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1	1	Cog.Eng. W. S. Josephson		3/23/95	T3-04	P. L. Hapke		4/25/95	I4-05	1	1
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RELEASE AUTHORIZATION

Document Number:	WHC-SD-WM-ES-324, REV 0
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7. Abstract

This engineering study generates cost estimates of treatment options for RMW process equipment in excess of 12 feet in length retrieved from waste storage tanks.

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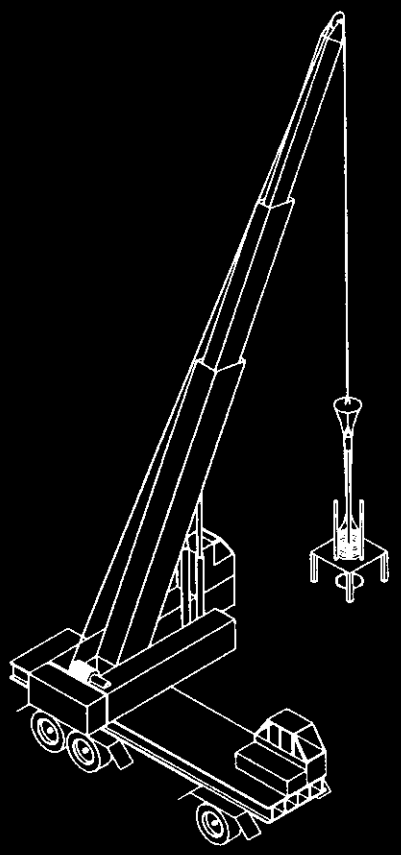

Issued by: W. S. Josephson

Westinghouse Hanford Company

April 1995

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Richland Operations Office
Richland, Washington

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Executive Summary

This study evaluated a variety of treatment and disposal technologies for mixed waste (MW) meeting the following criteria:

1. Single-Shell and Double-Shell Tank System (tank farms) equipment and other debris
2. length greater than 12 feet
3. contaminated with listed MW from the tank farms

This waste stream, commonly referred to as tank farms long-length contaminated equipment (LLCE), poses a unique and costly set of challenges during all phases of the waste management lifecycle. For example, due to the physical size, dose rate and shielded weight involved, the SY-101 air lance retrieval project required some $1,200,000 per air lance simply to get this type of waste into storage. Projected treatment and disposal costs would significantly add to that total.

Clearly, a more cost-effective process path was needed for LLCE, and treatment would be an integral part of this process path. This study was conducted to select the optimum technology for treatment and disposal of LLCE based on cost, regulatory, and technical considerations. The preferred treatment and disposal technologies will be incorporated into the overall process path.

The results showed that two alternatives were clearly superior to the others in terms of cost, and offered competing advantages and disadvantages. The first alternative, called the "Full-Size Macroencapsulation" (FSM) alternative, would entail treatment of transuranic (TRU) LLCE items at WRAP-2B and macroencapsulation of the remaining LLCE items in seal-welded polyethylene containers in accordance with 40 CFR 268.45. Other container materials such as stainless steel and fiberglass composites would also be suitable for FSM. The polyethylene containers would then be disposed in a landfill meeting the minimum technology requirements for MW disposal in accordance with RCRA Subtitle C (i.e., double-liner, leachate collection system, and groundwater monitoring).

The second alternative, called the "Grout Vault" alternative, would entail treatment of TRU LLCE items at WRAP-2B and macroencapsulation and disposal of the remaining LLCE items in the grout vaults in accordance with 40 CFR 268.45. The grout vaults also meet minimum technology requirements for MW disposal in accordance with RCRA Subtitle C.

The grout vault alternative is the most cost-effective in the long run, however the grout vaults are covered by a Tri-Party Agreement milestone and would require resolution of Safety Analysis Report and Performance Assessment issues. In addition, the high level of containment and shielding provided by the grout vaults may be better utilized for disposal of extremely high dose rate process equipment during decontamination and decommissioning of the canyon buildings.

The FSM alternative, on the other hand, would be less cost-effective in the long run, but would use unmodified existing facilities which do not have significant regulatory, safety and performance assessment issues, and would save grout vault space for high dose equipment disposal. As a result, this study recommends the immediate

development of the FSM treatment alternative to meet near-term treatment needs, while continuing to develop the grout vault alternative for disposal of high dose rate equipment. This study also recommends that when the grout vaults have been modified for waste disposal, a cost-benefit analysis be conducted to determine if LLCE disposal should be shifted to the grout vaults at that time.

Development of FSM should concentrate on the following items:

1. brief regulating agencies on position that LLCE does not contain free liquids

2. design and procure polyethylene macroencapsulation containers

3. modify design of retrieval and transportation equipment to be compatible with full-size macroencapsulation

Development of the grout vault alternative should concentrate on the following items:

1. brief regulating agencies on position that LLCE does not contain free liquids

2. resolve treatment after placement in a landfill issues

3. resolve question of grout vault availability for waste disposal

4. determine acceptability of the grout vault macro-encapsulation concept to regulating agencies and stakeholder groups

5. evaluate the availability of capital to modify the grout vaults for the waste disposal mission

The resulting LLCE macroencapsulation process line will provide low cost, robust and flexible treatment capability for LLCE and a wide range of similar equipment contaminated with listed MW.

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Treatment Options for Tank Farms Long-Length Contaminated Equipment

1.0 Objective

The primary objective of this study was to select the treatment method, or combination of methods, which should be developed for long-length contaminated equipment (LLCE) from the Single-Shell and Double-Shell Tank systems. The information developed would then serve as justification for more detailed development of the preferred treatment method(s).

The secondary objective was to develop a preliminary basis for sizing LLCE storage and disposal facilities. Clearly, both the expected LLCE retrieval rate and the planned treatment methods addressed by this study would have significant impact on future needs in these areas, therefore the results would provide important justification for selecting design capacity of ongoing facility construction projects.

1.1 Background and Scope

Throughout the majority of Hanford's operational history, LLCE from the various tank farms were simply rinsed off, wrapped in plastic, and buried as radioactive low-level waste (LLW). In February 1990 the Double-Shell Tank System Part A, Form 3 Permit Application was revised to include listed waste code F003, which resulted in reclassification of tank farms waste as listed MW, and imposed hazardous waste handling requirements on MW-contaminated equipment such as LLCE. Ecology, RL and WHC recognized that the regulatory framework at the time did not adequately address management of equipment which had been in contact with listed MW. Therefore, a slightly modified version of the original rinse and disposal practice, based on the EPA/Ecology triple rinse requirement for empty hazardous waste containers, was approved for use by DOE and Ecology on site. Tank farms operations continued essentially as before[1,2].

In 1992, however, the EPA promulgated a collection of changes to the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations which specifically addressed management of listed MW-contaminated equipment. Known as the "Debris Rule," this legislation invalidated the Ecology-approved triple rinse procedure and subjected all listed MW-contacted equipment to the new EPA standards for hazardous debris management.

Since that time, WHC has expended considerable effort to develop a RCRA-compliant, cradle-to-grave mechanism to disposition failed LLCE. These efforts have so far resulted in improved retrieval equipment and procedures, standardized generic transportation equipment, and development of storage facilities to handle long, heavily shielded containerized equipment. As the latest step in this ongoing process, this study was performed to initiate detailed development of treatment capability for LLCE.

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[1]Letter, T. L. Nord, Ecology, to S. H. Wisness, RL, "Equipment Decontamination Procedures," dated July, 24, 1991.

[2]Letter, E. A. Bracken, RL, to T. L. Nord, Ecology, "Equipment Decontamination," 9102456 91-EAB-123, dated June, 5, 1991.

1.2 Purpose and Need

LLCE has been and will continue to be generated, both to support general tank farms operations and long-term tank waste retrieval/ vitrification milestones. However, due to the regulated nature of LLCE, they would be restricted from land disposal until successful completion of treatment. Therefore, LLCE would continue to collect in storage until treatment capability could become operational.

This constraint applies to all listed MW generated on site. However, the unique size, shielded weight and high dose rate characteristics of LLCE would make all phases of retrieval, transportation and storage extremely expensive. Thus, while long-term storage for future treatment has been a cost effective tactic for most listed MW on site, LLCE was thought to be an exception.

To verify this qualitative evaluation, and to provide adequate fiscal justification to support development of treatment capabilities, a detailed study was clearly needed to compare the storage costs of deferral with the cost of treatment activities. This study was conducted to meet that need.

2.0 Summary

The study methodology and findings have been summarized below. First, the treatment methods available for LLCE and the inherent restrictions applicable to each treatment method were defined. To account for individual treatment method restrictions, combinations of treatment methods were designed to treat the entire LLCE waste stream. As a result, each of these treatment method combinations, called "treatment alternatives" for the purposes of this study, would constitute a RCRA-compliant cradle-to-grave waste management plan for LLCE.

A detailed cost estimate of each alternative was then conducted, and the best compromise between technical, regulatory and cost concerns were determined. Based on the information in this study, two treatment alternatives were selected as preferred alternatives for future development.

The first alternative would defer treatment of the transuranic (TRU) fraction of the LLCE waste stream until WRAP-2B, and would treat the remaining LLCE components by full-size macro-encapsulation (FSM). FSM would be accomplished by transferring the LLCE item into a long polyethylene container, filling the internal void spaces, and welding the end cap on. Other container materials such as stainless steel and fiberglass composites would also be suitable for FSM. The FSM container would then be disposed in a landfill meeting the minimum technology requirements for MW disposal in accordance with RCRA Subtitle C.

The second alternative would defer treatment of the TRU fraction of the LLCE waste stream until WRAP-2B, and would treat the remaining LLCE components by macroencapsulation in the grout vaults. In this alternative, the grout vaults would serve as a combination treatment and disposal facility.

The FSM alternative would be achievable in the next fiscal year, use off-the-shelf technology and require little or no additional funding. As a result, the FSM alternative was selected for immediate development. The grout vault alternative would offer minimum cost,

minimum disposed waste volume, simplified handling and improved ability to handle very high dose rate items, however a number of regulatory and funding issues would require resolution. Therefore, the grout vaults were selected for longer term development.

3.0 Recommendations and Conclusions

3.1 Recommendations

This study recommends development of the FSM alternative to meet near-term treatment needs, and development of the grout vaults for treatment of high dose rate equipment. Detailed recommendations have been broken down into the following areas:

3.1.1 FSM Development

The following recommendations should be implemented by SWD and TWRS immediately to develop FSM treatment.

1. Initiate a joint SWD/TWRS engineering design and development effort for FSM treatment.

2. Initiate re-engineering of the generic transport container/ trailer system to be consistent with the FSM design effort.

3. Grant a schedule extension to the transportation equipment design team to allow joint development of transportation equipment and FSM treatment.

4. Ensure that transportation system redesign would also be compatible with the grout vault concept.

5. Initiate a dialog between SWD, TWRS, Bechtel Hanford Incorporated (BHI) and DOE-RL to potentially increase the space allotted to SWD in the Project W-025/W-025A trenches.

6. Based on the discussions with BHI, determine the need for a line item project to construct additional RCRA subtitle C trench space.

7. Ensure that the site-wide Form 2 revision includes all provisions necessary to support macroencapsulation of hazardous debris.

8. Initiate the required permit modifications.

3.1.2 Grout Vault Development

The following recommendations should be implemented by SWD and TWRS to develop the grout vault concept:

1. Initiate dialog with the regulating agencies and stakeholder groups to assess the acceptability of the concept.

2. Evaluate the availability of capital funding required to support grout vault modifications.

3. If availability, acceptability and funding issues can be successfully resolved, initiate a line item project to modify the grout vaults for high dose rate treatment.

4. Once the grout vaults are operational, perform an updated cost-benefit study to determine if LLCE treatment and disposal should be shifted to the grout vaults.

3.1.3 SWD Planning

The following recommendations should be implemented immediately to ensure that SWD long-range planning remains consistent with the results of this study.

1. Suspend projects to develop extraction-based treatment methods for LLCE. Since future data may indicate that the trapped liquid portion of the LLCE waste stream was underestimated by this study, or future studies may determine that an extraction-based treatment capability is required for other applications, the data generated by these development activities should be retained.

2. Continue to fund development of WRAP-2B. Ensure that LLCE requirements have been scoped into WRAP-2B planning, or planning for any follow-on remote-handled (RH) TRU capable treatment facility.

3. Continue to develop LLCE storage pads. Size the pads to store a minimum of 20 LLCE items.

4. Review the SWD cost structure to ensure that appropriate cost incentives are in place to encourage waste treatment by the waste generator versus storage.

5. Update the Solid Waste Program Technical Baseline Description (WHC-SD-WM-RPT-060) to reflect development the FSM and grout vault missions.

3.1.4 Site-Wide Planning

Even using the most cost effective technologies available, the cost of LLCE retrieval/disposal operations would be considerable ($200 K to $600 K per item). Therefore, the following recommendations should be considered for site-wide implementation.

1. Establish a policy to leave as many LLCE items in place as is consistent with tank farms operations and TPA milestones.

2. Endeavor to place removed LLCE in an empty riser in the same tank if at all possible.

3. Endeavor to place removed LLCE in an empty riser in the same tank farm if a riser in the same tank is not available.

4. Factor LLCE life cycle cost information into the selection process for tank waste retrieval system designs.

3.2 Conclusions

Deferral of treatment of the TRU fraction of LLCE until WRAP-2B is the only viable option available, and should be pursued by implementing the recommendations in Section 3.1.

FSM would be the most cost-effective and robust treatment alternative

available in the near-term, and should be developed by implementing the recommendations in Section 3.1.

The grout vault concept has the potential to offer lower treatment and disposal cost in the future, and should be developed by implementing the recommendations in Section 3.1.

4.0 Uncertainties

While any cost estimate effort is subject to a variety of minor uncertainties, the following areas were considered to be the major sources of uncertainty. To allow for uncertainties in these areas the cost estimate models in Appendix C and E were designed to be easily updated as more information becomes available, which would allow revalidation the conclusions reached by this study.

4.1 Overhead Costs

The direct-billed activities regarding LLCE treatment have been reasonably well established by this study, however a reliable and proven method to assess the impact of overhead cost could not be determined, and therefore was not included. The overhead costs incurred by operations in a fixed facility were thought to exceed those for field operations. As a result, the actual cost differential between the grout vaults and FSM may be slightly smaller than shown in Appendix G.

4.2 Treatability Group Percentages

The treatability group percentage calculations discussed in Section 5.4 were conducted with the best data available at present, however empirical data from future LLCE retrieval operations may indicate a significantly different distribution of LLCE items. For example, a marked increase in TRU generation may make it cost effective to accelerate WRAP-2B, or as is more likely, to develop a modest TRU size reduction and repackaging capability before WRAP-2B becomes operational.

5.0 Description of Treatment Methods and Alternatives

For the purposes of this study the following definitions were used:

- A treatment method was defined as a sequence of processes from the point of generation to the point of disposal which collectively meet current regulatory requirements for a subset of the LLCE waste stream.

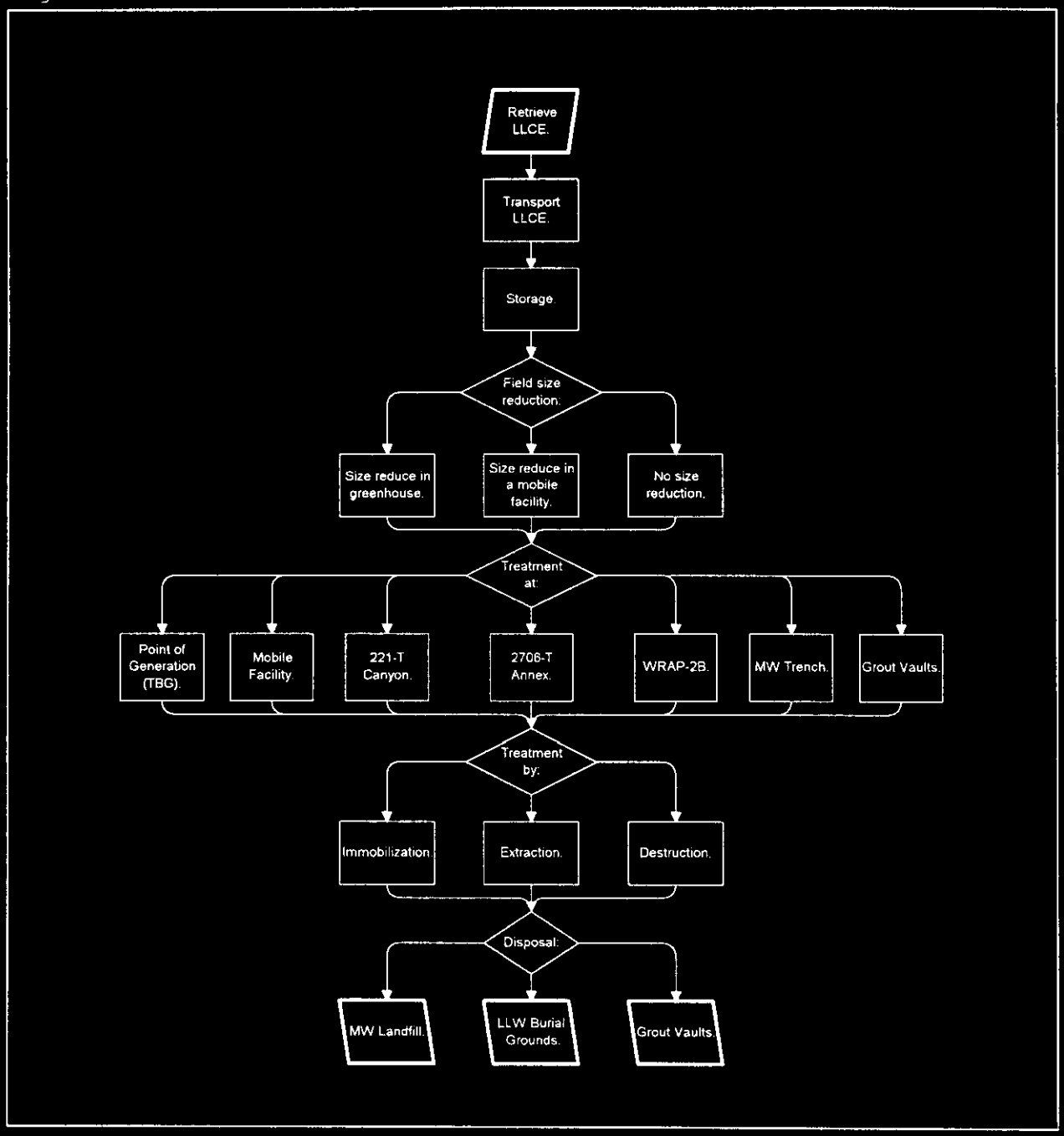
- A treatment alternative was defined as a combination of treatment methods which effectively dispositions the entire LLCE waste stream.

Since most of the treatment methods evaluated in this study would be applicable only to a subset of the LLCE waste stream, a distinction between "treatment methods" and "treatment alternatives" was necessary. A discussion of the individual treatment methods selected for evaluation, the restrictions applicable to each method, and the combination of available methods into separate alternatives has been included in this section. Cost comparisons were conducted between alternatives, as opposed to between methods, to ensure that the results were representative of the entire LLCE waste stream.

5.1 Acceptable Treatment Methods

A Value Engineering study with TWRS and SWD subject matter experts was used to identify the various LLCE treatment methods which would be both technically feasible and acceptable from a regulatory perspective. The results of the Value Engineering study have been summarized in Figure 1.

Figure 1. Treatment Methods - Basic



5.2 Initial Screening

Figure 1 clearly illustrates that a substantial number of acceptable treatment methods would be available. To simplify Figure 1 to a

manageable size and complexity, a series of initial cost and qualitative screening evaluations were conducted. A discussion of the rationale for each initial screening evaluation has been included in Section 5.2.1 through 5.2.5 below.

5.2.1 Extraction/Destruction Methods

Although both extraction-based and destruction-based treatment methods would generally be applicable to LLCE waste, further investigation showed that extraction-based methods had far more potential for success and fewer contaminant restriction concerns. As a result, destruction-based methods were not pursued further.

5.2.2 Treatment by Generator

Extraction treatment under treatment by generator (TBG) provisions[3] would require significantly more cost and effort than immobilization under TBG. Extraction treatment would require provisions for handling any solid or liquid secondary waste generated, for repackaging the LLCE after treatment into burial containers, and for assessing compliance with a difficult performance standard based upon a visual inspection of the contaminated surface. On the other hand, immobilization treatment would require none of these capabilities. As a result, immobilization was the only TBG method considered.

5.2.3 Immobilization

Although numerous technologies currently exist for immobilization of waste, the cost of conducting immobilization would be significantly lower when performed in a container as a TBG activity. The Form 2 notification[4] process required for TBG activities would be significantly easier, quicker and less expensive than the traditional permitting process, and has already been initiated to cover immobilization technologies. Also, TBG activities would offer significant operational savings in terms of simplified waste analysis, facility design, construction and operation requirements. As a result, TBG-compatible immobilization methods were considered wherever possible.

5.2.4 Mobile Facility Options

Initial cost estimates on a variety of mobile facility concepts showed that the cost differences between mobile size reduction facilities and full mobile treatment facilities would be minimal, therefore only full mobile treatment facility options were pursued further. Concept sketches and the associated cost estimate results have been included for reference in Appendix G.

The major advantage of using a mobile treatment facility would be the ability to place the facility within the arc of the retrieval crane, thereby allowing transfer of the LLCE to the treatment facility without associated transportation costs. Unfortunately, however, many of the individual tank farms have extensive above-ground equipment and

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[3]WAC-173-303, Dangerous Waste Regulations, Section 170(3), "Requirements for generators of dangerous waste," dated December 8, 1993.

[4]WAC-173-303, Dangerous Waste Regulations, Section 060(2), "Notification and identification numbers," dated December 8, 1993.

other interferences which would prevent placement of a mobile facility within the arc of the crane. As a result, LLCE would have to be transported in many cases and the benefit of treatment facility mobility would be lost. The mobile facility would become in reality a "temporary" facility in a fixed location.

If transportation costs to bring LLCE to the facility were added to facility procurement costs, the cost of this type of "temporary" facility would be comparable to or higher than the fixed facility concepts under consideration. Therefore, mobile treatment facility concepts were not pursued further.

5.2.5 WRAP-2A

WRAP-2A had been planned as a MW macro/microencapsulation facility which would handle debris and any other waste streams amenable to encapsulation. Since limited remote-handling capability and no size reduction capability has been planned for WRAP-2A, LLCE would have to be processed to meet < 200 mr/hr and 4 ft by 4 ft by 4 ft box size requirements prior to treatment there[5]. LLCE which met these criteria could also be macroencapsulated in the field (either in the tank farm or a SWD facility) for a fraction of the projected $650/ft^3 treatment cost at WRAP-2A. As a result, use of WRAP-2A as a LLCE treatment facility was not pursued further.

5.2.6 Summary

Using the results in Section 5.2.1 through 5.2.5, the treatment methods tree in Figure 1 was greatly simplified. The resulting treatment methods tree has been summarized in Figure 2. A detailed description of each treatment method shown in Figure 2 has been provided in Section 5.3.

5.3 Description of Treatment Methods

This section contains more detailed descriptions of the treatment methods summarized in Figure 2. Each method was also assigned a shorthand notation for later use.

5.3.1 No Action (NA)

The no action alternative would entail deferral of all treatment. LLCE would be stored indefinitely.

5.3.2 WRAP-2B (2B)

Treatment at WRAP-2B was assumed to entail a size reduction step followed by extraction-based treatment. After treatment, the TRU fraction would be packaged for shipment to the Waste Isolation Pilot Plant (WIPP) and the LLW fraction would be sent to disposal. The LLW fraction which met the release requirements from RCRA[6] following extraction technology treatment would be disposed in the LLW burial grounds, and the LLW fraction which did not would be macroencapsulated

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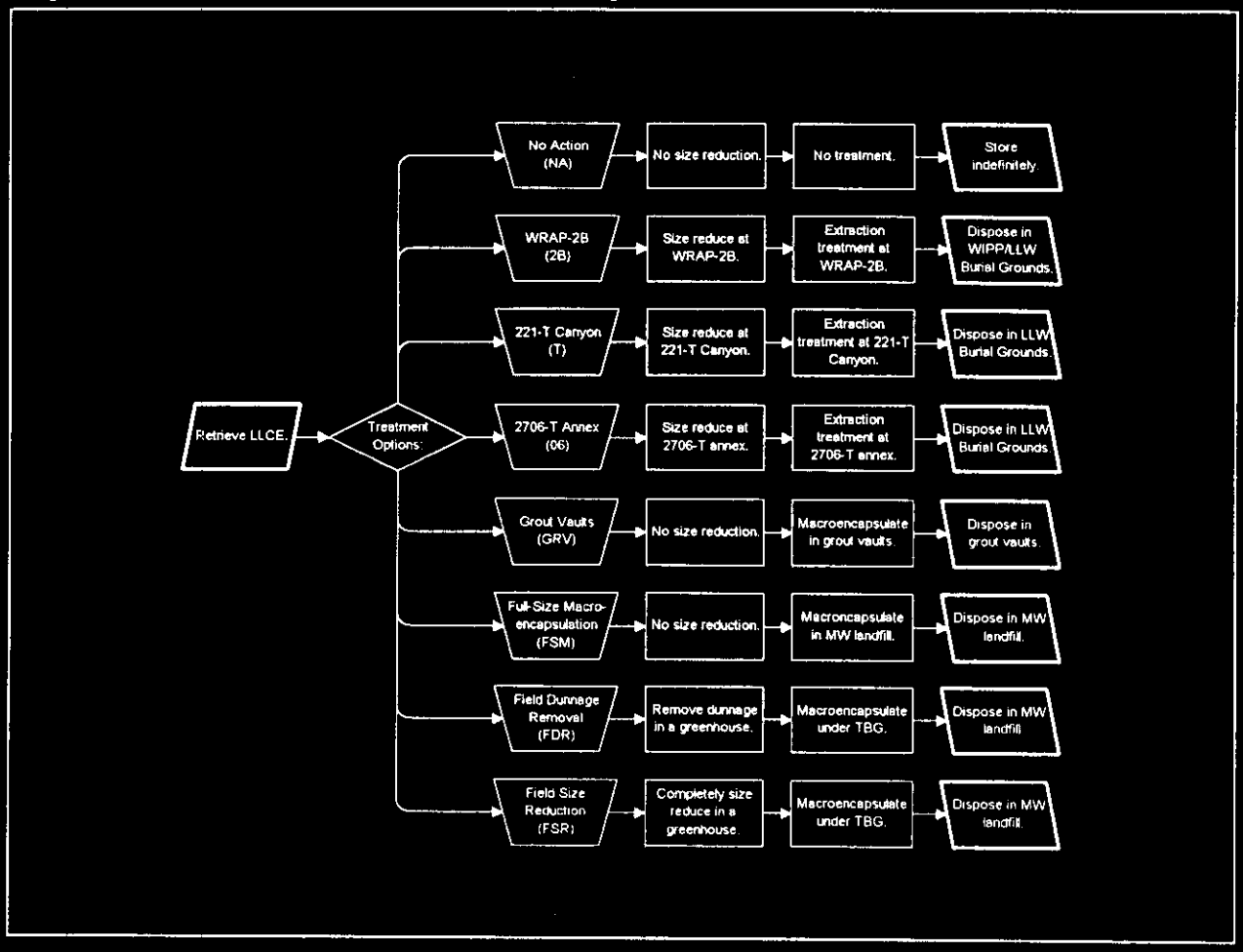
[5]WHC-FD-W100-FDC-001, Functional Design Criteria, Waste Receiving and Processing Module 2A, Project W-100, Section 1.0, Revision 2, dated October 4, 1993.

[6]40 CFR 268, Land Disposal Restrictions, Paragraph 268.45(c), "Conditioned exclusion of treated debris," dated July 1, 1992.

Figure 2. Treatment Methods - Simplified



and disposed in the MW landfill.

WRAP-2B was assumed to be a green field facility, constructed from the ground up for treatment of both TRU and remote-handled waste. When used in concert with other treatment methods, WRAP-2B was assumed to treat the available TRU waste inventory first, then use any excess capacity to treat LLW.

Each LLCE item destined for treatment at WRAP-2B would be stored in its type B transport container or a specialized storage container on an uncovered storage pad until a treatment slot became available.

5.3.3 221-T Canyon (T)

Treatment at 221-T would entail a size reduction step followed by extraction-based treatment. After treatment, the fraction which met the release requirements from RCRA would be disposed in the LLW burial grounds, and the fraction which did not would be encapsulated and disposed in the MW landfill.

The 221-T process line would be installed on the T Plant canyon deck, along with provisions to allow LLCE to be brought into the canyon, liquid waste handling upgrades, ventilation upgrades, and other work

required to bring the canyon deck work area up to code[7]. Due to canyon deck space constraints, 221-T would have only one process line. This fact, along with other facility constraints[8], would restrict 221-T to processing only LLW and not TRU.

Each LLCE item destined for treatment at 221-T would be stored in its type B transport container or a specialized storage container on an uncovered storage pad until a treatment slot became available.

5.3.4 2706-T Annex (06)

Treatment at 2706-T would entail a size reduction step followed by extraction-based treatment. After treatment, the fraction which met the release requirements from RCRA would be disposed in the LLW burial grounds, and the fraction which did not would be encapsulated and disposed in the MW landfill.

The 2706-T process line would be installed in an annex to the existing 2706-T facility at the T Plant[9]. To minimize facility costs, the 2706-T annex would have only one process line. This fact, along with other facility constraints[10], would restrict 2706-T to processing only LLW and not TRU.

Each LLCE item destined for treatment at 2706-T would be stored in its type B transport container or a specialized storage container on an uncovered storage pad until a treatment slot became available.

5.3.5 Grout Vaults (GRV)

The most cost effective mechanism for macroencapsulation treatment in the grout vaults would entail loading LLCE into a grout vault as they are generated, storing the LLCE until a layer of equipment had accumulated, and covering the LLCE layer with a complete lift of encapsulating material. In this way, the encapsulating material would serve as the macroencapsulant, and the grout vault would serve as an interim storage facility and as the MW land disposal facility.

5.3.6 Full-Size Macroencapsulation (FSM)

FSM design primarily considered TBG macroencapsulation methods. A TBG macroencapsulation method would have to meet the basic TBG requirements[11]:

- Treatment must occur in an accumulation tank or container.

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[7]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 6.0, "Alternative 1: T Plant," Revision 0, Draft.

[8]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Appendix A, "T Plant Systems Engineering Study," Section 4.4.2, "Transuranics," Revision 0, Draft.

[9]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 7.0, "Alternative 2: New Facility," Revision 0, Draft.

[10]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Appendix A, "T Plant Systems Engineering Study," Section 4.4.2, "Transuranics," Revision 0, Draft.

[11]WAC-173-303, Dangerous Waste Regulations, Section 170(3)(b), "Requirements for generators of dangerous waste," dated December 8, 1993.

- The waste must be treated, and subsequently stored or disposed, in a permitted facility within 90 days of the generation date.

The technology chosen for consideration was based on a polyethylene macroencapsulation container with a specially-designed thermal weld sealing capability. In order to address radionuclide content concerns, the macroencapsulation container would also be selected to meet NRC high integrity container (HIC) criteria. Certification of the container by the NRC would not be required, however. This type of macroencapsulation HIC, or MHIC, design would require only minor modifications to commercial HICs available from a number of vendors.

Treatment would entail rolling the LLCE into the MHIC, filling the void space to prevent burial ground subsidence, and welding on the lid. All steps were initially planned to be performed by TWRS at the point of generation (tank farm) under TBG. The package would then be shipped to the MW landfill and disposed. Treatment at the tank farm would provide the advantages of fewer handling operations (particularly under high dose rate conditions), simplified permitting and shipment direct to disposal, but would require re-design of the transport container, transport trailer and MW landfill to allow for handling of the added weight of void space fill materials.

5.3.7 Field Dunnage Removal (FDR)

Treatment by this method would entail dunnage removal in the field using a specially-designed greenhouse and cutting equipment, followed by a macroencapsulation method similar to the FSM method described in Section 5.3.6. Dunnage refers to top flanges, pump motors and other hardware above riser flange level, which would require a significantly larger container diameter than the majority of the LLCE item. The FDR method would offer the advantages of smaller, lighter MHIC packages and smaller MW trench space requirements, but would require a complex hands-on cutting operation in the field.

5.3.8 Field Size Reduction (FSR)

Treatment by this method would entail size reduction of the entire LLCE item in the field using existing cutting equipment, followed by macroencapsulation in a smaller version of the MHIC discussed in Section 5.3.6. A crane would be used to lower the LLCE vertically into a glove bag, which would be positioned on top of a 150 gal MHIC. A shear-type cutting mechanism enclosed in the glove bag would then be used to cut the item at the desired length, and the cut piece would be placed into the MHIC. Once the MHIC was full, the remaining LLCE item would be bagged and moved to another pre-positioned MHIC assembly. The above process would be repeated as necessary until size reduction was complete. Following size reduction, the void spaces in the MHICs would be filled and the lids would be welded on. All steps would be performed by TWRS at the point of generation (tank farm) under TBG. The packages would then be shipped to the MW landfill and disposed.

The FSR operation would basically be a contact-handled evolution, and would be limited to LLCE with a maximum dose rate of approximately 100 mr/hr gamma and desired dose rate significantly less. Since shielding beta radiation would be much easier than gamma, higher dose rate items

could be accepted if the radiation was primarily beta[12]. Also, the existing shear equipment is limited to 4 inch OD items, and shears with significantly larger capacity would not be sufficiently mobile to be compatible with FSR.

5.4 Treatability Groups

As discussed in Section 5.0, each treatment method would incur different operating restrictions based on the physical and radiological characteristics of the waste, as well as the design and construction of the treatment equipment and regulatory requirements. As a result, the LLCE waste stream was subdivided into separate treatability groups, based on treatment method restrictions, in order to conduct meaningful comparisons. Given the treatment methods listed in Figure 2, the following waste characteristics were found to be significant:

- Waste Classification: TRU vs LLW
- Geometry: Complex Geometry vs Straight Pipe
- Dose Rate: Contact-Handled vs Remote-Handled
- Trapped Liquids: Trapped Liquids vs No Trapped Liquids
- Diameter: ≤4 inch vs > 4 inch

A discussion of the justification for each subdivision has been included below.

5.4.1 Waste Classification

The classification of LLCE as TRU or LLW would be significant for two reasons:

1. TRU materials are restricted from land disposal by DOE Order 5820.2 and 10 CFR 61.

2. TRU-capable treatment facilities must meet more stringent requirements for ventilation, contamination control, and assay equipment than non-TRU facilities (DOE Order 6430.1A).

Due to the DOE ban on near-surface land disposal of TRU materials, a processing line for TRU LLCE would have to either size reduce and macroencapsulate the TRU LLCE for disposal at WIPP, or remove sufficient TRU radionuclides from the waste matrix to change the classification to LLW. Consequently, a viable TRU facility would generally have a size reduction line followed by an extraction line, a macroencapsulation line, or a combination of the two.

As discussed in Section 5.3, the size reduction/extraction treatment methods under development at 221-T and the 2706-T annex would also be non-viable for TRU. Therefore, the only viable option for processing TRU equipment would be WRAP-2B.

5.4.2 Geometry

LLCE geometry would be significant primarily because existing FSR capabilities would be limited to relatively simple straight pipe items. Therefore, the LLCE waste stream was divided into a straight

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[12]Per telephone conversation, D. P. Neibuhr to W. S. Josephson, on October 17, 1994.

pipe treatability group, which would encompass all FSR-compatible equipment configurations, and a complex geometry treatability group, which would encompass all other equipment configurations.

5.4.3 Dose Rate

Equipment dose rate would be significant primarily because FSR operations would be limited to contact-handled items (dose rate < 100 mr/hr).

5.4.4 Trapped Liquids

The presence of free liquids would be significant because free liquids are prohibited from land disposal[13]. Extraction-based treatment methods would remove free liquids as part of the treatment process, however immobilization-based methods would not. Therefore, LLCE immobilized via macroencapsulation (i.e. FSM, FDR, FSR and grout vault treatment methods) must not contain free liquids to be acceptable for land disposal.

The analytical method to determine whether containerized waste contains free liquids involves obtaining a representative sample of the waste and placing a 100-g sample into a paint filter[14,15]. If liquid is observed dripping from the filter holding the sample during a five minute period, the waste matrix is considered to have free liquids. It is, however, virtually impossible to obtain a representative sample from LLCE waste. Since this type of sampling difficulty is exactly why EPA promulgated the debris rule, this discussion is offered in lieu of sampling to establish that the LLCE waste stream does not contain free liquids.

The term "free liquids" refers to liquids which readily separate from the solid portion of the waste under ambient temperature and pressure[16]. Based on this definition, there are two types of liquids in a macroencapsulated LLCE disposal package which warrant discussion. The two types of liquids, neither of which meet the regulatory definition of free liquids, are residual liquids and trapped liquids. Residual liquids refers to occasional drops of water and/or surface films that could remain on the exterior of an LLCE item following rinsing as part of retrieval operations from a tank. Residual liquids are not considered free liquids because surface tension properties will not allow this liquid to readily separate from the LLCE following retrieval from a tank.

The second circumstance warranting discussion concerns trapped liquids. This term refers to measurable quantities of liquid which

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[13]WAC-173-303, Dangerous Waste Regulations, Section 140(4)(b), "Disposal of liquid waste," dated December 8, 1993.

[14]US EPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Test Method 9050, "Paint Filter Liquids Test," Update 2, dated April 1985.

[15]WAC-173-303, Dangerous Waste Regulations, Section 140(4)(b)(iii), "Disposal of liquid waste," dated December 8, 1993.

[16]40 CFR 260, Hazardous Waste Management System: General, Paragraph 260.10, "Definitions," dated July 1, 1992.

could be trapped or retained in some LLCE designs. By definition[17], LLCE with trapped liquids could be construed as a container. When a LLCE item can meet the definition of container and the definition of an empty container[18] the empty container rule and the debris rule would be utilized to dispose of LLCE as follows.

In cases where the internal and external surfaces of the LLCE met the clean debris surface performance standard for hazardous debris[19], but the interior components of the LLCE contain trapped liquids, the debris rule would be utilized to exit RCRA and the empty container rule would be utilized to dispose of the LLCE item as an intact, empty container (crushing the container would be impractical). Disposal of intact, empty containers are not subject to the standards for hazardous debris and would only have to meet disposal standards for low-level radioactive waste. Since residual wastes (both solid and liquid) are allowed to be disposed of in intact empty containers as long as wastes have been taken out using practices commonly employed to remove materials from that type of container, disposal of trapped liquids in this scenario meets all applicable RCRA requirements. These trapped liquids would not be considered free liquids because they would not readily separate from the LLCE item following retrieval from a tank.

In other trapped liquid scenarios, the internal and external surfaces of the LLCE item would not meet the clean debris surface performance standard (e.g. still be contaminated with waste from the tank farms). In this case, the LLCE would be disposed of both as an intact empty container and as macroencapsulated hazardous debris. In this situation, the LLCE item may also display other characteristics[20] or criteria[21] of a dangerous waste. The empty container provisions would be utilized to allow for disposal of trapped liquids. Because of the contaminated surfaces of the LLCE item, the provisions for macroencapsulated hazardous debris would also be utilized to allow for disposal as mixed waste. Since the theoretical maximum volume of trapped liquid in any LLCE design falls well below the 1% of capacity requirement for empty containers[22], the elements of the empty container rule would be satisfied for both situations above.

Finally, each LLCE item will be retrieved from a tank into a flexible receiver so that the LLCE item is not exposed to the atmosphere during retrieval activities. Sufficient absorbent material has been

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[17]WAC-173-303, Dangerous Waste Regulations, Section 040, "Definitions," dated December 8, 1993.

[18]WAC-173-303, Dangerous Waste Regulations, Section 160(2)(a), "Containers," dated December 8, 1993.

[19]40 CFR 268, Land Disposal Restrictions, Paragraph 268.45 Table 1, "Alternative Treatment Standards for Hazardous Debris," Footnote 3, dated July 1, 1992.

[20]WAC-173-303, Dangerous Waste Regulations, Section 090, "Dangerous waste characteristics," dated December 8, 1993.

[21]WAC-173-303, Dangerous Waste Regulations, Section 100, "Dangerous waste criteria," dated December 8, 1993.

[22]WAC-173-303, Dangerous Waste Regulations, Section 160(2)(a), "Containers," dated December 8, 1993.

incorporated into the flexible receiver design to provide a minimum 2:1 absorbent ratio inside the flexible receiver bag for any liquids.

5.4.5 Diameter

Equipment diameter would be significant primarily because existing field size reduction capabilities are limited to ≤ 4 inch OD items.

5.4.6 Summary

The subdivisions in Section 5.4.1 through Section 5.4.5 were traced through a flow chart to determine the percentages of each treatability group. The calculated treatability group percentages have been summarized in Table 1. A detailed description of the percentage calculations has been included in Appendix D. For compactness, the shorthand notation for each treatability group assigned in Table 1 was used throughout the remainder of this study.

Table 1. Treatability Groups

Treatability Group	Notation	Percentage
TRU	TRU	4.0 %
Trapped Liquids	TL	12.8 %
LLW, Complex Geometry, OD > 4 inch or RH	MACRO	50.7 %
LLW, Straight Pipe, CH, OD ≤ 4 inch	FSR	32.5 %

5.4.7 Other Criteria

A number of important considerations and concerns were generated during the Value Engineering session which subsequent investigations ultimately determined did not warrant a subdivision of the LLCE waste stream. However, the reasoning for rejecting these criteria has been included for future reference.

5.4.7.1 Chemical Content

The chemical content of the waste was originally thought to be a potential limiting factor since many of the debris treatment technologies in 40 CFR 268.45 have significant contaminant restrictions. However, as treatment method designs were further refined, it became clear that the methods most applicable to LLCE would be extraction and immobilization, which would not have any contaminant restrictions relevant to LLCE treatment.

5.4.7.2 Lubricants

Many pumps have lubricating oil sumps or sealed bearings lubricated with grease, and these substances may, under some circumstances, be prohibited from land disposal. For example, new lubricating oil and grease may carry EPA toxicity, Washington state toxicity, and Washington state persistence codes depending on the constituents. Also, old lubricants may be designated with EPA or Washington state toxicity codes due to entrained metals. If the total weight of lubricants were to exceed 10% of the waste item, the waste would be considered organic/carbonaceous waste, which would be land disposal

restricted in Washington state[23]. Finally, liquid lubricants would incur the free liquids restrictions discussed in Section 5.4.4.

However, following removal of any liquid lubricants (draining the crankcase, etc.) there would generally be sufficiently small amounts of lubricants remaining, in the form of sealed bearings and residual films, that application of concentration-based codes would be unlikely. Thus EPA toxicity, Washington state toxicity and Washington state persistence codes would no longer apply. Similarly, it would be unlikely that the waste would be considered organic/carbonaceous waste. The residual film would also not meet the regulatory definition of free liquid and would be considered residual liquids. Therefore, all LLCE items were assumed to have any liquid lubricants removed, to the maximum extent possible, prior to immobilization.

5.4.7.3 Waste Category

Macroencapsulation-based treatment methods would not be applicable to greater than category 3 or greater than class C waste, since the former is prohibited from land disposal by WHC procedures and the latter by DOE order 5820.2A. However, the most detailed LLCE characterization studies available[24] indicated that greater than category 3/greater than class C waste would in most cases also be TRU, therefore a separate treatability group would not be warranted.

5.5 Description of Alternatives

In this section, the treatment methods listed in Figure 2 and the treatability groups listed in Table 1 were combined into treatment alternatives. Some of the possible combinations of methods were deleted in order to avoid overlapping treatment capability (i.e. both T Plant and 2706-T were not included together in the same alternative, etc).

The matrix of the treatment alternatives considered, with the applicable codes, have been summarized in Table 2.

6.0 Cost Estimates

Cost estimates were conducted for each treatment alternative described in Table 2 to provide a basis for selecting the preferred treatment alternative. A detailed description of the modeling and cost estimation methodologies used have been included in Appendix E and F. The cost estimate results have been summarized in Figure 3 through Figure 8, and included in table form in Appendix H.

7.0 Cost Analysis

The cost estimate data in Figure 3 through Figure 8 was analyzed to determine the optimum treatment alternatives. The analysis steps and results have been summarized in this section.

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[23]WAC-173-303, Dangerous Waste Regulations, Section 140(4)(d), "Disposal of organic/carbonaceous waste," dated December 8, 1993.

[24]WHC-SD-WM-ES-265, Disposal of Tank Farm Long-Length Contaminated Equipment: Alternative Options Study and Engineering Support Information, Table D-6, Revision 0, "Maximum Curie Content for Each Waste Container," dated December 7, 1993.

Table 2. Treatment Alternatives

Alternative Code	Treatability Groups			
	TRU	TL	MACRO	FSR
NA	Storage	Storage	Storage	Storage
2B	WRAP-2B	WRAP-2B	WRAP-2B	WRAP-2B
2B/T	WRAP-2B	221-T Canyon	221-T Canyon	221-T Canyon
2B/06	WRAP-2B	2706-T Annex	2706-T Annex	2706-T Annex
2B/GRV	WRAP-2B	Grout Vaults	Grout Vaults	Grout Vaults
2B/FSM	WRAP-2B	FSM	FSM	FSM
2B/FDR	WRAP-2B	FDR	FDR	FDR
2B/FSR	WRAP-2B	WRAP-2B	WRAP-2B	FSR
2B/T/FSR	WRAP-2B	221-T Canyon	221-T Canyon	FSR
2B/06/FSR	WRAP-2B	2706-T Annex	2706-T Annex	FSR
2B/GRV/FSR	WRAP-2B	Grout Vaults	Grout Vaults	FSR
2B/FSM/FSR	WRAP-2B	FSM	FSM	FSR
2B/2B/FSM	WRAP-2B	WRAP-2B	FSM	FSM
2B/06/FSM	WRAP-2B	2706-T Annex	FSM	FSM
2B/2B/GRV	WRAP-2B	WRAP-2B	Grout Vaults	Grout Vaults
2B/06/FSM	WRAP-2B	2706-T Annex	Grout Vaults	Grout Vaults

7.1 No Action Alternative

As shown in Figure 3, the no action alternative was prohibitively expensive for all feed rates. Therefore, the no action alternative was rejected.

7.2 Deferral

As shown in Figure 3, the per item cost of the WRAP-2B only option (deferral for future treatment) would approach the per item cost of the other alternatives at low feed rates. It is important to note that even at the lowest feed rate modeled, the per item cost of the 2B alternative was still 19% higher than the FSM alternative and 28% higher than grout vault alternative. As a result, the WRAP-2B only alternative was rejected.

7.3 Fixed Facilities

As shown in Figure 3, the per item cost of treating LLCE in a fixed facility, in particular the 2706-T annex, was found to approach the per item cost of the FSM and grout vault alternatives at the baseline retrieval rate (1921 items retrieved). At lower retrieval rates the capital cost of the facility would be spread over a smaller feed stream and would drive up per item cost. At higher retrieval rates the retrieved LLCE exceed the treatment capacity of the facility. The additional storage cost incurred would exceed the cost benefit from

spreading the capital cost of the facility across a large feed stream, and again would tend to drive up per item cost. All fixed facilities displayed this minimum cost point behavior.

To determine the sensitivity of this behavior to 2706-T construction cost, the construction cost was set to zero and the model was recalculated. The results of the zero cost run have been included as Figure 4. It is instructive to note that even at zero construction cost, the 2706-T curve did not reach breakover with the FSM or grout vault options.

7.4 Dunnage Removal

To further develop the FSM concept, the cost benefit of dunnage removal was explored in Figure 5. The cost of performing dunnage removal was found to almost exactly offset the cost savings in terms of burial trench space, smaller MHICs and simplified handling at lower retrieval rates. Also, at higher retrieval rates the 2B/FDR alternative became significantly more costly due to capacity limitations. Consequently, the dunnage removal option would offer little or no cost benefit. In addition, the dunnage removal operation would involve increased risk of worker exposure. As a result, the FDR alternative was rejected.

7.5 Field Size Reduction

As shown in Figure 6, FSR would offer appreciable cost benefit when added to the FSM alternative. The FSR operation would, however, involve an increased risk of worker exposure. The decision to conduct FSR would then become a risk management decision. Since worker exposure concerns have led some key elements of TWRS operations to consider FSR unfit for routine, repetitive use, FSR-related alternatives were not considered as a preferred alternative. However, if planned operations would require removal of a thermocouple-sized item from a tank with known low Cs-137 content, the concerns with FSR would be minimized. In such one-time-only applications, field size reduction operations should be seriously considered.

Figure 6 also clearly shows that FSR provides little or no cost benefit when added to the grout vault alternative until very high retrieval rates have been reached. Therefore, if the grout vault treatment line were operational, FSR operations should not be considered unless processing at the grout vaults was unavailable at the time of retrieval.

7.6 Trapped Liquids

As shown in Figure 7 and Figure 8, if LLCE items containing trapped liquids were prohibited from immobilization, the small size of the TL treatability group would not justify construction of an extraction-based treatment facility such as the 2706-T Annex. Therefore, in this scenario treatment of the TL treatability group should be deferred for WRAP-2B.

8.0 Discussion of Preferred Alternatives

The 2B/GRV alternative proved to be the most cost effective, with a per unit cost approximately 25% less than the 2B/FSM alternative. This cost difference was within the accuracy of this analysis, and certainly within the potential increase in grout vault cost given the

unresolved issues. As a result, cost alone could not provide a clear choice between the 2B/GRV and 2B/FSM alternatives. Therefore a more detailed examination of the advantages and disadvantages of each alternative was conducted.

8.1 FSM Advantages/Disadvantages

8.1.1 Advantages

The FSM alternative would use off-the-shelf technology and existing disposal facilities, therefore an operational date in FY 1996 would be a reasonable estimate. Also, development of the FSM alternative would require only CENRTC and expense funding and should be achievable within the existing funding allocation. Polyethylene macroencapsulation is a standard waste treatment practice outside the nuclear industry, thus a precedent for FSM has been well-established. For this reason, most significant regulatory questions have largely been resolved. Regulator concurrence with the residual and trapped liquid discussion in Section 5.4.4 is still an outstanding issue, however this issue would be common to both FSM and the grout vault alternative.

8.1.2 Disadvantages

The FSM alternative would require rigging and handling of long, heavy, potentially high dose rate items without the advantage of specialized remote handling equipment. The complexity of the handling operations would, as a result, drive the per unit cost above the grout vault alternative. Also, since each LLCE item would take up the worst-case solid volume, the total disposed volume would be 10 times greater than the grout vault alternative.

8.2 Grout Vault Advantages/Disadvantages

8.2.1 Advantages

Due to the remote handling capability provided, the 2B/GRV alternative would offer the simplest handling requirements and greatest ease of operation. This simplified handling was primarily responsible for the low per unit cost of the grout vault alternative as well. Also, since the LLCE items would be stacked in the grout vaults covered only by the flexible receiver as opposed to a large diameter cylinder, the disposed volume of waste for the grout vault alternative would be a factor of 10 lower than full-size macroencapsulation.

8.2.2 Disadvantages

The grout vault alternative has a number of significant unresolved issues which would strongly affect feasibility and cost effectiveness. Since the grout vaults have been identified as a back-up to the new DST construction project, there is no clear indication that the grout vaults would be available for this mission regardless of the relative cost effectiveness. Also, the LLCE would be macroencapsulated to meet the treatment standard after placement in a land disposal unit. The existing regulatory framework does not support this mode of operation. Finally, the grout vault alternative would require approximately $7,000,000 of capital funding to modify the first vault for LLCE, and approximately $1,500,000 for subsequent vaults. Since capital funding of this magnitude would only be available through the line item funding process, the operational date of the grout vaults would be

five years in the future at best and would be subject to the whims of congressional funding.

8.3 Summary

The FSM alternative would be achievable in the next fiscal year, use off-the-shelf technology and require no additional funding. As a result, the FSM alternative was selected for immediate development. The grout vault alternative would offer minimum cost, minimum disposed waste volume, simplified handling and improved ability to handle very high dose rate equipment, however a number of regulatory and funding issues would require resolution. Therefore, the grout vaults were selected for longer term development.

9.0 Storage Capacity Planning

From FY 1995 to FY 2005, the predicted storage requirements for the two preferred alternatives would be:

2B/FSM: 10 items
2B/GRV: 70 items

Therefore, the recommended approach would be to provide storage for a median number of items, with the understanding that as more data becomes available on LLCE retrieval rates, additional storage modules may need to be constructed in the future. The recommendation of this study would be to provide storage for 20 items in the near term.

Figure 3. Cost/Item Comparison - Overall

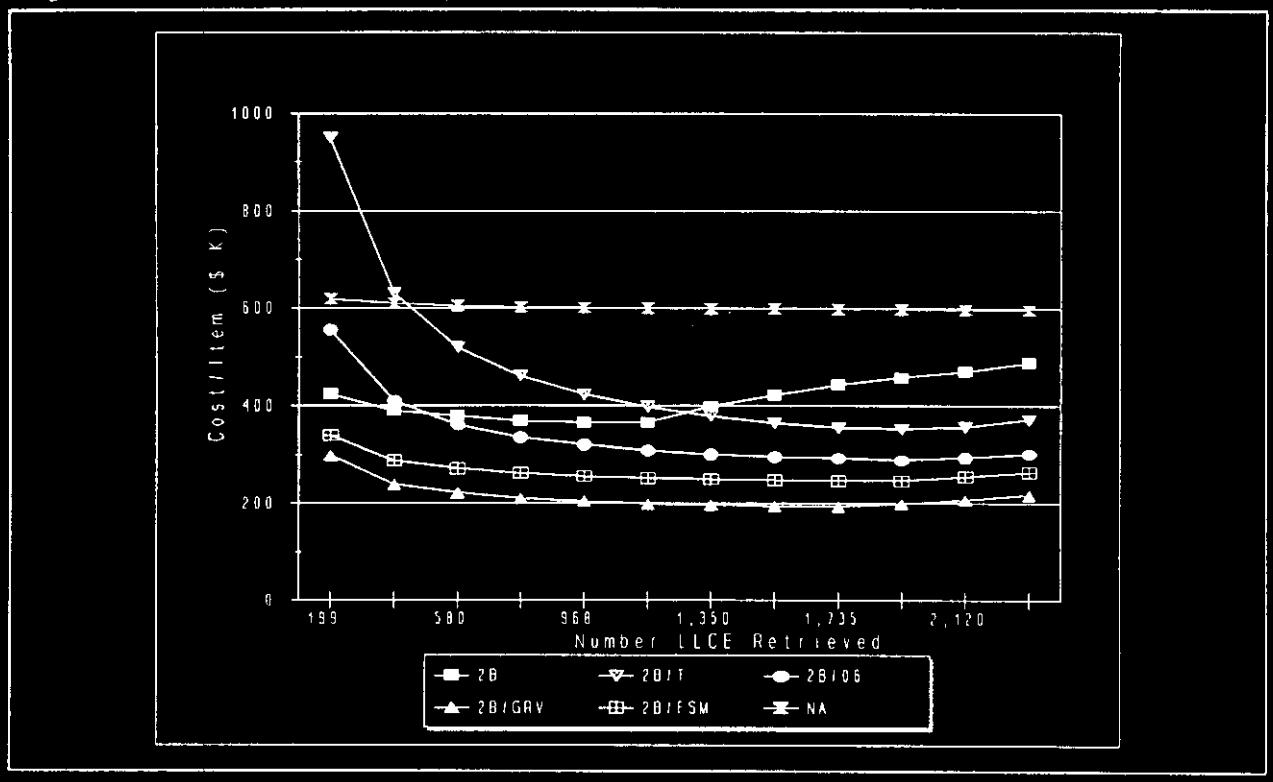


Figure 4. Cost/Item Comparison - 2706-T Zero Cost Results

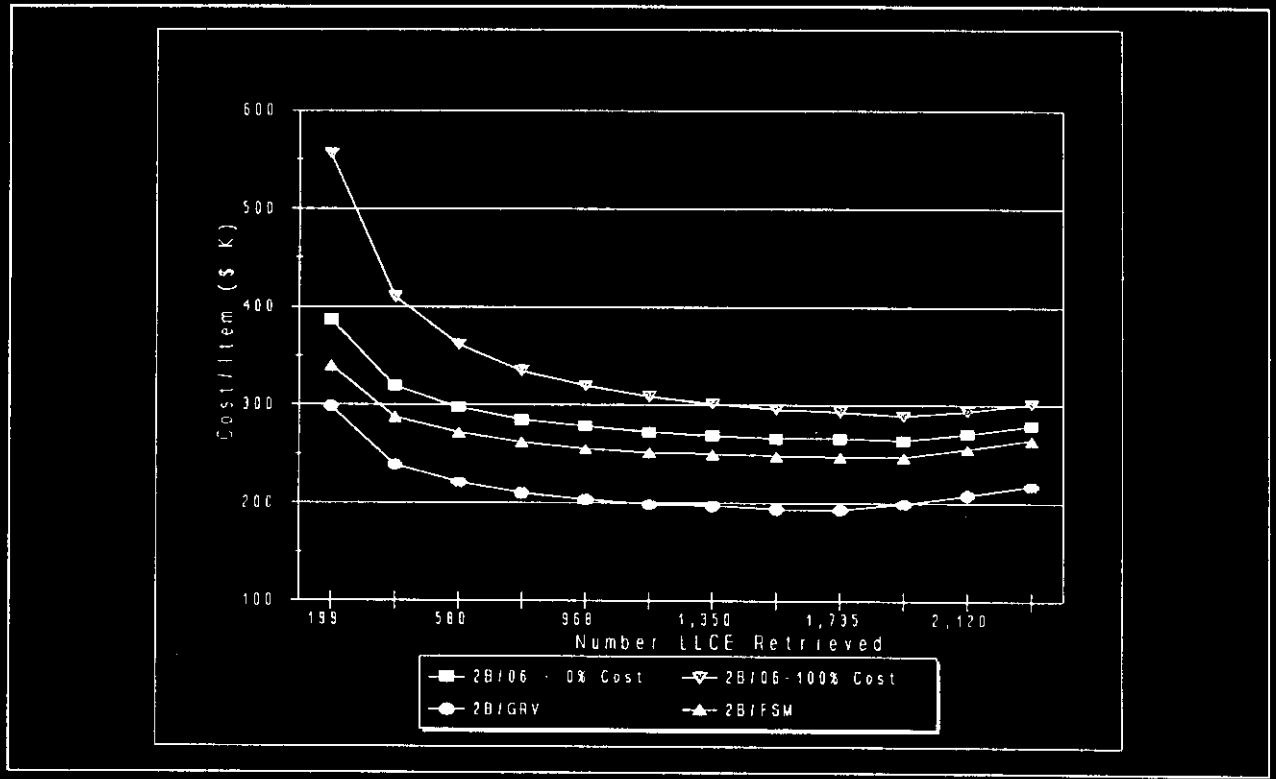


Figure 5. Cost/Item Comparison - Field Dunnage Removal

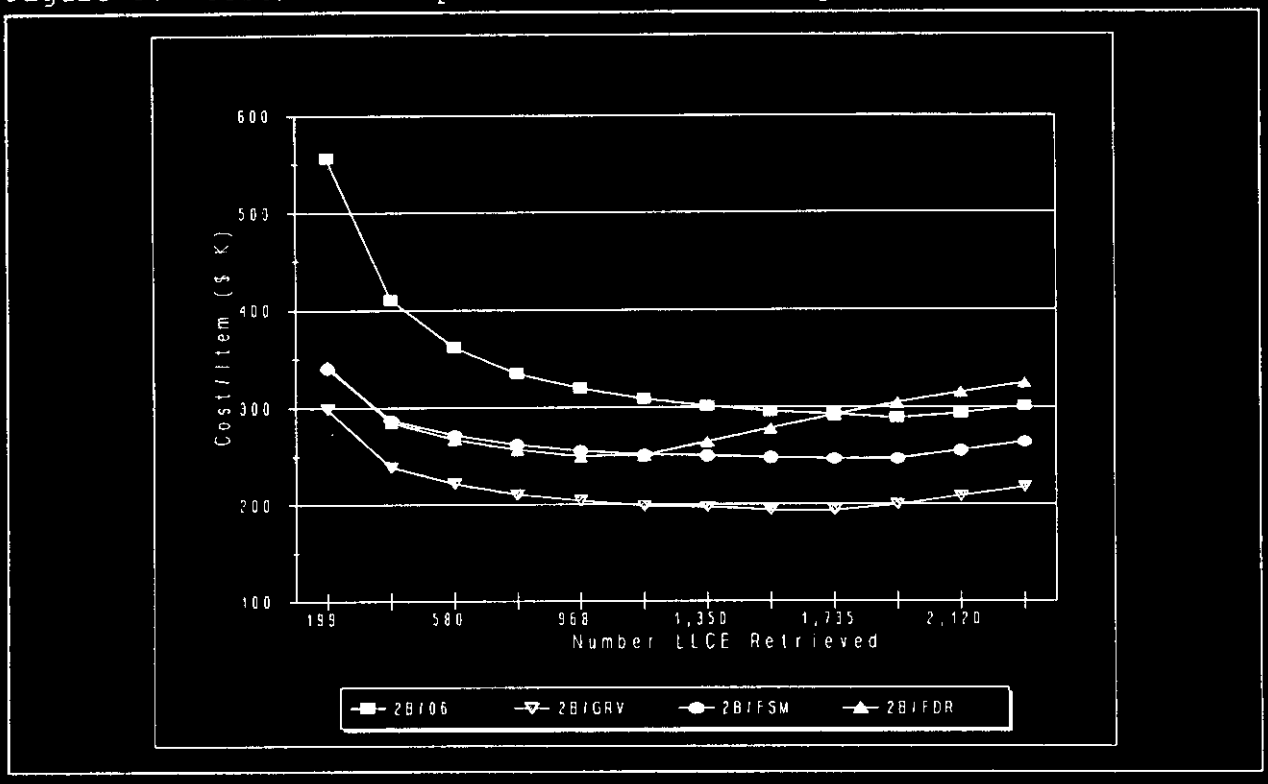


Figure 6. Cost/Item Comparison - Field Size Reduction

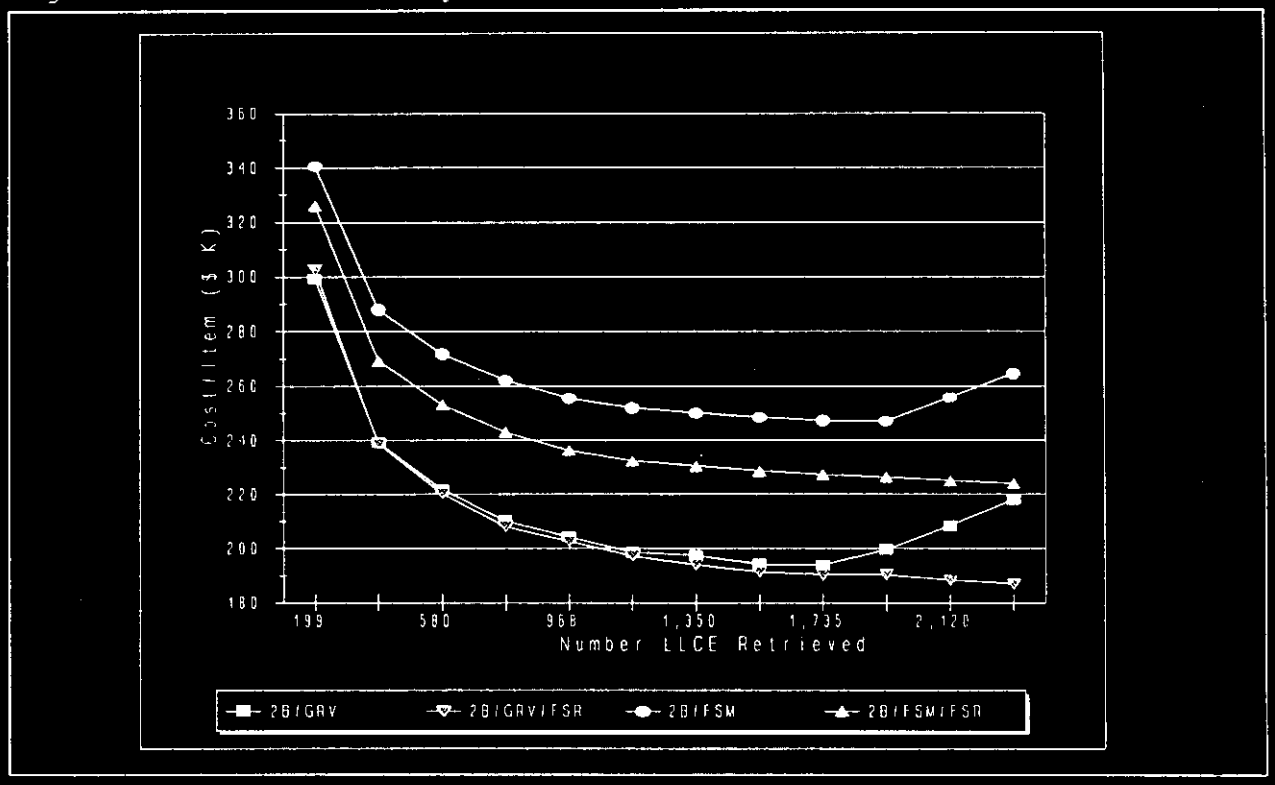


Figure 7. Cost/Item Comparison - 2B/FSM Option w/ Trapped Liquids

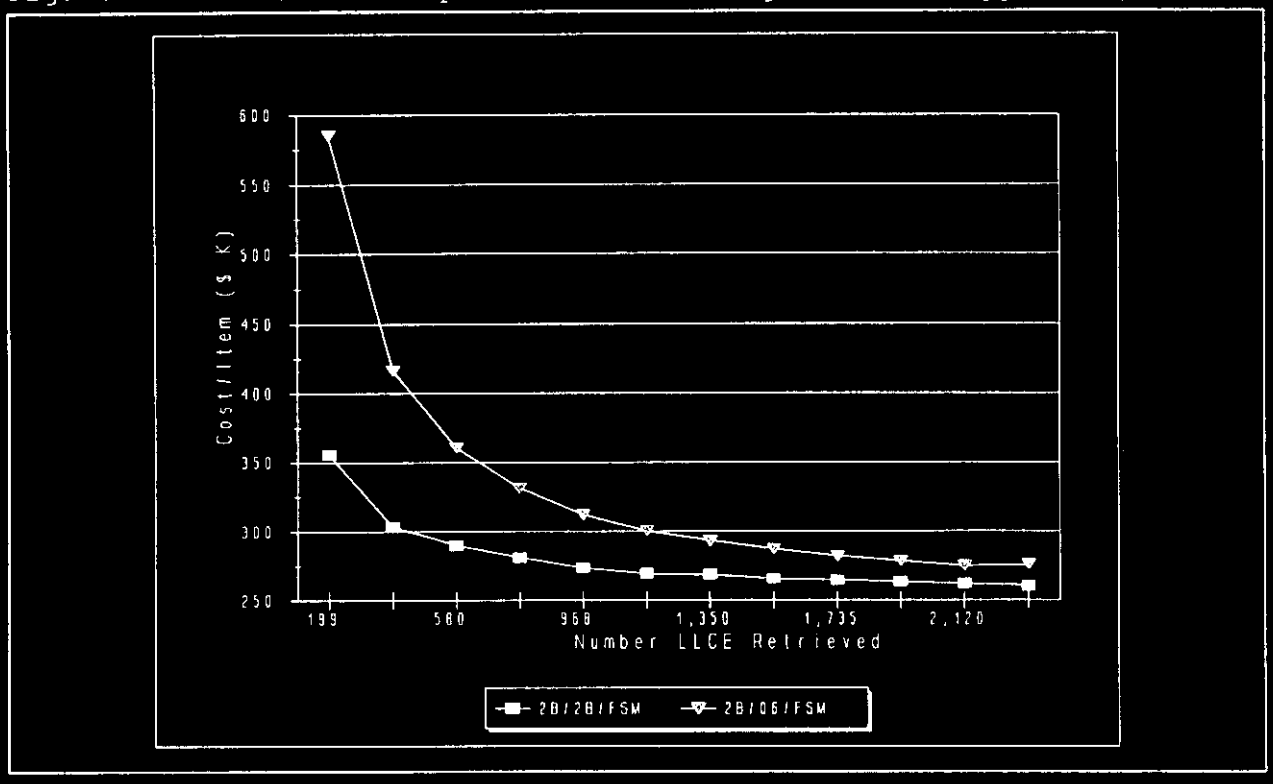
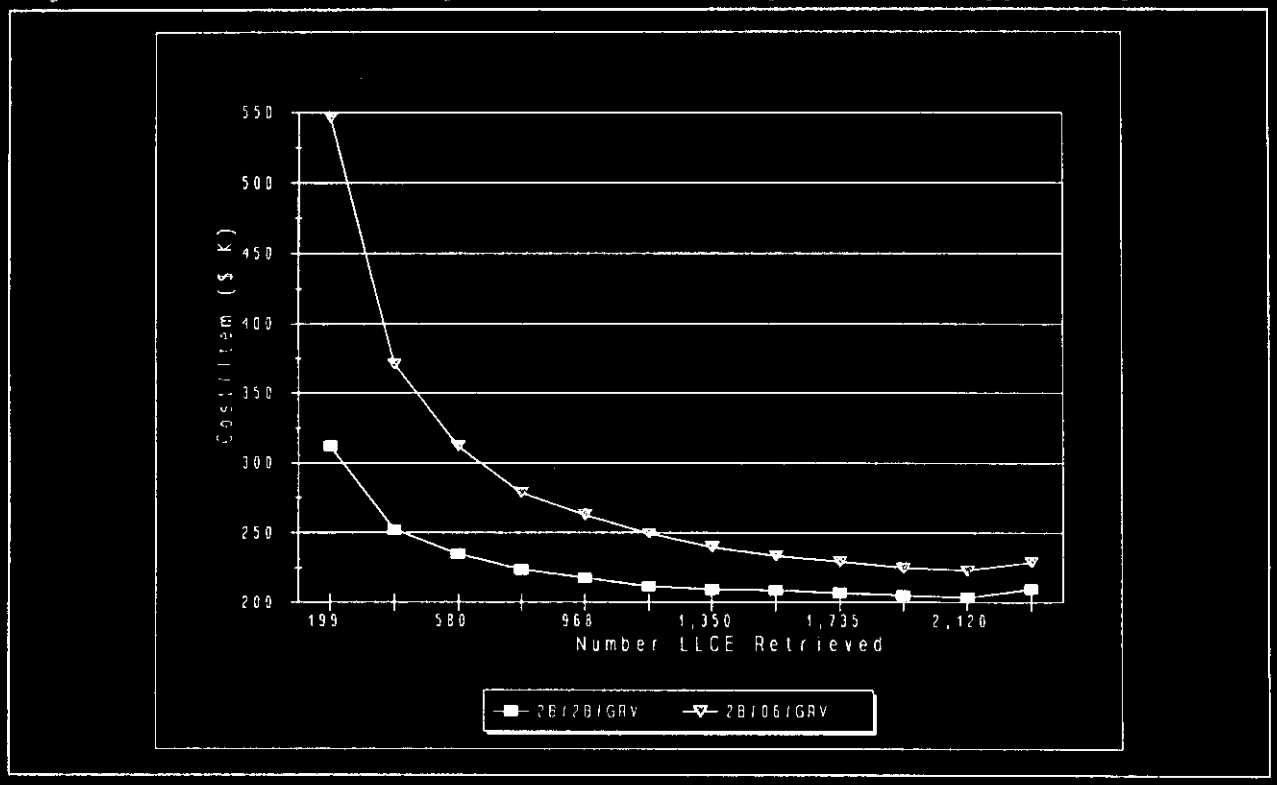


Figure 8. Cost/Item Comparison - 2B/GRV Option w/ Trapped Liquids



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Appendix A:

LLCE Equipment List

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Table A-1: TWRS Riser Study/ LLCE Equipment List

						LLCE EQUIPMENT FORECAST BY YEAR				
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
1	DCRT		244-A	F	1994	PUMP, TRANSFER	H-2-38232			
2	DCRT		244BX	2	1994	PUMP, TRANSFER	H-2-73935			
3	DCRT		244-S	H	1994	PUMP, TRANSFER	H-2-71056			
4	DCRT		244-TX	2	1994	PUMP, TRANSFER	H-2-73935			
5	DCRT		244-TX	3	1994	PUMP, AGITATOR	H-2-95279			
6	101	AP	1A	3A	1994	PUMP, TRANSFER	H-2-91943			
7	107	AP	7A	3A	1994	PUMP, TRANSFER	H-2-91943			
8	102	AW	2E	24A	1994	PUMP, 242A FEED	H-2-91943			
9	106	AW	6A	3A	1994	PUMP, TRANSFER	H-2-91943			
10	102	SY	2E	24A	1994	PUMP, X-SITE, FLEX FLOAT	H-2-75352			
11	108	AP	8A	3A	1995	PUMP, TRANSFER	H-2-91943			
12	102	SY	---	7A	1995	SPECIFIC GRAVITY	H-2-37766			
13	CATCH		U301B	12"	1996	PUMP, TRANSFER, SUBMERSIBLE	H-2-93099			
14	CATCH		A302	12"	1996	PUMP, TRANSFER	H-2-93099			
15	CATCH		UX-302	12"	1996	PUMP, CATCH TANK	H-2-93099			
16	DCRT		244-CR-3	---	1996	PUMP, TRANSFER	H-2-99161			
17	DCRT		244-CR-3	---	1996	PUMP, AGITATOR	H-2-36021			
18	102	AP	2D	13	1996	PUMP, GROUT FEED	H-2-91943			
19	104	AW	4A	3A	1996	PUMP, TRANSFER	H-2-91943			
20	101	AZ	1D	1A	1996	PUMP, MIXER	VENDOR			
21	101	AZ	1E	1C	1996	PUMP, MIXER	VENDOR			
22	106	C	6A	9	1996	PUMP, SLURRY	NEW			
23	106	C	6B	13	1996	PUMP, HEEL	NEW			
24	106	C	6C	3	1996	SLUICER	NEW			
25	101	SY	---	5B	1996	CAMERA	H-2-131617			
26	101	SY	---	17B	1996	MIT	H-2-85123			
27	101	SY	---	1B	1996	VDTT TREE	H-2-815016			
28	101	SY	---	17C	1996	MIT	H-2-85123			
29	101	SY	---	14A	1996	VDTT TREE	H-2-815016			
30	CATCH		311-ER	12"	1997	PUMP, CATCH TANK, SUBMERSIBLE	H-2-93099			
31	CATCH		A-350	12"	1997	PUMP, TRANSFER	H-2-95322			
32	CATCH		151AZ	12"	1997	PUMP, CATCH TANK	H-2-68371	H-9-1105 (026P10)		
33	101	AN	1A	3A	1997	PUMP, TRANSFER	H-2-91943			
34	107	AN	7A	11A	1997	PUMP, EJECT MIXER,	H-2-85264			
35	104	AP	4A	3A	1997	PUMP, TRANSFER	H-2-91943			
36	105	AP	5A	3A	1997	PUMP, TRANSFER	H-2-91943			
37	106	AP	6A	3A	1997	PUMP, TRANSFER	H-2-91943			
38	101	AW	---	4	1997	THERMOCOUPLE TREE	H-2-34304			
39	101	AW	1A	3A	1997	PUMP, TRANSFER	H-2-91943			
40	102	AW	2E	24A	1997	PUMP, 242A FEED	H-2-91943			
41	105	AW	5A	3A	1997	PUMP, FLEX FLOAT	H-2-91943			
42	101	AY	1B OR 1D	1B OR 1D	1997	PUMP, TRANSFER	H-2-93179			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
43	102	AY	2D	1D	1997	PUMP, TRANSFER	H-2-93179			
44	106	C	----	14	1997	THERMOCOUPLE TREE	H-2-90342			
45	106	C	----	8	1997	THERMOCOUPLE TREE	H-2-90342-20			
46	102	SY	2A	3A	1997	PUMP, FLEX FLOAT	H-2-75352			
47	103	SY	—	4A	1997	THERMOCOUPLE TREE	H-2-34304			
48	103	SY	3A	3A	1997	PUMP, TRANSFER	H-2-75352			
49	DCRT		244-U	15	1998	DIP TUBES	H-2-73867			
50	DCRT		244-U	2	1998	PUMP, TRANSFER	H-2-73935			
51	102	AN	2A	3A	1998	PUMP, TRANSFER	H-2-91943			
52	103	AP	—	4	1998	THERMOCOUPLE TREE	H-2-90492			
53	103	AP	3A	3A	1998	PUMP, TRANSFER	H-2-91943			
54	103	AW	3A	3A	1998	PUMP, FLEX FLOAT	H-2-91943			
55	101	SY	----	11B	1998	DIP LEG	H-2-37766			
56	101	SY	1A	12A	1998	PUMP, MIXER	VENDOR			
57	102	SY	----	4A	1998	THERMOCOUPLE TREE	H-2-34304			
58	CATCH		S-304	12"	1999	PUMP, CATCH TANK	H-2-93099			
59	101	AN	—	4A	1999	THERMOCOUPLE TREE	H-2-34304			
60	102	AN	---	4A	1999	THERMOCOUPLE TREE	H-2-34304			
61	103	AN	—	4	1999	THERMOCOUPLE TREE	H-2-34304			
62	107	AN	---	4A	1999	THERMOCOUPLE TREE	H-2-34304			
63	107	AN	7A	3A	1999	PUMP, TRANSFER	H-2-91943			
64	101	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
65	102	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
66	102	AP	2D	13	1999	PUMP, TRANSFER	H-2-91943			
67	104	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
68	105	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
69	106	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
70	107	AP	—	4	1999	THERMOCOUPLE TREE	H-2-90492			
71	108	AP	---	4	1999	THERMOCOUPLE TREE	H-2-90492			
72	101	AW	1A	3A	1999	PUMP, CDU FEED	H-2-91943			
73	102	AW	—	7A	1999	SPECIFIC GRAVITY	H-2-70356-2			
74	102	AW	—	4A	1999	THERMOCOUPLE TREE	H-2-34304			
75	102	AW	2A	11A	1999	AIR LIFT CIRCULATOR	H-2-70548			
76	102	AW	2E	24A	1999	PUMP, 242A FEED	H-2-91943			
77	104	AW	4A	3A	1999	PUMP, TRANSFER	H-2-91943			
78	DCRT		244-A	F	2000	PUMP, TRANSFER	H-2-38232			
79	DCRT		244BX	2	2000	PUMP, TRANSFER	H-2-73935			
80	DCRT		244-TX	3	2000	PUMP, AGITATOR	H-2-95279			
81	103	AN	3A	3A	2000	PUMP, TRANSFER	H-2-91943			
82	107	AN	7B	20A	2000	PUMP, ANNULUS	H-2-95323			
83	107	AN	7C	LDP	2000	PUMP, LEAK DETECT	H-2-95323			
84	101	AW	1C	LDP	2000	PUMP, LEAK DETECT	H-2-95323			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
85	101	AW	6B	20A	2000	PUMP, ANNULUS	H-2-96323			
86	101	AY	---	13 OR 16	2000	THERMOCOUPLE TREE	H-2-34304	H-2-99138	H-2-36509	
87	101	AY	1B OR 1D	1B OR 1D	2000	PUMP, TRANSFER	H-2-93179			
88	105	C	---	1	2000	THERMOCOUPLE TREE	H-2-90342-10			
89	105	C	5A	9	2000	PUMP, SLUDGE	TBD			
90	105	C	5B	13	2000	DISTRIBUTER JET	TBD			
91	DCRT		244-S		2001	PUMP, TRANSFER	H-2-71056			
92	104	AN	---	4	2001	THERMOCOUPLE TREE	H-2-34304			
93	104	AN	4A	3A	2001	PUMP, TRANSFER	H-2-91943			
94	103	AP	3A	3A	2001	PUMP, TRANSFER	H-2-91943			
95	104	AP	4A	3A	2001	PUMP, TRANSFER	H-2-91943			
96	105	AP	5A	3A	2001	PUMP, TRANSFER	H-2-91943			
97	106	AP	6A	3A	2001	PUMP, TRANSFER	H-2-91943			
98	107	AP	7A	3A	2001	PUMP, TRANSFER	H-2-91943			
99	108	AP	8A	3A	2001	PUMP, TRANSFER	H-2-91943			
100	102	AW	2E	24A	2001	PUMP, 242A FEED	H-2-91943			
101	103	AW	---	4A	2001	THERMOCOUPLE TREE	H-2-34304			
102	103	AW	3A	3A	2001	PUMP, TRANSFER	H-2-91943			
103	104	AW	---	4A	2001	THERMOCOUPLE TREE	H-2-34304			
104	105	AW	---	4A	2001	THERMOCOUPLE TREE	H-2-34304			
105	105	AW	5A	3A	2001	PUMP, TRANSFER	H-2-91943			
106	106	AW	---	4A	2001	THERMOCOUPLE TREE	H-2-34304			
107	106	AW	6A	3A	2001	PUMP, TRANSFER	H-2-91943			
108	105	AN	---	4	2002	THERMOCOUPLE TREE	H-2-34304			
109	105	AN	5A	3A	2002	PUMP, TRANSFER	H-2-91943			
110	101	A	---	2	2003	THERMOCOUPLE TREE	H-2-58036	H-2-99138	H-2-74691-3	H-2-74691-4
							H-2-58998	H-2-55922	H-2-74691-2	H-2-32537-1-2
							H-2-74691	H-2-36509	H-2-34304	H-2-83312-6
111	101	A	---	15	2003	LIQUID LEVEL WELL	TBD			
112	101	A	---	12	2003	THERMOCOUPLE TREE, PROFILE	H-2-58036	H-2-99138	H-2-74691-3	H-2-74691-4
							H-2-58998	H-2-55922	H-2-74691-2	H-2-32537-1-2
							H-2-74691	H-2-36509	H-2-34304	H-2-83312-6
113	101	A	---	10	2003	THERMOCOUPLE TREE	H-2-58036	H-2-99138	H-2-74691-3	H-2-74691-4
							H-2-58998	H-2-55922	H-2-74691-2	H-2-32537-1-2
							H-2-74691	H-2-36509	H-2-34304	H-2-83312-6
114	101	A	---	19	2003	LIQUID OBSERVATION WELL	H-2-93715			
115	101	A	---	7	2003	CRUST BREAKER	TBD			
116	101	A	1D	18	2003	STEAM COIL	H-2-64673			
117	101	A	1G	17	2003	STEAM COIL	H-2-64673			
118	106	AN	---	4	2003	THERMOCOUPLE TREE	H-2-34304			
119	106	AN	6A	3A	2003	PUMP, TRANSFER	H-2-91943			
120	101	AP	1A	11	2003	PUMP, MIXER	H-2-93715	H-2-71203		

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
121	102	AW	2E	24A	2003	PUMP, 242A FEED	H-2-91943			
122	101	SY	—	5B	2003	CAMERA	H-2-131617			
123	101	SY	1A	12A	2003	PUMP, MIXER	VENDOR			
124	103	SY	—	5B	2003	CAMERA	H-2-131617			
125	103	SY	3A	3A	2003	PUMP, TRANSFER	H-2-75352			
126	103	SY	3A	12A	2003	PUMP, MIXER	VENDOR			
127	101	TX		6	2003	SALTWELL SCREEN	H-2-34955			
128	101	TX		6	2003	PUMP, SALTWELL	H-2-70863			
129	102	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
130	102	TX		11A	2003	LIQUID OBSERVATION WELL	H-2-93715			
131	102	TX		3	2003	LIQUID LEVEL WELL	TBD			
132	102	TX	2A	6	2003	PUMP, SALTWELL	H-2-33461			
133	102	TX	2A	13B	2003	AIR LIFT CIRCULATOR	H-2-34790			
134	102	TX	2A	6	2003	SALTWELL SCREEN	H-2-34955			
135	102	TX	2C	10B	2003	AIR LIFT CIRCULATOR	H-2-34790			
136	102	TX	2D	12B	2003	AIR LIFT CIRCULATOR	H-2-34790			
137	103	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
138	103	TX	3A	6	2003	PUMP, P-103	H-2-36412	H-2-70863		
139	104	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
140	104	TX		10B	2003	SLUICING NOZZLE	TBD			
141	104	TX		12A	2003	RECIRC NOZZLE	TBD			
142	104	TX		12B	2003	SLUICING NOZZLE	TBD			
143	104	TX		10A	2003	RECIRC NOZZLE	TBD			
144	104	TX	4A	6	2003	PUMP, P-104	H-2-36412	H-2-70863		
145	105	TX		4	2003	THERMOCOUPLE TREE	H-2-90342-40			
146	105	TX		10B	2003	AIR LIFT CIRCULATOR	H-2-34790			
147	105	TX	5A	6	2003	PUMP, HEEL JET	H-2-70863			
148	105	TX	5A	13B	2003	AIR LIFT CIRCULATOR	H-2-34790			
149	106	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
150	106	TX		11A	2003	LIQUID OBSERVATION WELL	H-2-93715			
151	106	TX		10B	2003	AIR LIFT CIRCULATOR	H-2-34790			
152	106	TX	6A	13B	2003	AIR LIFT CIRCULATOR	H-2-34790			
153	106	TX	6A	6	2003	SALTWELL SCREEN	H-2-69757			
154	106	TX	6A	6	2003	PUMP, HEEL JET	H-2-70863			
155	107	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
156	107	TX	7A	6	2003	PUMP, P107	H-2-36412			
157	108	TX		12A	2003	SLUICING NOZZLE	TBD			
158	108	TX		9A	2003	LIQUID OBSERVATION WELL	H-2-93715			
159	108	TX		10B	2003	SLUICING NOZZLE	TBD			
160	108	TX		4	2003	THERMOCOUPLE TREE	H-2-34304			
161	108	TX		6	2003	SALTWELL SCREEN	H-2-34955	H-2-69757		
162	108	TX		6	2003	PUMP, SALT WELL	H-2-69758			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR

ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
163	109	TX		3	2003	LIQUID OBSERVATION WELL	H-2-93715			
164	109	TX		8	2003	THERMOCOUPLE TREE	H-2-34304			
165	110	TX		8	2003	THERMOCOUPLE TREE	H-2-90342			
166	110	TX		13A	2003	AIR CIRCULATOR	H-2-34790			
167	110	TX		13B	2003	LIQUID OBSERVATION WELL	H-2-93715			
168	110	TX		9A	2003	AIR CIRCULATOR	H-2-34790			
169	110	TX		11A	2003	AIR CIRCULATOR	H-2-34790			
170	110	TX	10A	6	2003	PUMP, SALTWELL	H-2-69758			
171	110	TX	10A	6	2003	SALTWELL SCREEN	H-2-34955			
172	111	TX		11A	2003	AIR CIRCULATOR	H-2-34790			
173	111	TX		11B	2003	LIQUID OBSERVATION WELL	H-2-93715			
174	111	TX		8	2003	THERMOCOUPLE TREE	H-2-34304			
175	111	TX		13A	2003	AIR CIRCULATOR	H-2-34790			
176	111	TX		9A	2003	AIR CIRCULATOR	H-2-34790			
177	111	TX		5	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-68506	H-2-58998
							H-2-41762-6	H-2-36509	H-2-34304	H-2-35733
							H-2-41334-5	H-2-83312-6		
178	111	TX	11A	6	2003	SALTWELL SCREEN	H-2-34955			
179	111	TX	11A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
180	112	TX		7	2003	LIQUID OBSERVATION WELL	TBD			
181	112	TX		12A	2003	LIQUID OBSERVATION WELL	H-2-93715			
182	112	TX		8	2003	THERMOCOUPLE TREE	H-2-34304			
183	112	TX		13A	2003	AIR CIRCULATOR	TBD			
184	112	TX	12A	6	2003	SALTWELL SCREEN	H-2-34955			
185	112	TX	12A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
186	113	TX		8	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-68506	H-2-58998
							H-2-41762-6	H-2-36509	H-2-34304	H-2-35733
							H-2-41334-5	H-2-83312-6		
187	113	TX		10A	2003	AIR CIRCULATOR	H-2-34790			
188	113	TX		4	2003	LIQUID OBSERVATION WELL	H-2-93715			
189	113	TX		3	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-68506	H-2-58998
							H-2-41762-6	H-2-36509	H-2-34304	H-2-35733
							H-2-41334-5	H-2-83312-6		
190	113	TX		13A	2003	AIR CIRCULATOR	H-2-34790			
191	113	TX		12B	2003	AIR CIRCULATOR	H-2-34790			
192	113	TX	13A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
193	113	TX	13A	6	2003	SALTWELL SCREEN	H-2-34955			
194	114	TX		12A	2003	LIQUID OBSERVATION WELL	H-2-93715			
195	114	TX		9A	2003	LIQUID OBSERVATION WELL	H-2-93715			
196	114	TX		13B	2003	AIR CIRCULATOR	H-2-34790			
197	114	TX		7A	2003	LIQUID OBSERVATION WELL	H-2-93715			
198	114	TX		4	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-68506	H-2-58998

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
							H-2-41762-6	H-2-36509	H-2-34304	H-2-35733
							H-2-41334-5	H-2-83312-6		
199	114	TX		10	2003	IMMERSION HEATER	TBD			
200	114	TX		9B	2003	AIR CIRCULATOR	H-2-34790			
201	114	TX	14A	6	2003	SALTWELL SCREEN	H-2-34955			
202	114	TX	14A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
203	115	TX		9A	2003	AIR CIRCULATOR	H-2-34790			
204	115	TX		9A	2003	AIR CIRCULATOR	H-2-34790			
205	115	TX		9A	2003	LIQUID OBSERVATION WELL	H-2-93715			
206	115	TX		13	2003	PUMP, SUPERNATANT	TBD			
207	115	TX		3	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-68506	H-2-58998
							H-2-41762-6	H-2-36509	H-2-34304	H-2-35733
							H-2-41334-5	H-2-83312-6		
208	115	TX	15A	6	2003	PUMP., SLUICING	TBD			
209	116	TX	16A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
210	116	TX	16A	6	2003	SALTWELL SCREEN	H-2-34955			
211	117	TX		7A	2003	LIQUID OBSERVATION WELL	H-2-93715			
212	117	TX	17A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
213	117	TX	17A	6	2003	SALTWELL SCREEN	H-2-34955			
214	118	TX		5A	2003	LIQUID OBSERVATION WELL	H-2-83715			
215	118	TX		3	2003	THERMOCOUPLE TREE	H-2-34304			
216	118	TX	18A	6	2003	SALTWELL SCREEN	H-2-34955			
217	118	TX	18A	6	2003	PUMP, SALTWELL	H-2-70178	H-2-69758	H-2-73990	
218	101	U		13	2003	PUMP, HEEL JET	H-2-69757			
219	101	U		2	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
220	101	U	UR-1A	6	2003	SLUICE NOZZLE	TBD			
221	101	U	UR-1A	5	2003	DIP LEG	TBD			
222	101	U	UR-1C	3	2003	SLUICE NOZZLE	TBD			
223	101	U	UR-1C	4	2003	DIP LEG	TBD			
224	102	U		2	2003	LIQUID OBSERVATION WELL	H-2-93715			
225	102	U	——	1	2003	THERMOCOUPLE TREE	H-2-34304			
226	102	U	UR-2A	5	2003	DIP LEG	TBD			
227	102	U	UR-2A	6	2003	SLUICE NOZZLE	TBD			
228	102	U	UR-2B	13	2003	SALTWELL SCREEN	H-2-69757			
229	102	U	UR-2B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
230	102	U	UR-2C	4	2003	DIP LEG	TBD			
231	102	U	UR-2C	3	2003	SLUICE NOZZLE	TBD			
232	103	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
233	103	U		19	2003	LIQUID OBSERVATION WELL	H-2-93715			
234	103	U		7	2003	DIP TUBES	H-2-41252-3			
235	103	U	UR-2B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
236	103	U	UR-2B	13	2003	SALTWELL SCREEN	H-2-69757			
237	103	U	UR-3A	5	2003	DIP LEG	TBD			
238	103	U	UR-3A	6	2003	SLUICE NOZZLE	TBD			
239	103	U	UR-3C	3	2003	SLUICE NOZZLE	TBD			
240	103	U	UR-3C	4	2003	DIP LEG	TBD			
241	104	U	UR-4A	6	2003	SLUICE NOZZLE	TBD			
242	104	U	UR-4A	18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
243	104	U	UR-4A	5	2003	DIP LEG	TBD			
244	104	U	UR-4B	13	2003	PUMP, HEEL JET	H-2-38777	H-2-73990		
245	104	U	UR-4C	3	2003	SLUICE NOZZLE	TBD			
246	104	U	UR-4C	4	2003	DIP LEG	TBD			
247	105	U		19	2003	LIQUID OBSERVATION WELL	H-2-93715			
248	105	U		18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
249	105	U	UR-5A	5	2003	DIP LEG	TBD			
250	105	U	UR-5A	6	2003	SLUICE NOZZLE	TBD			
251	105	U	UR-5B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
252	105	U	UR-5B	13	2003	SALTWELL SCREEN	H-2-69757			
253	105	U	UR-5C	3	2003	SLUICE NOZZLE	TBD			
254	105	U	UR-5C	4	2003	DIP LEG	TBD			
255	106	U		18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
256	106	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
257	106	U		9	2003	LIQUID OBSERVATION WELL	H-2-93715			
258	106	U	UR-6A	6	2003	SLUICE NOZZLE	TBD			
259	106	U	UR-6A	5	2003	DIP LEG	TBD			
260	106	U	UR-6B	13	2003	SALTWELL SCREEN	H-2-69757			
261	106	U	UR-6B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
262	106	U	UR-6C	3	2003	SLUICE NOZZLE	TBD			
263	106	U	UR-6C	4	2003	DIP LEG	TBD			
264	107	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
265	107	U		19	2003	LIQUID OBSERVATION WELL	H-2-93715			
266	107	U	UR-7A	18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
267	107	U	UR-7A	5	2003	DIP LEG	TBD			
268	107	U	UR-7A	6	2003	SLUICE NOZZLE	TBD			
269	107	U	UR-7B	13	2003	SALTWELL SCREEN	H-2-69757			
270	107	U	UR-7B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
271	107	U	UR-7C	4	2003	DIP LEG	TBD			
272	107	U	UR-7C	3	2003	SLUICE NOZZLE	TBD			
273	108	U		19	2003	LIQUID OBSERVATION WELL	H-2-93715			
274	108	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
275	108	U	UR-8A	18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
276	108	U	UR-8A	6	2003	SLUICE NOZZLE	TBD			
277	108	U	UR-8A	5	2003	DIP LEG	TBD			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
278	108	U	UR-8B	13	2003	SALTWELL SCREEN	H-2-69757			
279	108	U	UR-8B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
280	108	U	UR-8C	4	2003	DIP LEG	TBD			
281	108	U	UR-8C	3	2003	SLUICE NOZZLE	TBD			
282	109	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
283	109	U		9	2003	LIQUID OBSERVATION WELL	H-2-93715			
284	109	U	UR-9A	6	2003	SLUICE NOZZLE	TBD			
285	109	U	UR-9A	18	2003	PUMP, SLUDGE	H-2-38777	H-2-73990		
286	109	U	UR-9A	5	2003	DIP LEG	TBD			
287	109	U	UR-9B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
288	109	U	UR-9B	13	2003	SALTWELL SCREEN	H-2-69757			
289	109	U	UR9C	3	2003	SLUICE NOZZLE	TBD			
290	109	U	UR9C	4	2003	DIP LEG	TBD			
291	110	U		5	2003	DIP LEG	TBD			
292	110	U		1	2003	THERMOCOUPLE TREE	H-2-34304			
293	110	U	U10B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
294	110	U	U10B	13	2003	SALTWELL SCREEN	H-2-69757			
295	111	U		5	2003	THERMOCOUPLE TREE	H-2-34304			
296	111	U	U11A	1	2003	DIP LEG	TBD			
297	111	U	U11B	13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
298	111	U	U11B	13	2003	SALTWELL SCREEN	H-2-69757			
299	112	U		13	2003	PUMP, SALTWELL	H-2-38777	H-2-73990		
300	112	U		13	2003	SALTWELL SCREEN	H-2-69757			
301	112	U		5	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
302	201	U		4	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
303	202	U		4	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
304	203	U		4	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
305	204	U		4	2003	THERMOCOUPLE TREE	H-2-41334-7	H-2-41334-6	H-2-58998	H-2-36509
							H-2-34304	H-2-83312-6		
306	103	AN	3A	11A	2004	PUMP, MIXER	NEW			
307	101	AW	1A	11A	2004	PUMP, MIXER	NEW			
308	101	A	1H	4	2005	PUMP, SALTWELL	H-2-65054	H-2-73990		
309	101	A	1H	4	2005	SALTWELL SCREEN	H-2-69757			
310	104	AN	4A	11A	2005	PUMP, MIXER	NEW			
311	102	AW	2E	24A	2005	PUMP, 242A FEED	H-2-91943			
312	102	AZ	—	16A	2005	THERMOCOUPLE TREE, SLUDGE	H-2-68339-4			
313	102	AZ	—	13A	2005	THERMOCOUPLE TREE, PROFILE	H-2-68339-3			
314	102	AZ	—	13B	2005	THERMOCOUPLE TREE, PROFILE	H-2-68339-3			

Table A-1: TWRS Riser Study/ LLCE Equipment List

						LLCE EQUIPMENT FORECAST BY YEAR				
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
315	102	AZ	---	16B	2005	THERMOCOUPLE TREE, SLUDGE	H-2-68339-4			
316	102	AZ	---	13C	2005	THERMOCOUPLE TREE, PROFILE	H-2-68339-3			
317	102	AZ	---	13D	2005	THERMOCOUPLE TREE, PROFILE	H-2-68339-3			
318	102	AZ	---	16C	2005	THERMOCOUPLE TREE, SLUDGE	H-2-68339-4			
319	102	AZ	2B	2B	2005	PUMP, TRANSFER	H-2-93179			
320	101	BY	---	1	2005	THERMOCOUPLE TREE	H-2-68506			
321	101	BY	1A	7	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
322	101	BY	1A	7	2005	SALTWELL SCREEN	H-2-69757			
323	101	BY	1C	11A	2005	PUMP	H-2-70178	H-2-34958	H-2-38043	H-2-73990
324	101	BY	1D	9A	2005	LIQUID OBSERVATION WELL	H-2-93715			
325	101	BY	INST PIT	12A	2005	DIP TUBE	H-2-41762-5			
326	102	BY	---	1	2005	LIQUID OBSERVATION WELL	H-2-93715			
327	102	BY	2A	13	2005	AIR CIRCULATOR	H-2-34119			
328	102	BY	2A	7	2005	PUMP, HEEL JET	H-2-41294			
329	102	BY	2D	9	2005	PUMP, SLURRY	H-2-70178	H-2-34958	H-2-38043	H-2-73990
330	103	BY	---	10A	2005	LIQUID OBSERVATION WELL	H-2-93715			
331	103	BY	---	1	2005	THERMOCOUPLE TREE	H-2-68506	H-2-58998	H-2-36509	H-2-34304
							H-2-41762-5	H-2-62436-1	H-2-62437	H-2-83312-6
332	103	BY	---	12B	2005	AIR LIFT CIRCULATOR	TBD			
333	103	BY	---	10C	2005	AIR LIFT CIRCULATOR	TBD			
334	103	BY	3A	13B	2005	AIR LIFT CIRCULATOR	TBD			
335	103	BY	3C	11B	2005	PUMP, SUPERNATANT	H-2-70178	H-2-34958	H-2-38043	H-2-73990
336	104	BY	---	1	2005	THERMOCOUPLE TREE	H-2-90342-40			
337	104	BY	---	10C	2005	LIQUID OBSERVATION WELL	H-2-93715			
338	104	BY	4A	7	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
339	104	BY	4A	7	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
340	105	BY	---	10C	2005	AIR LIFT CIRCULATOR	TBD			
341	105	BY	---	10A	2005	LIQUID OBSERVATION WELL	H-2-93715			
342	105	BY	---	1	2005	THERMOCOUPLE TREE	H-2-90342-40			
343	105	BY	---	12C	2005	AIR LIFT CIRCULATOR	TBD			
344	105	BY	5A	7	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
345	105	BY	5A	13B	2005	AIR LIFT CIRCULATOR	TBD			
346	105	BY	5A	7	2005	PUMP., SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
347	106	BY	---	10B	2005	LIQUID OBSERVATION WELL	H-2-93715			
348	106	BY	---	1	2005	THERMOCOUPLE TREE	H-2-90342-40			
349	106	BY	---	10C	2005	AIR LIFT CIRCULATOR	H-2-34790			
350	106	BY	---	12C	2005	AIR LIFT CIRCULATOR	H-2-34790			
351	106	BY	6A	7	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
352	106	BY	6A	7	2005	SALT WELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
353	106	BY	6D	9	2005	BOTTOMS COOLER	H-2-36091			
354	107	BY		6	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
355	107	BY		7	2005	LIQUID OBSERVATION WELL	H-2-93715			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR									
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
356	107	BY		11A	2005	AIR CIRCULATOR	H-2-35041			
357	107	BY		9A	2005	AIR CIRCULATOR	H-2-35041			
358	107	BY		12A	2005	AIR CIRCULATOR	H-2-35041			
359	107	BY		6	2005	PUMP, SALTWELL	H-2-38043			
360	107	BY		1	2005	THERMOCOUPLE TREE	H-2-68506	H-2-58998	H-2-36509	H-2-34304
							H-2-41762-5	H-2-62436-1	H-2-62437	H-2-83312-6
361	108	BY		10A	2005	AIR CIRCULATOR	H-2-35041			
362	108	BY		8	2005	THERMOCOUPLE TREE, PROFILE	H-2-68506	H-2-58998	H-2-36509	H-2-34304
							H-2-41762-5	H-2-62436-1	H-2-62437	H-2-83312-6
363	108	BY		6	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
364	108	BY		6	2005	PUMP, SALTWELL	H-2-38043			
365	108	BY		11A	2005	AIR CIRCULATOR	H-2-35041			
366	108	BY		12A	2005	AIR CIRCULATOR	H-2-35041			
367	109	BY		12B	2005	LIQUID OBSERVATION WELL	H-2-93715			
368	109	BY	9A	6	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
369	109	BY	9A	6	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
370	109	BY	9A	13	2005	PUMP	H-2-70178	H-2-34958	H-2-38043	H-2-73990
371	110	BY		3	2005	LIQUID OBSERVATION WELL	H-2-93715			
372	110	BY		8	2005	THERMOCOUPLE TREE	H-2-90342			
373	110	BY		1	2005	THERMOCOUPLE TREE	H-2-90342-30			
374	110	BY	10A	6	2005	SALTWELL SCREEN	H-2-69758			
375	110	BY	10A	6	2005	PUMP, SALTWELL	H-2-69757			
376	111	BY		7	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
377	111	BY		7	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
378	111	BY		1	2005	LIQUID OBSERVATION WELL	H-2-93715			
379	111	BY	11D	9	2005	PUMP, TRANSFER	H-2-70178	H-2-34958	H-2-38043	H-2-73990
380	112	BY		7	2005	SALTWELL SCREEN	H-2-36966	H-2-69757	H-2-34957	H-2-38034
381	112	BY		15	2005	LIQUID OBSERVATION WELL	H-2-93715			
382	112	BY		13	2005	ELEC HTR & AIR CIRCULATOR	TBD			
383	112	BY		7	2005	PUMP, SALTWELL	H-2-70178	H-2-34958	H-2-38043	H-2-73990
384	112	BY	11C	11	2005	CONDENSER	TBD			
385	102	C		8	2005	LIQUID OBSERVATION WELL	H-2-93715			
386	102	C		7	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
387	102	C	2A	9	2005	PUMP, SLUDGE	TBD			
388	102	C	2A	5	2005	DIP LEG	H-2-41318	H-2-41323		
389	102	C	2B	13	2005	PUMP, SALTWELL	H-2-38598			
390	102	C	2B	13	2005	SALTWELL SCREEN	H-2-38587			
391	102	C	2C	4	2005	DIP LEG	H-2-41318	H-2-41323		
392	103	C		1	2005	THERMOCOUPLE TREE	H-2-90342			
393	103	C	3A	5	2005	DIP LEG	H-2-41318	H-2-41323		
394	103	C	3A	9	2005	PUMP, SUPERNATANT AND COOLER	H-2-4582			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
395	103	C	3B	13	2005	PUMP, SALTWELL	H-2-38598			
396	103	C	3B	13	2005	SALTWELL SCREEN	H-2-38587			
397	103	C	3C	4	2005	DIP LEG	H-2-41318	H-2-41323		
398	104	C		7	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
399	104	C	4A	9	2005	PUMP, SLUDGE	TBD			
400	104	C	4A	5	2005	DIP LEG	H-2-41318	H-2-41323		
401	104	C	4B	13	2005	PUMP, SALTWELL	H-2-38598			
402	104	C	4B	13	2005	SALTWELL SCREEN	H-2-38587			
403	104	C	4C	4	2005	DIP LEG	H-2-41318	H-2-41323		
404	105	C	5A	5	2005	DIP LEG	H-2-41318	H-2-41323		
405	105	C	5C	4	2005	DIP LEG	H-2-41318	H-2-41323		
406	107	C		13	2005	PUMP, SALTWELL	H-2-38598			
407	107	C		5	2005	THERMOCOUPLE TREE	H-2-90342			
408	107	C		13	2005	SALTWELL SCREEN	H-2-38587			
409	108	C		5	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
410	109	C		8	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
411	109	C		13	2005	SALTWELL SCREEN	H-2-38587			
412	109	C		13	2005	PUMP, SALTWELL	H-2-38598			
413	110	C		13	2005	PUMP, SALTWELL	H-2-38598			
414	110	C		13	2005	SALTWELL SCREEN	H-2-38587			
415	110	C		8	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
416	111	C		5	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
417	112	C		1	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
418	112	C		13	2005	PUMP, SALTWELL	H-2-38598			
419	112	C		13	2005	SALTWELL SCREEN	H-2-38587			
420	201	C		6	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
421	202	C		6	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
422	203	C		6	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
423	204	C		6	2005	THERMOCOUPLE TREE	H-2-41762-7	H-2-99138	H-2-68506	H-2-41762-6
							H-2-36509			
424	105	AN	5A	11A	2006	PUMP, MIXER	NEW			
425	106	AN	6A	11A	2006	PUMP, MIXER	NEW			
426	103	AP	3B	20	2006	PUMP, LEAK DETECT	H-2-90576			

Table A-1: TWRS Riser Study/ LLCE Equipment List

LLCE EQUIPMENT FORECAST BY YEAR										
ITEM #	TANK	FARM	PIT	RISER	FY	EQUIPMENT TYPE	DRAWING NO	DRAWING NO	DRAWING NO	DRAWING NO
427	103	AP	3B	20	2006	PUMP, ANNULUS	H-2-90576			
428	101	AX	—	13B	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-2			
429	101	AX	—	7B	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-4			
430	101	AX	—	7A	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-4			
431	101	AX	—	9A	2006	LIQUID OBSERVATION WELL	H-2-93715			
432	101	AX	—	13A	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-2			
433	101	AX	—	13C	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-2			
434	101	AX	—	14	2006	STEAM COIL	H-2-34264			
435	101	AX	—	9B	2006	THERMOCOUPLE TREE	H-2-44733			
436	101	AX	—	7D	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-4			
437	101	AX	—	7C	2006	THERMOCOUPLE TREE, PROFILE	H-2-44733-4			
438	101	AX	—	1A	2006	STEAM COIL	H-2-34264			
439	101	AX	1A	5A	2006	PUMP, SALTWELL	H-2-65054			
440	101	AX	1A	5A	2006	SALTWELL SCREEN	H-2-69757			
441	101	AX	1B	1B	2006	SLUICER	H-2-68154			
442	102	AY	—	13C	2006	THERMOCOUPLE TREE, PROFILE	H-2-64368-3			
443	102	AY	—	16B	2006	THERMOCOUPLE TREE, SLUDGE	H-2-64368-4			
444	102	AY	—	13A	2006	THERMOCOUPLE TREE, PROFILE	H-2-64368-3			
445	102	AY	—	16A	2006	THERMOCOUPLE TREE, SLUDGE	H-2-64368-4			
446	102	AY	—	13D	2006	THERMOCOUPLE TREE, PROFILE	H-2-64368-3			
447	102	AY	—	16C	2006	THERMOCOUPLE TREE, SLUDGE	H-2-64368-4			
448	102	AY	—	13B	2006	THERMOCOUPLE TREE, PROFILE	H-2-64368-3			
449	102	AY	2D	2D	2006	PUMP, TRANSFER	H-2-93179			

Appendix B:

LLCE Equipment List
Numerical Analysis Tables

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Table B-1: LLCE Items by Equipment Type

NUMBER OF LLCE ITEMS BY EQUIPMENT TYPE

EQUIPMENT TYPE	NUMBER	PERCENT
AGITATOR	1	0.22
AIR LIFT CIRCULATOR	37	8.24
AIR INLET STACK	0	0
BOTTOMS COOLER	1	0.22
CAMERA	3	0.67
CIRCULATOR	0	0
CONDENSER	1	0.22
CRUST BREAKER	1	0.22
DIP LEG, PRESSURE	11	2.45
DIP LEG, RECIRCULATION	8	1.78
DIP LEG, SPECIFIC GRAVITY	13	2.9
DIP LEG, SPECIFIC GRAVITY/TEMP	3	0.67
DISTRIBUTOR JET	1	0.22
ELECTRIC IMMERSION HEATER	1	0.22
HEATER	1	0.22
LIQUID LEVEL ALARM	0	0
LIQUID LEVEL WELL	2	0.45
LIQUID OBSERVATION WELL	37	8.24
MIT	2	0.45
PUMP, AGITATOR	2	0.45
PUMP, FLEX FLOAT	3	0.67
PUMP, FLEX FLOAT, FLUSH ASSY	2	0.45
PUMP, HEEL JET	1	0.22
PUMP, JET	30	6.68
PUMP, MIXER	11	2.45
PUMP, SLUICE	1	0.22
PUMP, SLURRY	2	0.45
PUMP, SUBMERSIBLE	5	1.11
PUMP, VERTICAL TURBINE	81	18.04
PUMP, VERTICAL TURBINE, COOLER	1	0.22
PUMP, VERTICAL TURBINE, FLUSH ASSY	9	2
PUMP, VERTICAL TURBINE, RECIRC LINE	0	0
PUMP, VERTICAL TURBINE, SUCTION BOWL	0	0
RECIRC NOZZLE	2	0.45
SALT WELL CASING	41	9.13
SLUICER	24	5.35
STEAM COIL	4	0.89
THERMOCOUPLE	105	23.39
VDTT TREE	2	0.45
TOTAL	449	100.01

Table B-2: TRU/LLW Percentages

POTENTIAL TRU ITEMS

POTENTIAL TRU TANKS

TANK	NUMBER
A-101	10
A-102	0
A-106	0
AN-102	2
AN-104	3
AN-107	5
AZ-101	2
B-101	0
B-110	0
B-202	0
BX-101	0
BY-103	6
C-102	7
C-103	6
C-104	6
C-105	5
C-106	5
S-107	0
TX-118	4

NON-TRU TANKS

TANK	NUMBER	TANK	NUMBER	TANK	NUMBER	TANK	NUMBER
CATCH	7	AY-101	3	C-202	1	TX-116	2
DCRT	13	AY-102	9	C-203	1	TX-117	3
AN-101	2	AZ-102	8	C-204	1	U-101	6
AN-103	3	BY-101	6	SY-101	9	U-102	8
AN-105	3	BY-102	4	SY-102	4	U-103	9
AN-106	3	BY-104	4	SY-103	5	U-104	6
AP-101	3	BY-105	7	TX-101	2	U-105	8
AP-102	3	BY-106	7	TX-102	8	U-106	9
AP-103	5	BY-107	7	TX-103	2	U-107	9
AP-104	3	BY-108	6	TX-104	6	U-108	9
AP-105	3	BY-109	4	TX-105	4	U-109	9
AP-106	3	BY-110	5	TX-106	6	U-110	4
AP-107	3	BY-111	4	TX-107	2	U-111	4
AP-108	3	BY-112	5	TX-108	6	U-112	3
AW-101	6	C-107	3	TX-109	2	U-201	1
AW-102	9	C-108	1	TX-110	7	U-202	1
AW-103	3	C-109	3	TX-111	8	U-203	1
AW-104	3	C-110	3	TX-112	6	U-204	1
AW-105	3	C-111	1	TX-113	8		
AW-106	3	C-112	3	TX-114	9		
AX-101	14	C-201	1	TX-115	6		

TRU/LLW PERCENTAGES

TRU		LLW	
SUBTOTAL	61	SUBTOTAL	388
PERCENT	13.6	PERCENT	86.4
RINSE EFF	0.7	RINSE EFF	1.0
TOTAL	18	TOTAL	431
PERCENT	4.0	PERCENT	96.0

Table B-3: Geometry Percentages

LLCE GEOMETRY

STRAIGHT PIPE		COMPLEX GEOMETRY	
EQUIPMENT TYPE	NUMBER	EQUIPMENT TYPE	NUMBER
DIP LEG, PRESSURE	11	AGITATOR	1
DIP LEG, RECIRCULATION	8	AIR LIFT CIRCULATOR	37
DIP LEG, SPECIFIC GRAVITY	13	AIR INLET STACK	0
DIP LEG, SPECIFIC GRAV/TEMP	3	BOTTOMS COOLER	1
LIQUID LEVEL ALARM	0	CAMERA	3
LIQUID LEVEL WELL	2	CIRCULATOR	0
LIQUID OBSERVATION WELL	37	CONDENSER	1
MIT	2	CRUST BREAKER	1
SALT WELL CASING	41	DISTRIBUTOR JET	1
THERMOCOUPLE	105	ELECTRIC IMMERSION HEATER	1
VDTT TREE	2	HEATER	1
		PUMP, AGITATOR	2
		PUMP, FLEX FLOAT	3
		PUMP, FLEX FLOAT, FLUSH ASSY	2
		PUMP, HEEL JET	1
		PUMP, JET	30
		PUMP, MIXER	11
		PUMP, SLUICE	1
		PUMP, SLURRY	2
		PUMP, SUBMERSIBLE	5
		PUMP, VERTICAL TURBINE	81
		PUMP, VERTICAL TURBINE, COOLER	1
		PUMP, VERTICAL TURBINE, FLUSH ASSY	9
		PUMP, VERTICAL TURBINE, RECIRC LINE	0
		PUMP, VERTICAL TURBINE, SUCTION BOWL	0
		RECIRC NOZZLE	2
		SLUICER	24
		STEAM COIL	4
TOTAL	224	TOTAL	225
PERCENT	49.9	PERCENT	50.1

Table B-4: Dose Rate Percentages - StraightPipe

SURFACES EXPOSED TO WASTE			
INNER & OUTER SURFACES		OUTER SURFACES ONLY	
EQUIPMENT TYPE	NUMBER	EQUIPMENT TYPE	NUMBER
DIP LEG, PRESSURE	11	MIT	2
DIP LEG, RECIRCULATION	8	THERMOCOUPLE	105
DIP LEG, SPECIFIC GRAVITY	13	VDTT TREE	2
DIP LEG, SPECIFIC GRAV/TEMP	3		
LIQUID LEVEL ALARM	0		
LIQUID LEVEL WELL	2		
LIQUID OBSERVATION WELL	37		
SALT WELL CASING	41		

DOSE RATE PERCENTAGES: STRAIGHT PIPE, OD < 4 in			
REMOTE-HANDLED		CONTACT-HANDLED	
SUBTOTAL	115	SUBTOTAL	109
PERCENT	51.3	PERCENT	48.7
RINSING EFFECTIVENESS	0.7	RINSING EFFECTIVENESS	1.0
TOTAL	35	TOTAL	189
PERCENT	15.6	PERCENT	84.4

Table B-5: Dose Rate Data - Complex Geometry

DOSE RATE DATA: COMPLEX GEOMETRY LLCE						
ITEM NO	TANK	COMPONENT	DATE	DOSE RATE	DR LOCATION	DRAWING NO
1	102-C	PUMP, FLEX FLOAT	08-06-69	1,000	4 IN	H-2-31956
2	103-SX	PUMP, VERTICAL TURBINE	09-28-84	5,000	CONTACT	H-2-33461
3	107-C	PUMP, FLEX FLOAT	12-16-69	5,000	3 FT	H-2-34343
4	101-C	PUMP, HEEL JET	11-21-79	4,000	6 IN	H-2-41294
5	104-BY	PUMP, VERTICAL TURBINE	06-06-70	1,000	8 IN	H-2-62426
6	108-BY	PUMP, VERTICAL TURBINE	10-15-69	5,000	CONTACT	H-2-62426
7	112-BY	PUMP, VERTICAL TURBINE	10-22-69	100	CONTACT	H-2-62426
8	112-BY	PUMP, VERTICAL TURBINE	08-08-69	5,000	CONTACT	H-2-62426
9	112-BY	PUMP, VERTICAL TURBINE	02-10-70	1,500	5 FT	H-2-62646
10	105-BY	PUMP, VERTICAL TURBINE	02-21-79	2,300	3 IN	H-2-69758
11	111-BX	PUMP, VERTICAL TURBINE	1-27-80	100	1 FT	H-2-69758
12	101-AZ	PUMP, VERTICAL TURBINE	11-23-83	5,000	CONTACT	H-2-70790
13	102-AZ	PUMP, VERTICAL TURBINE	03-27-86	5,000	10 FT	H-2-70790
14	102-AY	PUMP, VERTICAL TURBINE	10-09-86	60,000	CONTACT	H-2-70790
15	102-AZ	PUMP, VERTICAL TURBINE	12-20-85	5,000	4 FT	H-2-70790
16	116-TX	PUMP, JET	03-06-84	800	CONTACT	H-2-70863
17	108-TX	PUMP, JET	03-05-84	1,000	CONTACT	H-2-70863
18	102-TY	PUMP, JET	03-30-84	150	CONTACT	H-2-70863
19	103-TY	PUMP, JET	04-02-84	150	2 IN	H-2-70863
20	105-TY	PUMP, JET	04-03-84	400	CONTACT	H-2-70863
21	105-TX	PUMP, JET	03-07-84	2,000	CONTACT	H-2-70863
22	106-TX	PUMP, JET	03-09-84	500	CONTACT	H-2-70863
23	115-TX	PUMP, JET	03-14-84	2,000	CONTACT	H-2-70863
24	115-TX	PUMP, JET	03-14-84	250	CONTACT	H-2-70863
25	104-TX	PUMP, JET	01-05-84	1,000	CONTACT	H-2-70863
26	115-TX	PUMP, JET	03-14-84	2,000	CONTACT	H-2-70863
27	101-TY	PUMP, JET	03-28-84	200	CONTACT	H-2-70863
28	102-TX	PUMP, JET	03-27-84	3,000	CONTACT	H-2-70863
29	112-TX	PUMP, JET	03-16-84	1,000	CONTACT	H-2-70863
30	108-TX	PUMP, JET	03-20-84	150	CONTACT	H-2-70863
31	106-AW	PUMP, VERTICAL TURBINE	01-16-85	4,000	6 IN	H-2-91943
32	106-AW	PUMP, VERTICAL TURBINE	11-25-85	750	3 FT	H-2-91943
33	106-AW	PUMP, VERTICAL TURBINE	07-28-88	700	CONTACT	H-2-91943
34	101-AN	PUMP, VERTICAL TURBINE	04-30-84	1,000	6 IN	H-2-91943
35	102-AW	PUMP, VERTICAL TURBINE	01-09-86	3,000	2 IN	H-2-91943
36	101-AW	PUMP, VERTICAL TURBINE	06-18-84	1,500	CONTACT	H-2-91943

Table B-6: Trapped Liquids Percentages

TRAPPED LIQUIDS, COMPLEX GEOMETRY			
LOW PROBABILITY OF TRAPPED LIQUIDS		HIGH PROBABILITY OF TRAPPED LIQUIDS	
EQUIPMENT TYPE	NUMBER	EQUIPMENT TYPE	NUMBER
AGITATOR	1	PUMP, AGITATOR	2
AIR LIFT CIRCULATOR	37	PUMP, FLEX FLOAT, FLUSH ASSY	2
AIR INLET STACK	0	PUMP, HEEL JET	3
BOTTOMS COOLER	1	PUMP, JET	30
CAMERA	3	PUMP, MIXER	11
CIRCULATOR	0	PUMP, SLURRY	2
CONDENSER	1	PUMP, VERTICAL TURBINE, COOLER	1
CRUST BREAKER	1	PUMP, VERTICAL TURBINE, FLUSH ASSY	9
DISTRIBUTOR JET	1		
ELECTRIC IMMERSION HEATER	1		
HEATER	1		
PUMP, FLEX FLOAT	1		
PUMP, SLUICE	1		
PUMP, SUBMERSIBLE	5		
PUMP, VERTICAL TURBINE	81		
PUMP, VERTICAL TURBINE, RECIRC LINE	0		
PUMP, VERTICAL TURBINE, SUCTION BOWL	0		
RECIRC NOZZLE	2		
SLUICER	24		
STEAM COIL	4		
TOTAL	185	TOTAL	60
PERCENT	73.3	PERCENT	26.7

Table B-7: Diameter Percentages

DIAMETER, STRAIGHT PIPE LLCE			
< 4 in OD		> 4 in OD	
EQUIPMENT TYPE	NUMBER	EQUIPMENT TYPE	NUMBER
DIP LEG, PRESSURE	11	DIP LEG, SPECIFIC GRAV/TEMP	3
DIP LEG, RECIRCULATION	8	SALT WELL CASING	41
DIP LEG, SPECIFIC GRAVITY	13		
LIQUID LEVEL ALARM	0		
LIQUID LEVEL WELL	2		
LIQUID OBSERVATION WELL	37		
MIT	2		
THERMOCOUPLE	105		
VDTT TREE	2		
TOTAL	180	TOTAL	44
PERCENT	80.4	PERCENT	19.6

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Appendix C:

Forecast Module Summary Sheets

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Forecast Module: General

Baseline Retrieval Rate																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
TWRS FY 1995 30 yr forecast.	10	5	15	9	13	15	19	18	20	43	41	48	61	53	63	70	88
Treatment Capacity																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
221-T.	0	0	0	0	0	25	37	49	51	51	51	51	51	51	51	51	51
2706-T.	0	0	0	0	0	31	46	61	63	63	63	63	63	63	63	63	63
Grout Vaults.	0	0	0	0	0	0	60	90	120	120	120	120	120	120	120	120	120
FSM.	0	72	108	144	144	144	144	144	144	144	144	144	144	144	144	144	144
FDR.	0	42	63	84	84	84	84	84	84	84	84	84	84	84	84	84	84
FSR.	72	108	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Treatability Group Percentages																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
TRU percentage.	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
TL percentage.	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128
MACRO percentage.	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507
FSR percentage.	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
Treatability Group Retrieval Rate																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Forecast multiplier.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Annual LLCE forecast.	10	5	15	9	13	15	19	18	20	43	41	48	61	53	63	70	88
Annual TRU items retrieved.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TL items retrieved.	1	1	2	1	2	2	2	2	3	6	5	6	8	7	8	9	11
Annual MACRO items retrieved.	5	3	8	5	7	8	10	9	10	22	21	24	31	27	32	35	45
Annual FSR items retrieved.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29

Total LLCE retrieved.	1922
Total TRU items retrieved.	77
Total TL items retrieved.	245
Total MACRO items retrieved.	975
Total FSR items retrieved.	625

Forecast Module: General

Baseline Retrieval Rate																	
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TWRS FY 1995 30 yr forecast.	106	113	134	152	159	162	48	56	64	75	87	87	87	0	0	0	0
Treatment Capacity																	
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
WRAP-2B.	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
221-T.	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
2706-T.	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
Grout Vaults.	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
FSM.	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
FDR.	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
FSR.	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Treatability Group Percentages																	
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TRU percentage.	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
TL percentage.	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128
MACRO percentage.	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507
FSR percentage.	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
Treatability Group Retrieval Rate																	
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Forecast multiplier.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Annual LLCE forecast.	106	113	134	152	159	162	48	56	64	75	87	87	87	0	0	0	0
Annual TRU items retrieved.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TL items retrieved.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual MACRO items retrieved.	54	57	68	77	81	82	24	28	32	38	44	44	44	0	0	0	0
Annual FSR items retrieved.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0

Total LLCE retrieved.
Total TRU items retrieved.
Total TL items retrieved.
Total MACRO items retrieved.
Total FSR items retrieved.

Forecast Module: NA

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual LLCE items shipped to storage.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Cumulative LLCE items in storage.	9	15	31	40	54	70	89	107	128	172	213	261	322	375	438	508	597

Total LLCE items retreived.	1922
Total LLCE items shipped to storage.	1922
Max LLCE items in storage.	1922
Max number of annual storage evolutions.	162

Forecast Module: NA

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86
Annual LLCE items shipped to storage.	106	113	134	151	159	162	48	55	64	75	86	86	86
Cumulative LLCE items in storage.	703	816	950	1101	1260	1422	1470	1525	1589	1664	1750	1836	1922

Total LLCE items retreived.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B

Material Movement																
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual LLCE items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual LLCE items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual LLCE items shipped to storage.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	30	29
Annual number of storage evolutions.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	30	29
Cumulative LLCE items in storage.	9	15	31	40	54	70	89	107	128	172	213	261	322	375	438	468	497
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2034
Total LLCE treated in WRAP-2B.	1922
Total LLCE items shipped direct to WRAP-2B.	1062
Total LLCE items shipped to storage.	860
Max LLCE items in storage.	842
Max number of annual storage evolutions.	82

Forecast Module: 2B

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual LLCE items shipped direct to WRAP-2B.	80	80	80	80	80	80	48	55	64	75	80	80	80	0	0	0	0
Annual LLCE items treated at WRAP-2B.	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Annual LLCE items shipped to storage.	26	33	54	71	79	82	0	0	0	0	6	6	6	0	0	0	0
Annual number of storage evolutions.	26	33	54	71	79	82	32	25	16	5	6	6	6	80	80	80	80
Cumulative LLCE items in storage.	523	556	610	681	760	842	810	785	769	764	770	776	782	702	622	542	462
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B

Forecast Module: 2

Material Movement	2029	2030	2031	2032	2033	2034	2035
Annual LLCE items retreived.	0	0	0	0	0	0	0
Annual LLCE items shipped direct to WRAP-2B.	0	0	0	0	0	0	0
Annual LLCE items treated at WRAP-2B.	80	80	80	80	80	62	0
Annual LLCE items shipped to storage.	0	0	0	0	0	0	0
Annual number of storage evolutions.	80	80	80	80	80	62	0
Cumulative LLCE items in storage.	382	302	222	142	62	0	0
Years LLCE program in operation.	2029	2030	2031	2032	2033	2034	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.

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Forecast Module: 2B/T

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual LLW items retreived.	9	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items shipped direct to 221-T.	0	0	0	0	0	15	18	17	20	42	39	46	51	51	51	51	51
Annual LLW items treated in 221-T.	0	0	0	0	0	25	37	40	20	42	39	46	51	51	51	51	51
Annual LLW items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	34
Annual LLW items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	49
Annual LLW items shipped to storage.	9	6	15	9	13	0	0	0	0	0	0	0	8	0	9	0	0
Cumulative LLW items in storage.	9	15	30	39	52	42	23	0	0	0	0	0	8	8	17	15	0
Annual number of storage evolutions.	9	6	16	9	14	11	20	24	1	2	2	2	10	2	12	19	0
Cumulative LLCE items in storage.	9	15	31	40	54	45	27	5	6	8	10	12	22	24	36	15	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	755
Total LLCE treated in 221-T.	1167
Total LLCE items shipped direct to WRAP-2B.	642
Total LLCE items shipped direct to 221-T.	1110
Total LLCE items shipped to storage.	170
Max LLCE items in storage.	82
Max number of annual storage evolutions.	31

Forecast Module: 2B/T

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual LLW items retreived.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items shipped direct to 221-T.	51	51	51	51	51	51	46	51	51	51	51	51	51	0	0	0	0
Annual LLW items treated in 221-T.	51	51	51	51	51	51	51	51	51	51	51	51	51	0	0	0	0
Annual LLW items shipped direct to WRAP-2B.	51	57	75	74	74	74	0	2	10	21	32	32	32	0	0	0	0
Annual LLW items treated in WRAP-2B.	51	57	75	74	74	74	77	2	10	21	32	32	32	0	0	0	0
Annual LLW items shipped to storage.	0	0	3	20	28	31	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	0	0	3	23	51	82	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	3	20	28	31	5	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	3	23	51	82	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 221-T.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 221-T.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/06

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual LLW items retreived.	9	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items shipped direct to 2706-T.	0	0	0	0	0	15	18	17	20	42	39	46	59	51	60	63	63
Annual LLW items treated in 2706-T.	0	0	0	0	0	31	46	25	20	42	39	46	59	51	60	63	63
Annual LLW items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	22
Annual LLW items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	22
Annual LLW items shipped to storage.	9	6	15	9	13	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	9	15	30	39	52	36	8	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	6	16	9	14	17	29	9	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	9	15	31	40	54	39	12	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	570
Total LLCE treated in 2706-T.	1352
Total LLCE items shipped direct to WRAP-2B.	525
Total LLCE items shipped direct to 2706-T.	1283
Total LLCE items shipped to storage.	114
Max LLCE items in storage.	54
Max number of annual storage evolutions.	29

Forecast Module: 2B/06

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual LLW items retreived.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items shipped direct to 2706-T.	63	63	63	63	63	63	46	53	61	63	63	63	63	0	0	0	0
Annual LLW items treated in 2706-T.	63	63	63	63	63	63	63	53	61	63	63	63	63	0	0	0	0
Annual LLW items shipped direct to WRAP-2B.	39	45	66	74	74	74	0	0	0	9	20	20	20	0	0	0	0
Annual LLW items treated in WRAP-2B.	39	45	66	74	74	74	26	0	0	9	20	20	20	0	0	0	0
Annual LLW items shipped to storage.	0	0	0	8	16	19	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	0	0	0	8	24	43	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	8	16	19	17	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	8	24	43	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 2706-T.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 2706-T.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/GRV

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual LLW items retreived.	9	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items shipped direct to grout vaults.	0	0	0	0	0	0	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items treated in grout vaults.	0	0	0	0	0	0	60	42	20	42	39	46	59	51	60	67	85
Annual LLW items shipped to storage.	9	6	15	9	13	15	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	9	15	30	39	52	67	25	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	6	16	9	14	16	43	26	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	9	15	31	40	54	70	29	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in grout vaults.	1845
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to grout vaults.	1675
Total LLCE items shipped to storage.	189
Max LLCE items in storage.	103
Max number of annual storage evolutions.	103

Forecast Module: 2B/GRV

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual LLW items retreived.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items shipped direct to grout vaults.	102	108	120	120	120	120	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items treated in grout vaults.	102	108	120	120	120	120	120	82	61	72	83	83	83	0	0	0	0
Annual LLW items shipped to storage.	0	0	9	25	33	36	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	0	0	9	34	67	103	29	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	9	25	33	36	74	29	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	9	34	67	103	29	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0
Total LLCE items retreived.																	
Year of LLCE program shutdown.																	
Total LLCE treated in WRAP-2B.																	
Total LLCE treated in grout vaults.																	
Total LLCE items shipped direct to WRAP-2B.																	
Total LLCE items shipped direct to grout vaults.																	
Total LLCE items shipped to storage.																	
Max LLCE items in storage.																	
Max number of annual storage evolutions.																	

Forecast Module: 2B/FSM

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual LLW items retreived.	9	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items sent direct to FSM.	0	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items treated by FSM.	0	15	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items shipped to storage.	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	9	1	0	1	1	1	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	9	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated by FSM.	1845
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items sent direct to FSM.	1836
Total LLCE items shipped to storage.	28
Max LLCE items in storage.	22
Max number of annual storage evolutions.	22

Forecast Module: 2B/FSM

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual LLW items retreived.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items sent direct to FSM.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items treated by FSM.	102	108	129	144	144	144	68	53	61	72	83	83	83	0	0	0	0
Annual LLW items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	0	0	0	1	10	22	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	-1	-9	-12	22	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	1	10	22	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated by FSM.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items sent direct to FSM.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/FDR

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual LLW items retreived.	9	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items sent direct to FDR.	0	6	15	9	13	15	18	17	20	42	39	46	59	51	60	67	85
Annual LLW items treated by FDR.	0	15	15	9	13	15	18	17	20	42	39	46	59	51	60	67	84
Annual LLW items shipped to storage.	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annual number of storage evolutions.	9	9	1	0	1	1	1	1	1	2	2	2	2	2	3	19	-1
Cumulative LLCE items in storage.	9	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	1
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated by FDR.	1845
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items sent direct to FDR.	1836
Total LLCE items shipped to storage.	28
Max LLCE items in storage.	290
Max number of annual storage evolutions.	84

Forecast Module: 2B/FDR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual LLW items retreived.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items sent direct to FDR.	102	108	129	145	153	156	46	53	61	72	83	83	83	0	0	0	0
Annual LLW items treated by FDR.	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	15	0
Annual LLW items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLW items in storage.	19	43	88	149	218	290	252	221	198	186	185	184	183	99	15	0	0
Annual number of storage evolutions.	-18	-24	-45	-61	-69	-72	38	31	23	12	1	1	1	84	84	15	0
Cumulative LLCE items in storage.	19	43	88	149	218	290	252	221	198	186	185	184	183	99	15	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated by FDR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items sent direct to FDR.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/FSR

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual non-FSR items retreived.	6	4	11	6	10	11	13	12	14	30	28	32	41	36	43	47	60
Annual non-FSR items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual non-FSR items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual non-FSR items shipped to storage.	6	4	11	6	10	11	13	12	14	30	28	32	41	36	43	7	0
Annual number of storage evolutions.	6	4	11	6	10	11	13	12	14	30	28	32	41	36	43	7	0
Cumulative non-FSR items in storage.	6	10	21	27	37	48	61	73	87	117	145	177	218	254	297	304	304
Annual FSR items retreived.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items treated by FSR.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2026
Total LLCE treated in WRAP-2B.	1297
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	905
Total LLCE items shipped to storage.	392
Max LLCE items in storage.	380
Max number of annual storage evolutions.	80

Forecast Module: 2B/FSR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual non-FSR items retreived.	72	76	90	102	107	109	32	37	43	51	58	58	58	0	0	0	0
Annual non-FSR items shipped direct to WRAP-2B.	72	76	80	80	80	80	32	37	43	51	58	58	58	0	0	0	0
Annual non-FSR items treated at WRAP-2B.	80	80	80	80	80	80	80	80	80	80	80	80	80	80	77	0	0
Annual non-FSR items shipped to storage.	0	0	10	22	27	29	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	8	4	10	22	27	29	48	43	37	29	22	22	22	80	77	0	0
Cumulative non-FSR items in storage.	296	292	302	324	351	380	332	289	252	223	201	179	157	77	0	0	0
Annual FSR items retreived.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items treated by FSR.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated by FSR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/T/FSR

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL/MACRO items retreived.	6	4	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped direct to 221-T.	0	0	0	0	0	10	12	11	13	28	26	30	39	34	40	44	51
Annual TL/MACRO items treated in 221-T.	0	0	0	0	0	25	32	11	13	28	26	30	39	34	40	44	51
Annual TL/MACRO items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Annual TL/MACRO items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Annual TL/MACRO items shipped to storage.	6	4	10	6	9	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	6	10	20	26	35	20	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items treated by FSR.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	6	4	11	6	10	16	21	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	6	10	21	27	37	23	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	312
Total LLCE treated in 221-T.	985
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	293
Total LLCE items shipped direct to 221-T.	950
Total LLCE items shipped to storage.	54
Max LLCE items in storage.	37
Max number of annual storage evolutions.	21

Forecast Module: 2B/T/FSR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items retreived.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped direct to 221-T.	51	51	51	51	51	51	30	35	40	48	51	51	51	0	0	0	0
Annual TL/MACRO items treated in 221-T.	51	51	51	51	51	51	30	35	40	48	51	51	51	0	0	0	0
Annual TL/MACRO items shipped direct to WRAP-2B.	17	20	34	45	50	52	0	0	0	0	4	4	4	0	0	0	0
Annual TL/MACRO items treated in WRAP-2B.	17	20	34	45	50	52	0	0	0	0	4	4	4	0	0	0	0
Annual TL/MACRO items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items treated by FSR.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 221-T.
Total LLCE treated by FSR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 221-T.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/06/FSR

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL/MACRO items retreived.	6	4	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped direct to 2706-T.	0	0	0	0	0	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items treated in 2706-T.	0	0	0	0	0	31	26	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items shipped to storage.	6	4	10	6	9	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	6	10	20	26	35	14	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items treated by FSR.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	6	4	11	6	10	22	15	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	6	10	21	27	37	17	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	223
Total LLCE treated in 2706-T.	1074
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	204
Total LLCE items shipped direct to 2706-T.	1039
Total LLCE items shipped to storage.	54
Max LLCE items in storage.	37
Max number of annual storage evolutions.	22

Forecast Module: 2B/06/FSR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items retreived.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped direct to 2706-T.	63	63	63	63	63	63	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items treated in 2706-T.	63	63	63	63	63	63	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped direct to WRAP-2B.	5	8	22	33	38	40	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items treated in WRAP-2B.	5	8	22	33	38	40	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items treated by FSR.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 2706-T.
Total LLCE treated by FSR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 2706-T.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/GRV/FSR

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL/MACRO items retreived.	6	4	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped direct to grout vaults.	0	0	0	0	0	0	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items treated in grout vaults.	0	0	0	0	0	0	57	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped to storage.	6	4	10	6	9	10	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	6	10	20	26	35	45	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items treated by FSR.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	6	4	11	6	10	11	46	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	6	10	21	27	37	48	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in grout vaults.	1220
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to grout vaults.	1175
Total LLCE items shipped to storage.	64
Max LLCE items in storage.	48
Max number of annual storage evolutions.	46

Forecast Module: 2B/GRV/FSR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items retreived.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped direct to grout vaults.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items treated in grout vaults.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items treated by FSR.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in grout vaults.
Total LLCE treated by FSR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to grout vaults.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/FSM/FSR

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL/MACRO items retreived.	6	4	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items sent direct to FSM.	0	4	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items treated by FSM.	0	10	10	6	9	10	12	11	13	28	26	30	39	34	40	44	56
Annual TL/MACRO items shipped to storage.	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items treated by FSR.	3	2	5	3	4	5	6	6	7	14	13	16	20	17	20	23	29
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	6	6	1	0	1	1	1	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	6	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated by FSM.	1220
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items sent direct to FSM.	1214
Total LLCE items shipped to storage.	25
Max LLCE items in storage.	19
Max number of annual storage evolutions.	19

Forecast Module: 2B/FSM/FSR

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL/MACRO items retreived.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items sent direct to FSM.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items treated by FSM.	68	71	85	96	101	103	30	35	40	48	55	55	55	0	0	0	0
Annual TL/MACRO items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL/MACRO items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual FSR items retreived.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items treated by FSR.	34	37	44	49	52	53	16	18	21	24	28	28	28	0	0	0	0
Annual FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated by FSM.
Total LLCE treated by FSR.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items sent direct to FSM.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/2B/FSM

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU/TL items retreived.	1	1	3	1	3	3	3	3	4	8	7	8	10	9	11	12	15
Annual TRU/TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	15
Annual TRU/TL items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual TRU/TL items shipped to storage.	1	1	3	1	3	3	3	3	4	8	7	8	10	9	11	0	0
Cumulative TRU/TL items in storage.	1	2	5	6	9	12	15	18	22	30	37	45	55	64	75	47	2
Annual MACRO/FSR items retreived.	8	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items sent direct to FSM.	0	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items treated by FSM.	0	13	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped to storage.	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	9	3	1	3	3	3	3	4	8	7	8	10	9	11	28	45
Cumulative LLCE items in storage.	9	2	5	6	9	12	15	18	22	30	37	45	55	64	75	47	2
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	322
Total LLCE treated by FSM.	1600
Total LLCE items shipped direct to WRAP-2B.	247
Total LLCE items sent direct to FSM.	1592
Total LLCE items shipped to storage.	83
Max LLCE items in storage.	75
Max number of annual storage evolutions.	45

Forecast Module: 2B/2B/FSM

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU/TL items retreived.	18	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items shipped direct to WRAP-2B.	18	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items treated at WRAP-2B.	20	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU/TL items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items sent direct to FSM.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items treated by FSM.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated by FSM.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items sent direct to FSM.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/06/FSM

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL items retreived.	1	1	2	1	2	2	2	2	3	6	5	6	8	7	8	9	11
Annual TL items shipped direct to 2706-T.	0	0	0	0	0	2	2	2	3	6	5	6	8	7	8	9	11
Annual TL items treated in 2706-T.	0	0	0	0	0	9	2	2	3	6	5	6	8	7	8	9	11
Annual TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items shipped to storage.	1	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL items in storage.	1	2	4	5	7	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	8	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items sent direct to FSM.	0	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items treated by FSM.	0	13	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped to storage.	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	9	3	1	3	8	1	1	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	9	2	5	6	9	3	4	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in 2706-T.	245
Total LLCE treated by FSM.	1600
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to 2706-T.	238
Total LLCE items sent direct to FSM.	1592
Total LLCE items shipped to storage.	34
Max LLCE items in storage.	19
Max number of annual storage evolutions.	19

Forecast Module: 2B/06/FSM

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items retreived.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items shipped direct to 2706-T.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items treated in 2706-T.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items sent direct to FSM.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items treated by FSM.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 2706-T.
Total LLCE treated by FSM.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 2706-T.
Total LLCE items sent direct to FSM.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/2B/GRV

Material Movement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU/TL items retreived.	1	1	3	1	3	3	3	3	4	8	7	8	10	9	11	12	15
Annual TRU/TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	15
Annual TRU/TL items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60
Annual TRU/TL items shipped to storage.	1	1	3	1	3	3	3	3	4	8	7	8	10	9	11	0	0
Cumulative TRU/TL items in storage.	1	2	5	6	9	12	15	18	22	30	37	45	55	64	75	47	2
Annual MACRO/FSR items retreived.	8	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped direct to grout vaults.	0	0	0	0	0	0	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items treated in grout vaults.	0	0	0	0	0	0	60	29	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped to storage.	8	5	13	8	11	13	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	8	13	26	34	45	58	14	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	6	16	9	14	16	47	17	4	8	7	8	10	9	11	28	45
Cumulative LLCE items in storage.	9	15	31	40	54	70	29	18	22	30	37	45	55	64	75	47	2
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	322
Total LLCE treated in grout vaults.	1600
Total LLCE items shipped direct to WRAP-2B.	247
Total LLCE items shipped direct to grout vaults.	1508
Total LLCE items shipped to storage.	167
Max LLCE items in storage.	75
Max number of annual storage evolutions.	75

Forecast Module: 2B/2B/GRV

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU/TL items retreived.	18	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items shipped direct to WRAP-2B.	18	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items treated at WRAP-2B.	20	19	22	25	26	27	8	9	11	13	14	14	14	0	0	0	0
Annual TRU/TL items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU/TL items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped direct to grout vaults.	88	94	112	120	120	120	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items treated in grout vaults.	88	94	112	120	120	120	74	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped to storage.	0	0	0	6	13	15	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	0	0	0	6	19	34	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	2	0	0	6	13	15	34	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	6	19	34	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in grout vaults.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to grout vaults.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Forecast Module: 2B/06/GRV

Material Movement																	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual LLCE items retreived.	9	6	16	9	14	16	19	18	21	44	41	48	61	53	63	70	89
Annual TRU items retreived.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	3	4
Annual TRU items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Annual TRU items treated at WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	4
Annual TRU items shipped to storage.	0	0	1	0	1	1	1	1	1	2	2	2	2	2	3	0	0
Cumulative TRU items in storage.	0	0	1	1	2	3	4	5	6	8	10	12	14	16	19	0	0
Annual TL items retreived.	1	1	2	1	2	2	2	2	3	6	5	6	8	7	8	9	11
Annual TL items shipped direct to 2706-T.	0	0	0	0	0	2	2	2	3	6	5	6	8	7	8	9	11
Annual TL items treated in 2706-T.	0	0	0	0	0	9	2	2	3	6	5	6	8	7	8	9	11
Annual TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items shipped to storage.	1	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL items in storage.	1	2	4	5	7	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	8	5	13	8	11	13	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped direct to grout vaults.	0	0	0	0	0	0	16	15	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items treated in grout vaults.	0	0	0	0	0	0	60	29	17	36	34	40	51	44	52	58	74
Annual MACRO/FSR items shipped to storage.	8	5	13	8	11	13	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	8	13	26	34	45	58	14	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	9	6	16	9	14	21	45	15	1	2	2	2	2	2	3	19	0
Cumulative LLCE items in storage.	9	15	31	40	54	61	18	5	6	8	10	12	14	16	19	0	0
Years LLCE program in operation.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

Total LLCE items retreived.	1922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in 2706-T.	245
Total LLCE treated in grout vaults.	1600
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to 2706-T.	238
Total LLCE items shipped direct to grout vaults.	1508
Total LLCE items shipped to storage.	111
Max LLCE items in storage.	61
Max number of annual storage evolutions.	61

Forecast Module: 2B/06/GRV

Material Movement	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Annual LLCE items retreived.	106	113	134	151	159	162	48	55	64	75	86	86	86	0	0	0	0
Annual TRU items retreived.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped direct to WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items treated at WRAP-2B.	4	5	5	6	6	6	2	2	3	3	3	3	3	0	0	0	0
Annual TRU items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TRU items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items retreived.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items shipped direct to 2706-T.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items treated in 2706-T.	14	14	17	19	20	21	6	7	8	10	11	11	11	0	0	0	0
Annual TL items shipped direct to WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items treated in WRAP-2B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual TL items shipped to storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative TL items in storage.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual MACRO/FSR items retreived.	88	94	112	126	133	135	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped direct to grout vaults.	88	94	112	120	120	120	40	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items treated in grout vaults.	88	94	112	120	120	120	74	46	53	62	72	72	72	0	0	0	0
Annual MACRO/FSR items shipped to storage.	0	0	0	6	13	15	0	0	0	0	0	0	0	0	0	0	0
Cumulative MACRO/FSR items in storage.	0	0	0	6	19	34	0	0	0	0	0	0	0	0	0	0	0
Annual number of storage evolutions.	0	0	0	6	13	15	34	0	0	0	0	0	0	0	0	0	0
Cumulative LLCE items in storage.	0	0	0	6	19	34	0	0	0	0	0	0	0	0	0	0	0
Years LLCE program in operation.	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	0	0	0	0

Total LLCE items retreived.
Year of LLCE program shutdown.
Total LLCE treated in WRAP-2B.
Total LLCE treated in 2706-T.
Total LLCE treated in grout vaults.
Total LLCE items shipped direct to WRAP-2B.
Total LLCE items shipped direct to 2706-T.
Total LLCE items shipped direct to grout vaults.
Total LLCE items shipped to storage.
Max LLCE items in storage.
Max number of annual storage evolutions.

Appendix D:

Forecast Module Basis

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Figures

Tables

Appendix D:
Forecast Module Basis

1.0 Discussion

This appendix describes in detail the basis for each element found in the forecast module sheets in Appendix C.

2.0 Retrieval Rate

The baseline retrieval rate was taken from the FY 1995 edition of the TWRS 30 year waste forecast. To simulate variations in retrieval rate, the baseline retrieval number for each year was multiplied by a scaling factor, and the resulting fraction was rounded to the nearest whole number. The scaling factor was then varied from 0.1 to 1.2. In this way, any desired total number of retrieved items could be simulated. This approach was selected on the basis of simplicity, however it would suffer from the following disadvantages:

- The baseline retrieval rate curve would be shifted up or down, as shown in Figure D-1, but would retain the same basic shape. This approach would not provide the ability to vary retrieval rate on a year to year basis.
- A small amount of round-off error would be introduced, however this round-off error was calculated to be less than 1%.

The above disadvantages were not considered to be unnecessarily limiting. Retrieval rate modeling results have been summarized in Figure D-1.

3.0 Treatment Capacity

The treatment capacity vs years in operation curve for any treatment method would at first be characterized by a start-up date and an initial treatment capacity. As a crew gains experience, the treatment capacity would be expected to ramp up to some maximum value and then level out. This basic shape was assumed for all LLCE treatment methods.

3.1 WRAP-2B

Treatment capacity figures for WRAP-2B have not been determined to date, therefore the following parameters were assumed by the author.

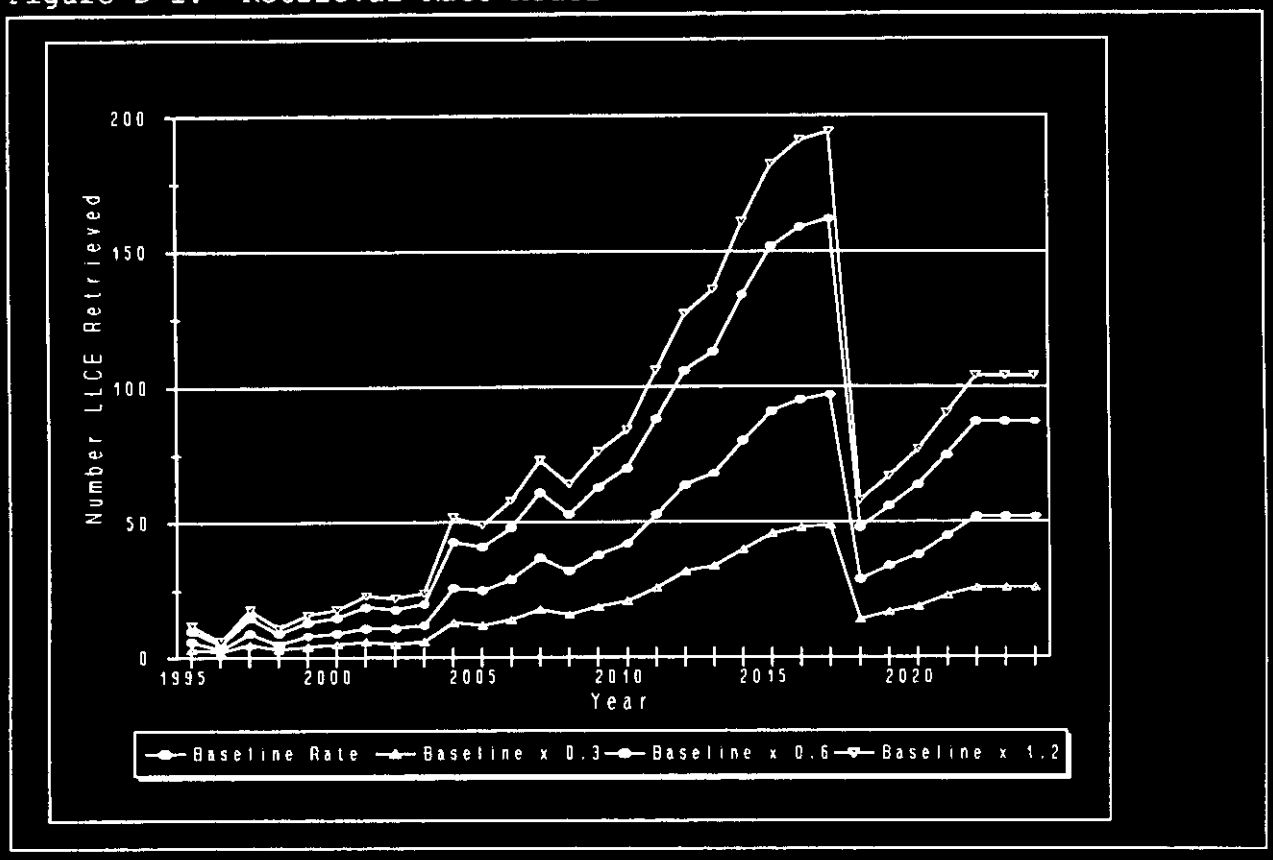
3.1.1 Start-up Date

The year 2010 was selected for the WRAP-2B start-up date, based on the best available estimates of on-site needs. No firm start-up date has been established.

3.1.2 100% Treatment Capacity

The WRAP-2B 100% treatment capacity of 80 items per year was based on the best available estimates of on-site needs. No firm facility design has been established.

Figure D-1. Retrieval Rate Model



3.1.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.1.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.2 221-T

3.2.1 Start-up Date

The 221-T start-up date was based on incorporating the required canyon upgrades into the project W-259 (T Plant Leak Detection and Secondary Containment) scope of work. Project W-259 was established to meet a year 2000 TPA milestone, therefore 221-T start-up would also be in the year 2000.

3.2.2 100% Treatment Capacity

The current 221-T process line design was estimated to require 28 consecutive shift hours to perform all required treatment functions[1].

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[1]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 6.0, "Alternative 1: T Plant," Figure 6.6, "Throughput Analysis," Revision 0, Draft.

From WRAP-A efficiency studies, a typical facility operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work[2]. As a result, the average treatment capacity for 221-T would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{28\ hrs} = \frac{34\ items}{year}$$

At higher retrieval rates, this limited treatment capacity would cause significant numbers of LLCE to be placed in storage at great cost. It would be more cost effective to operate 221-T in multiple shifts than to store LLCE. To account for second shift operation, a 50% increase in the average treatment capacity was applied. Therefore, the 100% treatment capacity for 221-T would be 51 items per year.

3.2.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.2.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.3 2706-T Annex

3.3.1 Start-up Date

The 2706-T start-up date was based on incorporating the required construction into the project W-259 (T Plant Leak Detection and Secondary Containment) scope of work. Project W-259 was established to meet a year 2000 TPA milestone, therefore 2706-T start-up would also be in the year 2000.

3.3.2 100% Treatment Capacity

The current 2706-T process line design was estimated to require 23 consecutive shift hours to perform all required treatment functions[3]. From Section 3.2.2, a typical facility operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. As a result, the average treatment capacity for 2706-T would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{23\ hrs} = \frac{42\ items}{year}$$

As discussed Section 3.2.2, the 100% treatment capacity was assumed to be 50% greater than the average treatment capacity above. Therefore, the 100% treatment capacity for 2706-T would be 63 items per year.

3.3.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

---

[2]Per telephone conversation, W. S. Josephson to D. E. Nester and O. L. Kruger, on November 16, 1994.

[3]Per telephone conversation, W. S. Josephson to A. R. Rathmacher, on November 16, 1994.

3.3.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.4 Grout Vaults

3.4.1 Start-up Date

The grout vault start-up date was based on FY 1995 project initiation and a typical line item funding cycle. The line item funding cycle would require four years to obtain funding[4]. One additional year was allotted for design and another year for construction and start-up activities. Therefore, grout vault start-up would be in the year 2001.

3.4.2 100% Treatment Capacity

The grout vault process line design was estimated to require 12 consecutive shift hours to all required treatment functions. From Section 3.2.2, a typical facility operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. As a result, the average treatment capacity for the grout vaults would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{23\ hrs} = \frac{80\ items}{year}$$

As discussed in Section 3.2.2, the 100% treatment capacity was assumed to be 50% greater than the average treatment capacity above. Therefore, the 100% treatment capacity for the grout vaults would be 120 items per year.

3.4.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.4.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.4.5 Grout Vault Capacity

The number of LLCE items which could be treated in a grout vault was determined from the scale diagram in Figure D-2. Each grout vault was estimated to accommodate 1218 items.

3.5 FSM

3.5.1 Start-up Date

In order to be consistent with a TWRS milestone to have a generic LLCE process path in place by the end of FY 1995, FSM was assumed to be operational in FY 1996.

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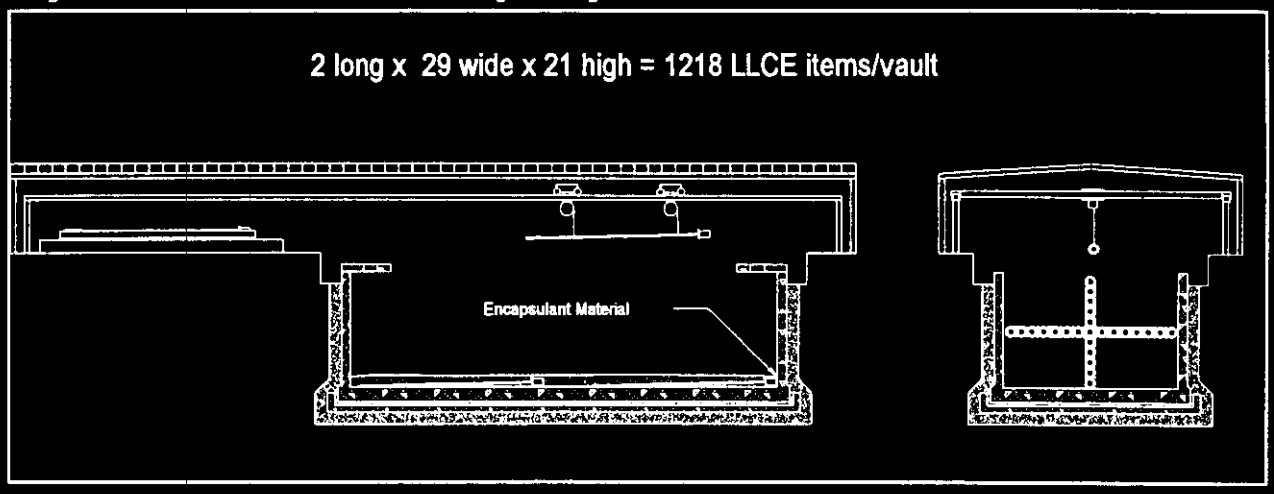
[4]WHC-CM-6-2, Project Management, Table 1.0-1, "Project Budget Cycle for Line Items," Revision 6, dated August 2, 1993.

Figure D-2. Grout Vault Capacity



3.5.2 100% Treatment Capacity

From Section 3.2.2, a typical operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. From Appendix F, FSM operations were assumed to require 10 consecutive shift hours. As a result, the average treatment capacity for FSM would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{10\ hrs} = \frac{96\ items}{year}$$

As discussed Section 3.2.2, the 100% treatment capacity was assumed to be 50% greater than the average treatment capacity above. Therefore, the 100% treatment capacity for FSM would be 144 items per year.

3.5.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.5.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.6 FDR

3.6.1 Start-up Date

In order to be consistent with a TWRS milestone to have a generic LLCE process path in place by the end of FY 1995, FDR was assumed to be operational in FY 1996.

3.6.2 100% Treatment Capacity

From Section 3.2.2, a typical operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. From Appendix F, FDR operations were assumed to require 34 consecutive shift hours. As a result, the average treatment capacity for FDR would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{34\ hrs} = \frac{28\ items}{year}$$

Operation of duplicate crews in 200 East and 200 West would expand this capacity to 56 items. As discussed Section 3.2.2, the 100% treatment capacity was assumed to be 50% greater than the average treatment capacity above. Therefore, the 100% treatment capacity for FDR would be 84 items per year.

3.6.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.6.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

3.7 FSR

3.7.1 Start-up Date

FSR is currently operational.

3.7.2 100% Treatment Capacity

From Section 3.2.2, a typical operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. From Appendix F, FSR operations were assumed to require 20 consecutive shift hours. As a result, the average treatment capacity for FSR would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{20\ hrs} = \frac{48\ items}{year}$$

Operation of duplicate crews in 200 East and 200 West would expand this capacity to 96 items. As discussed Section 3.2.2, the 100% treatment capacity was assumed to be 50% greater than the average treatment capacity above. Therefore, the 100% treatment capacity for FSR would be 144 items per year.

3.7.3 Initial Treatment Capacity

Initial treatment capacity for all treatment methods was assumed to be 50% of the 100% treatment capacity.

3.7.4 Ramp-up Rate

Ramp-up rate for all treatment methods was assumed to be 25% of the 100% treatment capacity.

4.0 Treatability Group Percentages

To account for treatment method restrictions, the total LLCE waste stream was subdivided using the following waste characteristics:

- Waste Classification: TRU vs LLW
- Geometry: Complex Geometry vs Straight Pipe
- Dose Rate: Contact-Handled vs Remote-Handled
- Trapped Liquids: Trapped Liquids vs No Trapped Liquids

- Diameter: ≤4 inch and >4 inch

These characteristics were combined into separate treatability groups, and the percentages of each treatability group were then calculated. This section describes the basis for and calculations of the treatability group percentages.

4.1 Waste Classification (TRU vs LLW)

In order to calculate the TRU percentage of the LLCE waste stream, the following information would be required:

- weight of each LLCE item
- amount of residual tank waste remaining on each item
- the radionuclide content of the residual tank waste

Clearly the majority of this data would not be available until actual removal of the LLCE item, and would be heavily influenced by the relative success of rinsing operations during removal. As a result, it was not possible to quantify, with any accuracy, the TRU fraction of the LLCE waste stream in advance. However, a reasonable upper bound was determined from existing studies.

First, source term calculations done in support of TWRS LLCE container design efforts[5] were used to identify potential TRU-producing tanks. The source term studies used worst-case LLCE item design data, an assumed residual thickness of waste, and radiochemical data from tank waste analysis to calculate total curie loadings under a variety of scenarios. The calculations showed that only the tanks listed in Table D-1 had sufficient TRU content to produce a TRU LLCE item[6].

Table D-1. Potential TRU-Producing Tanks

SST				DST
C-103	C-105	TX-118	A-106	AN-104
C-104	S-107	B-101	B-110	AZ-101
B-202	C-106	BY-103	A-102	AN-107
C-102	A-101	BX-101		AN-102

The percentage of LLCE items from potential TRU-producing tanks was then determined from LLCE forecast information. Most of the available forecast data provided only raw numbers of LLCE per year, with no indication of the source tank or equipment design. However, detailed information on source tanks, equipment H-2 drawings, and estimated generation dates was available from a TWRS retrieval equipment design study[7]. A component-by-component equipment list of all LLCE which could potentially be retrieved over the next ten years had already been prepared, and was used to calculate TRU percentages. The LLCE

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[5]WHC-SD-WM-ES-265, Disposal of Tank Farm Long-Length Contaminated Equipment: Alternative Options Study and Engineering Support Information, Section 5.3, "Tank Farm Hardware Waste Characterization," Revision 0, dated December 7, 1993.

[6]Per cc:Mail message, H. L. Roach to W. S. Josephson, on December 5, 1994.

[7]Per cc:Mail message, H. L. Roach to W. S. Josephson, on November 3, 1994.

equipment list has been included as Appendix A.

The LLCE equipment list in Appendix A was assumed to be a representative subset of the total LLCE waste stream. In that way, the percentages calculated for the 449 items listed in Appendix A would be representative of the 1,921 items forecasted for retrieval over the next 30 years.

From analysis of the LLCE equipment list, only 61 out of 449 total LLCE items were found to come from TRU-producing tanks, which would correspond to a maximum TRU percentage of 13.6%. However, since all LLCE items would be thoroughly rinsed during retrieval[8], the entire number coming from potential TRU tanks would not actually be TRU. Assuming a rinsing efficiency of 70%, the nominal TRU percentage would be approximately 4.0%, and the nominal LLW percentage would be approximately 96.0%.

The raw data and calculations used to determine TRU percentage have been included in Appendix B, Table B-2.

4.2 Geometry

The LLCE equipment list in Appendix A was used to divide the LLW group into straight pipe and complex geometry subgroups. Straight pipe items were defined as those which consisted primarily of one or more pipes, without significant bends, fittings or attachments. Complex geometry items were defined as those which did not meet the straight pipe criteria. The H-2 drawings referenced in Appendix A were used to determine the configuration of each type of LLCE and assign it to either the straight pipe or complex geometry group. The LLCE equipment list in Appendix A was then used to determine the number of items in each equipment type, and these numbers were used to calculate straight pipe and complex geometry percentages. The nominal straight pipe percentage was found to be 49.9% and the nominal complex geometry percentage was found to be 51.1%

The raw data and calculations used to determine equipment geometry percentages have been included in Appendix B, Table B-3.

4.3 Dose Rate

4.3.1 Straight Pipe

Unfortunately, no reliable historical dose rate information could be located for the straight pipe subgroup. Therefore, an indirect method was required to estimate dose rate. From analysis of the H-2 drawings in Appendix A, the straight pipe treatability group was found to consists of two basic designs:

1. Closed pipe designs, where tank waste would only come in contact with the outer surface of the item.
2. Open pipe designs, where tank waste would contact both the inner and outer surfaces of the item.

The H-2 drawings were used to determine the configuration of each type

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[8]WHC-SD-WM-ES-265, Disposal of Tank Farm Long-Length Contaminated Equipment: Alternative Options Study and Engineering Support Information, Section 3.1.1, "Near-Term Removal Methods," Revision 0, dated December 7, 1993.

of straight pipe LLCE and assign it to either the closed pipe or open pipe subgroups. The LLCE equipment list in Appendix A was then used to determine the number of items in each equipment type, and these numbers were used to calculate closed pipe and open pipe percentages. The nominal closed pipe percentage was found to be 51.3% and the nominal open pipe percentage was found to be 48.7%

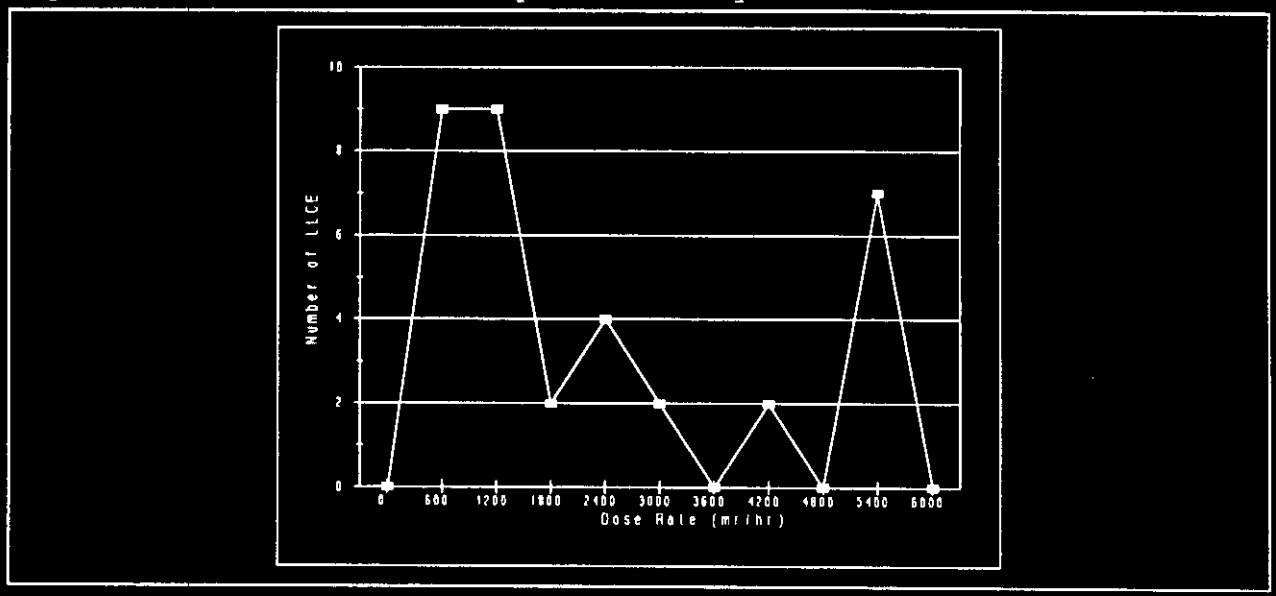
It was assumed that the aggressive mechanical action of the planned external rinse system would effectively decontaminate closed pipe items to contact-handled levels (dose rate < 100 mr/hr). Open pipe items, on the other hand, would have internal surfaces which could only be passively flushed. A 70% rinsing effectiveness to contact-handled levels was assumed for these items. Allowing for limited rinsing effectiveness of open pipe designs, the nominal straight pipe contact-handled percentage would be 80.4% and the nominal straight pipe remote-handled percentage would be 19.6%

The raw data and calculations used to determine dose rate percentages have been included in Appendix B, Table B-4.

4.3.2 Complex Geometry

Historical dose rate information was used to determine the dose rate percentages of the complex geometry subgroup. A study of past LLCE retrieval operations produced a list of 36 radiological surveys with reliable dose rate information[9]. All the radiological surveys addressed pump retrievals, therefore the results were only considered valid for the complex geometry group. These survey results have been listed in Appendix B, Table B-5 and have been summarized in Figure D-3.

Figure D-3. Dose Rate - Complex Geometry



From the historical results in Appendix B, Table B-5 and Figure D-3, virtually all the complex geometry items would have dose rates in

[9]WHC-SD-WM-ES-265, Disposal of Tank Farm Long-Length Contaminated Equipment: Alternative Options Study and Engineering Support Information, Table D-4, "Dose Rates for Tank Farm Equipment Removed in the Past," Revision 0, dated December 7, 1993.

excess of 100 mr/hr. Therefore, all complex geometry items were considered to be remote-handled.

4.4 Trapped Liquids

As discussed in Section 5.4.4 of the parent study, "residual liquids" and "trapped liquids" have been differentiated from "free liquids." Residual liquids and trapped liquids were not considered to meet the regulatory definition of free liquids, and therefore would not warrant special handling. Section 5.4.4 has a detailed discussion of the rationale for this free liquids interpretation.

At this point, the regulating agencies have not expressed agreement or disagreement with the free liquids interpretation in Section 5.4.4, and a possibility exists that trapped liquids could be determined to be free liquids and would be excluded from macroencapsulation. The percentage of items with trapped liquids was calculated to compare alternatives in that event.

4.4.1 Straight Pipe

From analysis of the H-2 drawings in Appendix A, all items in the straight pipe subgroup were found to have a negligible probability of containing trapped liquids, except in the case of a closed pipe design which had experienced an equipment boundary failure (i.e failed weld, cracked equipment mounting, etc). No data exists on the frequency of this type of failure, therefore no attempt was made to quantify the number of items with liquids from this source. As a result, all straight pipe items were assumed to have no trapped liquids.

4.4.2 Complex Geometry

From analysis of the H-2 drawings in Appendix A, the complex geometry subgroup was found to consists of two basic designs:

1. Designs which have a high probability of trapping liquids, in the form of tank waste or rinse water, internally. These designs were assumed to have trapped liquids.
2. Designs which have no significant probability of trapping free liquids. These designs were assumed to have no trapped liquids.

The H-2 drawings were used to determine the configuration of each type of complex geometry LLCE and assign it to either the trapped liquids or no trapped liquids subgroups. The LLCE equipment list in Appendix A was then used to determine the number of items in each equipment type, and these numbers were used to calculate trapped liquids and no trapped liquids percentages. The nominal trapped liquids percentage was found to be 26.7% and the nominal no trapped liquids percentage was found to be 73.3%

The raw data and calculations used to determine trapped liquids percentages have been included in Appendix B, Table B-6.

4.5 Diameter

From analysis of the H-2 drawings in Appendix A, the straight pipe treatability group was found to consists of two basic designs:

1. Designs with an outside diameter in excess of 4 inches.

2. Designs with an outside diameter less than or equal to 4 inches.

The H-2 drawings were used to determine the configuration of each type of straight pipe LLCE and assign it to either the ≤4 inch OD or >4 inch subgroups. The LLCE equipment list in Appendix A was then used to determine the number of items in each equipment type, and these numbers were used to calculate closed pipe and open pipe percentages. The nominal ≤4 inch OD pipe percentage was found to be 80.4% and the nominal > 4 inch percentage was found to be 19.6%

The raw data and calculations used to determine equipment diameter percentages have been included in Appendix B, Table B-7.

4.6 Flow Chart Analysis

The individual waste characteristic percentages listed in Section 4.1 through Section 4.5 were subjected to flow chart analysis to determine the treatability groups and associated percentages. The flow chart has been included as Figure D-4, and the calculated treatability group percentages have been summarized in Table D-2. For compactness, each treatability group was assigned a shorthand notation, which has been adopted throughout this study.

Table D-2. Treatability Group Percentages

Treatability Group	Notation	Percentage
TRU	TRU	4.0 %
Trapped Liquids	TL	12.8 %
LLW, Complex Geometry, OD > 4 inch or RH	MACRO	50.7 %
LLW, Straight Pipe, CH, OD ≤ 4 inch	FSR	32.5 %

5.0 Treatability Group Retrieval Rate

The retrieval rate for each treatability group was calculated as follows. The annual retrieval number, adjusted by the scaling factor discussed in Section 2.0, was multiplied by the treatability group percentages listed in Table D-2, and the resulting fractions were rounded to the nearest whole number. This approach would obviously suffer from the same disadvantages as the retrieval rate modeling approach discussed in Section 2.0, however the error introduced by this approach was considered to be minimal.

6.0 Material Movement

The following assumptions and calculations were used to determine the flow of each LLCE item through the treatment model.

1. LLCE were assumed to be shipped directly to treatment if a treatment slot was available. Storage was considered a last resort due to the cost involved.

2. The annual number of open treatment slots in each treatment facility was calculated as follows:

$$\frac{\text{open slots}}{\text{year}} = \text{number in storage} - \text{annual treatment capacity}$$

3. The annual number of items shipped to storage was calculated as follows:

$$\frac{\text{shipped to storage}}{\text{year}} = \text{number retrieved} - \text{open treatment slots}$$

4. The number of items treated in each treatment facility was calculated using the following algorithm:

$$\frac{\text{Items treated}}{\text{year}} = \text{Max}\left(\begin{array}{c}\text{number in storage} + \text{number retrieved} \\ \text{or} \\ \text{annual treatment capacity}\end{array}\right)$$

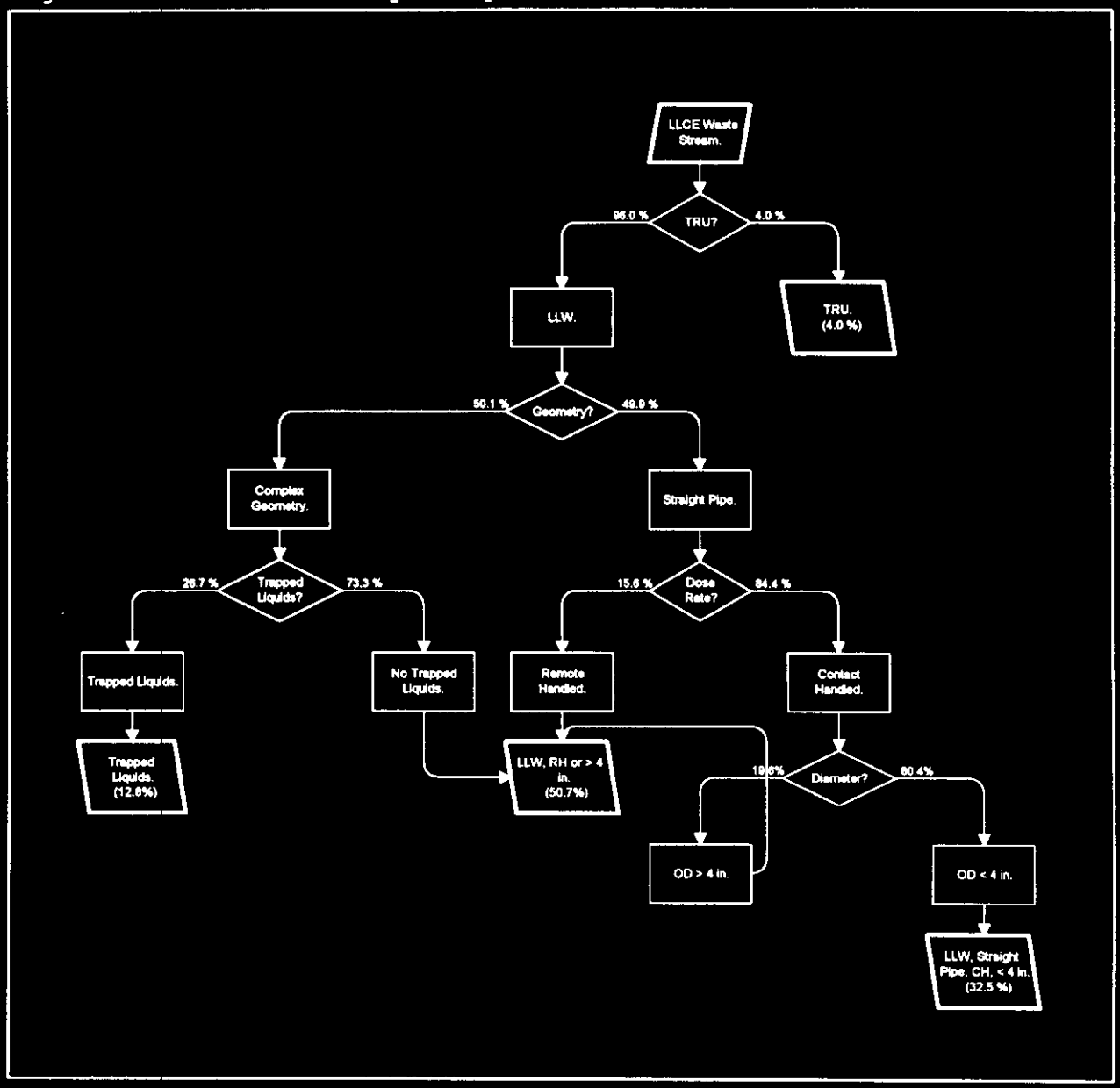
5. The cumulative number of items in storage, or storage inventory, was calculated as follows:

$$\text{storage inventory} = \text{previous inventory} + \text{number retrieved} - \text{number treated}$$

6. The maximum number of annual storage evolutions included items coming into storage and items taken out of storage for shipment to treatment.

At the end of the LLCE program, each type of material movement evolution was summed and provided to the cost modules in Appendix E.

Figure D-4. Treatability Group Flow Chart



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Appendix E:

Cost Module Summary Sheets

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Cost Module: NA

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Total LLCE items shipped to storage.	1,922		
Max LLCE items in storage.	1,922		
Max number of annual storage evolutions.	162		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	1,922	19,253	37,004,266
Subtotal			37,004,266
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
Subtotal			734,000
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	1,923	404,000	776,892,000
Fabricate reusable carriages.	1,923	21,700	41,729,100
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	0	2,000,000	0
Subtotal			823,521,100
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.	1,922	2,260	4,343,720
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	1,922	4,000	7,688,000
Ship LLCE to storage.	1,922	3,000	5,766,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Subtotal			275,345,720
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	1,922	6,000	11,532,000
Subtotal			11,532,000
Total Cost			
Total cost			1,148,137,086
Total cost/item			597,366

Cost Module: 2B

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2034
Total LLCE treated in WRAP-2B.	1,922
Total LLCE items shipped direct to WRAP-2B.	1,062
Total LLCE items shipped to storage.	860
Max LLCE items in storage.	842
Max number of annual storage evolutions.	82

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	842	19,253	16,211,026
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	1,922	29	55,738
Construct LLW trenches: transport containers.	843	1,512	1,274,616
Construct MW trenches: secondary MW.	1,922	345	663,090
Subtotal			18,704,470

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
Subtotal			734,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	843	404,000	340,572,000
Fabricate reusable carriages.	843	21,700	18,293,100
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	0	2,000,000	0
Subtotal			363,765,100

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,922	2,260	4,343,720
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.		1,062	3,000	3,186,000
Ship LLCE to storage.		860	3,000	2,580,000
Restore from retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:				
	Ship LLCE from storage to WRAP-2B.	860	3,000	2,580,000
	Labor.	1,922	24,762	47,592,564
	Consumables.	1,922	1,000	1,922,000
	Maintenance.	25	1,200,002	30,000,050
	Process secondary MW.	1,922	2,934	5,639,148
	Transfer liquid MW.	1,922	6,750	12,973,500

Liquid MW disposal.	1,922	50,000	96,100,000
Ship transport container to storage.	1,922	2,260	4,343,720
Ship size reduced LLCE to LLW trench.	1,922	1,200	2,306,400
Place size reduced LLCE in LLW trench.	1,922	1,200	2,306,400
Ship transport container to LLW trench.	843	2,260	1,905,180
Place transport container in LLW trench.	843	2,260	1,905,180
Ship secondary MW to MW trench.	1,922	1,200	2,306,400
Place secondary MW in MW trench.	1,922	1,200	2,306,400
Sample leachate.	25	0	0
Transfer leachate.	25	0	0
Leachate disposal.	25	0	0
Subtotal			489,532,662
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	842	6,000	5,052,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	1,922	29	55,738
Backfill LLW trenches: transport containers.	843	1,512	1,274,616
Backfill MW trenches: secondary MW.	1,922	172	330,584
Subtotal			6,712,938
Total Cost			
Total cost			879,449,170
Total cost/item			457,570

Cost Module: 2B/T

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	755
Total LLCE treated in 221-T.	1,167
Total LLCE items shipped direct to WRAP-2B.	642
Total LLCE items shipped direct to 221-T.	1,110
Total LLCE items shipped to storage.	170
Max LLCE items in storage.	82
Max number of annual storage evolutions.	31

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	82	19,253	1,578,746
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Upgrade 221-T.	1	87,271,858	87,271,858
Construct LLW trenches: size reduced LLCE.	1,922	29	55,738
Construct LLW trenches: transport containers.	83	1,512	125,496
Construct MW trenches: secondary MW.	1,922	345	663,090
Subtotal			90,194,928

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
221-T start-up.	1	1,611,000	1,611,000
Subtotal			2,345,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	83	404,000	33,532,000
Fabricate reusable carriages.	83	21,700	1,801,100
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	0	2,000,000	0
Subtotal			40,233,100

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,922	2,260	4,343,720
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.		642	3,000	1,926,000
Ship LLCE direct to 221-T.		1,110	3,000	3,330,000
Ship LLCE to storage.		170	3,000	510,000
Restore from retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:				
Ship LLCE from storage to WRAP-2B.		113	3,000	339,000

Labor.	755	24,762	18,695,310
Consumables.	755	1,000	755,000
Maintenance.	15	992,424	14,886,360
Process secondary MW.	755	2,934	2,215,170
Transfer liquid MW.	755	6,750	5,096,250
Liquid MW disposal.	755	50,000	37,750,000
Ship transport container to storage.	755	2,260	1,706,300
Process LLCE at 221-T:			
Ship LLCE from storage to 221-T.	57	3,000	171,000
Labor.	1,167	39,765	46,405,755
Consumables.	1,167	1,000	1,167,000
Maintenance.	25	1,937,877	48,446,925
Process secondary MW.	1,167	2,934	3,423,978
Transfer liquid MW.	1,167	6,750	7,877,250
Liquid MW disposal.	1,167	50,000	58,350,000
Ship transport container to storage.	1,167	2,260	2,637,420
Ship size reduced LLCE to LLW trench.	1,922	1,200	2,306,400
Place size reduced LLCE in LLW trench.	1,922	1,200	2,306,400
Ship transport container to LLW trench.	83	2,260	187,580
Place transport container in LLW trench.	83	2,260	187,580
Ship secondary MW to MW trench.	1,922	1,200	2,306,400
Place secondary MW in MW trench.	1,922	1,200	2,306,400
Sample leachate.	25	0	0
Transfer leachate.	25	0	0
Leachate disposal.	25	0	0
Subtotal			534,869,198
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	82	6,000	492,000
D&D WRAP-2B.	1	0	0
Additional D&D 221-T.	1	10,000,000	10,000,000
Backfill LLW trenches: size reduced LLCE.	1,922	29	55,738
Backfill LLW trenches: transport containers.	83	1,512	125,496
Backfill MW trenches: secondary MW.	1,922	172	330,584
Subtotal			11,003,818
Total Cost			
Total cost			678,646,044
Total cost/item			353,094

Cost Module: 2B/06

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	570
Total LLCE treated in 2706-T.	1,352
Total LLCE items shipped direct to WRAP-2B.	525
Total LLCE items shipped direct to 2706-T.	1,283
Total LLCE items shipped to storage.	114
Max LLCE items in storage.	54
Max number of annual storage evolutions.	29

Construction Costs

Cost Element	Number	Cost	Total
Construct LLCE storage.	54	19,253	1,039,662
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct 2706-T Annex.	1	20,634,299	20,634,299
Construct LLW trenches: size reduced LLCE.	1,922	29	55,738
Construct LLW trenches: transport containers.	55	1,512	83,160
Construct MW trenches: secondary MW.	1,922	345	663,090
Subtotal			22,975,949

Start-up Costs

Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
2706-T start-up.	1	6,623,500	6,623,500
Subtotal			7,357,500

CENRTC Costs

Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	55	404,000	22,220,000
Fabricate reusable carriages.	55	21,700	1,193,500
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	0	2,000,000	0
Subtotal			28,313,500

Operational Costs

Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.	1,922	2,260	4,343,720
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.	525	3,000	1,575,000
Ship LLCE direct to 2706-T annex.	1,283	3,000	3,849,000
Ship LLCE to storage.	114	3,000	342,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	45	3,000	135,000

Labor.	570	24,762	14,114,340
Consumables.	570	1,000	570,000
Maintenance.	15	914,801	13,722,015
Process secondary MW.	570	2,934	1,672,380
Transfer liquid MW.	570	6,750	3,847,500
Liquid MW disposal.	570	50,000	28,500,000
Ship transport container to storage.	570	2,260	1,288,200
Process LLCE at 2706-T Annex:			
Ship LLCE from storage to 2706-T annex.	69	3,000	207,000
Labor.	1,352	24,762	33,478,224
Consumables.	1,352	1,000	1,352,000
Maintenance.	25	559,007	13,975,175
Process secondary MW.	1,352	2,934	3,966,768
Transfer liquid MW.	1,352	6,750	9,126,000
Liquid MW disposal.	1,352	50,000	67,600,000
Ship transport container to storage.	1,352	2,260	3,055,520
Ship size reduced LLCE to LLW trench.	1,922	1,200	2,306,400
Place size reduced LLCE in LLW trench.	1,922	1,200	2,306,400
Ship transport container to LLW trench.	55	2,260	124,300
Place transport container in LLW trench.	55	2,260	124,300
Ship secondary MW to MW trench.	1,922	1,200	2,306,400
Place secondary MW in MW trench.	1,922	1,200	2,306,400
Sample leachate.	25	0	0
Transfer leachate.	25	0	0
Leachate disposal.	25	0	0
Subtotal			481,430,042
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	54	6,000	324,000
D&D WRAP-2B.	1	0	0
D&D 2706-T Annex.	1	15,000,000	15,000,000
Backfill LLW trenches: size reduced LLCE.	1,922	29	55,738
Backfill LLW trenches: transport containers.	55	1,512	83,160
Backfill MW trenches: secondary MW.	1,922	172	330,584
Subtotal			15,793,482
Total Cost			
Total cost			555,870,473
Total cost/item			289,215

Cost Module: 2B/GRV

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in grout vaults.	1,845
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to grout vaults.	1,675
Total LLCE items shipped to storage.	189
Max LLCE items in storage.	103
Max number of annual storage evolutions.	103

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	103	19,253	1,983,059
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Modify first grout vault for LLCE.	1	7,000,000	7,000,000
Modify subsequent grout vaults for LLCE.	1	1,500,000	1,500,000
Construct LLW trenches: size reduced LLCE.	77	29	2,233
Construct LLW trenches: transport containers.	104	1,512	157,248
Construct MW trenches: secondary MW.	77	345	26,565
Subtotal			11,169,105

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
Grout vault start-up.	1	3,000,000	3,000,000
Subtotal			3,734,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	104	404,000	42,016,000
Fabricate reusable carriages.	104	21,700	2,256,800
Procure storage facility cranes.	2	500,000	1,000,000
Subtotal			49,172,800

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,922	2,260	4,343,720
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.		58	3,000	174,000
Ship direct to grout vaults.		1,675	3,000	5,025,000
Ship LLCE to storage.		189	3,000	567,000
Restore from retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:				
	Ship LLCE from storage to WRAP-2B.	19	3,000	57,000

Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE in grout vaults:			
Ship LLCE from storage to grout vaults.	170	3,000	510,000
Labor: place LLCE.	1,845	5,600	10,332,000
Labor: add encapsulant material.	1,845	2,800	5,166,000
Consumables.	1,845	644	1,188,470
Maintenance.	24	169,259	4,062,216
Ship transport container to storage.	1,845	2,260	4,169,700
Ship size reduced LLCE to LLW trench.	77	1,200	92,400
Place size reduced LLCE in LLW trench.	77	1,200	92,400
Ship transport container to LLW trench.	104	2,260	235,040
Place transport container in LLW trench.	104	2,260	235,040
Ship secondary MW to MW trench.	77	1,200	92,400
Place secondary MW in MW trench.	77	1,200	92,400
Sample leachate.	15	0	0
Transfer leachate.	15	0	0
Leachate disposal.	15	0	0
Subtotal			315,794,053
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	103	6,000	618,000
D&D WRAP-2B.	1	0	0
Close grout vaults.	2	1,500,000	3,000,000
Backfill LLW trenches: size reduced LLCE.	77	29	2,233
Backfill LLW trenches: transport containers.	104	1,512	157,248
Backfill MW trenches: secondary MW.	77	172	13,244
Subtotal			3,790,725
Total Cost			
Total cost			383,660,683
Total cost/item			199,615

Cost Module: 2B/FSM

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Year of LLCE program shutdown.	2024		
Total LLCE treated in WRAP-2B.	77		
Total LLCE treated by FSM.	1,845		
Total LLCE items shipped direct to WRAP-2B.	58		
Total LLCE items sent direct to FSM.	1,836		
Total LLCE items shipped to storage.	28		
Max LLCE items in storage.	22		
Max number of annual storage evolutions.	22		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	22	19,253	423,566
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	77	29	2,233
Construct LLW trenches: transport containers.	23	1,512	34,776
Construct MW trenches: FSM.	1,845	9,652	17,807,940
Construct MW trenches: secondary MW.	77	345	26,565
Subtotal			18,795,080
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
FSM start-up.	1	1,000,000	1,000,000
Subtotal			1,734,000
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	23	404,000	9,292,000
Fabricate reusable carriages.	23	21,700	499,100
Fabricate disposable carriages.	1,845	16,120	29,741,400
Procure storage facility cranes.	0	500,000	0
Procure disposal facility crane.	1	2,000,000	2,000,000
Subtotal			45,432,500
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Load MHIC tube into transport container.	1,845	2,260	4,169,700
Ship transport container to tank farm.	1,922	2,260	4,343,720
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	77	4,000	308,000
Load LLCE into MHIC tube.	1,845	4,000	7,380,000
Ship LLCE direct to WRAP-2B.	58	3,000	174,000
Send LLCE direct to FSM.	1,836	0	0
Ship LLCE to storage.	28	3,000	84,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000

Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE by FSM:			
Ship LLCE from storage to FSM.	9	3,000	27,000
Labor.	1,845	2,500	4,612,500
Procure MHIC.	1,845	15,000	27,675,000
Consumables.	1,845	21,484	39,637,980
Ship size reduced LLCE to LLW trench.	77	1,200	92,400
Place size reduced LLCE in LLW trench.	77	1,200	92,400
Ship transport container to LLW trench.	23	2,260	51,980
Place transport container in LLW trench.	23	2,260	51,980
Ship secondary MW to MW trench.	77	1,200	92,400
Place secondary MW in MW trench.	77	1,200	92,400
Ship FSM LLCE to MW trench.	1,845	3,000	5,535,000
Ship transport container to storage.	1,845	2,260	4,169,700
Place FSM LLCE in MW trench.	1,845	12,000	22,140,000
Sample leachate.	29	75,000	2,175,000
Transfer leachate.	29	30,000	870,000
Leachate disposal.	29	150,000	4,350,000
Subtotal			399,853,427
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	22	6,000	132,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	77	29	2,233
Backfill LLW trenches: transport containers.	23	1,512	34,776
Backfill MW trenches: FSM.	1,845	4,813	8,879,985
Backfill MW trenches: secondary MW.	77	172	13,244
Subtotal			9,062,238
Total Cost			
Total cost			474,877,245
Total cost/item			247,075

Cost Module: 2B/FDR

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated by FDR.	1,845
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items sent direct to FDR.	1,836
Total LLCE items shipped to storage.	28
Max LLCE items in storage.	290
Max number of annual storage evolutions.	84

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	290	19,253	5,583,370
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	77	29	2,233
Construct LLW trenches: transport containers.	291	1,512	439,992
Construct MW trenches: FDR.	1,845	1,409	2,599,605
Construct MW trenches: secondary MW.	77	345	26,565
Subtotal			9,151,765

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
FDR start-up.	1	2,000,000	2,000,000
Subtotal			2,734,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure dunnage removal equipment.	1	1,200,000	1,200,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	291	404,000	117,564,000
Fabricate reusable carriages.	291	21,700	6,314,700
Fabricate disposable carriages.	1,845	16,120	29,741,400
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	1	2,000,000	2,000,000
Subtotal			161,720,100

Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Load MHIC tube into transport container.	1,845	2,260	4,169,700
Ship transport container to tank farm.	1,922	2,260	4,343,720
Ship MHIC box to tank farm.	1,845	1,200	2,214,000
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	77	4,000	308,000
Load LLCE into MHIC tube.	1,845	4,000	7,380,000
Load dunnage into MHIC box.	1,845	2,000	3,690,000
Ship LLCE direct to WRAP-2B.	58	3,000	174,000
Send LLCE direct to FDR.	1,836	0	0

Ship LLCE to storage.	28	3,000	84,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE by FDR:			
Ship LLCE from storage to FDR.	9	3,000	27,000
Labor: dunnage removal.	1,845	27,600	50,922,000
Labor: macroencapsulation.	1,845	2,500	4,612,500
Procure MHICs.	1,845	10,000	18,450,000
Consumables.	1,845	3,125	5,765,625
Ship size reduced LLCE to LLW trench.	77	1,200	92,400
Place size reduced LLCE in LLW trench.	77	1,200	92,400
Ship transport container to LLW trench.	291	2,260	657,660
Place transport container in LLW trench.	291	2,260	657,660
Ship secondary MW to MW trench.	77	1,200	92,400
Place secondary MW in MW trench.	77	1,200	92,400
Ship FDR LLCE to MW trench.	1,845	3,000	5,535,000
Place FDR LLCE in MW trench.	1,845	6,000	11,070,000
Ship transport container to storage.	1,845	2,260	4,169,700
Ship MHIC box to MW trench.	1,845	1,200	2,214,000
Place MHIC box in MW trench.	1,845	1,200	2,214,000
Sample leachate.	29	75,000	2,175,000
Transfer leachate.	29	30,000	870,000
Leachate disposal.	29	150,000	4,350,000
Subtotal			408,151,432
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	290	6,000	1,740,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	77	29	2,233
Backfill LLW trenches: transport containers.	291	1,512	439,992
Backfill MW trenches: FDR.	1,845	703	1,297,035
Backfill MW trenches: secondary MW.	77	172	13,244
Subtotal			3,492,504
Total Cost			
Total cost			585,249,801
Total cost/item			304,500

Cost Module: 2B/FSR

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Year of LLCE program shutdown.	2026		
Total LLCE treated in WRAP-2B.	1,297		
Total LLCE treated by FSR.	625		
Total LLCE items shipped direct to WRAP-2B.	905		
Total LLCE items shipped to storage.	392		
Max LLCE items in storage.	380		
Max number of annual storage evolutions.	80		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	380	19,253	7,316,140
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	1,297	29	37,613
Construct LLW trenches: transport containers.	381	1,512	576,072
Construct MW trenches: FSR.	625	517	323,125
Construct MW trenches: secondary MW.	1,297	345	447,465
Subtotal			9,200,415
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
FSR start-up.	1	1,000,000	1,000,000
Subtotal			1,734,000
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	381	404,000	153,924,000
Fabricate reusable carriages.	381	21,700	8,267,700
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	0	2,000,000	0
Subtotal			167,091,700
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.	1,297	2,260	2,931,220
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	1,297	4,000	5,188,000
Ship LLCE direct to WRAP-2B.	905	3,000	2,715,000
Ship LLCE to storage.	392	3,000	1,176,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	392	3,000	1,176,000
Labor.	1,297	24,762	32,116,314

Consumables.	1,297	1,000	1,297,000
Maintenance.	17	1,193,322	20,286,474
Process secondary MW.	1,297	2,934	3,805,398
Transfer liquid MW.	1,297	6,750	8,754,750
Liquid MW disposal.	1,297	50,000	64,850,000
Ship transport container to storage.	1,297	2,260	2,931,220
Process LLCE by FSR:			
Labor: size reduction.	625	18,400	11,500,000
Labor: macroencapsulation.	625	1,000	625,000
Procure MHICs.	625	2,400	1,500,000
Consumables.	625	7,000	4,375,000
Ship size reduced LLCE to LLW trench.	1,297	1,200	1,556,400
Place size reduced LLCE in LLW trench.	1,297	1,200	1,556,400
Ship transport container to LLW trench.	381	2,260	861,060
Place transport container in LLW trench.	381	2,260	861,060
Ship size reduced LLCE to MW trench.	625	1,200	750,000
Place size reduced LLCE in MW trench.	625	1,200	750,000
Ship secondary MW to MW trench.	1,297	1,200	1,556,400
Place secondary MW in MW trench.	1,297	1,200	1,556,400
Sample leachate.	32	0	0
Transfer leachate.	32	0	0
Leachate disposal.	32	0	0
Subtotal			432,223,096
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	380	6,000	2,280,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	1,297	29	37,613
Backfill LLW trenches: transport containers.	381	1,512	576,072
Backfill MW trenches: FSR.	625	258	161,250
Backfill MW trenches: secondary MW.	1,922	172	330,584
Subtotal			3,385,519
Total Cost			
Total cost			613,634,730
Total cost/item			319,269

Cost Module: 2B/T/FSR

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Year of LLCE program shutdown.	2024		
Total LLCE treated in WRAP-2B.	312		
Total LLCE treated in 221-T.	985		
Total LLCE treated by FSR.	625		
Total LLCE items shipped direct to WRAP-2B.	293		
Total LLCE items shipped direct to 221-T.	950		
Total LLCE items shipped to storage.	54		
Max LLCE items in storage.	37		
Max number of annual storage evolutions.	21		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	54	19,253	1,039,662
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Upgrade 221-T.	1	87,271,858	87,271,858
Construct LLW trenches: size reduced LLCE.	1,297	29	37,613
Construct LLW trenches: transport containers.	38	1,512	57,456
Construct MW trenches: FSR.	625	517	323,125
Construct MW trenches: secondary MW.	1,297	345	447,465
Subtotal			89,677,179
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
221-T start-up.	1	1,611,000	1,611,000
FSR start-up.	1	1,000,000	1,000,000
Subtotal			3,345,000
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	38	404,000	15,352,000
Fabricate reusable carriages.	38	21,700	824,600
Procure storage facility cranes.	0	500,000	0
Procure disposal facility crane.	0	2,000,000	0
Subtotal			20,076,600
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.	1,297	2,260	2,931,220
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	1,297	4,000	5,188,000
Ship LLCE direct to WRAP-2B.	293	3,000	879,000
Ship LLCE direct to 221-T.	950	3,000	2,850,000
Ship LLCE to storage.	54	3,000	162,000
Restore from retrieval operation:			

Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	312	24,762	7,725,744
Consumables.	312	1,000	312,000
Maintenance.	15	753,005	11,295,075
Process secondary MW.	312	2,934	915,408
Transfer liquid MW.	312	6,750	2,106,000
Liquid MW disposal.	312	50,000	15,600,000
Ship transport container to storage.	312	2,260	705,120
Process LLCE at 221-T:			
Ship LLCE from storage to 221-T.	35	3,000	105,000
Labor.	985	39,765	39,168,525
Consumables.	985	1,000	985,000
Maintenance.	25	1,777,892	44,447,300
Process secondary MW.	985	2,934	2,889,990
Transfer liquid MW.	985	6,750	6,648,750
Liquid MW disposal.	985	50,000	49,250,000
Ship transport container to storage.	985	2,260	2,226,100
Process LLCE by FSR:			
Labor: size reduction.	625	18,400	11,500,000
Labor: macroencapsulation.	625	1,000	625,000
Procure MHICs.	625	2,400	1,500,000
Consumables.	625	7,000	4,375,000
Ship size reduced LLCE to LLW trench.	1,297	1,200	1,556,400
Place size reduced LLCE in LLW trench.	1,297	1,200	1,556,400
Ship transport container to LLW trench.	38	2,260	85,880
Place transport container in LLW trench.	38	2,260	85,880
Ship size reduced LLCE to MW trench.	625	1,200	750,000
Place size reduced LLCE in MW trench.	625	1,200	750,000
Ship secondary MW to MW trench.	1,297	1,200	1,556,400
Place secondary MW in MW trench.	1,297	1,200	1,556,400
Sample leachate.	30	0	0
Transfer leachate.	30	0	0
Leachate disposal.	30	0	0
Subtotal			479,892,592
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	54	6,000	324,000
D&D WRAP-2B.	1	0	0
Additional D&D 221-T.	1	10,000,000	10,000,000
Backfill LLW trenches: size reduced LLCE.	1,297	29	37,613
Backfill LLW trenches: transport containers.	38	1,512	57,456
Backfill MW trenches: FSR.	625	258	161,250
Backfill MW trenches: secondary MW.	1,297	172	223,084
Subtotal			10,803,403
Total Cost			
Total cost			603,794,774
Total cost/item			314,149

Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	223	24,762	5,521,926
Consumables.	223	1,000	223,000
Maintenance.	15	670,167	10,052,505
Process secondary MW.	223	2,934	654,282
Transfer liquid MW.	223	6,750	1,505,250
Liquid MW disposal.	223	50,000	11,150,000
Ship transport container to storage.	223	2,260	503,980
Process LLCE at 2706-T Annex:			
Ship LLCE from storage to 2706-T annex.	35	3,000	105,000
Labor.	1,074	24,762	26,594,388
Consumables.	1,074	1,000	1,074,000
Maintenance.	25	508,848	12,721,200
Process secondary MW.	1,074	2,934	3,151,116
Transfer liquid MW.	1,074	6,750	7,249,500
Liquid MW disposal.	1,074	50,000	53,700,000
Ship transport container to storage.	1,074	2,260	2,427,240
Process LLCE by FSR:			
Labor: size reduction.	625	18,400	11,500,000
Labor: macroencapsulation.	625	1,000	625,000
Procure MHICs.	625	2,400	1,500,000
Consumables.	625	7,000	4,375,000
Ship size reduced LLCE to LLW trench.	1,297	1,200	1,556,400
Place size reduced LLCE in LLW trench.	1,297	1,200	1,556,400
Ship transport container to LLW trench.	38	2,260	85,880
Place transport container in LLW trench.	38	2,260	85,880
Ship size reduced LLCE to MW trench.	625	1,200	750,000
Place size reduced LLCE in MW trench.	625	1,200	750,000
Ship secondary MW to MW trench.	1,297	1,200	1,556,400
Place secondary MW in MW trench.	1,297	1,200	1,556,400
Sample leachate.	30	0	0
Transfer leachate.	30	0	0
Leachate disposal.	30	0	0
Subtotal			432,145,967

Closure Costs

Cost Element	Number	Cost	Total
D&D LLCE storage.	54	6,000	324,000
D&D WRAP-2B.	1	0	0
D&D 2706-T Annex.	1	15,000,000	15,000,000
Backfill LLW trenches: size reduced LLCE.	1,297	29	37,613
Backfill LLW trenches: transport containers.	38	1,512	57,456
Backfill MW trenches: FSR.	625	258	161,250
Backfill MW trenches: secondary MW.	1,297	172	223,084
Subtotal			15,803,403

Total Cost

Total cost	499,423,090
Total cost/item	259,846

Cost Module: 2B/06/FSR

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	223
Total LLCE treated in 2706-T.	1,074
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	204
Total LLCE items shipped direct to 2706-T.	1,039
Total LLCE items shipped to storage.	54
Max LLCE items in storage.	37
Max number of annual storage evolutions.	22

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	54	19,253	1,039,662
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct 2706-T Annex.	1	20,634,299	20,634,299
Construct LLW trenches: size reduced LLCE.	1,297	29	37,613
Construct LLW trenches: transport containers.	38	1,512	57,456
Construct MW trenches: FSR.	625	517	323,125
Construct MW trenches: secondary MW.	1,297	345	447,465
Subtotal			23,039,620

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
2706-T start-up.	1	6,623,500	6,623,500
FSR start-up.	1	1,000,000	1,000,000
Subtotal			8,357,500

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	38	404,000	15,352,000
Fabricate reusable carriages.	38	21,700	824,600
Procure storage facility cranes.	0	500,000	0
Procure disposal facility crane.	0	2,000,000	0
Subtotal			20,076,600

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,297	2,260	2,931,220
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,297	4,000	5,188,000
Ship LLCE direct to WRAP-2B.		204	3,000	612,000
Ship LLCE direct to 2706-T annex.		1,039	3,000	3,117,000
Ship LLCE to storage.		54	3,000	162,000
Restore from retrieval operation:				

Cost Module: 2B/GRV/FSR

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in grout vaults.	1,220
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to grout vaults.	1,175
Total LLCE items shipped to storage.	64
Max LLCE items in storage.	48
Max number of annual storage evolutions.	46

Construction Costs

Cost Element	Number	Cost	Total
Construct LLCE storage.	48	19,253	924,144
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Modify first grout vault for LLCE.	1	7,000,000	7,000,000
Modify subsequent grout vaults for LLCE.	1	1,500,000	1,500,000
Construct LLW trenches: size reduced LLCE.	77	29	2,233
Construct LLW trenches: transport containers.	49	1,512	74,088
Construct MW trenches: FSR.	625	517	323,125
Construct MW trenches: secondary MW.	77	345	26,565
Subtotal			10,350,155

Start-up Costs

Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
Grout vault start-up.	1	3,000,000	3,000,000
FSR start-up.	1	1,000,000	1,000,000
Subtotal			4,734,000

CENRTC Costs

Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	49	404,000	19,796,000
Fabricate reusable carriages.	49	21,700	1,063,300
Procure storage facility cranes.	2	500,000	1,000,000
Subtotal			25,759,300

Operational Costs

Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,297	2,260	2,931,220
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,297	4,000	5,188,000
Ship LLCE direct to WRAP-2B.		58	3,000	174,000
Ship direct to grout vaults.		1,175	3,000	3,525,000
Ship LLCE to storage.		64	3,000	192,000
Restore from retrieval operation:				

Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	64	3,000	192,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE in grout vaults:			
Ship LLCE from storage to grout vaults.	45	3,000	135,000
Labor: place LLCE.	1,220	5,600	6,832,000
Labor: add encapsulant material.	1,220	2,800	3,416,000
Consumables.	1,220	644	785,871
Maintenance.	24	149,959	3,599,016
Ship transport container to storage.	1,220	2,260	2,757,200
Process LLCE by FSR:			
Labor: size reduction.	625	18,400	11,500,000
Labor: macroencapsulation.	625	1,000	625,000
Procure MHICs.	625	2,400	1,500,000
Consumables.	625	7,000	4,375,000
Ship size reduced LLCE to LLW trench.	77	1,200	92,400
Place size reduced LLCE in LLW trench.	77	1,200	92,400
Ship transport container to LLW trench.	49	2,260	110,740
Place transport container in LLW trench.	49	2,260	110,740
Ship size reduced LLCE to MW trench.	625	1,200	750,000
Place size reduced LLCE in MW trench.	625	1,200	750,000
Ship secondary MW to MW trench.	77	1,200	92,400
Place secondary MW in MW trench.	77	1,200	92,400
Sample leachate.	15	0	0
Transfer leachate.	30	0	0
Leachate disposal.	30	0	0
Subtotal			321,489,654
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	48	6,000	288,000
D&D WRAP-2B.	1	0	0
Close grout vaults.	2	1,500,000	3,000,000
Backfill LLW trenches: size reduced LLCE.	77	29	2,233
Backfill LLW trenches: transport containers.	49	1,512	74,088
Backfill MW trenches: FSR.	625	258	161,250
Backfill MW trenches: secondary MW.	77	172	13,244
Subtotal			3,538,815
Total Cost			
Total cost			365,871,924
Total cost/item			190,360

Cost Module: 2B/FSM/FSR

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated by FSM.	1,220
Total LLCE treated by FSR.	625
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items sent direct to FSM.	1,214
Total LLCE items shipped to storage.	25
Max LLCE items in storage.	19
Max number of annual storage evolutions.	19

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	19	19,253	365,807
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	77	29	2,233
Construct LLW trenches: transport containers.	20	1,512	30,240
Construct MW trenches: FSM.	1,220	9,652	11,775,440
Construct MW trenches: FSR.	625	517	323,125
Construct MW trenches: secondary MW.	77	345	26,565
Subtotal			13,023,410

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
FSM start-up.	1	1,000,000	1,000,000
FSR start-up.	1	1,000,000	1,000,000
Subtotal			2,734,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	20	404,000	8,080,000
Fabricate reusable carriages.	20	21,700	434,000
Fabricate disposable carriages.	1,220	16,120	19,666,400
Procure storage facility cranes.	0	500,000	0
Procure disposal facility crane.	1	2,000,000	2,000,000
Subtotal			34,080,400

Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Load MHIC tube into transport container.	1,220	2,260	2,757,200
Ship transport container to tank farm.	1,297	2,260	2,931,220
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	77	4,000	308,000
Load LLCE into MHIC tube.	1,220	4,000	4,880,000
Ship LLCE direct to WRAP-2B.	58	3,000	174,000

Send LLCE direct to FSM.	1,214	0	0
Ship LLCE to storage.	25	3,000	75,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	25	3,000	75,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE by FSM:			
Ship LLCE from storage to FSM.	6	3,000	18,000
Labor.	1,220	2,500	3,050,000
Procure MHIC.	1,220	15,000	18,300,000
Consumables.	1,220	21,484	26,210,480
Process LLCE by FSR:			
Labor: size reduction.	625	18,400	11,500,000
Labor: macroencapsulation.	625	1,000	625,000
Procure MHICs.	625	2,400	1,500,000
Consumables.	625	7,000	4,375,000
Ship size reduced LLCE to LLW trench.	77	1,200	92,400
Place size reduced LLCE in LLW trench.	77	1,200	92,400
Ship transport container to LLW trench.	20	2,260	45,200
Place transport container in LLW trench.	20	2,260	45,200
Ship FSM LLCE to MW trench.	1,220	3,000	3,660,000
Place FSM LLCE in MW trench.	1,220	12,000	14,640,000
Ship transport container to storage.	1,220	2,260	2,757,200
Ship size reduced LLCE to MW trench.	625	1,200	750,000
Place size reduced LLCE in MW trench.	625	1,200	750,000
Ship secondary MW to MW trench.	77	1,200	92,400
Place secondary MW in MW trench.	77	1,200	92,400
Sample leachate.	30	75,000	2,250,000
Transfer leachate.	30	30,000	900,000
Leachate disposal.	30	150,000	4,500,000
Subtotal			379,117,367
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	19	6,000	114,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	77	29	2,233
Backfill LLW trenches: transport containers.	20	1,512	30,240
Backfill MW trenches: FSM.	1,220	4,813	5,871,860
Backfill MW trenches: FSR.	625	258	161,250
Backfill MW trenches: secondary MW.	77	172	13,244
Subtotal			6,192,827
Total Cost			
Total cost			435,148,004
Total cost/item			226,404

Cost Module: 2B/2B/FSM

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Year of LLCE program shutdown.	2024		
Total LLCE treated in WRAP-2B.	322		
Total LLCE treated by FSM.	1,600		
Total LLCE items shipped direct to WRAP-2B.	247		
Total LLCE items sent direct to FSM.	1,592		
Total LLCE items shipped to storage.	83		
Max LLCE items in storage.	75		
Max number of annual storage evolutions.	45		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	75	19,253	1,443,975
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct LLW trenches: size reduced LLCE.	322	29	9,338
Construct LLW trenches: transport containers.	76	1,512	114,912
Construct MW trenches: FSM.	1,600	9,652	15,443,200
Construct MW trenches: secondary MW.	322	345	111,090
Subtotal			17,622,515
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
FSM start-up.	1	1,000,000	1,000,000
Subtotal			1,734,000
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	76	404,000	30,704,000
Fabricate reusable carriages.	76	21,700	1,649,200
Fabricate disposable carriages.	1,600	16,120	25,792,000
Procure storage facility cranes.	2	500,000	1,000,000
Procure disposal facility crane.	1	2,000,000	2,000,000
Subtotal			65,045,200
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Load MHIC tube into transport container.	1,600	2,260	3,616,000
Ship transport container to tank farm.	1,922	2,260	4,343,720
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	322	4,000	1,288,000
Load LLCE into MHIC tube.	1,600	4,000	6,400,000
Ship LLCE direct to WRAP-2B.	247	3,000	741,000
Send LLCE direct to FSM.	1,592	0	0
Ship LLCE to storage.	83	3,000	249,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000

Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	75	3,000	225,000
Labor.	322	24,762	7,973,364
Consumables.	322	1,000	322,000
Maintenance.	15	761,258	11,418,870
Process secondary MW.	322	2,934	944,748
Transfer liquid MW.	322	6,750	2,173,500
Liquid MW disposal.	322	50,000	16,100,000
Ship transport container to storage.	322	2,260	727,720
Process LLCE by FSM:			
Ship LLCE from storage to FSM.	8	3,000	24,000
Labor.	1,600	2,500	4,000,000
Procure MHIC.	1,600	15,000	24,000,000
Consumables.	1,600	21,484	34,374,400
Ship size reduced LLCE to LLW trench.	322	1,200	386,400
Place size reduced LLCE in LLW trench.	322	1,200	386,400
Ship transport container to LLW trench.	76	2,260	171,760
Place transport container in LLW trench.	76	2,260	171,760
Ship secondary MW to MW trench.	322	1,200	386,400
Place secondary MW in MW trench.	322	1,200	386,400
Ship FSM LLCE to MW trench.	1,600	3,000	4,800,000
Ship transport container to storage.	1,600	2,260	3,616,000
Place FSM LLCE in MW trench.	1,600	12,000	19,200,000
Sample leachate.	29	75,000	2,175,000
Transfer leachate.	29	30,000	870,000
Leachate disposal.	29	150,000	4,350,000
Subtotal			413,369,442
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	75	6,000	450,000
D&D WRAP-2B.	1	0	0
Backfill LLW trenches: size reduced LLCE.	322	29	9,338
Backfill LLW trenches: transport containers.	76	1,512	114,912
Backfill MW trenches: FSM.	1,600	4,813	7,700,800
Backfill MW trenches: secondary MW.	322	172	55,384
Subtotal			8,330,434
Total Cost			
Total cost			506,101,591
Total cost/item			263,320

Cost Module: 2B/06/FSM

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	77
Total LLCE treated in 2706-T.	245
Total LLCE treated by FSM.	1,600
Total LLCE items shipped direct to WRAP-2B.	58
Total LLCE items shipped direct to 2706-T.	238
Total LLCE items sent direct to FSM.	1,592
Total LLCE items shipped to storage.	34
Max LLCE items in storage.	19
Max number of annual storage evolutions.	19

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	19	19,253	365,807
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct 2706-T Annex.	1	20,634,299	20,634,299
Construct LLW trenches: size reduced LLCE.	322	29	9,338
Construct LLW trenches: transport containers.	20	1,512	30,240
Construct MW trenches: FSM.	1,600	9,652	15,443,200
Construct MW trenches: secondary MW.	322	345	111,090
Subtotal			37,093,974

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
2706-T start-up.	1	6,623,500	6,623,500
FSM start-up.	1	1,000,000	1,000,000
Subtotal			8,357,500

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure field size reduction equipment.	1	0	0
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	20	404,000	8,080,000
Fabricate reusable carriages.	20	21,700	434,000
Fabricate disposable carriages.	1,600	16,120	25,792,000
Procure storage facility cranes.	0	500,000	0
Procure disposal facility crane.	1	2,000,000	2,000,000
Subtotal			40,206,000

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Load MHIC tube into transport container.		1,600	2,260	3,616,000
Ship transport container to tank farm.		1,922	2,260	4,343,720
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		322	4,000	1,288,000
Load LLCE into MHIC tube.		1,600	4,000	6,400,000

Ship LLCE direct to WRAP-2B.	58	3,000	174,000
Ship LLCE direct to 2706-T annex.	238	3,000	714,000
Send LLCE direct to FSM.	1,592	0	0
Ship LLCE to storage.	34	3,000	102,000
Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE at 2706-T Annex:			
Ship LLCE from storage to 2706-T annex.	7	3,000	21,000
Labor.	245	24,762	6,066,690
Consumables.	245	1,000	245,000
Maintenance.	25	315,515	7,887,875
Process secondary MW.	245	2,934	718,830
Transfer liquid MW.	245	6,750	1,653,750
Liquid MW disposal.	245	50,000	12,250,000
Ship transport container to storage.	245	2,260	553,700
Process LLCE by FSM:			
Ship LLCE from storage to FSM.	8	3,000	24,000
Labor.	1,600	2,500	4,000,000
Procure MHIC.	1,600	15,000	24,000,000
Consumables.	1,600	21,484	34,374,400
Ship size reduced LLCE to LLW trench.	322	1,200	386,400
Place size reduced LLCE in LLW trench.	322	1,200	386,400
Ship transport container to LLW trench.	20	2,260	45,200
Place transport container in LLW trench.	20	2,260	45,200
Ship FSM LLCE to MW trench.	1,600	3,000	4,800,000
Place FSM LLCE in MW trench.	1,600	12,000	19,200,000
Ship transport container to storage.	1,600	2,260	3,616,000
Ship secondary MW to MW trench.	322	1,200	386,400
Place secondary MW in MW trench.	322	1,200	386,400
Sample leachate.	30	75,000	2,250,000
Transfer leachate.	30	30,000	900,000
Leachate disposal.	30	150,000	4,500,000
Subtotal			417,063,232

Closure Costs

Cost Element	Number	Cost	Total
D&D LLCE storage.	1,592	6,000	9,552,000
D&D WRAP-2B.	1	0	0
D&D 2706-T Annex.	1	15,000,000	15,000,000
Backfill LLW trenches: size reduced LLCE.	322	29	9,338
Backfill LLW trenches: transport containers.	20	1,512	30,240
Backfill MW trenches: FSM.	1,600	4,813	7,700,800
Backfill MW trenches: secondary MW.	322	172	55,384

Subtotal	32,347,762
Total Cost	
Total cost	535,068,468
Total cost/item	278,392

Intentionally Blank

Cost Module: 2B/2B/GRV

Material Movement Inputs	
Total LLCE items retreived.	1,922
Year of LLCE program shutdown.	2024
Total LLCE treated in WRAP-2B.	322
Total LLCE treated in grout vaults.	1,600
Total LLCE items shipped direct to WRAP-2B.	247
Total LLCE items shipped direct to grout vaults.	1,508
Total LLCE items shipped to storage.	167
Max LLCE items in storage.	75
Max number of annual storage evolutions.	75

Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	75	19,253	1,443,975
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Modify first grout vault for LLCE.	1	7,000,000	7,000,000
Modify subsequent grout vaults for LLCE.	1	1,500,000	1,500,000
Construct LLW trenches: size reduced LLCE.	322	29	9,338
Construct LLW trenches: transport containers.	76	1,512	114,912
Construct MW trenches: secondary MW.	322	345	111,090
Subtotal			10,679,315

Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
Grout vault start-up.	1	3,000,000	3,000,000
Subtotal			3,734,000

CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	76	404,000	30,704,000
Fabricate reusable carriages.	76	21,700	1,649,200
Procure storage facility cranes.	2	500,000	1,000,000
Subtotal			37,253,200

Operational Costs				
Cost Element		Number	Cost	Total
Prepare for retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Materials.	1,922	18,000	34,596,000
	Engineering.	1,922	2,000	3,844,000
	Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.		1,922	2,260	4,343,720
Retrieve LLCE.		1,922	8,000	15,376,000
Load LLCE into transport container.		1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.		247	3,000	741,000
Ship direct to grout vaults.		1,508	3,000	4,524,000
Ship LLCE to storage.		167	3,000	501,000
Restore from retrieval operation:				
	Labor.	1,922	40,000	76,880,000
	Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:				
Ship LLCE from storage to WRAP-2B.		75	3,000	225,000

Labor.	322	24,762	7,973,364
Consumables.	322	1,000	322,000
Maintenance.	15	761,258	11,418,870
Process secondary MW.	322	2,934	944,748
Transfer liquid MW.	322	6,750	2,173,500
Liquid MW disposal.	322	50,000	16,100,000
Ship transport container to storage.	322	2,260	727,720
Process LLCE in grout vaults:			
Ship LLCE from storage to grout vaults.	92	3,000	276,000
Labor: place LLCE.	1,600	5,600	8,960,000
Labor: add encapsulant material.	1,600	2,800	4,480,000
Consumables.	1,600	644	1,030,651
Maintenance.	24	162,335	3,896,040
Ship transport container to storage.	1,600	2,260	3,616,000
Ship size reduced LLCE to LLW trench.	322	1,200	386,400
Place size reduced LLCE in LLW trench.	322	1,200	386,400
Ship transport container to LLW trench.	76	2,260	171,760
Place transport container in LLW trench.	76	2,260	171,760
Ship secondary MW to MW trench.	322	1,200	386,400
Place secondary MW in MW trench.	322	1,200	386,400
Sample leachate.	15	0	0
Transfer leachate.	15	0	0
Leachate disposal.	15	0	0
Subtotal			339,378,733
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	75	6,000	450,000
D&D WRAP-2B.	1	0	0
Close grout vaults.	2	1,500,000	3,000,000
Backfill LLW trenches: size reduced LLCE.	322	29	9,338
Backfill LLW trenches: transport containers.	76	1,512	114,912
Backfill MW trenches: secondary MW.	322	172	55,384
Subtotal			3,629,634
Total Cost			
Total cost			394,674,882
Total cost/item			205,346

Cost Module: 2B/2B/GRV

Material Movement Inputs			
Total LLCE items retreived.	1,922		
Year of LLCE program shutdown.	2024		
Total LLCE treated in WRAP-2B.	77		
Total LLCE treated in 2706-T.	245		
Total LLCE treated in grout vaults.	1,600		
Total LLCE items shipped direct to WRAP-2B.	58		
Total LLCE items shipped direct to 2706-T.	238		
Total LLCE items shipped direct to grout vaults.	1,508		
Total LLCE items shipped to storage.	111		
Max LLCE items in storage.	61		
Max number of annual storage evolutions.	61		
Construction Costs			
Cost Element	Number	Cost	Total
Construct LLCE storage.	61	19,253	1,174,433
Construct transport container storage.	1	500,000	500,000
Construct WRAP-2B.	1	0	0
Construct 2706-T Annex.	1	20,634,299	20,634,299
Modify first grout vault for LLCE.	1	7,000,000	7,000,000
Modify subsequent grout vaults for LLCE.	1	1,500,000	1,500,000
Construct LLW trenches: size reduced LLCE.	322	29	9,338
Construct LLW trenches: transport containers.	62	1,512	93,744
Construct MW trenches: secondary MW.	322	345	111,090
Subtotal			31,022,904
Start-up Costs			
Cost Element	Number	Cost	Total
Transport container design.	1	184,000	184,000
Transport container SARP.	1	300,000	300,000
Retrieval system start-up.	1	250,000	250,000
WRAP-2B start-up.	1	0	0
2706-T start-up.	1	6,623,500	6,623,500
Grout vault start-up.	1	3,000,000	3,000,000
Subtotal			10,357,500
CENRTC Costs			
Cost Element	Number	Cost	Total
Fabricate retrieval equipment.	2	1,000,000	2,000,000
Procure transporters.	2	950,000	1,900,000
Fabricate reusable transport container.	62	404,000	25,048,000
Fabricate reusable carriages.	62	21,700	1,345,400
Procure storage facility cranes.	2	500,000	1,000,000
Subtotal			31,293,400
Operational Costs			
Cost Element	Number	Cost	Total
Prepare for retrieval operation:			
Labor.	1,922	40,000	76,880,000
Materials.	1,922	18,000	34,596,000
Engineering.	1,922	2,000	3,844,000
Administrative.	1,922	24,000	46,128,000
Ship transport container to tank farm.	1,922	2,260	4,343,720
Retrieve LLCE.	1,922	8,000	15,376,000
Load LLCE into transport container.	1,922	4,000	7,688,000
Ship LLCE direct to WRAP-2B.	58	3,000	174,000
Ship LLCE direct to 2706-T annex.	238	3,000	714,000
Ship direct to grout vaults.	1,508	3,000	4,524,000
Ship LLCE to storage.	111	3,000	333,000

Restore from retrieval operation:			
Labor.	1,922	40,000	76,880,000
Administrative.	1,922	2,000	3,844,000
Process LLCE at WRAP-2B:			
Ship LLCE from storage to WRAP-2B.	19	3,000	57,000
Labor.	77	24,762	1,906,674
Consumables.	77	1,000	77,000
Maintenance.	15	491,327	7,369,905
Process secondary MW.	77	2,934	225,918
Transfer liquid MW.	77	6,750	519,750
Liquid MW disposal.	77	50,000	3,850,000
Ship transport container to storage.	77	2,260	174,020
Process LLCE at 2706-T Annex:			
Ship LLCE from storage to 2706-T annex.	7	3,000	21,000
Labor.	245	24,762	6,066,690
Consumables.	245	1,000	245,000
Maintenance.	25	315,515	7,887,875
Process secondary MW.	245	2,934	718,830
Transfer liquid MW.	245	6,750	1,653,750
Liquid MW disposal.	245	50,000	12,250,000
Ship transport container to storage.	245	2,260	553,700
Process LLCE in grout vaults:			
Ship LLCE from storage to grout vaults.	92	3,000	276,000
Labor: place LLCE.	1,600	5,600	8,960,000
Labor: add encapsulant material.	1,600	2,800	4,480,000
Consumables.	1,600	644	1,030,651
Maintenance.	24	162,335	3,896,040
Ship transport container to storage.	1,600	2,260	3,616,000
Ship size reduced LLCE to LLW trench.	322	1,200	386,400
Place size reduced LLCE in LLW trench.	322	1,200	386,400
Ship transport container to LLW trench.	62	2,260	140,120
Place transport container in LLW trench.	62	2,260	140,120
Ship secondary MW to MW trench.	322	1,200	386,400
Place secondary MW in MW trench.	322	1,200	386,400
Sample leachate.	15	0	0
Transfer leachate.	15	0	0
Leachate disposal.	15	0	0
Subtotal			342,986,363
Closure Costs			
Cost Element	Number	Cost	Total
D&D LLCE storage.	61	6,000	366,000
D&D WRAP-2B.	1	0	0
D&D 2706-T Annex.	1	15,000,000	15,000,000
Close grout vaults.	1	1,500,000	1,500,000
Backfill LLW trenches: size reduced LLCE.	322	29	9,338
Backfill LLW trenches: transport containers.	62	1,512	93,744
Backfill MW trenches: secondary MW.	322	172	55,384
Subtotal			17,024,466
Total Cost			
Total cost			432,684,633
Total cost/item			225,122

Appendix F:

Cost Module Basis

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Appendix F:
Cost Module Basis

1.0 Discussion

This appendix describes in detail the basis for each cost element found in the cost module sheets in Appendix E. For simplicity, all cost elements were rounded to the nearest dollar.

2.0 Construction Costs

2.1 Construct LLCE Storage

LLCE storage facility construction cost was estimated on a per item basis from cost data for Project W-373 (Long-Length Waste Equipment Storage Facility). Construction cost for the preferred storage facility, an uncovered RCRA-compliant storage pad, was estimated to be $29.62/ft^2 [1]. Since the average transport container would be approximately 70.5 ft long by 5.5 ft in diameter[2], and WHC procedures would require a 3 ft corridor between waste items and on each end for purposes of inspection, the storage area required per LLCE item would be:

$$\frac{storage\ area}{item} = \frac{76.5\ ft\ long \times 8.5\ ft\ wide}{item} = 650\ ft^2$$

Therefore, average storage facility construction cost per item would be:

$$\frac{cost}{item} = \frac{\$\ 29.62}{ft^2} \times \frac{650\ ft^2}{item} = \frac{\$\ 19{,}253}{item}$$

2.2 Construct Transport Container Storage

Transport container storage facility construction cost was estimated on a total cost basis from cost data for Project W-374 (Empty Long-Length Waste Equipment Transport/Storage Container Storage Facility). Transport container storage facility construction cost was estimated to be $500,000[3].

2.3 Construct WRAP-2B

Since WRAP-2B would be constructed whether LLCE was treated there or not, the construction cost would not be reflected against LLCE treatment efforts. Therefore, WRAP-2B construction cost was not included.

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[1]WHC-SD-WM-ES-316, Storage Options for Long Equipment Items - Engineering Study, Table 4, "Storage Site Construction Cost Evaluation," Revision 0, dated December 2, 1994.

[2]WHC-SD-WM-ES-265, Disposal of Tank Farm Long-Length Contaminated Equipment: Alternative Options Study and Engineering Support Information, Section 5.2, "Tank Farm Hardware Waste Container Size Identification," Revision 0, dated January 26, 1995.

[3]Total Project Cost in the Construction Project Management Menu, WHC Soft Reporting, dated September 7, 1994.

2.4 Upgrade 221-T

Construction cost for the 221-T facility was estimated on a total cost basis as follows. An extensive engineering study, performed by Parsons, was conducted to address the facility design and construction costs for an extraction treatment line in the 221-T canyon building. Construction and equipment cost to upgrade 221-T for LLCE treatment was estimated to be $87,271,858[4].

2.5 Construct 2706-T Annex

Construction cost for the 2706-T annex was estimated on a total cost basis as follows. The Parsons study discussed in Section 2.4 also addressed facility design and construction costs for an extraction treatment line in an annex to the 2706-T facility. Construction and equipment cost for the 2706-T annex was estimated to be $20,634,299[5].

2.6 Modify Grout Vaults

Construction cost to modify the existing grout vaults for LLCE treatment was estimated on a total cost basis as follows. An engineering study was conducted by Solid Waste Disposal Programs to address the facility design and construction costs for a macro-encapsulation treatment line in the grout vaults. Construction and equipment cost to modify the first vault was estimated to be $7,000,000. Average construction cost to modify subsequent vaults was estimated to be $1,500,000 per vault[6].

2.7 Construct LLW Trenches: General

LLW trench construction cost was estimated on a per cubic foot basis as follows. A standard LLW trench, as described in Figure F-1 below, would have approximately 336,000 ft^3 of usable disposal volume. Trench construction cost was estimated at $200,000 per trench[7]. Therefore, average LLW trench construction cost per ft^3 would be:

$$\frac{cost}{ft^3} = \frac{\$\ 200{,}000}{336{,}000\ ft^3} = \frac{\$\ 0.60}{ft^3}$$

2.7.1 Construct LLW Trenches: Size Reduced LLCE

LLW trench construction cost for size reduced LLCE was estimated on a per item basis as follows. From Appendix B, Table B-1, the two largest fractions of the LLCE waste stream would be thermocouples and vertical turbine pumps, and they would occur in approximately equal percentages. Thus, the LLCE waste stream could be reasonably

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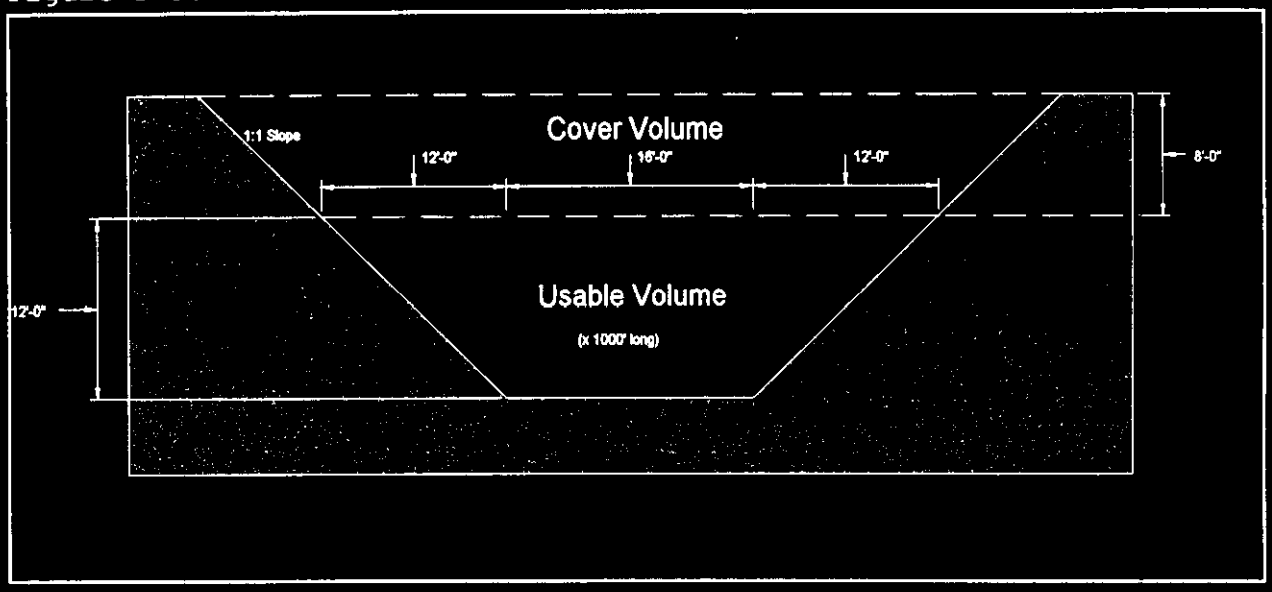
[4]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 6.0, "Alternative 1: T Plant," Table 6.3, "T Plant Scenario 1 Cost Estimate," Revision 0, Draft.

[5]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 7.0, "Alternative 2: New Facility," Table 7.1, "New Facility Scenario 1 Cost Estimate," Revision 0, Draft.

[6]WHC-SD-WM-ES-303, Concept Study: Use of Grout Vaults for Disposal of Long Length Contaminated Equipment, Section 4.6.1, "Vault Modification Costs," Table 3, "Vault Modification Costs," Revision 0, dated September 26, 1994.

[7]Per telephone conversation, W. S. Josephson to B. E. Poremba, on October 17, 1994.

Figure F-1. Standard LLW Burial Trench



approximated as 50% thermocouples and 50% pumps. The size reduced volume of a representative thermocouple and representative pump were calculated from H-2 drawings referenced in Appendix A, and a correction factor to allow for realistic packaging considerations was applied. The calculated values have been summarized in Table F-1:

Table F-1. Size Reduced LLCE Disposal Volume

	Thermocouple	Vertical Turbine Pump
Percentage of waste stream	50%	50%
In-Tank Diameter	2 in	6 in
In-Tank Length	50 ft	50 ft
Dunnage size	1 ft OD x 2 ft	2 ft OD x 4 ft
Size Reduced Volume (close packed)	3.5 ft^3	28.5 ft^3
Actual Packaged Volume (close pack x 3)	10.5 ft^3	85.5 ft^3
Average Disposal Volume	48 ft^3	

Therefore, average LLW trench construction cost per item for size reduced LLCE would be:

$$\frac{cost}{item} = \frac{48\ ft^3}{item} \times \frac{\$\ 0.60}{ft^3} = \frac{\$\ 29}{item}$$

2.7.2 Construct LLW Trenches: Transport Containers

LLW trench construction cost for LLCE transport containers was estimated on a per container basis as follows. From Section 2.1, the average transport container would be approximately 70.5 ft long by 5.5 ft diameter. Using a 1 ft cover depth between layers, the trench volume required per transport container would be:

$$\frac{\text{trench volume}}{\text{container}} = \frac{5.5\ ft \times 70.5\ ft \times 5.5\ ft}{\text{container}} + \frac{5.5\ ft \times 70.5 ft \times 1\ ft}{\text{cover}} = \frac{2{,}520\ ft^3}{\text{container}}$$

Therefore, average LLW trench construction cost per transport container would be:

$$\frac{\text{cost}}{\text{container}} = \frac{2{,}520\ ft^3}{\text{container}} \times \frac{\$\ 0.60}{ft^3} = \frac{\$\ 1{,}512}{\text{container}}$$

2.8 Construct MW Trenches: General

MW trench construction cost was estimated on a per cubic foot basis as follows. A standard MW trench, as constructed by Project W-025 (MW Land Disposal Facility - First and Second Trench), would have from 28,000 yd^3 to 86,500 yd^3 of usable disposal volume depending on the closure cover design. For the purposes of this study, a disposal volume of 43,480 yd^3 based on a 10% grade closure cover design was used[8]. Construction cost for Project W-025 was estimated at $8,985,000[9] for two trenches. Therefore, average MW trench construction cost per ft^3 would be:

$$\frac{\text{cost}}{ft^3} = \frac{\$\ 8{,}985{,}000}{2 \times 43{,}480\ yd^3} \times \frac{yd^3}{27\ ft^3} = \frac{\$\ 3.83}{ft^3}$$

2.8.1 Construct MW Trenches: FSM

MW trench construction cost for FSM waste was estimated on a per item basis as follows. The average FSM item would require an MHIC tube of approximately the same size as an average transport container, which from Section 2.7.2 would occupy 2,520 ft^3 of trench volume. Therefore, average MW trench construction cost per item for FSM would be:

$$\frac{\text{cost}}{\text{item}} = \frac{2{,}520\ ft^3}{\text{item}} \times \frac{\$\ 3.83}{ft^3} = \frac{\$\ 9{,}652}{\text{item}}$$

2.8.2 Construct MW Trenches: FDR

MW trench construction cost for FDR waste was estimated on a per item basis as follows. The average FDR item would require a 16 inch OD by 70 ft long MHIC tube. Using a 1 ft cover depth between layers, the trench volume required per MHIC tube would be:

$$\frac{\text{trench volume}}{\text{EHIC}} = \frac{1.3\ ft \times 70\ ft \times 1.3\ ft}{\text{tube}} + \frac{1.3\ ft \times 70 ft \times 1\ ft}{\text{cover}} = \frac{218\ ft^3}{\text{EHIC}}$$

The removed dunnage would require a separate 5 ft by 5 ft by 5 ft MHIC box. Using a 1 ft cover depth between layers, the trench volume required per MHIC box would be:

$$\frac{\text{trench volume}}{\text{EHIC}} = \frac{5\ ft \times 5\ ft \times 5\ ft}{\text{box}} + \frac{5\ ft \times 5 ft \times 1\ ft}{\text{cover}} = \frac{150\ ft^3}{\text{EHIC}}$$

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[8]Engineering Study, Golder Associates, 903-1254.500, Alternative Operational Backfill Material Study for W-025 Landfill, Hanford Washington, Section 1.2, "Background," dated August 2, 1991.

[9]Total Project Cost in the Construction Project Management Menu, WHC Soft Reporting, dated September 7, 1994.

Therefore, average MW trench construction cost per item for FDR would be:

$$\frac{cost}{item} = \left(\frac{218\ ft^3}{EHIC\ tube} + \frac{150\ ft^3}{EHIC\ box}\right) \times \frac{\$\ 3.83}{ft^3} = \frac{\$\ 1,409}{item}$$

2.8.3 Construct MW Trenches: FSR

MW trench construction cost for FSR waste was estimated on a per item basis as follows. LLCE treated by FSR would consist primarily of thermocouple-sized items, and would be contact-handled. From Table F-1, the average disposal volume of such items would be approximately 10.5 ft^3. In addition, FSR was estimated by the author to produce approximately 50 ft^3 of secondary MW, primarily from tank waste contacted consumables such as glove bags and protective clothing. This volume would require three 150 gal MHICs for treatment. Using a 1 ft cover depth between layers, the trench volume required per MHIC would be:

$$\frac{trench\ volume}{EHIC} = \frac{3\ ft \times 3\ ft \times 4\ ft}{EHIC} + \frac{3\ ft \times 3ft \times 1\ ft}{cover} = \frac{45\ ft^3}{EHIC}$$

Therefore, average MW trench construction cost per item for FSR would be:

$$\frac{cost}{item} = \frac{3\ EHICs}{item} \times \frac{45\ ft^3}{EHIC} \times \frac{\$\ 3.83}{ft^3} = \frac{\$\ 517}{item}$$

2.8.4 Construct MW Trenches: Secondary MW

MW trench construction cost for secondary MW was estimated on a per item basis as follows. Extraction treatment methods were estimated by the author to produce two 150 gal MHICs of secondary MW per LLCE item, primarily from flexible receiver debris, pieces of LLCE which would not meet the debris rule treatment standard and MW contacted consumables. Therefore, average MW trench construction cost per item for secondary MW would be:

$$\frac{cost}{item} = \frac{2\ EHICs}{item} \times \frac{45\ ft^3}{EHIC} \times \frac{\$\ 3.83}{ft^3} = \frac{\$\ 345}{item}$$

3.0 Start-up Costs

3.1 Transport System

3.1.1 Transport Container Design

Transport container design cost was estimated on a total cost basis by the TWRS LLCE project. Transport container design cost was estimated to be $184,000[10].

3.1.2 Transport Container SARP

Transport container safety analysis report for packaging (SARP) cost was estimated on a total cost basis by the TWRS LLCE project.

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[10]Meeting minutes, P. A. Titzler, on January 5, 1995.

Transport container SARP cost was estimated to be $300,000[11].

3.2 Retrieval System Start-up

Start-up cost for the LLCE retrieval system was estimated on a total cost basis as follows. Start-up costs would include NEPA, operator certification, procedures and readiness review. Start-up cost for the retrieval system was estimated by the author to be $250,000.

3.3 WRAP-2B Start-up

Since WRAP-2B would undergo start-up whether LLCE was treated there or not, the start-up cost would not be reflected against LLCE treatment efforts. Therefore, WRAP-2B start-up cost was not included.

3.4 221-T Start-up

Start-up cost for the 221-T facility was estimated on a total cost basis as follows. The Parsons study discussed in Section 2.4 also addressed facility start-up cost for an extraction treatment line in the 221-T canyon building. Start-up costs would include NEPA, permitting, operator certification, procedures and readiness review. Start-up cost for 221-T was estimated to be $1,611,000[12].

3.5 2706-T Start-up

Start-up cost for the 2706-T annex was estimated on a total cost basis as follows. The Parsons study discussed in Section 2.4 also addressed facility start-up cost for an extraction treatment line in an annex to 2706-T. Start-up costs would include NEPA, permitting, operator certification, procedures and readiness review. Start-up cost for the 2706-T annex was estimated to be $6,623,500[13].

3.6 Grout Vault Start-up

Start-up cost for the modified grout vaults was estimated on a total cost basis as follows. Start-up costs would include NEPA, permitting, operator certification, procedures, readiness review, and major revisions to the grout vault performance assessment. Start-up cost for the grout vaults was estimated by the author to be $3,000,000.

3.7 FSM Start-up

Start-up cost for FSM was estimated on a total cost basis as follows. Start-up costs would include NEPA, permitting, operator certification, procedures and readiness review. Start-up cost for FSM was estimated by the author to be $1,000,000.

3.8 FDR Start-up

Start-up cost for FDR was estimated on a total cost basis as follows. Start-up costs would include NEPA, permitting, operator certification,

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[11]Meeting minutes, P. A. Titzler, on January 5, 1995.

[12]WHC-SD-ES-283, Long Term Decontamination Engineering Study, Section 6.0, "Alternative 1: T Plant," Revision 0, Table 6.3, Draft.

[13]WHC-SD-ES-283, Long Term Decontamination Engineering Study, Section 7.0, "Alternative 2: New Facility," Revision 0, Table 7.1, Draft.

procedures and readiness review. Start-up cost for FDR was estimated by the author to be $2,000,000.

3.9 FSR Start-up

Start-up cost for FSR was estimated on a total cost basis as follows. Start-up costs would include NEPA, permitting, operator certification, procedures and readiness review. Start-up cost for FSR was estimated by the author to be $1,000,000.

4.0 CENRTC Costs

4.1 Fabricate Retrieval Equipment

Retrieval equipment fabrication cost was estimated on a total cost basis by the TWRS LLCE project. Two flexible receiver units were estimated to be required to support retrieval operations. Flexible receiver fabrication cost was estimated to be $1,000,000[14] per unit.

4.2 Fabricate Reusable Transport Container

Reusable transport container fabrication cost was estimated on a total cost basis by the TWRS LLCE project. Average fabrication cost for a stainless steel reusable transport container was estimated to be $404,000[15] per container.

4.3 Fabricate Reusable LLCE Carriages

Reusable carriage fabrication cost was estimated on a total cost basis by the TWRS LLCE project. Average fabrication cost for a stainless steel reusable carriage was estimated to be $21,700 per carriage[16].

4.4 Fabricate Disposable LLCE Carriages

Disposable carriage fabrication cost was estimated on a total cost basis by the TWRS LLCE project. Average fabrication cost for a carbon steel carriage was estimated to be $16,120 per carriage[17].

4.5 Procure Dunnage Removal Equipment

Dunnage removal equipment procurement cost was estimated on a total cost basis by the TWRS LLCE project. Dunnage removal equipment procurement cost was estimated to be $1,200,000[18].

4.6 Procure Field Size Reduction Equipment

FSR was assumed to use existing equipment. Therefore procurement costs were not included.

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[14]Meeting minutes, P. A. Titzler, on January 5, 1995.

[15]Meeting minutes, P. A. Titzler, on January 5, 1995.

[16]Meeting minutes, S. R. Crow, on December 1, 1994.

[17]Meeting minutes, S. R. Crow, on December 1, 1994.

[18]Meeting minutes, P. A. Titzler, on January 5, 1995.

4.7 Procure Transporters

Transporter procurement cost was estimated on a total cost basis by the TWRS LLCE project. One tilt trailer and one transport trailer were estimated to be required to support retrieval operations. LLCE transporter procurement cost was estimated to be $950,000[19] per trailer.

4.8 Procure Storage Facility Cranes

Storage facility crane procurement cost was estimated on a total cost basis as follows. Alternatives which would exceed 25 handling evolutions per year at the storage facility were considered to require a dedicated crane. Two smaller cranes would be preferred over one larger crane for handling LLCE at the storage facility due to the varying center of gravity from item to item[20]. Storage facility crane procurement cost was estimated to be $500,000 per crane.

4.9 Procure Disposal Facility Crane

Disposal facility crane procurement cost was estimated on a total cost basis as follows. Alternatives which would exceed 25 full-size handling evolutions per year at the MW trench were considered to require a dedicated crane. One large crane would be the preferred option for handling LLCE at the disposal facility. Disposal facility crane procurement cost was estimated to be $2,000,000.

5.0 Operational Costs

5.1 Prepare for Retrieval Operations

5.1.1 Labor

Labor cost to prepare for LLCE retrieval operations was estimated on a per evolution basis as follows. The crane and rigging crew required to handle retrieval equipment would consist of one supervisor, one crane operator, one truck driver and three riggers, and would bill out at 6 people x $83/hr = $498/hr[21]. Also, one supervisor, 7 operators and two HPT's from TWRS would be required to support the crane and rigging crew. This support would bill out at 10 people x $50/hr = $500/hr[22]. Crew cost per hour would be $998/hr, which was rounded to $1,000/hr for simplicity. The evolution was estimated by the author to take 5 complete shifts. Therefore, average labor cost per item to prepare for retrieval operations would be:

$$\frac{cost}{item} = \frac{5\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 1,000}{hr} = \frac{\$\ 40,000}{item}$$

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[19]Meeting minutes, P. A. Titzler, on January 5, 1995.

[20]Per telephone conversation, W. S. Josephson to R. B. Laws, on October 11, 1994.

[21]Per telephone conversation, W. S. Josephson to S. M. Holloman, on October 5, 1994.

[22]Per telephone conversation, W. S. Josephson to W. C. Mallory, Jr., on October 19, 1994.

5.1.2 Materials

Materials cost to prepare for LLCE retrieval operations was estimated on a per evolution basis as follows. Preparation materials would consist primarily of a flexible receiver bag, glove bags, plastic sheets and protective equipment. Average material cost for to prepare for retrieval operations was estimated by the author to be $18,000 per item.

5.1.3 Engineering

Engineering cost to prepare for LLCE retrieval operations was estimated on a per evolution basis as follows. Engineering support would consist primarily of retrieval equipment selection and waste characterization. These evolutions were estimated by the author to take one man-week. Therefore, average engineering cost per item to prepare for retrieval operations would be:

$$\frac{cost}{item} = \frac{5\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 2,000}{item}$$

5.1.4 Administrative

Administrative cost to prepare for LLCE retrieval operations was estimated on a per evolution basis as follows. Administrative support would consist primarily of work package preparation and scheduling. These evolutions were estimated by the author to take 12 man-weeks. Therefore, average administrative cost per item to prepare for retrieval operations would be:

$$\frac{cost}{item} = \frac{60\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 24,000}{item}$$

5.2 Restore From Retrieval Operations

5.2.1 Labor

Labor cost to restore from LLCE retrieval operations was estimated on a per evolution basis as follows. The crew discussed in Section 5.1.1 would also be required to restore from retrieval operations. Crew cost per hour would be $998/hr, which was rounded to $1,000/hr for simplicity. The evolution was estimated by the author to take 5 complete shifts. Therefore, average labor cost per item to restore from retrieval operations would be:

$$\frac{cost}{item} = \frac{5\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 1,000}{hr} = \frac{\$\ 40,000}{item}$$

5.2.2 Administrative

Administrative cost to restore from LLCE retrieval operations was estimated on a per evolution basis as follows. Administrative support would consist primarily of characterization and shipping documentation preparation. These evolutions were estimated by the author to take 1 man-week. Therefore, average administrative cost per item to restore from retrieval operations would be:

$$\frac{cost}{item} = \frac{5\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 2,000}{item}$$

5.3 Handling Costs

Handling evolutions related to LLCE treatment were grouped as follows (in descending order of complexity):

- Handle LLCE following retrieval.
- Handle full-size LLCE packages.
- Handle empty LLCE transport container.
- Handle standard sized packages.

Costs for each level of complexity were calculated separately as described below.

5.3.1 Handle LLCE Following Retrieval

Handling costs for LLCE items following retrieval were determined on a per evolution basis as follows. The crane and operating crew listed in Section 5.1.1 would be required to handle the LLCE item following retrieval. Crew hours and total costs for different tasks were estimated by the author, and have been summarized in Table F-2.

5.3.2 Handle Full-Size LLCE Packages

Handling costs for full-size LLCE packages were determined on a per evolution basis as follows. The crane and rigging crew required to handle a full-size LLCE package would consists of one supervisor, one crane operator, one truck driver and three riggers, and would bill out at 6 people x $83/hr = $498/hr. Also, one supervisor, two operators and two HPT's from TWRS/SWD would be required to support the crane and rigging crew. This support would bill out at 5 people x $50/hr = $250/hr. Therefore, crew costs per hour would be $748/hr, which was rounded to $750/hr for simplicity. Crew-hours and total costs for different tasks were estimated by the author, and have been summarized in Table F-2.

5.3.3 Handle Empty LLCE Transport Container

Handling costs for empty LLCE transport containers were determined on a per evolution basis as follows. The crane and rigging crew required to handle an empty LLCE transport container would consists of one supervisor, one crane operator, one truck driver and two riggers, and would bill out at 5 people x $83/hr = $415/hr. Also, one supervisor, one operator and one HPT from TWRS/SWD would be required to support the crane and rigging crew. This support would bill out at 3 people x $50/hr = $150/hr. Therefore, crew costs per hour would be $565/hr. Crew-hours and total costs for different tasks were estimated by the author, and have been summarized in Table F-2.

5.3.4 Handle Standard Containers

Handling costs for standard containers were determined on a per evolution basis as follows. "Standard" containers were defined as containers which would not require specialized crane and rigging support for handling, such as 55 gal drums and 150 gal MHICs. A crew of one supervisor, three operators, one truck driver and one HPT would be sufficient for handling. Therefore, crew costs per hour would be 6 people x $50/hr = $300/hr. Crew-hours and total costs for different tasks were estimated by the author, and have been summarized in Table F-2.

Table F-2. Handling Costs

Task	Crew-hrs	Cost/hr	Total Cost
Retrieve LLCE.	8.0	$1,000	$8,000
Load LLCE into transport container.	4.0	$1,000	$4,000
Load LLCE into MHIC tube.	4.0	$1,000	$4,000
Load dunnage into MHIC box.	2.0	$1,000	$2,000
Ship LLCE direct to WRAP-2B.	4.0	$750	$3,000
Ship LLCE direct to 221-T.	4.0	$750	$3,000
Ship LLCE direct to 2706-T annex.	4.0	$750	$3,000
Ship LLCE direct to grout vaults.	4.0	$750	$3,000
Ship LLCE to storage.	4.0	$750	$3,000
Ship LLCE from storage to WRAP-2B.	4.0	$750	$3,000
Ship LLCE from storage to 221-T.	4.0	$750	$3,000
Ship LLCE from storage to 2706-T annex.	4.0	$750	$3,000
Ship LLCE from storage to grout vaults.	4.0	$750	$3,000
Ship LLCE from storage to FSM.	4.0	$750	$3,000
Ship LLCE from storage to FDR.	4.0	$750	$3,000
Ship FSM LLCE to MW trench.	4.0	$750	$3,000
Ship FDR LLCE to MW trench.	4.0	$750	$3,000
Place FSM LLCE in MW trench.	16.0	$750	$12,000
Place FDR LLCE in MW trench.	8.0	$750	$6,000
Load MHIC tube into transport container.	4.0	$565	$2,260
Ship transport container to tank farm.	4.0	$565	$2,260
Ship transport container to storage.	4.0	$565	$2,260
Ship transport container to LLW trench.	4.0	$565	$2,260
Place transport container in LLW trench.	4.0	$565	$2,260
Ship MHIC box to tank farm.	4.0	$300	$1,200
Ship size reduced LLCE to LLW trench.	4.0	$300	$1,200
Ship size reduced LLCE to MW trench.	4.0	$300	$1,200
Ship secondary MW to MW trench.	4.0	$300	$1,200
Ship MHIC box to MW trench.	4.0	$300	$1,200
Place size reduced LLCE in LLW trench.	4.0	$300	$1,200
Place size reduced LLCE in MW trench.	4.0	$300	$1,200
Place secondary MW in MW trench.	4.0	$300	$1,200
Place MHIC box in MW trench.	4.0	$300	$1,200

5.4 Process LLCE at WRAP-2B

Processing cost for WRAP-2B was estimated on a per item basis as follows. No process line development has been completed for WRAP-2B, however the processing costs for WRAP-2B should be similar to the 2706-T extraction facility listed in Section 5.6. Maintenance costs, however, were estimated to be twice the cost listed in Section 5.6 due to the higher facility capacity, RH capability and TRU requirements.

5.4.1 Labor

As discussed in Section 5.6.1, average labor cost for WRAP-2B would be $24,762 per item.

5.4.2 Consumables

As discussed in Section 5.6.2, average consumables cost for WRAP-2B would be $1000 per item.

5.4.3 Maintenance

As discussed in Section 5.6.3, average maintenance cost per year for WRAP-2B would be:

$$\frac{maint\ cost}{year} = \frac{2 \times \$\ 619,029}{year} \times \frac{capacity\ correction\ factor}{100\ \%}$$

5.4.4 Process Secondary MW

As discussed in Section 5.6.4, average secondary MW processing cost for WRAP-2B would be $2,934 per item.

5.4.5 Transfer Liquid MW

As discussed in Section 5.6.5, average liquid MW transfer cost for WRAP-2B would be $6,750 per item.

5.4.6 Liquid MW Disposal

As discussed in Section 5.6.6, average liquid MW disposal cost for WRAP-2B would be $50,000 per item.

5.5 Process LLCE at 221-T

5.5.1 Labor

Labor cost for treatment at 221-T was estimated on an annual basis as follows. The current 221-T process line design was estimated to require a 13 person shift to size reduce the LLCE, package the LLCE pieces for disposal, and decontaminate the transport container and carriage[23]. Therefore, annual labor cost would be:

$$\frac{cost}{year} = \frac{52\ weeks}{year} \times \frac{40\ hrs}{week} \times \frac{13\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 1,352,000}{year}$$

The current 221-T process line design was estimated to require 28

[23]Per telephone conversation, W. S. Josephson to A. R. Rathmacher, on November 16, 1994.

consecutive shift hours to perform all required treatment functions[24]. From WRAP-A efficiency studies, a typical facility operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work[25]. As a result, the average capacity for 221-T would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{28\ hrs} = \frac{34\ items}{year}$$

Therefore, average labor cost per item for processing at 221-T would be:

$$\frac{cost}{item} = \frac{\$\ 1{,}352{,}000}{year} \times \frac{year}{34\ items} = \frac{\$\ 39{,}765}{item}$$

5.5.2 Consumables

Consumables cost was estimated on a per item basis as follows. WRAP-A studies have estimated that $1000 of consumables, such as disposal containers, protective clothing and void space fill materials, would be required per 4 ft by 4 ft by 4 ft waste box[26]. Each LLCE item would produce approximately the same volume of treated LLW at 221-T. Therefore, average consumables cost for 221-T would be $1000 per item.

5.5.3 Maintenance

Maintenance cost for 221-T was estimated on an annual basis as follows. Typical industrial maintenance rates average from 3-5% of investment per year at 100% capacity for mild corrosivity and wear conditions[27]. Due to the moderate wear conditions involved, a maintenance rate of 3% of investment per year was selected for use. From the Parsons study discussed in Section 2.4, the investment for 221-T (not including general plant upgrades) would be $68,911,595. Therefore, average maintenance cost per year at 100% capacity would be:

$$\frac{cost}{year} = \$\ 68{,}911{,}595 \times \frac{3\ \%}{year} = \frac{\$\ 2{,}067{,}348}{year}$$

The above 100% capacity maintenance cost was corrected for actual plant capacity as follows. From Appendix D, the 100% capacity for 221-T would be 51 items per year. An average plant capacity for 221-T over the life of the LLCE program was calculated using:

$$avg\ capacity = \frac{total\ LLCE\ items\ treated}{total\ years\ operational} \times \frac{100\ \%}{51\ items/yr}$$

and that number was used to determine a capacity correction factor

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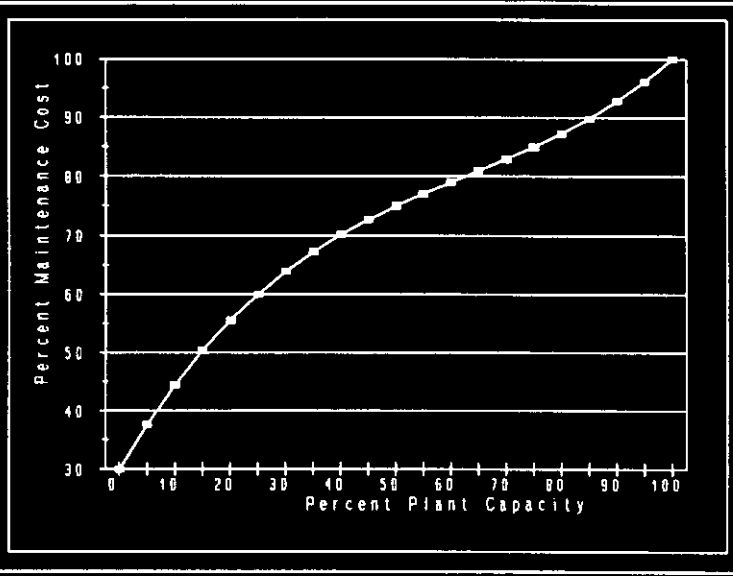
[24]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 6.0, "Alternative 1: T Plant," Figure 6.6, "Throughput Analysis," Revision 0, Draft.

[25]Per telephone conversation, W. S. Josephson to D. E. Nester and O. L. Kruger, on November 16, 1994.

[26]Per telephone conversation, W. S. Josephson to D. E. Nester and O. L. Kruger, on November 16, 1994.

[27]Project and Cost Engineer's Handbook, Humphreys, K. K. et al, Chapter 3, "Cost Estimating," Table 3.10, third edition.

Figure F-2. Maintenance Cost vs Plant Capacity



from Figure F-2[28]. Therefore, average maintenance cost per year for 221-T would be:

$$\frac{maint\ cost}{year} = \frac{\$\ 2,067,348}{year} \times \frac{capacity\ correction\ factor}{100\ \%}$$

5.5.4 Process Secondary MW

Secondary MW processing cost was estimated on a per item basis as follows. A polyethylene MHIC macroencapsulation method similar to the FSR method was assumed for 221-T secondary MW. From Section 2.8.4, each LLCE item would produce two 150 gal MHICs of secondary MW. From Section 5.10, the labor cost per item would be:

$$\frac{cost}{item} = \frac{2}{3} \times \frac{4\ shift\text{-}hrs}{item} \times \frac{5\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 667}{item}$$

the MHIC cost per item would be:

$$\frac{cost}{item} = \frac{2\ EHICs}{item} \times \frac{\$\ 800}{EHIC} = \frac{\$\ 1,600}{item}$$

and the consumables cost would be:

$$\frac{cost}{item} = \frac{2}{3} \times \frac{\$\ 1,000}{item} = \frac{\$\ 667}{item}$$

Therefore, average secondary MW processing cost per item for 221-T would be:

$$\frac{cost}{item} = \frac{\$\ 667 + \$\ 1,600 + 667}{item} = \frac{\$\ 2,934}{item}$$

5.5.5 Transfer Liquid MW

Liquid MW transfer cost was estimated on a per item basis as follows. T Plant currently ships liquid MW by rail car shipments to the 204-AR

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[28] Project and Cost Engineer's Handbook, Humphreys, K. K. et al, Chapter 3, "Cost Estimating," third edition.

Waste Unloading Facility. Average operational cost for each 20,000 gal shipment was estimated to be approximately $27,000[29]. The current 221-T process line design was estimated to produce approximately 5,000 gal of liquid waste generation per LLCE item[30]. Therefore, average liquid MW transfer cost per item for 221-T would be:

$$\frac{cost}{item} = \frac{5{,}000\ gal}{item} \times \frac{\$\ 27{,}000}{20{,}000\ gal} = \frac{\$\ 6{,}750}{item}$$

5.5.6 Liquid MW Disposal

Liquid MW disposal cost was estimated on a per item basis as follows. Cost data for waste vitrification operations was not available. In the absence of better data, a historical a figure of $10 per gallon for pumping and evaporator operations was used to represent liquid MW disposal[31]. From Section 5.5.5, each LLCE item would produce 5,000 gal of liquid MW. Therefore, average liquid MW disposal cost per item for 221-T would be:

$$\frac{cost}{item} = \frac{5{,}000\ gal}{item} \times \frac{\$\ 10}{gal} = \frac{\$\ 50{,}000}{item}$$

5.6 Process LLCE at 2706-T Annex

5.6.1 Labor

Labor cost for treatment at 2706-T was estimated on an annual basis as follows. The current 221-T process line design was estimated to require a 10 person shift to size reduce the LLCE, package the LLCE pieces for disposal, and decontaminate the transport container and carriage. Therefore, annual labor cost would be:

$$\frac{cost}{year} = \frac{52\ weeks}{year} \times \frac{40\ hrs}{week} \times \frac{10\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 1{,}040{,}000}{year}$$

The current 2706-T process line design was estimated to require 23 consecutive shift hours to perform all required treatment functions[32]. From Section 5.5.1, a typical facility operating year would have 175 operational days, and the average shift would produce 5.5 hrs of productive work. As a result, the average capacity for 2706-T would be:

$$\frac{items}{year} = \frac{175\ days}{year} \times \frac{5.5\ hrs}{day} \times \frac{item}{23\ hrs} = \frac{42\ items}{year}$$

Therefore, average labor cost per item for processing at 2706-T would be:

$$\frac{cost}{item} = \frac{\$\ 1{,}040{,}000}{year} \times \frac{year}{42\ items} = \frac{\$\ 24{,}762}{item}$$

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[29]Per telephone conversation, W. S. Josephson to L. T. Blackford, on October 17, 1994.

[30]Per telephone conversation, W. S. Josephson to A. R. Rathmacher, on November 16, 1994.

[31]Per telephone conversation, W. S. Josephson to T. J. Venetz, on December 13, 1994.

[32]Per telephone conversation, W. S. Josephson to A. R. Rathmacher, on November 16, 1994.

5.6.2 Consumables

As discussed in Section 5.5.2, average consumables cost for 2706-T would be $1000 per item.

5.6.3 Maintenance

Maintenance cost for 2706-T was estimated on an annual basis as follows. From Section 5.5.3, an average 100% capacity maintenance cost of 3% of investment per year was used for 2706-T. From the Parsons study discussed in Section 2.4, the investment for 2706-T would be $20,634,299. Therefore, average maintenance cost per year at 100% capacity would be:

$$\frac{cost}{year} = \$\ 20{,}634{,}299 \times \frac{3\ \%}{year} = \frac{\$\ 619{,}029}{year}$$

The above 100% capacity maintenance cost was corrected for actual plant capacity as follows. From Appendix D, the 100% capacity for 2706-T would be 63 items per year. An average plant capacity for 2706-T over the life of the LLCE program was calculated using:

$$avg\ capacity = \frac{total\ LLCE\ items\ treated}{total\ years\ operational} \times \frac{100\ \%}{63\ items/yr}$$

and that number was used to determine a capacity correction factor from Figure F-2. Therefore, average maintenance cost per year for 2706-T would be:

$$\frac{maint\ cost}{year} = \frac{\$\ 619{,}029}{year} \times \frac{capacity\ correction\ factor}{100\ \%}$$

5.6.4 Process Secondary MW

As discussed in Section 5.5.4, average secondary MW processing cost for 2706-T would be $2,934 per item.

5.6.5 Transfer Liquid MW

As discussed in Section 5.5.5, average liquid MW transfer cost for 2706-T would be $6,750 per item.

5.6.6 Liquid MW Disposal

As discussed in Section 5.5.6, average liquid MW disposal cost for 2706-T would be $50,000 per item.

5.7 Process LLCE in Grout Vaults

5.7.1 Labor: Place LLCE

The crane and rigging crew required to place the LLCE into the grout vault would consist of one supervisor, two crane operators, one truck driver and two riggers, and would bill out at 6 people x $83/hr = $498/hr. Also, one supervisor, two operators and one HPT's from TWRS/SWD would be required to support the crane crew. This support crew would bill out at 4 people x $50/hr = $200/hr. Therefore, crew cost per hour would be $698/hr, which was rounded to $700/hr for simplicity. This evolution was estimated by the author to take one shift. Therefore, average labor cost per item for placing the LLCE would be:

$$\frac{cost}{item} = \frac{1\ shift}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 700}{hr} = \frac{\$\ 5,600}{item}$$

5.7.2 Labor: Add Encapsulant Material

The crane and rigging crew required to operate the encapsulant material addition equipment would consist of one supervisor, two crane operators, one truck driver and two riggers, and would bill out at 6 people x $83/hr = $498/hr. Also, one supervisor, two operators and one HPT's from TWRS/SWD would be required to support the crane crew. This support crew would bill out at 4 people x $50/hr = $200/hr. Therefore, crew cost per hour would be $698/hr, which was rounded to $700/hr for simplicity. This evolution was estimated by the author to take four hours. Therefore, average labor cost per item for adding encapsulant material would be:

$$\frac{cost}{item} = \frac{4\ hrs}{item} \times \frac{\$\ 700}{hr} = \frac{\$\ 2,800}{item}$$

5.7.3 Consumables

Consumables cost was estimated on a per item basis as follows. From Appendix D, each grout vault would have a payload volume of 212,050 ft^3 and would hold approximately 1218 LLCE items. The average void volume per item would be:

$$\frac{void\ vol}{item} = \frac{212,050\ ft^3}{vault} \times \frac{vault}{1218\ items} = \frac{174\ ft^3}{item}$$

In bulk quantities, encapsulant material procurement cost would be approximately $3.70/$ft^3$ delivered. Therefore, average consumables cost per item for adding encapsulant material would be:

$$\frac{cost}{item} = \frac{174\ ft^3}{item} \times \frac{\$\ 3.70}{hr} = \frac{\$\ 644}{item}$$

5.7.4 Maintenance

Maintenance cost for the grout vaults was estimated on an annual basis as follows. From Section 5.5.3, an average 100% capacity maintenance cost of 3% of investment per year was used for the grout vaults. From Section 2.6, the investment for the grout vaults would be $7,000,000. Therefore, average maintenance cost per year at 100% capacity would be:

$$\frac{cost}{year} = \$\ 7,000,00 \times \frac{3\ \%}{year} = \frac{\$\ 210,000}{year}$$

The above 100% capacity maintenance cost was corrected for actual plant capacity as follows. From Appendix D, the 100% capacity for the grout vaults would be 120 items per year. An average plant capacity for the grout vaults over the life of the LLCE program was calculated using:

$$avg\ capacity = \frac{total\ LLCE\ items\ treated}{total\ years\ operational} \times \frac{100\ \%}{120\ items/yr}$$

and that number was used to determine a capacity correction factor from Figure F-2. Therefore, average maintenance cost per year for the grout vaults would be:

$$\frac{maint\ cost}{year} = \frac{\$\ 210{,}000}{year} \times \frac{capacity\ correction\ factor}{100\ \%}$$

5.8 Process LLCE by FSM

5.8.1 Labor

Labor cost for FSM was estimated on a per item basis as follows. Void space fill and macroencapsulation efforts were estimated by the author to require 10 shift hours of a 5 person shift. Therefore, average labor cost per item for FSM would be:

$$\frac{cost}{item} = \frac{10\ shift\ hrs}{item} \times \frac{5\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 2{,}500}{item}$$

5.8.2 Procure MHIC

MHIC procurement cost was estimated on a per item basis as follows. MHICs in a 5 ft OD by 70 ft long size were estimated by the vendor to cost approximately $15,000[33] per container. Therefore, average MHIC procurement cost for FSM would be $15,000 per item.

5.8.3 Consumables

Consumables cost was estimated on a per item basis as follows. Including void space fill materials, consumables cost per cubic foot should be similar to WRAP-A operations as discussed in Section 5.5.2. This treatment method would generate, on average, approximately 1,375 ft^3 of treated waste per item. Therefore, average consumables cost per item for FSM would be:

$$\frac{cost}{item} = \frac{\$\ 1{,}000}{64\ ft^3} \times \frac{1{,}375\ ft^3}{item} = \frac{\$\ 21{,}484}{item}$$

5.9 Process LLCE by FDR

5.9.1 Labor: Dunnage Removal

Labor cost for dunnage removal was estimated on a per item basis as follows. The crane and rigging crew required to handle the LLCE following retrieval would consist of one supervisor, one crane operator, one truck driver and three riggers, and would bill out at 6 people x $83/hr = $498/hr. Also, one supervisor, 10 operators and two HPT's from TWRS would be required to perform dunnage removal operations. This crew would bill out at 13 people x $50/hr = $650/hr. Therefore, crew cost per hour would be $1,148/hr, which was rounded to $1,150/hr for simplicity. Based on past experience, approximately 3 shifts would be required to perform dunnage removal operations. Therefore, average labor cost per item for dunnage removal would be:

$$\frac{cost}{item} = \frac{3\ shifts}{item} \times \frac{8\ hrs}{shift} \times \frac{\$\ 1{,}150}{hr} = \frac{\$\ 27{,}600}{item}$$

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[33]Per telephone conversation, W. S. Josephson, WHC, to J. L. Harvey, Scientific Ecology Group, on November 16, 1994.

5.9.2 Labor: Macroencapsulation

Labor cost for macroencapsulation was estimated on a per item basis as follows. Void space fill and macroencapsulation efforts were estimated by the author to require 10 shift hours of a 5 person shift. Therefore, average labor cost per item for macroencapsulation would be:

$$\frac{cost}{item} = \frac{10\ shift\ hrs}{item} \times \frac{5\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 2,500}{item}$$

5.9.3 Procure MHICs

MHIC procurement cost was estimated on a per item basis as follows. MHICs in a 16 inch OD by 70 ft long size were estimated by the vendor to cost approximately $6,000. MHICs in the 5 ft by 5 ft by 5 ft size were estimated by the vendor to cost approximately $4,000 per container[34]. Therefore, average MHIC procurement cost for FDR would be $10,000 per item.

5.9.4 Consumables

Consumables cost was estimated on a per item basis as follows. Including void space fill materials, consumables cost per cubic foot should be similar to WRAP-A operations as discussed in Section 5.5.2. This treatment method would generate, on average, approximately 200 ft^3 of treated waste per item. Therefore, average consumables cost per item for FDR would be:

$$\frac{cost}{item} = \frac{\$\ 1,000}{64\ ft^3} \times \frac{200\ ft^3}{item} = \frac{\$\ 3,125}{item}$$

5.10 Process LLCE by FSR

5.10.1 Labor: Size Reduction

Labor cost for size reduction was estimated on a per item basis as follows. The crane and rigging crew required to handle the LLCE following retrieval would consist of one supervisor, one crane operator, one truck driver and three riggers, and would bill out at 6 people x $83/hr = $498/hr. Also, one supervisor, 10 operators and two HPT's from TWRS would be required size reduction operations. This crew would bill out at 13 people x $50/hr = $650/hr. Therefore, crew cost per hour would be $1,148/hr, which was rounded to $1,150/hr for simplicity. Based on past experience, approximately 16 hours[35] would be required to perform size reduction and macroencapsulation operations. Therefore, average labor costs per item for size reduction would be:

$$\frac{cost}{item} = \frac{16\ hrs}{item} \times \frac{\$\ 1,150}{hr} = \frac{\$\ 18,400}{item}$$

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[34]Per telephone conversation, W. S. Josephson, WHC, to J. L. Harvey, Scientific Ecology Group, on November 16, 1994.

[35]Per telephone conversation, W. S. Josephson to D. G. Niebuhr, on November 10, 1994.

5.10.2 Labor: Macroencapsulation

Labor cost for macroencapsulation was estimated on a per item basis as follows. Void space fill and macroencapsulation efforts were estimated by the author to require 4 shift hours of a 5 person shift. Therefore, average labor cost per item for macroencapsulation would be:

$$\frac{cost}{item} = \frac{4\ shift\text{-}hrs}{item} \times \frac{5\ people}{shift} \times \frac{\$\ 50}{hr} = \frac{\$\ 1,000}{item}$$

5.10.3 Procure MHICs

MHIC procurement cost was estimated on a per item basis as follows. From Section 2.8.3, FSR operations were estimated to require three 150 gal MHICs. MHICs in a 150 gal size were estimated by the vendor to cost approximately $800[36] per container. Therefore, average MHIC procurement cost per item for FSR would be:

$$\frac{cost}{item} = \frac{3\ EHICs}{item} \times \frac{\$\ 800}{EHIC} = \frac{\$\ 2,400}{item}$$

5.10.4 Consumables

Consumables cost was estimated on a per item basis as follows. Consumable cost per cubic foot should be similar to WRAP-A operations as discussed in Section 5.5.2, with added cost for glove bags and a greenhouse. The required glove bags were estimated to be $1,000 per item and the greenhouse was estimated to be $5,000 per item[37]. Therefore, average consumables cost for FSR would be $7,000 per item.

5.11 Process Leachate

5.11.1 Sample Leachate

Leachate sampling cost was estimated on an annual basis as follows. A standard MW trench was estimated to collect an average of 150,000 gal of leachate per operational year[38]. Since the accumulation tank for each trench would hold 10,000 gal, 15 disposal evolutions would be required per year. Prior to disposal, a sample would have to be drawn and analyzed at a cost of $5,000/sample. Therefore, average leachate sampling cost per year would be:

$$\frac{cost}{year} = \frac{15\ samples}{year} \times \frac{\$\ 5,000}{sample} = \frac{\$\ 75,000}{evolution}$$

5.11.2 Transfer Leachate

Leachate transfer cost was estimated on an annual basis as follows. From Section 5.11.1, a standard MW trench would require an average of 15 leachate transfer evolutions per operational year. The crew

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[36]Per telephone conversation, W. S. Josephson, WHC, to J. L. Harvey, Scientific Ecology Group, on November 16, 1994.

[37]Per telephone conversation, W. S. Josephson to R. L. Brown, on November 11, 1994.

[38]Per telephone conversation, W. S. Josephson to D. W. Carlyle, on December 15, 1994.

required to perform leachate transfer would consist of one supervisor, two operators, one HPT and one truck driver, and would bill out at 5 people x $50/hr = $250/hr. The evolution was estimated by the author to take 1 shift. Therefore, average leachate transfer cost per year would be:

$$\frac{cost}{year} = \frac{15\ evolutions}{year} \times \frac{1\ shift}{evolution} \times \frac{8\ hours}{shift} \times \frac{\$\ 250}{hour} = \frac{\$\ 30,000}{year}$$

5.11.3 Leachate Disposal

Leachate disposal cost was estimated on an annual basis as follows. From Section 5.11.1, a standard MW trench would produce an average of 150,000 gal of leachate per operational year. The leachate would be treated by the Effluent Treatment Facility (ETF) and released. Processing cost per gallon data for the ETF was not available. Manufacturing cost for nuclear-grade purified water would be approximately $1.00/gal, and should be roughly representative of ETF processing costs. Therefore, leachate disposal cost per year would be:

$$\frac{cost}{year} = \frac{\$\ 150,000\ gal}{year} \times \frac{\$\ 1.00}{gal} = \frac{\$\ 150,000}{year}$$

5.11.4 Leachate Disposal: Extraction

Leachate disposal cost for extraction treatment methods was estimated on an annual basis as follows. Extraction treatment methods would only send minor amounts secondary MW to a MW trench. The volume of secondary waste would not exceed 15% of the capacity of a single MW trench. In addition, the waste could be stored for campaign disposal. Therefore, extraction treatment methods would not incur significant leachate disposal costs.

5.11.5 Leachate Disposal: Grout Vaults

Leachate disposal cost for the grout vaults was estimated on an annual basis as follows. The design of the grout vaults makes collection of significant leachate volume highly unlikely. Therefore, the grout vaults would not incur significant leachate disposal costs.

5.11.6 Leachate Disposal: FSM

Leachate disposal cost for FSM was estimated on an annual basis as follows. FSM would require at least one MW trench to be in operation at all times during the duration of LLCE treatment efforts, and would utilize the entire volume of one or more MW trenches. Therefore, FSM would incur the full leachate disposal costs listed in Section 5.11.1, Section 5.11.2 and Section 5.11.3 for each operational year.

5.11.7 Leachate Disposal: FDR

Leachate disposal cost for FDR was estimated on an annual basis as follows. FDR would require at least one MW trench to be in operation at all times during the duration of LLCE treatment efforts, and would utilize the entire volume of one or more MW trenches. Therefore, FDR would incur the full leachate disposal costs listed in Section 5.11.1, Section 5.11.2 and Section 5.11.3 for each operational year.

5.11.8 Leachate Disposal: FSR

Leachate disposal cost for FSR was estimated on an annual basis as follows. FSR would only send only minor volumes of MW to a MW trench. The volume of MW would not exceed 20% of the capacity of a single MW trench. In addition, the waste could be stored for campaign disposal. Therefore, FSR would not incur significant leachate disposal costs.

6.0 Closure Costs

6.1 D&D LLCE Storage

Decontamination and decommissioning costs for the LLCE storage pads were determined on a per LLCE item basis as follows. D&D cost for a 60 ft by 200 ft storage pad was estimated to be $120,000[39]. Since a pad of that size would store 20 LLCE items, D&D costs per item would be:

$$\frac{cost}{item} = \frac{\$\ 120{,}000}{20\ items} = \frac{\$\ 6000}{item}$$

6.2 D&D WRAP-2B

Since WRAP-2B would undergo decontamination and decommissioning whether LLCE was treated there or not, the D&D cost would not be reflected against LLCE treatment efforts. Therefore, D&D cost for WRAP-2B was not included.

6.3 Additional D&D 221-T

Decontamination and decommissioning cost for the 221-T facility was estimated on an added cost basis as follows. The Parsons study discussed in Section 2.4 also addressed D&D costs for 221-T. Additional D&D cost for 221-T due to LLCE treatment was estimated to be $10,000,000[40].

6.4 D&D 2706-T Annex

Decontamination and decommissioning cost for the 2706-T annex was estimated on a total cost basis as follows. The Parsons study discussed in Section 2.4 also addressed D&D costs for the 2706-T annex. D&D cost for the 2706-T annex was estimated to be $15,000,000[41].

6.5 Close Grout Vaults

Grout vault closure cost was estimated on per vault basis as follows. The closure effort would be similar in scope to the initial modification effort. From Section 2.6, the initial modification cost would be $1,500,000 per vault. Therefore, grout vault closure cost would be $1,500,000 per vault.

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[39]L. H. Rosson, KEH Cost Estimation, File No. Z278SAA5, dated November 9, 1994. See Appendix G.

[40]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 9.0, "Alternative Evaluation," Table 9.2, "Cost Comparison," Revision 0, Draft.

[41]WHC-SD-WM-ES-283, Long Term Decontamination Engineering Study, Section 9.0, "Alternative Evaluation," Table 9.2, "Cost Comparison," Revision 0, Draft.

6.6 Backfill LLW Trenches: General

LLW trench backfill cost was estimated on a per cubic foot basis as follows. Trench backfill costs were estimated at $200,000 per trench[42]. Therefore, average LLW trench backfill cost per ft^3 would be:

$$\frac{cost}{ft^3} = \frac{\$\ 200{,}000}{336{,}000\ ft^3} = \frac{\$\ 0.60}{ft^3}$$

6.6.1 Backfill LLW Trenches: Size Reduced LLCE

LLW trench backfill cost for size reduced LLCE was estimated on a per item basis as follows. From 2.7.1, the average size reduced LLCE item would require 48 ft^3 of LLW trench volume. Therefore, average LLW trench backfill cost per item for size reduced LLCE would be:

$$\frac{cost}{item} = \frac{48\ ft^3}{item} \times \frac{\$\ 0.60}{ft^3} = \frac{\$\ 29}{item}$$

6.6.2 Backfill LLW Trenches: Transport Containers

LLW trench backfill cost for LLCE transport containers was estimated on a per container basis as follows. From Section 2.7.2, the average transport container would require 2,520 ft^3 of LLW trench volume. Therefore, average LLW trench backfill cost per transport container would be:

$$\frac{cost}{container} = \frac{2{,}520\ ft^3}{container} \times \frac{\$\ 0.60}{ft^3} = \frac{\$\ 1{,}512}{container}$$

6.7 Backfill MW Trenches: General

MW trench backfill cost was estimated on a per cubic foot basis as follows. Exact requirements for closure of MW trenches have not been finalized, and as a result no detailed cost estimates have been generated. However, based on the similarity between several proposed closure cover designs[43] and the trench itself, backfill costs were estimated by the author to be approximately 50% of initial construction costs. Therefore, average MW trench backfill cost per ft^3 would be:

$$\frac{cost}{ft^3} = \frac{\$\ 4{,}492{,}500}{2 \times 43{,}480\ yd^3} \times \frac{yd^3}{27\ ft^3} = \frac{\$\ 1.91}{ft^3}$$

6.7.1 Backfill MW Trenches: FSM

MW trench construction cost for FSM waste was estimated on a per item basis as follows. From Section 2.8.1, the average FSM operation would require 2,520 ft^3 of MW trench volume. Therefore, average MW trench backfill cost per item for FSM would be:

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[42]Per telephone conversation, W. S. Josephson to B. E. Poremba, on October 17, 1994.

[43]Engineering Study, Golder Associates, 903-1254.500, Alternative Operational Backfill Material Study for W-025 Landfill, Hanford Washington, Section 1.2, "Background," and Appendix C, dated August 2, 1991.

$$\frac{cost}{item} = \frac{2{,}520\ ft^3}{item} \times \frac{\$\ 1.91}{ft^3} = \frac{\$\ 4{,}813}{item}$$

6.7.2 Backfill MW Trenches: FDR

MW trench construction cost for FDR waste was estimated on a per item basis as follows. From Section 2.8.2, the average FDR operation would require 368 ft^3 of MW trench volume. Therefore, average MW trench backfill cost per item for FDR would be:

$$\frac{cost}{item} = \frac{368\ ft^3}{item} \times \frac{\$\ 1.91}{ft^3} = \frac{\$\ 703}{item}$$

6.7.3 Backfill MW Trenches: FSR

MW trench backfill cost for FSR waste was estimated on a per item basis as follows. From Section 2.8.3, the FSR operation would require 135 ft^3 of MW trench volume. Therefore, average MW trench backfill cost per item for FSR would be:

$$\frac{cost}{item} = \frac{135\ ft^3}{item} \times \frac{\$\ 1.91}{ft^3} = \frac{\$\ 258}{item}$$

6.7.4 Backfill MW Trenches: Secondary MW

MW trench backfill cost for secondary MW was estimated on a per item basis as follows. From Section 2.8.4, the average LLCE item treated by extraction methods would require 90 ft^3 of MW trench volume for secondary waste. Therefore, average MW trench backfill cost per item for secondary waste would be:

$$\frac{cost}{item} = \frac{90\ ft^3}{item} \times \frac{\$\ 1.91}{ft^3} = \frac{\$\ 172}{item}$$

Appendix G:

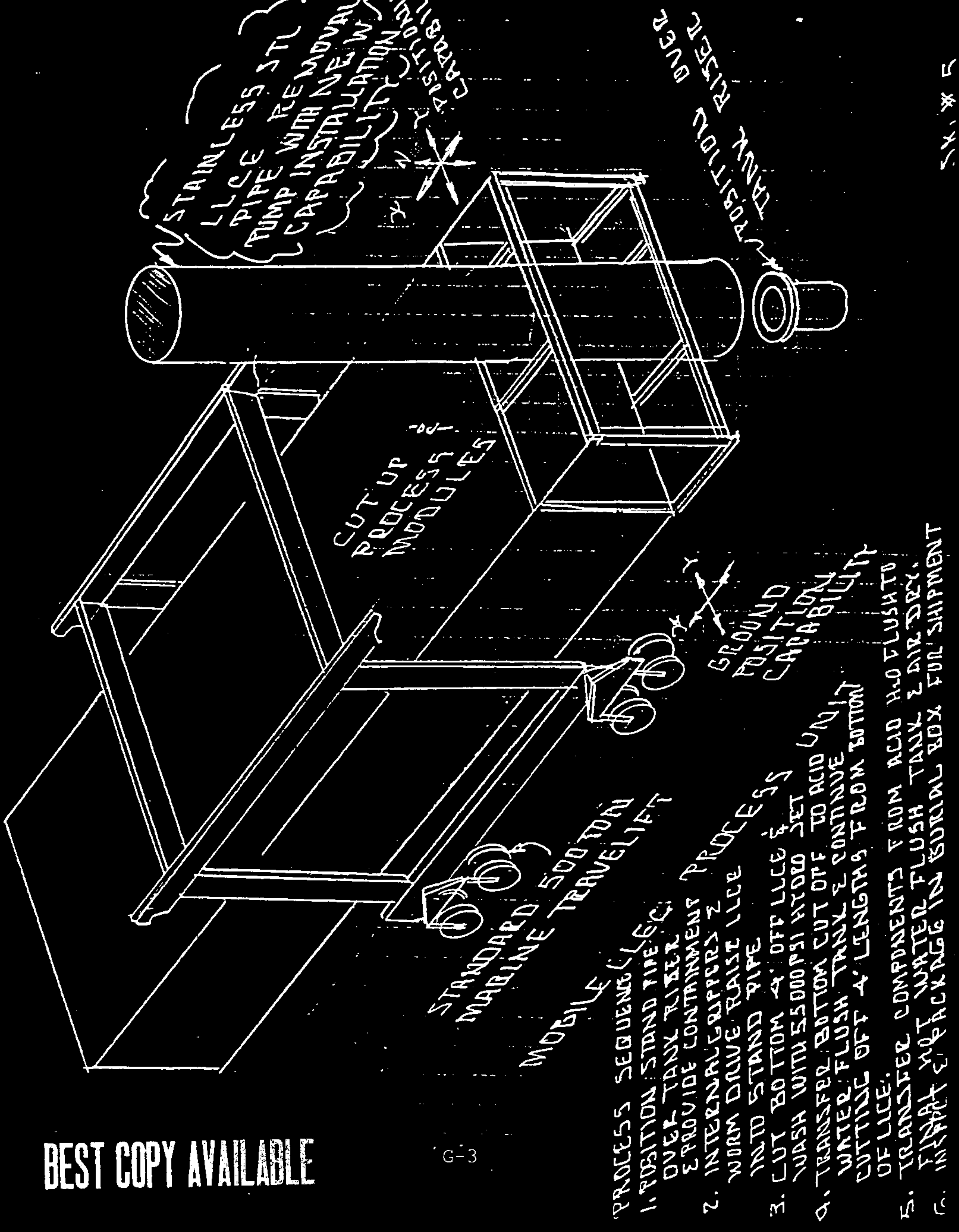
KEH Cost Estimates

Intentionally Blank

Mobile Treatment Facility, Portable:

KEH Estimate

Intentionally Blank



BEST COPY AVAILABLE

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z278SAA7
FILE NO. Z278SAA7

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 7
PORTABLE PROCESSING FAC. ROUGH ORDER OF MAGNITUDE
DOE_R01 - PROJECT COST SUMMARY

DATE 11/10/94 11:17:47
BY LEE H. ROSSON

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS	20,670,000	30	6,200,000	26,870,000
	(ADJUSTED TO MEET DOE 5100.4)	+30,000			+130,000
	PROJECT TOTAL	20,700,000	30	6,200,000	27,000,000

TYPE OF ESTIMATE	ROUGH ORDER OF MAGNITUDE 11-10-94	REMARKS:
ARCHITECT ENGINEER		
OPERATING CONTRACTOR		

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4600000	0	4600000	0.00	0	4600000	30	1380000	5980000
SUBTOTAL 111	DEFINITIVE DESIGN-CAT 1	4600000	0	4600000	0.00	0	4600000	30	1380000	5980000
SUBTOTAL 1	ENGINEERING	4600000	0	4600000	0.00	0	4600000	30	1380000	5980000
311100	LLCE FIELD SIZE REDUCTION UNIT	15300000	0	15300000	0.00	0	15300000	30	4590000	19890000
SUBTOTAL 31	FA CONST-ONSITE E/C	15300000	0	15300000	0.00	0	15300000	30	4590000	19890000
341100	PROJECT MANAGEMENT-O/C	765000	0	765000	0.00	0	765000	30	229500	994500
SUBTOTAL 34	PROJECT MANAGEMENT-O/C	765000	0	765000	0.00	0	765000	30	229500	994500
SUBTOTAL 3	CONSTRUCTION	16065000	0	16065000	0.00	0	16065000	30	4819500	20884500
PROJECT TOTAL		20,665,000	0	20,665,000	0.00	0	20,665,000	30	6,199,500	26,864,500

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: LETTER OF INSTRUCTION, ICFKH ESTIMATE Z281SAA1, RMP T-PLANT COST ESTIMATE.

DRAWINGS: UNTITLED, UNDATED SKETCHES 1, 2, & 3

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR THE FOLLOWING ITEMS:

3. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS, TECHNICAL SERVICES AND CRAFT OVERHEAD COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEH ESTIMATING FACTOR/BILLING SCHEDULE, REVISION 16, DATED OCTOBER 01, 1993. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, FOR THIS PROJECT, IS 93% FOR SHOP WORK AND 134% FOR FIELD WORK, WHICH IS REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL.

B.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP) BASED ON THE ESTIMATING FACTOR/BILLING SCHEDULE. THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE KEH SUMMARY REPORT DOER07, INCLUDED WITH THIS ESTIMATE. (FINAL ESTIMATES MAY BE PARTIALLY MANLOADED AND INCLUDED WITHIN THE ESTIMATE DETAIL)

5. ESCALATION

NO ESCALATION HAS BEEN COMPUTED AS AN ENGINEERING SCHEDULE HASN'T BEEN RECEIVED.

6. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE I-32 SUBPARAGRAPH (M), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE I-11, DATED 10-31-84.

7. REMARKS

A.) EQUIPMENT PRICES ARE FROM REFERENCED ESTIMATES.
B.) ESTIMATE IS BASED ON USING AN EXISTING" ON SITE SHEAR" MODIFIED FOR LLCE USE.

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS									
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4600000	0	4600000	0.00	0	4600000	30	1380000	5980000
311100	LLCE FIELD SIZE REDUCTION UNIT	15300000	0	15300000	0.00	0	15300000	30	4590000	19890000
341100	PROJECT MANAGEMENT-O/C	765000	0	765000	0.00	0	765000	30	229500	994500
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	20665000	0	20665000	0.00	0	20665000	30	6199500	26864500
PROJECT TOTAL		20,665,000	0	20,665,000	0.00	0	20,665,000	30	6,199,500	26,864,500

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
CONSTRUCTION										
00	TECHNICAL SERVICES	4600000	0	4600000	0.00	0	4600000	30	1380000	5980000
02	SITEWORK	100000	0	100000	0.00	0	100000	30	30000	130000
11	EQUIPMENT	15200000	0	15200000	0.00	0	15200000	30	4560000	19760000
19	PROJECT MANAGEMENT	765000	0	765000	0.00	0	765000	30	229500	994500
TOTAL CONSTRUCTION		20,665,000	0	20,665,000	0.00	0	20,665,000	30	6,199,500	26,864,500
PROJECT TOTAL		20,665,000	0	20,665,000	0.00	0	20,665,000	30	6,199,500	26,864,500

REFERENCE: ESTIMATE BASIS SHEET PAGE 3 OF 7
COST CODE ACCOUNT SUMMARY PAGE 5 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A ROUGH ORDER OF MAGNITUDE ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15 TO 50% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

AVERAGE ENGINEERING CONTINGENCY 30 %

CONSTRUCTION

AVERAGE CONSTRUCTION CONTINGENCY 30 %

AVERAGE PROJECT CONTINGENCY 30 %

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z278SAA7
FILE NO. Z278SAA7

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 7
PORTABLE PROCESSING FAC. ROUGH ORDER OF MAGNITUDE
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

DATE 11/10/94 11:18:15
BY LEE H. ROSSON

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4600000	0.00	0	0	0	0
311100	LLCE FIELD SIZE REDUCTION UNIT	15300000	0.00	0	0	0	0
341100	PROJECT MANAGEMENT-O/C	765000	0.00	0	0	0	0
PROJECT TOTAL		20,665,000		0	0	0	0

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C										
111100.00	TECHNICAL SERVICES										
111100.0011000	ENGINEERING - 30% OF COSTS ASSUME STUDY DIRECT TO DEFIN DESIGN	700	1 EA	0	0	0	0	4600000	0	0	4600000
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	4,600,000	0	0	4,600,000
TOTAL	COST CODE 70000			0	0	0	0	4,600,000	0	0	4,600,000
	WBS 111100										
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
TOTAL WBS 111100 DEFINITIVE DESIGN-CAT 1-ONSITE E/C				0	0	0	0	4,600,000	0	0	4,600,000

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
311100	LLCE FIELD SIZE REDUCTION UNIT										
311100.02	SITEWORK										
311100.0211010	RAILBED & RAILS FOR MARINE JET STRADDLE CARRIER ALLOW	700	1 EA	0	0	0	0	100000	0	0	100000
SUBTOTAL	SITEWORK			0		0		100,000		0	
					0		0		0		100,000
TOTAL	COST CODE 70002			0		0		100,000		0	
	WBS 311100				0		0		0		100,000
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
311100.11	EQUIPMENT										
311100.1111010	SUPPORT PROCESS UNIT, W/ STACK, HEPA FILTERS, MISC. DUCTWORK. NO FAN HP, STACK SIZE, FILTER REQ'TS ETC.	700	1 EA	0	0	0	0	3600000	0	0	3600000
311100.1111020	CUT & PACAKAGE WASTE, UNIT 2 NO EQUIPT LIST, OR REQUIRM'T AVAILABLE ALLOW	700	1 EA	0	0	0	0	4000000	0	0	4000000
311100.1111030	PROCESS AREA UNIT 3, NO EQUIPT LIST, OR REQUIREMENTS AVAILABLE ALLOW	700	1 EA	0	0	0	0	3200000	0	0	3200000
311100.1111043	AIR LOCK UNIT 4, W/FLANGE REMOVAL MECHANISM, NO PARTI-CULARS AVAILABLE ALLOW	700	1 EA	0	0	0	0	2400000	0	0	2400000
311100.1111050	STRADDLE CARRIER, MARINEJET TRAVEL LIFT, 500TON CAPACITY	700	1 EA	0	0	0	0	2000000	0	0	2000000
SUBTOTAL	EQUIPMENT			0		0		15,200,000		0	
					0		0		0		15,200,000
TOTAL	COST CODE 70011			0		0		15,200,000		0	
	WBS 311100				0		0		0		15,200,000
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
TOTAL WBS 311100 LLCE FIELD SIZE REDUCTION UNIT				0		0		15,300,000		0	
					0		0		0		15,300,000

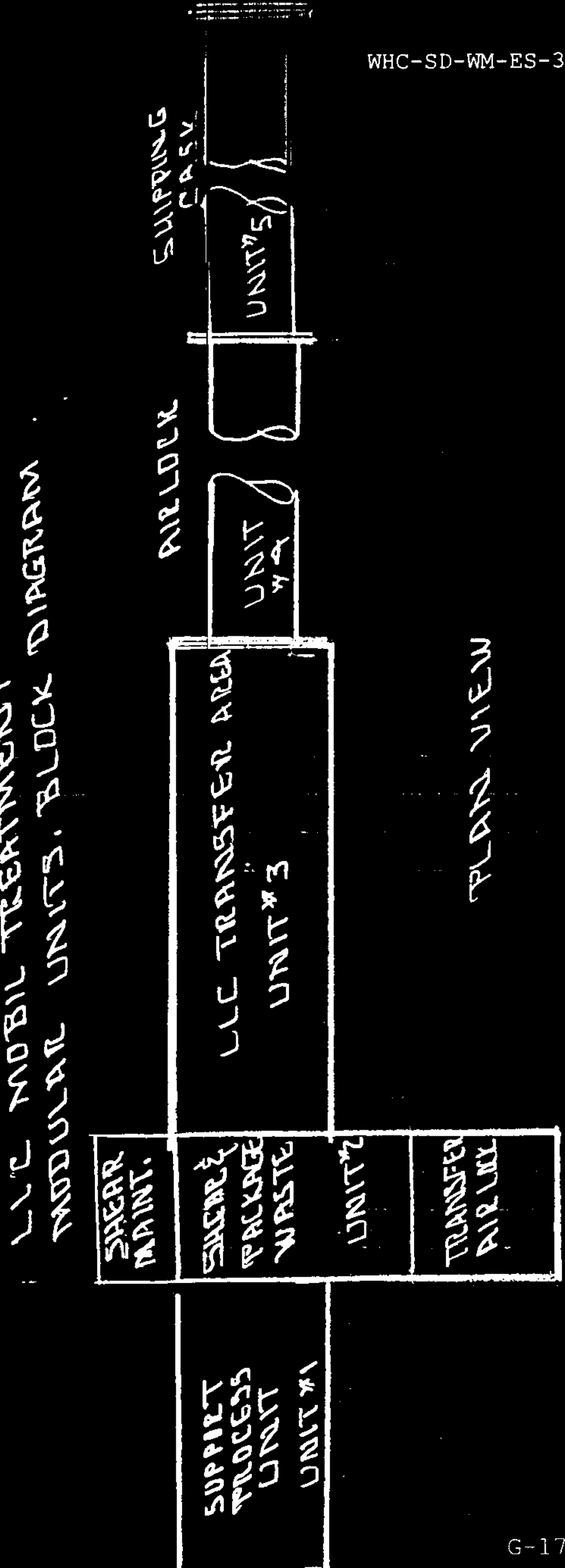
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
341100	PROJECT MANAGEMENT-O/C										
341100.19	PROJECT MANAGEMENT										
341100.1911010	OPC MANAGEMENT 5% OF COSTS	700	1 EA	0	0	0	0	765000	0	0	765000
SUBTOTAL	PROJECT MANAGEMENT			0	0	0	0	765,000	0	0	765,000
TOTAL	COST CODE 70019			0	0	0	0	765,000	0	0	765,000
	WBS 341100										
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
TOTAL WBS 341100 PROJECT MANAGEMENT-O/C				0	0	0	0	765,000	0	0	765,000

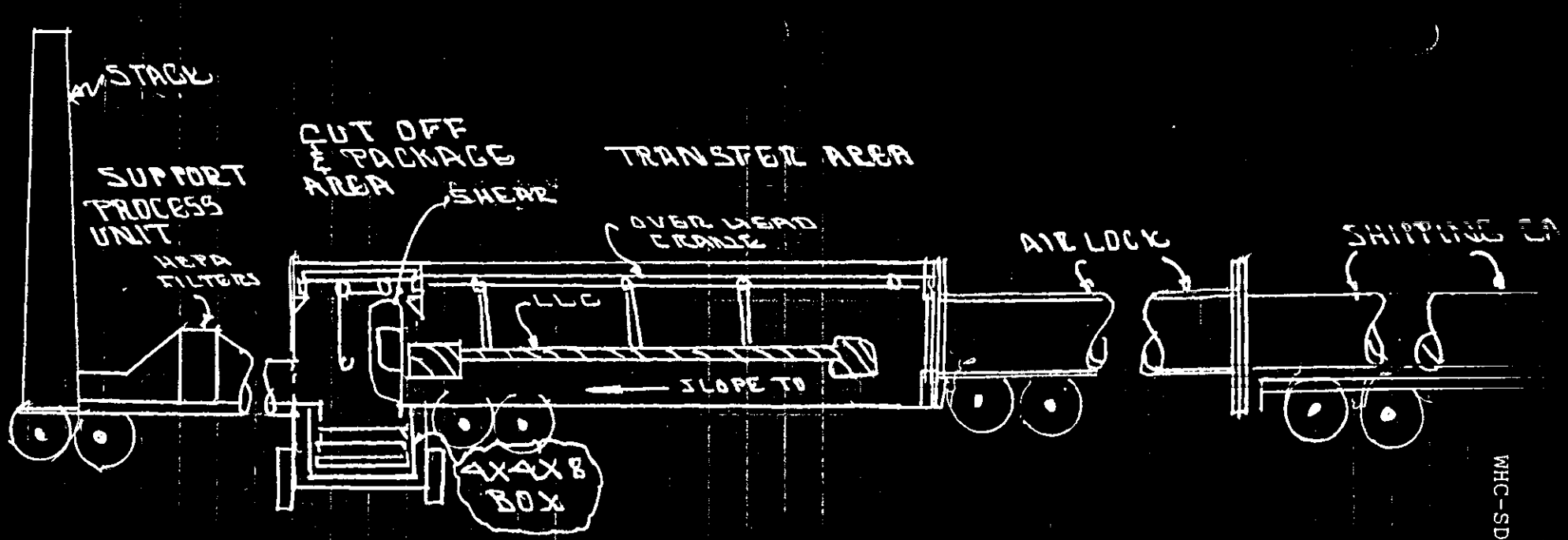
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
REPORT TOTAL				0		0	20,665,000			0	
					0		0		0		20,665,000

Mobile Treatment Facility, Horizontal Access:

KEH Estimate

Intentionally Blank


LLC MOBIL TREATMENT
MODULAR UNITS, BLOCK DIAGRAM
SUPPORT PROCESS UNIT
UNIT #1
SHEAR MAINT.
SHEAR & PACKAGE WASTE
UNIT #2
TRANSFER AIR LOCK
LLC TRANSFER AREA
UNIT #3
UNIT #4
AIRLOCK
UNIT #5
SHIPPING CASK
PLAN VIEW

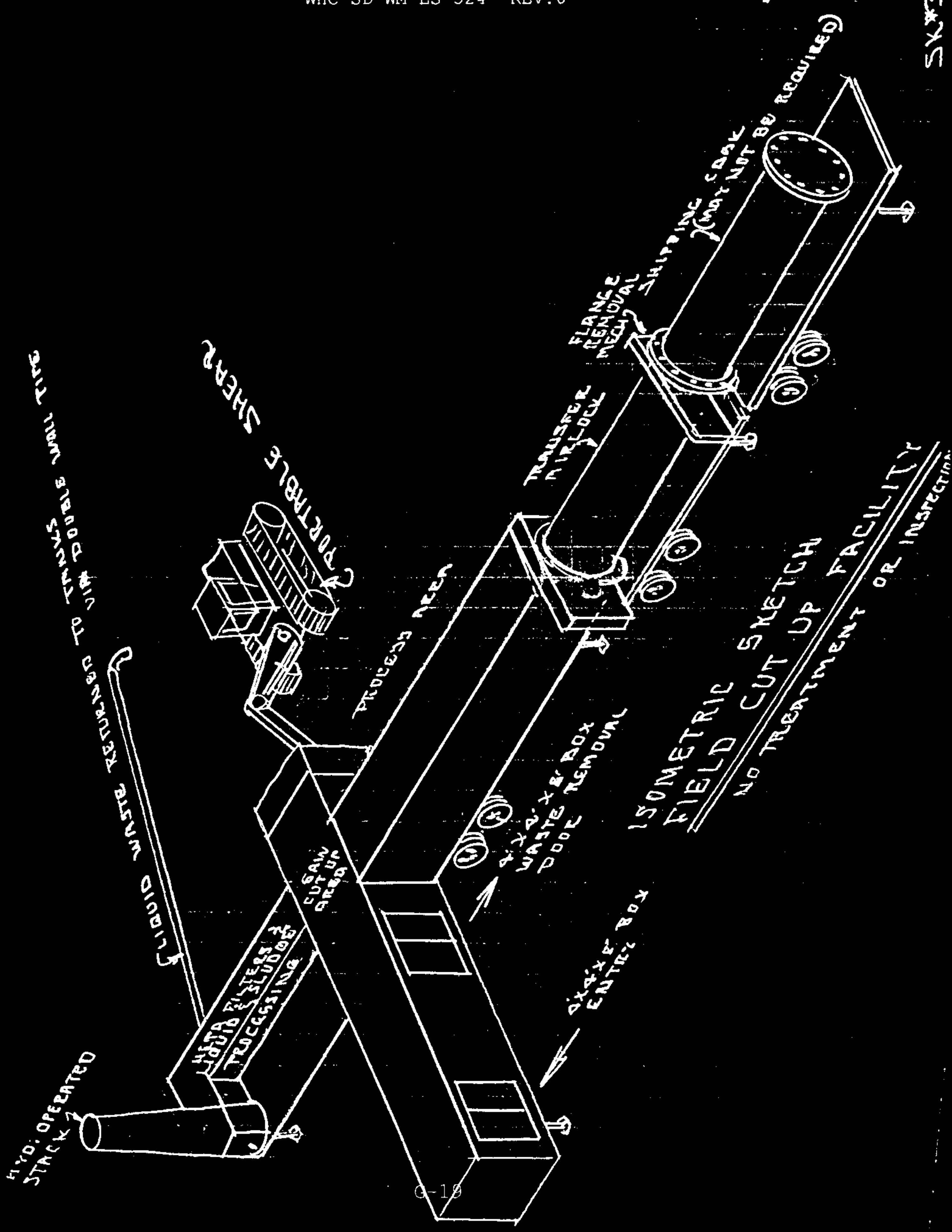


ELEVATION VIEW.

MAJOR DESIGN ISSUES WITH MOBIL PROCESS UNITS.

1. DOE ORDERS 6430.1A
   - A. DOUBLE CONTAINMENT
   - B. MISSILE PROTECTION
   - C. HVAC & HEPA FILTERS
   - D. EMERGENCY POWER/STD. POWER
   - E. FIRE PROTECTION & WATER SUPPLY
   - F SHIELDING FOR 30R/HR ~ 12" CONCRETE OR 150#/SQ.FT.

SK#2


SK#3
SHIPPING CASK
(MAY NOT BE REQUIRED)
FLANGE REMOVAL MECH
TRANSFER AIRLOCK
PORTABLE SHEAR
LIQUID WASTE RETURNED TO TANKS VIA DOUBLE WALL PIPE
PROCESS AREA
4'x4'x8' BOX WASTE REMOVAL DOOR
ISOMETRIC SKETCH
FIELD CUT UP FACILITY
NO TREATMENT OR INSPECTIO
SAW CUT UP AREA
HEPA FILTERS
LIQUID & SLUDGE PROCESSING
8'x4'x8' ENTRY BOX
HYD. OPERATED STACK

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/22789AA3
FILE NO. 22789AA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_R01 - PROJECT COST SUMMARY

PAGE 1 OF 7
DATE 11/08/94 13:40:21
BY LEE H. ROSSON

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS	17,900,000	30	5,370,000	23,270,000
	(ADJUSTED TO MEET DOE 5100.4)	+100,000		-370,000	-270,000
	PROJECT TOTAL	18,000,000	30	5,000,000	23,000,000

TYPE OF ESTIMATE: ROUGH ORDER OF MAGNITUDE 11-8-94
ARCHITECT ENGINEER: DOE
OPERATING CONTRACTOR:

REMARKS: INCORPORATED CLIENT COMMENTS.

CHECK

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/2270SAA3
FILE NO. 2270SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

DATE 11/08/94 13:40:31
BY LEE N. ROSSON

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4000000	0	4000000	0.00	0	4000000	30	1200000	[illegible]
SUBTOTAL 111	DEFINITIVE DESIGN-CAT 1	4000000	0	4000000	0.00	0	4000000	30	1200000	[illegible]
SUBTOTAL 1	ENGINEERING	4000000	0	4000000	0.00	0	4000000	30	1200000	[illegible]
311100	LLCE FIELD SIZE REDUCTION UNIT	13200000	0	13200000	0.00	0	13200000	30	3960000	[illegible]
SUBTOTAL 31	FA CONST-ONSITE E/C	13200000	0	13200000	0.00	0	13200000	30	3960000	[illegible]
341100	PROJECT MANAGEMENT-O/C	700000	0	700000	0.00	0	700000	30	210000	[illegible]
SUBTOTAL 34	PROJECT MANAGEMENT-O/C	700000	0	700000	0.00	0	700000	30	210000	[illegible]
SUBTOTAL 3	CONSTRUCTION	13900000	0	13900000	0.00	0	13900000	30	4170000	[illegible]
PROJECT TOTAL		17,900,000	0	17,900,000	0.00	0	17,900,000	30	5,370,000	[illegible]

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: LETTER OF INSTRUCTION, ICFKH ESTIMATE Z281SAA1, RNP T-PLANT COST ESTIMATE.

DRAWINGS: UNTITLED, UNDATED SKETCHES 1, 2, & 3

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR THE FOLLOWING ITEMS:

3. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS, TECHNICAL SERVICES AND CRAFT OVERHEAD COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEH ESTIMATING FACTOR/BILLING SCHEDULE, REVISION 16, DATED OCTOBER 01, 1993. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, FOR THIS PROJECT, IS 93% FOR SHOP WORK AND 134% FOR FIELD WORK, WHICH IS REFLECTED IN THE "OH&P/D&I" COLUMN OF THE ESTIMATE DETAIL.

B.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP) BASED ON THE ESTIMATING FACTOR/BILLING SCHEDULE. THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE KEH SUMMARY REPORT DOER07, INCLUDED WITH THIS ESTIMATE. (FINAL ESTIMATES MAY BE PARTIALLY MANLOADED AND INCLUDED WITHIN THE ESTIMATE DETAIL)

5. ESCALATION

NO ESCALATION HAS BEEN COMPUTED AS AN ENGINEERING SCHEDULE HASN'T BEEN RECEIVED.

6. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE I-32 SUBPARAGRAPH (H), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE I-11, DATED 10-31-84.

7. REMARKS

A.) EQUIPMENT PRICES ARE FROM REFERENCED ESTIMATES.
B.) ESTIMATE IS BASED ON USING AN EXISTING" ON SITE SHEAR" MODIFIED FOR LLCE USE.

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z270SAA3
FILE NO. Z270SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_R04 - COST CODE ACCOUNT SUMMARY

PAGE 4 OF 7
DATE 11/08/94 13:40:40
BY LEE H. ROSSON

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS									
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4000000	0	4000000	0.00	0	4000000	30	[illegible]	[illegible]
311100	LLCE FIELD SIZE REDUCTION UNIT	13200000	0	13200000	0.00	0	13200000	30	3960000	[illegible]
341100	PROJECT MANAGEMENT-O/C	700000	0	700000	0.00	0	700000	30	210000	[illegible]
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	17900000	0	17900000	0.00	0	17900000	30	5370000	[illegible]
PROJECT TOTAL		17,900,000	0	17,900,000	0.00	0	17,900,000	30	5,370,000	[illegible]

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/2270SAA3
FILE NO. 2270SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_ROS - ESTIMATE SUMMARY BY CSI DIVISION

DATE 11/08/94 13:40:47
BY LEE W. ROSSON

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
	CONSTRUCTION									
00	TECHNICAL SERVICES	4000000	0	4000000	0.00	0	4000000	30	1200000	[illegible]
11	EQUIPMENT	13200000	0	13200000	0.00	0	13200000	30	3960000	[illegible]
19	PROJECT MANAGEMENT	700000	0	700000	0.00	0	700000	30	210000	[illegible]
	TOTAL CONSTRUCTION	17,900,000	0	17,900,000	0.00	0	17,900,000	30	5,370,000	[illegible]
	PROJECT TOTAL	17,900,000	0	17,900,000	0.00	0	17,900,000	30	5,370,000	[illegible]

REFERENCE: ESTIMATE BASIS SHEET — PAGE 3 OF 7
COST CODE ACCOUNT SUMMARY — PAGE 5 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A ROUGH ORDER OF MAGNITUDE ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15 TO 50% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

AVERAGE ENGINEERING CONTINGENCY 30 %

CONSTRUCTION

AVERAGE CONSTRUCTION CONTINGENCY 30 %

AVERAGE PROJECT CONTINGENCY 30 %

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/2278SAA3
FILE NO. 2278SAA3

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

DATE 11/08/94 13:40:54
BY LEE H. ROSSON

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	4000000	0.00	0	0	0	0
311100	LLCE FIELD SIZE REDUCTION UNIT	13200000	0.00	0	0	0	0
341100	PROJECT MANAGEMENT-O/C	700000	0.00	0	0	0	0
	PROJECT TOTAL	17,900,000		0	0	0	0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/2278SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 1
DATE 11/08/94 13:41:02
BY LEE H. ROSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C										
111100.00	TECHNICAL SERVICES										
111100.0011000	ENGINEERING - 30% OF COSTS ASSUME STUDY DIRECT TO DEFIN DESIGN	700	1 EA	0	0	0	0	4000000	0	0	[illegible]
SUBTOTAL	TECHNICAL SERVICES			0	0		0	4,000,000	0	0	[illegible]
TOTAL	COST CODE 70000			0	0		0	4,000,000	0	0	[illegible]
	WBS 111100			0	0		0	4,000,000	0	0	[illegible]
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
TOTAL WBS 111100 DEFINITIVE DESIGN-CAT 1-ONSITE E/C				0	0		0	4,000,000	0	0	[illegible]

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z278SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
ODE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

DATE 11/08/94 13:41:02
BY LEE H. ROSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
311100	LLCE FIELD SIZE REDUCTION UNIT										
311100.11	EQUIPMENT										
311100.1111010	SUPPORT PROCESS UNIT, W/ STACK, HEPA FILTERS, MISC. DUCTWORK. NO FAN HP, STACK SIZE, FILTER REQ'TS ETC.	700	1 EA	0	0	0	0	3600000	0	0	3600000
311100.1111020	CUT & PACAKAGE WASTE, UNIT 2 NO EQUIPT LIST, OR REQUIRM'T AVAILABLE ALLOW	700	1 EA	0	0	0	0	4000000	0	0	4000000
311100.1111030	PROCESS AREA UNIT 3, NO EQUIPT LIST, OR REQUIREMENTS AVAILABLE ALLOW	700	1 EA	0	0	0	0	3200000	0	0	3200000
311100.1111043	AIR LOCK UNIT 4, W/FLANGE REMOVAL MECHANISH, NO PARTI-CULARS AVAILABLE ALLOW	700	1 EA	0	0	0	0	2400000	0	0	2400000
SUBTOTAL	EQUIPMENT			0	0	0	13,200,000		0		
					0		0		0		13,200,000
TOTAL	COST CODE 70011			0	0	0	13,200,000		0		
	WBS 311100 (ESCALATION 0.00% - CONTINGENCY 30.00 %)				0		0		0		13,200,000
TOTAL WBS 311100 LLCE FIELD SIZE REDUCTION UNIT				0	0	0	13,200,000		0		
					0		0		0		13,200,000

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z270SAA3

** TEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 3
DATE 11/08/94 13:41:02
BY LEE M. ROSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
341100	PROJECT MANAGEMENT-O/C										
341100.19	PROJECT MANAGEMENT										
341100.1911010	OPC MANAGEMENT 5% OF COSTS	700	1 EA	0	0	0	0	700000	0	0	700000
SUBTOTAL	PROJECT MANAGEMENT			0		0		700,000		0	
					0		0		0		700,000
TOTAL	COST CODE 70019			0		0		700,000		0	
	WBS 341100				0		0		0		700,000
	(ESCALATION 0.00% - CONTINGENCY 30.00 %)										
TOTAL WBS 341100 PROJECT MANAGEMENT-O/C				0		0		700,000		0	
					0		0		0		700,000

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/2278SAA3

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 3
ROUGH ORDER OF MAGNITUDE
DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 4
DATE 11/08/94 13:41:02
BY LEE N. NOSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
REPORT TOTAL				0	0	0	0	17,900,000	0	0	17,900,000

Mobile Treatment Facility, Vertical Access:

KEH Estimate

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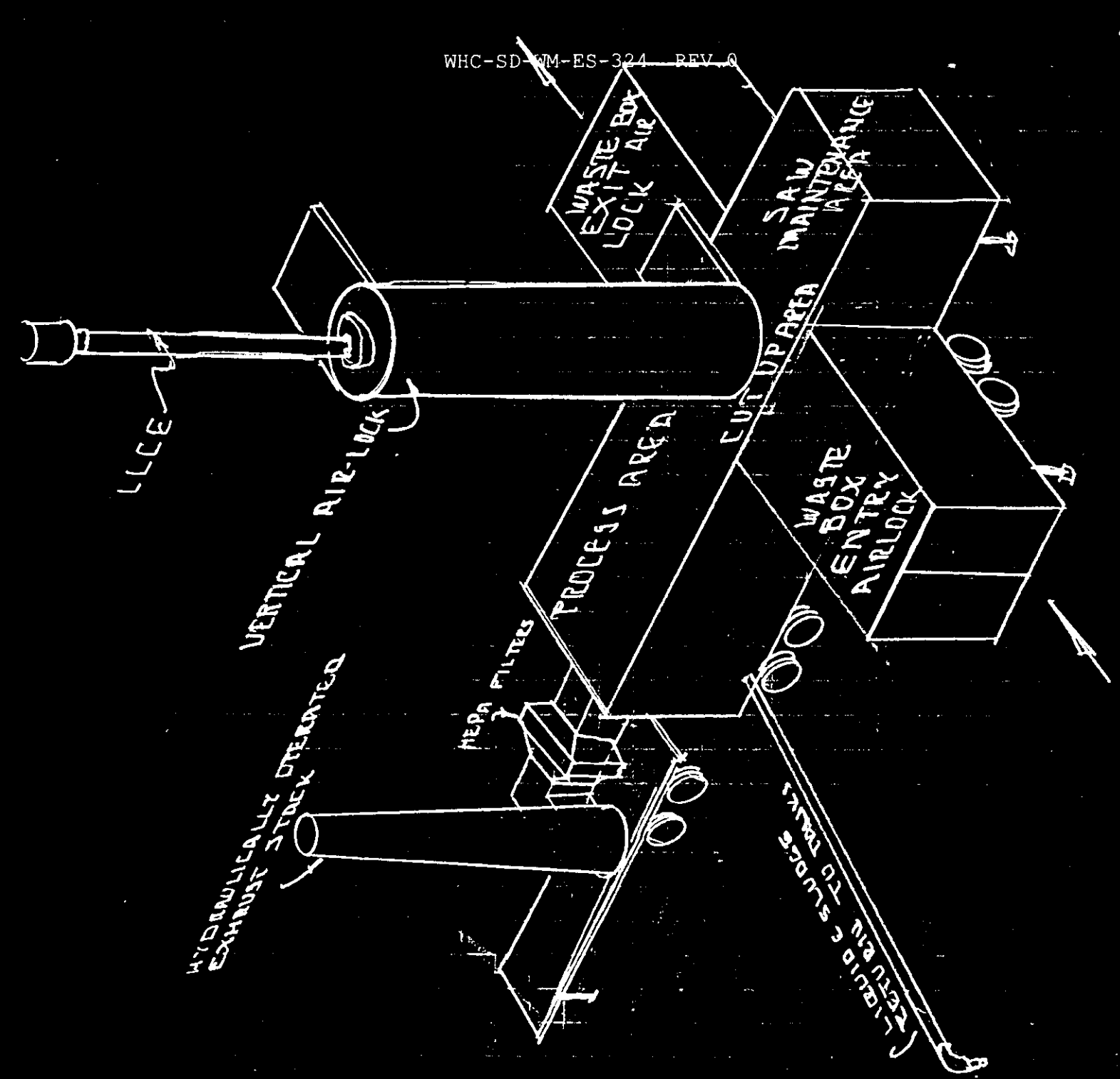
WASTE BOX EXIT AIR LOCK
SAW MAINTENANCE AREA
LLCE
VERTICAL AIR-LOCK
PROCESS AREA
CUT UP AREA
WASTE BOX ENTRY AIRLOCK
HEPA FILTERS
HYDRAULICALLY OPERATED AIRLOCK
EXHAUST
LIQUID & SLUDGE RETURN TO TANKS

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 4
ROUGH ORDER OF MAGNITUDE, VERTICAL AIRLOCK
DOE_R01 - PROJECT COST SUMMARY

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS	36,850,000	50	18,430,000	55,280,000
	(ADJUSTED TO MEET DOE 5100.4)	+ 150,000		-430,000	-280,000
	PROJECT TOTAL	37,000,000	50	18,000,000	55,000,000

TYPE OF ESTIMATE: ROUGH ORDER OF MAGNITUDE 11-14-94	REMARKS:
ARCHITECT ENGINEER	
OPERATING CONTRACTOR	

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	8200000	0	8200000	0.00	0	8200000	50	4100000	12300000
SUBTOTAL 111	DEFINITIVE DESIGN-CAT 1	8200000	0	8200000	0.00	0	8200000	50	4100000	12300000
SUBTOTAL 1	ENGINEERING	8200000	0	8200000	0.00	0	8200000	50	4100000	12300000
311100	LLCE FIELD SIZE REDUCTION UNIT	27250000	0	27250000	0.00	0	27250000	50	13625000	40875000
SUBTOTAL 31	FA CONST-ONSITE E/C	27250000	0	27250000	0.00	0	27250000	50	13625000	40875000
341100	PROJECT MANAGEMENT-O/C	1400000	0	1400000	0.00	0	1400000	50	700000	2100000
SUBTOTAL 34	PROJECT MANAGEMENT-O/C	1400000	0	1400000	0.00	0	1400000	50	700000	2100000
SUBTOTAL 3	CONSTRUCTION	28650000	0	28650000	0.00	0	28650000	50	14325000	42975000
PROJECT TOTAL		36,850,000	0	36,850,000	0.00	0	36,850,000	50	18,425,000	55,275,000

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: LETTER OF INSTRUCTION, ICFKH ESTIMATE Z281SAA1, RMP T-PLANT COST ESTIMATE.

DRAWINGS: UNTITLED, UNDATED SKETCH #

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR THE FOLLOWING ITEMS:

3. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS, TECHNICAL SERVICES AND CRAFT OVERHEAD COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEH ESTIMATING FACTOR/BILLING SCHEDULE, REVISION 16, DATED OCTOBER 01, 1993. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, FOR THIS PROJECT, IS 93% FOR SHOP WORK AND 134% FOR FIELD WORK, WHICH IS REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL.

B.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP) BASED ON THE ESTIMATING FACTOR/BILLING SCHEDULE. THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE KEH SUMMARY REPORT DOER07, INCLUDED WITH THIS ESTIMATE. (FINAL ESTIMATES MAY BE PARTIALLY MANLOADED AND INCLUDED WITHIN THE ESTIMATE DETAIL)

5. ESCALATION

NO ESCALATION HAS BEEN COMPUTED AS AN ENGINEERING SCHEDULE HASN'T BEEN RECEIVED.

6. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE I-32 SUBPARAGRAPH (M), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE I-11, DATED 10-31-84.

7. REMARKS

A.) EQUIPMENT PRICES ARE FROM REFERENCED ESTIMATES.
B.) ESTIMATE IS BASED ON USING AN EXISTING" ON SITE SHEAR" MODIFIED FOR LLCE USE.

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
700	SPECIAL EQUIP/PROCESS SYSTEMS									
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	8200000	0	8200000	0.00	0	8200000	50	4100000	12300000
311100	LLCE FIELD SIZE REDUCTION UNIT	27250000	0	27250000	0.00	0	27250000	50	13625000	40875000
341100	PROJECT MANAGEMENT-O/C	1400000	0	1400000	0.00	0	1400000	50	700000	2100000
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	36850000	0	36850000	0.00	0	36850000	50	18425000	55275000
PROJECT TOTAL		36,850,000	0	36,850,000	0.00	0	36,850,000	50	18,425,000	55,275,000

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
CONSTRUCTION										
00	TECHNICAL SERVICES	8200000	0	8200000	0.00	0	8200000	50	4100000	12300000
11	EQUIPMENT	27250000	0	27250000	0.00	0	27250000	50	13625000	40875000
19	PROJECT MANAGEMENT	1400000	0	1400000	0.00	0	1400000	50	700000	2100000
TOTAL CONSTRUCTION		36,850,000	0	36,850,000	0.00	0	36,850,000	50	18,425,000	55,275,000
PROJECT TOTAL		36,850,000	0	36,850,000	0.00	0	36,850,000	50	18,425,000	55,275,000

REFERENCE: ESTIMATE BASIS SHEET PAGE 4 OF 7
COST CODE ACCOUNT SUMMARY PAGE 5 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR AN R. O. M. ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15 TO 50 % .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

AVERAGE ENGINEERING CONTINGENCY 50 %

CONSTRUCTION

AVERAGE CONSTRUCTION CONTINGENCY 50 %

AVERAGE PROJECT CONTINGENCY 50 %

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	8200000	0.00	0	0	0	0
311100	LLCE FIELD SIZE REDUCTION UNIT	27250000	0.00	0	0	0	0
341100	PROJECT MANAGEMENT-O/C	1400000	0.00	0	0	0	0
PROJECT TOTAL		36,850,000		0	0	0	0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E13571/Z278SAA4

** IEST - INTERACTIVE ESTIMATING **
LLCE OPTIONS STUDY, SIZE REDUCTION OPTION 4
ROUGH ORDER OF MAGNITUDE, VERTICAL AIRLOCK
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 1
DATE 11/07/94 09:40:13
BY LEE H. ROSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C										
111100.00	TECHNICAL SERVICES										
111100.0011000	ENGINEERING - 30% OF COSTS ASSUME STUDY DIRECT TO DEFIN DESIGN	700	1 EA	0	0	0	0	8200000	0	0	8200000
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	8,200,000	0	0	8,200,000
TOTAL	COST CODE 70000			0	0	0	0	8,200,000	0	0	8,200,000
	WBS 111100										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 111100 DEFINITIVE DESIGN-CAT 1-ONSITE E/C				0	0	0	0	8,200,000	0	0	8,200,000

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
311100	LLCE FIELD SIZE REDUCTION UNIT										
311100.11	EQUIPMENT										
311100.1111010	SUPPORT PROCESS UNIT, W/ STACK, HEPA FILTERS, MISC. DUCTWORK. NO FAN HP, STACK SIZE, FILTER REQ'TS ETC.	700	1 EA	0	0	0	0	6000000	0	0	6000000
311100.1111020	CUT & PACAKAGE WASTE, UNIT 2 NO EQUIPT LIST, OR REQUIRM'T AVAILABLE ALLOW	700	1 EA	0	0	0	0	8000000	0	0	8000000
311100.1111030	PROCESS AREA UNIT 3, NO EQUIPT LIST, OR REQUIREMENTS AVAILABLE ALLOW	700	1 EA	0	0	0	0	7000000	0	0	7000000
311100.1111043	AIR LOCK UNIT 4, W/FLANGE REMOVAL MECHANISM, NO PARTICULARS AVAIL. VERT. POSIT'N INSTALLATION. ALLOW	700	1 EA	0	0	0	0	6250000	0	0	6250000
SUBTOTAL	EQUIPMENT			0	0	0	0	27,250,000	0	0	27,250,000
TOTAL	COST CODE 70011			0	0	0	0	27,250,000	0	0	27,250,000
	WBS 311100 (ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 311100 LLCE FIELD SIZE REDUCTION UNIT				0	0	0	0	27,250,000	0	0	27,250,000

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
341100	PROJECT MANAGEMENT-O/C										
341100.19	PROJECT MANAGEMENT										
341100.1911010	OPC MANAGEMENT 5% OF COSTS	700	1 EA	0	0	0	0	1400000	0	0	1400000
SUBTOTAL	PROJECT MANAGEMENT			0	0	0	0	1,400,000	0	0	1,400,000
TOTAL	COST CODE 70019			0	0	0	0	1,400,000	0	0	1,400,000
	WBS 341100										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 341100 PROJECT MANAGEMENT-O/C				0	0	0	0	1,400,000	0	0	1,400,000

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
REPORT TOTAL				0		0	36,850,000			0	
					0		0		0		36,850,000

D&D Storage Pad:

KEH Estimate

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/Z278SAA5
FILE NO. Z278SAA5

** JEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R01 - PROJECT COST SUMMARY

DATE 11/09/94 13:41:29
BY LEE H. ROSSON

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY X	CONTINGENCY TOTAL	TOTAL DOLLARS
810	DEMOLITION	80,000	50	40,000	120,000
	(ADJUSTED TO MEET DOE 5100.4)				
	PROJECT TOTAL	80,000	50	40,000	120,000

TYPE OF ESTIMATE: ROUGH ORDER OF MAGNITUDE 11-9-94
ARCHITECT ENGINEER: GEL
OPERATING CONTRACTOR:

REMARKS: CHECK

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	20700	0	20700	0.00	0	20700	50	10350	3105
SUBTOTAL 111	DEFINITIVE DESIGN-CAT 1	20700	0	20700	0.00	0	20700	50	10350	3105
SUBTOTAL 1	ENGINEERING	20700	0	20700	0.00	0	20700	50	10350	3105
311100	FORCE ACCOUNT CONSTR - ONSITE E/C	56925	0	56925	0.00	0	56925	50	28463	8538
SUBTOTAL 31	FA CONST-ONSITE E/C	56925	0	56925	0.00	0	56925	50	28463	8538
341100	PROJECT MANAGEMENT-O/C	3450	0	3450	0.00	0	3450	50	1725	517
SUBTOTAL 34	PROJECT MANAGEMENT-O/C	3450	0	3450	0.00	0	3450	50	1725	517
SUBTOTAL 3	CONSTRUCTION	60375	0	60375	0.00	0	60375	50	30188	9056
PROJECT TOTAL		81,075	0	81,075	0.00	0	81,075	50	40,538	12,161

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/Z270SAA5
FILE NO. Z270SAA5

** TEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R03 - ESTIMATE BASIS SHEET

DATE 11/09/94 12:48:15
BY LEE M. ROSSON

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: LETTER OF INTENT, UNDATED

DRAWINGS: NONE

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR THE FOLLOWING ITEMS:
NOTHING SPECIFIED

3. ESCALATION

NO ESCALATION WAS CALCULATED, NO SCHEDULE HAS BEEN RECEIVED FROM ENGINEERING.

4. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE I-32 SUBPARAGRAPH (M), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE I-11, DATED 10-31-84.

5. REMARKS

A.) INFORMATION OF LIQUID RETENTION IS VERY SKETCHY.
B.) NO DECONTAMINATION IS INCLUDED IN THIS ESTIMATE.

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/Z278SAA5
FILE NO. Z278SAA5

** JEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE
SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R04 - COST CODE ACCOUNT SUMMARY

DATE 11/09/94 13:41:43
BY LEE H. ROSSON

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
810	DEMOLITION									
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	20700	0	20700	0.00	0	20700	50	10350	3105
311100	FORCE ACCOUNT CONSTR - ONSITE E/C	56925	0	56925	0.00	0	56925	50	28463	8538
341100	PROJECT MANAGEMENT-O/C	3450	0	3450	0.00	0	3450	50	1725	517
TOTAL 810	DEMOLITION	81075	0	81075	0.00	0	81075	50	40538	12161
PROJECT TOTAL		81,075	0	81,075	0.00	0	81,075	50	40,538	21,61

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/Z278SAA5
FILE NO. Z278SAA5

** TEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE
SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R05 - ESTIMATE SUMMARY BY CSI DIVISION

DATE 11/09/94 13:41:50
BY LEE M. ROSSON

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
CONSTRUCTION										
00	TECHNICAL SERVICES	20700	0	20700	0.00	0	20700	50	10350	310
02	SITEWORK	5175	0	5175	0.00	0	5175	50	2588	77
03	CONCRETE	51750	0	51750	0.00	0	51750	50	25875	776
19	PROJECT MANAGEMENT	3450	0	3450	0.00	0	3450	50	1725	51
TOTAL CONSTRUCTION		81,075	0	81,075	0.00	0	81,075	50	40,538	21,6
PROJECT TOTAL		81,075	0	81,075	0.00	0	81,075	50	40,538	1,6

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGE 3 OF 7
PAGE 5 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A R.O.M. ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15 TO 50 % .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

AVERAGE ENGINEERING CONTINGENCY 50 %

CONSTRUCTION

1) LACK OF CONTAMINATION INFORMATION AND DETAILS OF USE DICTATES A 50% CONTINGENCY.

AVERAGE CONSTRUCTION CONTINGENCY 50 %

AVERAGE PROJECT CONTINGENCY 50 %

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/2278SAA5
FILE NO. 2278SAA5

** TEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

DATE 11/09/94 13:41:57
BY LEE H. ROSSON

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C	20700	0.00	0	0	0	
311100	FORCE ACCOUNT CONSTR - ONSITE E/C	56925	0.00	0	0	0	
341100	PROJECT MANAGEMENT-O/C	3450	0.00	0	0	0	
PROJECT TOTAL		81,075		0	0	0	

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/2278SAA5

** TEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

DATE 11/09/94 13:42:05
BY LEE H. ROSSON

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	ON&P / B & I	TOTAL DOLLARS
111100	DEFINITIVE DESIGN-CAT 1-ONSITE E/C										
111100.00	TECHNICAL SERVICES										
111100.0011000	ENGINEERING. 30% TOTAL COST	810	1 LOT	0	0	0	0	18000	0	2700	20,7
SUBTOTAL	TECHNICAL SERVICES			0		0		18,000		2,700	
					0		0		0		20,7
TOTAL	COST CODE 81000			0		0		18,000		2,700	
	WBS 111100				0		0		0		20,7
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 111100 DEFINITIVE DESIGN-CAT 1-ONSITE E/C				0		0		18,000		2,700	
					0		0		0		20,7

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLAR
311100	FORCE ACCOUNT CONSTR - ONSITE E/C										
311100.02	SITEWORK										
311100.0211010	BACKFILL & LEVEL - RESEED .67' X 60' X 200' = 12000SFT	810	300 CYD	0	0	0	0	4500	0	675	5,1
SUBTOTAL	SITEWORK			0	0	0	0	4,500	0	675	5,1
TOTAL	COST CODE 81002 WBS 311100 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	4,500	0	675	5,1
311100.03	CONCRETE										
311100.0311010	DEMOLITION, CONC. SLAB .67' X 60' X 200. BREAKUP, HAUL TO SALVAGE.	810	300 CYD	0	0	0	0	45000	0	6750	51,7
SUBTOTAL	CONCRETE			0	0	0	0	45,000	0	6,750	51,7
TOTAL	COST CODE 81003 WBS 311100 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	45,000	0	6,750	51,7
TOTAL WBS 311100 FORCE ACCOUNT CONSTR - ONSITE E/C				0	0	0	0	49,500	0	7,425	56,9

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P	TOTAL
341100	PROJECT MANAGEMENT-O/C										
341100.19	PROJECT MANAGEMENT										
341100.1911010	OPC MANAGEMENT, 5% CONSTRUCTION COSTS	810	1 LS	0	0	0	0	3000	0	450	3,4
SUBTOTAL	PROJECT MANAGEMENT			0	0	0	0	3,000	0	450	3,4
TOTAL	COST CODE 81019 WBS 341100 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	3,000	0	450	3,4
TOTAL WBS 341100 PROJECT MANAGEMENT-O/C				0	0	0	0	3,000	0	450	3,4

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD
JOB NO. E1357/2278SAA5

** TEST - INTERACTIVE ESTIMATING **
DECOMMISSION & REMOVE .67' X 60' X 200' CONCRETE
SLAB. LLCE OPTION STUDY, ROM, OPTION 5
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / G & A	TOTAL DOLLAR
REPORT TOTAL				0	0	0	0	70,500	0	10,575	81,07

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Appendix H:

Cost Estimate Scenario Results

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Cost Estimate Results

Total Cost Results

Multiplier	Number Retrieved	Total Cost ($ M)														
		NA	2B	2B/T	2B/06	2B/GRV	2B/FSM	2B/FDR	2B/FSR	2B/T/FSR	2B/06/FSR	2B/GRV/FSR	2B/FSM/FSR	2B/2B/FSM	2B/06/FSM	2B/2B/GRV	2B/06/GRV
1.0	1,922	1,148.14	879.45	678.65	555.87	383.66	474.88	585.25	613.63	603.79	499.42	365.87	435.15	506.10	535.07	394.67	432.68
0.1	199	123.31	84.50	189.04	110.63	59.54	67.77	68.31	72.87	180.93	105.79	60.22	64.91	70.86	116.50	62.15	108.82
0.2	390	237.80	152.00	246.09	160.14	93.30	112.36	111.36	129.16	230.06	149.17	93.20	105.10	118.43	162.54	98.28	144.77
0.3	580	350.70	220.20	301.59	209.82	128.70	157.64	155.11	186.11	279.25	193.59	127.84	146.98	168.09	209.27	136.21	181.16
0.4	767	461.82	283.56	353.44	256.94	161.26	201.15	197.07	239.08	325.59	235.88	159.61	186.57	215.52	254.23	171.65	214.08
0.5	968	581.26	354.07	410.11	309.86	197.84	247.48	241.74	297.34	375.67	282.15	196.16	228.83	264.84	302.11	210.64	254.41
0.6	1,153	691.19	422.62	459.39	356.28	228.95	290.61	289.33	349.45	419.14	322.76	227.41	268.04	310.79	346.62	243.90	287.60
0.7	1,350	808.25	538.39	512.52	407.02	266.55	337.85	357.51	408.12	466.89	367.91	261.82	311.29	362.27	395.32	282.85	324.19
0.8	1,536	918.77	647.39	561.12	454.16	298.35	381.74	427.86	458.89	510.53	409.76	293.85	351.24	408.01	440.56	320.43	358.89
0.9	1,735	1,037.02	768.28	616.46	508.41	336.31	429.03	506.55	528.22	559.31	456.42	330.11	394.54	458.93	489.26	359.02	398.40
1.0	1,922	1,148.14	879.45	678.65	555.87	383.66	474.88	585.25	613.63	603.79	499.42	365.87	435.15	506.10	535.07	394.67	432.68
1.1	2,120	1,265.79	995.57	758.19	623.35	442.11	542.19	669.21	702.39	649.63	543.65	399.64	477.23	555.41	582.62	432.04	473.75
1.2	2,305	1,375.72	1,125.08	858.88	695.48	502.75	609.99	749.69	785.91	692.62	585.78	430.95	516.40	600.65	636.13	483.22	527.70

Cost/Item Results

Multiplier	Number Retrieved	Cost/Item ($ K)														
		NA	2B	2B/T	2B/06	2B/GRV	2B/FSM	2B/FDR	2B/FSR	2B/T/FSR	2B/06/FSR	2B/GRV/FSR	2B/FSM/FSR	2B/2B/FSM	2B/06/FSM	2B/2B/GRV	2B/06/GRV
1.0	1,922	597.37	457.57	353.09	289.21	199.62	247.07	304.50	319.27	314.15	259.85	190.36	226.40	263.32	278.39	205.35	225.12
0.1	199	619.64	424.61	949.97	555.91	299.20	340.54	343.25	366.16	909.22	531.61	302.60	326.16	356.10	585.42	312.33	546.83
0.2	390	609.75	389.74	630.99	410.60	239.24	288.10	285.53	331.18	589.90	382.49	238.97	269.50	303.68	416.76	252.01	371.21
0.3	580	604.66	379.66	519.98	361.76	221.89	271.80	267.43	320.88	481.46	333.77	220.42	253.42	289.80	360.81	234.84	312.34
0.4	767	602.11	369.70	460.81	335.00	210.25	262.26	256.94	311.71	424.50	307.53	208.10	243.24	281.00	331.46	223.79	279.12
0.5	968	600.47	365.77	423.67	320.10	204.48	255.66	249.74	307.17	388.09	291.48	202.64	236.40	273.59	312.10	217.60	262.82
0.6	1,153	599.47	366.54	398.43	309.01	198.57	252.05	250.94	303.08	363.52	279.93	197.23	232.47	269.55	300.62	211.53	249.44
0.7	1,350	598.70	398.81	379.65	301.50	197.44	250.26	264.82	302.31	345.84	272.52	193.94	230.59	268.35	292.83	209.52	240.14
0.8	1,536	598.16	421.48	365.31	295.68	194.24	248.53	278.55	298.75	332.38	266.77	191.31	228.67	265.63	286.83	208.61	233.65
0.9	1,735	597.71	442.81	355.31	293.03	193.84	247.28	291.96	304.45	322.37	263.07	190.27	227.40	264.51	281.99	206.93	229.62
1.0	1,922	597.37	457.57	353.09	289.21	199.62	247.07	304.50	319.27	314.15	259.85	190.36	226.40	263.32	278.39	205.35	225.12
1.1	2,120	597.07	469.61	357.64	294.03	208.54	255.75	315.67	331.32	306.43	256.53	188.51	225.11	261.99	274.82	203.79	223.47
1.2	2,305	596.84	488.10	372.62	301.73	218.11	264.64	325.24	340.96	300.49	254.13	186.96	224.04	260.58	275.98	209.64	228.94

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