Sampling and Analysis	659 ERDF Disposal Soil Cost (\$/Sample)	481	EA	\$497	\$239,057	HISTORICAL	3	3	1	Sampling of each load of soil prior to disposal in ERDF. Assuming average load of 13 tons each.
3	276-S	Mob/Demob; Temp. Utilities and Facilities	817 ERDF Waste Treatment	624	Ton	\$11.28	\$7,039	OTHER	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
3	276-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	OTHER	3	3	1	Soil Excavation Labor
3	276-S	Treatment and Disposal	811 ERDF WG	493	Ton	\$69.70	\$34,362	OTHER	3	3	1	Disposal of debris from tanks 276-S-141 and 276-S-142 and all associated piping and equipment. Assumed LLW/MLLW.
3	276-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	3	3	1	Allowance for sampling of debris from 276-S Tank Removal prior to disposal in ERDF
3	276-S	Treatment and Disposal	817 ERDF Waste Treatment	49	Ton	\$11.28	\$553	OTHER	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.

Table A-4. Alternative 3 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
3	276-S	Demolition and Removal	803 Work Crew, General D&D	6	MO	\$190,000	\$1,140,000	OTHER	3	3	1	Tank Demo Labor
3	276-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Closeout Report - 276-S
4	293-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Allowance for design and planning of building removal
4	293-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	4	4	1	Allowance for sampling of debris from 293-S demo activities prior to disposal in ERDF
4	293-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	HISTORICAL	4	4	1	Labor to complete demolition and removal of Nitric Acid Absorber, Radioactive Iodine Scrubber, piping and equipment
4	293-S	Treatment and Disposal	811 ERDF WG	114	Ton	\$69.70	\$7,946	OTHER	4	4	1	Disposal of debris from 293-S interior cleanout. Includes piping and equipment, Absorber, Scrubber, ventilation equipment, and acid storage tank. Waste assumed LLW/MLLW.
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	11	Ton	\$11.28	\$124	OTHER	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	OTHER	4	4	1	Labor cost for demolition of above grade structure
4	293-S	Treatment and Disposal	811 ERDF WG	175	Ton	\$69.70	\$12,198	OTHER	4	4	1	Disposal of structural debris from above grade areas. Includes concrete structure, SWP and Control rooms and ventilation equipment pad. waste assumed LLW/MLLW
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	18	Ton	\$11.28	\$203	OTHER	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	0.5	MO	\$190,000	\$95,000	OTHER	4	4	1	Labor for grout pour in below grade spaces of 293-S
4	293-S	Grout Activities	1063 Grout Material	452	ECY	\$120	\$54,240	HISTORICAL	4	4	1	Grout material cost for below grade portions of structure
4	293-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	OTHER	4	4	1	Closeout Report - 293-S
1	REDOX Complex	Treatment and Disposal	819 ERDF Waste Transportation	610	Load	\$60.05	\$36,631	OTHER	4	4	1	Transportation cost for all LLW/MLLW waste generated during hazard abatement activities, demo prep of 202-S Silo Service Areas, and demolition of 293-S. Assumed waste disposal at ERDF
2	202-S	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	OTHER	4	4	1	Site air monitoring during demo prep activities within 202-S above grade galleries, annex areas, and Canyon Deck
2	202-S	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	12	MO	\$20,000	\$240,000	OTHER	5	7	1	Site air monitoring during demo prep activities within 202-S above grade galleries, annex areas, and Canyon Deck
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	4	5	1	Demo Prep Labor, Pipe Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	166	Ton	\$69.70	\$11,570	OTHER	5	5	1	North and South Pipe Galleries (including cross-canyon passage) Demo Prep waste disposal. Assumed LLW/MLLW
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	5	6	1	Demo Prep Labor, Operating Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	248	Ton	\$69.70	\$17,286	OTHER	6	6	1	North and South Operating Galleries Demo Prep waste disposal (includes SWP change room and Health Instrument Storage room). Assumed LLW/MLLW

Table A-4. Alternative 3 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	6	6	1	Allowance for sampling of debris from Gallery Demo Prep activities prior to disposal in ERDF
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	42	Ton	\$11.28	\$474	OTHER	6	6	1	ERDF cost for treatment/stabilization of demo prep waste from Pipe and Operating Gallery levels. Assumed 10% of total waste requires treatment.
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	6	7	1	Demo Prep Labor, North, Southwest, and East Annex (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	535	Ton	\$69.70	\$37,290	OTHER	7	7	1	Demo Prep waste disposal from North, Southwest, and East Annex. Assumed LLW/MLLW
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	OTHER	7	7	1	Allowance for sampling of debris from North, Southwest, and East Annex Demo Prep activities prior to disposal in ERDF
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	54	Ton	\$11.28	\$609	OTHER	7	7	1	ERDF cost for treatment/stabilization of waste from North, Southwest, and East Annex areas. Assumed 10% of total waste requires treatment.
2	202-S	Treatment and Disposal	819 ERDF Waste Transportation	79	Load	\$60.05	\$4,744	OTHER	7	7	1	Transportation cost for all LLW/MLLW waste generated during demo prep activities within 202-S above grade galleries, canyon deck, and annex areas. Assumed waste disposal at ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	HISTORICAL	7	7	1	Demo Prep Labor, Canyon Deck (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	67	Ton	\$70	\$4,670	OTHER	7	7	1	Canyon Deck Demo Prep waste disposal assumed LLW/MLLW
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	7	Ton	\$11.28	\$79	OTHER	7	7	1	ERDF cost for treatment/stabilization of Canyon Deck waste. Assumed 10% of total waste requires treatment.
<b>Capital Costs Markups</b>												
<b>Subtotal with MDBI</b>						<b>\$49,199,076</b>						
Contractors Overhead				15%		\$4,211,861	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.					
Contractors Profit				10%		\$2,807,908	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.					
<b>Subtotal with OH&amp;P</b>						<b>\$56,218,845</b>						
Washington State Sales Tax				8.60%		\$594,379	Applied to 30% of Subtotal with Subcontractor OH&P, excluding lines items designated as 100% labor					
<b>Subtotal with Sales Tax</b>						<b>\$56,813,223</b>						
Scope Contingency				25%		\$14,203,306	As per EPA 540-R-00-002, Exhibit 5-7					
Bid Contingency				20%		\$11,362,645						
<b>Subtotal with Contingency</b>						<b>\$82,379,174</b>						
Project Management				5%		\$4,118,959	As per EPA 540-R-00-002, Exhibit 5-8					
Remedial Design				6%		\$4,942,750	As per EPA 540-R-00-002, Exhibit 5-8					
Construction Management				6%		\$4,942,750	As per EPA 540-R-00-002, Exhibit 5-8					
<b>Subtotal</b>						<b>\$96,383,633</b>						
CHPRC G&A				20%		\$19,276,727	CHPRC FY 2016 Rates-Multipliers					
<b>Cost Per Year</b>						<b>\$115,660,360</b>	<b>Total Annual Capital Costs</b>					

Table A-4. Alternative 3 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
<b>Total Nondiscounted</b>						<b>\$135,229,630</b>	<b>Total Nondiscounted Value of Capital Cost</b>					
<b>Total Present Value</b>						<b>\$129,271,064</b>	<b>Total Present Value of Capital Costs</b>					

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

Table A-5. Alternative 3 Operations & Maintenance Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Source	Start Year	End Year	Interval	Notes
<b>Annual O&amp;M Costs</b>												
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1102 Bathroom Trailer	1	YR	\$30,000	\$30,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Annual Surveillance	800 Surveillance and Maintenance Program	1	YR	\$277,000	\$277,000	Historical	0	25	1	Annual facility surveillance activities
<b>Periodic O&amp;M Costs</b>												
1	REDOX Complex	Hazard Abatement	1104 Hazard Abatement Allowance	1	EA	\$1,500,000	\$1,500,000	Other	0	25	5	Periodic hazard abatement allowance to mitigate hazards discovered during work activities
1	REDOX Complex	Document Preparation	954 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	Other	25	25	1	Final on-scene coordinator report following all removal action activities

<b>Annual O&amp;M Markups</b>			
<b>Subtotal with MDBI</b>		<b>\$371,800</b>	
Contractors Overhead	15%	\$55,770	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$37,180	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$464,750</b>	
Washington State Sales Tax	8.60%	\$8,933	Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.
<b>Subtotal with Sales Tax</b>		<b>\$473,683</b>	
O&M Contingency	50%	\$236,842	
<b>Subtotal with Contingency</b>		<b>\$710,525</b>	
Technical Support Services	30.75%	\$218,509	Percentage for Technical Support Services varies for each line item and ranges from 26% to 45%. Percentage presented is weighted average for all annual O&M items.
<b>Subtotal</b>		<b>\$929,034</b>	
CHPRC G&A	20%	\$185,807	CHPRC FY 2016 Rates-Multipliers
<b>Cost Per Year</b>		<b>\$1,114,841</b>	<b>Total Annual O&amp;M Costs</b>
<b>Total Nondiscounted</b>		<b>\$28,985,856</b>	<b>Total Nondiscounted Value of Annual O&amp;M Costs</b>
<b>Total Present Value</b>		<b>\$24,217,107</b>	<b>Total Present Value of Annual O&amp;M Costs</b>

Periodic O&M Markups			
<b>Subtotal with MDBI</b>		<b>\$9,949,780</b>	
Contractors Overhead	15%	\$1,492,467	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$994,978	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$12,437,226</b>	
Washington State Sales Tax	8.60%	\$320,880	Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.
<b>Subtotal with Sales Tax</b>		<b>\$12,758,106</b>	
O&M Contingency	50%	\$6,379,053	
<b>Subtotal with Contingency</b>		<b>\$19,137,159</b>	
Technical Support Services	19.88%	\$3,803,512	Percentage for Technical Support Services varies for each line item and ranges from 19% to 33%. Percentage presented is weighted average for all periodic O&M items.
<b>Subtotal</b>		<b>\$22,940,672</b>	
CHPRC DD/G&A	20%	\$4,588,132	CHPRC FY 2016 Rates-Multipliers
<b>Total Nondiscounted</b>		<b>\$27,528,805</b>	<b>Total Nondiscounted Value of Periodic O&amp;M Costs</b>
<b>Total Present Value</b>		<b>\$22,989,592</b>	<b>Total Present Value of Periodic O&amp;M Costs</b>

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

### A3.3 Total Present Value Cost Estimate for Alternative 3

Total present values for all capital costs and annual and periodic O&M costs for Alternative 3 are presented in Table A-6. This summary table provides the total present value for all costs associated with Alternative 3 as well as the -30/+50% expected accuracy range for this alternative.

Table A-6. Alternative 3 Total Present Value

<b>Capital Costs</b>	\$129.3 M	Total Present Value of Capital Costs
<b>Annual O&amp;M Costs</b>	\$24.2 M	Total Present Value of Annual O&M Activities
<b>Periodic O&amp;M Costs</b>	\$23.0 M	Total Present Value of Periodic O&M Activities
<b>Alternative 3 Total Present Value</b>	\$176.5 M	Total Present Value of Alternative 3
<b>Expected Accuracy Range for Total Present Value is -30% to +50%</b>		
<b>-30%</b>	\$123.5 M	
<b>+50%</b>	\$264.7 M	

Note: Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

## A4 Alternative 4

The capital cost line items for Alternative 4 are presented in Table A-7. All O&M items for Alternative 4 are presented in Table A-8.

### A4.1 Capital Cost Estimate for Alternative 4

The capital cost line items include all activities to occur under the Alternative 4 removal action as described in the REDOX Complex EE/CA (DOE/RL-2016-16). Table A-7 also includes a summary of all markups, taxes, and contingencies applied to Alternative 4 capital costs.

### A4.2 O&M Cost Estimate for Alternative 4

The O&M line items include all annual and periodic costs to occur under the Alternative 4 removal action as described in the REDOX Complex EE/CA (DOE/RL-2016-16). Table A-8 also includes a summary of all markups, taxes, and contingencies applied to Alternative 4 annual and periodic costs

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Alternative 4			
Location:	REDOX Complex	Base Year:	2017
Phase:	EE/CA	Date:	9/6/2016
Description:	Alternative 3 plus Demolition of the Annex		

Table A-7. Alternative 4 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Start Year	End Year	Interval	Notes
<b>Capital Costs</b>											
1	REDOX Complex	Mob/Demob; Temp. Utilities and Facilities	01 Site Preparation	1	LS	\$1,500,000	\$1,500,000	0	0	1	Secure site; Power connections; Set up Work Zones and Equipment & Waste Areas; Set up temporary facilities and utilities.
1	REDOX Complex	Facility Modification or Upgrade	60 Ventilation System Modification	1	LS	\$10,000,000	\$10,000,000	0	0	1	Budget allowance for bringing ventilation system into compliance for proposed work activities
1	REDOX Complex	Facility Modification or Upgrade	62 Life Safety Updates	1	LS	\$1,500,000	\$1,500,000	0	0	1	Updates to facility to bring into compliance with life safety requirements of DSA and FHA documents
1	REDOX Complex	Document Preparation	1051 DSA / FHA Review and Update	1	EA	\$100,000	\$100,000	0	0	1	Updates to life safety documentation in response to facility modifications
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	650 Characterization Sampling	350	EA	\$5,000	\$1,750,000	0	0	1	Characterization sampling campaign throughout REDOX Canyon Building to identify contaminants of concern and associated concentrations prior to hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	0	0	1	Characterization sampling campaign labor
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	12	MO	\$20,000	\$240,000	0	3	1	Site air monitoring during characterization sampling and hazard abatement activities
1	REDOX Complex	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	4	4	1	Site air monitoring during characterization sampling and hazard abatement activities
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	0	0	1	Allowance for sampling of debris from Gallery Hazard Abatement activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	1	MO	\$300,000	\$300,000	0	0	1	Hazard Abatement Labor, Storage Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	1	Ton	\$69.70	\$70	0	0	1	Storage Gallery Hazard Abatement waste disposal assumed LLW/MLLW
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	0	1	1	Hazard Abatement Labor, Sample Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	76	Ton	\$69.70	\$5,297	1	1	1	Sample Galleries Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the sum quantity of waste from North and South Sample Galleries
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	1	1	1	Hazard Abatement Labor, South Operating Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	44	Ton	\$69.70	\$3,067	1	1	1	South Operating Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to the quantity of waste from South Operating Gallery
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	2	2	1	Hazard Abatement Labor, South Pipe Gallery (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	50	Ton	\$69.70	\$3,485	2	2	1	South Pipe Gallery Hazard Abatement waste disposal. Assumed LLW/MLLW. Presented quantity is equal to quantity of waste from South Pipe Gallery

Table A-7. Alternative 4 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Start Year	End Year	Interval	Notes
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	17	Ton	\$11.28	\$192	2	2	1	ERDF cost for treatment/stabilization of waste generated from Hazard Abatement activities within REDOX Galleries. (10% of total waste)
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	2	2	1	Allowance for sampling of debris from Silo Demo Prep activities prior to disposal in ERDF
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	12	MO	\$300,000	\$3,600,000	2	2	1	Demo Prep Labor, Silo Service Area (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	723	Ton	\$69.70	\$50,393	2	2	1	Demo Prep waste disposal, Silo Service Area (includes pipe and elevator shafts). Assumed LLW/MLLW
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	72	Ton	\$11.28	\$812	2	2	1	ERDF cost for treatment/stabilization of waste from Silo. Assumed 10% of total waste requires treatment.
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	3	3	1	Closure report following cleanout of Silo Service Areas
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	3	3	1	Demo Prep Labor, Pu Load-Out Hood (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	810 ERDF WF	162	CM	\$1,962.82	\$317,977	3	3	1	Storage cost for Pu Load-Out Hood TRU waste, not including treatment
2	202-S	Treatment and Disposal	850 TRU Waste Treatment / Repackaging	162	CM	\$38,000	\$6,156,000	3	3	1	Treatment Cost for TRU waste
2	202-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	3	3	1	Closure report following removal of Pu Load-Out Hood
3	276-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	3	3	1	Allowance for design and planning of tank removal
3	276-S	Treatment and Disposal	811 ERDF WG	6242	Ton	\$69.70	\$435,067	3	3	1	Soil Disposal
3	276-S	Monitoring, Testing, Sampling and Analysis	659 ERDF Disposal Soil Cost (\$/Sample)	481	EA	\$497	\$239,057	3	3	1	Sampling of each load of soil prior to disposal in ERDF. Assuming average load of 13 tons each.
3	276-S	Mob/Demob; Temp. Utilities and Facilities	817 ERDF Waste Treatment	624	Ton	\$11.28	\$7,039	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
3	276-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	3	3	1	Soil Excavation Labor
3	276-S	Treatment and Disposal	811 ERDF WG	493	Ton	\$69.70	\$34,362	3	3	1	Disposal of debris from tanks 276-S-141 and 276-S-142 and all associated piping and equipment. Assumed LLW/MLLW.
3	276-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	3	3	1	Allowance for sampling of debris from 276-S Tank Removal prior to disposal in ERDF
3	276-S	Treatment and Disposal	817 ERDF Waste Treatment	49	Ton	\$11.28	\$553	3	3	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
3	276-S	Demolition and Removal	803 Work Crew, General D&D	6	MO	\$190,000	\$1,140,000	3	3	1	Tank Demo Labor
3	276-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	4	4	1	Closeout Report - 276-S
4	293-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	4	4	1	Allowance for design and planning of building removal
4	293-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	4	4	1	Allowance for sampling of debris from 293-S demo activities prior to disposal in ERDF
4	293-S	Demolition and Removal	801 Work Crew, Interior Specialized	3	MO	\$300,000	\$900,000	4	4	1	Labor to complete demolition and removal of Nitric Acid Absorber, Radioactive Iodine Scrubber, piping and equipment
4	293-S	Treatment and Disposal	811 ERDF WG	114	Ton	\$69.70	\$7,946	4	4	1	Disposal of debris from 293-S interior cleanout. Includes piping and equipment, Absorber, Scrubber, ventilation equipment, and acid storage tank. Waste assumed LLW/MLLW.

Table A-7. Alternative 4 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Start Year	End Year	Interval	Notes
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	11	Ton	\$11.28	\$124	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	1	MO	\$190,000	\$190,000	4	4	1	Labor cost for demolition of above grade structure
4	293-S	Treatment and Disposal	811 ERDF WG	175	Ton	\$69.70	\$12,198	4	4	1	Disposal of structural debris from above grade areas. Includes concrete structure, SWP and Control rooms and ventilation equipment pad. waste assumed LLW/MLLW
4	293-S	Treatment and Disposal	817 ERDF Waste Treatment	18	Ton	\$11.28	\$203	4	4	1	ERDF cost for treatment/stabilization of waste. Assumed 10% of total waste requires treatment.
4	293-S	Demolition and Removal	803 Work Crew, General D&D	0.5	MO	\$190,000	\$95,000	4	4	1	Labor for grout pour in below grade spaces of 293-S
4	293-S	Grout Activities	1063 Grout Material	452	ECY	\$120	\$54,240	4	4	1	Grout material cost for below grade portions of structure
4	293-S	Document Preparation	1057 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	4	4	1	Closeout Report - 293-S
1	REDOX Complex	Treatment and Disposal	819 ERDF Waste Transportation	610	Load	\$60.05	\$36,631	4	4	1	Transportation cost for all LLW/MLLW waste generated during hazard abatement activities, demo prep of 202-S Silo Service Areas, and demolition of 293-S. Assumed waste disposal at ERDF
2	202-S	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	4	4	1	Site air monitoring during demo prep activities within 202-S above grade galleries, annex areas, and Canyon Deck
2	202-S	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	12	MO	\$20,000	\$240,000	5	7	1	Site air monitoring during demo prep activities within 202-S above grade galleries, annex areas, and Canyon Deck
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	4	5	1	Demo Prep Labor, Pipe Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	166	Ton	\$69.70	\$11,570	5	5	1	North and South Pipe Galleries (including cross-canyon passage) Demo Prep waste disposal. Assumed LLW/MLLW
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	5	6	1	Demo Prep Labor, Operating Galleries (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	248	Ton	\$69.70	\$17,286	6	6	1	North and South Operating Galleries Demo Prep waste disposal (includes SWP change room and Health Instrument Storage room). Assumed LLW/MLLW
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	6	6	1	Allowance for sampling of debris from Gallery Demo Prep activities prior to disposal in ERDF
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	42	Ton	\$11.28	\$474	6	6	1	ERDF cost for treatment/stabilization of demo prep waste from Pipe and Operating Gallery levels. Assumed 10% of total waste requires treatment.
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	6	7	1	Demo Prep Labor, North, Southwest, and East Annex (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	535	Ton	\$69.70	\$37,290	7	7	1	Demo Prep waste disposal from North, Southwest, and East Annex. Assumed LLW/MLLW
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	7	7	1	Allowance for sampling of debris from North, Southwest, and East Annex Demo Prep activities prior to disposal in ERDF
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	54	Ton	\$11.28	\$609	7	7	1	ERDF cost for treatment/stabilization of waste from North, Southwest, and East Annex areas. Assumed 10% of total waste requires treatment.
2	202-S	Treatment and Disposal	819 ERDF Waste Transportation	79	Load	\$60.05	\$4,744	7	7	1	Transportation cost for all LLW/MLLW waste generated during demo prep activities within 202-S above grade galleries, canyon deck, and annex areas. Assumed waste disposal at ERDF

Table A-7. Alternative 4 Capital Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Start Year	End Year	Interval	Notes
2	202-S	Demolition and Removal	801 Work Crew, Interior Specialized	6	MO	\$300,000	\$1,800,000	7	7	1	Demo Prep Labor, Canyon Deck (includes 20 FTE, materials, taxes and licenses, and G&A)
2	202-S	Treatment and Disposal	811 ERDF WG	67	Ton	\$70	\$4,670	7	7	1	Canyon Deck Demo Prep waste disposal assumed LLW/MLLW
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	7	Ton	\$11	\$79	7	7	1	ERDF cost for treatment/stabilization of Canyon Deck waste. Assumed 10% of total waste requires treatment.
2	202-S	Monitoring, Testing, Sampling and Analysis	662 Site Air Monitoring	6	MO	\$20,000	\$120,000	8	8	1	Site air monitoring during demolition of 202-S North, Southwest, and East Annex structures
2	202-S	Document Preparation	1053 Demolition Analysis	1	EA	\$100,000	\$100,000	8	8	1	Allowance for design and planning of building removal
2	202-S	Demolition and Removal	803 Work Crew, General D&D	6	MO	\$190,000	\$1,140,000	8	8	1	Labor for demolition of North, Southwest, and East Annex structures
2	202-S	Treatment and Disposal	811 ERDF WG	3,242	Ton	\$69.70	\$225,967	8	8	1	Demolition debris disposal, North, Southwest, and East Annex structures. Assumed 100% concrete. Disposed as LLW/MLLW
2	202-S	Monitoring, Testing, Sampling and Analysis	656 Miscellaneous Sampling and Analysis (non-soil)	1	LS	\$50,000	\$50,000	8	8	1	Allowance for sampling of debris from North, Southwest, and East Annex Demolition activities prior to disposal in ERDF
2	202-S	Treatment and Disposal	817 ERDF Waste Treatment	324	Ton	\$11.28	\$3,655	8	8	1	ERDF cost for treatment/stabilization of waste from North, Southwest, and East Annex structures. Assumed 10% of total waste requires treatment.
2	202-S	Treatment and Disposal	819 ERDF Waste Transportation	250	Load	\$60.05	\$15,013	8	8	1	Transportation cost for all LLW/MLLW waste generated during demolition of North, Southwest, and East Annex structures. Assumed waste disposal at ERDF
<b>Capital Cost Markups</b>											
<b>Subtotal with MDBI</b>						<b>\$51,019,174</b>					
Contractors Overhead				15%		\$4,484,876	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.				
Contractors Profit				10%		\$2,989,917	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.				
<b>Subtotal w/ OH&amp;P</b>						<b>\$58,493,967</b>					
WA State Sales Tax				8.60%		\$644,398	Applied to 30% of Subtotal w/ Subcontractor OH&P, excluding line items designated as 100% labor				
<b>Subtotal</b>						<b>\$59,138,365</b>					
Scope Contingency				25%		\$14,784,591	As per EPA 540-R-00-002, Exhibit 5-7				
Bid Contingency				20%		\$11,827,673					
<b>Subtotal with Contingency</b>						<b>\$85,750,630</b>					
Project Management				5%		\$4,287,531	As per EPA 540-R-00-002, Exhibit 5-8				
Remedial Design				6%		\$5,145,038	As per EPA 540-R-00-002, Exhibit 5-8				
Construction Management				6%		\$5,145,038	As per EPA 540-R-00-002, Exhibit 5-8				
<b>Subtotal</b>						<b>\$100,328,237</b>					
CHPRC DD/G&A				20%		\$20,065,647	CHPRC FY 2016 Rates-Multipliers				
<b>Cost per Year</b>						<b>\$120,393,884</b>	<b>Total Annual Capital Costs</b>				
<b>Total Nondiscounted</b>						<b>\$139,963,154</b>	<b>Total Nondiscounted Value of Capital Cost</b>				
<b>Total Present Value</b>						<b>\$133,455,279</b>	<b>Total Present Value of Capital Costs</b>				

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

Table A-8. Alternative 4 Operations & Maintenance Costs

Site	Site Name	WBS Top Tier	Description	Qty	Unit	Unit Cost	Subtotal	Unit Source	Start Year	End Year	Interval	Notes
<b>Annual O&amp;M Costs</b>												
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1100 Single Wide Trailer	1	YR	\$12,000	\$12,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1101 Double Wide Trailer	1	YR	\$20,400	\$20,400	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Facility Maintenance	1102 Bathroom Trailer	1	YR	\$30,000	\$30,000	Historical	0	25	1	Annual rental and maintenance
1	REDOX Complex	Annual Surveillance	800 Surveillance and Maintenance Program	1	YR	\$277,000	\$277,000	Historical	0	25	1	Annual facility surveillance activities
<b>Periodic O&amp;M Costs</b>												
1	REDOX Complex	Hazard Abatement	1104 Hazard Abatement Allowance	1	EA	\$1,500,000	\$1,500,000	Other	0	25	5	Periodic hazard abatement allowance to mitigate hazards discovered during work activities
1	REDOX Complex	Document Preparation	954 On-Scene Coordinator Report - Final	1	EA	\$100,000	\$100,000	Other	25	25	1	Final on-scene coordinator report following all removal action activities
<b>Annual O&amp;M Markups</b>												
<b>Subtotal with MDBI</b>						<b>\$371,800</b>						
Contractors Overhead				15%		\$55,770		Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.				
Contractors Profit				10%		\$37,180		Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.				
<b>Subtotal with OH&amp;P</b>						<b>\$464,750</b>						
Washington State Sales Tax				8.6%		\$8,933		Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.				
<b>Subtotal with Sales Tax</b>						<b>\$473,683</b>						
O&M Contingency				50%		\$236,842						
<b>Subtotal with Contingency</b>						<b>\$710,525</b>						
Technical Support Services				30.75%		\$218,509		Percentage for Technical Support Services varies for each line item and ranges from 26% to 45%. Percentage presented is weighted average for all annual O&M items.				
<b>Subtotal</b>						<b>\$929,034</b>						
CHPRC G&A				20%		\$185,807		CHPRC FY 2016 Rates-Multipliers				
<b>Cost Per Year</b>						<b>\$1,114,841</b>		<b>Total Annual O&amp;M Costs</b>				
<b>Total Nondiscounted</b>						<b>\$28,985,856</b>		<b>Total Nondiscounted Value of Annual O&amp;M Costs</b>				
<b>Total Present Value</b>						<b>\$24,217,107</b>		<b>Total Present Value of Annual O&amp;M Costs</b>				

Periodic O&M Markups			
<b>Subtotal with MDBI</b>		<b>\$9,949,780</b>	
Contractors Overhead	15%	\$1,492,467	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
Contractors Profit	10%	\$994,978	Per R.S. Means, 2010, <i>Building Construction Cost Data</i> , 68 <sup>th</sup> annual edition. Excludes line items with OH&P already included.
<b>Subtotal with OH&amp;P</b>		<b>\$12,437,226</b>	
Washington State Sales Tax	8.6%	\$320,880	Applied to 30% of subtotal with Subcontractor OH&P, excluding line items designated as 100% labor.
<b>Subtotal with Sales Tax</b>		<b>\$12,758,106</b>	
O&M Contingency	50%	\$6,379,053	
<b>Subtotal with Contingency</b>		<b>\$19,137,159</b>	
Technical Support Services	19.88%	\$3,803,512	Percentage for Technical Support Services varies for each line item and ranges from 19% to 33%. Percentage presented is weighted average for all periodic O&M items.
<b>Subtotal</b>		<b>\$22,940,672</b>	
CHPRC DD/G&A	20%	\$4,588,132	CHPRC FY 2016 Rates-Multipliers
<b>Total Nondiscounted</b>		<b>\$27,528,805</b>	<b>Total Nondiscounted Value of Periodic O&amp;M Costs</b>
<b>Total Present Value</b>		<b>\$22,989,592</b>	<b>Total Present Value of Periodic O&amp;M Costs</b>

Note: Key terms and references used in the tables within this appendix are defined in the Terms list and References section (Section A6), respectively.

Costs calculated using displayed values may vary from results found in this table due to rounding.

Cost estimates are order-of-magnitude with an expected accuracy range of +50%/-30%.

### A4.3 Total Present Value Cost Estimate for Alternative 4

Total present values for all capital costs and annual and periodic O&M costs for Alternative 4 are presented in Table A-9. This summary table provides the total present value for all costs associated with Alternative 4 as well as the -30/+50% expected accuracy range for this alternative.

Table A-9. Alternative 4 Total Present Value

<b>Capital Costs</b>	\$133.5 M	Total Present Value of Capital Costs
<b>Annual O&amp;M Costs</b>	\$24.2 M	Total Present Value of Annual O&M Activities
<b>Periodic O&amp;M Costs</b>	\$23.0 M	Total Present Value of Periodic O&M Activities
<b>Alternative 4 Total Present Value</b>	\$180.7 M	Total Present Value of Alternative 4
<b>Expected Accuracy Range for Total Present Value is -30% to +50%</b>		
<b>-30%</b>	<b>\$126.5 M</b>	
<b>+50%</b>	<b>\$271.0 M</b>	

### A5 Labor Duration and Cost Breakdown

The following subsections present estimated durations for all labor activities and breakdowns of general and specialized crew costs and other costs.

#### A5.1 Project Duration Summary Table

Table A-10 presents the estimated durations for all labor activities to occur within the REDOX Complex for all of the alternatives, as described in the REDOX Complex EE/CA (DOE/RL-2016-16).

Table A-10. Project Duration Summary

<b>Action</b>	<b>Duration (months)</b>
<b>Alternative 2</b>	
Characterization Sampling (Interior Specialized Crew)	6
Hazard Abatement of Storage Gallery (Interior Specialized Crew)	1
Hazard Abatement of Sample Galleries (Interior Specialized Crew)	12
Hazard Abatement of Operating Galleries (Interior Specialized Crew)	3
Hazard Abatement of Pipe Galleries (Interior Specialized Crew)	3
Demolition Preparation of Silo Service Areas (Interior Specialized Crew)	12
Hazard Abatement of Pu Loadout Hood (Interior Specialized Crew)	6
Demolition of 276-S Hexone Storage Tanks (General D&D Crew)	7
Demolition Preparation of 293-S (Interior Specialized Crew)	3

Table A-10. Project Duration Summary

Action	Duration (months)
Demolition and grouting of 293-S (General D&D Crew)	1.5
<b>Alternative 3</b>	
Demolition Preparation of Annex (Interior Specialized Crew)	12
Demolition Preparation of Canyon Deck (Interior Specialized Crew)	6
Demolition Preparation of Operating Galleries (Interior Specialized Crew)	12
Demolition Preparation of Pipe Galleries (Interior Specialized Crew)	12
<b>Alternative 4</b>	
Demolition of Annex (General D&D Crew)	6

D&D = decontamination and decommissioning

## A5.2 Interior Specialized Crew Breakdown

Table A-11 presents the cost breakdown for the interior specialized crew proposed for removal actions within the REDOX Complex. This table presents the total cost for each labor category and monthly usage. In addition to crew labor, this estimate includes materials, subcontractor labor, taxes and licenses, overhead, and G&A allocations. This information is derived from actual crew data from the Plutonium Finishing Plant from October and November 2015. The average of these 2 months is used for this cost estimate.

Table A-11. Cost Breakdown for Interior Specialized Crew

Category	Average Monthly Expenses (\$1,000s)	Average Monthly Crew Size (FTE)
<b>0 - Labor and Staff Aug</b>	201.51	--
C060 - Millwrights	0.37	0.03
C081 - Plumbers & Pipe (Pipefitter)	16.70	1.64
C121 - Other Crafts (Insulators)	1.64	0.16
M010 - First Line Supervisors	17.93	0.96
R051 - Nuclear Wst Process Oper (NCO)	28.37	2.28
R052 - Nuclear Wst Process Oper (D&D)	68.77	8.68
R070 - Utilities System Operators	9.25	1.09
T050 - Health Physics Technicians	58.61	5.89
Z030 - Variance Distribution	-0.30	0.00
Z050 - Non-Standard Pay	0.18	0.00

Table A-11. Cost Breakdown for Interior Specialized Crew

Category	Average Monthly Expenses (\$1,000s)	Average Monthly Crew Size (FTE)
<b>1 – Materials</b>	43.13	--
10 - Material and Equipment	42.34	--
FR – Freight	0.79	--
<b>2 – Subcontractors</b>	5.55	--
<b>24 - Taxes and Licenses</b>	5.55	--
<b>6 - Overhead Allocations</b>	48.85	--
<b>7D - General &amp; Administrative</b>	48.85	--
<b>Grand Total</b>	299.04	20.73
<b>Modified Total for Estimate</b>	<b>\$300,000.00</b>	<b>20</b>

### A5.3 General D&D Crew Breakdown

Table A-12 presents the labor breakdown for the general D&D crew proposed for demolition activities within the REDOX Complex. This table presents the actual crew breakdown for a recent demolition activity at the 200 West Area Construction Forces Facility, AKA the “Gypsy Camp.” A similar crew makeup is assumed for this cost estimate. In addition, recent cost estimates for the REDOX Complex were used to develop a D&D crew cost. The cost estimate for the PUREX North Closure Plan, ECE-200E15-00003 uses a daily crew of six personnel, split equally between hot zone and support personnel. Actual crew breakdown will vary depending on activity but is assumed to utilize personnel similarly to the gypsy camp demolition.

Table A-12. Labor Breakdown for D&amp;D Crew

Actual Crew Breakdown from Gypsy Camp Demolition	%
AG00 - Contract Labor	2.42%
C010 – Carpenters	1.34%
C020 – Electricians	0.11%
C121 - Other Crafts-Insulators	3.16%
E040 - Electrical Engineers	0.04%
E070 - Mechanical Engineers	0.07%
E100 - Plant Engineers	0.03%
E120 - Safety Engineers	2.16%
E130 - Other Engineers	1.21%
M010 - First Line Supervisors	13.25%

Table A-12. Labor Breakdown for D&amp;D Crew

<b>Actual Crew Breakdown from Gypsy Camp Demolition</b>	<b>%</b>
M020 - Managers & Executives	4.80%
P070 - Planner/Scheduler/Estimator	9.70%
P080 - Health Physicists	0.80%
P090 - Industrial Hygienists	5.51%
P140 - Safeguards & Security Spec	2.54%
P160 - Technical Writer	0.32%
P170 - Other Professionals	6.92%
R051 - Nuclear Wst Process Oper (NCO)	1.45%
R052 - Nuclear Wst Process Oper (D&D)	36.37%
S010 – Chemists	0.33%
S020 - Environmental Scientists	3.90%
T021 - Drafters – Exempt	0.14%
T050 - Health Physics Technicians	3.43%
<b>General D&amp;D Cost Breakdown</b>	
Average Daily Cost (assumed)	\$ 10,000.00
Number of working days per month (assumed)	19
Total Monthly Cost	\$190,000.00
Crew Expense (70%)	\$133,000.00
Equipment & Materials Expense (30%)	\$ 57,000.00

#### A5.4 Waste Treatment Cost Breakdown

Table A-13 presents the cost breakdown for waste treatment conducted at ERDF prior to disposal of LLW/MLLW.

Table A-13. Waste Treatment Cost Breakdown

<b>ERDF Treatment Buildup</b>	
ERDF Hourly Rate	\$36.66
Production Rate (hours to treat one container)	4
Cost per container	\$146.64
Average ERDF Load (ton)	13
Treatment cost per ton	\$11.28

## A5.5 Characterization Sampling Buildup

Table A-14 presents the cost breakdown for characterization sampling to be conducted prior to work activities within the 202-A Canyon Building.

Table A-14. Characterization Sampling Cost Breakdown

<b>REDOX Characterization Sampling Buildup</b>	
8 Galleries @ 20 Samples each	160
2 Annex Areas @ 20 samples each	40
East End of Canyon Rooms and Deck @ 20 samples each	80
Silo Levels @ 10 Samples each (skip level 6)	70
Total Number of Samples	350
Cost for each sample	\$5,000
<b>TOTAL COST</b>	<b>\$1,750,000</b>

## A5.6 Capital Unit Cost Summary

Table A-15 presents the unit cost for each line item of this estimate. References for cost sources are included in the Notes/References columns.

## A5.7 O&M Unit Cost Summary

Table A-16 presents the cost breakdown for each O&M line item of this estimate. References for cost sources are included in the Notes/References columns.

Table A-15. Capital Unit Cost Summary

Line #	Item	Unit Cost	Units	Source	Add Overhead and Profit?	Labor Only?	% of Nonlabor Item to be Taxed	Notes/References
1	Site Preparation	\$1,500,000	LS	Other	Yes	No	30%	CHPRC PM allowance to secure site and power connections; set up work zones, equipment, and waste areas; set up temporary facilities and utilities.
60	Ventilation System Modification	\$10,000,000	LS	Other	Yes	No	30%	CHPRC PM allowance for bringing ventilation system into compliance for proposed work activities
62	Life Safety Updates	\$1,500,000	LS	Other	Yes	No	30%	CHPRC PM allowance for bringing ventilation system into compliance for proposed work activities
100	Bulk Excavation with Some Variation, > 2,000 to 20,000 tons	\$25	Ton	Historical	Yes	No	0%	Environmental Remediation/Quality Assurance (ERQA) Unit cost
650	Characterization Sampling	\$5,000	EA	Other	Yes	No	0%	CHPRC PM allowance
656	Miscellaneous Sampling and Analysis (nonsoil)	\$50,000	LS	Other	Yes	No	30%	CHPRC PM allowance
659	ERDF Disposal Soil Cost (\$/Sample)	\$497	EA	Historical	Yes	No	30%	Environmental Remediation/Quality Assurance (ERQA) Unit cost

Table A-15. Capital Unit Cost Summary

Line #	Item	Unit Cost	Units	Source	Add Overhead and Profit?	Labor Only?	% of Nonlabor Item to be Taxed	Notes/References
662	Site Air Monitoring	\$20,000	MO	Other	Yes	No	30%	CHPRC PM allowance
801	Work Crew, Interior Specialized	\$300,000	MO	Historical	No	No	0%	From Plutonium Finishing Plant actuals
803	Work Crew, General D&D	\$190,000	MO	Other	Yes	No	30%	Estimator buildup, assumed 70% labor and 30% equipment and materials
810	ERDF WF	\$1,962.82	M <sup>3</sup>	Other	Yes	No	0%	ERDF Waste Rates 9/30/2015
811	ERDF WG	\$69.70	Ton	Other	Yes	No	0%	ERDF Waste Rates 9/30/2015
817	ERDF Waste Treatment	\$11.28	Ton	Other	Yes	No	0%	Estimator Buildup
819	ERDF Waste Transportation	\$60.05	Load	Other	Yes	No	0%	Estimator Buildup
850	TRU Waste Treatment/ Repackaging	\$38,000	M <sup>3</sup>	Other	Yes	No	0%	Fully burdened rate estimate from CHPRC W&FMP
1051	DSA/FHA Review and Update	\$100,000	Ea	Other	Yes	No	30%	CHPRC PM Allowance
1053	Demolition Analysis	\$100,000	Ea	Other	Yes	No	30%	CHPRC PM Allowance
1055	Site Closeout Report - High	\$105,820	Ea	Historical	Yes	No	30%	Environmental Remediation/Quality Assurance (ERQA) Unit cost
1057	On-Scene Coordinator Report - Final	\$100,000	Ea	Other	Yes	No	30%	CHPRC PM Allowance
1063	Grout Material	\$120	Yard <sup>3</sup>	Historical	Yes	No	100%	U Canyon Grout Material Cost

Table A-16. Operations & Maintenance Unit Cost Summary

Line #	Item	Unit Cost	Units	Source	Add Overhead and Profit?	Labor Only?	% of Nonlabor Item to be Taxed	Notes/References
800	Surveillance and maintenance program	\$277,000	YR	Historical	Yes	No	30%	Annual S&M Program Cost for REDOX Complex (2013)
954	On-scene coordinator report - final	\$100,000	EA	Other	Yes	No	30%	CHPRC PM Allowance
1100	Single-wide trailer	\$12,000	YR	Historical	Yes	No	0%	Yearly rental and operation costs (\$1,000/month)
1101	Double-wide trailer	\$20,400	YR	Historical	Yes	No	0%	Yearly rental and operation costs (\$1,700/month)
1102	Bathroom trailer	\$30,000	YR	Historical	Yes	No	0%	Yearly rental and operation costs (\$2,500/month)
1104	Hazard abatement allowance	\$1,500,000	EA	Other	Yes	No	30%	CHPRC PM Allowance

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