# OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
# ANALYSIS/MODEL COVER SHEET

1. QA: L



*Complete Only Applicable Items*

| 2. | | 3. | |
|---|---|---|---|
| ☑ Analysis | ☑ Engineering | ☐ Model | ☐ Conceptual Model Documentation |
| | ☐ Performance Assessment | | ☐ Model Documentation |
| | ☐ Scientific | | ☐ Model Validation Documentation |

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12. Remarks:

The following TBVs are identified as inputs to this analysis: TBV-228, TBV-428, and TBV-459. None of these identified inputs affect the critical characteristics of this analysis, nor the conclusions reached in this analysis.

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# OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
## ANALYSIS/MODEL REVISION RECORD



*Complete Only Applicable Items*

2. Analysis or Model Title:
Secondary Low-Level Waste Treatment Strategy Analysis

3. Document Identifier (including Rev. No. and Change No., if applicable):

BCBD00000-01717-0200-00025 REV00

| 4. Revision/Change No. | 5. Description of Revision/Change |
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| 00 | Initial Issue |

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## CONTENTS, Continued

# TABLES

# 1. PURPOSE

This analysis has been prepared under the work direction provided in Reference 8.8, and in accordance with Administrative Procedure AP-3.10Q.

The objective of this analysis is to identify and review potential options for processing and disposing of the secondary low-level waste (LLW) that will be generated through operation of the Monitored Geologic Repository (MGR). An estimate of annual secondary LLW is generated utilizing the mechanism[1] established in *Secondary Waste Treatment Analysis* (Reference 8.1) and *Secondary Low-Level Waste Generation Rate Analysis* (Reference 8.5). The secondary LLW quantities are based on the spent fuel and high-level waste (HLW) arrival schedule as defined in the *Controlled Design Assumptions Document* (CDA) (Reference 8.6).

This analysis presents estimates of the quantities of LLW in its various forms. A review of applicable laws, codes, and standards is discussed, and a synopsis of those applicable laws, codes, and standards and their impacts on potential processing and disposal options is presented. The analysis identifies viable processing/disposal options in light of the existing laws, codes, and standards, and then evaluates these options in regard to:

- Process and equipment requirements
- LLW disposal volumes
- Facility requirements

The options are:

- Baseline Option: Treatment/solidification/packaging of liquid wastes within the Waste Treatment Building (WTB) for disposal at the Nevada Test Site (NTS). Dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS. Sorting (including delisting), shredding, and compacting of compactible dry active waste (DAW) within the WTB for disposal at the NTS. Packaging of non-compactible DAW within the WTB for disposal at the NTS.

- Option 1: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS. Bulk packaging in 55-gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at the NTS.

[1] Secondary LLW generation rates are built up from cask processing rates, cask physical dimensions, assumed frequencies of decontamination, operational staff size, and predictable recurring secondary LLW producing operations.

- Option 2: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at a site other than the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at a site other than the NTS. Bulk packaging in 55 gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at a site other than the NTS.

The analysis utilizes the LLW processing scheme presented in *Secondary Waste Treatment Analysis*, Reference 8.1, as the Baseline Option. Utilizing the equipment requirements, facility requirements, and the estimated LLW disposal volumes, the analysis defines rough-order-of-magnitude (ROM) estimates for capital, operating, and life-cycle costs. The analysis discusses technical, regulatory, and economic risks associated with the various options. The analysis then proposes a recommended processing/disposal scheme for the MGR generated secondary LLW.

Although the primary purpose of this analysis is to analyze options for the processing of LLW, and transuranic (TRU) waste is not included in that primary purpose, some discussion on potential impacts of the handling of damaged spent fuel which could result in TRU waste generation is warranted. A brief discussion of this issue is presented in Section 6.3.8, Transuranic Waste Issues.

## 2. QUALITY ASSURANCE

An activity evaluation, *Site-Generated Radiological Waste Systems and Facilities Design,* (Work Packages 24012392M3 and 24012403M3) (Reference 8.2) has been performed in accordance with QAP-2-0, *Conduct of Activities,* and has determined that this analysis is subject to the requirements of the *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program (QARD)* (Reference 8.3). In addition, review of the classification of permanent items described in *Classification of the Preliminary MGDS Repository Design* (TBV-228) (Reference 8.4), prepared in accordance with QAP-2-3, *Classification of Permanent Items,* has been performed, and indicates that for the System Design Descriptions (SDDs) SU02, SU04, SU10, SU12, SU13, SU37, and SU47 some of the items are "Q". (Assumption 5.1) Therefore, items addressed in this analysis are to be considered "Q" items (i.e., having a quality assurance (QA) classification), and, as specified in NLP-3-18, *Documentation of QA Controls on Drawings, Specifications, Design Analyses, and Technical Documents,* this analysis is documented as being subject to QA controls. Table 2-1 presents the quality classification assignments for features and systems associated with secondary LLW for the Waste Handling Building (WHB), the Waste Treatment Building (WTB), and the Carrier Preparation Building (CPB) (formerly named the Carrier Staging Shed).

Table 2-1. Secondary LLW Systems Quality Classification Assignment

| SDD Number | System | QA Classification (Assumption 5.1) (TBV-228) |
|---|---|---|
| SU02 | Waste Handling Facility (WHF)[2] System (SDD) | |
| | Facility Decontamination System (SSC) | QA-3 |
| | Piped Utility Systems (SSC) | QA-5 |
| SU04 | Radiological Waste Treatment Facility System (SDD) | |
| | Process Supply Systems (SSC) | non-Q (TBV-459) |
| | Waste Treatment Building (SSC) | QA-3 (TBV-459) |
| SU10 | Assembly Transfer System (SDD) | |
| | Cask Preparation System (SSC) | |
| | Decontamination Equipment (Level 3) | QA-3 (TBV-459) |
| | Dry Handling System (SSC) | |
| | Disposal Container (DC) Decontamination Manipulator (Level 3) | QA-3 (TBV-459) |
| | Decontamination Equipment (Level 3) | QA-3 (TBV-459) |
| SU12 | Waste Package (WP) Remediation System (SDD) | |
| | Decontamination and Survey System (SSC) | QA-3 (TBV-459) |
| SU13 | DC Handling System (SDD) | |
| | DC Emplacement Preparation Systems (SSC) | |
| | WP Decontamination Device (Level 3) | QA-3 (TBV-459) |
| | WP Decontamination Sample Pass Through (Level 3) | QA-3 (TBV-459) |
| | WP Decontamination/Inspection Manipulator (Level 3) | non-Q (TBV-459) |
| SU37 | Site-Generated Radioactive Waste Handling System (SDD) | |
| | Aqueous LLW Processing System (SSC) | QA-3 (TBV-459) |
| | Chemical LLW System (SSC) | QA-3 (TBV-459) |
| | Solid LLW Processing System (SSC) | QA-3 (TBV-459) |
| SU47 | Site Generated Hazardous and Non-Hazardous Waste Disposal Systems (SDD) | |
| | Hazardous Waste Collection System (SSC) | non-Q (TBV-228) |

where: SSC – structures, systems and components; and Level 3 – sub-elements to SSCs

It is assumed that the decontamination equipment associated with the Canister Transfer System (SU11) has a QA classification of QA-3 (Assumption 5.18).

## 3. COMPUTER SOFTWARE AND COMPUTER USAGE

EXCEL97™ was utilized in performing simple spreadsheet calculations in the attachments to this analysis. All numerical calculations were checked by performing hand calculations to verify the accuracy of the spreadsheet calculations.

[2] The Waste Handling Facility is now called the Waste Handling Building (WHB).

# 4. INPUTS

Certain of the references, i.e., References 8.1, 8.13, and 8.14, used in the preparation of this analysis were prepared to support Viability Assessment (VA) and contain preliminary data that is not tracked using the formal TBV/TBD process. Tracking per the direction provided in NLP-3-15 is not required for these inputs because changes to these inputs will not impact the conclusions reached within this analysis.

## 4.1 PARAMETERS

The following engineering and conversion factors were utilized in the preparation of this analysis:

| INPUT | REFERENCE |
|---|---|
| 1 becquerel = 1 disintegration/second | 10 CFR 20.1005 (Section 4.3.1.4) |
| 1 curie = $3.7 \times 10^{10}$ disintegrations/second<br>= $3.7 \times 10^{10}$ becquerels<br>= $2.22 \times 10^{12}$ disintegrations/minute | 10 CFR 20.1005 (Section 4.3.1.4) |
| 1 $ft^3$ = 7.48 gal (rounded) | Reference 8.7, page 1-24 |
| $\pi$ = 3.14 (rounded) | Reference 8.7, page 2-3 |
| 1 gal = 3.785 liters | Reference 8.7, page 1-25 |
| 1 $ft^3$ = 0.028317 $m^3$ | Reference 8.7, page 1-24 |

The waste arrival and emplacement schedules used in the preparation of this design analysis are taken from the *Controlled Design Assumption Document (CDA),* Key 001, Key 002, and Key 003, Reference 8.6. Additional Key Assumptions are also included as design parameters.

### 4.1.1 Cask Arrival Scenario (Key 001)

The transportation cask arrival schedule at the MGR is indicated in the tables of Key Assumption 001. Table 3-1 (Key 001) provides the nominal number of transportation casks, by year, arriving at the repository by legal weight trucks. These casks do not contain canisters. Table 3-2 provides the nominal number of transportation casks, by year, arriving at the repository by train. These casks also do not contain canisters. Table 3-3 provides the nominal number of casks

arriving, by year, at the repository by train. These casks contain non-disposable canisters. Table 3-4 provides the nominal number of casks arriving, by year, at the repository. The HLW and U. S. Department of Energy (DOE) spent nuclear fuel (SNF) will have been loaded in disposable canisters before shipment to the repository, as indicated in Key Assumption 002 and 005. As discussed in Key Assumption 005, a very small amount of the DOE SNF may be received uncanistered in casks if it can be handled and processed in the same facilities as the commercial SNF. This small quantity is not identified and analyzed in this document.

Exceptions to these tables must also be accommodated in order to create a design with sufficient flexibility to respond to present waste stream unknowns.

Exception 1: The total number of transportation casks received in any single year could reach 820.

Exception 2: The number of large disposable canisters containing commercial SNF received in any single year could reach 300.

Exception 3: Surges in commercial SNF shipments could reach 20% per month higher than the monthly average in the peak year for 4 consecutive months.

### 4.1.2 Waste Form Arrival Scenario (Key 002)

The assembly arrival schedule at the MGR is indicated in the tables of Key Assumption 002. Table 3-5 (Key 002) provides the nominal number of assemblies, by year, arriving at the repository by legal weight trucks. These assemblies are not contained in canisters. Table 3-6 provides the nominal number of assemblies, by year, arriving at the repository by train. These assemblies also are not contained in canisters. Table 3-7 provides the nominal number of assemblies arriving, by year, at the repository by train. These assemblies are contained in non-disposable canisters. Table 3-8 provides the nominal number of commercial SNF assemblies (arriving in canisters or as bare assemblies) and high-level waste (HLW) and DOE SNF in disposable canisters arriving, by year, at the repository. As discussed in Key Assumption 005, a very small amount of the DOE SNF may be received uncanistered in casks if it can be handled and processed in the same facilities as the commercial SNF. This small quantity is not identified and analyzed in this document.

### 4.1.3 Waste Package Emplacement Scenario (Key 003)

The waste package emplacement scenario at the MGR is as indicated in Table 3-9 of Key Assumption 003. The total amount of commercial SNF disposed of in this scenario is 63,000 metric tons of heavy metal (MTHM). The HLW and DOE SNF total approximately 7,000 MTHM equivalents combined (see Key Assumption 005).

### 4.1.4 No Rod Consolidation (Key 008)

Rod consolidation will not be performed at the MGR. If rod consolidation is performed, the secondary LLW generation rates will change.

### 4.1.5 Site Generated Wastes (Key 024)

Per the CDA, Key 024, "Secondary site generated waste (low-level, hazardous, mixed, and municipal) will be transported to government-approved offsite facilities for disposal." Radioactive LLW will be processed (including volume reduction) and packaged for shipment to off-Yucca Mountain-Site disposal, as designated in Key Assumption 082, and in compliance with the waste acceptance criteria for that disposal site. Used dual-purpose canisters (DPCs) will be prepared for off-site recycling. Hazardous and mixed wastes will be collected and packaged for transport to Resource Conservation and Recovery Act (RCRA)-approved off-site treatment (Section 4.3.1.1), storage and disposal facility. This activity will be limited to packaging required for transportation and acceptance of the hazardous and mixed waste at the disposal facility. Measures will be taken to maintain separation of the hazardous and low-level wastes during HLW processing to preclude formation of mixed waste. Temporary accumulations of site-generated wastes will be accommodated onsite to facilitate treatment of low-level waste and packaging of all waste types prior to transport to designated facilities. Offsite disposal and recycling options are to be assessed during design of the MGR surface facilities, in accordance with applicable regulatory requirements.

### 4.1.6 LLW Disposal at NTS (Key 082)

The DOE Nevada Test Site (NTS) LLW disposal facilities will be made available for MGR-generated LLW. This would be an off-Yucca Mountain Site compatible with Key Assumption 024. The volume of LLW to be shipped to the disposal facility will be minimized through appropriate means at the MGR.

### 4.1.7 Underground Waste Generation (DCS 011)

"Significant quantities of secondary mixed or low-level radioactive wastes will not be generated by underground emplacement operations."

### 4.1.8 No HLW in Waste Treatment Building (DCS 012)

The WTB will not process secondary transuranic or HLW. If such waste materials are generated, they will be packaged at the point of generation and disposed in the underground emplacement area via the WHB.

### 4.1.9 Waste generated by Performance Confirmation Activities (DCS 013)

Waste quantities generated by the performance confirmation operations will be negligible in comparison to the waste generated during normal receiving, handling and repackaging of SNF and HLW for disposal. As a result, wastes generated in the performance confirmation operations will not impact the design of the Waste Treatment Building (WTB).

## 4.2 CRITERIA

Design criteria are imposed by *Site-Generated Radiological Waste Handling System Description Document,* Reference 8.10. Design criteria in regard to LLW and mixed waste handling and disposal are also imposed by Code of Federal Regulations (CFR) citations.

### 4.2.1 Low-Level Waste Disposal

If the design of the Repository Segment provides for the disposal of licensed low-level waste material into sanitary sewerage, the requirements of 10 CFR 20.2003 (Section 4.3.1.4) shall be met.

If the design of the Repository Segment provides for the treatment or disposal of licensed low-level waste material by incineration, only the amounts and forms specified in 10 CFR 20.2005 (Section 4.3.1.4), or specifically approved by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 20.2002, shall be allowed.

### 4.2.2 Transportation Protection

The Repository Segment shall be provided with the capability to comply with the requirements for packaging and transporting radioactive materials contained in 10 CFR 71 (Section 4.3.1.4) and 49 CFR 173 (Section 4.3.1.6) when shipping licensed radioactive material from the MGR.

### 4.2.3 Solid Waste Control

The management and disposal of any solid and hazardous wastes shall be conducted in accordance with the requirements of the Resource Conservation and Recovery Act, as amended (42 USC 6901 et seq.) (Section 4.3.1.1). The Federal regulations that govern solid and hazardous waste management that may impact the design of the repository are included in 40 CFR 261, 40 CFR 262, and 40 CFR 270 (Section 4.3.1.5).

### 4.2.4 Site-Generated Waste Treatment

Radioactive waste treatment facilities shall be designed to process any radioactive waste generated at the Geologic Repository Operations Area (GROA) into a form suitable to permit safe disposal at the GROA or to permit safe transportation and conversion to a form suitable for disposal at an alternative site in accordance with any regulations that are applicable. (10 CFR 60.132(d), Section 4.3.1.4)

Facilities shall be provided to manage and dispose of site-generated solid and sanitary wastes (excluding hazardous and radioactive wastes) in accordance with requirements of the Clean Water Act (CWA) (Section 4.3.1.2), unless arrangements are made for off-site disposal.

### 4.2.5 System Functions

System functions are defined in *Site-Generated Radiological Waste Handling System Description Document,* Reference 8.10, Section 1.1 as:

- The system collects, treats, and prepares solid, liquid, and gaseous LLW for shipment off-site. The system maintains radiation exposures to operating and maintenance personnel as low as reasonably achievable (ALARA).
- The system evaporates liquid LLW to facilitate water recycling.
- The system contains solid, liquid, and gaseous LLW.
- The system stores liquid LLW for processing.
- The system stages LLW packages prior to off-site shipment.
- The system collects, packages, and stages mixed waste for off-site shipment.
- The system monitors the effectiveness of the LLW treatment process.
- The system reduces the volume of LLW requiring disposal.

### 4.2.6 System Performance

System performance requirements are defined in *Site-Generated Radiological Waste Handling System Description Document,* Reference 8.10, Section 1.2.1 (TBV-428) as:

- The system shall collect, treat, and prepare site-generated solid and liquid LLW to accommodate the estimated maximum annual waste generation rates. The maximum annual quantities of waste identified in Reference 8.10 are[3] :

| | |
|---|---|
| Solid LLW | 64,130 ft$^3$ (TBV-428) |
| Non-recyclable liquid LLW | 56,700 gal (TBV-428) |
| Recyclable liquid LLW | 182,000 gal (TBV-428) |

  The system shall be designed to collect and prepare for disposal the estimated mixed waste streams.

| | |
|---|---|
| Solid mixed waste | 11 ft$^3$ (TBV-428) |
| Liquid mixed waste | 32 gal (TBV-428) |

- The system shall be designed with the capability to collect and prepare for offsite recycling the spent DPCs. The presently estimated quantity of DPCs is 3,493 (TBV-428).

- The system shall treat, as necessary, and prepare LLW for shipment to the NTS LLW disposal facilities in accordance with the applicable disposal requirements in the *Nevada Test Site Waste Acceptance Criteria (WAC).* (Reference 8.11)

- The system shall treat and recycle aqueous waste for the purposes of water conservation and waste minimization.

- The system shall provide volume reduction of solid LLW.

- The system shall retrieve samples of liquid, slurry, and gaseous LLW source streams.

- The system shall monitor and record the radionuclides in effluents. Monitors shall include alarms that can be periodically tested.

[3] These waste quantities identified in Reference 8.10 have not been updated to incorporate the values determined in *Secondary Low-Level Waste Generation Rate Analysis,* Reference 8.5. Calculations performed in this analysis use the values for LLW as determined in Reference 8.5.

- The system shall be designed to separately manage site-generated low-level radioactive waste from hazardous wastes to preclude generation of mixed waste. This will also facilitate cost effective treatment and disposal.

### 4.2.7 Nuclear Safety Criteria

Nuclear safety criteria are defined in *Site-Generated Radiological Waste Handling System Description Document,* Section 1.2.2.1 of Reference 8.10, as:

- The system shall control waste feed sources in the case of system malfunction.
- The system shall contain spills of radioactive and mixed waste.

## 4.3 CODES AND STANDARDS

### 4.3.1 Laws and Code of Federal Regulations (CFR)

**4.3.1.1** Resource Conservation and Recovery Act (RCRA) of 1976, 42 USC s/s et. seq.

**4.3.1.2** Clean Water Act (CWA) of 1977, 33 USC s/s et. seq.

**4.3.1.3** Not used.

**4.3.1.4** 10 CFR, Energy

10 CFR 20, *Standards for Protection Against Radiation*, January 1,1998.

10 CFR 50, *Licensing of Production and Utilization Facilities*, January 1, 1998.

10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, January 1, 1998.

10 CFR 61, *Licensing Requirements for Land Disposal of Radioactive Wastes*, January 1, 1998.

10 CFR 71, *Packaging and Transportation of Radioactive Materials*, January 1, 1998.

#### 4.3.1.5 40 CFR, Protection of Environment

40 CFR 261, *Identification and Listing of Hazardous Materials*, July 1, 1998.

40 CFR 262, *Standards Applicable to Generators of Hazardous Waste*, July 1,1998.

40 CFR 270, *EPA Administered Permit Programs: The Hazardous Waste Permit Program*, July 1, 1998.

#### 4.3.1.6 49 CFR, *Transportation*

49 CFR 173, *Shippers – General Requirements for Shipping and Packaging*, October 1, 1998.

49 CFR 178, *Specifications for Packagings*, October 1, 1998.

### 4.3.2 U.S. Nuclear Regulatory Commission Regulatory Guides and Publications

Regulatory Guide 1.143, Revision 1, 1979. *Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.*

Regulatory Guide 3.53, Revision 0, 1982. *Applicability of Existing Regulatory Guides to the Design and Operation of an Independent Spent Fuel Storage Installation.*

NUREG/BR-0216, 1998. *Radioactive Waste: Production, Storage, Disposal.*

### 4.3.3 ANSI/ANS Standards

ANSI/ANS-40.35-1991. *Volume Reduction of Low-Level Radioactive Waste or Mixed Waste.*

ANSI/ANS-55.1-1992. *Solid Radioactive Waste Processing System for Light-Water-Cooled Reactor Plants.*

ANSI/ANS-55.6-1993. *Liquid Radioactive Waste Processing System for Light Water Reactor Plants.*

# 5. ASSUMPTIONS

Design assumptions were screened in regard to TBV/TBD applicability. The results of this screening identified no newly generated TBV/TBDs to be tracked per the requirements of NLP-3-15. Inputs are annotated with the following codes to indicate their individual screening results:

- The input is not data and does not affect the system's critical characteristics, nor is it directly relied upon to address safety and waste isolation issues; therefore, it should not be controlled as TBV/TBD. (Classification Code 1)

- The input is data, but does not affect the system's critical characteristics, nor is it directly relied upon to address safety and waste isolation issues; therefore, it should not be controlled as TBV/TBD. (Classification Code 2)

**5.1** It is assumed that the QA classifications identified in Section 2., Quality Assurance, have been correctly assigned.

Basis: This assumption is based on the work performed in *Classification of the Preliminary MGDS Repository Design* (Reference 8.4) which carries a TBV for these classifications (TBV-228 and TBV-459).

Used: Section 2.

[TBV: TBV-228 and TBV-459]

**5.2** It is assumed that the LLW rate analysis methods and data presented in the *Secondary Low-Level Waste Generation Rate Analysis,* Reference 8.5, provide a reasonable basis for the estimating of LLW generation on an annual basis.

Basis: Reference 8.5 identified LLW production rates as a function of work processes and work process throughput. Since there is no plan to change the work processes during the lifetime of WTB operation, it is believed reasonable to establish LLW generation rates as a function of process throughput. Those operations which remain independent of throughput, e.g., floor washdown, produce a constant quantity of LLW each year.

Used: Section 6.2.

[TBV: Classification Code 1]

5.3 It is assumed that utilizing the rates established by Reference 8.5 for the year 2026 provides a reasonably bounding method for projecting LLW production for any given year of MGR operation.

Basis: The year 2026 is the year in which the maximum quantities of liquid wastes and solid wastes are generated as a function of cask and DPC decontamination. It is believed that utilizing the quantities of waste from this year to establish waste generation rates presents a reasonably bounding basis for this analysis.

Used: Section 6.2.

[TBV: Classification Code 2]

5.4 It is assumed that 80 percent of both spent ion exchange resins and spent filter cartridges are generated in the WHB. The remaining 20 percent of spent ion exchange resins and spent filter cartridges are generated by operations in the WTB.

Basis: The primary source of radionuclide contamination is from the opening of casks and DPCs in the Assembly Transfer System (ATS) pool system. The pool system waters are treated to remove this dissolved and particulate contamination in the pool water treatment system in the WHB. This water treatment is comprised of filtration to remove particulates and ion exchange to remove dissolved constituents. The filters and ion exchange resins used in the WTB are used in the processing of recyclable water generated in decontamination activities, e.g., floor washdown. Since the bulk of radioactive contamination is removed in pool water treatment, it is believed reasonably bounding for the purposes of this analysis to utilize a 80 percent/20 percent split between the WHB and WTB, respectively, for spent ion exchange resins and filter cartridges.

Used: Section 6.2.8.

[TBV: Classification Code 1]

5.5 It is assumed that the quantity of ion exchange resin utilized in the WHB is a direct function of the number of casks and canisters processed through the ATS pools.

Basis: Contamination comes into the pool through the opening of casks and DPCs in the pool. It is intuitive that the amount of contamination is directly related to the number of casks and DPCs opened in a given period of time. It is realized that the quantity of radioactive material introduced into the pool from the opening of a given cask or DPC will fluctuate depending upon the history of the contained fuel assemblies. It is believed that using an average quantity in this manner allows a reasonable multiplying constant to be established for waste generation for utilization in this analysis.

Used: Section 6.2.8.

[TBV: Classification Code 1]

**5.6** It is assumed that the quantity of ion exchange resins and filter cartridges utilized in the WTB is a direct function of the amount of recyclable water processed.

Basis: The only liquid waste treated in the WTB by filtration and ion exchange is the recyclable water which is processed to be reused in decontamination activities. It is intuitive that the quantity of resin and filter cartridges is directly proportional to the quantity of water processed. It is also realized that the amount of particulate and dissolved radionuclides is a function of a number of other variables. It is believed that using an average quantity of resin and filter cartridges per unit of recyclable water is reasonably bounding for the purposes of this analysis.

Used: Section 6.2.8.

[TBV: Classification Code 1]

**5.7** It is not anticipated that any hazardous wastes or mixed wastes will be generated through the direct activities within the WHB associated with receiving and repackaging of SNF/HLW for disposal at the MGR. It is also not anticipated that any hazardous wastes or mixed wastes will be generated through the processing of LLW within the WTB.

Basis: It is presently envisioned that only two sources of chemical materials will be inputs associated with the processing of SNF/HLW through the WHB. These two chemical sources are ion exchange resins used in water treatment and commercial chemical decontamination solutions. Nuclear grade ion exchange resins are used for water treatment of radioactive waste streams and are not classified as hazardous materials. Although the actual decontamination solutions have not been defined, it is anticipated that non-hazardous decontamination agents, the industry norm, will be employed when required.

Used: Section 6.3.6.

[TBV: Classification Code 1]

**5.8** In all options it is assumed that ion exchange resins and filter cartridges are processed/packaged for disposal at the MGR in either the WTB or in the WHB.

Basis: There is a reasonable probability that these two waste forms may be classified as

greater-than-Class C. Although design analysis has not been performed, it is reasonable to assume that packaging requirements for transportation will be as restrictive as packaging requirements for disposal. It is therefore believed a reasonable assumption that packaging of these two wastes for disposal will remain a responsibility of the MGR under all LLW disposal options. It is believed that the comparison of LLW disposal options is independent of these waste forms.

Used: Section 6.4.1 and Section 6.3.7.2.

[TBV: Classification Code 1]

**5.9** A space allocation of 800 $ft^2$ is adequate for the bulk packaging of solid LLW.

Basis: It is believed that this will provide sufficient space for the stationing of a sorting glovebox and drum loading equipment, and allow sufficient space between equipment to maintain ALARA, and permit surface decontamination activities as required.

Used: Section 6.4.3

[TBV: Classification Code 1]

**5.10** Because there are fewer process operations under Options 1 and 2 (as discussed in Section 6.4.1), space requirements for Facility Support Areas; Heating, Ventilating and Air-Conditioning (HVAC) Equipment Areas; and Miscellaneous Building Support Areas are expected to decrease under Options 1 and 2 (as discussed in Section 6.4.3) in comparison to the space requirements for the Baseline Option. It is assumed that these space requirements will decrease as a direct function of the decrease in process space requirements. This decrease is not applied to the space allocation for security of 450 $ft^2$.

Basis: It is believed reasonable to assume that process operational space and required support space are inter-related. It is also believed reasonable to assume that this is a direct function for the purposes of this analysis.

Used: Section 6.4.3

[TBV: Classification Code 1]

**5.11** Cost estimates assume that operations start one year prior to start of processing SNF through the MGR. This first year is utilized for operating procedure development, operator training, and waste process system checkout. The WTB then operates at full staff from the year 2010 through 2033 during emplacement operations. An additional

year is then allocated for the processing of residual waste from SNF handling operations and for the cleanout and mothballing of WTB process equipment. The total operating span is therefore assumed at twenty-six years.

Basis: It is believed reasonable for the purposes of this analysis to assume one year for operator and equipment readiness, and to assume one year for the work-off of residual material and to mothball equipment.

Used: Section 6.5.1.2, Section 6.5.2.2, and 6.5.3.2.

[TBV: Classification Code 1]

**5.12** It is assumed that 30% of compactible and non-compactible DAW can be de-listed from radioactive waste through the process of sorting out non-contaminated material. This delisted material can be disposed of as non-radioactive waste.

Basis: Reference 8.12, pages 4-12 and 4-41 of Volume 1, identifies that sorting typically allows de-listing of between 30 % to 60 % of DAW. It is believed that using the lower value of 30 % provides a reasonably bounding basis from the purposes of this analysis.

Used: Section 6.5.1.2.

[TBV: Classification Code 2]

**5.13** The assumed density of compacted waste is 40 $lb/ft^3$ and it is assumed that waste drums are filled to 80 percent of their 55-gal capacity.

Basis: The density and drum fill is taken from Section 4.3.14 of Reference 8.1.

Used: Section 6.5.1.2.
[TBV: Classification Code 1]

**5.14** The assumed density of liquid waste to be grouted is 65 $lb/ft^3$.

Basis: The liquid waste will contain dissolved particulates, some small particulates, cleaning agents, etc. Utilizing 65 $lb/ft^3$ for the density of the liquid waste provides a reasonable density for the purposes of this analysis.

Used: Section 6.5.1.2 and 6.5.2.2.

[TBV: Classification Code 1]

**5.15** It is assumed that 55-gallon drums will be 90 percent filled when used for grout disposal.

Basis: Drums are typically filled such that the majority of drum capacity is utilized while still allowing room for thermal expansion. Using 90 percent for fill is believed reasonably bounding for the purposes of this analysis.

Used: Section 6.5.1.2.

[TBV: Classification Code 1]

**5.16** A 90 percent bulk fill of spent ion exchange resin into 55-gallon high-integrity-containers (HICs) and a 60 percent fill of filter cartridges into 55-gallon HICs is assumed for determining the number of HICs necessary for disposal of resin and filter cartridges.

Basis: Drums are typically filled to 90 percent for liquids and particulates which readily flow (see Assumption 5.15). Filter cartridges are rigid cylinders and will have to be packed into the HICs. Using a 60 percent fill for filter cartridges provides a reasonably bounding basis for the purposes of this analysis. In the case of placing ion exchange resins into HICs, the actual void volume is greater than the residual 10 percent volume at the top of a HIC. Ion exchange resins are spherical in shape, and even when close packed, allow a high void fraction. The 90 percent fill for ion exchange resins is a bulk fill value, and does not include the void volume between the spherical resin beads.

Used: Section 6.5.1.2.

[TBV: Classification Code 1]

**5.17** It is assumed that the operating staff for Options 1 and 2 (as discussed in Section 6.4.1) would be one-half the operating staff for the Baseline Option plus eight personnel for the bulk packaging of solid wastes.[4]

Basis: It is believed that eight personnel are sufficient for the operations of sorting, packaging, and surveying drums, and provides a reasonably bounding basis for the purposes of this analysis.

[4] These personnel will be utilized in rough sorting of dry active waste (DAW) to ensure that hazardous waste materials are not inadvertently included in wastes, perform required regulatory waste counting and classification, and the loading of DAW into drums for disposal.

Used: Section 6.5.2.2.

[TBV: Classification Code 1]

5.18 It is assumed that the decontamination equipment associated with the Canister Transfer System (SU11) has a QA classification of QA-3.

Basis: Although specific QA classifications for decontamination equipment are not identified in Reference 8.4, QA classification for decontamination equipment in the Assembly Transfer System (SU10) is QA-3.

Used: Section 2.

[TBV: Classification Code 1]

# 6. DESIGN ANALYSIS

## 6.1 INTRODUCTION

This analysis identifies the estimated quantities of LLW to be generated on an annual basis (Section 6.2). The analysis reviews applicable regulations, codes, and standards (Section 6.3), and then identifies potential options for the processing/packaging of LLW for disposal, and identifies potential options for that disposal (Section 6.4). The analysis identifies the required equipment and facility space for the studied options (Section 6.4), and then provides estimates of life-cycle cost for the various options (Section 6.5). Section 6.6 identifies potential technical/regulatory risks associated with the options. Section 6.7 provides and overall summary of the assessment of the options and recommends a processing scheme for the handling, processing and disposal of MGR LLW.

The system description document (Reference 8.10, Section 1.1) identified the requirement for the collection, treatment, and preparation for shipment off-site of solid, liquid, gaseous, and mixed waste. As discussed in this analysis, all liquid wastes will be solidified prior to disposal. The anticipated levels of gaseous effluents and any treatment of such effluents are not discussed in this analysis

## 6.2 QUANTIFICATION OF LOW-LEVEL WASTE

An estimate of the quantities of low-level waste to be produced during the processing of SNF through the MGR is provided in *Secondary Low-Level Waste Generation Rate Analysis,* Reference 8.5. A maximum annual rate for LLW generation was identified in Reference 8.5 to provide input for design purposes and for license application (LA). To perform life-cycle-cost

analysis, this estimate must be expanded to provided a year-by-year estimate of the various forms of LLW. It is assumed that the LLW rate analysis methods and data presented in Reference 8.5 provide a reasonable basis for the estimating of LLW generation on an annual basis (Assumption 5.2).

The disposition of used DPCs is being evaluated in an external engineering analysis. Therefore, this analysis does not address this issue. Because the disposition of DPCs will be the same in all options considered in this analysis, the outcome of the DPC analysis will not impact the conclusions drawn in this analysis.

Reference 8.5 utilized the cask arrival schedule and cask data, projected facility square footage data, and projected manpower data to generate estimates for the various LLW forms. This analysis utilizes the estimates generated within Reference 8.5 to produce a simplified method of estimating LLW as a function of cask, canister, and DC quantities, manpower, and facility square footage.

The reference year utilized for establishing waste generation factors is year 2026, the reference year presented in Reference 8.5. It is assumed that utilizing the rates established by Reference 8.5 for the year 2026 provides a reasonably bounding method for projecting LLW production for any given year of MGR operation. (Assumption 5.3)

Table II-1 of Attachment II utilizes the LLW generation rates to estimate the quantities of recyclable liquid waste, non-recyclable liquid waste, compactible dry active waste (DAW), non-compactible DAW, and wet-solid waste. These waste quantities are a function of operational quantities, e.g., a portion of the recyclable liquid waste is a direct function of the number of DPCs processed through the WHB. The factors used in generating the waste estimates in Table II-1 are derived in the following discussion. To facilitate this discussion, Table I-2 of Reference 8.5 is reproduced as Table II-2, Attachment II of this analysis.

Table 6-1 presents the projected waste receipt schedule and SNF/HLW placement schedule as established by Key Assumptions 001, 002, and 003, Reference 8.6. (This table is a compilation of Table I-1 of Reference 8.5).

### 6.2.1 DPC Decontamination Waste

From Table II-2, Attachment II, the solid LLW generated from DPC and overpack processing through the Assembly Transfer System (ATS) is estimated at 1,118 lb/yr. From Section 7.2.2 of Reference 8.5 this is the quantity of compactible cloth, plastic, and paper, and is 70 percent of the total compactible DAW. The density of DAW, Reference 8.5, Section 7.2.2, is 6 lb/ft$^3$. The total volume of compactible waste is [1,118 lb/yr/(0.70 x 6 lb/ft$^3$)] ft$^3$/yr, or approximately 266 ft$^3$/yr. From Section 7.2.2 of Reference 8.5, the amount of non-compactible DAW is estimated

by multiplying the amount of compactible DAW by the factor of 0.44/0.56. Utilizing this factor, the amount of non-compactible DAW generated is (266 $ft^3$/yr x 0.44/0.56 =) 209 $ft^3$/yr.

Table 6-1. Projected Cask Arrival and DC Schedule

| YEAR | INCOMING CASKS | | | | | Disposal Containers |
|---|---|---|---|---|---|---|
| | ASSEMBLY TRANSFER SYSTEM | | | CANISTER TRANSFER SYSTEM | TOTAL | |
| | Uncanistered Fuel (Truck and Rail) | Dual Purpose Canisters (Rail) | Total Assembly Transfer System | HLW and DSNF | | |
| 2010 | 32 | 25 | 57 | 1 | 58 | 38 |
| 2011 | 103 | 6 | 109 | 1 | 110 | 76 |
| 2012 | 211 | 2 | 213 | 3 | 216 | 152 |
| 2013 | 321 | 24 | 345 | 6 | 351 | 251 |
| 2014 | 530 | 10 | 540 | 8 | 548 | 373 |
| 2015 | 505 | 14 | 519 | 137 | 656 | 503 |
| 2016 | 529 | 22 | 551 | 145 | 696 | 524 |
| 2017 | 490 | 43 | 533 | 138 | 671 | 492 |
| 2018 | 493 | 48 | 541 | 151 | 692 | 524 |
| 2019 | 436 | 96 | 532 | 153 | 685 | 507 |
| 2020 | 376 | 123 | 499 | 154 | 653 | 510 |
| 2021 | 310 | 161 | 471 | 154 | 625 | 505 |
| 2022 | 319 | 177 | 496 | 140 | 636 | 499 |
| 2023 | 304 | 179 | 483 | 140 | 623 | 485 |
| 2024 | 258 | 199 | 457 | 145 | 602 | 495 |
| 2025 | 269 | 250 | 519 | 150 | 669 | 510 |
| 2026 | 18 | 411 | 429 | 149 | 578 | 508 |
| 2027 | 37 | 381 | 418 | 147 | 565 | 492 |
| 2028 | 29 | 347 | 376 | 147 | 523 | 479 |
| 2029 | 17 | 347 | 364 | 181 | 545 | 493 |
| 2030 | 33 | 319 | 352 | 187 | 539 | 513 |
| 2031 | 43 | 302 | 345 | 181 | 526 | 499 |
| 2032 | 278 | 6 | 284 | 143 | 427 | 473 |
| 2033 | 170 | 1 | 171 | 105 | 276 | 312 |
| Totals | 6,111 | 3,493 | 9,604 | 2,866 | 12,470 | 10,213 |

Using the quantity of DPCs of 411 (year 2026), the DAW generation rates are:

- compactible DAW generation rate = 266/411 $ft^3$/DPC[5]
- non-compactible DAW generation rate = 209/411 $ft^3$/DPC

From Table II-2 the recyclable liquid LLW is 17,525 gal/yr. The recyclable liquid LLW generation rate is therefore:

recyclable liquid generation rate = 17,525/411 gal/DPC

In a similar manner, the non-recyclable liquid LLW generation rate is 5,842/411 gal/DPC.

### 6.2.2 Assembly Transfer System Cask Decontamination Waste

The ATS cask decontamination waste generation rates are calculated in the same manner as the DPC decontamination rates. These rates are:

- Compactible DAW generation rate = 1177 lb/yr/(0.70 x 6 lb/$ft^3$)/429 ATS casks/yr = 280/429 $ft^3$/ATS cask
- Non-compactible DAW generation rate = 1177 lb/yr x (0.44/0.56)/(0.70 x 6 lb/$ft^3$)/429 = 220/429 $ft^3$/ATS cask
- Recyclable liquid LLW generation rate = 18,455/429 gal/ATS cask
- Non-recyclable liquid LLW generation rate = 6,152/429 gal/ATS cask

### 6.2.3 Canister Transfer System Cask Decontamination Waste

The Canister Transfer System (CTS) cask decontamination waste generation rates include the quantities of wastes generated from the decontamination of handling fixtures used in CTS cask operations. The compactible DAW generated is equal to the sum of the decontamination DAW of casks plus the decontamination DAW of fixtures (Table II-2, Attachment II) (810 lb/yr + 88 lb/yr =) 898 lb/yr. Utilizing the 0.7 factor and the density of DAW, the total compactible DAW is (898 lb/yr/0.7/6 lb/$ft^3$ =) 214 $ft^3$/yr. Employing the factors from above, the non-compactible DAW generation is estimated at 168 $ft^3$/yr. There are 149 casks (Table II-2, Attachment II) processed through the CTS in the year 2026, the DAW generation rates are therefore:

[5] Ratios are utilized for the waste generation rates to eliminate rounding errors created by performing the indicated division and then rounding to the appropriate number of significant digits.

- Compactible DAW generation rate = 214 $ft^3$/yr/149 CTS casks/yr = 214/149 $ft^3$/CTS cask
- Non-compactible DAW generation rate = 168 $ft^3$/yr/149 CTS casks/yr = 168/149 $ft^3$/CTS cask

In a similar manner, the liquid LLW rates are calculated as:

- Recyclable liquid LLW = 18,218/149 gal/CTS cask
- Non-recyclable liquid LLW = 1,776/149 gal/CTS cask

### 6.2.4 Disposal Container Decontamination Wastes

The DC solid decontamination wastes includes the wastes generated from the decontamination of the DC lid tops prior to DC welding, the waste generated from the decontamination of the entire DC prior to transfer to subsurface, and the waste generated from the decontamination of the DC handling collars. From Table II-2, Attachment II, the total quantity of compactible cloth, plastic, and paper is 810 lb + 88 lb + 229 lb = 1,127 lb. Using the 70 percent conversion factor and the density of compactible waste, this converts to [1,127 lb/yr/(0.7 x 6 lb/ft3) =] 270 $ft^3$/yr. The non-compactible waste is approximately (270 $ft^3$/yr x 0.44/0.56 =) 212 $ft^3$/yr. The calculated waste generation rates for DC decontamination are:

- Compactible DAW = 270/508 $ft^3$/DC
- Non-compactible DAW = 212/508 $ft^3$/DC

The total recyclable liquid from DC decontamination (Attachment II-2) is 35,580 gal + 4,951 gal = 40,531 gal. The total non-recyclable liquid is 5,930 gal + 367 gal = 6,297 gal. These volumes yield the following rates:

- Recyclable liquid LLW = 40,531/508 gal/DC
- Non-recyclable liquid LLW = 6,297/508 gal/DC

### 6.2.5 Dry Active Waste from Cask Handling and Operational Personnel

DAW is also generated by cask handling operations and by operating personnel who work within radiological areas. From Section 7.2.2 (second and fourth paragraphs) and Assumption 4.3.11 of Reference 8.5, DAW is generated at the following rates:

- DAW from operating personnel = 100 $ft^3$/operating person/year
- DAW from cask handling = 20 $ft^3$/incoming cask handling operation

Utilizing these rates, the total compactible and non-compactible DAW generation rates for these operations is:

- Compactible DAW from operating personnel (100 $ft^3$/operating person/year/0.7) = 143 $ft^3$/operating person/year
- Non-compactible DAW from operating personnel (143 $ft^3$/operating person/year x 0.44/0.56) = 112 $ft^3$/operating person/year
- Compactible DAW from cask handling (20 $ft^3$/cask handling operation/0.7) = 29 $ft^3$/cask handling operation
- Non-compactible DAW from cask handling (29 $ft^3$/cask handling operation x 0.44/0.56) = 23 $ft^3$/cask handling operation

### 6.2.6 Facility Floor Decontamination

Table II-2 of Attachment II, also presents estimates of recyclable liquid LLW, non-recyclable liquid LLW, compactible DAW, and non-compactible DAW for plant sources, i.e., facility floor washdown and carrier washdown, from the reference year 2026, and as presented in Table I-2 of Reference 8.5. Facility washdown LLW generation rates are a function of square footages, and carrier washdown is a function of the number of cask carriers passed through per year (Assumption 4.3.10 of Reference 8.5).

Table II-2, identifies the various floor areas washed down within the WHB; the sum of these areas is (9,240 $ft^2$ + 8,658 $ft^2$ + 8,910 $ft^2$ + 4,450 $ft^2$ + 11,500 $ft^2$ + 61,100 $ft^2$ + 2,030 $ft^2$ + 24,500 $ft^2$ + 8,020 $ft^2$ =) 138,408 $ft^2$, rounded to 138,400 $ft^2$. The total solid LLW generated by these washdowns is (92 lb + 1,039 lb + 2,138 lb+ 89 lb + 1,380 lb + 1,222 lb + 487 lb + 1,470 lb + 160 lb =) 8,077 lb/yr. Utilizing the 0.7 factor for total compactible DAW, the 0.44/0.56 factor for non-compactible DAW, and the density of 6 lb/$ft^3$, the compactible DAW is estimated at (8,077 lb/yr/0.70/6 lb/$ft^3$ =) 1920 $ft^3$/yr, and the non-compactible DAW is estimated at (1920 $ft^3$/yr x 0.44/0.56 =) 1510 $ft^3$/yr. The generation rates are therefore:

- For compactible DAW = 1920/138,400 $ft^3$ of DAW/$ft^2$ washed
- For non-compactible DAW = 1510/138,400 $ft^3$ of DAW/$ft^2$ washed

In a similar manner the recyclable liquid generation rates and the non-recyclable liquid generation rates are calculated for the WHB as:

- Recyclable liquid LLW = 116,330/138,400 gal/$ft^2$ of WHB

- Non-recyclable liquid LLW = 51,700/138,400 gal/ft$^2$ of WHB

The generation rates for the WTB are calculated in like manner utilizing the floor space of 36,800 ft$^2$:

- Compactible DAW = 88/36,800 ft$^3$ of DAW/ft$^2$ washed
- Non-compactible DAW = 69/36,800 x $10^{-3}$ ft$^3$ of DAW/ft$^2$ washed
- Recyclable liquid LLW = 5,299/36,800 gal/ft$^2$ washed
- Non-recyclable liquid LLW = 2,355/36,800 gal/ft$^2$ washed

### 6.2.7 Carrier Washdown Wastes

Carrier washdown waste rates are calculated in a similar manner (similar to floor washdown) from Table II-2, as a function of the number of carriers. These rates are:

- Compactible DAW = 16/578 ft$^3$ of DAW/carrier
- Non-compactible DAW = 13/578 ft$^3$ of DAW/carrier
- Recyclable liquid LLW = 555/578 gal/carrier

### 6.2.8 Wet-Solid Low-Level Waste

Wet-solid LLW, ion exchange resins and filter cartridges are generated from operations within the WHB (pool water treatment) and WTB (recyclable waste processing). Reference 8.5, Assumption 4.3.14, identified an estimated quantity of these two wastes forms at 1,295 ft$^3$/yr each, 2,590 ft$^3$/yr total, for the Baseline Option of year 2026. Reference 8.5 did not identify how much wet-solid waste might be generated in the WHB and how much might be generated in the WTB. It is anticipated that the majority of the spent ion exchange resins and filter cartridges would be generated in the process of treating pool water in the WHB. For the purposes of this analysis, it is assumed that 80 percent of both the ion exchange resins and the filter cartridges is generated in the WHB, the remaining 20 percent is generated in the WTB (Assumption 5.4). The amount of ion exchange resin and filter cartridge waste in the WHB should be directly related to the number of casks passing through the Assembly Transfer System (Assumption 5.5). Using this relationship, waste generation factors are calculated as:

- WHB resin = 1,295 ft$^3$/yr x 0.8 / 429 ATS casks = 1,036/429 ft$^3$/ATS cask
- WHB filter cartridges = 1,295 ft$^3$/yr x 0.8 / 429 ATS casks = 1,036/429 ft$^3$/ATS cask

The amount of resin waste and filter cartridge waste from the WTB is a direct function of the amount of recyclable liquid processed (Assumption 5.6). From Table II-2, the amount of

recyclable liquid processed in 2026 is estimated at approximately 216,911 gal/yr. Using this relationship, waste generation factors are calculated as:

- WTB resin = 1,295 $ft^3$/yr x 0.2/ 216,911 gal = 259/216,911 $ft^3$/gallon of recyclable liquid

- WTB filter cartridges = 1,295 $ft^3$/yr x 0.2/ 216,823 gal = 259/216,911 $ft^3$/gallon of recyclable liquid

### 6.2.9 Summary of LLW Generated

The waste generation rate factors derived in Sections 6.2.1 through 6.2.8 are utilized in generating annual waste summary tables for estimated secondary LLW. Table II-1 presents this summary table for the year 2026. Table II-3 of Attachment II presents a summary of the waste generation rate factors derived in Sections 6.2.1 through 6.2.8.

Table II-1 of Attachment II, reference year 2026, utilizes the generation rates factors by multiplying the rate factor by the scaling basis (e.g., number of decontaminations) to estimate the total wastes in a given year.

Attachment III contains estimates of LLW for each year in the period from 2010 to 2033. For example, for year 2020 (Table III-11, Attachment III) for DPC decontamination, the total recyclable liquid waste generated is estimated at (17,525/411 gal/DPC x 123 DPC/yr =) 5,245 gal/yr, or 5.24 one-thousand gallon units/year.

Table 6-2 presents a summary, on an annual basis for all the estimated quantities of secondary LLW to be generated from the processing of SNF through the WHB. This table is derived from Tables III-1 through III-24 which provide the estimated quantities of secondary generated LLW for the years 2010 through 2033, respectively.

Table 6-2. Summary Secondary LLW

| Year | Compactible DAW ($ft^3$/yr) | Non-Compactible DAW ($ft^3$/yr) | Wet-Solid LLW ($ft^3$/yr) | | Liquid LLW (gal/yr) | |
|---|---|---|---|---|---|---|
| | | | Ion-Exchange Resins | Filter Cartridges | Recyclable Liquid | Chemical Liquid |
| 2010 | 24,200 | 19,000 | 290 | 290 | 128,400 | 55,700 |
| 2011 | 25,800 | 20,200 | 420 | 420 | 132,900 | 56,700 |
| 2012 | 29,000 | 22,700 | 690 | 690 | 143,600 | 59,100 |
| 2013 | 33,000 | 26,000 | 1,020 | 1,020 | 158,600 | 62,500 |
| 2014 | 38,900 | 30,700 | 1,510 | 1,510 | 176,500 | 66,700 |
| 2015 | 42,300 | 33,300 | 1,490 | 1,490 | 202,100 | 69,600 |
| 2016 | 43,500 | 34,300 | 1,580 | 1,580 | 206,500 | 70,500 |
| 2017 | 42,800 | 33,700 | 1,530 | 1,530 | 203,200 | 70,100 |
| 2018 | 43,400 | 34,200 | 1,550 | 1,550 | 207,900 | 70,800 |
| 2019 | 43,200 | 34,100 | 1,530 | 1,530 | 208,400 | 71,200 |
| 2020 | 42,300 | 33,300 | 1,450 | 1,450 | 208,500 | 71,100 |
| 2021 | 41,500 | 32,700 | 1,390 | 1,390 | 208,500 | 71,200 |
| 2022 | 41,800 | 32,900 | 1,450 | 1,450 | 208,100 | 71,500 |
| 2023 | 41,400 | 32,600 | 1,410 | 1,410 | 206,500 | 71,200 |
| 2024 | 40,800 | 32,200 | 1,350 | 1,350 | 207,600 | 71,300 |
| 2025 | 42,900 | 33,800 | 1,510 | 1,510 | 214,300 | 73,200 |
| 2026 | 40,300 | 31,700 | 1,300 | 1,300 | 216,900 | 74,100 |
| 2027 | 39,800 | 31,400 | 1,260 | 1,260 | 213,600 | 73,300 |
| 2028 | 38,600 | 30,400 | 1160 | 1,160 | 209,300 | 72,100 |
| 2029 | 39,300 | 30,900 | 1,140 | 1,140 | 214,100 | 72,500 |
| 2030 | 39,100 | 30,800 | 1,110 | 1,110 | 214,700 | 72,200 |
| 2031 | 38,700 | 30,400 | 1,090 | 1,090 | 211,800 | 71,600 |
| 2032 | 35,500 | 27,900 | 910 | 910 | 189,700 | 65,800 |
| 2033 | 30,900 | 24,300 | 610 | 610 | 167,000 | 61,600 |
| Totals | 919,000 | 723,500 | 28,750 | 28,750 | 4,658,700 | 1,645,600 |

## 6.3 REGULATORY REQUIREMENTS FOR LOW-LEVEL WASTE PROCESSING AND DISPOSAL

This section discusses the various regulations associated with the processing, transportation and disposal of LLW. An understanding of these regulations is required prior to defining viable options for processing, transportation, and disposal of the secondary LLW to be generated during the course of operations at the MGR. Section 6.3.1 presents a summary of the regulations in regard to the processing of LLW. Section 6.3.2 discusses the transportation of LLW. Section 6.3.3 discusses the requirements for disposal of LLW. Section 6.3.4 briefly discusses the potential imposition of mixed waste requirements. Section 6.3.5 summarizes the LLW requirements and their impact to the available options for processing/disposal of secondary LLW generated at the MGR.

### 6.3.1 General Requirements for Low-Level Waste Processing

10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories,* states, "Radioactive waste treatment facilities shall be designed to process any radioactive wastes generated at the geologic repository operations area into a form suitable to permit safe disposal at the geologic repository operations area or to permit safe transportation and conversion to a form suitable for disposal at an alternative site in accordance with any regulations that are applicable. [10 CFR 60.132(d) *Waste treatment*]

NRC Regulatory Guide 3.53, *Applicability of Existing Regulatory Guides to the Design and Operation of an Independent Spent Fuel Storage Installation* (Section 4.3.2) identifies the applicablility of NRC Regulatory Guide 1.143, Revision 1, *Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants* (Section 4.3.2) for Waste Management Systems. NRC Regulatory Guide 1.143 identifies ANSI/ANS-55.1-1992 (Section 4.3.3) as applicable design guidance for solid radioactive waste systems and ANSI/ANS-55.6-1993 (Section 4.3.3) as applicable design guidance for liquid radioactive waste systems.

Guidance is provided in ANSI/ANS-55.1-1992, *Solid Radioactive Waste Processing System for Light-Water-Cooled Reactor Plants,* Section 3.1.1, Solid Waste Processing, which states: "Except as noted below, liquids and solids removed from liquid processing systems, including spent resins, filter sludges, and evaporator and reverse osmosis concentrates, shall be collected, stored for decay when appropriate (i.e., radioactive waste with short-lived radioactive isotopes), solidified or dewatered, and packaged prior to storage and subsequent loading for shipment. Other solid wastes, including spent filters, DAWs, incinerator ash, and mixed waste shall be appropriately contained, collected, segregated, stored, and packaged prior to shipment except when an off-site contractor is used for processing. The high-integrity containers (HICs) may be used in cases where waste characteristics meet 10 CFR 61.56(b) (Section 4.3.1.4) regulatory requirements, e.g., de-watered resin." This standard also recommends that appropriate equipment is incorporated into the handling and packaging equipment to accomplish waste

minimization objectives. This equipment would typically include sorting, shredding, and compaction techniques.

ANSI/ANS-55.6-1993 (Section 4.3.3), *Liquid Radioactive Waste Processing System for Light Water Reactor Plants*, identifies release criteria for liquid effluents as imposed by: 10 CFR 50 (Section 4.3.1.4), *Licensing of Production and Utilization Facilities*; 10 CFR 20 (Section 4.3.1.4), *Standards for Protection Against Radiation*; and, Federal, State, and local environmental requirements. This standard identifies processing options for liquid radioactive waste streams, but does not restrict which options may be utilized in obtaining processing objectives. It does recommend that recycle of liquids be utilized where technically and economically viable. Process options include filtration, membrane separations, ion exchange, evaporation, and reuse and recycle.

ANSI/ANS-40.35-1991 (Section 4.3.3), *Volume Reduction of Low-Level Radioactive Waste and Mixed Waste*, provides design criteria for volume reduction systems for both liquid and solid LLW and mixed waste streams.

### 6.3.2 Transportation Requirements

Packaging and transportation requirements for radioactive material are imposed by 10 CFR 71 *Packaging and Transportation of Radioactive Material* (Section 4.3.1.4). Secondary LLW to be shipped from the MGR falls under the requirements of this CFR. Certain of the shipments of LLW may have sufficiently low amounts of radioactivity to be excluded from these requirements as discussed in 10 CFR 71.10 *Exemption of Low-Level Materials*. It is anticipated that the majority of LLW which does not meet the exemption requirements will be deemed Type A quantity wastes as defined in 10 CFR 71.4 *Definitions*, with the determining methodology defined in 10 CFR Appendix A *Determination of $A_1$ and $A_2$*. Small amounts of the secondary LLW generated at the MGR may have sufficient radioactive concentrations (e.g., ion exchange resins) to warrant designation as Type B. For wastes of this type, Type B packaging and associated safety analysis reports for packaging (SARP) for Type B packaging will be required.

Additional packaging and transportation requirements are imposed by 49 CFR 173 Subpart I *Class 7 (Radioactive) Materials* (Section 4.3.1.6). These requirements supplement 10 CFR 71 in many areas, and in particular 49 CFR 173 Subpart I specifies requirements for Type A, B, and C packaging in regard to package labeling, shipping papers and documentation, and transporting vehicles and enclosures.

In addition, 49 CFR 173 allows for the shipment of low specific activity (LSA) liquids under the following restrictions:

- Material in which the Class 7 (radioactive) material is distributed throughout and the average specific activity does not exceed $10^{-4}$ $A_2/g$ for solids and gases, and $10^{-5}A_2/g$ for liquids.

  (49 CFR 173.403 Definitions)

- The shipment is performed in either Type A packaging or in a IM 101 or IM 102 portable tank as defined in 49 CFR 178.270, 178.271, and 178.272 (Section 4.3.1.6). These portable tanks are typically a maximum of 2,500 gallons in volume and have the following physical features:

  - The tank is designed and constructed to Section VIII, Division 1 of the ASME Code (stamp is not required).

  - The tank has a secondary containment system to contain any leakage of the primary tank.

  - An overall external structural protection, such as a jacket, which is rigidly secured to the tank with a layer of cushioning material installed between the external structural protection of the tank; or a complete framework surrounding the tank including both longitudinal and transverse structural members.

  (49 CFR 173.411 Industrial packages)

Liquids which exceed the definition of LSA can only be shipped in limited quantity (approximately 10 liters maximum) and packaged such that an external absorbent material (in a surrounding secondary containment), with sufficient absorbent capacity to absorb twice the available liquid, surrounds the liquid primary container.

### 6.3.3 Requirements for Disposal

Per the requirements of 10 CFR 20.2001 *General Requirements* (Section 4.3.1.4), a licensee shall dispose of licensed material[6] only:

- By transfer to an authorized recipient as provided in 10 CFR 20.2006 or in the regulations in parts 30, 40, 60, 61, 70, or 72 of 10 CFR; or

- By decay in storage; or

[6] *Licensed material* means source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under general or specific license by the NRC (10 CFR 20.1003 *Definitions*).

- By release in effluents within the limits in 10 CFR 20.1301; or
- As authorized under Sections 20.2002, 20.2003, 20.2004, or 20.2005 of 10 CFR.

A person must be specifically licensed to receive waste containing licensed material[7] from other persons for any or all of the following:

- Treatment prior to disposal
- Treatment or disposal by incineration
- Decay in storage
- Disposal at a land disposal facility licensed under 10 CFR 61
- Disposal at a geologic repository under 10 CFR 60

All LLW to be disposed of from the MGR shall be transferred per the requirements in 10 CFR 20 Appendix G *Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests.* These requirements include providing general information, e.g., shipper information, address etc., volume and number of containers, etc., and specific detailed information:

- An apha/numeric identification that uniquely identifies each container.
- A physical description of the disposal container, including the manufacturer and model of any HIC.
- The volume displaced by the disposal container.
- The gross weight of the disposal container, including the waste.
- The maximum radiation level at the surface of each disposal container.

[7] Per guidance presented in Reference 8.6, Key Assumption 082, LLW is to be disposed of at the Nevada Test Site. This analysis does not include any cost allocation for the potential licensing of the Nevada Test Site LLW disposal system.

- A physical and chemical description of the waste.

- The total weight percentage of chelating agent for any waste containing more than 0.1% chelating agent[8] by weight, plus the identity of the principal chelating agent.

- The approximate volume of waste within a container.

- The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name.

- The identities and activities of individual radionuclides contained in each container, the masses of $^{233}U$, $^{235}U$, and plutonium in special nuclear material, and the masses of uranium and thorium in source material. For discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed sources/devices, and wastes in solidification/stabilization media), the identities and activities of individual radionuclides associated with or contained in these waste types within a disposal container shall be reported.

- The total radioactivity within each container.

- For wastes consigned to a disposal facility, the classification of the waste pursuant to Section 61.55 of 10 CFR. Waste not meeting the structural stability requirements of Section 61.55 must be identified.

### 6.3.4 Waste Classification

LLWs, which are acceptable for near-surface disposal, are classified into three classes (10 CFR 61.55 *Waste Classification*) (Section 4.3.1.4):

- Class A Waste – waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in 10 CFR 61.56(a) *Waste Characteristics*. If Class A waste also meets the stability requirements set forth in 10 CFR 61.56(b), it is not necessary to segregate the waste for disposal.

- Class B Waste – waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in 10 CFR 61.56.

[8] Per 10 CFR 61.2 *Definitions*, chelating agents are amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid).

- Class C Waste – waste that not only must meet more rigorous requirements on waste form to ensure stability, but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in 10 CFR 61.56.

LLW that is not generally acceptable for near-surface disposal (i.e., greater-than-Class C Waste) is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in 10 CFR 61, such waste must be disposed of in a geologic repository as defined in 10 CFR 60, unless proposals for disposal of such waste in a disposal site licensed pursuant to 10 CFR 61 are approved by the NRC.

The mechanism utilized for the classification of wastes is presented in Attachment I.

### 6.3.5 Waste Characteristics

Per the requirements of 10 CFR 61.56(a) *Waste Characteristics* (Section 4.3.1.4), the following minimum requirements are imposed for all classes of wastes. These requirements are intended to facilitate handling at the disposal site and provide personnel health and safety protection:

- Waste must not be packaged in cardboard or fiberboard boxes.

- Liquid waste must be solidified or packaged in sufficient absorbent material to absorb twice the volume of liquid.

- Solid waste containing liquid shall contain as little free standing liquid and non-corrosive liquid as reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume.

- Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

- Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with 10 CFR 61.56 (a)(7).

- Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.

- Waste in gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. Total activity must not exceed 100 curies per container.

- Waste containing hazardous, biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practical the potential hazard from the non-radiological materials.

In addition to the minimum requirements imposed by 10 CFR 61.56 (a), additional requirements are imposed by 10 CFR 61.56 (b) to provide stability to the waste:

- Waste must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.

- Notwithstanding the provisions in 10 CFR 61.56 (a), liquid wastes, or wastes containing liquid, must be converted into a form that contains as little free standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.

### 6.3.6 Potential Mixed Waste Requirements

It is not anticipated that any substantial quantities of hazardous wastes or mixed wastes will be generated through the direct activities within the WHB associated with receiving and repackaging of SNF/HLW for disposal at the MGR. It is also not anticipated that any substantial quantities of hazardous wastes or mixed wastes will be generated through the processing of LLW within the WTB. (Assumption 5.7)

If hazardous or mixed waste streams are generated, 40 CFR 261 *Identification and Listing of Hazardous Materials,* (Section 4.3.1.5) 40 CFR 262 *Standards Applicable to Generators of Hazardous Waste,* and 40 CFR 270, *EPA Administered Permit Programs: The Hazardous Waste Permit Program* impose requirements for the disposition of these wastes.

Provisions should be designed into the waste management systems to accommodate packaging and temporary storage of hazardous and mixed wastes. Because this analysis is focused on secondary LLW, additional discussion of options for hazardous or mixed waste is not presented.

It is recommended that future consideration be given to the sharing of licensed temporary storage facilities at the NTS for potential hazardous or mixed waste generated at the MGR.

### 6.3.7 Summary LLW Regulations and Impact to Available Processing/Disposal Options

Section 6.3.1 of this analysis identified the general processing criteria and requirements for liquid and solid radioactive waste at the MGR. This section summarizes these criteria and requirements and suggests what potential options are available for further consideration in light of these criteria and requirements.

#### 6.3.7.1 Potential Options for the Processing/Disposal of Liquid Wastes

Even though liquid wastes can be transferred offsite for processing, i.e., LSA liquids can be bulk transferred offsite for processing, this provision is only intended for the non-routine generator of liquid LLW. It is reasonably probable that the liquid LLW generated by planned continuous operations at the MGR will routinely exceed LSA exemption criteria, and therefore, provisions must be incorporated into the system for the processing of liquid LLW.

These liquid wastes must be immobilized and packaged sufficient for transport and disposal at a licensed near surface disposal facility.

#### 6.3.7.2 Potential Options for Processing/Disposal of Wet-Solid Wastes

The anticipated wet-solid wastes to be generated by operations at the MGR are filter cartridges and spent ion exchange resins. These waste forms will contain substantial quantities of radionuclides and will probably require some form of shielding prior to transporting (Section 7.3.3 of *Secondary Low-Level Waste Generation Rate Analysis,* Reference 8.5). (Assumption 5.8) The requirements for packaging will be the same as those for disposal, and therefore, provisions must be incorporated into the MGR waste processing system to accommodate these waste forms.

#### 6.3.7.3 Potential Options for Processing/Disposal of Solid LLW

As long as the solid LLW generated at the MGR does not contain sufficient radioactivity contamination to warrant packaging as Type B wastes, the solid waste can either be bulk packaged (drums or boxes) for disposal or processed through volume reduction for disposal. If bulk packaging is utilized for waste preparation, the waste can be: 1) disposed at the NTS (Reference 8.11, Section 3.2.5); 2) disposed of at a licensed disposal site; or, 3) transported offsite for processing at a licensed LLW processing facility and then disposed of either at the NTS or a licensed disposal facility.

### 6.3.8 Transuranic Waste Issues

Due to the reasonable potential of receiving spent fuel materials with significant cladding failures, the probability of generating TRU wastes forms is sufficiently high that considerations for provisions within the WHB for the handling of such waste are requisite. Although detailed discussion of this issue is beyond the scope of this analysis, a brief discussion of those provisions is warranted.

The wastes which are generated through the handling of typical spent fuel will be normally LLW where the contaminating constituents are the result of fuel crud particles containing activation products becoming dislodged from the surface of fuel assemblies and ending up in solid and liquid wastes. The regulatory limit for alpha emitting TRU nuclides is low, 100 nano ($10^{-9}$) curies/gram (Table I-1 of Attachment I). It will take only a very small amount of spent fuel debris to cause LLW to be classified as TRU waste, and therefore excluded from near surface LLW disposal facilities (10 CFR 61.55 *Waste Classification*)(Section 4.3.1.4). There are two additional concerns associated with this issue. First, once LLW collection, treatment, and/or packaging equipment become contaminated with alpha emitting TRU material, they may not be readily decontaminated. This will result in continued cross-contamination of LLW. Therefore it is recommended that special waste collection, treatment, and packaging features and equipment be installed in the WHB in areas where TRU contamination is reasonably probable. Second, many alpha emitting materials have the ability to become airborne, and because the major health hazard associated with these materials is through ingestion, special isolation and ventilation provisions should be installed in those areas where a reasonable probability of TRU contamination exists.

## 6.4 WASTE PROCESSING/DISPOSAL OPTIONS

As identified in Section 6.3 the secondary LLW from the processing of SNF/HLW through the MGR will require various treatment and packaging operations prior to their disposition at an acceptable and licensed disposal site. Certain of these processing operations will be required to be performed onsite prior to any shipment of the waste form. The waste processing operations which are required are:

- Radiological/chemical/physical characterization of wastes
- Sorting of DAW to ensure exclusion of hazardous materials
- Packaging of DAW for offsite processing or disposal
- Volume reduction and recycling of recyclable liquids
- Volume reduction of chemical non-recyclable liquids
- Grouting of liquid wastes
- Packaging of grouted liquid wastes
- Packaging of wet-solid wastes (e.g., filter cartridges)

- Solidification and packaging of spent ion exchange resins

Figures IV-1 and IV-2, Attachment IV, present simplified block diagrams of waste treatment operations for aqueous (recyclable) LLW and non-recyclable liquid LLW.

Other processing operations may be performed onsite or at a licensed offsite waste processor/disposal provider. These waste treatment and packaging operations include:

- Additional sorting and survey of DAW for delisting of waste
- Shredding of DAW
- Compaction of DAW

Figure IV-3, Attachment IV, presents a simplified block diagram for solid (DAW) LLW which includes sorting, shredding, and compaction of DAW.

Figure IV-4, Attachment IV, presents a simplified block flow diagram for wet solid LLW processing. Wet solid LLW includes ion exchange resins and used filter cartridges.

### 6.4.1 Identification of Waste Processing/Disposal Options

This subsection presents the various alternative scenarios for processing/disposal of the secondary LLW anticipated to be generated through routine operations at the MGR. The processing of secondary LLW at the WTB, as presented in *Secondary Waste Treatment Analysis,* Reference 8.1, and disposal of applicable wastes at the NTS waste disposal facility is utilized as the baseline processing/disposal scheme which other options are compared against.

The options are:

- Baseline Option: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS.[9] Sorting (including delisting), shredding, and compacting of compactible DAW within the WTB for disposal at the NTS. Packaging of non-compactible DAW within the WTB for disposal at the NTS.

[9] In all options it is assumed that ion exchange resins and filter cartridges are processed/packaged for disposal at the MGR in either the WTB, in the WHB, or in both facilities. (Assumption 5.8) The primary reason for this assumption is that the regulatory requirements for transportation for these waste forms are essentially the same as the requirements for disposal. Therefore, no economic advantage can be achieved by transporting these wastes to an offsite processor.

- Option 1: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS. Bulk packaging in 55 gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at the NTS.

- Option 2: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at a site other than the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at a site other than the NTS. Bulk packaging in 55 gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at a site other than the NTS.

During the preparation of this analysis, early consideration was given to two additional options:

- Shipping of bulk quantities of compactible DAW and non-compactible DAW to an offsite treatment facility for volume reduction and then transport of this material either back to the NTS for disposal or to another NRC approved LLW disposal site.

- Having all LLW processed onsite by an offsite commercial contractor in a facility designed, constructed, and operated by that contractor with LLW disposal at the NTS.

In the case of the first additional option it was determined from the review of Option 2 transportation costs, that costs associated with two-way transportation for this quantity of LLW becomes prohibitive. For this reason, this potential option was discarded, and excluded from further analysis.

In the case of the second additional option, a commercial contractor, preliminary evaluation of studies of similar potential commercialization projects at other DOE facilities indicates no clear conclusion as to potential cost savings. In reality, the MGR will in all probability be operated under a DOE contract, such as a management and operating (M&O) contract, requiring potential contractors have special qualifications and experience in the handling and processing of LLW. Therefore, there is little potential for cost savings due to an experience factor. There is a potential for an offsite contractor being interested in building and operating, for profit, a LLW treatment system which would process and package additional LLW from other private sources along with MGR LLW, thereby creating some economy of scale. Given the remote location of the potential MGR, and the identified costs associated with the transport of LLW to and from such a location, it is unlikely that any real commercial interest would exist. In addition, such a facility would carry certain risk in regard to accomplishment of MGR mission objectives. Those risks include timely licensing for the transport and handling of outside LLW. The risk also exists that unlicensed waste received from outside could result in discontinuity in the LLW license, thereby stopping MGR operations in that interim. For these reasons, the potential option of having LLW processed onsite by an offsite commercial contractor was deemed unreasonable and removed from further consideration within this analysis. If interest exists to further consider this

potential option, it is recommended that the only way to effectively perform additional evaluation would be through the issuance of a DOE contractual instrument, e.g., a request for proposals. An evaluation of this depth is believed to be well beyond the scope of this analysis.

### 6.4.2 Processes and Equipment Requirements for Options

#### 6.4.2.1 Baseline Option Processes and Equipment Requirements

Figure IV-1, Attachment IV, presents a block flow diagram for Aqueous LLW Processing (Recycling). This block flow diagram presents the primary processing steps for the recycling of aqueous LLW. (It should be noted that there is not a one-to-one correlation between the block flow diagram and the equipment requirements).

Table IV-1, Attachment IV, presents a tabulation of LLW processing operations for the Baseline Option, Option 1, and Option 2.

The equipment requirements for recyclable liquid treatment under the Baseline Option (from Reference 8.1) include:

- Recyclable water collection tank
- Recyclable water filters (quantity - 2)
- Filtered recyclable water surge tank
- Recyclable water evaporator
- Evaporator overheads condenser
- Evaporator overheads surge tank
- Recyclable water ion exchange
- Recycle water surge tanks (quantity -2)
- Pumps (quantity – 5)

Figure IV-2, Attachment IV, presents a block flow diagram for non-recyclable liquid LLW processing. This block flow diagram presents the primary processing steps for the recycling of aqueous LLW. (It should be noted that there is not a one-to-one correlation between the block flow diagram and the equipment requirements).

The equipment requirements for non-recyclable liquid treatment under the Baseline Option include:

- WTB floor drain collection tank
- Non-recyclable liquid waste collection tank

- pH adjustment tank
- Waste drum filling station
- Cement hopper
- Cement feeder
- Drum mixing stations (quantity -2)
- Pumps (quantity – 3)

Figure IV-3, Attachment IV, presents a simplified block flow diagram for solid (DAW) LLW processing, and Figure IV-4, Attachment IV, presents a simplified block flow diagram for wet-solid LLW processing. These block flow diagrams present the primary processing steps for the processing of solid LLW. (It should be noted that there is not a one-to-one correlation between the block flow diagram and the equipment requirements; tabulation of equipment is presented in Table IV-1, Attachment IV).

The equipment requirements for wet-solid LLW packaging under the Baseline Option include:

- Ion exchange mix tank
- Grouting station
- Ion exchange loading station
- Cartridge filter loading station

The equipment requirements for DAW processing and packaging under the Baseline Option include:

- Oversize solid waste sizing and packaging glovebox
- Solid LLW sorting glovebox
- Pre-shredder sorting glovebox
- LLW shredder/drum filling station
- LLW compactor
- Truck loading area equipment

### 6.4.2.2 Option 1 Processes and Equipment Requirements

The equipment requirements for recyclable liquid treatment under Option 1 include:
(Refer to Figure IV-1 and Table IV-1, Attachment IV)

- Recyclable water collection tank
- Recyclable water filters (quantity - 2)

- Filtered recyclable water surge tank
- Recyclable water evaporator
- Evaporator overheads condenser
- Evaporator overheads surge tank
- Recyclable water ion exchange
- Recycle water surge tanks (quantity - 2)
- Pumps (quantity – 5)

The equipment requirements for non-recyclable liquid treatment under Option 1 include: (Refer to Figures IV-1 and IV-2, and Table IV-1, Attachment IV)

- WTB floor drain collection tank
- Aqueous chemical waste collection tank
- pH adjustment tank
- Waste drum filling station
- Cement hopper
- Cement feeder
- Drum mixing stations (quantity -2)
- Pumps (quantity – 3)

The equipment requirements for wet-solid LLW packaging under Option 1 include: (Refer to Figure IV-4, and Table IV-1, Attachment IV)

- Ion exchange mix tank
- Grouting station
- Ion exchange loading station
- Cartridge filter loading station

The equipment requirements for DAW processing and packaging under Option 1 include: (Refer Table IV-1, Attachment IV)

- Sorting and classifying station
- Drum loading station
- Truck loading area equipment

### 6.4.2.3 Option 2 Processes and Equipment Requirements

Same as Option 1.

### 6.4.3 Facility Requirements for Baseline Option and Options 1 and 2

The facility requirement for the Baseline Option is the WTB as presented in *Surface Nuclear Facilities Space Program Analysis,* Reference 8.13, Section 7.3.6. Table 6-3 presents these space allocations for the WTB identified in Reference 8.13 in the first sub-column of the Floor Area column. Figure V-1, Attachment V, depicts the floor layout of the WTB as presented in Figure 4 of Attachment I, Reference 8.13. From Figure V-1, it can be seen that the space allocated for waste treatment is approximately 150 ft by 260 ft (39,000 $ft^2$). This is slightly larger than the minimum process area required in Section 7.3.6, Reference 8.13, of 37,600 $ft^2$. Because costs estimates used in economic evaluations presented in the analysis are based on the building layout drawings of Attachment I, Reference 8.13, the space allocations in the WTB are adjusted upward in the second sub-column of the Floor Area column of Table 7-3. For example:

Total Process Area from Table 7.3-2 of Reference 8.13 - 37,600 $ft^2$
Total Process Area from Figure 4, Attachment I of Reference 8.13 - 39,000 $ft^2$
Non-recyclable liquid LLW Processing Space from Table 7-3 (taken from Reference 8.13) is 7,000 $ft^2$.

Adjusted non-recyclable liquid LLW processing space is 7000 $ft^2$ x (39,000 $ft^2$/37,600 $ft^2$) = 7,260.6 $ft^2$ ; rounded to 7,300 $ft^2$.

This same ratio is applied to all the various space allocations in the WTB to yield a total estimated space of 67,100 $ft^2$.

Table 6-3. WTB Space Allocations – Baseline Option

| Facility Areas/Spaces | Floor Area ($ft^2$) | | | | Space Height (ft) |
|---|---|---|---|---|---|
| | Minimum Space | Adjusted Space | Sub Area | Area | |
| **Process Area** | | | | | |
| Low-Level Waste | | | | | |
| Non-Recyclable Liquid LLW Processing | 7,000 | 7,300 | | | 28 |
| Solid LLW Processing | 10,600 | 11,000 | | | 20 |
| Recyclable Liquid LLW Processing | 13,300 | 13,800 | | | 34 (recycled water tank)<br>28 (remaining) |
| Circulation Corridors | 5,900 | 6,100 | | | 20 |
| Subtotal LLW Processing | | | 38,200 | | |
| Mixed and Hazardous Waste Staging | 800 | 830 | | | |
| Total Process Area | | | | 39,030 | |
| **Facility Support Areas** | | | | | |
| Security | 450 | 470 | 470 | | 9 |
| Operations | 5,620 | 5,830 | 5,830 | | 9 and 12 |
| Administration | 1,990 | 2,060 | 2,060 | | 9 |
| Circulation | 1,140 | 1,180 | 1,180 | | 9 |
| Total Facility Support Areas | | | | 9,540 | |
| **HVAC Equipment Areas** | | | | | |
| Total HVAC Equipment Areas | 15,800 | 16,390 | 16,390 | 16,390 | |
| **Miscellaneous Building Support Areas** | | | | | |
| Total Miscellaneous Building Support Areas | 2,100 | 2,180 | 2,180 | 2,180 | |
| **Total Waste Treatment Building (Rounded Area)** | | | | **67,100 $ft^2$** | |

The estimated space requirements for Options 1 and 2 are presented in Table 6-4. These options do not require space for Solid LLW processing. A space allocation of 800 $ft^2$ is allocated for the bulk packaging of Solid LLW. (Assumption 5.9)

Table 6-4. WTB Space Allocations for Options 1 and 2

| Facility Areas/Spaces | Floor Area ($ft^2$) | | | | Space Height (ft) |
|---|---|---|---|---|---|
| | Minimum Space | Adjusted Space | Sub Area | Area | |
| **Process Area** | | | | | |
| Low-Level Waste | | | | | |
| Non-Recyclable Liquid LLW Processing | 7,000 | 7,300 | | | 28 |
| Solid LLW Bulk Packaging | 800 (Assumption 5.9) | 800 (Assumption 5.9) | | | 20 |
| Recyclable Liquid LLW Processing | 13,300 | 13,800 | | | 34 (recycled water tank) 28 (remaining) |
| Circulation Corridors | 4,000 | 4,200 | | | 20 |
| Subtotal LLW Processing | | | 26,100 | | |
| Mixed and Hazardous Waste Staging | 800 | 830 | | | |
| Total Process Area | | | | 26,930 | |
| **Facility Support Areas** | | | | | |
| Security | 450 | 470 | 470 | | 9 |
| Operations | 3,880 | 4,020 | 4,020 | | 9 and 12 |
| Administration | 1,370 | 1,420 | 1,420 | | 9 |
| Circulation | 790 | 820 | 820 | | 9 |
| Total Facility Support Areas | | | | 6,730 | |
| **HVAC Equipment Areas** | | | | | |
| Total HVAC Equipment Areas | 10,900 | 11,300 | 11,300 | 11,300 | |
| **Miscellaneous Building Support Areas** | | | | | |
| Total Miscellaneous Building Support Areas | 1,450 | 1,500 | 1,500 | 1,500 | |
| **Total Waste Treatment Building (Rounded Area)** | | | | **46,400 $ft^2$** | |

Because the minimum process space requirements will decrease under Options 1 and 2 from (7,000 $ft^2$ + 10,600 $ft^2$ + 13,300 $ft^2$ =) 30,900 $ft^2$ to (7,000 $ft^2$ + 13,300 $ft^2$ =) 20,300 $ft^2$, the required circulation corridor space will also decrease. Page 94 of Reference 8.13 used a factor of 0.19 for the calculation of required corridor space. Using this factor the required circulation corridor space for Options 1 and 2 is estimated at:

0.19 x 21,100 $ft^2$ = 4,009 $ft^2$, rounded to 4,000 $ft^2$.

The minimum space requirements for Facility Support Areas, HVAC Equipment Areas, and Miscellaneous Building Support Areas are expected to decrease under Options 1 and 2. It is assumed that these space requirements will decrease as a direct function of the decrease in process space requirements[10] (Assumption 5.10). These minimum space requirements have been recalculated using the factor of (26,900 $ft^2$/39,000 $ft^2$), or approximately, 0.69. For example, the Operations minimum space requirement is projected to decrease from 5,620 $ft^2$ to (5,620 $ft^2$ x 0.69 =) 3,877.8 $ft^2$, rounded to 3,880 $ft^2$.

For consistency, these minimum factored support areas have been adjusted using the same adjustment factor as employed in Table 6-3 for the Baseline Option. For example operations minimum space requirement of 3,880 $ft^2$ is adjusted by the same ratio of 39,000 $ft^2$/37,600 $ft^2$, the adjusted value is 4,024 $ft^2$, rounded to 4,020 $ft^2$. Estimated total space requirements for the WTB under Options 1 and 2 is 46,400 $ft^2$.

## 6.5 EVALUATIONS OF OPTIONS

This section presents cost analysis for the Baseline Option, Option 1, and Option 2. Capital costs, operating costs, decontamination and decommissioning costs, and life-cycle costs are estimated in 1999 dollars for the options. In addition to the cost estimates presented in this section, Attachment VI presents estimated life-cycle costs on a year-to-year basis.

### 6.5.1 Evaluation of Baseline Option

The Baseline Option includes processing of both liquid and solid LLW to a form suitable for disposal at the waste management complex located on the NTS. Cost analysis is in constant FY 1999 dollars. Cost data is provided by Reference 8.9.

[10] This excludes the space allocation for Security which is expected to be independent of operational space requirements (Assumption 5.10).

### 6.5.1.1 Capital Costs of WTB – Baseline Option

The total estimated cost (TEC) of the WTB under the Baseline Option is:

| | | |
|---|---|---|
| Direct Field Cost (DFC) | | |
| Direct Labor | $5,110,000 | |
| Material | 4,514,000 | |
| Equipment | 4,276,000 | |
| Subcontract | 2,895,000 | |
| Subtotal DFC | | $16,795,000 |
| Indirect Field Cost | | 5,740,000 |
| Engineering Design and Inspection | | 4,282,000 |
| Construction Management | | 1,803,000 |
| Total Estimated Cost | | $28,620,000 |

### 6.5.1.2 Estimated Operating Costs for Baseline Option

This estimate assumes that operations start one year prior to start of processing SNF through the MGR. This first year is utilized for operating procedure development, operator training, and waste process system checkout. The WTB then operates at full staff from the year 2010 through 2033 during emplacement operations. An additional year is then allocated for the processing of residual waste from SNF handling operations and for the cleanout and mothballing of WTB process equipment. The total operating span is therefore assumed at twenty-six years. (Assumption 5.11)

Operating costs include the following elements:

- Operating labor
- Maintenance
- Waste disposal costs (transportation and burial)
- Operating materials and consumables
- Utility costs

**Operating Labor**

From Table 6-1 of Reference 8.14, *Monitored Geologic Repository Operations Staffing Report,* the Baseline Option would utilize 26 operators. The support staff for the WTB is identified as 12 personnel. The total staff is 38 personnel.

The average cost per personnel is $93,500/yr. Cost data is provided by Reference 8.9. The total operating labor cost is therefore estimated at:

$93,500/personnel/yr x 38 personnel x 26 yr = $92,378,000

**Maintenance Costs**

Maintenance costs are estimated at 5 percent/yr of operation of the sum of initial material costs, plus equipment costs, plus 50 percent of subcontract cost (Reference 8.9). The estimated maintenance cost for the Baseline Option is therefore:

0.05 x ($4,514,000 + $4,276,000 + 0.5 x $2,895,000)/yr x 26 yr = $13,308,750, rounded to $13,309,000.

**Waste Disposal Costs**

The first step in estimating the LLW disposal costs is to define the waste volumes going to disposal. Section 6.2 of this analysis defined the estimated quantities of wastes generated by MGR operations. Table 6-2 identified the total LLW quantities as:

| | |
|---|---|
| Compactible DAW | 919,000 $ft^3$ |
| Non-compactible DAW | 723,500 $ft^3$ |
| Ion exchange resins | 28,750 $ft^3$ |
| Filter cartridges | 28,750 $ft^3$ |
| Recyclable liquid | 4,658,700 gal |
| Non-recyclable liquid | 1,645,600 gal |

The compactible waste is sorted, shredded, and compacted into 55-gallon drums. The process of sorting the waste includes the use of radiological instrumentation to define contamination levels. This sorting process identifies a portion of the DAW with radiological counts less than 100 counts/minute above background which allows the waste to be de-listed as non-radiological waste. It is assumed that 30% of the DAW (both compactible and non-compactible) which is sorted is de-listed waste (Assumption 5.12). The amount of compactible DAW and non-compactible DAW requiring disposal is thereby reduced to (919,000 $ft^3$ x 0.7 =) 643,300 $ft^3$ and (723,500 $ft^3$ x 0.7 =) 506,450 $ft^3$, respectively. The assumed density of compacted waste is 40 $lb/ft^3$ and it is assumed that waste drums are filled to 80 percent of their 55-gal capacity. (Assumption 5.13) The volume of compactible waste is therefore reduced by a factor of from 6 $lb/ft^3$ (see Section 6.2.1) to 40 $lb/ft^3$, or, (6/40 =) 0.15. The disposed of compacted waste is therefore approximately (643,300 $ft^3$ x 0.15 =) 96,500 $ft^3$ (rounded). Using a conversion factor of

7.48 gal/ft$^3$, this waste will be packaged into [96,500 ft$^3$ /(0.80 x 55 gal/7.48 gal/ ft$^3$ )=] 16,405 55-gal drums.

Non-compactible waste is packaged directly into 55-gal drums with an assumed 80% fill factor. The total number of drums is therefore estimated at approximately [506,450 ft$^3$ /(0.80 x 55 gal/7.48 gal/ ft$^3$ )=] 86,097 55-gal drums.

Recyclable liquid is processed through an evaporator where the disposed of volume is reduced by approximately 90% (Assumption 4.3.12 of Reference 8.1). This results in a volume of liquid to be made into grout of approximately (4,658,700 gal x 0.10 =) 465,870 gal. The total liquid volume to be made into grout is the sum of this concentrated recyclable liquid and the non-recyclable liquid, or (465,870 gal + 1,645,600 gal =) 2,111,470 gal.

The assumed density of the liquid waste to be grouted is 65 lb/ft$^3$ (Assumption 5.14). The weight of the liquid waste to be grouted is therefore approximately (2,111,470 gal/7.48 gal/ft$^3$ x 65 lb/ft$^3$ =) 18,348,336 lb. The ratio of portland cement to liquid waste is 1 lb of portland cement/0.45 lb of liquid waste (Assumption 4.3.14 of Reference 8.1). The total weight of grout is therefore approximately (18,348,336 lb + 18,348,336 lb/0.45 =) 59,122,416 lb. Using a density for grout of 196 lb/ft$^3$ (page 3-90 of Reference 8.7), the volume of grouted waste is approximately (7.48 gal/ft$^3$ x 59,122,416 lb/196 lb/ft$^3$ =) 2,256,304 gal. Assuming a fill of 90% for grout into 55-gal drums (Assumption 5.15) the total number of drums of grout is approximately [2,256,304 gal/(0.9 x 55 gal/drum) =] 45,582 55-gal drums.

From Section 7.3.2 of Reference 8.5, liquid LLW is estimated to have an average primary radionuclide content of:

$^{60}$Co - 1 x 10$^{-3}$ micro Ci/ml

$^{137}$Cs - 1.5 x 10$^{-3}$ micro Ci/ml

The concentration of primary radionuclides for the concentrated recyclable LLW would be nine times the feed concentration, approximately [9 x (1 x 10$^{-3}$ micro Ci/ml for $^{60}$Co + 1.5 x 10$^{-3}$ micro Ci/ml for $^{137}$Cs ) =] 9 x 10$^{-3}$ micro Ci/ml for $^{60}$Co + 1.35 x 10$^{-2}$ micro Ci/ml for $^{137}$Cs. The average concentration of the primary radionuclides in the mixture of concentrated recyclable LLW and non-recyclable liquid LLW to be grouted is:

Concentration of $^{60}$Co = 9 x 10$^{-6}$ Ci/L x 3.785 L/gal x 465,870 gal
+ 1 x 10$^{-6}$ Ci/L x 3.785 L/gal x 1,645,600 gal)/2,111,470 gal
= 1.05 x 10$^{-5}$ Ci/gal (rounded)

Concentration of $^{137}$Cs = (1.35 x 10$^{-5}$ Ci/L x 3.785 L/gal x 465,640 gal

$+ 1.5 \times 10^{-6}$ Ci/L x 3.785 L/gal x 1,644,600 gal)/2,110,240 gal
$= 1.57 \times 10^{-5}$ Ci/gal

These concentrations are then converted as follows:

Concentration of $^{60}Co = 1.05 \times 10^{-5}$ Ci/gal x 7.48 gal/ft$^3$ $= 7.85 \times 10^{-5}$ Ci/ft$^3$

Concentration of $^{137}Cs = 1.57 \times 10^{-5}$ Ci/gal x 7.48 gal/ft$^3$ $= 1.17 \times 10^{-4}$ Ci/ft$^3$

Dividing by the density of mixture of 65 lb/ft$^3$:

Concentration of $^{60}Co = 7.85 \times 10^{-5}$ Ci/ft$^3$/65 lb/ft$^3$ $= 1.21 \times 10^{-6}$ Ci/lb

Concentration of $^{137}Cs = 1.17 \times 10^{-4}$ Ci/ft$^3$/65 lb/ft$^3$ $= 1.80 \times 10^{-6}$ Ci/lb

Using the grout recipe from above, the average concentration of the primary radionuclides is:

Concentration of $^{60}Co = 1.21 \times 10^{-6}$ Ci/lb x 0.45 lb liquid/lb cement/1.45 lb grout
$= 3.8 \times 10^{-7}$ Ci/lb grout

Concentration of $^{137}Cs = 1.80 \times 10^{-6}$ Ci/lb x 0.45 lb liquid/lb cement/1.45 lb grout
$= 5.6 \times 10^{-7}$ Ci/lb grout

or, using density of grout of 196 lb/ft$^3$ (page 3-90 of Reference 8.7):

Concentration of $^{60}Co = 3.8 \times 10^{-7}$ Ci/lb grout x 196 lb/ft$^3$ $= 7.4 \times 10^{-5}$ Ci/ft$^3$

Concentration of $^{137}Cs = 5.6 \times 10^{-7}$ Ci/lb grout x 196 lb/ft$^3$ $= 1.1 \times 10^{-4}$ Ci/ft$^3$

or, using the conversion of 1 ft$^3$ = 0.028317 m$^3$

Concentration of $^{60}Co = 7.4 \times 10^{-5}$ Ci/ft$^3$/0.028317 m$^3$/ft$^3$ $= 2.6 \times 10^{-3}$ Ci/m$^3$

Concentration of $^{137}Cs = 1.1 \times 10^{-4}$ Ci/ft$^3$/0.028317 m$^3$/ft$^3$ $= 3.9 \times 10^{-3}$ Ci/m$^3$

Attachment I identifies the methodology of waste classification as dictated by 10 CFR 61 (Section 4.3.1.4). Using the concentrations for the average primary radionuclides in the grout product derived above, the waste is classified as follows:

- The waste is screened against Table I-1, and determined that it does not contain the identified long-lived radionuclides.

- The waste is screened against Table I-2, for Class A waste, to determine short-lived radionuclide concentrations.

  Concentration of $^{60}Co = 2.6 \times 10^{-3}$ Ci/m$^3$ < 700 Ci/m$^3$

  Concentration of $^{137}Cs = 3.9 \times 10^{-3}$ Ci/m$^3$ < 1 Ci/m$^3$

- The waste is then screened to ensure the sum of the fractions is less than 1.

  Concentration of $^{60}Co = 2.6 \times 10^{-3}$ Ci/m$^3$ / 700 Ci/m$^3$ = $3.7 \times 10^{-6}$

  Concentration of $^{137}Cs = 3.9 \times 10^{-3}$ Ci/m$^3$ / 1 Ci/m$^3$ = $3.9 \times 10^{-3}$

- Since the sum of the fractions is less than 1 for the Class A concentration, the waste is classified as Class A waste.

The wet-solid LLW (resin and filter cartridges) will be placed into 55-gal shielded high-integrity containers (HIC). Assuming a 90 percent fill of these HICs for ion exchange resin and a 60 percent fill for filter cartridges (Assumption 5.16), the total number of HICs will be approximately [(28,750 ft$^3$ x 7.48 gal/ft$^3$/0.90 x 55 gal) + (28,750 ft$^3$ x 7.48 gal/ft$^3$/0.60 x 55 gal) =] 10,862 HICs.

The total waste to be shipped is therefore (16,405 55-gal drums + 86,097 55-gal drums + 45,582 55-gal drums =) 148,084 55-gal drums, and 10,862 HICs.

A forty-eight foot trailer can carry 88 drums (Reference 8.15, page 8), the number of shipments is therefore [(148,084 + 10,862)/88 =] 1807 trips. The estimated distance is 30 miles. The cost of shipping the waste from the MGR to the NTS waste management complex is calculated at $5.94/mile plus a flat fee of $880/shipment. (Reference 8.15, page 8). The total estimated cost for transportation is therefore ($880/shipment x 1807 shipments + 1807 shipments x 30 mile/shipment x $5.94/mile =) $1,912,167.

Disposal fees at the NTS are $8.50/ft$^3$ (Reference 8.9). The total disposed waste volume is approximately [(55 gal/7.78 gal/ft$^3$) x (148,084 drums + 10,862 HICs) = ] 1,168,720 ft$^3$. The estimated total disposal cost is therefore (1,168,720 ft$^3$ x $8.50/ft$^3$ =) $9,934,120.

Total disposal costs (transportation plus disposal fee) is estimated at ($1,912,167 + $9,934,120=) $11,846,287, rounded to $11,846,000.

**Operating Materials and Consumables Costs**

The operating materials and consumables are comprised of primarily of packaging materials for waste disposal (55-gal drums and HICs) and portland cement. Small amounts of sulfuric acid and caustic soda (liquid) will be consumed for the neutralization of liquid waste prior to grouting. Because the amounts of acid and caustic are minimal in comparison to waste packaging materials, these items are omitted from this cost analysis.

The cost of 55-gal drums is $55/drum (including plastic liner) and the cost of HICs is $500/HIC. The total packaging materials costs are therefore estimated at approximately (148,084 55-gal drums x $55/drum + 10,862 HICs x $500/HIC = ) $13,575,620.

The total quantity of portland cement is (18,348,336 lb of liquid/0.45 lb of liquid/lb of cement =) 40,774,080 lb of cement. The density of dry, bulk, loose portland cement is 94 lb/$ft^3$ (Reference 8.7, page 3-90). The total volume of portland cement is therefore approximately (40,774,080 lb/ 94 lb/$ft^3$ =) 433,767 $ft^3$ = 16,065 $yd^3$. The cost of portland cement is $65/$yd^3$. The total cost for portland cement is approximately (16,065 $yd^3$ x $65/$yd^3$ =) $1,044,225.

The total for operating materials and consumables is ($13,575,620 + $1,044,225 =) $14,619,845, rounded to $14,620,000.

**Utility Costs**

Utility costs are estimated at $5.00/$ft^2$ of building/yr. The total estimated utility cost are therefore (67,100 $ft^2$ x $5.00/$ft^2$/yr x 26 yr =) $8,723,000 for the Baseline Option.

**Total Operating Costs**

The total operating cost for the Baseline Option is therefore estimated at ($92,378,000 + $13,309,000 + $11,846,000 + $14,620,000 + $8,723,000 =) $140,876,000.

### 6.5.1.3 Decommissioning Costs for the Baseline Option

Decommissioning costs are estimated at 15% of total facility cost (TFC) (Reference 8.9), see Section 6.5.1.1. TFC is comprised of DFC plus indirect field cost, and is therefore estimated at ($16,795,000 + $5,740,000 =) $22,535,000. The estimated decommissioning costs are ($22,535,000 x 0.15 =) $3,380,250, rounded to $3,380,000.

### 6.5.1.4 Life Cycle Cost for Baseline Option

Life cycle cost for the Baseline Option is the sum of capital costs, operating costs, and decommissioning costs. The total estimated lifecycle cost (in FY 1999 dollars) for the Baseline Option, i.e., the WTB as presently configured, is ($28,620,000 + $140,876,000 + $3,380,000 =) $172,876,000.

### 6.5.2 Evaluation of Option 1

Option 1 consists of the treatment/solidifcation/packaging of liquid wastes within the WTB for disposal at the NTS. Option 1 also includes dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS, and bulk packaging of DAW (both compactible and non-compactible) with disposal of the packaged DAW at the NTS.

### 6.5.2.1 Capital Costs of Option 1

The total estimated cost (TEC) of the WTB under Option 1 is (Reference 8.9):

| | | |
|---|---|---|
| Direct Field Cost (DFC) | | |
| Direct Labor | $3,612,000 | |
| Material | 3,233,000 | |
| Equipment | 2,178,000 | |
| Subcontract | 1,186,000 | |
| Subtotal DFC | | $10,209,000 |
| Indirect Field Cost | | 3,502,000 |
| Engineering Design and Inspection | | 2,605,000 |
| Construction Management | | 1,098,000 |
| Total Estimated Cost | | $17,414,000 |

### 6.5.2.2 Estimated Operating Costs for Option 1

As with the Baseline Option, this estimate assumes that operations initiate one year prior to start of processing SNF through the MGR. This first year is utilized for operating procedure development, operator training, and waste process system checkout. The WTB then operates at full staff from the year 2010 through 2033 during emplacement operations. An additional year is then allocated for the processing of residual waste from SNF handling operations and for the cleanout and mothballing of WTB process equipment. The total operating span is therefore assumed at twenty-six years. (Assumption 5.11)

Operating costs include the following elements:

- Operating labor
- Maintenance
- Waste disposal costs (transportation and burial)
- Operating materials and consumables
- Utility costs

**Operating Labor**

From Table 6-1 of Reference 8.14, *Monitored Geologic Repository Operations Staffing Report,* the Baseline Option would utilize 26 operators. It is assumed that the operating staff for Options 1 and 2 would be one-half the operating staff for the Baseline Option plus eight personnel for the bulk packaging of solid wastes[11] (Assumption 5.17). This equates to an operating staff of (26 operators x 0.50 + 8 operators =) 21 operators.

Support/management staff size is 12 personnel; this staff size should not change appreciably between the Baseline Option and Options 1 and 2. The average cost per personnel is $93,500/yr (Reference 8.9). The total operating labor cost is therefore estimated at:

$93,500/personnel/yr x 33 personnel x 26 yr = $80,223,000.

**Maintenance Costs**

Maintenance costs are estimated at 5 percent/yr of operation of the sum of initial material costs, plus equipment costs, plus 50 percent of subcontract cost. Cost data is provided by Reference 8.9.

The estimated maintenance cost for Option 1 is therefore:

0.05 x ($3,233,000 + $2,178,000 + 0.5 x $1,186,000)/yr x 26 yr = $7,805,200, rounded to $7,805,000.

[11] These personnel will be utilized in rough sorting of DAW to ensure that hazardous waste materials are not inadvertently included in wastes, perform required regulatory waste counting and classification, and the loading of DAW into drums for disposal.

**Waste Disposal Costs**

The first step in estimating the LLW disposal costs is to define the waste volumes going to disposal. Section 6.2 of this analysis defined the estimated quantities of wastes generated by MGR operations for the Baseline Option. Under Option 1, two changes in inputs occur from the inputs for the Baseline Option 1: 1) the minimum[12] square footage of the WTB is reduced from 38,600 $ft^2$ to 25,100 $ft^2$; and, 2) the number of operators for WTB operations is reduced from 26 personnel to 21 personnel and therefore the total number of radiation area working operators (WHB and WTB) is reduced from 143 to 138.

The estimated quantities of LLW generated under Option 1 are caluculated through the same methods used in Section 6.2 for the Baseline Option. These two changes result in reductions in the amount of LLW generated under Option 1 in comparison to the Baseline Option. Tables III-25 through III-48 of Attachment III present the estimated annual quantities of LLW generated under Option 1. Table 6-5 presents a summary of the estimated LLW quantities from Attachment III for Option 1.

For Option 1, the compactible waste is placed directly into 55-gallon drums. The assumed density of compactible waste is 6 lb/$ft^3$ and it is assumed that waste drums are filled to 80% of their 55-gal capacity (Assumption 5.13). Using a conversion factor of 7.48 gal/$ft^3$, this waste will be packaged into [901,300 $ft^3$ / (0.80 x 55 gal/7.48 gal/ $ft^3$ ) = ] 153,221 55-gal drums.

Non-compactible waste is packaged directly into 55-gal drums with an assumed 80% fill factor. The total number of drums is therefore estimated at approximately (709,800 $ft^3$ / (0.80 x 55 gal/7.48 gal/ $ft^3$ =) 120,666 55-gal drums.

Recyclable liquid is processed through an evaporator where the disposed volume is reduced by approximately 90% (Assumption 4.3.12 of Reference 8.1). This results in a volume of liquid to be made into grout of approximately (4,618,200 gal x 0.10 =) 461,820 gal. The total liquid volume to be made into grout is the sum of this condensed recyclable liquid and the non-recyclable liquid, or (461,820 gal + 1,627,500 gal =) 2,089,320 gal.

The assumed density of the liquid waste to be grouted is 65 lb/$ft^3$ (Assumption 5.14). The weight of the liquid waste to be grouted is therefore approximately (2,089,320 gal/7.48 gal/$ft^3$ x 65 lb/$ft^3$ =) 18,155,856 lb. The ratio of portland cement to liquid waste is 1 lb of portland cement/0.45 lb of liquid waste (Reference 8.1). The total weight of grout is therefore approximately (18,155,856 lb + 18,155,856 lb/0.45 =) 58,502,200 lb. Using a density for grout of 196 lb/$ft^3$ (Reference 8.7, page 3-90), the volume of grout waste is approximately (7.48 gal/$ft^3$

[12] Minimum square footages are utilized in these calculations because the LLW rate factors were generated utilizing the estimated minimum square footages.

x 58,502,200 lb/196 lb/$ft^3$ =) 2,232,635 gal. Assuming a fill of 90% for grout into 55-gal drums (Assumption 5.15) the total number of drums of grout is approximately [2,232,635 gal/(0.9 x 55 gal/drum ) =] 45,104 55-gal drums.

The wet-solid LLW (resin and filter cartridges) will be placed into 55-gal shielded high-integrity containers (HIC). Assuming a 90 percent fill of these HICs for ion exchange resin and a 60 percent fill for filter cartridges (Assumption 5.16), the total number of HICs will be approximately [28,690 $ft^3$ x 7.48 gal/$ft^3$/(0.90 x 55 gal) + 28,690 $ft^3$ x 7.48 gal/$ft^3$/(0.60 x 55 gal) =] 10,839 HICs.

The total waste to be shipped is therefore (153,221 55-gal drums + 120,666 55-gal drums + 45,104 55-gal drums =) 318,991 55-gal drums, and 10,839 HICs.

Table 6-5. Summary Secondary LLW for Option 1

| Year | Compactible DAW ($ft^3$/yr) | Non-Compactible DAW ($ft^3$/yr) | Wet-Solid LLW ($ft^3$/yr) | | Liquid LLW (gal/yr) | |
|---|---|---|---|---|---|---|
| | | | Ion-Exchange Resins | Filter [a]Cartridges | Recyclable Liquid | Chemical Liquid |
| 2010 | 23,500 | 18,400 | 290 | 290 | 126,700 | 55,000 |
| 2011 | 25,000 | 19,600 | 420 | 420 | 131,200 | 55,900 |
| 2012 | 28,200 | 22,200 | 680 | 680 | 141,900 | 58,300 |
| 2013 | 32,300 | 25,400 | 1,020 | 1,020 | 156,900 | 61,800 |
| 2014 | 38,200 | 30,100 | 1,510 | 1,510 | 174,900 | 65,900 |
| 2015 | 41,600 | 32,800 | 1,490 | 1,490 | 200,400 | 68,800 |
| 2016 | 42,800 | 33,700 | 1,580 | 1,580 | 204,800 | 69,700 |
| 2017 | 42,000 | 33,100 | 1,530 | 1,530 | 201,500 | 69,300 |
| 2018 | 42,700 | 33,600 | 1,550 | 1,550 | 206,200 | 70,000 |
| 2019 | 42,500 | 33,500 | 1,530 | 1,530 | 206,700 | 70,400 |
| 2020 | 41,600 | 32,800 | 1,450 | 1,450 | 206,800 | 70,400 |
| 2021 | 40,800 | 32,100 | 1,380 | 1,380 | 206,800 | 70,400 |
| 2022 | 41,100 | 32,400 | 1,440 | 1,440 | 206,400 | 70,800 |
| 2023 | 40,700 | 32,100 | 1,410 | 1,410 | 204,800 | 70,500 |
| 2024 | 40,100 | 31,600 | 1,350 | 1,350 | 205,900 | 70,600 |
| 2025 | 42,100 | 33,200 | 1,510 | 1,510 | 212,600 | 72,400 |
| 2026 | 39,500 | 31,100 | 1,290 | 1,290 | 215,200 | 73,400 |
| 2027 | 39,100 | 30,800 | 1,260 | 1,260 | 211,900 | 72,600 |
| 2028 | 37,800 | 29,800 | 1,160 | 1,160 | 207,700 | 71,300 |
| 2029 | 38,500 | 30,300 | 1,130 | 1,130 | 212,400 | 71,700 |
| 2030 | 38,300 | 30,200 | 1,110 | 1,110 | 213,000 | 71,500 |
| 2031 | 37,900 | 29,900 | 1,080 | 1,080 | 210,100 | 70,900 |
| 2032 | 34,800 | 27,400 | 910 | 910 | 188,100 | 65,000 |
| 2033 | 30,200 | 23,700 | 610 | 610 | 165,300 | 60,900 |
| Totals | 901,300 | 709,800 | 28,690 | 28,690 | 4,618,200 | 1,627,500 |

A 48-foot foot trailer can carry 88 drums (Reference 8.15, page 8), the number of shipments is therefore [(318,991 + 10,839)/88 =] 3,748 trips. The estimated distance is 30 miles. The cost of shipping the waste from the MGR to the NTS waste management complex is calculated at $5.94/mile plus a flat fee of $880/shipment. (Reference 8.15, page 8) The total estimated cost for transportation to the NTS is therefore ($880 x 3,748 + 3,748 x 30 mile/trip x $5.94/mile =) $3,966,134.

Disposal fees at the NTS are $8.50/ft$^3$ (Reference 8.9). The total disposed waste volume is approximately [(55 gal/7.48 gal/ft$^3$) x (318,991 55-gal drums + 10,839 HICs) = ] 2,425,220 ft$^3$. The estimated total disposal cost is therefore (2,425,220 ft$^3$ x $8.50/ft$^3$ =) $20,614,370.

Total disposal costs (transportation plus disposal fee) is estimated at ($3,996,134 + $20,614,370 =) $24,580,504, rounded to $24,581,000.

**Operating Materials and Consumables Costs**

The operating materials and consumables are comprised of primarily of packaging materials for waste disposal (55-gal drums and HICs) and portland cement. Small amounts of sulfuric acid and caustic soda (liquid) will be consumed for the neutralization of liquid waste prior to grouting. Because the amounts of acid and caustic are minimal in comparison to waste packaging materials, these items are omitted from this cost analysis.

The cost of 55-gal drums is $55/drum (including plastic liner) and the cost of HICs is $500/HIC. The total materials costs are therefore estimated at approximately (318,991 55-gal drums x $55/drum + 10,839 HICs x $500/HIC = ) $22,964,005.

The total quantity of portland cement is (18,155,856 lb of liquid/0.45 lb of liquid/lb of cement =) 40,346,347 lb. The density of dry, bulk, loose portland cement is 94 lb/ft$^3$ (Reference 8.7, page 3-90). The total volume of portland cement is therefore approximately (40,346,347 lb/ 94 lb/ft$^3$ =) 429,216 ft$^3$ = 15,897 yd$^3$. The cost of portland cement is $65/yd$^3$. The total cost for portland cement is approximately (15,897 yd$^3$ x $65/yd$^3$ =) $1,033,305.

The total for operating materials and consumables is ($22,964,005 + $1,033,305 =) $23,997,310, rounded to $23,997,000.

**Utility Costs**

Utility costs are estimated at $5.00/ft$^2$ of facility/yr. The total estimated utility cost are therefore (46,400 ft$^2$ x $5.00/ft$^2$/yr x 26 yr =) $6,032,000.

**Total Operating Costs**

The total operating cost for Option 1 is therefore estimated at ($80,223,000 + $7,805,000 + $24,581,000 + $23,997,000 + $6,032,000 =) $142,638,000.

### 6.5.2.3 Decommissioning Costs for the Option 1

Decommissioning costs are estimated at 15 percent of total facility cost (TFC). TFC is comprised of DFC plus indirect field costs, and is therefore estimated at ($10,209,000 + $3,502,000 =) $13,711,000. The estimated decommissioning costs are ($13,711,000 x 0.15 =) $2,056,650, rounded to $2,057,000.

### 6.5.2.4 Life Cycle Cost for Option 1

Life cycle cost for Option 1 is the sum of capital costs, operating costs, and decommissioning costs. The total estimated lifecycle cost (in FY 1999 dollars) for Option 1, i.e., the WTB under Option 1, is ($17,414,000 + $142,638,000 + $2,057,000 =) $162,109,000.

### 6.5.3 Evaluation of Option 2

Option 2 consists of the treatment/solidification/packaging of liquids in the WTB, bulk packaging of DAW, and dewatering and packaging of wet-solid LLW. All LLW will be disposed of at a site other than the NTS.

### 6.5.3.1 Capital Costs of Option 2

The total estimated cost (TEC) of the WTB under Option 2, is the same as Option 1, or:

| | | |
|---|---|---|
| Direct Field Cost (DFC) | | |
| Direct Labor | $3,612,000 | |
| Material | 3,233,000 | |
| Equipment | 2,178,000 | |
| Subcontract | 1,186,000 | |
| Subtotal DFC | | $10,209,000 |
| Indirect Field Cost | | 3,502,000 |
| Engineering Design and Inspection | | 2,605,000 |
| Construction Management | | 1,098,000 |
| Total Estimated Cost | | $17,414,000 |

### 6.5.3.2 Estimated Operating Costs for Option 2

As with the Baseline Option, this estimate assumes that operations initiate one year prior to start of processing SNF through the MGR. This first year is utilized for operating procedure development, operator training, and waste process system checkout. The WTB then operates at full staff from the year 2010 through 2033 during emplacement operations. An additional year is then allocated for the processing of residual waste from SNF handling operations and for the cleanout and mothballing of WTB process equipment. The total operating span is therefore assumed at twenty-six years. (Assumption 5.11)

Operating costs include the following elements:

- Operating labor
- Maintenance
- Waste disposal costs (transportation and burial)
- Operating materials and consumables
- Utility costs

**Operating Labor**

Operating labor for Option 2 is estimated in the same manner and the same operating personnel as Option 1. The estimated operating labor cost is $80,223,000.

**Maintenance Costs**

Maintenance costs for Option 2 are the estimated in the same manner and the same level as Option 1. The estimated maintenance cost is $7,805,000.

**Waste Disposal Costs**

The first step in estimating the LLW disposal costs is to define the waste volumes going to disposal. The estimated quantities of LLW are the same, both as generated and packaged for disposal, as Option 1. The waste disposal costs under Option 2 will be different than Option 1 in that under Option 2 waste is transported offsite for disposal. Therefore, both transportation and disposal costs will be different.

There are three sites presently available and NRC licensed for disposal of these types of LLW (Reference *Radioactive Waste: Production, Storage, Disposal* (NUREG/BR-0216) (Section 4.3.2). These sites are the U.S. Ecology site on the Hanford Reservation (U.S. DOE), near

Richland, Washington; the Envirocare of Utah site, near Clive, Utah; and the ChemNuclear site, near Barnwell, South Carolina. The Envirocare site has recently been licensed to accept certain Class A wastes which have $^{137}Cs$ and $^{60}Co$ levels substantially lower than normal NRC Class A limits (Reference 8.16). Because of this restriction, the Envirocare site was excluded from further analysis.[13] The U.S. Ecology site is utilized in this analysis due to its closer proximity to the Yucca Mountain site, and disposal fees at the U.S. Ecology site are approximately one-third the cost of disposal fees at the ChemNuclear site.

The same number of shipments are required as Option 1, i.e., 3748 shipments. The estimated distance is 1162 miles. The cost of shipping the waste from the MGR to the Washington site is calculated at $4.00/mile plus a flat fee of $880/shipment (Reference 8.15, pages 4, 5, and 8). The total estimated cost for transportation to Washington is therefore ($880 x 3748 shipments + 3748 shipments x 1162 mile/shipment x $4.00/mile =) $20,718,944.

Disposal fees at the Washington site are $70.50/ft$^3$ + $140,611 annual fee + Perpetual Care and Maintenance Fee of $1.75/ft3 + Business and Occupation tax of 3.3 percent + Site Surveillance Fee of $6.00/ft3 + Surcharge of $6.50/ft3 + NRC fee of 1 percent of rates and charges.

Estimated disposal costs at U.S. Ecology (Hanford Site) is [(318,991 55-gal drums, and 10,839 HICs) x (55 gal/7.48 gal/ft$^3$ ) x ($70.50/ft$^3$ + $1.75/ft$^3$ + $6.00/ft$^3$ + $6.50/ft$^3$ ) x (1 + 0.033 + 0.01) =] $214,375,555 for disposal costs. The total annual fee for 26 years would be (26 x $140,611 =) $3,655,886. The total of all fees and charges for disposal of the DAW at the U.S. Ecology site would be ($214,375,555 + $3,655,886 =) $218,031,441.

Total disposal costs (transportation plus disposal fee) is estimated at ($20,718,944 + $218,031,441 =) $238,750,435, rounded to $238,750,000.

**Operating Materials and Consumables Costs**

The estimated costs for materials and consumables under Option 2 is the same as estimated for Option 1, i.e., $23,997,000.

**Utility Costs**

The estimated utility costs under Option 2 are the same as estimated for Option 1, i.e., $6,032,000.

**Total Operating Costs**

[13] A portion of the secondary LLW to be generated may fall within the limits for Cs and Co. Insufficient data is presently available to determine how much of the waste could potentially go to this site. The use of the U. S. Ecology site is believed reasonably bounding for this analysis.

The total operating cost for Option 2 is therefore estimated at ($80,223,000 + $7,805,000 + $238,750,000 + $23,997,000 + $6,032,000 =) $356,807,000.

#### 6.5.3.3 Decommissioning Costs for the Option 2

Decommissioning costs are estimated at 15% of total facility cost (TFC). TFC is comprised of DFC plus indirect field costs, and is therefore estimated at ($10,209,000 + $3,502,000 =) $13,711,000. The estimated decommissioning costs are ($13,711,000 x 0.15 =) $2,056,650, rounded to $2,057,000.

#### 6.5.3.4 Life Cycle Cost for Option 2

Life cycle cost for Option 2 is the sum of capital costs, operating costs, and decommissioning costs. The total estimated lifecycle cost (in FY 1999 dollars) for Option 2, i.e., the WTB as presently configured, is ($17,414,000 + $356,807,000 + $2,057,000 =) $376,278,000.

## 6.6 POTENTIAL TECHNICAL/REGULATORY RISKS

The technical requirements for the processing and disposal of the anticipated waste forms are well defined, and the technology is well demonstrated in the nuclear power industry. There are no perceived technical risks for the Baseline Option, Option 1 or Option 2.

The regulatory requirements are well defined, and there does not appear to be any impending alterations to existing regulatory policy in regard to LLW disposal. In the area of waste minimization, existing regulations suggest the use of existing techniques for shredding and compacting of waste, but they do not impose a requirement for the use of these techniques. Therefore, there are no perceived regulatory risks for the Baseline Option, Option 1, or Option 2.

Option 2 presents the only identified significant risk in that this option requires frequent transportation of LLW over the public road system. There is a reasonable probability of a transportation accident over the lifetime of operation.

## 6.7 SUMMARY OF OPTION ANALYSIS

The Baseline Option, Option 1, and Option 2 all meet the requirements for the processing and disposal of LLW as imposed by existing regulation.

Cost analysis indicates that Option 1 is slightly less costly than the Baseline Option, and both the Baseline Option and Option I are substantially less costly than Option 2. The life-cycle costs, as presented in Section 6.5 are:

- Baseline Option $172,876,000
- Option 1 $162,109,000
- Option 2 $376,278,000

The delta in costs between Option 1 and the Baseline Option is approximately 6 percent. Sensitivity analysis of the various cost elements indicates that there are two areas where cost changes could have major impact on this analysis. These areas are manpower costs, and land disposal costs. Sensitivity analysis of the capital cost estimates indicates that since the facilities are so similar in nature, shape and internal features, little impact to relative costs would be noted if the accuracy of the cost estimate is increased from the present conceptual level.

If manpower costs escalate greater than material costs escalate in the interim period until actual operation, Option 1 will become even more favorable in regard to life-cycle costs.

The cost of disposal of $\$8.50/ft^3$ is substantially less than the costs imposed to the private sector for LLW disposal, roughly $1/10^{th}$ the private sector costs. The reason for this is that burial costs at NTS are not set at a full recovery basis, and there are no adders for external oversight, nor multipliers for profits and fees. If burial costs at NTS increase greater than inflation rates, due to regulatory requirements or some other external influence (i.e., costs be placed on a full recovery basis), the need for waste minimization may become fiscally mandated.

It is recommended that the Baseline Option be chosen as the LLW treatment strategy, this option affords the maximum waste minimization with only minor life-cycle cost impacts.

## 7. CONCLUSIONS

Table 6-2, Section 6.2, presents the estimated LLW quantities on an annual basis. This table also identifies the estimated totals for LLW to be generated over the entire period of operation.

Section 6.3 identified the various regulatory drivers for waste treatment, waste transportation, and disposal. Utilizing the regulatory requirements identified, Section 6.4 identifies the potential options for LLW treatment and disposal. Three options are identified, the Baseline Option, Option 1, and Option 2. These options are:

- Baseline Option: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at the NTS. Dewatering and packaging of wet-solid LLW within

the WTB for disposal at the NTS.[14] Sorting (including delisting), shredding, and compacting of compactible DAW within the WTB for disposal at the NTS. Packaging of non-compactible DAW within the WTB for disposal at the NTS.

- Option 1: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at the NTS. Bulk packaging in 55 gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at the NTS.

- Option 2: Treatment/solidification/packaging of liquid wastes within the WTB for disposal at a site other than the NTS. Dewatering and packaging of wet-solid LLW within the WTB for disposal at a site other than the NTS. Bulk packaging in 55 gal drums of compactible DAW and non-compactible DAW within the WTB for disposal at a site other than the NTS.

Section 6.4.2 identifies the equipment requirements for the options, and Section 6.4.3 identifies the facility requirements for the options.

Section 6.5 presents costs estimates, capital, operating, decontamination and decommissioning, and life-cycle for the options. The estimated life-cycle costs for the options are:

- Baseline Option $172,876,000
- Option 1 $162,109,000
- Option 2 $376,278,000

It is recommended that the Baseline Option be chosen as the LLW treatment strategy.

## 8. REFERENCES

8.1 CRWMS M&O (Civilian Radioactive Waste Management System Management and Operating Contractor) 1997. *Secondary Waste Treatment Analysis.* BCBD00000-01717-0200-00005 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19971208.0201.

[14] In all options it is assumed that ion exchange resins and filter cartridges are processed/packaged for disposal at the MGR in either the WTB, in the WHB, or in both facilities. (Assumption 5.8) The primary reason for this assumption is that these two waste forms will have to be packaged sufficient for disposal prior to transport and therefore, no economic advantage can be achieved by transporting these wastes to an offsite processor.

8.2 CRWMS M&O 1998. *Site-Generated Radiological Waste Systems and Facilities Design,* (Work Packages 24012392M3 and 24012403M3). Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19981229.0138.

8.3 DOE (U.S. Department of Energy) 1998. *Quality Assurance Requirements and Description.* DOE/RW-0333P REV 8. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.19980601.0022.

8.4 CRWMS M&O 1998. *Classification of the Preliminary MGDS Repository Design.* B00000000-01717-0200-00134 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19981103.0546.

8.5 CRWMS M&O 1999. *Secondary Low-Level Waste Generation Rate Analysis.* BCBD00000-01717-0200-00020 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990511.0368.

8.6 CRWMS M&O 1998. *Controlled Design Assumptions Document.* B00000000-01717-4600-00032 REV 05. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980804.0481.

8.7 Perry, R. H., and Chilton, C. H. 1973. *Chemical Engineers Handbook (Fifth Edition).* New York, New York: McGraw-Hill Inc. ISBN 0-07-049478-9. TIC: 237826.

8.8 CRWMS M&O 1999. *Work Direction for Secondary LLW Treatment Strategy Analysis.* LV.SD.MJG.03/99.018. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990419.0255.

8.9 CRWMS M&O 1999. *Cost Data for Secondary LLW Treatment Strategy Analysis.* LV.SD.MJG.03/99.016. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990419.0271.

8.10 CRWMS M&O 1998. *Site-Generated Radiological Waste Handling System Description Document.* BCB000000-01717-1705-00013 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19981211.0397.

8.11 DOE 1997. *Nevada Test Site Waste Acceptance Criteria,* DOE/NV-325 NTSWAC (Rev.1). Las Vegas, Nevada: U. S Department of Energy, Las Vegas Operations Office. ACC: MOL.19990318.0235.

8.12 EPRI 1984. *Identification of Radwaste Sources and Reduction Techniques, Volume 1.* NP-3370. Palo Alto, California: Electric Power Research Institute. TIC: 242200.

**8.13** CRWMS M&O 1997. *Surface Nuclear Facilities Space Program Analysis.* BCBD00000-01717-0200-00012 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980204.0138.

**8.14** CRWMS M&O 1998. *Monitored Geologic Repository Operations Staffing Report.* BC0000000-01717-5705-00021 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19981211.0036.

**8.15** Feizollahi, F.; Shropshire, D.; Burton, D.; and Lockheed Martin Idaho Technologies Company, 1995. *Waste Management Facilities Cost Information for Transportation of Radioactive and Hazardous Materials.* INEL-95/0300, Revision 1. Idaho Falls, Idaho: U. S. Department of Energy, Idaho Operations Office. TIC: 233465.

**8.16** State of Utah 1999. *Radioactive Material License*, License Number UT 2300249 Amendment #01 (Envirocare of Utah, Inc.). Salt Lake City, Utah: Utah Department of Environmental Quality, Division of Radiation Control. TIC: 243585.

## 9. ATTACHMENTS

| | |
|---|---|
| Attachment I | Determination of Waste Classification |
| Attachment II | Estimated Secondary LLW Generation Rate Tables |
| Attachment III | Estimated Secondary LLW – Annual Quantities |
| Attachment IV | Process Block Flow Diagrams |
| Attachment V | Waste Treatment Building |
| Attachment VI | Life-Cycle Costs – Yearly Basis |

# APPENDIX A
# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACC | accession number |
| ALARA | as low as reasonably achievable |
| ANS | American Nuclear Society |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ATS | Assembly Transfer System |
| Ci | curie |
| CDA | Controlled Design Assumptions |
| CFR | Code of Federal Regulations |
| Co | cobalt |
| CPB | Carrier Preparation Building |
| CRWMS | Civilian Radioactive Waste Management System |
| Cs | cesium |
| CTS | Canister Transfer System |
| CWA | Clean Water Act |
| DAW | dry active waste |
| DC | disposal container |
| DFC | direct field costs |
| DOE | U.S. Department of Energy |
| DOE/RW | U.S. Department of Energy/Office of Civilian Radioactive Waste |
| DPC | dual-purpose canister |
| EPA | U. S. Environmental Protection Agency |
| ft | foot |
| FY | fiscal year |
| gal | gallon |
| GROA | Geologic Repository Operations Area |
| HIC | high-integrity container |
| HLW | high-level waste |
| HVAC | heating, ventilating, and air conditioning |
| L | liter |
| LA | license application |
| lb | pound |
| LLW | low-level waste |
| LSA | low specific activity |
| m | meter |
| MGDS | Mined Geologic Disposal System |

| | |
|---|---|
| MGDS-RD | Mined Geologic Disposal System – Requirements Document |
| MGR | Monitored Geologic Repository |
| ml | milliliter |
| MTHM | metric tons heavy metal |
| M&O | management and operations |
| NLP | Nevada Line Procedure |
| NRC | (U. S.) Nuclear Regulatory Commission |
| NTS | Nevada Test Site |
| QA | Quality Assurance |
| QAP | Quality Administrative Procedure |
| QARD | Quality Assurance Requirements and Description |
| RCRA | Resource Conservation Recovery Act |
| ROM | rough-order-of-magnitude |
| SARP | safety analysis report for packaging |
| SDD | system description document |
| SNF | spent nuclear fuel |
| TBD | to be determined |
| TBV | to be verified |
| TEC | total estimated cost |
| TFC | total facility costs |
| TIC | Technical Information Center (catalog number) |
| USC | United States Code |
| VA | Viability Assessment |
| WAC | Waste Acceptance Criteria |
| WHB | Waste Handling Building |
| WHF | Waste Handling Facility |
| WP | waste package |
| WTB | Waste Treatment Building |
| YMP | Yucca Mountain Site Characterization Project |
| YMP/CM | Yucca Mountain Site Characterization Project/U. S. Department of Energy Office of Civilian Radioactive Waste Management |
| yd | yard |
| yr | year |

Actual classification of waste is performed as a function of concentrations of long-lived radionuclides in the following manner:

**Long-lived Radionuclides**

If the waste only contains radionuclides listed in Table I-1, classification is determined as follows:

- If the concentration does not exceed 0.1 times the value in Table I-1, the waste is Class A.
- If the concentration exceeds 0.1 times the value in Table I-1, but does not exceed the value in this table, the waste is Class C.
- If the concentration exceeds the value in Table I-1, the waste is not generally acceptable for near-surface disposal.
- For wastes containing mixtures of radionuclides listed in Table I-1, the total concentration is determined by the sum of the fractions.

Table I-1. Long-Lived Radionuclides Used in Waste Classification

| Radionuclide | Concentration (Ci/m$^3$) |
|---|---|
| $^{14}C$ | 8 |
| $^{14}C$ in activated metal | 80 |
| $^{59}Ni$ in activated metal | 220 |
| $^{94}Nb$ in activated metal | 0.2 |
| $^{99}Tc$ | 3 |
| $^{129}I$ | 0.08 |
| Alpha emitting transuranic nuclides with half-life greater than five years | 100 nanocuries/gram |
| $^{241}Pu$ | 3,500 nanocuries/gram |
| $^{242}Cm$ | 20,000 nanocuries/gram |

**Short-Lived Radionuclides**

If the waste does not include any of the radionuclides contained in Table I-1, the classification is made as a function of short-lived radionuclides based on the concentrations in Table I-2. If the radioactive waste does not contain any of the radionuclides in either Table I-1 or I-2, the waste is classified as Class A. Classification as a function of concentrations of short-lived radionuclides is performed in the following manner:

- If the concentration does not exceed the value in Column 1 of Table I-2, the waste is Class A.
- If the concentration exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.
- If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.
- If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.
- For wastes containing mixtures of the radionuclides listed in Table I-2, the total concentration is determined by the sum of the fractions.

The sum of the fractions for mixtures of radionuclides is determined by:

- Dividing each radionuclide concentration by the appropriate limit
- Summing the resulting values
- The appropriate limits must be taken from the same column of the same table
- The sum of the fractions for the column must be less than 1.0 if the waste is to be classification is to be determined by that column.

The concentration of a radionuclide may be determined by indirect methods such as scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be

averaged over the volume of the waste, or weight of the waste, if the units are expressed as nanocuries/gram.

Table I-2 Short-Lived Radionuclides Used in Waste Classification

| Radionuclide | Concentration (Ci/m$^3$) | | |
|---|---|---|---|
| | Column 1 | Column 2 | Column 3 |
| Total of all radionuclides with a half-life of less than five years | 700 | See Footnote (1) | See Footnote (1) |
| $^{3}H$ (tritium) | 40 | See Footnote (1) | See Footnote (1) |
| $^{60}Co$ | 700 | See Footnote (1) | See Footnote (1) |
| $^{63}Ni$ | 3.5 | 70 | 700 |
| $^{63}Ni$ in activated metal | 35 | 700 | 7000 |
| $^{90}Sr$ | 0.04 | 150 | 7000 |
| $^{137}Cs$ | 1 | 44 | 4600 |

1 There are no limits established for these radionuclides in Class B or Class C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations of these wastes. These wastes shall be Class B unless the concentrations of other radionuclides in Table I-2 determine the waste to be Class C independent of these radionuclides.

Table II-1. Estimated Secondary LLW – Year 2026

| Secondary Waste Generation Estimate Year 2026 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| LLW | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| **Unit Sources:** | | | | | | | | | |
| DPC Decon | # DPC | 411 | 17.53 | 5.84 | 0.27 | - | 0.27 | 0.21 | - |
| ATS Cask Decon | # ATS casks | 429 | 18.46 | 6.15 | 0.28 | - | 0.28 | 0.22 | - |
| CTS Cask Decon | #CTS casks | 149 | 18.22 | 1.78 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 508 | 40.53 | 6.30 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 578 | - | - | - | 16.76 | 16.76 | 13.29 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| **Plant Sources:** | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 578 | 0.56 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| **Water Treatment Sources** | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Filter Cartridges - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Spent Resin - WTB | gal recycle | 216,930 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 216,930 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 216.9 | 74.1 | 3.1 | 37.2 | 40.3 | 31.7 | 2.6 |

## Table II-2. Secondary Waste Generation from Decontamination/Floor Washdown Operations

| Area/Item | Qty./ Year | Freq. (Mos.) | Percent Decon. | ft²/ Unit | ft²/ Year | Area Decon (%) | | Decon (%) by Type | | | | Solid LLW(lbs) | Liq.LLW (gals) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Wiped | Spray | Wipe | Water | Non-Recl | Vacuum | | Rec. Liq | Non-Recycl |
| **Pre WHB** | | | | | | | | | | | | | | |
| Carriers | 578 | | 5% | 400 | 11,560 | 10% | 100% | 80% | 20% | | | 69 | 555 | |
| **WHB Washdown** | | | | | | | | | | | | | | |
| Cask Prep | na | 12 | | 9,240 | 9,240 | | 100% | | 60% | 40% | | 92 | 1,331 | 591 |
| Assembly Transfer | na | | | | | | | | | | | | | |
| Pool Areas (excl. pools) | na | 1 | | 8,658 | 103,896 | | 100% | | 60% | 40% | | 1,039 | 14,961 | 6,649 |
| Assy Cell (dry) | na | 0.5 | | 8,910 | 213,840 | | 100% | | 60% | 40% | | 2,138 | 30,793 | 13,686 |
| DC Load/Decon | na | 6 | | 4,450 | 8,900 | | 100% | | 60% | 40% | | 89 | 1,282 | 570 |
| Canister Transfer | na | 1 | | 11,500 | 138,000 | | 100% | | 60% | 40% | | 1,380 | 19,872 | 8,832 |
| DC Handling | na | 6 | | 61,100 | 122,200 | | 100% | | 60% | 40% | | 1,222 | 17,597 | 7,821 |
| WP Remediation | na | 0.5 | | 2,930 | 48,720 | | 100% | | 60% | 40% | | 487 | 7,016 | 3,118 |
| Primary Support Areas | na | 2 | | 24,500 | 147,000 | | 100% | | 60% | 40% | | 1,470 | 21,168 | 9,408 |
| Pool Support Areas | na | 6 | | 8,020 | 16,040 | | 100% | | 60% | 40% | | 160 | 2,310 | 1,027 |
| **WTB Washdown** | | | | | | | | | | | | | | |
| Floor Areas | na | 12 | | 36,800 | 36,800 | | 100% | | 60% | 40% | | 368 | 5,299 | 2,355 |
| **WHB Items** | | | | | | | | | | | | | | |
| Assembly Transfer System | | | | | | | | | | | | | | |
| Incoming Casks | 429 | | 0% | | 0 | na | na | na | na | na | | | | |
| Outgoing Casks | 429 | | 100% | | 192,243 | 5% | 100% | 5% | 40% | 20% | | 1,177 | 18,455 | 6,152 |
| DPC Overpacks | 411 | | 100% | | 182,547 | 5% | 100% | 5% | 40% | 20% | | 1,118 | 17,525 | 5,842 |
| Pool Tooling & Misc. | 200 | | 100% | 200 | 40,000 | | 100% | | | | | | | |
| Pool Yokes | 40 | 6 | 100% | 400 | 32,000 | | 100% | | | | | | | |
| DC, Top Edge | 508 | | 100% | 50 | 25,400 | | 100% | | | | 100% | 508 | | |
| DC, Full | 508 | | 100% | | 185,312 | | 100% | | 80% | 20% | | 1,853 | 35,580 | 5,930 |
| Canister Transfer System | | | | | | | | | | | | | | |
| Incoming Casks | 149 | | 0% | | 0 | na | na | na | na | na | | | | |
| Outgoing Casks | 149 | | 100% | | 79,010 | 10% | 100% | 5% | 90% | 10% | | 810 | 17,066 | 1,264 |
| Fixtures & Misc. | 10 | 6 | 100% | 400 | 8,000 | 10% | 100% | 20% | 60% | 40% | | 88 | 1,152 | 512 |
| DC Handling | | | | | | | | | | | | | | |
| Collars | 1146 | | 10% | 200 | 22,920 | | 100% | | 90% | 10% | | 229 | 4,951 | 367 |
| **Total:** | | | | | | | | | | | | 14,299 | 216,911 | 74,123 |

na - not applicable

Table II-3. Low-Level Waste Generation Rate Factors

| Waste Source | Scaling Basis | Low-Level Waste Generation Rate Factors | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Decon. Operations | | | General Operations | | | |
| | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| LLW | | (1000 gal/unit) | (1000 gal/unit) | ($1000ft^3$/unit) | ($1000ft^3$/unit) | ($1000ft^3$/unit) | ($1000ft^3$/unit) | ($1000ft^3$/unit) |
| **Unit Sources:** | | | | | | | | |
| DPC Decon | # DPC | 17.525/411 | 5.842/411 | .266/411 | - | .266/411 | .209/411 | - |
| ATS Cask Decon | # ATS casks | 18.455/429 | 6.152/429 | .280/429 | - | .280/429 | .220/429 | - |
| CTS Cask Decon | #CTS casks | 18.218/149 | 1.776/149 | .214/149 | - | .214/149 | .168/149 | - |
| DC Decon | #DC | 40.531/508 | 6.297/508 | .270/508 | - | .270/508 | .212/508 | - |
| Cask Handling (Casks) | #casks | - | - | - | 0.029 | 0.029 | 0.023 | - |
| Plant Operators (WHB + WTB) | #operators | - | - | - | 0.143 | 0.143 | 0.112 | - |
| **Plant Sources:** | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | |
| WHB Floor | $ft^2$ | 116.3/138400 | 51.7/138400 | 1.92/138400 | - | 1.92/138400 | 1.51/138400 | - |
| WTB Floor | $ft^2$ | 5.299/36800 | 2.355/36800 | 0.088/36800 | - | 0.088/36800 | 0.069/36800 | - |
| Carrier Washdown | #carriers | 0.56 | - | 0.016 | - | 0.016 | 0.013 | - |
| **Water Treatment Sources** | | | | | | | | |
| Spent Resin - WHB | #ATS casks | - | - | - | - | - | - | 1.036/429 |
| Filter Cartridges - WHB | #ATS casks | - | - | - | - | - | - | 1.036/429 |
| Spent Resin - WTB | gal recycle | - | - | - | - | - | - | 0.259/216911 |
| Filter Cartridges - WTB | gal recycle | - | - | - | - | - | - | 0.259/216911 |

Table III-1. Estimated Secondary LLW – Year 2010 (Baseline Option)

| Secondary Waste Generation Estimate Year 2010 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| **LLW** | | | | | | | | | |
| **Unit Sources:** | | | | | | | | | |
| DPC Decon | # DPC | 25 | 1.07 | 0.36 | 0.02 | - | 0.02 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 57 | 2.45 | 0.82 | 0.04 | - | 0.04 | 0.03 | - |
| CTS Cask Decon | #CTS casks | 1 | 0.12 | 0.01 | 0.00 | - | 0.00 | 0.00 | - |
| DC Decon | #DC | 38 | 3.03 | 0.47 | 0.02 | - | 0.02 | 0.02 | - |
| Cask Handling (Casks) | #casks | 58 | - | - | - | 1.68 | 1.68 | 1.33 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| **Plant Sources:** | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 58 | 0.06 | 0.00 | 0.00 | - | 0.00 | 0.00 | - |
| **Water Treatment Sources** | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 57 | - | - | - | - | - | - | 0.14 |
| Filter Cartridges - WHB | #ATS casks | 57 | - | - | - | - | - | - | 0.14 |
| Spent Resin - WTB | gal recycle | 128,357 | - | - | - | - | - | - | 0.15 |
| Filter Cartridges - WTB | gal recycle | 128,357 | - | - | - | - | - | - | 0.15 |
| **Total forOperations:** | | | 128.4 | 55.7 | 2.1 | 22.1 | 24.2 | 19.0 | 0.6 |

Table III-2. Estimated Secondary LLW – Year 2011 (Baseline Option)

| Secondary Waste Generation Estimate Year 2011 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | | |
| | | | Decon. Operations | | | General Operations | | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW | |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | |
| LLW | | | | | | | | | | |
| Unit Sources: | | | | | | | | | | |
| DPC Decon | # DPC | 6 | 0.26 | 0.09 | 0.00 | - | 0.00 | 0.00 | - | |
| ATS Cask Decon | # ATS casks | 109 | 4.69 | 1.56 | 0.07 | - | 0.07 | 0.06 | - | |
| CTS Cask Decon | #CTS casks | 1 | 0.12 | 0.01 | 0.00 | - | 0.00 | 0.00 | - | |
| DC Decon | #DC | 76 | 6.06 | 0.94 | 0.04 | - | 0.04 | 0.03 | - | |
| Cask Handling (Casks) | #casks | 110 | - | - | - | 3.19 | 3.19 | 2.53 | - | |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - | |
| Plant Sources: | | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - | |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - | |
| Carrier Washdown | #carriers | 110 | 0.11 | 0.00 | 0.00 | - | 0.00 | 0.00 | - | |
| Water Treatment Sources | | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 109 | - | - | - | - | - | - | 0.26 | |
| Filter Cartridges - WHB | #ATS casks | 109 | - | - | - | - | - | - | 0.26 | |
| Spent Resin - WTB | gal recycle | 132,865 | - | - | - | - | - | - | 0.16 | |
| Filter Cartridges - WTB | gal recycle | 132,865 | - | - | - | - | - | - | 0.16 | |
| Total forOperations: | | | 132.9 | 56.7 | 2.1 | 23.6 | 25.8 | 20.2 | 0.8 | |

Table III-3. Estimated Secondary LLW – Year 2012 (Baseline Option)

| Secondary Waste Generation Estimate Year 2012 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 2 | 0.09 | 0.03 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 213 | 9.16 | 3.05 | 0.14 | - | 0.14 | 0.11 | - |
| CTS Cask Decon | #CTS casks | 3 | 0.37 | 0.04 | 0.00 | - | 0.00 | 0.00 | - |
| DC Decon | #DC | 152 | 12.13 | 1.88 | 0.08 | - | 0.08 | 0.06 | - |
| Cask Handling (Casks) | #casks | 216 | - | - | - | 6.26 | 6.26 | 4.97 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 216 | 0.21 | 0.00 | 0.01 | - | 0.01 | 0.00 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 213 | - | - | - | - | - | - | 0.51 |
| Filter Cartridges - WHB | #ATS casks | 213 | - | - | - | - | - | - | 0.51 |
| Spent Resin - WTB | gal recycle | 143,579 | - | - | - | - | - | - | 0.17 |
| Filter Cartridges - WTB | gal recycle | 143,579 | - | - | - | - | - | - | 0.17 |
| Total forOperations: | | | 143.6 | 59.1 | 2.2 | 26.7 | 29.0 | 22.7 | 1.4 |

Table III-4. Estimated LLW – Year 2013 (Baseline Option)

| Secondary Waste Generation Estimate Year 2013 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 24 | 1.02 | 0.34 | 0.02 | - | 0.02 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 345 | 14.84 | 4.95 | 0.23 | - | 0.23 | 0.18 | - |
| CTS Cask Decon | #CTS casks | 6 | 0.73 | 0.07 | 0.01 | - | 0.01 | 0.01 | - |
| DC Decon | #DC | 251 | 20.03 | 3.11 | 0.13 | - | 0.13 | 0.10 | - |
| Cask Handling (Casks) | #casks | 351 | - | - | - | 10.18 | 10.18 | 8.07 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 351 | 0.34 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Filter Cartridges - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Spent Resin - WTB | gal recycle | 158,591 | - | - | - | - | - | - | 0.19 |
| Filter Cartridges - WTB | gal recycle | 158,591 | - | - | - | - | - | - | 0.19 |
| Total forOperations: | | | 158.6 | 62.5 | 2.4 | 30.6 | 33.0 | 26.0 | 2.0 |

Table III-5. Estimated Secondary LLW – Year 2014 (Baseline Option)

| Secondary Waste Generation Estimate Year 2014 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 10 | 0.43 | 0.14 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 540 | 23.23 | 7.74 | 0.35 | - | 0.35 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 8 | 0.98 | 0.10 | 0.01 | - | 0.01 | 0.01 | - |
| DC Decon | #DC | 373 | 29.76 | 4.62 | 0.20 | - | 0.20 | 0.16 | - |
| Cask Handling (Casks) | #casks | 548 | - | - | - | 15.89 | 15.89 | 12.60 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 548 | 0.53 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 540 | - | - | - | - | - | - | 1.30 |
| Filter Cartridges - WHB | #ATS casks | 540 | - | - | - | - | - | - | 1.30 |
| Spent Resin - WTB | gal recycle | 176,550 | - | - | - | - | - | - | 0.21 |
| Filter Cartridges - WTB | gal recycle | 176,550 | - | - | - | - | - | - | 0.21 |
| Total forOperations: | | | 176.5 | 66.7 | 2.6 | 36.3 | 38.9 | 30.7 | 3.0 |

Table III-6. Estimated Secondary LLW – Year 2015 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 14 | 0.60 | 0.20 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 519 | 22.33 | 7.44 | 0.34 | - | 0.34 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 137 | 16.75 | 1.63 | 0.20 | - | 0.20 | 0.15 | - |
| DC Decon | #DC | 503 | 40.13 | 6.24 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 656 | - | - | - | 19.02 | 19.02 | 15.09 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 656 | 0.63 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Filter Cartridges - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Spent Resin - WTB | gal recycle | 202,065 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 202,065 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 202.1 | 69.6 | 2.8 | 39.5 | 42.3 | 33.3 | 3.0 |

Table III-7. Estimated Secondary LLW – Year 2016 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2016 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 22 | 0.94 | 0.31 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 551 | 23.70 | 7.90 | 0.36 | - | 0.36 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 145 | 17.73 | 1.73 | 0.21 | - | 0.21 | 0.16 | - |
| DC Decon | #DC | 524 | 41.81 | 6.50 | 0.28 | - | 0.28 | 0.22 | - |
| Cask Handling (Casks) | #casks | 696 | - | - | - | 20.18 | 20.18 | 16.01 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 696 | 0.67 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 551 | - | - | - | - | - | - | 1.33 |
| Filter Cartridges - WHB | #ATS casks | 551 | - | - | - | - | - | - | 1.33 |
| Spent Resin - WTB | gal recycle | 206,475 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,475 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.5 | 70.5 | 2.9 | 40.6 | 43.5 | 34.3 | 3.2 |

Table III-8. Estimated Secondary LLW – Year 2017 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2017 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 43 | 1.83 | 0.61 | 0.03 | - | 0.03 | 0.02 | - |
| ATS Cask Decon | # ATS casks | 533 | 22.93 | 7.64 | 0.35 | - | 0.35 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 138 | 16.87 | 1.64 | 0.20 | - | 0.20 | 0.16 | - |
| DC Decon | #DC | 492 | 39.25 | 6.10 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 671 | - | - | - | 19.46 | 19.46 | 15.43 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 671 | 0.64 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 533 | - | - | - | - | - | - | 1.29 |
| Filter Cartridges - WHB | #ATS casks | 533 | - | - | - | - | - | - | 1.29 |
| Spent Resin - WTB | gal recycle | 203,163 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 203,163 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 203.2 | 70.1 | 2.9 | 39.9 | 42.8 | 33.7 | 3.1 |

Table III-9. Estimated Secondary LLW – Year 2018 (Baseline Option)

| Secondary Waste Generation Estimate Year 2018 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| LLW | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 48 | 2.05 | 0.68 | 0.03 | - | 0.03 | 0.02 | - |
| ATS Cask Decon | # ATS casks | 541 | 23.27 | 7.76 | 0.35 | - | 0.35 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 151 | 18.46 | 1.80 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 524 | 41.81 | 6.50 | 0.28 | - | 0.28 | 0.22 | - |
| Cask Handling (Casks) | #casks | 692 | - | - | - | 20.07 | 20.07 | 15.92 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 692 | 0.66 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 541 | - | - | - | - | - | - | 1.31 |
| Filter Cartridges - WHB | #ATS casks | 541 | - | - | - | - | - | - | 1.31 |
| Spent Resin - WTB | gal recycle | 207,883 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 207,883 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 207.9 | 70.8 | 2.9 | 40.5 | 43.4 | 34.2 | 3.1 |

Table III-10. Estimated Secondary LLW – Year 2019 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2019 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 96 | 4.09 | 1.36 | 0.06 | - | 0.06 | 0.05 | - |
| ATS Cask Decon | # ATS casks | 532 | 22.89 | 7.63 | 0.35 | - | 0.35 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 153 | 18.71 | 1.82 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 507 | 40.45 | 6.28 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 685 | - | - | - | 19.87 | 19.87 | 15.76 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 685 | 0.66 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 532 | - | - | - | - | - | - | 1.28 |
| Filter Cartridges - WHB | #ATS casks | 532 | - | - | - | - | - | - | 1.28 |
| Spent Resin - WTB | gal recycle | 208,424 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 208,424 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 208.4 | 71.2 | 2.9 | 40.3 | 43.2 | 34.1 | 3.1 |

Table III-11. Estimated Secondary LLW – Year 2020 (Baseline Option)

| Secondary Waste Generation Estimate Year 2020 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 123 | 5.24 | 1.75 | 0.08 | - | 0.08 | 0.06 | - |
| ATS Cask Decon | # ATS casks | 499 | 21.47 | 7.16 | 0.33 | - | 0.33 | 0.26 | - |
| CTS Cask Decon | #CTS casks | 154 | 18.83 | 1.84 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 510 | 40.69 | 6.32 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 653 | - | - | - | 18.94 | 18.94 | 15.02 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 653 | 0.63 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 499 | - | - | - | - | - | - | 1.21 |
| Filter Cartridges - WHB | #ATS casks | 499 | - | - | - | - | - | - | 1.21 |
| Spent Resin - WTB | gal recycle | 208,487 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 208,487 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 208.5 | 71.1 | 2.9 | 39.4 | 42.3 | 33.3 | 2.9 |

Table III-12. Estimated Secondary LLW – Year 2021 (Baseline Option)

| Secondary Waste Generation Estimate Year 2021 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 161 | 6.87 | 2.29 | 0.10 | - | 0.10 | 0.08 | - |
| ATS Cask Decon | # ATS casks | 471 | 20.26 | 6.75 | 0.31 | - | 0.31 | 0.24 | - |
| CTS Cask Decon | #CTS casks | 154 | 18.83 | 1.84 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 505 | 40.29 | 6.26 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 625 | - | - | - | 18.13 | 18.13 | 14.38 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 625 | 0.60 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 471 | - | - | - | - | - | - | 1.14 |
| Filter Cartridges - WHB | #ATS casks | 471 | - | - | - | - | - | - | 1.14 |
| Spent Resin - WTB | gal recycle | 208,477 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 208,477 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 208.5 | 71.2 | 2.9 | 38.6 | 41.5 | 32.7 | 2.8 |

Table III-13. Estimated Secondary LLW – Year 2022 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2022 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | | |
| | | | Decon. Operations | | | General Operations | | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW | |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | |
| LLW | | | | | | | | | | |
| Unit Sources: | | | | | | | | | | |
| DPC Decon | # DPC | 177 | 7.55 | 2.52 | 0.11 | - | 0.11 | 0.09 | - | |
| ATS Cask Decon | # ATS casks | 496 | 21.34 | 7.11 | 0.32 | - | 0.32 | 0.25 | - | |
| CTS Cask Decon | #CTS casks | 140 | 17.12 | 1.67 | 0.20 | - | 0.20 | 0.16 | - | |
| DC Decon | #DC | 499 | 39.81 | 6.19 | 0.27 | - | 0.27 | 0.21 | - | |
| Cask Handling (Casks) | #casks | 636 | - | - | - | 18.44 | 18.44 | 14.63 | - | |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - | |
| Plant Sources: | | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - | |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - | |
| Carrier Washdown | #carriers | 636 | 0.61 | 0.00 | 0.02 | - | 0.02 | 0.01 | - | |
| Water Treatment Sources | | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 496 | - | - | - | - | - | - | 1.20 | |
| Filter Cartridges - WHB | #ATS casks | 496 | - | - | - | - | - | - | 1.20 | |
| Spent Resin - WTB | gal recycle | 208,055 | - | - | - | - | - | - | 0.25 | |
| Filter Cartridges - WTB | gal recycle | 208,055 | - | - | - | - | - | - | 0.25 | |
| Total forOperations: | | | 208.1 | 71.5 | 2.9 | 38.9 | 41.8 | 32.9 | 2.9 | |

Table III-14. Estimated Secondary LLW – Year 2023 (Baseline Option)

| Secondary Waste Generation Estimate Year2023 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 179 | 7.63 | 2.54 | 0.12 | - | 0.12 | 0.09 | - |
| ATS Cask Decon | # ATS casks | 483 | 20.78 | 6.93 | 0.32 | - | 0.32 | 0.25 | - |
| CTS Cask Decon | #CTS casks | 140 | 17.12 | 1.67 | 0.20 | - | 0.20 | 0.16 | - |
| DC Decon | #DC | 485 | 38.70 | 6.01 | 0.26 | - | 0.26 | 0.20 | - |
| Cask Handling (Casks) | #casks | 623 | - | - | - | 18.07 | 18.07 | 14.33 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 623 | 0.60 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 483 | - | - | - | - | - | - | 1.17 |
| Filter Cartridges - WHB | #ATS casks | 483 | - | - | - | - | - | - | 1.17 |
| Spent Resin - WTB | gal recycle | 206,451 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,451 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.5 | 71.2 | 2.9 | 38.5 | 41.4 | 32.6 | 2.8 |

Table III-15. Estimated Secondary LLW – Year 2024 (Baseline Option)

| Secondary Waste Generation Estimate Year 2024 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | | |
| | | | Decon. Operations | | | General Operations | | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW | |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | |
| LLW | | | | | | | | | | |
| Unit Sources: | | | | | | | | | | |
| DPC Decon | # DPC | 199 | 8.49 | 2.83 | 0.13 | - | 0.13 | 0.10 | - | |
| ATS Cask Decon | # ATS casks | 457 | 19.66 | 6.55 | 0.30 | - | 0.30 | 0.23 | - | |
| CTS Cask Decon | #CTS casks | 145 | 17.73 | 1.73 | 0.21 | - | 0.21 | 0.16 | - | |
| DC Decon | #DC | 495 | 39.49 | 6.14 | 0.26 | - | 0.26 | 0.21 | - | |
| Cask Handling (Casks) | #casks | 602 | - | - | - | 17.46 | 17.46 | 13.85 | - | |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - | |
| Plant Sources: | | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - | |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - | |
| Carrier Washdown | #carriers | 602 | 0.58 | 0.00 | 0.02 | - | 0.02 | 0.01 | - | |
| Water Treatment Sources | | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 457 | - | - | - | - | - | - | 1.10 | |
| Filter Cartridges - WHB | #ATS casks | 457 | - | - | - | - | - | - | 1.10 | |
| Spent Resin - WTB | gal recycle | 207,575 | - | - | - | - | - | - | 0.25 | |
| Filter Cartridges - WTB | gal recycle | 207,575 | - | - | - | - | - | - | 0.25 | |
| Total forOperations: | | | 207.6 | 71.3 | 2.9 | 37.9 | 40.8 | 32.2 | 2.7 | |

Table III-16. Estimated Secondary LLW – Year 2025 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2025 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 250 | 10.66 | 3.55 | 0.16 | - | 0.16 | 0.13 | - |
| ATS Cask Decon | # ATS casks | 519 | 22.33 | 7.44 | 0.34 | - | 0.34 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 150 | 18.34 | 1.79 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 510 | 40.69 | 6.32 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 669 | - | - | - | 19.40 | 19.40 | 15.39 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 669 | 0.64 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Filter Cartridges - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Spent Resin - WTB | gal recycle | 214,289 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 214,289 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 214.3 | 73.2 | 3.0 | 39.9 | 42.9 | 33.8 | 3.0 |

Table III-17. Estimated Secondary LLW – Year 2026 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2026 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 411 | 17.53 | 5.84 | 0.27 | - | 0.27 | 0.21 | - |
| ATS Cask Decon | # ATS casks | 429 | 18.46 | 6.15 | 0.28 | - | 0.28 | 0.22 | - |
| CTS Cask Decon | #CTS casks | 149 | 18.22 | 1.78 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 508 | 40.53 | 6.30 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 578 | - | - | - | 16.76 | 16.76 | 13.29 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 578 | 0.56 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Filter Cartridges - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Spent Resin - WTB | gal recycle | 216,913 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 216,913 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 216.9 | 74.1 | 3.1 | 37.2 | 40.3 | 31.7 | 2.6 |

Table III-18. Estimated Secondary LLW – Year 2027 (Baseline Option)

| Secondary Waste Generation Estimate Year 2027 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 381 | 16.25 | 5.42 | 0.25 | - | 0.25 | 0.19 | - |
| ATS Cask Decon | # ATS casks | 418 | 17.98 | 5.99 | 0.27 | - | 0.27 | 0.21 | - |
| CTS Cask Decon | #CTS casks | 147 | 17.97 | 1.75 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 492 | 39.25 | 6.10 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 565 | - | - | - | 16.39 | 16.39 | 13.00 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 565 | 0.54 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 418 | - | - | - | - | - | - | 1.01 |
| Filter Cartridges - WHB | #ATS casks | 418 | - | - | - | - | - | - | 1.01 |
| Spent Resin - WTB | gal recycle | 213,627 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 213,627 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 213.6 | 73.3 | 3.0 | 36.8 | 39.8 | 31.4 | 2.5 |

Table III-19. Estimated Secondary LLW – Year 2028 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2028 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 347 | 14.80 | 4.93 | 0.22 | - | 0.22 | 0.18 | - |
| ATS Cask Decon | # ATS casks | 376 | 16.18 | 5.39 | 0.25 | - | 0.25 | 0.19 | - |
| CTS Cask Decon | #CTS casks | 147 | 17.97 | 1.75 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 479 | 38.22 | 5.94 | 0.25 | - | 0.25 | 0.20 | - |
| Cask Handling (Casks) | #casks | 523 | - | - | - | 15.17 | 15.17 | 12.03 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 523 | 0.50 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 376 | - | - | - | - | - | - | 0.91 |
| Filter Cartridges - WHB | #ATS casks | 376 | - | - | - | - | - | - | 0.91 |
| Spent Resin - WTB | gal recycle | 209,293 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 209,293 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 209.3 | 72.1 | 3.0 | 35.6 | 38.6 | 30.4 | 2.3 |

Table III-20. Estimated Secondary LLW – Year 2029 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2029 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 347 | 14.80 | 4.93 | 0.22 | - | 0.22 | 0.18 | - |
| ATS Cask Decon | # ATS casks | 364 | 15.66 | 5.22 | 0.24 | - | 0.24 | 0.19 | - |
| CTS Cask Decon | #CTS casks | 181 | 22.13 | 2.16 | 0.26 | - | 0.26 | 0.20 | - |
| DC Decon | #DC | 493 | 39.33 | 6.11 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 545 | - | - | - | 15.81 | 15.81 | 12.54 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 545 | 0.52 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 364 | - | - | - | - | - | - | 0.88 |
| Filter Cartridges - WHB | #ATS casks | 364 | - | - | - | - | - | - | 0.88 |
| Spent Resin - WTB | gal recycle | 214,072 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 214,072 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 214.1 | 72.5 | 3.0 | 36.3 | 39.3 | 30.9 | 2.3 |

Table III-21. Estimated Secondary LLW – Year 2030 (Baseline Option)

| Secondary Waste Generation Estimate Year 2030 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | | |
| | | | Decon. Operations | | | General Operations | | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) | |
| LLW | | | | | | | | | | |
| Unit Sources: | | | | | | | | | | |
| DPC Decon | # DPC | 319 | 13.60 | 4.53 | 0.21 | - | 0.21 | 0.16 | - | |
| ATS Cask Decon | # ATS casks | 352 | 15.14 | 5.05 | 0.23 | - | 0.23 | 0.18 | - | |
| CTS Cask Decon | #CTS casks | 187 | 22.86 | 2.23 | 0.27 | - | 0.27 | 0.21 | - | |
| DC Decon | #DC | 513 | 40.93 | 6.36 | 0.27 | - | 0.27 | 0.21 | - | |
| Cask Handling (Casks) | #casks | 539 | - | - | - | 15.63 | 15.63 | 12.40 | - | |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - | |
| Plant Sources: | | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - | |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - | |
| Carrier Washdown | #carriers | 539 | 0.52 | 0.00 | 0.01 | - | 0.01 | 0.01 | - | |
| Water Treatment Sources | | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 352 | - | - | - | - | - | - | 0.85 | |
| Filter Cartridges - WHB | #ATS casks | 352 | - | - | - | - | - | - | 0.85 | |
| Spent Resin - WTB | gal recycle | 214,685 | - | - | - | - | - | - | 0.26 | |
| Filter Cartridges - WTB | gal recycle | 214,685 | - | - | - | - | - | - | 0.26 | |
| Total forOperations: | | | 214.7 | 72.2 | 3.0 | 36.1 | 39.1 | 30.8 | 2.2 | |

Table III-22. Estimated Secondary LLW – Year 2031 (Baseline Option)

| Secondary Waste Generation Estimate Year 2031 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 302 | 12.88 | 4.29 | 0.20 | - | 0.20 | 0.15 | - |
| ATS Cask Decon | # ATS casks | 345 | 14.84 | 4.95 | 0.23 | - | 0.23 | 0.18 | - |
| CTS Cask Decon | #CTS casks | 181 | 22.13 | 2.16 | 0.26 | - | 0.26 | 0.20 | - |
| DC Decon | #DC | 499 | 39.81 | 6.19 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 526 | - | - | - | 15.25 | 15.25 | 12.10 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 526 | 0.51 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Filter Cartridges - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Spent Resin - WTB | gal recycle | 211,796 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 211,796 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 211.8 | 71.6 | 3.0 | 35.7 | 38.7 | 30.4 | 2.2 |

Table III-23. Estimated Secondary LLW – Year 2032 (Baseline Option)

| Secondary Waste Generation Estimate<br>Year 2032 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 6 | 0.26 | 0.09 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 284 | 12.22 | 4.07 | 0.19 | - | 0.19 | 0.15 | - |
| CTS Cask Decon | #CTS casks | 143 | 17.48 | 1.70 | 0.21 | - | 0.21 | 0.16 | - |
| DC Decon | #DC | 473 | 37.74 | 5.86 | 0.25 | - | 0.25 | 0.20 | - |
| Cask Handling (Casks) | #casks | 427 | - | - | - | 12.38 | 12.38 | 9.82 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 427 | 0.41 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 284 | - | - | - | - | - | - | 0.69 |
| Filter Cartridges - WHB | #ATS casks | 284 | - | - | - | - | - | - | 0.69 |
| Spent Resin - WTB | gal recycle | 189,735 | - | - | - | - | - | - | 0.23 |
| Filter Cartridges - WTB | gal recycle | 189,735 | - | - | - | - | - | - | 0.23 |
| Total forOperations: | | | 189.7 | 65.8 | 2.7 | 32.8 | 35.5 | 27.9 | 1.8 |

Table III-24. Estimated Secondary LLW – Year 2033 (Baseline Option)

| Secondary Waste Generation Estimate Year 2033 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 1 | 0.04 | 0.01 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 171 | 7.36 | 2.45 | 0.11 | - | 0.11 | 0.09 | - |
| CTS Cask Decon | #CTS casks | 105 | 12.84 | 1.25 | 0.15 | - | 0.15 | 0.12 | - |
| DC Decon | #DC | 312 | 24.89 | 3.87 | 0.17 | - | 0.17 | 0.13 | - |
| Cask Handling (Casks) | #casks | 276 | - | - | - | 8.00 | 8.00 | 6.35 | - |
| Plant Operators (WHB + WTB) | #operators | 143 | - | - | - | 20.45 | 20.45 | 16.02 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 36,800 | 5.30 | 2.36 | 0.09 | - | 0.09 | 0.07 | - |
| Carrier Washdown | #carriers | 276 | 0.27 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 171 | - | - | - | - | - | - | 0.41 |
| Filter Cartridges - WHB | #ATS casks | 171 | - | - | - | - | - | - | 0.41 |
| Spent Resin - WTB | gal recycle | 167,024 | - | - | - | - | - | - | 0.20 |
| Filter Cartridges - WTB | gal recycle | 167,024 | - | - | - | - | - | - | 0.20 |
| Total forOperations: | | | 167.0 | 61.6 | 2.4 | 28.5 | 30.9 | 24.3 | 1.2 |

Table III-25. Estimated Secondary LLW – Year 2010 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2010 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 25 | 1.07 | 0.36 | 0.02 | - | 0.02 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 57 | 2.45 | 0.82 | 0.04 | - | 0.04 | 0.03 | - |
| CTS Cask Decon | #CTS casks | 1 | 0.12 | 0.01 | 0.00 | - | 0.00 | 0.00 | - |
| DC Decon | #DC | 38 | 3.03 | 0.47 | 0.02 | - | 0.02 | 0.02 | - |
| Cask Handling (Casks) | #casks | 58 | - | - | - | 1.68 | 1.68 | 1.33 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 58 | 0.06 | 0.00 | 0.00 | - | 0.00 | 0.00 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 57 | - | - | - | - | - | - | 0.14 |
| Filter Cartridges - WHB | #ATS casks | 57 | - | - | - | - | - | - | 0.14 |
| Spent Resin - WTB | gal recycle | 126,672 | - | - | - | - | - | - | 0.15 |
| Filter Cartridges - WTB | gal recycle | 126,672 | - | - | - | - | - | - | 0.15 |
| Total forOperations: | | | 126.7 | 55.0 | 2.1 | 21.4 | 23.5 | 18.4 | 0.6 |

Table III-26. Estimated Secondary LLW – Year 2011 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2011 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 6 | 0.26 | 0.09 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 109 | 4.69 | 1.56 | 0.07 | - | 0.07 | 0.06 | - |
| CTS Cask Decon | #CTS casks | 1 | 0.12 | 0.01 | 0.00 | - | 0.00 | 0.00 | - |
| DC Decon | #DC | 76 | 6.06 | 0.94 | 0.04 | - | 0.04 | 0.03 | - |
| Cask Handling (Casks) | #casks | 110 | - | - | - | 3.19 | 3.19 | 2.53 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 110 | 0.11 | 0.00 | 0.00 | - | 0.00 | 0.00 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 109 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WHB | #ATS casks | 109 | - | - | - | - | - | - | 0.26 |
| Spent Resin - WTB | gal recycle | 131,181 | - | - | - | - | - | - | 0.16 |
| Filter Cartridges - WTB | gal recycle | 131,181 | - | - | - | - | - | - | 0.16 |
| Total forOperations: | | | 131.2 | 55.9 | 2.1 | 22.9 | 25.0 | 19.6 | 0.8 |

Table III-27. Estimated Secondary LLW – Year 2012 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2012 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 2 | 0.09 | 0.03 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 213 | 9.16 | 3.05 | 0.14 | - | 0.14 | 0.11 | - |
| CTS Cask Decon | #CTS casks | 3 | 0.37 | 0.04 | 0.00 | - | 0.00 | 0.00 | - |
| DC Decon | #DC | 152 | 12.13 | 1.88 | 0.08 | - | 0.08 | 0.06 | - |
| Cask Handling (Casks) | #casks | 216 | - | - | - | 6.26 | 6.26 | 4.97 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 216 | 0.21 | 0.00 | 0.01 | - | 0.01 | 0.00 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 213 | - | - | - | - | - | - | 0.51 |
| Filter Cartridges - WHB | #ATS casks | 213 | - | - | - | - | - | - | 0.51 |
| Spent Resin - WTB | gal recycle | 141,894 | - | - | - | - | - | - | 0.17 |
| Filter Cartridges - WTB | gal recycle | 141,894 | - | - | - | - | - | - | 0.17 |
| Total forOperations: | | | 141.9 | 58.3 | 2.2 | 26.0 | 28.2 | 22.2 | 1.4 |

Table III-28. Estimated Secondary LLW – Year 2013 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2013 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 24 | 1.02 | 0.34 | 0.02 | - | 0.02 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 345 | 14.84 | 4.95 | 0.23 | - | 0.23 | 0.18 | - |
| CTS Cask Decon | #CTS casks | 6 | 0.73 | 0.07 | 0.01 | - | 0.01 | 0.01 | - |
| DC Decon | #DC | 251 | 20.03 | 3.11 | 0.13 | - | 0.13 | 0.10 | - |
| Cask Handling (Casks) | #casks | 351 | - | - | - | 10.18 | 10.18 | 8.07 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 351 | 0.34 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Filter Cartridges - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Spent Resin - WTB | gal recycle | 156,906 | - | - | - | - | - | - | 0.19 |
| Filter Cartridges - WTB | gal recycle | 156,906 | - | - | - | - | - | - | 0.19 |
| Total forOperations: | | | 156.9 | 61.8 | 2.4 | 29.9 | 32.3 | 25.4 | 2.0 |

Table III-29. Estimated Secondary LLW – Year 2014 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2014 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| **Unit Sources:** | | | | | | | | | |
| DPC Decon | # DPC | 10 | 0.43 | 0.14 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 540 | 23.23 | 7.74 | 0.35 | - | 0.35 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 8 | 0.98 | 0.10 | 0.01 | - | 0.01 | 0.01 | - |
| DC Decon | #DC | 373 | 29.76 | 4.62 | 0.20 | - | 0.20 | 0.16 | - |
| Cask Handling (Casks) | #casks | 548 | - | - | - | 15.89 | 15.89 | 12.60 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| **Plant Sources:** | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 548 | 0.53 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| **Water Treatment Sources** | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 540 | - | - | - | - | - | - | 1.30 |
| Filter Cartridges - WHB | #ATS casks | 540 | - | - | - | - | - | - | 1.30 |
| Spent Resin - WTB | gal recycle | 174,865 | - | - | - | - | - | - | 0.21 |
| Filter Cartridges - WTB | gal recycle | 174,865 | - | - | - | - | - | - | 0.21 |
| Total forOperations: | | | 174.9 | 65.9 | 2.6 | 35.6 | 38.2 | 30.1 | 3.0 |

Table III-30. Estimated Secondary LLW – Year 2015 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 14 | 0.60 | 0.20 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 519 | 22.33 | 7.44 | 0.34 | - | 0.34 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 137 | 16.75 | 1.63 | 0.20 | - | 0.20 | 0.15 | - |
| DC Decon | #DC | 503 | 40.13 | 6.24 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 656 | - | - | - | 19.02 | 19.02 | 15.09 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 656 | 0.63 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Filter Cartridges - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Spent Resin - WTB | gal recycle | 200,381 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 200,381 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 200.4 | 68.8 | 2.8 | 38.8 | 41.6 | 32.8 | 3.0 |

Table III-31. Estimated Secondary LLW – Year 2016 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2016 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 22 | 0.94 | 0.31 | 0.01 | - | 0.01 | 0.01 | - |
| ATS Cask Decon | # ATS casks | 551 | 23.70 | 7.90 | 0.36 | - | 0.36 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 145 | 17.73 | 1.73 | 0.21 | - | 0.21 | 0.16 | - |
| DC Decon | #DC | 524 | 41.81 | 6.50 | 0.28 | - | 0.28 | 0.22 | - |
| Cask Handling (Casks) | #casks | 696 | - | - | - | 20.18 | 20.18 | 16.01 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 696 | 0.67 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 551 | - | - | - | - | - | - | 1.33 |
| Filter Cartridges - WHB | #ATS casks | 551 | - | - | - | - | - | - | 1.33 |
| Spent Resin - WTB | gal recycle | 204,790 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 204,790 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 204.8 | 69.7 | 2.9 | 39.9 | 42.8 | 33.7 | 3.2 |

Table III-32. Estimated Secondary LLW – Year 2017 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2017 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 43 | 1.83 | 0.61 | 0.03 | - | 0.03 | 0.02 | - |
| ATS Cask Decon | # ATS casks | 533 | 22.93 | 7.64 | 0.35 | - | 0.35 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 138 | 16.87 | 1.64 | 0.20 | - | 0.20 | 0.16 | - |
| DC Decon | #DC | 492 | 39.25 | 6.10 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 671 | - | - | - | 19.46 | 19.46 | 15.43 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 671 | 0.64 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 533 | - | - | - | - | - | - | 1.29 |
| Filter Cartridges - WHB | #ATS casks | 533 | - | - | - | - | - | - | 1.29 |
| Spent Resin - WTB | gal recycle | 201,478 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 201,478 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 201.5 | 69.3 | 2.8 | 39.2 | 42.0 | 33.1 | 3.1 |

Table III-33. Estimated Secondary LLW – Year 2018 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2018 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 48 | 2.05 | 0.68 | 0.03 | - | 0.03 | 0.02 | - |
| ATS Cask Decon | # ATS casks | 541 | 23.27 | 7.76 | 0.35 | - | 0.35 | 0.28 | - |
| CTS Cask Decon | #CTS casks | 151 | 18.46 | 1.80 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 524 | 41.81 | 6.50 | 0.28 | - | 0.28 | 0.22 | - |
| Cask Handling (Casks) | #casks | 692 | - | - | - | 20.07 | 20.07 | 15.92 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 692 | 0.66 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 541 | - | - | - | - | - | - | 1.31 |
| Filter Cartridges - WHB | #ATS casks | 541 | - | - | - | - | - | - | 1.31 |
| Spent Resin - WTB | gal recycle | 206,199 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,199 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.2 | 70.0 | 2.9 | 39.8 | 42.7 | 33.6 | 3.1 |

Table III-34. Estimated Secondary LLW – Year 2019 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2019 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | | |
| | | | Decon. Operations | | | General Operations | | | | |
| | | | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW | |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | |
| LLW | | | | | | | | | | |
| Unit Sources: | | | | | | | | | | |
| DPC Decon | # DPC | 96 | 4.09 | 1.36 | 0.06 | - | 0.06 | 0.05 | - | |
| ATS Cask Decon | # ATS casks | 532 | 22.89 | 7.63 | 0.35 | - | 0.35 | 0.27 | - | |
| CTS Cask Decon | #CTS casks | 153 | 18.71 | 1.82 | 0.22 | - | 0.22 | 0.17 | - | |
| DC Decon | #DC | 507 | 40.45 | 6.28 | 0.27 | - | 0.27 | 0.21 | - | |
| Cask Handling (Casks) | #casks | 685 | - | - | - | 19.87 | 19.87 | 15.76 | - | |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - | |
| Plant Sources: | | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - | |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - | |
| Carrier Washdown | #carriers | 685 | 0.66 | 0.00 | 0.02 | - | 0.02 | 0.02 | - | |
| Water Treatment Sources | | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 532 | - | - | - | - | - | - | 1.28 | |
| Filter Cartridges - WHB | #ATS casks | 532 | - | - | - | - | - | - | 1.28 | |
| Spent Resin - WTB | gal recycle | 206,740 | - | - | - | - | - | - | 0.25 | |
| Filter Cartridges - WTB | gal recycle | 206,740 | - | - | - | - | - | - | 0.25 | |
| Total forOperations: | | | 206.7 | 70.4 | 2.9 | 39.6 | 42.5 | 33.5 | 3.1 | |

Table III-35. Estimated Secondary LLW – Year 2020 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2020 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 123 | 5.24 | 1.75 | 0.08 | - | 0.08 | 0.06 | - |
| ATS Cask Decon | # ATS casks | 499 | 21.47 | 7.16 | 0.33 | - | 0.33 | 0.26 | - |
| CTS Cask Decon | #CTS casks | 154 | 18.83 | 1.84 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 510 | 40.69 | 6.32 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 653 | - | - | - | 18.94 | 18.94 | 15.02 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 653 | 0.63 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 499 | - | - | - | - | - | - | 1.21 |
| Filter Cartridges - WHB | #ATS casks | 499 | - | - | - | - | - | - | 1.21 |
| Spent Resin - WTB | gal recycle | 206,802 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,802 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.8 | 70.4 | 2.9 | 38.7 | 41.6 | 32.8 | 2.9 |

Table III-36. Estimated Secondary LLW – Year 2021 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2021 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 161 | 6.87 | 2.29 | 0.10 | - | 0.10 | 0.08 | - |
| ATS Cask Decon | # ATS casks | 471 | 20.26 | 6.75 | 0.31 | - | 0.31 | 0.24 | - |
| CTS Cask Decon | #CTS casks | 154 | 18.83 | 1.84 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 505 | 40.29 | 6.26 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 625 | - | - | - | 18.13 | 18.13 | 14.38 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 625 | 0.60 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 471 | - | - | - | - | - | - | 1.14 |
| Filter Cartridges - WHB | #ATS casks | 471 | - | - | - | - | - | - | 1.14 |
| Spent Resin - WTB | gal recycle | 206,792 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,792 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.8 | 70.4 | 2.9 | 37.9 | 40.8 | 32.1 | 2.8 |

Table III-37. Estimated Secondary LLW – Year 2022 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 177 | 7.55 | 2.52 | 0.11 | - | 0.11 | 0.09 | - |
| ATS Cask Decon | # ATS casks | 496 | 21.34 | 7.11 | 0.32 | - | 0.32 | 0.25 | - |
| CTS Cask Decon | #CTS casks | 140 | 17.12 | 1.67 | 0.20 | - | 0.20 | 0.16 | - |
| DC Decon | #DC | 499 | 39.81 | 6.19 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 636 | - | - | - | 18.44 | 18.44 | 14.63 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 636 | 0.61 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 496 | - | - | - | - | - | - | 1.20 |
| Filter Cartridges - WHB | #ATS casks | 496 | - | - | - | - | - | - | 1.20 |
| Spent Resin - WTB | gal recycle | 206,370 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 206,370 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 206.4 | 70.8 | 2.9 | 38.2 | 41.1 | 32.4 | 2.9 |

Table III-38. Estimated Secondary LLW – Year 2023 (Options 1 and 2)

| Secondary Waste Generation Estimate Year2023 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 179 | 7.63 | 2.54 | 0.12 | - | 0.12 | 0.09 | - |
| ATS Cask Decon | # ATS casks | 483 | 20.78 | 6.93 | 0.32 | - | 0.32 | 0.25 | - |
| CTS Cask Decon | #CTS casks | 140 | 17.12 | 1.67 | 0.20 | - | 0.20 | 0.16 | - |
| DC Decon | #DC | 485 | 38.70 | 6.01 | 0.26 | - | 0.26 | 0.20 | - |
| Cask Handling (Casks) | #casks | 623 | - | - | - | 18.07 | 18.07 | 14.33 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 623 | 0.60 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 483 | - | - | - | - | - | - | 1.17 |
| Filter Cartridges - WHB | #ATS casks | 483 | - | - | - | - | - | - | 1.17 |
| Spent Resin - WTB | gal recycle | 204,767 | - | - | - | - | - | - | 0.24 |
| Filter Cartridges - WTB | gal recycle | 204,767 | - | - | - | - | - | - | 0.24 |
| Total forOperations: | | | 204.8 | 70.5 | 2.9 | 37.8 | 40.7 | 32.1 | 2.8 |

Table III-39. Estimated Secondary LLW – Year 2024 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2024 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 199 | 8.49 | 2.83 | 0.13 | - | 0.13 | 0.10 | - |
| ATS Cask Decon | # ATS casks | 457 | 19.66 | 6.55 | 0.30 | - | 0.30 | 0.23 | - |
| CTS Cask Decon | #CTS casks | 145 | 17.73 | 1.73 | 0.21 | - | 0.21 | 0.16 | - |
| DC Decon | #DC | 495 | 39.49 | 6.14 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 602 | - | - | - | 17.46 | 17.46 | 13.85 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 602 | 0.58 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 457 | - | - | - | - | - | - | 1.10 |
| Filter Cartridges - WHB | #ATS casks | 457 | - | - | - | - | - | - | 1.10 |
| Spent Resin - WTB | gal recycle | 205,890 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 205,890 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 205.9 | 70.6 | 2.9 | 37.2 | 40.1 | 31.6 | 2.7 |

Table III-40. Estimated Secondary LLW – Year 2025 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2025 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 250 | 10.66 | 3.55 | 0.16 | - | 0.16 | 0.13 | - |
| ATS Cask Decon | # ATS casks | 519 | 22.33 | 7.44 | 0.34 | - | 0.34 | 0.27 | - |
| CTS Cask Decon | #CTS casks | 150 | 18.34 | 1.79 | 0.22 | - | 0.22 | 0.17 | - |
| DC Decon | #DC | 510 | 40.69 | 6.32 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 669 | - | - | - | 19.40 | 19.40 | 15.39 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 669 | 0.64 | 0.00 | 0.02 | - | 0.02 | 0.02 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Filter Cartridges - WHB | #ATS casks | 519 | - | - | - | - | - | - | 1.25 |
| Spent Resin - WTB | gal recycle | 212,604 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 212,604 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 212.6 | 72.4 | 3.0 | 39.1 | 42.1 | 33.2 | 3.0 |

Table III-41. Estimated Secondary LLW – Year 2026 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2026 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 411 | 17.53 | 5.84 | 0.27 | - | 0.27 | 0.21 | - |
| ATS Cask Decon | # ATS casks | 429 | 18.46 | 6.15 | 0.28 | - | 0.28 | 0.22 | - |
| CTS Cask Decon | #CTS casks | 149 | 18.22 | 1.78 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 508 | 40.53 | 6.30 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 578 | - | - | - | 16.76 | 16.76 | 13.29 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 578 | 0.56 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Filter Cartridges - WHB | #ATS casks | 429 | - | - | - | - | - | - | 1.04 |
| Spent Resin - WTB | gal recycle | 215,228 | - | - | - | - | - | - | 0.26 |
| Filter Cartridges - WTB | gal recycle | 215,228 | - | - | - | - | - | - | 0.26 |
| Total forOperations: | | | 215.2 | 73.4 | 3.0 | 36.5 | 39.5 | 31.1 | 2.6 |

Table III-42. Estimated Secondary LLW – Year 2027 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2027 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 381 | 16.25 | 5.42 | 0.25 | - | 0.25 | 0.19 | - |
| ATS Cask Decon | # ATS casks | 418 | 17.98 | 5.99 | 0.27 | - | 0.27 | 0.21 | - |
| CTS Cask Decon | #CTS casks | 147 | 17.97 | 1.75 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 492 | 39.25 | 6.10 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 565 | - | - | - | 16.39 | 16.39 | 13.00 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 565 | 0.54 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 418 | - | - | - | - | - | - | 1.01 |
| Filter Cartridges - WHB | #ATS casks | 418 | - | - | - | - | - | - | 1.01 |
| Spent Resin - WTB | gal recycle | 211,942 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 211,942 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 211.9 | 72.6 | 3.0 | 36.1 | 39.1 | 30.8 | 2.5 |

Table III-43. Estimated Secondary LLW – Year 2028 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2028 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 347 | 14.80 | 4.93 | 0.22 | - | 0.22 | 0.18 | - |
| ATS Cask Decon | # ATS casks | 376 | 16.18 | 5.39 | 0.25 | - | 0.25 | 0.19 | - |
| CTS Cask Decon | #CTS casks | 147 | 17.97 | 1.75 | 0.21 | - | 0.21 | 0.17 | - |
| DC Decon | #DC | 479 | 38.22 | 5.94 | 0.25 | - | 0.25 | 0.20 | - |
| Cask Handling (Casks) | #casks | 523 | - | - | - | 15.17 | 15.17 | 12.03 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 523 | 0.50 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 376 | - | - | - | - | - | - | 0.91 |
| Filter Cartridges - WHB | #ATS casks | 376 | - | - | - | - | - | - | 0.91 |
| Spent Resin - WTB | gal recycle | 207,608 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 207,608 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 207.6 | 71.3 | 2.9 | 34.9 | 37.8 | 29.8 | 2.3 |

Table III-44. Estimated Secondary LLW – Year 2029 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2029 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste | Non-Recycl Liquid Waste | Compact. DAW | Other Compact. DAW | Total Compactible DAW | Non-Compactible DAW | Wet Solid LLW |
| | | | (1000Gals) | (1000 Gals) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) | (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 347 | 14.80 | 4.93 | 0.22 | - | 0.22 | 0.18 | - |
| ATS Cask Decon | # ATS casks | 364 | 15.66 | 5.22 | 0.24 | - | 0.24 | 0.19 | - |
| CTS Cask Decon | #CTS casks | 181 | 22.13 | 2.16 | 0.26 | - | 0.26 | 0.20 | - |
| DC Decon | #DC | 493 | 39.33 | 6.11 | 0.26 | - | 0.26 | 0.21 | - |
| Cask Handling (Casks) | #casks | 545 | - | - | - | 15.81 | 15.81 | 12.54 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 545 | 0.52 | 0.00 | 0.02 | - | 0.02 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 364 | - | - | - | - | - | - | 0.88 |
| Filter Cartridges - WHB | #ATS casks | 364 | - | - | - | - | - | - | 0.88 |
| Spent Resin - WTB | gal recycle | 212,387 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 212,387 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 212.4 | 71.7 | 3.0 | 35.5 | 38.5 | 30.3 | 2.3 |

Table III-45. Estimated Secondary LLW – Year 2030 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2030 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| **Unit Sources:** | | | | | | | | | |
| DPC Decon | # DPC | 319 | 13.60 | 4.53 | 0.21 | - | 0.21 | 0.16 | - |
| ATS Cask Decon | # ATS casks | 352 | 15.14 | 5.05 | 0.23 | - | 0.23 | 0.18 | - |
| CTS Cask Decon | #CTS casks | 187 | 22.86 | 2.23 | 0.27 | - | 0.27 | 0.21 | - |
| DC Decon | #DC | 513 | 40.93 | 6.36 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 539 | - | - | - | 15.63 | 15.63 | 12.40 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| **Plant Sources:** | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 539 | 0.52 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| **Water Treatment Sources** | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 352 | - | - | - | - | - | - | 0.85 |
| Filter Cartridges - WHB | #ATS casks | 352 | - | - | - | - | - | - | 0.85 |
| Spent Resin - WTB | gal recycle | 213,001 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 213,001 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 213.0 | 71.5 | 3.0 | 35.4 | 38.3 | 30.2 | 2.2 |

Table III-46. Estimated Secondary LLW – Year 2031 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2031 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 302 | 12.88 | 4.29 | 0.20 | - | 0.20 | 0.15 | - |
| ATS Cask Decon | # ATS casks | 345 | 14.84 | 4.95 | 0.23 | - | 0.23 | 0.18 | - |
| CTS Cask Decon | #CTS casks | 181 | 22.13 | 2.16 | 0.26 | - | 0.26 | 0.20 | - |
| DC Decon | #DC | 499 | 39.81 | 6.19 | 0.27 | - | 0.27 | 0.21 | - |
| Cask Handling (Casks) | #casks | 526 | - | - | - | 15.25 | 15.25 | 12.10 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 526 | 0.51 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Filter Cartridges - WHB | #ATS casks | 345 | - | - | - | - | - | - | 0.83 |
| Spent Resin - WTB | gal recycle | 210,112 | - | - | - | - | - | - | 0.25 |
| Filter Cartridges - WTB | gal recycle | 210,112 | - | - | - | - | - | - | 0.25 |
| Total forOperations: | | | 210.1 | 70.9 | 2.9 | 35.0 | 37.9 | 29.9 | 2.2 |

Table III-47. Estimated Secondary LLW – Year 2032 (Options 1 and 2)

| Secondary Waste Generation Estimate Year 2032 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| Waste Source | Scaling Basis | Quantity | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| Unit Sources: | | | | | | | | | |
| DPC Decon | # DPC | 6 | 0.26 | 0.09 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 284 | 12.22 | 4.07 | 0.19 | - | 0.19 | 0.15 | - |
| CTS Cask Decon | #CTS casks | 143 | 17.48 | 1.70 | 0.21 | - | 0.21 | 0.16 | - |
| DC Decon | #DC | 473 | 37.74 | 5.86 | 0.25 | - | 0.25 | 0.20 | - |
| Cask Handling (Casks) | #casks | 427 | - | - | - | 12.38 | 12.38 | 9.82 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| Plant Sources: | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 427 | 0.41 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| Water Treatment Sources | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 284 | - | - | - | - | - | - | 0.69 |
| Filter Cartridges - WHB | #ATS casks | 284 | - | - | - | - | - | - | 0.69 |
| Spent Resin - WTB | gal recycle | 188,050 | - | - | - | - | - | - | 0.22 |
| Filter Cartridges - WTB | gal recycle | 188,050 | - | - | - | - | - | - | 0.22 |
| Total forOperations: | | | 188.1 | 65.0 | 2.6 | 32.1 | 34.8 | 27.4 | 1.8 |

Table III-48. Estimated Secondary LLW – Year 2033 (Options 1 and 2)

| Secondary Waste Generation Estimate<br>Year 2033 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Waste Source | Scaling Basis | Quantity | Secondary LLW Waste Produced | | | | | | |
| | | | Decon. Operations | | | General Operations | | | |
| | | | Recyclable Liquid Waste (1000Gals) | Non-Recycl Liquid Waste (1000 Gals) | Compact. DAW (1000 ft3) | Other Compact. DAW (1000 ft3) | Total Compactible DAW (1000 ft3) | Non-Compactible DAW (1000 ft3) | Wet Solid LLW (1000 ft3) |
| LLW | | | | | | | | | |
| **Unit Sources:** | | | | | | | | | |
| DPC Decon | # DPC | 1 | 0.04 | 0.01 | 0.00 | - | 0.00 | 0.00 | - |
| ATS Cask Decon | # ATS casks | 171 | 7.36 | 2.45 | 0.11 | - | 0.11 | 0.09 | - |
| CTS Cask Decon | #CTS casks | 105 | 12.84 | 1.25 | 0.15 | - | 0.15 | 0.12 | - |
| DC Decon | #DC | 312 | 24.89 | 3.87 | 0.17 | - | 0.17 | 0.13 | - |
| Cask Handling (Casks) | #casks | 276 | - | - | - | 8.00 | 8.00 | 6.35 | - |
| Plant Operators (WHB + WTB) | #operators | 138 | - | - | - | 19.73 | 19.73 | 15.46 | - |
| **Plant Sources:** | | | | | | | | | |
| Facil Floor Decontamination: | | | | | | | | | |
| WHB Floor | $ft^2$ | 138,400 | 116.33 | 51.70 | 1.92 | - | 1.92 | 1.51 | - |
| WTB Floor | $ft^2$ | 25,100 | 3.61 | 1.61 | 0.06 | - | 0.06 | 0.05 | - |
| Carrier Washdown | #carriers | 276 | 0.27 | 0.00 | 0.01 | - | 0.01 | 0.01 | - |
| **Water Treatment Sources** | | | | | | | | | |
| Spent Resin - WHB | #ATS casks | 171 | - | - | - | - | - | - | 0.41 |
| Filter Cartridges - WHB | #ATS casks | 171 | - | - | - | - | - | - | 0.41 |
| Spent Resin - WTB | gal recycle | 165,339 | - | - | - | - | - | - | 0.20 |
| Filter Cartridges - WTB | gal recycle | 165,339 | - | - | - | - | - | - | 0.20 |
| Total forOperations: | | | 165.3 | 60.9 | 2.4 | 27.7 | 30.2 | 23.7 | 1.2 |

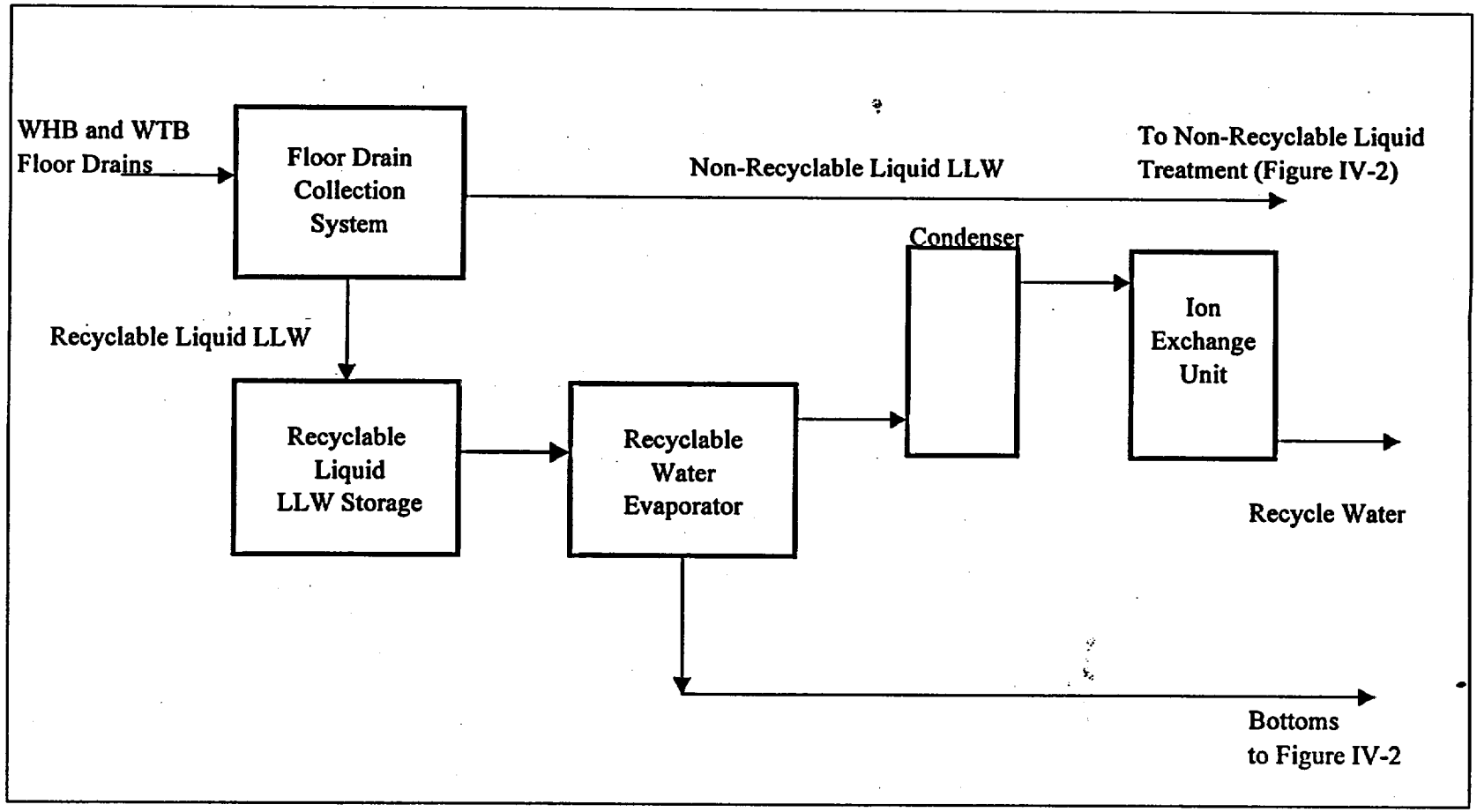


Figure IV-1. Aqueous (Recyclable) Liquid LLW Processing (Baseline Option, Option 1, and Option 2)

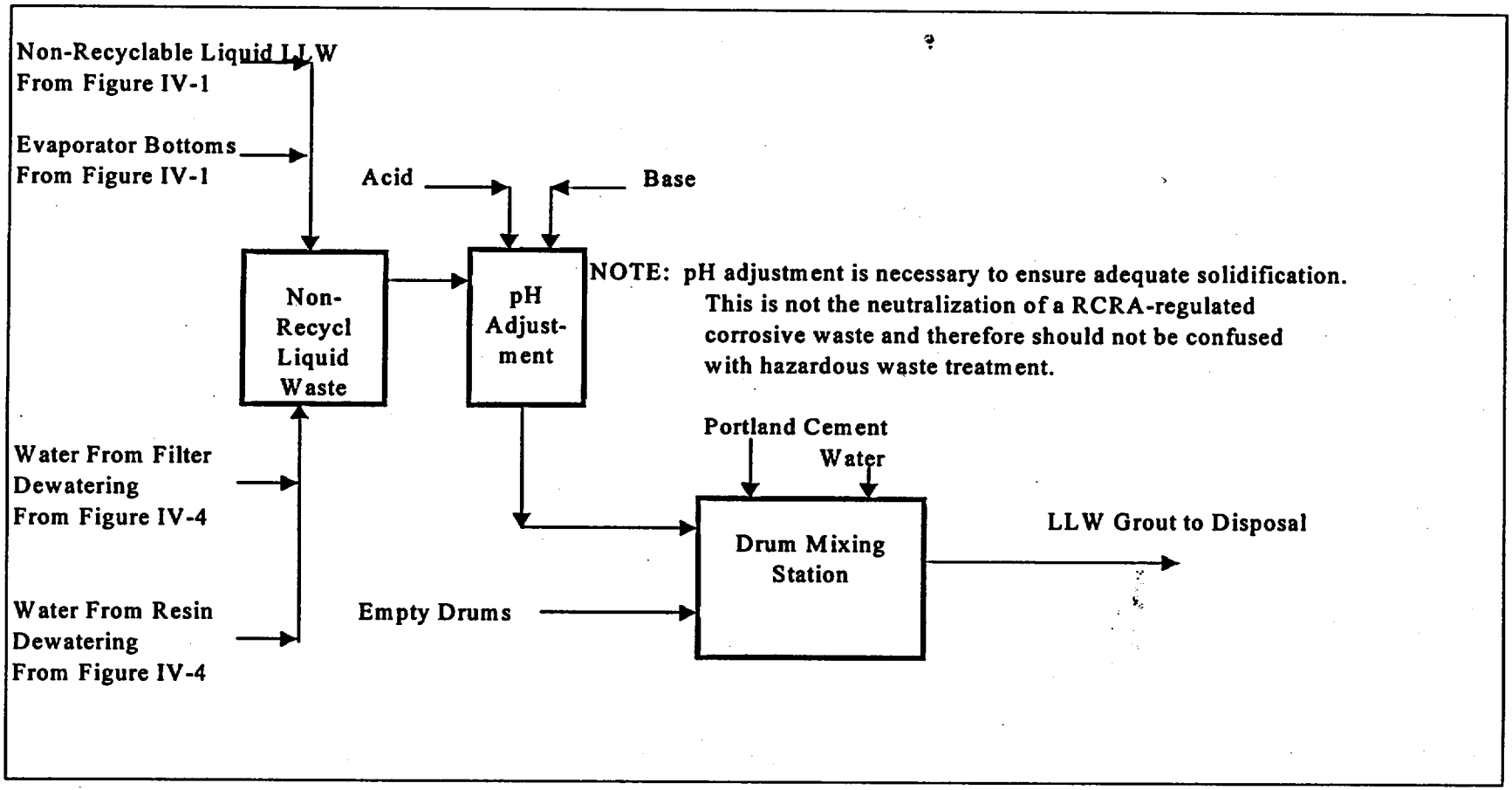


Figure IV-2 Non-Recyclable Liquid LLW Processing (Baseline Option, Option 1, and Option 2)

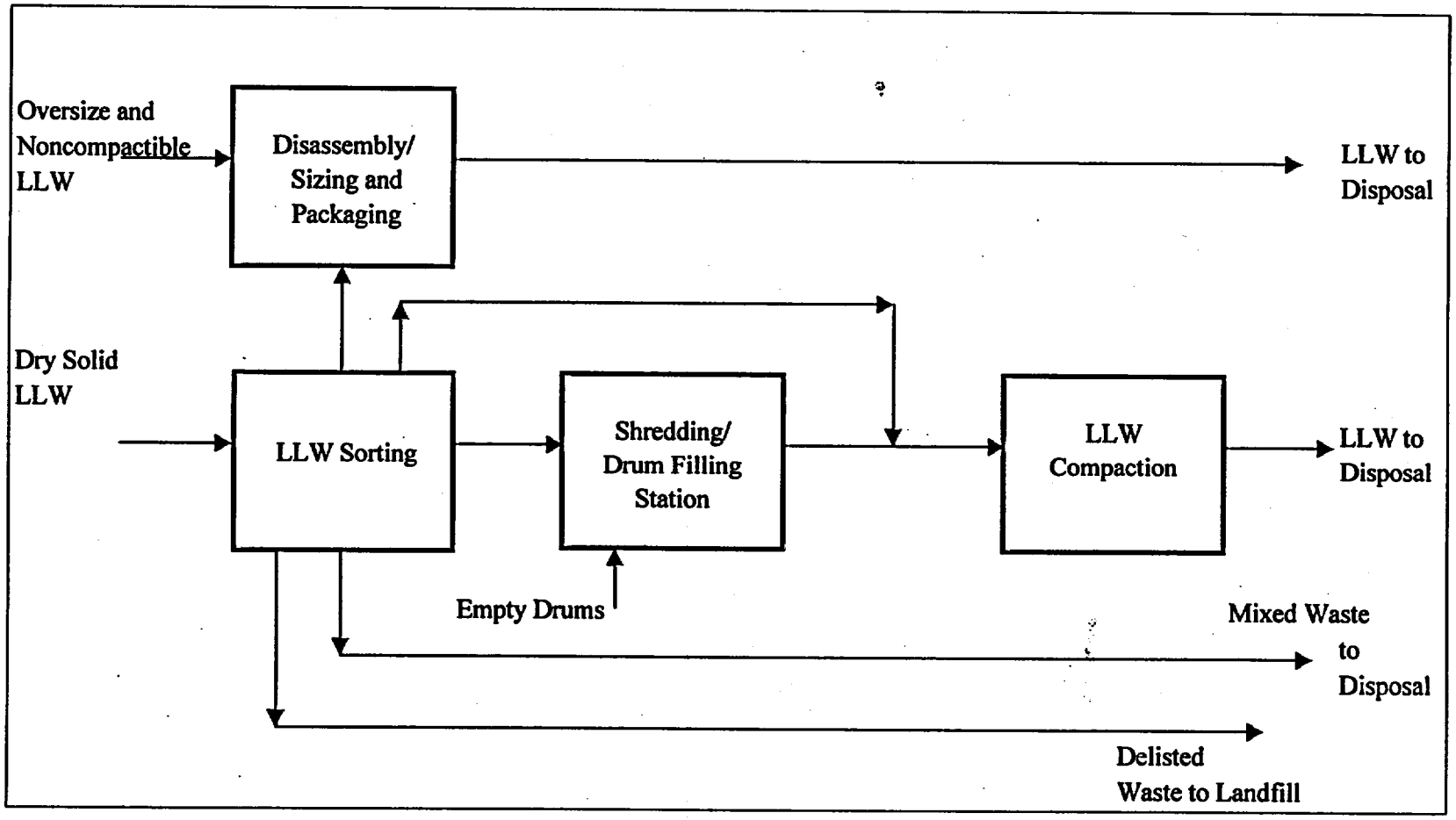


Figure IV-3. Dry Active Waste Processing (Baseline Option)

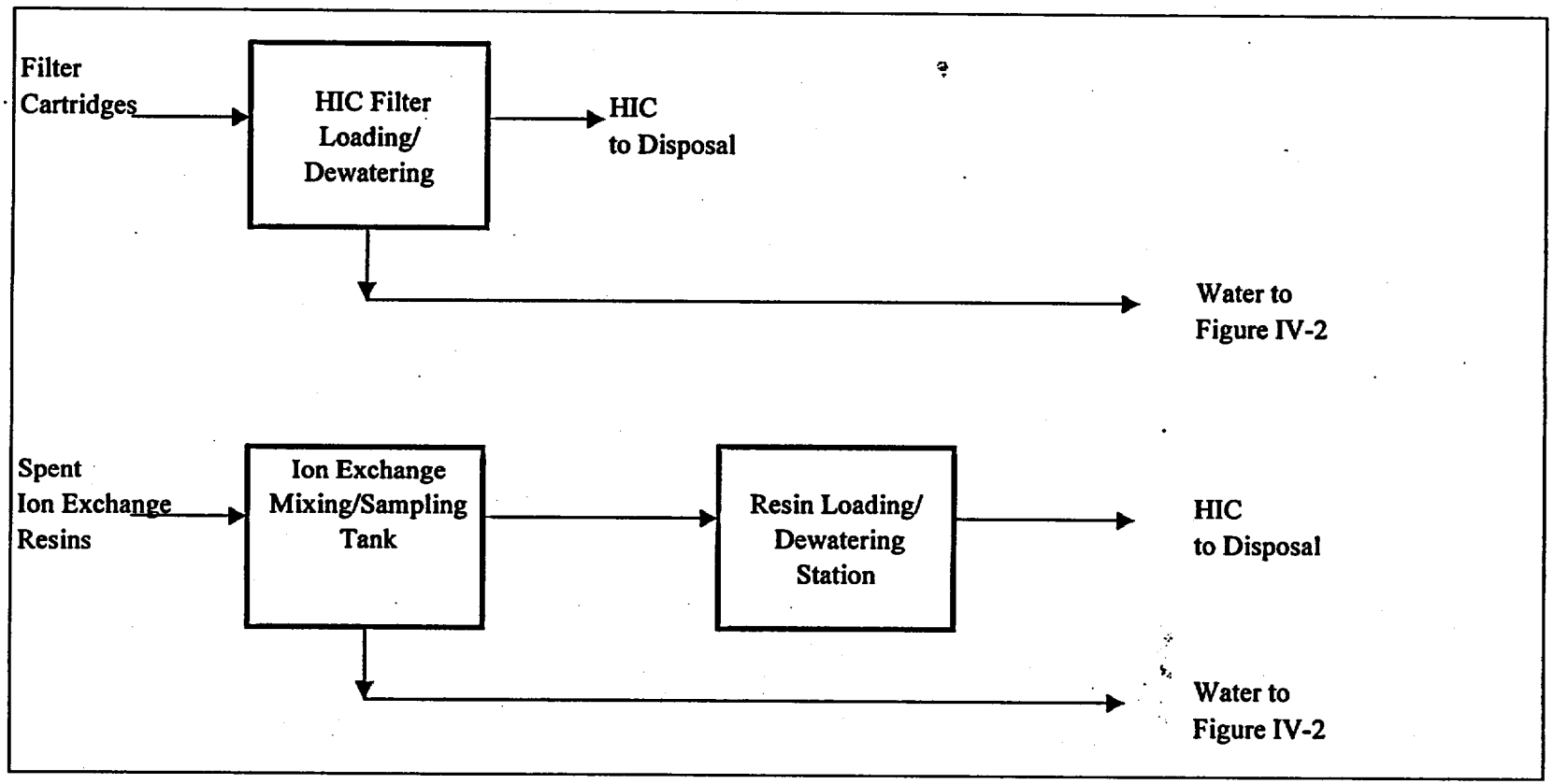


Figure IV-4. Wet Solid LLW Processing (Baseline Option, Option 1, and Option 2)

Table IV-1. Equipment Lists for Options

| | Baseline Option | Option 1 | Option 2 |
|---|---|---|---|
| Recyclable Water Collection Tank | X | X | X |
| Recyclable Water Filters (2 each) | X | X | X |
| Recyclable Water Evaporator | X | X | X |
| Evaporator Overheads Condenser | X | X | X |
| Evaporator Overheads Surge Tank | X | X | X |
| Recyclable Water Ion Exchange Unit | X | X | X |
| Recyclable Water Surge Tanks (2 each) | X | X | X |
| Pumps (5 each) | X | X | X |
| WTB Floor Drain Collection Tank | X | X | X |
| Non-Recyclable Liquid Waste Collection Tank | X | X | X |
| pH Adjustment Tank | X | X | X |
| Portland Cement Hopper | X | X | X |
| Portand Cement Feeder | X | X | X |
| Drum Mixing Stations (2 each) | X | X | X |
| Pumps (3 each) | X | X | X |
| Ion Exchange Mix Tank | X | X | X |
| Grouting Station | X | X | X |
| Ion Exchange Dewatering/Loading Station | X | X | X |
| Cartridge Filter Loading Station | X | X | X |
| Oversize Solid Waste Sizing and Packaging Glovebox | X | | |
| Solid LLW Sorting Glovebox | X | | |
| Pre-Shredder Sorting Glovebox | X | | |
| LLW Shredder/Drum Filling Station | X | | |
| LLW Compactor | X | | |
| DAW/Mixed Waste Sorting Glovebox | | X | X |
| Truck Loading Area Equipment | X | X | X |
| Drum Loading Station | | X | X |

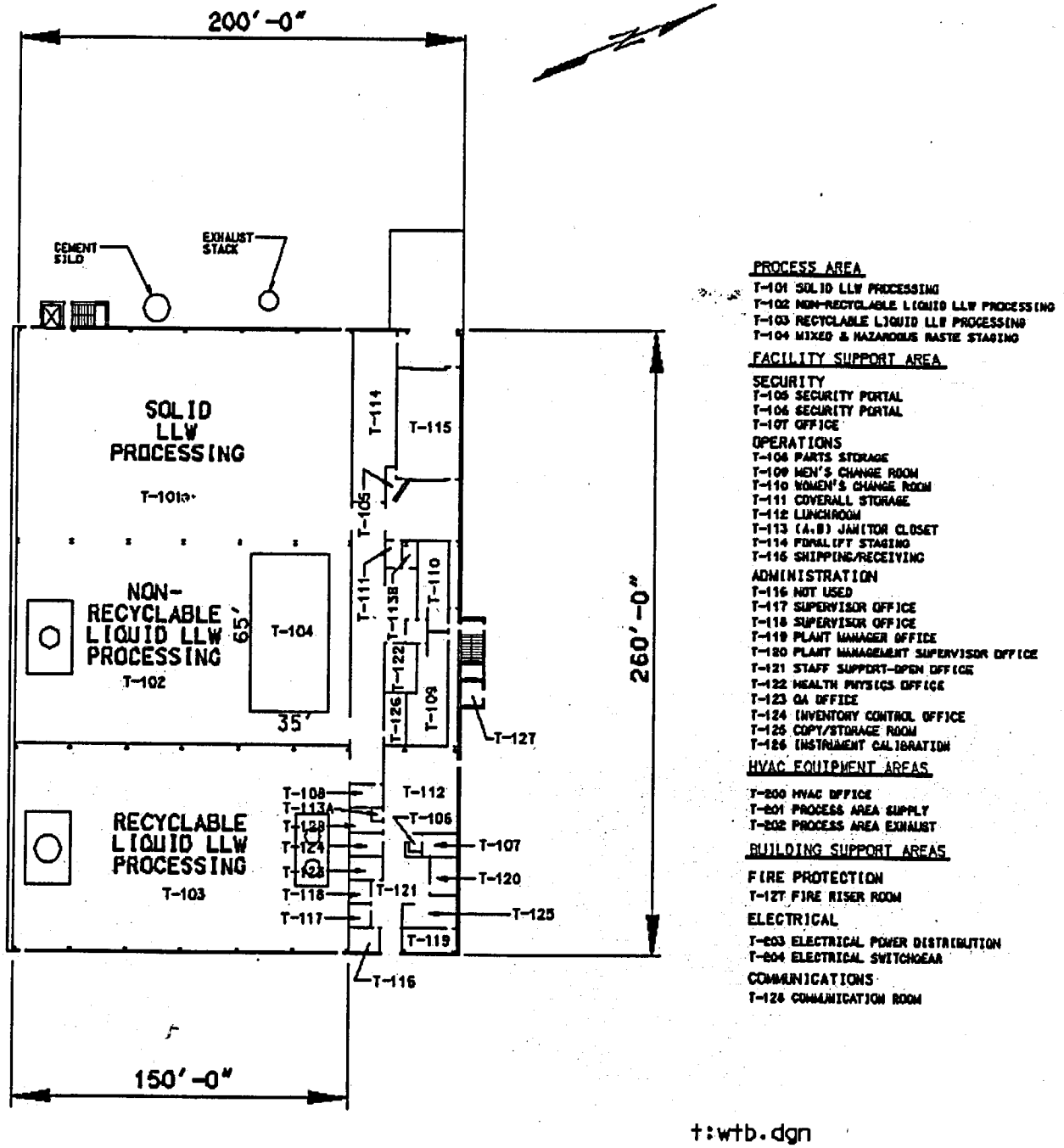


Figure V-1. Waste Treatment Building

Table VI-1. Life Cycle Costs ($1000)

| Life-Cycle Cost for Baseline Option | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | 1,141 | 1,141 | 1,141 | 298 | 206 | 155 | 200 | | | | | |
| Construction | | | | 6,682 | 8,738 | 7,710 | 1,208 | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | | | | | | | | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 |
| Utilities | | | | | | | | 335 | 336 | 335 | 336 | 335 |
| Maintenance | | | | | | | | 512 | 512 | 512 | 512 | 512 |
| Materials | | | | | | | | | 388 | 402 | 434 | 479 |
| Waste Disposal | | | | | | | | | 318 | 329 | 355 | 392 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 1,141 | 1,141 | 1,141 | 6,980 | 8,944 | 7,865 | 1,408 | 4,400 | 5,107 | 5,131 | 5,190 | 5,271 |
| Life-Cycle to Date | 1,141 | 2,282 | 3,423 | 10,403 | 19,347 | 27,212 | 28,620 | 33,020 | 38,127 | 43,258 | 48,448 | 53,719 |

| Life-Cycle Cost for Option 1 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | 695 | 695 | 695 | 150 | 120 | 100 | 150 | | | | | |
| Construction | | | | 4,500 | 5,100 | 4,900 | 309 | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | | | | | | | | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 |
| Utilities | | | | | | | | 232 | 232 | 232 | 232 | 232 |
| Maintenance | | | | | | | | 300 | 300 | 300 | 300 | 300 |
| Materials | | | | | | | | | 649 | 672 | 726 | 802 |
| Waste Disposal | | | | | | | | | 671 | 694 | 750 | 829 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 695 | 695 | 695 | 4,650 | 5,220 | 5,000 | 459 | 3,617 | 4,938 | 4,983 | 5,094 | 5,248 |
| Life-Cycle to Date | 695 | 1,390 | 2,085 | 6,735 | 11,955 | 16,955 | 17,414 | 21,031 | 25,969 | 30,952 | 36,046 | 41,294 |

| Life-Cycle Cost for Option 2 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | 695 | 695 | 695 | 150 | 120 | 100 | 150 | | | | | |
| Construction | | | | 4,500 | 5,100 | 4,900 | 309 | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | | | | | | | | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 |
| Utilities | | | | | | | | 232 | 232 | 232 | 232 | 232 |
| Maintenance | | | | | | | | 300 | 300 | 300 | 300 | 300 |
| Materials | | | | | | | | | 649 | 672 | 726 | 802 |
| Waste Disposal | | | | | | | | | 6487 | 6715 | 7256 | 8015 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 695 | 695 | 695 | 4,650 | 5,220 | 5,000 | 459 | 3,617 | 10,754 | 11,004 | 11,600 | 12,434 |
| Life-Cycle to Date | 695 | 1,390 | 2,085 | 6,735 | 11,955 | 16,955 | 17,414 | 21,031 | 31,785 | 42,789 | 54,389 | 66,823 |

## Table VI-1. Life Cycle Costs ($1000)

| Life-Cycle Cost for Baseline Option | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | | |
| Construction | | | | | | | | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 |
| Utilities | 336 | 335 | 336 | 335 | 336 | 335 | 336 | 335 | 336 | 335 | 336 | 335 |
| Maintenance | 512 | 512 | 512 | 512 | 512 | 512 | 512 | 511 | 512 | 512 | 512 | 512 |
| Materials | 534 | 611 | 624 | 614 | 628 | 630 | 630 | 630 | 629 | 624 | 628 | 648 |
| Waste Disposal | 437 | 500 | 511 | 503 | 514 | 516 | 516 | 516 | 515 | 511 | 514 | 530 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 5,372 | 5,511 | 5,536 | 5,517 | 5,543 | 5,546 | 5,547 | 5,545 | 5,545 | 5,535 | 5,543 | 5,578 |
| Life-Cycle to Date | 59,091 | 64,602 | 70,138 | 75,655 | 81,198 | 86,744 | 92,291 | 97,836 | 103,381 | 108,916 | 114,459 | 120,037 |

| Life-Cycle Cost for Option 1 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | | |
| Construction | | | | | | | | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 |
| Utilities | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 |
| Maintenance | 301 | 300 | 300 | 300 | 300 | 301 | 300 | 300 | 300 | 300 | 301 | 300 |
| Materials | 892 | 1022 | 1044 | 1027 | 1051 | 1053 | 1054 | 1054 | 1052 | 1044 | 1049 | 1083 |
| Waste Disposal | 923 | 1056 | 1079 | 1062 | 1087 | 1089 | 1090 | 1090 | 1088 | 1079 | 1085 | 1120 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 5,434 | 5,695 | 5,741 | 5,706 | 5,756 | 5,760 | 5,762 | 5,761 | 5,758 | 5,740 | 5,753 | 5,820 |
| Life-Cycle to Date | 46,728 | 52,423 | 58,164 | 63,870 | 69,626 | 75,386 | 81,148 | 86,909 | 92,667 | 98,407 | 104,160 | 109,980 |

| Life-Cycle Cost for Option 2 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | | |
| Construction | | | | | | | | | | | | |
| Operation | | | | | | | | | | | | |
| Labor | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 |
| Utilities | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 |
| Maintenance | 301 | 300 | 300 | 300 | 300 | 301 | 300 | 300 | 300 | 300 | 301 | 300 |
| Materials | 892 | 1022 | 1044 | 1027 | 1051 | 1053 | 1054 | 1054 | 1052 | 1044 | 1049 | 1083 |
| Waste Disposal | 8925 | 10215 | 10437 | 10270 | 10508 | 10533 | 10538 | 10538 | 10537 | 10437 | 10492 | 10831 |
| Decommissioning | | | | | | | | | | | | |
| Total for Year | 13,436 | 14,854 | 15,099 | 14,914 | 15,177 | 15,204 | 15,210 | 15,209 | 15,207 | 15,098 | 15,160 | 15,531 |
| Life-Cycle to Date | 80,259 | 95,113 | 110,212 | 125,126 | 140,303 | 155,507 | 170,717 | 185,926 | 201,133 | 216,231 | 231,391 | 246,922 |

## Table VI-1. Life Cycle Costs ($1000)

| Life-Cycle Cost for Baseline Option | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2034 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | 4,282 |
| Construction | | | | | | | | | | | 24,338 |
| Operation | | | | | | | | | | | |
| Labor | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | 3,553 | | 92378 |
| Utilities | 336 | 335 | 336 | 335 | 336 | 335 | 336 | 335 | 336 | | 8723 |
| Maintenance | 511 | 512 | 512 | 512 | 512 | 512 | 511 | 512 | 512 | | 13309 |
| Materials | 656 | 646 | 633 | 647 | 649 | 640 | 573 | 505 | 388 | | 14470 |
| Waste Disposal | 536 | 528 | 518 | 529 | 531 | 523 | 469 | 413 | 318 | | 11842 |
| Decommissioning | | | | | | | | 1126 | 1127 | 1127 | 3380 |
| Total for Year | 5,592 | 5,574 | 5,552 | 5,576 | 5,581 | 5,563 | 5,442 | 6,444 | 6,234 | 1,127 | |
| Life-Cycle to Date | 125,629 | 131,203 | 136,755 | 142,331 | 147,912 | 153,475 | 158,917 | 165,361 | 171,595 | 172,722 | 172,722 |

| Life-Cycle Cost for Option 1 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2034 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | 2,605 |
| Construction | | | | | | | | | | | 14,809 |
| Operation | | | | | | | | | | | |
| Labor | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | | 80223 |
| Utilities | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | | 6032 |
| Maintenance | 300 | 300 | 300 | 301 | 300 | 300 | 300 | 301 | 300 | | 7805 |
| Materials | 1096 | 1080 | 1058 | 1082 | 1085 | 1070 | 959 | 844 | 648 | | 24196 |
| Waste Disposal | 1134 | 1116 | 1094 | 1119 | 1123 | 1107 | 992 | 873 | 672 | | 25022 |
| Decommissioning | | | | | | | | 686 | 686 | 685 | 2057 |
| Total for Year | 5,848 | 5,813 | 5,770 | 5,819 | 5,826 | 5,794 | 5,569 | 6,021 | 5,624 | 685 | |
| Life-Cycle to Date | 115,828 | 121,641 | 127,411 | 133,230 | 139,056 | 144,850 | 150,419 | 156,440 | 162,064 | 162,749 | 162,749 |

| Life-Cycle Cost for Option 2 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2034 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | | | | | | | 2,605 |
| Construction | | | | | | | | | | | 14,809 |
| Operation | | | | | | | | | | | |
| Labor | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | 3,085 | 3,086 | | 80223 |
| Utilities | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | 232 | | 6032 |
| Maintenance | 300 | 300 | 300 | 301 | 300 | 300 | 300 | 301 | 300 | | 7805 |
| Materials | 1096 | 1080 | 1058 | 1082 | 1085 | 1070 | 959 | 844 | 648 | | 24196 |
| Waste Disposal | 10963 | 10797 | 10580 | 10822 | 10853 | 10706 | 9588 | 8440 | 6488 | | 241971 |
| Decommissioning | | | | | | | | 686 | 686 | 685 | 2057 |
| Total for Year | 15,677 | 15,494 | 15,256 | 15,522 | 15,556 | 15,393 | 14,165 | 13,588 | 11,440 | 685 | |
| Life-Cycle to Date | 262,599 | 278,093 | 293,349 | 308,871 | 324,427 | 339,820 | 353,985 | 367,573 | 379,013 | 379,698 | 379,698 |