Appendix B

Decommissioning Funding Plan for the Rare Element Resources, Inc. Bear Lodge Project

DECOMMISSIONING FUNDING PLAN FOR THE RARE ELEMENT RESOURCES, INC. BEAR LODGE PROJECT

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List of Acronyms

BLS	Bureau of Labor Statistics
CFR	Code of Federal Regulations
cm	centimeter
cm^2	square centimeter
CPI	Consumer Price Index
D&D	Decommissioning and Decontamination
DFP	Decommissioning Funding Plan
ER	Environmental Report
ERG	Environmental Restoration Group, Inc.
ft^2	square feet
hr	hour
Hydromet	Hydrometallurgical
I&C	instrumentation and controls
km	kilometer
LF	Linear Feet
LLW	Low Level Radioactive Waste
LQD	Land Quality Division
LS	leach solution
m	meter
m^2	square meter
MARSAME	Multi-Agency Radiological Survey and Assessment of Materials and Equipment
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
NRC	U.S. Nuclear Regulatory Commission
OES	Occupational Employment Statistics
PLS	pregnant leach solution
PPE	personal protective equipment
PUG	Physical Upgrade
RCT	Radiation Control Technician
RML	Radioactive Materials License
REE	rare earth elements

RER	Rare Element Resources, Inc.
TSF	Tailings Storage Facility
sec	second
UOM	Unit of Measure
WDEQ	Wyoming Department of Environmental Quality

1.0 INTRODUCTION

Rare Element Resources, Inc. (RER) is proposing to mine and recover rare earth elements (REE) in northeastern Wyoming as part of the Bear Lodge Project. REE are key components of green energy technologies and other high-technology applications. Some of the major applications include: hybrid automobiles, plug-in electric automobiles, advance wind turbines, nickel-metal hydride batteries, computer hard drives, magnetic refrigeration technologies, compact fluorescent light bulbs, metal alloys, additives in ceramics and glass, fluid and petroleum cracking catalysts, and a number of critical military uses. China currently produces approximately 96 percent of the approximate 140,000 tons of rare earths consumed annually worldwide, and China has been reducing its exports of rare earths each year. The rare earths market is growing rapidly at 7 to 10 percent per year, and is projected to accelerate if green technologies are implemented on a broad scale.

1.1 PURPOSE

RER is proposing the construction of a rare earth element mine and hydrometallurgical (beneficiation) processing plant, as part of its Bear Lodge Project. RER will be required to obtain permits and approvals to operate the Bull Hill Mine from the Forest Service and from the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ-LQD). RER will also be required to obtain a Radioactive Materials License (RML) to possess source material. These licensing requirements are contained in 10 CFR 40. As part of the U.S. Nuclear Regulatory Commission (NRC) Source Material License application process required in accordance with 10 CFR Part 40.36, it is necessary for RER to estimate the decommissioning costs, in the form of a Decommissioning Funding Plan (DFP) associated with those areas of the Bear Lodge Project that will be licensed. It should be noted that this DFP does not include reclamation or demolition costs for the facility other than those relating to processing of source material in licensed areas.

The Bear Lodge Project is described in the *Bear Lodge Project Plan of Operations for Mining Activities on National Forest System Lands* (RER, 2014) and consists of four components as follows:

- An open-pit mine operation at Bull Hill and associated support facilities located approximately 12 miles (19.31 km) by road north of Sundance, Wyoming;
- A physical upgrade (PUG) plant for mineral pre-concentration located on-site adjacent to the mine;
- A hydrometallurgical (Hydromet) plant for further concentration and recovery of the REE into a bulk rare earth concentrate product in Upton, Wyoming; and
- The continuation of exploration drilling and activities during mining operations.

This DFP is applicable only to the aforementioned PUG Plant and Hydromet Plant locations within the overall Bear Lodge Project. RER contracted Environmental Restoration Group, Inc. (ERG) to prepare this DFP to support the NRC license application. Appropriate elements from NRC NUREG 1757- *Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees* (NRC, 2006) were used as guidance in creating this document. RER is requesting the use and quantities of the radionuclides specified in Table 1.1-1. This report details the cost estimate for decommissioning the PUG Plant and Hydromet Plant based on the requested use and quantities of radionuclides in Table 1.1-1 along with key assumptions used to generate the cost estimate. The key assumptions used to generate the cost estimate are

contained in Section 7.0 below. If the licensed activities at the Bear Lodge Project change, an evaluation of how these changes affect the decommissioning cost estimate will be evaluated at that time. In addition, 10 CFR 40.36 requires a cost estimate adjustment to this DFP at intervals not to exceed 3 years and at the time of license renewal.

In the DFP, the operation of the PUG and Hydromet plants is described, and material and equipment is inventoried. Costs are ascribed to all anticipated decommissioning tasks and summed to derive an estimate for the cost of decommissioning. A 25 percent contingency factor is added to the final decommissioning cost estimate to account for uncertainty in contamination levels, waste disposal costs, and other costs associated with decommissioning. Finally, the mechanism to ensure funding is available to finance decommissioning activities and the method to adjust the decommissioning cost estimate over time are described.

1.2 FACILITY IDENTIFICATION

RER is proposing the construction of a REE mine and Hydromet (beneficiation) processing plant, as part of the Bear Lodge Project. The mine will be located in Crook County, Wyoming, approximately 12 miles (19 kilometers - km) north of Sundance, Wyoming. Mine ore will be physically upgraded into a pre-concentrate and shipped to RER's Hydromet facility (also referred to herein as the Upton Plant) near Upton in Weston County, Wyoming. There, the pre-concentrate will be processed through leaching, neutralization, and precipitation to a final REE product. Tailings generated from beneficiation will be dewatered, neutralized, and placed in the Tailings Storage Facility (TSF); part of the Upton Plant. Figure 1.2-1 shows the location of the Bull Hill Mine Site and Upton Plant Site.

1.3 SUMMARY OF LICENSE AND LICENSED ACTIVITIES

RER is requesting a license to possess unlimited quantities of unsealed, non-volatile source material in any chemical or physical form. The source material will be uranium and thorium in their natural isotopic abundance.

Structures and facilities at the PUG Plant will be involved in physical sizing and preparation of ores for transport; thus all uranium and thorium isotopes would be expected to be present in equilibrium with daughter radionuclides. Hydromet processes involve production level process chemistry including nitric acid dissolution with the intent to separate and dispose thorium from the REE product. The types and quantities of materials to be possessed under the RML are summarized in Table 1.1-1.

Table 1.1-1
Licensed Radioactive Material Description

Radioisotope	Chemical/ Physical Form	Maximum Possession Limit	Proposed Use
Pre-concentrates containing natural uranium and thorium	Any bound form	Unlimited Quantities	Possession of source material incident to the processing of rare earth elements
Natural Thorium	Hydroxide	Up to 10 Curies	Possession of source material incident to the processing of rare earth elements

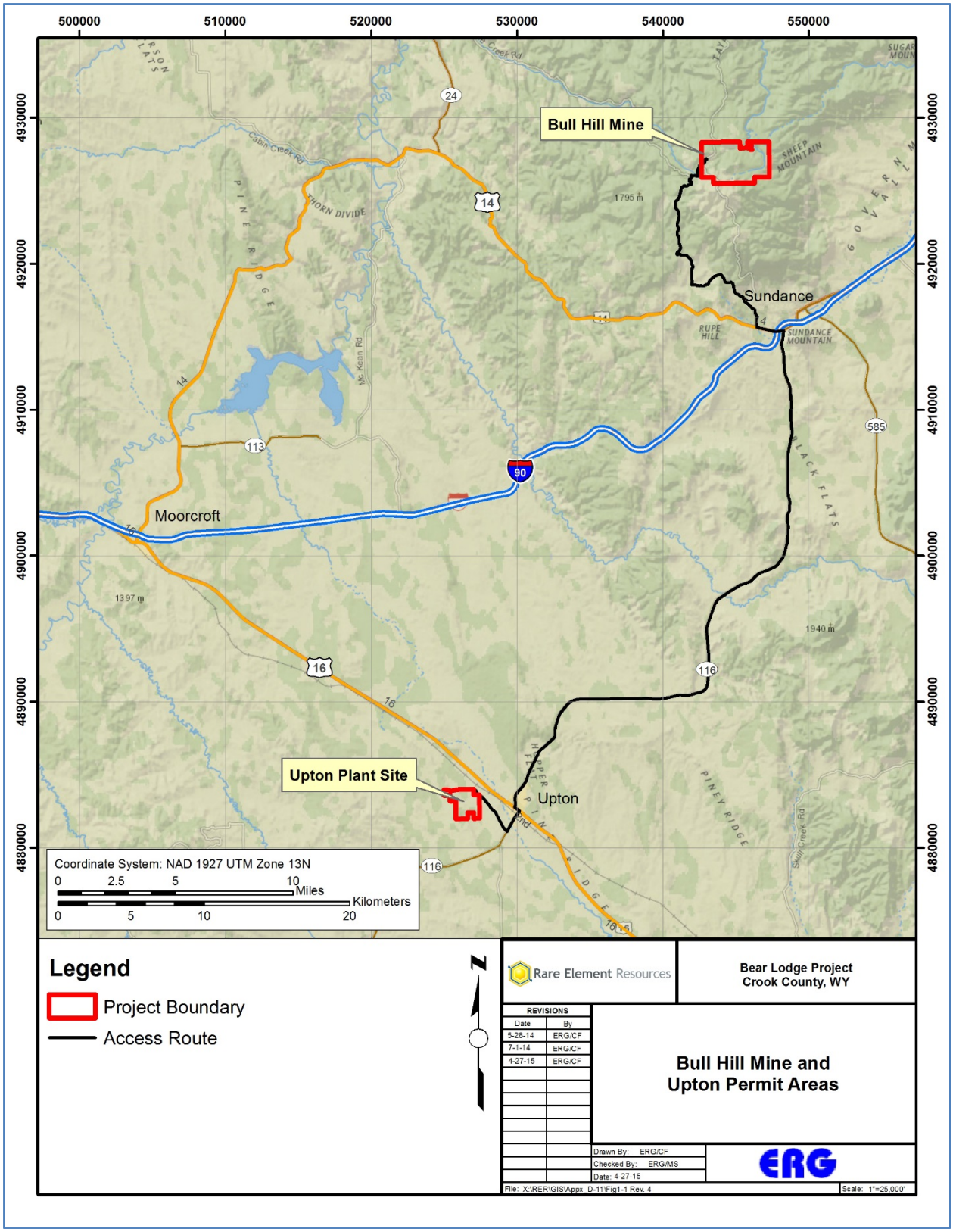

Figure 1.2-1
Bull Hill Mine and Upton Permit Areas

2.0 GENERAL SITE DESCRIPTION

The following section provides a general description of the proposed licensed areas associated with the RER Bear Lodge Project, including the PUG Plant and Hydromet Plant. A description of the facilities and processes is included.

2.1 PUG FACILITY DESCRIPTION

The PUG Plant is designed to maximize concentration of the rare earth minerals and produce a pre-concentrate using a screening and washing process. The PUG process employs a series of crushing, washing, and screening methods to concentrate the rare earth-bearing fines and reduce the physical mass. There are areas of the Mineable Pit that contain variable amounts of weathered oxide ores or OxCa ores, and that contain variable grades of stockwork mineralization adjacent to the higher grade ores. Each of these ore types has a different upgrade percentage and mass reduction in the PUG circuit. Figure 2.1-1 provides a layout drawing of the PUG Plant.

The mining plan will encounter each of these ore types within any given bench; therefore, the PUG circuit has the ability to process up to 1,600 tons per day of high grade oxide, OxCa stockwork, and low grade ores, which may be blended to meet mine pit production plans and market demands. These product streams will combine to produce up to 600 tons per day of bulk mixed rare earth carbonate pre-concentrate. The PUG processing strategy is to maximize the rare earth grade and recovery, and minimize the mass of the pre-concentrate that is transported to the Hydromet Plant.

2.2 HYDROMET FACILITY DESCRIPTION

The Hydromet Plant is designed to process the pre-concentrate production from the PUG Plant. The rare earth oxide production rate will vary based on the pre-concentrate production rate and grade. The rare earth concentrate produced by the Hydromet Plant will have an approximate rare earth equivalent content of 97 percent total rare earth oxide.

Figure 2.2-2 provides a plan view drawing of the layout of plant facilities. The Hydromet Plant consists of two processes. The first part of the process focuses on direct acid digestion of minerals in chloride media at moderate temperature (113 - 194 ^{o}F). About 97 to 99 percent of rare earths are digested and transferred into the pregnant leach solution (PLS). Subsequently, the rare earths are selectively precipitated from the PLS by means of oxalate reagent. All the un-precipitated metals, such as iron, manganese magnesium, calcium, aluminum, zinc, potassium, barium, and traces of uranium etc. remain in the barren leach solution (LS). At this point, about 95 to 99 percent of the rare earths are selectively transferred to the oxalate precipitate solids together with the thorium. The acidic effluent solution or barren leach solution, full of base metals, is transferred to the storage tanks next to a distillation column.

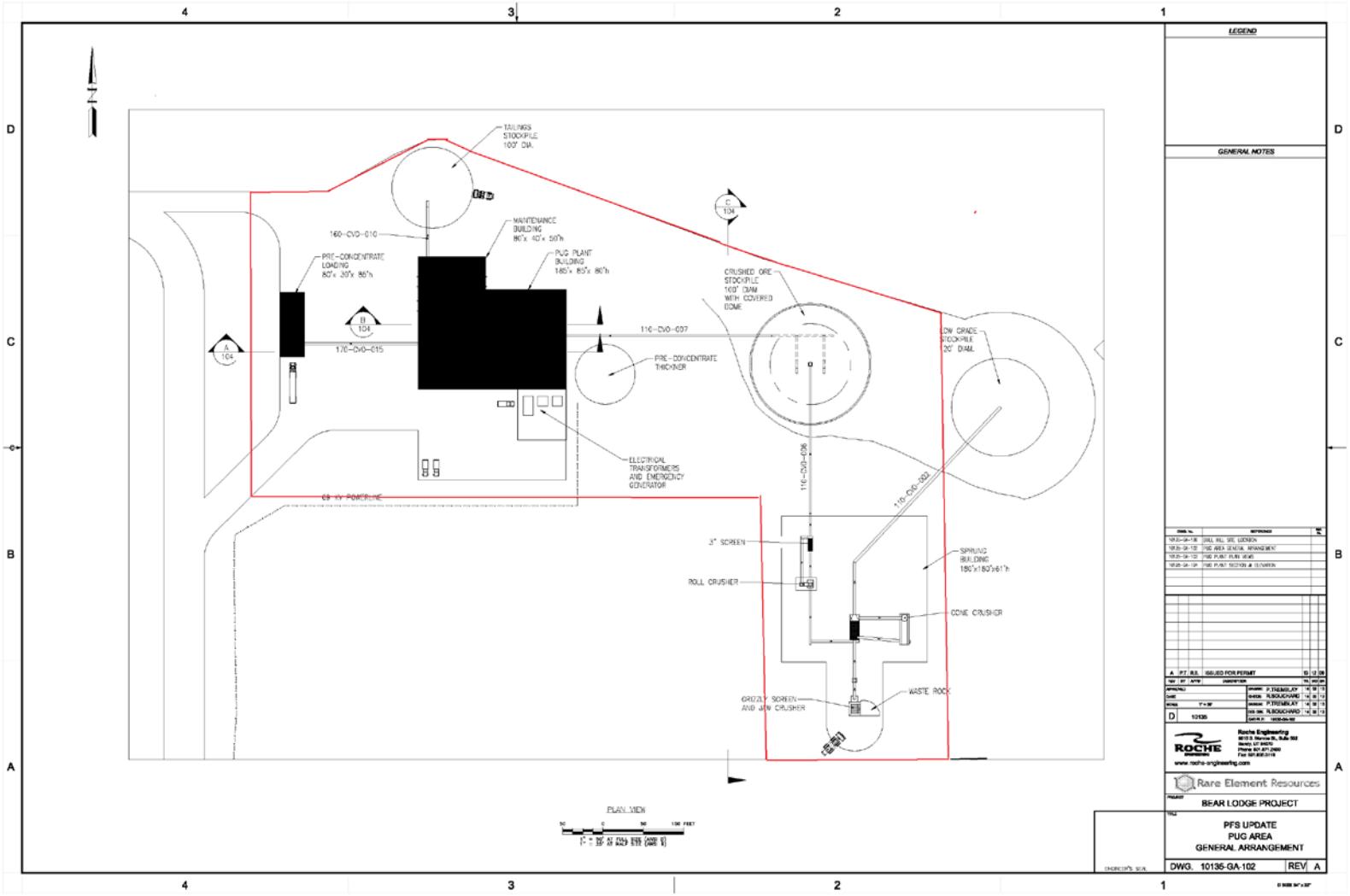

Figure 2.1-1
PUG Facility Layout

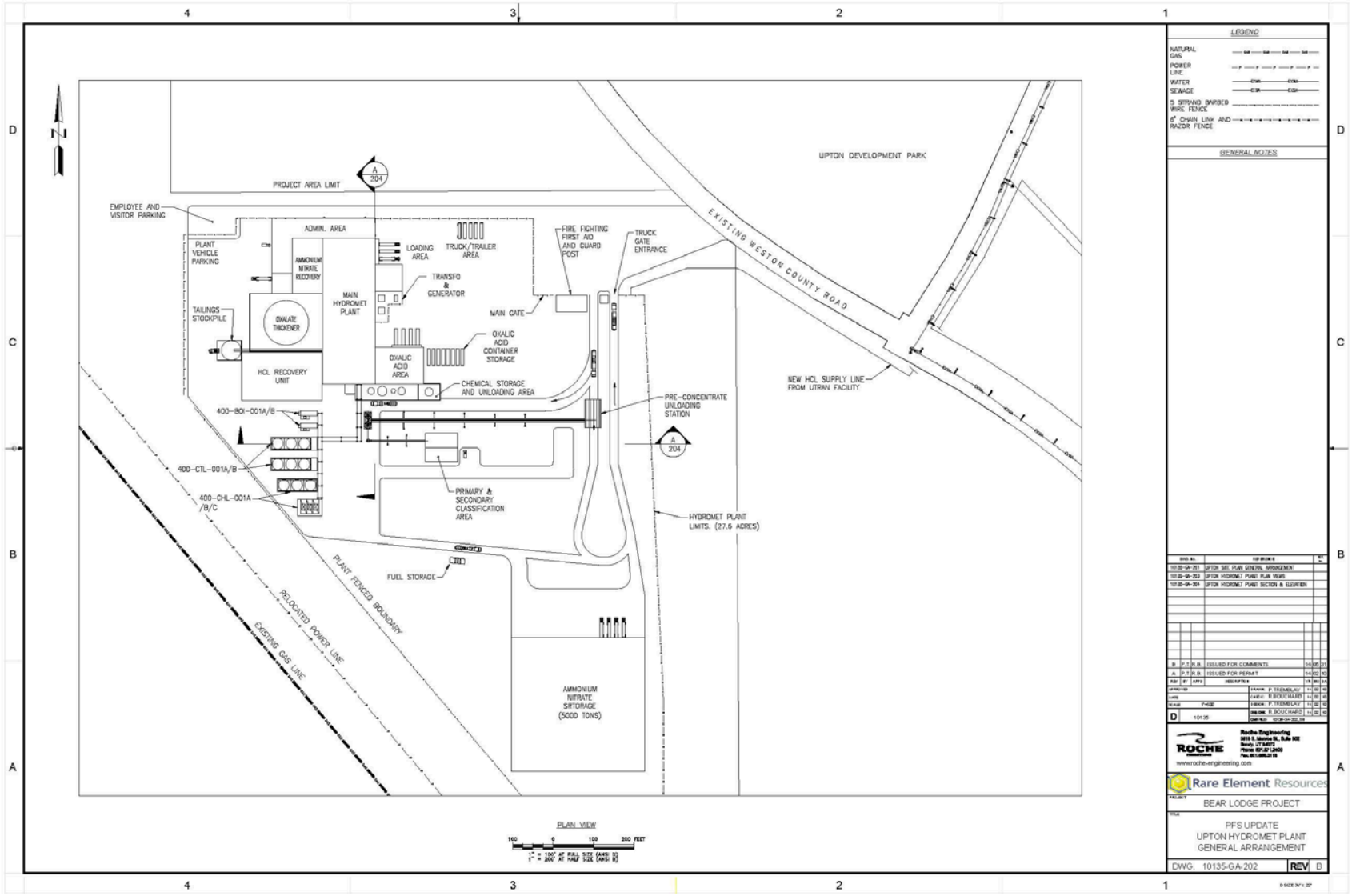

Figure 2.2-2
Hydromet Facility Layout

Because the Hydromet Plant is designed to be a zero-effluent process, the LS solution is subjected to distillation or boiling to vaporize and capture the free acid and water leaving behind a smaller residual liquor to be neutralized with an alkaline solution. The metals in the residual liquor are precipitated as carbonates, which will be co-mingled with leach residual solids plus alkaline media for neutralization to produce a paste for dry-stacking at the TSF.

The recovered hydrochloric acid and water are reused in the hydrometallurgical process mainly in the leach and dewatering stages.

The rare earth oxalate powder (with 97 percent REE) contains thorium. Therefore, the second part of the process is designed specifically to remove thorium from the oxalates and discard it via a licensed third party disposal facility. There are two main components in this part of the process, namely; 1) selective precipitation of thorium and 2) final precipitation of all the rare earths as hydroxides.

However, before thorium impurities are removed from the RE-oxalate solids, prior to removing thorium from the rare earth oxalates, it is necessary to convert the oxalates to oxides using a kiln. The rare earth oxides are then dissolved in nitric acid to enable downstream thorium precipitation as thorium hydroxide using a 20 percent solution of ammonium hydroxide. The thorium-free nitrate solution is transferred to another precipitation circuit where the rare earths are finally recovered as hydroxides and then calcined (or dried) to produce the final REO powder concentrate (>99 percent pure). The filtrate solution at this point, contains ammonium nitrate which may be recovered as a valuable by-product and the water fraction is recycled back to alkaline and acid preparation steps.

3.0 DETAILED SITE AND FACILITY DESCRIPTION

All areas within the PUG and Hydromet facilities are anticipated to be contaminated as a result of rare earth material processing, handling and storage; thus all contents and building surfaces are considered impacted. It is anticipated that radiological decontamination, demolition, and disposition will be applied to all tanks, structures, and conveyors contained within the facilities. The majority of this material will be decontaminated and released for unconditional use. Only porous materials such as conveyor belts and filter media as well as some grinding components are expected to be disposed of as low-level radioactive waste.

For cost estimation purposes, PUG and Hydromet facility areas and equipment are classified as Class 1 or 2 based on Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM, 2000) or impacted based on the Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME, 2009) guidelines, respectively. Class 1 areas have a high potential for radiological contamination or are known to have radiological contamination present.

Class 2 areas have a potential for residual radioactivity above background but likely below any dose based release level. Dose based surface contamination limits will be developed during the planning for final decommissioning. As such, Class 2 areas in this DFP are assumed to be facility surfaces where radioactive material or sources were processed, stored or inadvertently transferred to, but potential for contamination has been determined to be low.

3.1 PUG AND HYDROMET FACILITY EQUIPMENT AND STRUCTURES FOR DECOMMISSIONING AND DECONTAMINATION

Facility equipment and structures are grouped into the following categories for inventory and assessment of Decommissioning and Decontamination (D&D) methods:

- Tanks – typically steel process tanks requiring removal, staging, and size reduction as part of the D&D process prior to shipment as Low Level Radioactive Waste (LLW).
- Tanks Special Handling – typically large-area tank-like objects (likely uncontaminated or very lightly contaminated) that are assumed to be decontaminated with pressure washing, and acceptable for unrestricted release after radiological contamination surveys.
- Structures – includes piping, instrumentation and control (I&C) equipment, vessels, filters, supports, and other equipment used in facility processing.
- Conveyors – includes conveyor belts, rollers, supports, and related control equipment used to transport product during facility operations.
- Cranes – both the PUG and Hydromet plants contain overhead cranes that will be removed, decontaminated as necessary, surveyed for unrestricted release, and made available for salvage or resale.
- Ancillary Structures – includes fencing, exterior piping (non process-related) and materials removed in the process of executing D&D of contaminated structures.

Table 3.1-1 presents a summary of facility and structures for D&D by type.

Table 3.1-1
Summary of Facility and Structures for D&D by Type

Facility Description	Component	Total Units	UOM*
PUG	Tanks	376	ft^3
PUG	Tanks - Special Handling	102,102	ft^2
PUG	Structures	9,390	ft^3
PUG	Conveyors	2,936	ft^3
PUG	Crane	1	ea
HYDROMET	Ancillary Structures	22,415	lf
HYDROMET	Tanks	1,337	ft^3
HYDROMET	Structures and Silos	33,567	ft^3
HYDROMET	Conveyors	9,792	ft^3
HYDROMET	Crane	1	ea
*UOM = Unit of Measure			

Details of all dimensional analyses relating to structure quantities are taken directly from Knight Piésold and Co. (2014) and included in Attachment A, Table A-3.

3.2 CLASS 1 PUG AND HYDROMET SURFACES

The following areas are under radiological restriction during operations and are assumed to have a high potential for contamination above decommissioning release criteria. Although these rooms and areas are initially assumed as Class 1, final class determination will be made in developing the decommissioning plan. Table 3.2-1 summarizes floor and wall areas of these rooms; further descriptions of room features are included below.

Table 3.2-1
Summary of Facility and Structures Class 1 Radiological Survey Areas

Facility Description	Building Surface Type	Total Units	UOM
PUG	Class I Floors	82,961	ft^2
PUG	Class I Walls	12,360	ft^2
HYDROMET	Class I Floors	235,253	ft^2
HYDROMET	Class I Walls	32,582	ft^2
*UOM = Unit of Measure			

Details of all dimensional analyses relating to structure surface areas are taken directly from Knight Piésold and Co. (2014) and included in Attachment A, Tables A-1 and A-2.

3.3 CLASS 2 PUG AND HYDROMET SURFACES

The following areas are under radiological restriction during operations, but assumed to have a low potential for contamination below decommissioning release criteria due to their proximity to radioactive materials. Although these rooms and areas are initially assumed as Class 2, final class determination will be made in developing the decommissioning plan. Table 3.3-1summarizes floor and wall areas of these rooms; further descriptions of room features are included below.

Table 3.3-1
Summary of Facility and Structures Class 2 Radiological Survey Areas

Facility Description	Building Surface Type	Total Units	UOM
PUG	Class II Walls and Ceilings	194,885	ft^2
HYDROMET	Class II Walls and Ceilings	377,519	ft^2

Details of all dimensional analyses relating to structure surface areas are taken directly from Knight Piésold and Co. (2014) and included in Attachment A, Tables A-1 and A-2.

3.4 NON-IMPACTED AREAS

All licensed areas within the PUG and Hydromet facilities associated with the Bear Lodge Project are assumed to be impacted. Impacted areas outside of these facilities are not expected and are currently beyond the scope of this DFP.

4.0 FACILITY ASSESSMENT

4.1 HISTORICAL ASSESSMENT

Prior to final decommissioning operations, the facilities operating history and radiological safety/survey data through the operational period will be reviewed to better define extent of required decommissioning processes.

4.2 BASELINE RADIATION SURVEYS

A baseline radiological investigation of the Upton project area was initiated by RER as noted in the Environmental Report (ER) (RER, 2015) and the results are reported as a stand-alone document of the ER submitted to support the license application. The objective of the baseline investigation is to establish baseline conditions of the Upton project area to assess future potential impacts to human health and environment during construction, operation, and closure. Baseline concentrations of radionuclides including uranium, thorium, radium-226, and radium-228 for the following media were evaluated:

- Airborne particulates,
- Surface soil,
- Surface water, and
- Groundwater.

Gamma radiation exposure rates and radon flux from soil surface and radon concentrations in air were also evaluated.

A similar baseline investigation for the Bull Hill Mine Site is contained as Appendix G of the Plan of Operations (RER, 2014).

Another baseline survey objective is to establish total alpha and beta-gamma emission rates exhibited by common building surfaces prior to the introduction of source material. A background reference area(s) will be identified in the NRC-approved decommissioning plan for common building surfaces.

Radiological impacts incurred during the development and operation of the PUG and Upton plants, if any, will be evaluated in part by comparing the data sets of the baseline and operational monitoring.

4.3 PRE-DECOMMISSIONING RADIOLOGICAL SURVEYS

In support of regulatory requirements associated with planning at or near the time of facility closure, a pre -decommissioning radiological survey will be performed. These surveys will help better define actual conditions as to extent and magnitude of contamination within facility structures, on facility surfaces, and outside of historical control boundaries. This information will be used to modify decommissioning requirements and cost estimates.

5.0 FACILITY DECONTAMINATION, DISMANTLING, DISCARDING, AND DECOMMISSIONING

The following sections describe the processes and assumptions used to estimate cost associated with structure/equipment removal and finals status radiation surveys. Parametric cost models are applied to representative sized structures and equipment. In Attachment A, the

parametric cost is applied to the total number of structure units as shown in Tables 3.1-1, 3.2-1 and 3.3-1. The cost for labor, equipment, and materials is deconstructed and summed according to reporting categories specified in NUREG-1757. Details and calculations are shown in Attachment A, Tables A-5 through A-13.

5.1 STRUCTURE, TANK, EQUIPMENT DISPOSITION FOR FREE RELEASE

Tank, structure, and equipment disposition for free release processing work sequence is described in Attachment A, Table A-5 and includes:

1) Pressure wash tank interior and collect wash water in a Baker tank.
2) Rig tank for lifting and staging to sizing area.
3) Shear anchor bolts or struts associated with tank footings.
4) Lift tank and relocate to sizing area with existing 20 ton crane.
5) Using excavator/shear, cut and size tank into pieces allowing for surface contamination surveys.
6) As necessary, utilize hand tools for structure or equipment disassembly.
7) Radiation Control Technicians (RCTs) perform free release survey on inner and outer surfaces.
8) Free release tank, structure or equipment sections.

Assumptions

1) Applicable to all structures, tanks, conveyors, and silos. Does not apply to conveyor belts.
2) Assume reference tank surface area is 5,000 ft^2 (equivalent to 465 m^2).
3) Adequate work staging area is available.
4) Facility 20 ton crane is available to support tank removal.
5) Radiological scanning surveys will be performed at an average of 1 m^2 (10.8 ft^2)/2 minutes.
6) Total removal and sizing time = 10 hours for the reference tank.
7) Total survey time = 930 minutes =15.5 hour for the reference tank.
8) Assume after washing and sizing, tanks are acceptable for unrestricted release or industrial waste disposal.

5.2 CRANES

Ceiling cranes within both the PUG and Hydromet facilities will be demobilized, removed from struts with a portable crane, decontaminated as necessary, and surveyed for unrestricted release. It is assumed that the cranes will be disposed of with salvage value (not applied to decommissioning cost). Labor and equipment for this activity is noted in Attachment A, Table A-10.

5.3 ANCILLARY STRUCTURES

Ancillary Structure Disposition Work Sequence is described in Attachment A, Table A-9 and includes:

1) Perform all isolation/lockout tagout procedures.
2) Laborers remove lose items and stage at sizing area.
3) RCTs perform 100% hand survey of items, one (1) removable contamination smear every 6 meters (20 linear feet – LF).
3) Excavator operator shears contents of structure and loads directly into prepped roll-off transport containers.
4) Laborers assist and excavator operator may alternate between shear and grapple for loading.
5) Laborers prep, load, and label waste containers.
6) RCTs survey containers and prepare shipping info.
7) Loaded containers transferred via forklift to waste staging area or directly loaded on waste trucks for shipment.

Assumptions:

1) Ancillary structures include fencing, surface, and near surface utility piping.
2) Work unit is 305 meters (1,000 LF) of pipes or fencing.
3) All items are acceptable for unrestricted release/industrial disposal after survey.
4) Work is done in level D Personal Protective Equipment (PPE).
5) Contents shall be loaded into industrial waste containers not paid for or disposed as part of the radiological decommissioning project.
6) Through shearing and processing at the structure location, the reduction factor for debris is 20% of the original structure work volume.

5.4 FINAL RADIATION SURVEY – CLASS 1

Final Radiation Survey – Class 1 Work Sequence is described in Attachment A, Table A-11 and includes:

1) Identify and mark all MARSSIM Class I building survey surfaces. Clear loose obstructions.
2) Laborer vacuum/clean floors and surfaces in survey unit.
3) Initialize radiological survey equipment, function test, background, etc.
4) Perform large area radiological surveys.
5) Collect and analyze 20 static and removable contamination measurements on systematic grid.
6) Perform hand surveys for difficult access surfaces.
7) Process and dump data to survey report database.

Assumptions:

1) Work is performed in level D PPE.
2) All building contents and equipment have been emptied from survey areas. Applies to licensed floor areas and walls to a height of 2 meters above floor surface.
3) Assume all areas will meet unrestricted release criteria for total and removable contamination. No further decontamination necessary.
4) All floor coverings including tile, vinyl, carpet, etc. have been removed. Survey surface area of 10 m x 10 m floors; four walls to height of 2 m.
5) Total survey unit area of 100 m^2 (1,076 ft^2) assume residential use.
6) Surveys will be performed for alpha and beta-gamma emitting radionuclides, with primary indexing to thorium-232 + D, and uranium-238+D.
7) Assume that MARSSIM based characterization survey will meet requirements of final status survey.
8) Detector area is 10 centimeters (cm) x 50 cm.
9) Assumes large area survey system - Area of 500 cm^2, scanning speed 3 cm/sec. 500 cm^2 covered in 3.3 sec.
10) 1 m^2 covered in 66 seconds. Total survey coverage time 90 minutes.
11) Removable contamination swipes will be collected during survey; locations based on large area detection scanning results.
12) 10 percent of surfaces (10 m^2) will require hand scanning at 1 m^2/2 minutes.
13) Total automated scan time = 100/1.1 = 90 minutes. Total hand scanning time = 10 x 2 = 20 minutes.
14) Static and removable contamination survey require 0.5 hour.

5.5 FINAL RADIATION SURVEY – CLASS 2

Final Radiation Survey – Class 2 Work Sequence is described in Attachment A, Table A-12 and includes:

1) Identify and mark all MARSSIM Class 2 building survey surfaces. Clear loose obstructions.
2) Laborer vacuum/clean floors and surfaces in survey unit.
3) Initialize radiological survey equipment, function test, background, etc.
4) Perform large area radiological surveys.
5) Collect and analyze 20 static and removable contamination measurements on systematic grid.
6) Perform hand surveys for difficult access surfaces.
7) Process and dump data to survey report database.

Assumptions:

1) Work is performed in level D PPE.
2) All building contents and equipment have been emptied from survey areas. Applies to licensed walls and ceilings 2 m (6.6 ft) and greater above floor surface.
3) Assume all areas will meet unrestricted release criteria for total and removable contamination. No further decontamination is necessary.
4) All wall coverings including paneling, wallpaper, etc. have been removed. Survey surface area 10 m x 10 m ceiling; four walls from 2 m above ground surface to 10 m at ceiling level.
5) Total survey unit area of 100 m^2 (1,076 ft^2) assume residential use with 25 percent scan coverage= 25 m^2 (269 ft^2).
6) Surveys will be performed for alpha and beta-gamma emitting radionuclides, with primary indexing to thorium-232 + D, and uranium-238+D.
7) Assume that MARSSIM based characterization survey will meet requirements of final status survey.
8) Detector area is 10 cm x 50 cm.
9) Assumes large area survey system - area of 500 cm^2, scanning speed 3 cm/sec. 500 cm^2 covered in 3.3 sec.
10) 1 m^2 covered in 66 sec. Total survey coverage time 22.5 min.
11) Removable contamination swipes will be collected during survey; locations based on large area detection scanning results.
12) Total automated scan time = 100/1.1 = 90 min.
13) Static and removable contamination survey require 0.5 hr.

6.0 WASTE DISPOSAL

LLW resulting from decommissioning operations will be processed at the site, loaded into shipping containers and transported by truck to the U.S. Ecology Richland Disposal Site in Richland, Washington. The one way distance between Sundance, Wyoming and Richland is taken to be 978 miles. All waste will be transported and disposed of in Type A B-12 containers. Tables A-17 through A-20 of Attachment A present detailed cost estimates relating to waste packaging, transportation, and disposal. A total of 1,920 ft^3 of LLW waste is projected from decommissioning operations. Table 6.0-1 provides the basis for the LLW volume. The difference between the volume 1,920 ft^3 and that reported in Table 6.0-1 is due to packing material such as absorbent in the shipping package.

Table 6.0-1
Basis for Low Level Waste Volume Estimate

Material Type and ID	Length (ft)	Width (ft)	Thickness (ft)	Volume (ft^3)	Comments
Conveyor Belts					
600-CVO-001	150	1.5	0.083	18.8	
200-CVO-001	1160	1.5	0.083	145	
200-CVO-002	40	1.5	0.083	5	
200-CVO-003	320	1.5	0.083	40	
350-CVO-001	40	2	0.083	6.7	
200-CVO-004	320	2	0.083	53.3	
100-CVO-001	120	2.5	0.083	25.0	
110-CVO-002	84	2.5	0.083	17.5	
110-CVO-006	426	2	0.083	71.0	
110-SBF-001A	244	2	0.083	40.67	
110-SBF-001B	244	2	0.083	40.67	
110-CVO-007	538	2	0.083	89.67	
Crushing Equipment					
100-JCR-001	-	-	-	10	Assumed to be less than 10 ft^3
110-CCR-001				10	
110-RCR-001				10	
Press Filters					
600-PFT-001	2.7	1.7	1.6	7.41	
600-PFT-001	2.7	1.7	1.7	7.41	
Baghouse Filters (200-BGH-001)	6	0.25	-	4.71	Assume four filters per baghouse
Belt Filters					
200-BLF-001A	124	17.4	0.083	179.8	
200-BLF-001B	124	17.4	0.083	179.8	
600-BLF-001	99	10.8	0.083	89.1	
200-BLF-003A	124	17.4	0.083	179.8	
200-BLF-003B	124	17.4	0.083	179.8	
300-BLF-001	99	10.8	0.083	89.1	
350-BLF-002A/B	124	17.4	0.083	179.8	
Tank Agitators (total)	-	-	-	21	Only rubber lined agitators. Assume less than 3 ft^3 per agitator, 7 total
Total LLW				1,696	

7.0 KEY ASSUMPTIONS

In the following subsections, the assumptions that were made in generating the decommissioning cost estimate are presented.

7.1 GENERAL ASSUMPTIONS

General assumptions related to decontamination, decommissioning, and final radiological surveys are included in Sections 5.1 through 5.8, and in all Tables A-5 through A-13 associated with Attachment A. Assumptions relating to waste packaging, transport, and disposal are as follows:

- Disposal facility is U.S. Ecology located in Richland, Washington.
- Disposal rates are based on ft^3 rates as published in NUREG 1307 *Reports on Waste Burial Charges* (NRC, 2013) all surcharges as calculated from reference; no application of shipment or container surcharges.

7.2 REQUIRED ASSUMPTIONS

The following assumptions are required by NUREG-1757.

- Decommissioning will occur immediately after the cessation of facility operations. No surveillance costs for an interim period are necessary.
- Inventories of materials and waste at the time of decommissioning will be in amounts that are consistent with historically licensed material quantities and radioactive material uses.
- Third-party contractor(s) will decommission the facility.
- Salvage values for components and materials is zero during decommissioning.

8.0 COST ESTIMATE

The following section summarizes the cost estimate for decommissioning, the method of financial assurance, and the mechanisms used to adjust the cost estimate.

8.1 COST ESTIMATE

The complete cost estimate for decommissioning is $3,843,532 including a 25 percent contingency factor of $768,706. Table 8.1-1 shows a breakdown of the costs associated with generating the estimate.

Table 8.1-1
Total Decommissioning Costs

Task/Component	Base Year Cost 2014	Percentage of Total
Planning, Preparation and Project Management (A.3.6)	$279,353	9.1
Decon and Dismantling Labor (A.3.7)	$893,870	29.1
Final Radiation Survey Labor (A.3.9)	$658,736	21.4
Packing Material Costs (A.3.14(a))	$42,000	1.4
Shipping Costs (A.3.14(b))	$8,883	0.3
Waste Disposal Costs (A.3.14(c))	$588,474	19.1
Equipment/Supply Costs (A.3.15)	$580,396	18.9
Laboratory Costs (A.3.16)	$23,113	0.8
Miscellaneous Costs (A.3.17)	n/a	n/a
Subtotal	$3,074,826	100
25% Contingency	$768,706	-
TOTAL DECOMMISSIONING COST ESTIMATE	$3,843,532	100

8.2 COST ADJUSTMENT

Pursuant to 10 CFR 40.36 this cost estimate must be adjusted at least every 3 years over the life of the facility, or at the time of license amendments or renewals. Costs have been divided into three categories: labor, equipment and supplies, and disposal costs. The adjustment for each cost category is described below.

Labor

The method for adjusting labor rates periodically will be to compare labor classifications to the U.S. Department of Labor, Bureau of Labor Statistics (BLS, 2014) – Occupational Employment Statistics (OES) web page for the State of Wyoming to the wages used in Attachment A, Table A-15 -Worker Unit Cost Schedule.

Equipment and Supplies

The method for adjusting costs of equipment and supplies will be to use the Consumer Price Index (CPI) from BLS (2014). The rate of change in the CPI for the period between cost adjustments will be used as a multiplier to adjust previous equipment and supply cost estimates to current cost estimates.

Disposal Costs

Disposal costs were estimated using guidance from NUREG-1307. Future costs will be modified using the CPI rate of change multiplier as calculated above. Disposal costs associated with thorium hydroxide waste from the Hydromet Plant were assumed to be part of operations and are not included in the decommissioning cost estimate.

9.0 FINANCIAL ASSURANCE

The following sections address the financial assurance mechanisms for decommissioning.

9.1 DECOMMISSIONING FUNDING MECHANISM

RER presently intends to utilize a surety bond in conjunction with a Standby Trust as the method used to provide reasonable financial assurance that decommissioning funding will be available at the time of decommissioning the facility. At least six (6) months prior to the receipt of licensed material in quantities and form requiring decommissioning funding, RER will provide NRC the with the draft financial assurance instrument that intends to execute. Upon finalization of the specific funding instrument to be used and at least thirty (30) days prior to the commencement of operations, RER will provide the NRC the signed, executed documentation. The licensee shall not obtain radioactive material until the NRC reviews and approves the executed financial assurance instrument and certification of financial assurance. The surety bond will provide assurance that decommissioning costs will be paid in the unexpected event RER is unable to meet its obligations at the time of decommissioning. Funds drawn from the surety bond will be placed directly into a Standby Trust that names the NRC as the beneficiary.

9.2 ADJUSTING DECOMMISSIONING COSTS AND FUNDING

In accordance with 10 CFR 40.36(d), RER will update the decommissioning cost estimate over the life of the facility. Updates will take into account changes resulting from inflation or site-specific factors, such as changes in facility conditions or expected decommissioning procedures.

On an triennial basis, starting on the anniversary date of beginning licensed operations, the licensee shall provide an updated DFP and updated facility decommissioning cost estimate to the NRC for review. With each annual update, if the cost estimate exceeds the amount of financial assurance provided, the licensee shall provide financial assurance in the amount of the updated cost estimate and an updated certification of financial assurance to NRC for review and approval.

All updates to the DFP, and cost estimate for facility decommissioning and financial assurance instruments, shall be updated to current year United States dollars and shall encompass all current cost data, taking into account changes in inflation, possession limits, licensed material, labor rates, disposal and shipping rates and site and facility factors. All updates to the DFP, and cost estimate for facility decommissioning and financial assurance instruments shall also include updated costs for the disposal of radioactive material.

9.3 RECORDKEEPING PLANS RELATED TO DECOMMISSIONING FUNDING

In accordance with 10 CFR 40.36(f), RER will retain records until the termination of the license of information that could have a material effect on the ultimate costs of decommissioning. These records will include information regarding: (1) spills or other contamination that cause contaminants to remain following cleanup efforts, (2) as built drawings of structures and equipment and modifications thereto where radioactive contamination exists (e.g., from the use or storage of such materials), (3) original and modified cost estimates of decommissioning and (4) original and modified decommissioning funding instruments and supporting documentation.

10.0 CONCLUSION

The methods used to estimate decommissioning cost of the RER PUG Plant and Hydromet Plant are consistent with appropriate NRC guidance documents and are conservative in nature. Most of the material and equipment removed from these facilities is expected to meet free-release criteria and could be salvaged. The income generated from salvaging equipment and materials is not addressed in this DFP. There is also a 25 percent contingency factor added to the total decommissioning cost estimate to account for uncertainty in contamination levels, waste disposal costs, and other costs associated with decommissioning. The conservative nature of the methods used to estimate decommissioning costs coupled with the 25 percent contingency factor provide relative assurance that the $**3,843,532** required to fund the decommissioning is sufficient given the projected future radiological condition of the RER licensed facilities.

11.0 REFERENCES

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Attachment A

Cost Estimation Tables

TABLE A- 1 DIMENSIONS OF FLOOR AND ROOF AREAS

A.3.3 Bear Lodge Project - PUG and Hydromet Surface Areas and Proposed MARSSIM Class - Floor/Foundations and Roof/Ceilings

Note sourced directly from Knight Piesold - Bull Hill Mine and Upton Facility Closure Cost Estimate - Tables A.8 and B.8 (August 2014)
No calculations performed on worksheet

Facility	Decription	License Area	MARSSIM Class Floor	Floor A (ft2)	Material	MARSSIM Class Roof/ Ceiling	Roof/ Ceilings (ft2)	Material	Notes
PUG	Maintenance Building	Y	I	3200	concrete	II	3200	metal	
PUG	PUG Plant Building	Y	I	15725	concrete	II	15725	metal	
PUG	Preconcentrate Loading	Y	I	2400	concrete	II	2400	metal	
PUG	Control Room	Y	I	1600	concrete	II	1600	metal	
PUG	IT Room	Y	I	800	concrete	II	800	metal	
PUG	Lab	Y	I	800	concrete	II	800	metal	
PUG	Change Room and Shower	Y	I	1600	concrete	II	1600	metal	
PUG	Electrical Room	Y	I	2400	concrete	II	2400	metal	
PUG	Transformers	Y	I	3600	concrete	NA	0	NA	
PUG	Crushed Ore Stockpile - Dome	Y	I	7854	concrete	NA	0	NA	
PUG	Sprung Building	Y	I	32400	concrete	II	32400	metal	
PUG	Platform@ Elev 12'0"	Y	I	3744	metal	NA	0	NA	
PUG	Platform@ Elev 19'6"	Y	I	2138	metal	NA	0	NA	
PUG	Platform@ Elev 30'6"	Y	I	4700	metal	II	0	metal	
HYD	Admin and Lab - Foundation	Y	I	8500	concrete masonry	II	8500	metal	
HYD	Vehicle Maintenance and Warehouse - Foundation	Y	I	7350	concrete masonry	II	7350	metal	
HYD	Mechanical and Electrical Room - Foundation	Y	I	4225	concrete masonry	II	4225	metal	
HYD	Hydromet Building - Foundation	Y	I	46800	concrete masonry	II	46800	metal	
HYD	Containment - Foundation	Y	I	15625	concrete masonry	NA	0	NA	
HYD	Containment - Foundation	Y	I	5000	concrete masonry	NA	0	NA	
HYD	Main Guard and First Aid - Foundation	Y	I	5000	concrete masonry	II	5000	metal	
HYD	Pre concentrate Buildings - Foundation	Y	I	1680	concrete masonry	II	1680	metal	
HYD	Control and Lunch Room - Foundation	Y	I	4000	concrete masonry	II	4000	metal	
HYD	Control and Lunch Room - Inside Cons.	Y	I	4000	metal	NA	0	NA	
HYD	HCI Recovery Unit P1 - Foundation	Y	I	12000	concrete masonry	II	12000	metal	
HYD	HCI Recovery Unit P1 - Inside Cons.	Y	I	12000	metal	NA	0	NA	
HYD	HCI Recovery Unit P2 - Foundation	Y	I	12000	concrete masonry	II	12000	metal	
HYD	HCI Recovery Unit P2 - Foundation	Y	I	12000	metal	NA	0	NA	
HYD	Blowers Enclosure - Foundation	Y	I	625	concrete masonry	II	625	metal	
HYD	Chemical Storage Unloading Pad - Foundation	Y	I	1400	concrete masonry	NA	0	NA	
HYD	Silo Storage Unloading Pad - Foundation	Y	I	1400	concrete masonry	NA	0	NA	
HYD	Boiler Concrete Pad - Foundation	Y	I	1250	concrete masonry	NA	0	NA	
HYD	Cooling Tower Concrete- Foundation	Y	I	4200	concrete masonry	NA	0	NA	
HYD	Container for Thickener- Foundation	Y	I	17400	concrete masonry	NA	0	NA	
HYD	Tailing Stockpile Pad - Foundation	Y	I	1600	concrete masonry	NA	0	NA	
HYD	Sodium Oxalate Building - Foundation - Phase 1	Y	I	10800	concrete masonry	II	10800	metal	
HYD	Sodium Oxalate Building - Foundation - Phase 2	Y	I	10800	concrete masonry	II	10800	metal	
HYD	Leach Area- Phase 2	Y	I	1953	concrete masonry	NA	0	NA	
HYD	Control Room Second Floor	Y	I	900	concrete masonry	NA	0	NA	
HYD	Tailings Stockpile	Y	I	1610	concrete masonry	NA	0	NA	
HYD	400-CTL-001A	Y	I	3273	concrete masonry	NA	0	NA	
HYD	400-CTL-001B	Y	I	3273	concrete masonry	NA	0	NA	
HYD	400-BOI-001 B Phase 2	Y	I	561	concrete masonry	NA	0	NA	
HYD	400-BOI-001 A Phase 1	Y	I	561	concrete masonry	NA	0	NA	
HYD	Platform @ Elev 29'-6"	Y	I	17188	metal	NA	0	NA	
HYD	Generator and Transformer 1	Y	I	977	concrete masonry	NA	0	NA	
HYD	Generator and Transformer 2	Y	I	1190	concrete masonry	NA	0	NA	
HYD	Truck Load Bays 1	Y	I	563	concrete masonry	NA	0	NA	
HYD	Truck Load Bays 2	Y	I	525	concrete masonry	NA	0	NA	
HYD	Truck Load Bays 3	Y	I	525	concrete masonry	NA	0	NA	
HYD	Thorium Removal - Foundation	Y	I	2500	concrete masonry	II	2500	metal	

A.3.4 Bear Lodge Project - PUG and Hydromet Surface Areas and Proposed MARSSIM Class - Walls

Note sourced directly from Knight Piesold - Bull Hill Mine and Upton Facility Closure Cost Estimate - Tables A.8 and B.8 (August 2014)
No calculations performed on worksheet

Facility	Decription	License Area	Wall H (ft)	Wall A (ft2)	MARSSIM Class Floor + Wall < 6ft	Wall A < 6ft (ft2)	MARSSIM Class Wall > 6ft	Wall A >6ft (ft2)	Material	Notes
PUG	Maintenance Building	Y	50	8000	I	960	II	7040	metal	
PUG	PUG Plant Building	Y	80	43200	I	3240	II	39960	metal	
PUG	Preconcentrate Loading	Y	80	17600	I	1320	II	16280	metal	
PUG	Sprung Building	Y	61	43920	I	4320	II	39600	metal	
PUG	Control Room	Y	80	9600	I	720	II	8880	concrete	
PUG	IT Room	Y	80	4800	I	360	II	4440	concrete	
PUG	Lab	Y	80	4800	I	360	II	4440	concrete	
PUG	Change Room and Shower	Y	80	6400	I	480	II	5920	concrete	
PUG	Electrical Room	Y	80	8000	I	600	II	7400	concrete	
HYD	Lab	Y	30	4500	I	900	II	3600	concrete masonry	
HYD	Shower and Change Room	Y	30	3750	I	750	II	3000	concrete masonry	
HYD	Main Admin & Lunch Room	Y	30	4500	I	900	II	3600	concrete masonry	
HYD	Vehicle Maintenance	Y	30	5400	I	1080	II	4320	concrete masonry	
HYD	Workshop and Store	Y	30	3210	I	642	II	2568	concrete masonry	
HYD	Thorium Removal	Y	30	3000	I	600	II	2400	concrete masonry	
HYD	RER Bagging	Y	80	8800	I	660	II	8140	concrete masonry	
HYD	Hydromet Plant Building	Y	80	78400	I	5880	II	72520	concrete masonry	
HYD	Mechanical & Electrical Room	Y	30	6300	I	1260	II	5040	concrete masonry	
HYD	Leach Area Phase 2	Y	50	6250	I	750	II	5500	concrete masonry	
HYD	Sodium Oxalate Handling Phase 1	Y	40	13200	I	1980	II	11220	concrete masonry	
HYD	Sodium Oxalate Handling Phase 2	Y	40	16800	I	2520	II	14280	concrete masonry	
HYD	Chem Storage and Unloading Area	Y	40	13250	I	1988	II	11263	concrete masonry	
HYD	HCL Recovery Unit Phase 1	Y	80	41600	I	3120	II	38480	concrete masonry	
HYD	HCL Recovery Unit Phase 2	Y	80	36800	I	2760	II	34040	concrete masonry	
HYD	300-THK-001	Y	80	16000	I	1200	II	14800	concrete masonry	
HYD	Control Room	Y	10	1200	I	720	II	480	concrete masonry	
HYD	Interior Walls 1	Y	30	4755	I	951	II	3804	concrete masonry	
HYD	Interior Walls 2	Y	30	6000	I	1200	II	4800	concrete masonry	
HYD	Interior Walls 2	Y	30	3105	I	621	II	2484	concrete masonry	
HYD	Fire and First Aid	Y	20	4800	I	1440	II	3360	concrete masonry	
HYD	Guard Post	Y	20	2200	I	660	II	1540	concrete masonry	

TABLE A- 3 NUMBER AND DIMENSIONS OF FACILITY COMPONENTS

A.3.5 - Number and Dimensions of Facility Components.

Note sourced directly from Knight Piesold - Bull Hill Mine and Upton Facility Closure Cost Estimate - Tables A.8 and B.8 (August 2014)
No calculations performed on worksheet

Area	Item	Category	Description	QTY	H (ft)	W (ft)	L (ft)	D (ft)	t (ft)	LF (ft)	A (ft2)	V (ft3)
PUG	170 - THK-001	Tank	Metal	1	7			72.5	0.03125		1594	49.8
PUG	Septic Tank - 6000 gal	Tank	Metal	1	20			8	0.03125		503	15.7
PUG	Pre-Concentrate Silo - 175-BIN-003	Tank	Metal	1	50			12.5	0.03125		1963	61
PUG	190-TAK-009 and 010	Tank	Metal	2	25			17.5	0.03125		2749	85.9
PUG	180-TAK-007 and 008	Tank	Metal	2	25			22.5	0.03125		3534	110.4
PUG	170-TAK-001	Tank	Metal	1	15			10	0.03125		471	14.7
PUG	170-TAK-002	Tank	Metal	1	10			7.5	0.03125		236	7.4
PUG	170-TAK-003 and 005	Tank	Metal	2	15			10	0.03125		942	29.5
PUG	170-TAK-004	Tank	Metal	1	5			2.5	0.03125		39	1.2
PUG	Water Tank - 135,670 gal	Tank - Special Handling	Plastic	1	275			100	0.03125		86394	2700
PUG	Crushed ore stockpile - Dome	Tank - Special Handling	Metal	1	NA			100	0.03125		15708	490.9
PUG	145-SCL-001	Structures	Metal	1	20	20	15					1500
PUG	145-MCR-001	Structures	Metal	1	20	20	15					1500
PUG	130-SCR-005	Structures	Metal	1	6	5	10					45
PUG	120-SCR-003	Structures	Metal	1	12	7.5	17.5					236
PUG	130-RCR-002	Structures	Metal	1	12	15	10					180
PUG	150-MGS-001 and 002	Structures	Metal	2	10	10	17.5					3500
PUG	130-SCR-007	Structures	Metal	1	6	12.5	10					113
PUG	130-SCR-006	Structures	Metal	1	6	10	12.5					113
PUG	130-SCR-004	Structures	Metal	1	6	5	10					45
PUG	160-BLF-001	Structures	Metal	1	7.5	10	25					469
PUG	170-FPR-001	Structures	Metal	1	15	7.5	25					703
PUG	195-COM-001A/B/C	Structures	Metal	4	10	5	10					400
PUG	110-VIS-002 (SPRUNG)	Structures	Metal	1	10	9	3					41
PUG	110-RCR-001 (SPRUNG)	Structures	Metal	1	15	12	9					162
PUG	110-VIS-001 (SPRUNG)	Structures	Metal	1	7.5	6	16					108
PUG	110-CCR-001 (SPRUNG)	Structures	Metal	1	7.5	6	16					72
PUG	100-GRZ-001 (SPRUNG)	Structures	Metal	1	15	6	9					122
PUG	100-JCR-001 (SPRUNG)	Structures	Metal	1	15	6	9					81
PUG	170-CVO-015	Conveyors	Steel	1	1	3	180					540
PUG	PUG-1	Conveyors	Steel	1	1	3	15					45
PUG	PUG-2	Conveyors	Steel	1	1	3	35					105
PUG	110-CVO-007	Conveyors	Steel	1	1	3	160					480
PUG	Dome (2)	Conveyors	Steel	2	1	3	22					132
PUG	Dome 110-BLF-001A/B	Conveyors	Steel	1	1	3	62.5					188
PUG	110-CVO-006	Conveyors	Steel	1	1	3	125					375
PUG	Sprung (1)	Conveyors	Steel	1	1	3	28					84
PUG	Sprung (2)	Conveyors	Steel	1	1	3	16					48
PUG	Sprung (3)	Conveyors	Steel	1	1	3	38					114
PUG	Sprung (4)	Conveyors	Steel	1	1	3	25					75
PUG	Sprung (5)	Conveyors	Steel	1	1	3	38					114
PUG	Sprung (6)	Conveyors	Steel	1	1	3	31					93
PUG	Sprung (7)	Conveyors	Steel	1	1	3	25					75

TABLE A- 3 NUMBER AND DIMENSIONS OF FACILITY COMPONENTS

Area	Item	Category	Description	QTY	H (ft)	W (ft)	L (ft)	D (ft)	t (ft)	LF (ft)	A (ft2)	V (ft3)
PUG	Sprung (8)	Conveyors	Steel	1	1	3	31					93
PUG	110-CVO-002	Conveyors	Steel	1	1	3	125					375
PUG	20TCrane	Crane	Steel	1	3	85	185					4718
Hydromet	600-TAK-001	Tank	Steel	1	12.5			25	0.03125		982	30.7
Hydromet	600-TAK-0010 and 011	Tank	Steel	2	6.25			25	0.03125		982	30.7
Hydromet	400-TAK-002	Tank	Steel	1	6.25			25	0.03125		491	15
Hydromet	400-TAK-004 1	Tank	Steel	1	9.375			25	0.03125		736	23
Hydromet	400-TAK-004 2	Tank	Steel	1	12.5			25	0.03125		982	30.7
Hydromet	300-THK-001	Tank	Steel	1	15.625			25	0.03125		1227	38
Hydromet	600-TAK-001 and 0002	Tank	Steel	2	9.375			30	0.03125		1767	55.2
Hydromet	500-TAK-010	Tank	Steel	1	9.375			25	0.03125		736	23
Hydromet	500-TAK-007	Tank	Steel	1	9.375			25	0.03125		736	23
Hydromet	500-TAK-006	Tank	Steel	1	6.25			25	0.03125		491	15.3
Hydromet	200-TAK-004A	Tank	Steel	1	31.25			37	0.03125		3632	113.5
Hydromet	400-TAK-001	Tank	Steel	1	31.25			37	0.03125		3632	114
Hydromet	200-TAK-004B	Tank	Steel	1	31.25			34.375	0.03125		3375	105.5
Hydromet	Leach Area Tanks 1	Tank	Steel	3	21.875			25	0.03125		5154	161.1
Hydromet	Leach Area Tanks 2	Tank	Steel	1	18.75			25	0.03125		1473	46
Hydromet	Precipitation Area Tanks	Tank	Steel	4	21.875			25	0.03125		6872	214.8
Hydromet	500-SAT-001	Tank	Steel	1	28.125			25	0.03125		2209	69
Hydromet	Leach Area Phase 2 Tanks	Tank	Steel	2	21.875			25	0.03125		3436	107
Hydromet	500-TAK-003	Tank	Steel	1	21.785			18.75	0.03125		1283	40.1
Hydromet	500-TAK-001	Tank	Steel	1	18.75			18.75	0.03125		1104	34.5
Hydromet	500-TAK-002	Tank	Steel	1	12.5			9.375	0.03125		368	12
Hydromet	400-TAK-002	Tank	Steel	1	18.75			12.5	0.03125		736	23
Hydromet	400-TAK-008	Tank	Steel	1	12.5			9.375	0.03125		368	11.5
Hydromet	Fence 6ft 3 strand	Ancillary Structures	Metal	1						5700		
Hydromet	Fence 5-barb wire	Ancillary Structures	Metal	1						12000		
Hydromet	Sanitary Utility Pipes - PVC 6"	Ancillary Structures	Plastic	1						300		
Hydromet	Water Distribution and Fire Protection Pipes 6" and 8" iron	Ancillary Structures	Metal	1						4340		
Hydromet	Pipe Rack	Ancillary Structures	Metal	1						75		
Hydromet	600-BLF-001	Structures and Silos	Steel	1	10	9.375	25					586
Hydromet	600-PLF-001	Structures and Silos	Steel	1	10	6.25	21.875					1367
Hydromet	200-BLF-001A/B and 001C/D Phase 2	Structures and Silos	Steel	4	10	12.5	56.625					7078
Hydromet	300-BLF-001	Structures and Silos	Steel	1	10	9.375	50					1172
Hydromet	500-SIL-002 003 and 005	Structures and Silos	Steel	3	0.03125	12.5	25					92
Hydromet	Silo to the west of the Phase 2 Leach Area	Structures and Silos	Steel	1	0.03125	15.625	21					32
Hydromet	400-CTL-001A and 001B Phase2	Structures and Silos	Steel	2	21.875	35	93.5					14317
Hydromet	500-BLO-002 and 005	Structures and Silos	Steel	2	21.875	6.25	6.25					171
Hydromet	600-CRY-001A/B and 002	Structures and Silos	Steel	1	15	62.5	18.75					2637

TABLE A- 3 NUMBER AND DIMENSIONS OF FACILITY COMPONENTS

Area	Item	Category	Description	QTY	H (ft)	W (ft)	L (ft)	D (ft)	t (ft)	LF (ft)	A (ft2)	V (ft3)
Hydromet	600-SCD-001	Structures and Silos	Steel	1	18.75	9.375	37.5					1648
Hydromet	400-BOI-001A and 001B Phase 2	Structures and Silos	Steel	2	50	9.375	6.25					1172
Hydromet	Pre Concentrate Unloading Station (1)	Structures and Silos	Steel	1		29.3	75					220
Hydromet	Pre Concentrate Unloading Station (2)	Structures and Silos	Steel	1	12.5	9.38	75					879
Hydromet	Pre Concentrate Unloading Station (3)	Structures and Silos	Steel	1	18.75	3.125	75					439
Hydromet	Pre Concentrate Feed Silos (multiple)	Structures and Silos	Steel	1								1756.5
Hydromet	Conveyor 200-CVO-001	Conveyors	Steel	1	1	9.375	468.75					4395
Hydromet	Conveyor 200-CVO-002	Conveyors	Steel	1	1	9.375	43.75					410
Hydromet	Conveyor 200-CVO-003	Conveyors	Steel	1	1	9.375	150					1406
Hydromet	Conveyor 200-CVO-005	Conveyors	Steel	1	1	9.375	140.25					1315
Hydromet	Conveyor east of 400-BO-001A/B and 400-CTL-001 A/B	Conveyors	Steel	4	1	2	117					936
Hydromet	"	Conveyors	Steel	2	1	2	93.5					374
Hydromet	Inside Bagging Area	Conveyors	Steel	1	1	2	75					150
Hydromet	200-MIL-001 East of walkway Inside HydroMet Building	Conveyors	Steel	1	1	2	37.5					75
Hydromet	"	Conveyors	Steel	2	1	2	62.5					250
Hydromet	Conveyor 600-CVO--002	Conveyors	Steel	1	1	2	75					150
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	18.75					19
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	37.5					18
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	62.5					63
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	25					25
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	30					50
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	68					68
Hydromet	Conveyor Supports	Conveyors	Steel	1	1	1	87.5					88
Hydromet	15T Overhead Crane	Crane	Steel	1	3	125	334					12539

TABLE A- 4 PLANNING AND PREPARATION (WORK DAYS)

A.3.6 Planning and Preparation (Work Hours)

Labor Category (replace each column head with category)

Activity	Program Manager	Radiological Safety Officer/CHP	RCT Supervisor	Ops Super/ Foreman	PM Admin Assistant	Training Assistant	RCT
Preparation of Documentation for Regulatory Agencies	80	120	40	40	80		
Submittal of Decommissioning Plan to NRC/WYDEP when required.	80	160	40	40	20		
Development of work plans	20	160	40	20	40		
Procurement of special equipment	10	0	10	20	10		
Staff Training	20	20	20	20	20	80	
Initial characterization of radiological condition of facility.	40	100	100	100	40		400
Project Management	260	1040		260	260	260	
TOTAL HOURS	510	1600	250	500	470	340	400
TOTAL COST	$48,567	$153,840	$24,038	$22,180	$9,574	$6,926	$14,224

Cost Estimate Model DRAFT

Parameter Number: A1 **Parameter Name:** Structure,Tank, Equipment Disposition and Free Release

Cost Unit: Cubic Foot **Developed By:** M Madonia

Checked By:

Work Difficulty Factors

Work Break: 1 **Respiratory Protect.:** 1

Accessibility: 1 **Protective Clothing:** 1

Work Sequence:

1) Pressure wash tank, structure, or conveyor surface and collect wash water in Baker tank
2) Rig itemfor lifting and staging to sizing area.
3) Shear anchor bolts or struts associated with item footings
4) Lift item and relocate to sizing area with 20 T crane.
5) Using Excavator/shear, cut and size tank into pieces allowing surface contamination surveys.
6) As necessary, utilize hand tools for structure or equipment disassembly.
7) RCTs perform free release survey on inner surfaces.
8) RCTs survey containers and prepare shipping info.
9) Free release tank sections available for industrial waste disposal.

Assumptions

1) Applicable to all structures, tanks, conveyors, and silos. Does not apply to conveyor belts.
2) Assume reference tank surface area is 5000 ft^2. Equivalent to 465 m^2.
3) Adequate work staging area is available.
4) Radiological scanning surveys will be performed at an average of 1 m^2/2 min
5) Total removal and sizing time = 10 hours
6) Total survey time = 930 minutes =15.5 hr
7) Assume after washing and sizing, tanks are acceptable for unrestricted release or industrial waste disposal.

LABOR	Raw Hours	Effective Hours	Rate	Cost	Comments:
Laborer (2)	51	51.00	$ 19.28	$ 983.28	
Ops Super/Foreman	24	24.00	$ 44.36	$ 1,064.64	
Radiation Control Technician (2)	51	51.00	$ 35.56	$ 1,813.56	
Crane Operator	10	10.00	$ 29.66	$ 296.60	
Excavator Operator	12	12.00	$ 27.10	$ 325.20	
Container/Forklift Truck Driver	51	51.00	$ 27.10	$ 1,382.10	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
Subtotal:	199	199	--	$ 5,865.38	

EQUIPMENT	Units	Rate	Cost	Comments:
Manlift	25.50	$ 7.95	$ 202.84	
Forklift	25.50	$ 11.36	$ 289.77	
Shear Mechanisms	12.00	$ 6.82	$ 81.82	
Cat 300 Excavator	12.00	$ 45.45	$ 545.45	
Pressure Washer	4.00	$ 1.70	$ 6.82	
100 gallon Baker Tanks	20.00	$ 1.70	$ 34.09	
Radiological Survey Equipment - RCT	51.00	$ 22.50	$ 1,147.50	
Subtotal:	--	--	$ 2,308.30	

MATERIALS	Units	Rate/unit	Cost	Comments:
Diesel Fuel	16	$ 4.78	$ 76.48	
Level D Worker-Day	24.875	$ 18.75	$ 466.41	
Liquid waste sample - RCRA metals, gross alpha and beta	0.05	$ 1,200.00	$ 60.00	Note should result in 1 sample over all application
	0		$ -	
	0		$ -	
Subtotal:	--	--	$ 602.89	

		TOTAL:	$ 8,776.56	**per 5000 ft^2**
			$ 1.76	**per ft^2**

Deconstructed Labor - PUG		
51	2337	Laborer (2)
24	1100	Ops Super/Foreman
51	2337	Radiation Control Technician (2)
10	458	Crane Operator
12	550	Excavator Operator
51	2337	Container/Forklift Truck Driver
Deconstructed Labor - Hydromet		
51	4559	Laborer (2)
24	2145	Ops Super/Foreman
51	4559	Radiation Control Technician (2)
10	894	Crane Operator
12	1073	Excavator Operator
51	4559	Container/Forklift Truck Driver
Deconstructed Equipment		
26	3448	Manlift
26	3448	Forklift
12	1623	Shear Mechanisms
12	1623	Cat 300 Excavator
4	541	Pressure Washer
20	2704	100 gallon Baker Tanks
51	6896	Radiological Survey Equipment - RCT
Decontructed Materials		
16	2163	Diesel Fuel
25	3363	Level D Worker-Day
0.05	7	Liquid waste sample - RCRA metals, gross alpha and beta

TABLE A- 6 PARAMETRIC A2 - ANCILLARY STRUCTURES DISPOSITION

Cost Estimate Model DRAFT

Parameter Number:	A6	**Parameter Name:**	Ancillary Structures Disposition
Cost Unit:	Linear Foot	**Developed By:**	M Madonia
		Checked By:	

Work Difficulty Factors

Work Break:	1	**Respiratory Protect.:**	1
Accessibility:	1	**Protective Clothing:**	1

Work Sequence:

1) Perform all isolation/lockout tagout procedures
2) Laborers remove lose items and stage at sizing area.
3) RCTs perform 100% hand survey of items, one (1) removable contamination smear every 20 lf.
3) Excavator operator shears contents of structure and loads directly into prepped roll-off transport containers.
4) Laborers assist and excavator operator may alternate between shear and grapple for loading.
5) Laborers prep, load, and label waste containers.
6) RCTs survey containers and prepare shipping info.
7) Loaded containers transferred via forklift to waste staging area or directly loaded on waste trucks for shipment.

Assumptions

1) Ancillary structures include fencing, surface and near surface utility piping
2) Work unit is 1000 LF of pipes or fencing
3) All items are acceptable for unrestricted release/industrial disposal after survey
4) Work is done in level D PPE.
5) Contents shall be loaded into industrial waste containers not paid for or disposed as part of the radiological D&D project.

6) Through shearing and processing at the structure location, the reduction factor for debris is 20% of the original structure work volume.

LABOR	**Raw Hours**	**Effective Hours**	**Rate**	**Cost**	**Comments:**
Laborer (2)	16	16.00	$ 19.28	$ 308.48	
Ops Super/Foreman	4	4.00	$ 44.36	$ 177.44	
Radiation Control Technician (1)	16	16.00	$ 35.56	$ 568.96	
Excavator Operator	8	8.00	$ 27.10	$ 216.80	
Container/Forklift Truck Driver	8	8.00	$ 27.10	$ 216.80	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
Subtotal:	52	52	--	$ 1,488.48	

EQUIPMENT	**Units**	**Rate**	**Cost**	**Comments:**
forklift	8.00	$ 22.73	$ 181.82	
Shear Mechanisms	8.00	$ 6.82	$ 54.55	
Grappler Mechanisms	8.00	$ 4.55	$ 36.36	
Cat 300 Excavator	8.00	$ 45.45	$ 363.64	
Radiological Survey Equipment - RCT	16.00	$ 22.50	$ 360.00	
Subtotal:	--	--	$ 996.36	

MATERIALS	**Units**	**Rate/unit**	**Cost**	**Comments:**
Level D - Person Day	5.2	$ 156.25	$ 812.50	
Diesel Fuel	4	$ 4.78	$ 19.12	
	0		$ -	
	0		$ -	
Subtotal:	--	--	$ 831.62	

TOTAL:	$ 3,316.46	**per 1000 lf**
	$ 3.32	**per lf**

Deconstructed Labor - HYDROMET		
16	359	Laborer (2)
4	90	Ops Super/Foreman
16	359	Radiation Control Technician (1)
8	179	Excavator Operator
8	179	Container/Forklift Truck Driver
Deconstructed Equipment		
8	179	forklift
8	179	Shear Mechanisms
8	179	Grappler Mechanisms
8	179	Cat 300 Excavator
16	359	Radiological Survey Equipment - RCT
Decontructed Materials		
5	117	Level D - Person Day
4	90	Diesel Fuel

A.3.7 Summary Decontamination, Dismantling and Free Release of Facility Components

Facility Description	Component	Total Units	UOM	Final Units	Final UOM	Parametric Cost	Total Cost
PUG	Tanks[1]	376	ft^3	3756	ft^2	$ 1.76	$ 6,593
PUG	Tanks - Special Handling	102102	ft^2	102102	ft^2	$ 1.76	$ 179,221
PUG	Structures[1]	9390	ft^3	93900	ft^2	$ 1.76	$ 164,824
PUG	Conveyors[1]	2936	ft^3	29360	ft^2	$ 1.76	$ 51,536
PUG	Crane	1	ea	1	ea	$ 8,000.00	$ 8,000
HYDROMET	Ancillary Structures	22415	lf	22415	lf	$ 3.32	$ 74,339
HYDROMET	Tanks[1]	1337	ft^3	13366	ft^2	$ 1.76	$ 23,462
HYDROMET	Structures and Silos[1]	33567	ft^3	335665	ft^2	$ 1.76	$ 589,197
HYDROMET	Conveyors[1]	9792	ft^3	97920	ft^2	$ 1.76	$ 171,880
HYDROMET	Crane	1	ea	1	ea	$ 20,000.00	$ 20,000
					Total	$ 1,269,051	

(1) A conversion factor of 10 is applied to volume to reflect surfaces in structure

Facility Description	Component	Quantity	Unit	Method	Laborer	Ops Super/ Foreman	RCT	Crane Operator	Excavator Operator	Container/ Forklift Truck Driver	0
PUG	Tanks, Structures and Conveyors	229118	ft^2	Unrestricted Release	2337	1100	2337	458	550	2337	
PUG	Conveyor Belts, Motors	295	ft^3	Disposed - LLW	160	80	160	40	80	80	
PUG	Crane	1	ea	Unrestricted Release	40	20	80	40		20	
HYDROMET	Ancillary Structures	22415	lf	Unrestricted Release	359	90	359		179	179	
HYDROMET	Tanks, Structures, Silos and Conveyors	446951	ft^2	Unrestricted Release	4559	2145	4559	894	1073	4559	
HYDROMET	Conveyor Belts, Filters, Agitators, Motors	1350	ft^3	Disposed - LLW	320	160	320	80	160	160	
HYDROMET	Crane	1	ea	Unrestricted Release	40	20	120	40		20	
				Total Hours	7815	3615	7935	1552	2042	7355	0
				Total $	$150,664	$160,352	$282,152	$46,036	$55,335	$199,327	

TABLE A- 8 PARAMETRIC B1 - CLASS I BUILDING SURVEYS

Cost Estimate Model DRAFT

Parameter Number:	B1	**Parameter Name:**	Class I Building Survey Areas
Cost Unit:	Sq. Foot	**Developed By:**	M Madonia
		Checked By:	

Work Difficulty Factors

Work Break:	1.083	**Respiratory Protect.:**	1
Accessibility:	1	**Protective Clothing:**	1

Work Sequence:

1) Identify and mark all MARSSIM Class I building survey surfaces. Clear loose obstructions.
2) Laborer vacuum/clean floors and surfaces in survey unit.
3) Initialize radiological survey equipment, function test, background, etc.
4) Perform large area radiological surveys.
5) Collect and analyze 20 static and removable contamination measurements on systematic grid.
6) Perform hand surveys for difficult access surfaces.
7) Process and dump data to survey report database.

Assumptions

1) Work is performed in level D PPE.
2) All building contents and equipment have been emptied from survey areas. Applies to licensed floor areas and walls to a height of 6' above floor surface.
3) Assume all areas will meet unrestricted release criteria for total and removable contamination. No further decon necessary.

4) All floor coverings including tile, vinyl, carpet, etc. have been removed. Survey surface area 10 m x 10 m floors; four walls to height of 2 m.
5) Total survey unit area of 100 m^2 (1076 ft^2) assume residential use.

6) Surveys will be performed for alpha and beta-gamma emitting radionuclides, with primary indexing to thorium-232 + D, and uranium-238+D.
7) Assume that MARSSIM based characterization survey will meet requirements of final status survey.
8) Detector area is 10 cm x 50 cm.
9) Assumes large area survey system - Area of 500 cm^2, scanning speed 3 cm/s. 500 cm^2 covered in 3.3 sec.
10) 1 m^2 covered in 66 sec. Total survey coverage time 90 min.
11) Removable contamination swipes will be collected during survey; locations based on large area detection scanning results.
12) 10 % of surfaces (10 m^2) will require hand scanning at 1 m^2/2 min.
13) Total automated scan time = 100/1.1 = 90 min. Total hand scanning time = 10 x 2 = 20 min
14) Static and removable contamination survey require 0.5 hr.

LABOR	**Raw Hours**	**Effective Hours**		**Rate**		**Cost**	**Comments:**
RCT (automated scanning)	4	4.00	$	35.56	$	142.24	
RCT Supervisor	2	2.00	$	96.15	$	192.30	
Laborer	4	4.00	$	19.28	$	77.12	
Container/Forklift Truck Driver	4	4.00	$	27.10	$	108.40	
RCT (Hand scanning and swipe counting)	2	2.00	$	35.56	$	71.12	
Radiological Safety Officer/CHP (reporting)	3	3.00	$	96.15	$	288.45	
		0.00	$	-	$	-	
		0.00	$	-	$	-	
		0.00	$	-	$	-	
Subtotal:	19	19		--	$	879.63	

EQUIPMENT	**Units**		**Rate**		**Cost**	**Comments:**
Manlift	4.00	$	7.95	$	31.82	
Large Area Radiation Detection System	4.00	$	250.00	$	1,000.00	
Radiological Survey Equipment - RCT	8.00	$	22.50	$	180.00	
Subtotal:	--		--	$	1,211.82	

MATERIALS	**Units**		**Rate/unit**		**Cost**	**Comments:**
Miscellaneous Radiological Survey Supplies Class 1	1	$	312.50	$	312.50	
Diesel Fuel	1	$	4.78	$	4.78	
	0			$	-	
	0			$	-	

Subtotal:	--	--	$	317.28	

TOTAL:			$	2,408.73	**per 1076 ft^2**
			$	2.24	**per ft^2**

Deconstructed Labor - PUG		
4	354	RCT (automated scanning)
2	177	RCT Supervisor
4	354	Laborer
4	354	Container/Forklift Truck Driver
2	177	RCT (Hand scanning and swipe counting)
3	266	Radiological Safety Officer/CHP (reporting)
Deconstructed Labor - HYDROMET		
4	996	RCT (automated scanning)
2	498	RCT Supervisor
4	996	Laborer
4	996	Container/Forklift Truck Driver
2	498	RCT (Hand scanning and swipe counting)
3	747	Radiological Safety Officer/CHP (reporting)
Deconstructed Equipment		
4	1350	Manlift
4	1350	Large Area Radiation Detection System
8	2700	Radiological Survey Equipment - RCT
Decontructed Materials		
1	338	Miscellaneous Radiological Survey Supplies Class 1
1	338	Diesel Fuel

TABLE A- 9 PARAMETRIC B2 - CLASS II BUILDING SURVEYS

Cost Estimate Model DRAFT

Parameter Number: B2 **Parameter Name:** Class II Building Survey Areas

Cost Unit: Sq. Foot **Developed By:** M Madonia

Checked By:

Work Difficulty Factors

Work Break: 1.083 **Respiratory Protect.:** 1

Accessibility: 1 **Protective Clothing:** 1

Work Sequence:

1) Identify and mark all MARSSIM Class II building survey surfaces. Clear loose obstructions.
2) Laborer vacuum/clean floors and surfaces in survey unit.
3) Initialize radiological survey equipment, function test, background, etc.
4) Perform large area radiological surveys.
5) Collect and analyze 20 static and removable contamination measurements on systematic grid.
6) Perform hand surveys for difficult access surfaces.
7) Process and dump data to survey report database.

Assumptions

1) Work is performed in level D PPE.
2) All building contents and equipment have been emptied from survey areas. Applies to licensed walls and ceilings 2m and greater above floor surface.
3) Assume all areas will meet unrestricted release criteria for total and removable contamination. No further decon necessary.
4) All wall coverings including paneling, wallpaper, etc. have been removed. Survey surface area 10 m x 10 m ceiling; four walls from 2 m above ground surface to 10 m at ceiling level.
5) Total survey unit area of 100 m^2 (1076 ft^2) assume residential use with 25% scan coverage=269 ft2.
6) Surveys will be performed for alpha and beta-gamma emitting radionuclides, with primary indexing to thorium-232 + D, and uranium-238+D.
7) Assume that MARSSIM based characterization survey will meet requirements of final status survey.
8) Detector area is 10 cm x 50 cm.
9) Assumes large area survey system - Area of 500 cm^2, scanning speed 3 cm/s. 500 cm^2 covered in 3.3 sec.
10) 1 m^2 covered in 66 sec. Total survey coverage time 22.5 min.
11) Removable contamination swipes will be collected during survey; locations based on large area detection scanning results.
12) Total automated scan time = 100/1.1 = 90 min.
13) Static and removable contamination survey require 0.5 hr.

LABOR	Raw Hours	Effective Hours	Rate	Cost	Comments:
RCT (automated scanning)	2	2.00	$ 35.56	$ 71.12	
RCT Supervisor	2	2.00	$ 96.15	$ 192.30	
Laborer	2	2.00	$ 19.28	$ 38.56	
Container/Forklift Truck Driver	2	2.00	$ 27.10	$ 54.20	
RCT (Hand scanning and swipe counting)	1	1.00	$ 35.56	$ 35.56	
Radiological Safety Officer/RCT (reporting)	3	3.00	$ 96.15	$ 288.45	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
		0.00	$ -	$ -	
Subtotal:	12	12	--	$ 680.19	

EQUIPMENT	Units	Rate	Cost	Comments:
Manlift	4.00	$ 7.95	$ 31.82	
Large Area Radiation Detection System	4.00	$ 250.00	$ 1,000.00	
Radiological Survey Equipment - RCT	4.00	$ 22.50	$ 90.00	
Subtotal:	--	--	$ 1,121.82	

MATERIALS	Units	Rate/unit	Cost	Comments:
Miscellaneous Radiological Survey Supplies Class 2	1	$ 125.00	$ 125.00	
Diesel Fuel	1	$ 4.78	$ 4.78	
	0		$ -	
	0		$ -	
Subtotal:	--	--	$ 129.78	

		TOTAL:	$ 1,931.79	**per 1076 ft²**
			$ 1.80	**per ft²**
Deconstructed Labor - PUG				
2	362	RCT (automated scanning)		
2	362	RCT Supervisor		
2	362	Laborer		
2	362	Container/Forklift Truck Driver		
1	181	RCT (Hand scanning and swipe counting)		
3	543	Radiological Safety Officer/CHP (reporting)		
Deconstructed Labor - HYDROMET				
2	702	RCT (automated scanning)		
2	702	RCT Supervisor		
2	702	Laborer		
2	702	Container/Forklift Truck Driver		
1	351	RCT (Hand scanning and swipe counting)		
3	1053	Radiological Safety Officer/CHP (reporting)		
Deconstructed Equipment				
4	532	Manlift		
4	532	Large Area Radiation Detection System		
4	532	Radiological Survey Equipment - RCT		
Decontructed Materials				
1	532	Miscellaneous Radiological Survey Supplies Class 2		
1	532	Diesel Fuel		

A.3.9 Final Radiation Survey

Facility Description	Building Surface Type	Total Units	UOM	Parametric Cost	Total Cost
PUG	Class II Walls and Ceilings	194885	ft^2	$ 1.80	$ 349,885
HYDROMET	Class II Walls and Ceilings	377519	ft^2	$ 1.80	$ 677,775
				Total	$ 1,162,842

Facility Description	Building Surface Type	Total Units	UOM	Laborer	RCT Supervisor	RCT	RSO/CHP	Container/ Forklift Truck Driver
PUG	Class I Floors and Walls	95321	ft^2	354	177	532	266	354
PUG	Class II Walls and Ceilings	194885	ft^2	362	362	543	543	362
HYDROMET	Class I Floors and Walls	267834	ft^2	996	498	1493	747	996
HYDROMET	Class II Walls and Ceilings	377519	ft^2	702	702	1053	1053	702
			Total hours	2414	1739	3621	2608	2414
			Total $	$46,541	$167,201	$128,761	$250,801	$65,418

A.3.11 Total Work Days by Labor Category

Task	Program Manager	PM Admin Assistant	Training Assistant	Laborer	Ops Super/ Foreman	Crane Operator	Excavator Operator	Container/ Forklift Truck Driver	RCT	RCT Supervisor	RSO/CHP
Planning and preparation (A.3.6)	510	470	340	0	500	0	0	0	400	250	1600
Summary Decontamination, Dismantling and Free Release of Facility Components (A.3.7)	0	0	0	7815	3615	1552	2042	7355	7935	0	0
Restoration of contaminated areas on facility grounds(A.3.8)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
Final Radiation Survey (A.3.9)	0	0	0	2414	0	0	0	2414	3621	1739	2608
Site stabilization/surveillance(A.3.10)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

All values in above table are in hours

Task	Program Manager	PM Admin Assistant	Training Assistant	Laborer	Ops Super/ Foreman	Crane Operator	Excavator Operator	Container/ Forklift Truck Driver	RCT	RCT Supervisor	RSO/CHP
Planning and preparation (A.3.6)[1]	64	59	43	0	63	0	0	0	50	31	200
Release of Facility Components (A.3.7)[2]	0	0	0	977	452	194	255	919	992	0	0
Restoration of contaminated areas on facility grounds(A.3.8)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
Final Radiation Survey (A.3.9)[2]	0	0	0	302	0	0	0	302	453	217	326
Site stabilization/surveillance(A.3.10)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

Note 1 - Planning and preparation basis 8 hours per day
Note 2 - Field work basis 8 hours per day

A.3.12 Worker Unit Labor Rates Base Year

Resource Title	Labor Type	REF 2014 BASE YEAR-0 HOURLY RATE				
		Yr-0 Rate Direct	SCA Fringe 35.0%	W-2 Fringe 28.0%	DL OH 20.0%	Yr0 Rate Burdened
Program Manager	W-2	$62.00	$0.00	$17.36	$15.87	$95.23
PM Admin Assistant	W-2	$13.26	$0.00	$3.71	$3.39	$20.37
Training Assistant	W-2	$13.26	$0.00	$3.71	$3.39	$20.37
Laborer	SCA	$11.90	$4.17	$0.00	$3.21	$19.28
Ops Super/Foreman	W-2	$28.88	$0.00	$8.09	$7.39	$44.36
Crane Operator	SCA	$18.31	$6.41	$0.00	$4.94	$29.66
Excavator Operator	SCA	$16.73	$5.86	$0.00	$4.52	$27.10
Container/Forklift Truck Driver	SCA	$16.73	$5.86	$0.00	$4.52	$27.10
RCT	SCA	$21.95	$7.68	$0.00	$5.93	$35.56
RCT Supervisor	W-2	$62.60	$0.00	$17.53	$16.03	$96.15
Radiological Safety Officer/CHP	W-2	$62.60	$0.00	$17.53	$16.03	$96.15
Mechanic	W-2	$24.65	$0.00	$6.90	$6.31	$37.86
Equipment Maint Supervisor	W-2	$30.24	$0.00	$8.47	$7.74	$46.45
ESH&Q Manager	W-2	$60.00	$0.00	$16.80	$15.36	$92.16
Fuel Truck Operator	SCA	$19.13	$6.70	$0.00	$5.17	$30.99
Engr & Construction Manager	W-2	$62.00	$0.00	$17.36	$15.87	$95.23
Ops Mgr Admin Assistant	W-2	$19.13	$0.00	$5.36	$4.90	$29.38
Waste Mgmt Coordinator	W-2	$30.24	$0.00	$8.47	$7.74	$46.45
Waste Supervisor	W-2	$30.24	$0.00	$8.47	$7.74	$46.45

Labor Cost Component	Program Manager	PM Admin Assistant	Training Assistant	Laborer	Ops Super/ Foreman	Crane Operator	Excavator Operator	Container/ Forklift Truck Driver	RCT	RCT Supervisor	Radiological Safety Officer/ CHP
Salary & Fringe ($/year)	$165,069	$35,303	$35,303	$33,415	$76,890	$51,414	$46,978	$46,978	$61,636	$166,666	$166,666
Overhead Rate (%) Direct Labor	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Total Cost per year	$198,083	$42,364	$42,364	$40,098	$92,268	$61,697	$56,373	$56,373	$73,963	$199,999	$199,999
Total Cost per Work Day*	$762	$163	$163	$154	$355	$237	$217	$217	$284	$769	$769

* Based on 260 **work days per year (e.g., 260 days).**

From http://www.bls.gov/oes/2014/may/oes_3500002.htm#b17-0000

A.3.13 Total Labor Costs by Major Decommissioning Task

Task	Program Manager	PM Admin Assistant	Training Assistant	Laborer	Ops Super/ Foreman	Crane Operator	Excavator Operator	Container/ Forklift Truck Driver	RCT	RCT Supervisor	RSO/CHP
Planning and preparation (A.3.6)[1]	$48,568	$9,573	$6,925	$0	$22,180	$0	$0	$0	$14,224	$24,038	$153,846
Summary Decontamination, Dismantling and Free Release of Facility Components (A.3.7)[2]	$0	$0	$0	$150,649	$160,351	$46,040	$55,340	$199,346	$282,144	$0	$0
Restoration of contaminated areas on facility grounds(A.3.8)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
Final Radiation Survey (A.3.9)[2]	$0	$0	$0	$46,536	$0	$0	$0	$65,425	$128,757	$167,207	$250,810
Site stabilization/surveillance(A.3.10)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

Note 1 - Planning and preparation basis 8 hours per day
Note 2 - Field work basis 10 hours per day

A.3.14.C1 Assessment of US Ecology - Richland, WA Disposal Costs

Waste Type	Disposal Volume (ft3)	Proposed # Containers	Proposed # Shipments	Base US Ecology Disposal Rate ($/ft3)	Shipment Charge ($13,750) distributed ft^3	Container Charge ($7500) distributed ft^3	Exposure Charge ($92 per container) distributed ft3	Perpetual Care & Maint ($1.75 per ft3)	Site Surveilance Fee ($9 per ft3)	Surcharge (RCW 43.200.233) - (6.50 per ft3)	Distributed Site Availabilty Fee ($88,743) ft3	Subtotal Surcharges	Commission Regulatory Fee (1 % all rates & charges) ft3	Business and Occupation Tax (3.3 % all rates & charges) ($/ft3)	Total all Taxes and Surcharges ($/ft3)
Conveyor Belts, Motors - PUG	384	4	1	$115.50	$35.81	$78.13	$0.96	$1.75	$9.00	$6.50	$46.22	$178.36	$2.94	$9.70	$191.00
Conveyor Belts, Filters, Agitators, Motors HYDROMET	1536	16	4	$115.50	$35.81	$78.13	$0.96	$1.75	$9.00	$6.50	$46.22	$178.36	$2.94	$9.70	$191.00
Total	1920														

TABLE A- 15 OWNER OPERATOR INDEPENDENT DRIVERS ASSOCIATION (OOIDA) COST OF TRUCK OPERATIONS

A.3.14.C2 Owner Operator Independent Drivers Association (OOIDA) Cost of Truck Operations

Sept 2014 Wyoming Diesel	3.82	gallon
Average Truck Mileage	6	mi/gal

Cost of Operations *(based on 100,000 miles a year)*

In the example below, the drivers income is based on 30% of the Total Cost of Operation.

Total Miles Driven Annually	**100,000**

FIXED COSTS	**ANNUAL COSTS**	**MONTHLY COSTS**	**CENTS PER MILE**
Truck Payment	$16,000.00	$1,333.33	0.160
Trailer Payment	$0.00	$0.00	0.000
Collision/Comp Insur.	$5,700.00	$475.00	0.057
Bobtail Insur.	$704.00	$58.67	0.007
Cargo Insur.	$0.00	$0.00	0.000
Health Insur.	$2,643.00	$220.25	0.026
Licenses	$1,574.00	$131.17	0.016
Permits	$454.00	$37.83	0.005
Accounting Svcs	$541.00	$45.08	0.005
Return on Investment	$0.00	$0.00	0.000
Total Fixed Costs:	**$27,616.00**	**$2,301.33**	**0.276**

VARIABLE COSTS			
Tractor Fuel	$63,666.67	$5,305.56	0.637
Reefer Fuel	$0.00	$0.00	0.000
Tractor/Trailer Tires	$2,300.00	$191.67	0.023
Maintenance	$4,676.00	$389.67	0.047
Repair	$5,615.00	$467.92	0.056
Truck Wash	$701.00	$58.42	0.007
Telephone	$1,534.00	$127.83	0.015
Lodging	$788.00	$65.67	0.008
Meals	$5,177.00	$431.42	0.052
Loading/Unloading Charges	$0.00	$0.00	0.000
Tolls	$1,276.00	$106.33	0.013
Legal Fees	$0.00	$0.00	0.000
Fines	$0.00	$0.00	0.000
Cargo Claims	$0.00	$0.00	0.000
Scale Fees	$0.00	$0.00	0.000
Workman's Compensation	$0.00	$0.00	0.000
Taxes(Road, Use, Fuel, Fed)	$1,755.00	$146.25	0.018
Miscellaneous Expenses	$500.00	$41.67	0.005
Total Variable Costs:	**$87,989**	**$7,332.39**	**0.880**
Total Vehicle Costs:	**$115,605**	**$9,633.72**	**1.156**
Drivers Income:	**$49,545**	**$4,128.74**	**0.495**
Total Cost of Operation:	**$165,150**	**$13,762.46**	**1.651**

**In the example above you will note this driver has total expenses per mile of $0.88 cents a mile. If he's hauling 98 cents per mile freight, he's clearing 10 cents a mile which translatates into an annual wage of $9,362.*

A.3.14 Packaging, Shipping, and Disposal of Radioactive Wastes (excluding Labor costs)

(a) Packing Material Costs

Waste Type [1]	Original Volume (ft3)	Processed Volume (ft^3)	Number of Containers	Type of Container [2]	Unit Cost of Container	Total Packaging Costs
Conveyor Belts, Motors - PUG	295	295	4	Type A - B25 IP-1/88 ft^2	$ 2,100.00	$ 8,400.00
Conveyor Belts, Filters, Agitators, Motors - HYDROMET	1401	1401	16	Type A - B25 IP-1/88 ft^2	$ 2,100.00	$ 33,600.00
Total	1696	1696	20	-	-	$ 42,000.00

Note 1 - All waste is Class A LLW
Note 2 - Assume maximum loading to B25 container is 88 ft^3.

(b) Shipping Costs

Waste Type	Number of Truckloads[1]	Unit Cost ($/mile/ truckload)	Surchages ($/mile)[2]	Overwt charges ($/mi)	Distance Shipped (mi)[3]	Total Shipping Costs
Conveyor Belts, Motors - PUG	1	$1.65	$0.17		978	$ 1,776.68
Conveyor Belts, Filters, Agitators, Motors - HYDROMET	4	$1.65	$0.17		978	$ 7,106.71
Total	5	-	-	-	-	$ 8,883.39

Note 1 - Assume 4 containers per truckload.
Note 2 - 10% premium assumed for LLW transport.
Distance Sundance, WY to Richland, WA - 978 mi.

(c) Waste Disposal Costs

Waste Type	Disposal Volume (ft^3)[1]	Unit Cost ($/$ft^3$)	Surcharges ($/$ft^3$)[1]	Total Disposal Costs
Conveyor Belts, grinding components - PUG	384	$115.50	$191.00	$ 117,694.83
onveyor Belts, Filters, Agitators, grinding components - HYDROME	1536	$115.50	$191.00	$ 470,779.33
Total	1920	-	-	$ 588,474.16

Note 1 - Disposal volume is based on total B-25 container volume of 96 ft^3.

A.3.15 Equipment/Supply Costs (excluding containers)

	REF 2014 BASE $ YEAR-0 RATE							
Equipment Title	Qty	Rate Unit	Rate	MOB/DEMO 25.0%	Rate Burdened	HR Rate Burdened	Tot Units	Tot $
Cat 300 Excavator	1	Mo	$8,000.00	$2,000.00	$10,000.00	$45.45	1802	$81,904
Cat 960 Loader	1	Mo	$4,000.00	$1,000.00	$5,000.00	$22.73	0	$0
8 ton forklift	1	Mo	$4,000.00	$1,000.00	$5,000.00	$22.73	0	$0
forklift	1	Mo	$2,000.00	$500.00	$2,500.00	$11.36	3627	$41,219
Manlift	1	Mo	$1,400.00	$350.00	$1,750.00	$7.95	3448	$27,427
Shear Mechanisms	1	Mo	$1,200.00	$300.00	$1,500.00	$6.82	1802	$12,286
Grappler Mechanisms	1	Mo	$800.00	$200.00	$1,000.00	$4.55	179	$815
Dump Truck	1	Mo	$1,200.00	$300.00	$1,500.00	$6.82	0	$0
Low Boy Trailer	1	Mo	$1,000.00	$250.00	$1,250.00	$5.68	0	$0
Closed Haul Trailer	1	Mo	$1,500.00	$375.00	$1,875.00	$8.52	0	$0
Torch Cutting System	1	Mo	$600.00	$150.00	$750.00	$3.41	0	$0
Grease/Maintenance Truck	1	Mo	$1,000.00	$250.00	$1,250.00	$5.68	0	$0
Pressure Washer	1	Mo	$300.00	$75.00	$375.00	$1.70	541	$922
100 gallon Baker Tanks	1	Mo	$300.00	$75.00	$375.00	$1.70	2704	$4,610
Radiological Survey Equipment Package - RCT	1	Hr	$18.00	$4.50	$22.50	$22.50	7255	$163,227
Large Area Radiation Detection System	1	Hr	$200.00	$50.00	$250.00	$250.00	0	$0
Level C Person-Day	1	Ea	$125.00	$31.25	$156.25	NA	0	$0
Level D Person-Day	1	Ea	$15.00	$3.75	$18.75	NA	3480	$65,250
Diesel Fuel	1	Gal	$3.82	$0.96	$4.78	NA	2253	$10,770
Miscellaneous Radiological Survey Supplies Class 1	1	Ea	$250.00	$62.50	$312.50	NA	338	$105,470
Miscellaneous Radiological Survey Supplies Class 2	1	Ea	$100.00	$25.00	$125.00	NA	532	$66,497
Laboratory Analyses	Qty	Rate Unit	Rate	MOB/DEMO NA	Rate Burdened	HR Rate Burdened	Tot Units	Tot $
Liquid waste sample - RCRA metals &VOA, gross alpha and beta	1	Ea	$1,200.00	$0.00	$1,200.00	NA	7	$8,113
Full waste profile sample for disposal site	1	Ea	$7,500.00	$0.00	$7,500.00	NA	2	$15,000

Note: Waste containers priced in A.3.14

A.3.16 Laboratory Costs

Activity	Total Cost
Sampling	$ 8,112.83
Transport	
Testing/Analysis	
Waste Profile (2)	$ 15,000.00
TOTAL	$ 23,112.83

TABLE A- 19 TOTAL DECOMMISSIONING COSTS

A.3.18 Total Decommissioning Costs

Task/Component	Base Year Cost 2014	Percentage of Total
Planning, Preparation and Project Management (A.3.6)	$ 279,353	9.1%
Summary Decontamination, Dismantling and Free Release of Facility Components (A.3.7)	$ 893,870	29.1%
Restoration of Facility Grounds (A.3.8)	n/a	n/a
Final Radiation Survey Labor (A.3.9)	$ 658,736	21.4%
Site Stabilization and Long-term surveillance (A.3.10)	n/a	n/a
Packing Material Costs (A.3.14(a))	$ 42,000	1.4%
Shipping Costs (A.3.14(b))	$ 8,883	0.3%
Waste Disposal Costs (A.3.14(c))	$ 588,474	19.1%
Equipment/Supply Costs (A.3.15)	$ 580,396	18.9%
Laboratory Costs (A.3.16)	$ 23,113	0.8%
Miscellaneous Costs (A.3.17)	n/a	n/a
Subtotal	$ 3,074,826	100%
25% Contingency	$ 768,706	-
TOTAL DECOMMISSIONING COST ESTIMATE	$ 3,843,532	100%

0.025