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IDAHO NATIONAL ENGINEERING LABORATORY

Managed by the U.S. Department of Energy

Prepared for the
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Idaho Falls, Idaho 83403

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Summary

During the early years (1950-1965) of Idaho Chemical Processing Plant (ICPP) operations, eleven, 300,000-gallon waste storage tanks were constructed and now constitute the major portion of the ICPP Tank Farm. These tanks were built to the standards at the time of construction, but do not meet all current standards. A project was in progress to replace these aging tanks; however, since fuel reprocessing has been curtailed at ICPP, it is not clear that the new tanks are required. The Department of Energy (DOE) requested a systems engineering evaluation to determine the need for the new tanks. To satisfy this request, a Westinghouse Idaho Nuclear Company team was assembled to perform the study.

The systematic approach used for the study consisted of five steps: problem definition, functional requirements determination, alternatives determination, systems definition, and evaluation and optimization.

The defined problem, as presented to the committee, was to evaluate all feasible options for emptying the existing Tank Farm and to determine the need for new tanks. The functional requirements identified for the study were: it must meet current regulations, be cost effective, minimize technical risk, consider waste minimization, minimize the time required to treat the waste, minimize required new tank volume, and be compatible with all current wastes and any new wastes expected to be generated.

Over 100 alternatives were identified during a facilitated team meeting using Value Engineering techniques. After eliminating any ideas which clearly could not meet the requirements, the remaining ideas were combined into nine basic cases with five sub cases. These fourteen cases were then carefully defined using two methods. First, each case was drawn graphically to show waste processing equipment interfaces and time constraints where they existed or were imposed. Second, each case was analyzed using a time-dependent computer simulation of ICPP waste management activities to determine schedule interactions, liquid storage requirements, and solid waste quantities. The modeling was a life-cycle analysis that included processing of the waste, both liquid and solid, to an immobilized state. The simulation for each case was terminated when essentially all of the liquid and calcine had been processed. Life-cycle costs were calculated for each case based on these modeling results.

The evaluation and optimization steps were then carried out using data obtained for each case from a regulations analysis, computer modeling, a technical risk analysis, and a life-cycle cost analysis.

Based on the evaluation data, the team developed the following recommendations:

- Install and operate the high-level liquid waste evaporator.

- Minimize liquid waste generation as much as possible within the constraints of required ICPP operational, safety, and environmental commitments.

- Bring a Waste Immobilization Facility on line by 2008 or earlier.

- Operate NWCF as required to alleviate the need for new tank farm capacity (Waste Immobilization Facility process surge will still be required).

- Maximize the concentration of sodium and potassium in the calcine to minimize the final amount of waste requiring immobilization.

- Avoid using Bin Set 7 for calcine storage, if at all possible, to reduce future calcine retrieval and D&D costs.

- Use WM-190 for liquid waste storage and one of the pillar and panel vaulted tanks as the spare.

Operation of the high-level liquid waste evaporator and NWCF, if combined with waste minimization, should allow DOE to meet the Notice of Noncompliance (NON) Consent Order requirement to cease use of the tanks contained in pillar and panel vaults by 2009. Operation of the Waste Immobilization Facility should allow DOE to meet the NON Consent Order requirement to cease use of the remaining Tank Farm tanks by 2015. Replacement Tank Farm tanks should not be required with this proposed action. A thorough risk analysis was not done for these recommendations due to lack of time and the absence of the type of data required for a reliable analysis. Although each step in the modeling was carefully done to reflect what is expected to occur, the conditions modeled could change significantly during the years covered by the modeling. If the recommendations are not followed, or cannot be followed (due to changing conditions), new tanks or renegotiation of the NON Consent Order will be required and one or both should be prepared for sufficiently in advance to allow continued safe operation of the ICPP. Construction of a Waste Immobilization Facility is ultimately required no matter what waste management plan is followed; any delay in its construction increases life-cycle costs.

Although the team, as a whole, prefers this recommendation over other possible scenarios, other stakeholders may rank the cases differently than the team, due to giving higher or lower weighting to the various functional requirements. If a different, final recommendation results from the interaction of the various stakeholders, this is acceptable to the team since all of the cases described in the report lead to acceptable final waste treatment and storage conditions. Each case takes a somewhat different path to the end point and each case has its specific advantages and disadvantages.

Additional actions, not based on assumptions used in the model, which should be considered, are:

- Approach the State on the possibility of renegotiating the NON Consent Order to eliminate the requirement for operation of the NWCF every 3 consecutive years and to extend both cease use dates for the Tank Farm by approximately five years.

- Approach the District Court on the possibility of revising the Amended Order Modifying Order of June 28, 1993 to eliminate the requirement to remove all high-level liquid waste (that waste currently in WM-189) from the Tank Farm by 1998.

If successful, these actions would eliminate the need to operate NWCF or build new tanks and would ultimately save hundreds of millions of dollars. The high-level liquid waste evaporator and the 2008 Waste Immobilization Facility would still be required with this course of action.

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Abbreviations

ANN	Aluminum Nitrate Nonahydrate
BRC	Below Regulatory Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	Consent Order
CPPSIM	CPP Simulation Model
CsIX	Cesium Ion Exchange
CX	Categorical Exclusion
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOE-ID	Department of Energy - Idaho Operations Office
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
FFCA	Federal Facilities Compliance Act
FONSI	Finding of No Significant Impact
HAW	High Activity Waste
HEPA	High Efficiency Particulate Air
HLLW	High Level Liquid Waste
HLLWE	High Level Liquid Waste Evaporator

ICPP	Idaho Chemical Processing Plant
IDAPA	Idaho Administrative Procedures Act
IDHW	Idaho Department of Health and Welfare
INEL	Idaho National Engineering Laboratory
LAW	Low Activity Waste
LDR	Land Disposal Restrictions
LET&D	Liquid Effluent Treatment and Disposal
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_x	Nitrogen Oxides
NON	Notice of Noncompliance
NSPS	New Source Performance Standards
NWCF	New Waste Calcining Facility
PEWE	Process Equipment Waste Evaporator
PTC	Permit to Construct
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RD&D	Research, Development, and Demonstration
ROD	Record of Decision
SrEx	Strontium Extraction
TRU	Transuranic
TRUEX	Transuranic Extraction

TSD	Treatment, Storage, and Disposal
WIF	Waste Immobilization Facility
WINCO	Westinghouse Idaho Nuclear Company, Inc.

I. Introduction

The Idaho Chemical Processing Plant (ICPP) began operations in the early 1950s with two 300,000-gallon liquid waste tanks (WM-180 and WM-181) which were constructed from 1950 to 1953 and were housed in monolithic concrete vaults. As the scope of the ICPP operations increased, additional tanks were put into service. Tanks WM-182 through WM-186 were constructed from 1953 to 1957 and were housed in pillar and panel vaults. WM-187 through WM-190 were constructed from 1959 to 1965 and were housed in a four-sectioned, monolithic, concrete vault. All of these tanks were built to the standards at the time of construction and have served their designed function.

Due to aging of the tanks and more stringent requirements in the areas of secondary containment and seismic stability, a project was initiated in 1989 to replace the tanks. The Notice of Noncompliance (NON) issued by the Environmental Protection Agency (EPA) on January 28, 1990, supported the decision to construct replacement tanks by contending that the eleven tanks in the ICPP Tank Farm and much of their associated valves and piping were not in compliance with secondary containment requirements. The NON Consent Order, signed April 3, 1992, outlines a strict compliance schedule for the completion of several tasks that will ultimately result in the required permanent cessation of use of the 5 pillar and panel tank vaults[1] containing tanks WM-182 through WM-186 on or before March 31, 2009; and the remaining 6 monolithic vaults containing tanks WM-180, WM-181, and WM-187 through WM-190 on or before June 30, 2015, among other provisions. However, the April 1992 decision to no longer reprocess spent fuel at ICPP resulted in the tank replacement project being put on hold. The Amended Order Modifying (the District Court) Order of June 28, 1993 (signed December 22, 1993), calls for beginning construction of new tanks by the end of the 1996 construction season, if new tanks are determined to be needed in the Record of Decision (ROD) on the Environmental Impact Statement (EIS) required by the Order of June 28, 1993.

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[1]The waste tank vaults surrounding the tanks consist of three separate designs. The pillar and panel vaults are the vaults enclosing tanks WM-182 to WM-186. These vaults are precast reinforced concrete construction. Sixteen columns are distributed around the octagonal vault perimeter. Six-inch thick vertical precast wall panels are clipped to these columns. The monolithic vaults enclose tanks WM-180, WM-181, and WM-187 through WM-190. The vaults enclosing tanks WM-180 and WM-181 are octagonal in plan and were constructed completely of cast-in-place concrete. Tanks WM-187 through WM-190 are laid out on a 2 x 2 grid and are enclosed by a single rectangular vault with partition walls separating the tanks. The exterior and partition walls are integral with the mat.

To aid in deciding if the tank replacement project should be continued, the Idaho Operations Office for the Department of Energy (DOE-ID) asked Westinghouse Idaho Nuclear Company, Inc. (WINCO) to perform a systems engineering evaluation to determine the need for replacement tanks. To satisfy this request, a WINCO team was assembled in late October to perform the study and to issue a report of its conclusions to DOE-ID by January 31, 1994.

II. Background

The ICPP is one of the principal facilities at the United States Department of Energy's (DOE) Idaho National Engineering Laboratory (INEL). The ICPP facilities were originally designed for the storage and reprocessing of spent nuclear fuel from test and research reactors in the United States and foreign countries and from the U. S. Navy's ship propulsion reactors, and to effectively manage the radioactive wastes generated during fuel storage and reprocessing.

An extensive liquid waste management system is in place at the ICPP. The major processing storage units consist of the Tank Farm, the Process Equipment Waste Evaporator (PEWE), the Liquid Effluent Treatment and Disposal (LET&D) Facility, the New Waste Calcining Facility (NWCF)[2], the proposed High Level Liquid Waste Evaporator (HLLWE)[3], and the Calcine Storage Bin Sets.

Radioactive wastes generated from ICPP operations are generally concentrated in the PEWE prior to storage in the Tank Farm or occasionally sent directly to the Tank Farm. Acid in the PEW evaporator overheads is separated for recycle by the LET&D fractionators. The HLLWE is used to concentrate wastes stored in the Tank Farm prior to treatment in NWCF. In the NWCF, the liquid wastes are converted to a solid granular form, which is then stored in the calcine bin sets.

In the past, the NWCF has processed sodium waste by blending it with first-cycle raffinate wastes generated from fuel reprocessing. Since the ICPP will no longer reprocess spent fuel, no more reprocessing waste will be available, once tank WM-189 is emptied. Sodium waste cannot be calcined directly because the sodium and

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[2]The New Waste Calcining Facility houses the calciner, the high-efficiency particulate air (HEPA) filter leaching system, and the NWCF decontamination area, and will house the high level liquid waste evaporator. For this report, the term "NWCF", when used without a modifier, refers to the calciner and its associated process equipment.

[3]The HLLWE will process both high-level and non high-level liquid waste. It is referred to as the NWCF Evaporator Tank System in the Resource Conservation and Recovery Act (RCRA) permit application.

potassium form compounds that melt at calcination and bin storage temperatures causing the calcine to agglomerate. Experimental tests have determined that the sodium waste can be calcined if blended with aluminum nitrate at a ratio that results in calcine with a maximum sodium plus potassium mole percent of 8.4% to 11.5%. At concentrations higher than this, the feed blend becomes difficult to calcine in the NWCF and the calcine will agglomerate in the bins and not be retrievable.

The process to create an acceptable final waste form has yet to be selected. Options under consideration include immobilization of the calcine into either a glass or glass-ceramic, or redissolution of the calcine and subsequent separation of the waste into high- and low-activity waste streams followed by immobilization of the waste streams. The separation/immobilization processes are referred to as the Waste Immobilization Facility (WIF).

III. Systems Analysis

The systems engineering approach (DOE Order 4700.1, Project Management System) calls for performing the following basic steps:

1. Define the problem (needs, objectives, constraints),

2. Determine the functional requirements (what the system must do and how well it must do it),

3. Determine the alternatives that meet the requirements,

4. Define the system (schematics, models, etc.),

5. Evaluate and optimize the alternatives (trade-off studies, cost effectiveness analysis, support analysis, risk analysis), and

6. Build, test, and demonstrate the system.

The systems engineering approach is normally used in the beginning-to-end management of a project to assure project objectives are transformed into an operational system. However, the same principles (with some modifications) can be applied to an analysis such as an evaluation of liquid waste management options. These steps were performed by the team on a priority basis. Steps 1, 2, and 3 were done as a group, Steps 4 and 5 were, for the most part, done by individuals having specific assignments, and the final conclusions and recommendations at the end of Step 5 were developed as a group effort. The final step of building the system was, of course, not used. Since all of the systems engineering steps called for by the DOE order could not be completely followed, the term "systems analysis" is used for the purposes of this report.

1. Problem Definition

The problem is twofold. First, the NON Consent Order[4] required that the Tank Farm be emptied by 2015. Second, the Amended Order Modifying Order of June 28, 1993, required that construction of any needed new tanks commence before the end of the 1996 construction season. Since the current ICPP mission does not include reprocessing, less expensive tanks can be used to store the expected wastes, than was originally planned. However, design must begin immediately to be ready for construction of a smaller, less costly tank project to begin in 1996. Design cannot be delayed until the EIS ROD is completed in June 1995. As a result, DOE must invest significant funds in a design which may not be required. To avoid this potential waste of funds, DOE asked WINCO to perform the systems engineering study. If the study conclusively showed the tanks were not needed and DOE concurred that the EIS ROD would probably come to the same conclusion, then the tanks design could be terminated and the money saved.

The problem, as given to the committee, was to evaluate all feasible options for emptying the existing Tank Farm and to determine the need for replacement tanks. However, because of the NON Consent Order requirements, the problem and the defined system became much larger than just the new tanks. Since determining the need for new tanks also includes evaluating emptying of the existing tanks, many other factors must be considered. Some of these are: liquid waste generation, liquid waste storage capacity, phased removal from service of existing tanks for heel removal activities, calcine storage capacity, and waste immobilization. The defined system becomes all of the ICPP involved in generation, storage, or treatment of Tank Farm or related wastes.

2. Functional Requirements

The following functional requirements for the study and its conclusions were developed by the team:

[4]Note: Attachment A contains significant additional detail on many regulatory issues which affect decision making relative to ICPP waste management. Some of these issues are the NON Consent Order, the Amended Order Modifying Order of June 28, 1993, the Federal Facilities Compliance Act, and the applicable RCRA operating and permitting requirements. Information on permitting costs and schedules, closure schedules, and RCRA penalty provisions is also included.

a. The chosen alternative must meet all federal and state regulations and any agreements between DOE and the authorized regulatory agency (usually the State of Idaho or the Environmental Protection Agency (EPA)). However, the team tempered this requirement by recognizing that agreements can be negotiated, and that regulations can be changed. To this end, an alternative was not deleted if it did not meet a current regulation or agreement, if it appeared reasonable that a change could be negotiated or promulgated.

b. The chosen alternative must meet DOE Orders. The team again recognized that some DOE Orders could be changed.

c. The chosen alternative should minimize the amount of time required to treat the wastes. This includes both liquid and calcine.

d. The chosen alternative should minimize the required new tank volume.

e. The chosen alternative should minimize technical risk to present and future generations.

f. Waste minimization must be considered during alternative development. This includes both the quantity of liquid waste which must be stored and treated as well as the quantity of immobilized waste.

g. The chosen alternative should be cost effective. Specifically, the chosen option must be competitive in terms of life-cycle costs. Short-term (5-years) costs may also affect the decision-making process.

h. The chosen alternative must be compatible with all existing wastes and should be compatible with any new wastes expected to be generated by on-going processing of wastes or decontamination and decommissioning (D&D) at ICPP, the INEL, and other DOE facilities.

3. Alternatives Determination

Determining the alternatives to consider was deemed to be one of the most important steps in the study. To do it thoroughly and to minimize the chance of omitting any reasonable alternatives, a facilitated meeting, using Value Engineering techniques, was held. The method was essentially a carefully structured and controlled brainstorming session followed by a second step of selecting the viable alternatives from the brainstormed list. To further minimize the risk of overlooking any possible alternatives, the team was augmented by additional, selected WINCO personnel who are particularly creative and knowledgeable in the waste management area. The alternatives (cases) which were finally selected for detailed evaluation are listed in Table I. The cases are described in detail in Section 4.

Table I. Summary Description of Cases Examined in Systems Analysis Study

Case Number	NWCF Campaigns	HLLWE Operation	Early New Technology	Final New Technology	Date of Final Technology
0a	6	1996-2015	none	WIF	2015
0b	14+	1996-end	none	Glass-Ceramic	2015
1	4	1996-2008	none	WIF	2008
2a	0	none	none	WIF	2008
2b	0	none	none	WIF	2015
3	0	1996-2008	none	WIF	2008
4a	2	1996-2008	none	WIF	2008
4b	3	1996-2008	none	WIF	2008
5a	3+3	1996-2015	freeze crystallization+ grout	WIF	2015
5b	3+mini 3	1996-2015	neutralization + grout	WIF	2015
6	6 (11.5% Na+K)	1996-2015	none	WIF	2015
7	?	1996-2015	redesigned calciner	WIF	2015
8a	3	1996-2008	early glass plant	WIF	2015
8b	3	1996-2008	early glass plant	Glass Only	2008

Process on-line dates of 2008 and 2015 were used in defining the cases. The 2008 date is probably the earliest a major process/new project could be brought on line (1998 line item). The 2015 date was selected to put the new technology implementation beyond the NON Consent Order date of 2015 so new tank volume requirements could be shown independently from effects of new technology.

4. Systems Definition

4.1 Existing and Planned Facilities

Each of the cases chosen for evaluation involve several operations or technologies. One such technology common to almost all of the cases is the WIF. There are differences in how WIF is brought on line in the different cases; however, the overall WIF is similar in most cases and, for clarity, will be described by itself along with the other processes which are used in the cases. Additional detail on operating conditions for heel removal, the NWCF, and the HLLWE is provided in Attachment B.

WIF

The WIF is a facility that houses a combination of technologies that process sodium type liquid waste, other decon solutions, calcine, and even spent fuel if necessary. The technologies include calcine dissolution, transuranic extraction (TRUEX), strontium extraction (SrEx), cesium ion exchange (CsIX), low-activity and high-activity waste immobilization, and storage for the immobilized waste forms. The technology decision for WIF is not yet made. For the modeling, WIF was assumed to consist of a TRUEX-type process with a vitrification plant for immobilizing the high-activity waste and a grout plant for immobilizing the low-activity waste. With any technology, the facility will be sized for 185 gallons per hour liquid throughput. The process is designed to minimize the high-activity waste stream volume and the cost of producing the low-activity waste. In some cases, portions of WIF are brought on line before others to examine the cost effectiveness of individual technologies. When the WIF is operational, it has feed tanks that are used to collect and characterize any liquid waste being generated at the ICPP. Once one of the tanks is full, the WIF switches from calcine processing to liquid processing until the tank is emptied. Then the WIF returns to calcine processing.

Heel Removal[5]

In order to meet the NON Consent Order requirements, the Tank Farm tanks must be emptied, including the solid and liquid heel that remains after the bulk of the waste solution is jetted out. The same heel removal schedule is used for all the cases. Heel removal for the pillar and panel vaulted tanks begins in the year 2000. These tanks are emptied by 2006 and heelout is finished late in 2008, just before the

[5]The new tank farm project has recently completed a new heel removal schedule. This schedule, which addresses risks of schedule impact, shows a longer duration for each tank heel removal. The achieve a reasonably high (78%) chance of meeting the 2009 NON Consent Order date, the heel removal on the first tank starts earlier than previously planned and the last of the five pillar and panel vault tanks will be completed just prior to the March 2009 date. This new information was received too late to be included in the detailed modeling. However, a preliminary evaluation indicates that this new schedule will not significantly change the study's results for these 5 tanks.

2009 deadline. The remaining tank heelouts begin in 2008 and finish in late 2014.

The tank heelout plan in the results shows only four obvious pillar and panel tank heelouts. However, there are five tanks heeled out during this period of time, but at the time when one tank is taken out of service, the model places WM-190 into service for storage and places one of the heeled out tanks into spare mode. Since both tanks have the same volume and this exchange occurs at the same time, there is no capacity reduction seen in the graph.

NWCF

The NWCF is a fully operational process and is used in many of the cases. The gross processing rate of 180 gallons per hour that is used assumes regulator approval of a nitrogen oxides (NO_x) release limit of 472 lbs per hour. Aluminum nitrate, at a concentration of 2.2 molar, is added to the sodium waste to reduce the concentration of sodium plus potassium to the 8.4 percent limit. The process efficiency used is 75 percent, the historical value for the last NWCF campaign. The calciner operates for 18 months, goes through a mini-turnaround for 12 months, goes through another 18-month campaign, another mini-turnaround for 12 months, a third 18-month campaign, and finally a 36-month, more extensive turnaround followed by additional campaigns and turnarounds as required. The process flowsheet is similar for all cases for which it is used, except Case 6 (as explained later) uses a process flowsheet which produces calcine containing 11.5 mole percent sodium plus potassium rather than 8.4 mole percent which is used in the other cases.

High Level Liquid Waste Evaporator

The evaporator is used to concentrate dilute sodium or acid solutions to about 4 molar or an equivalent specific gravity of 1.3. Equipment for the HLLWE has been purchased and installation will occur during the current NWCF shutdown. The HLLWE is anticipated to be operational by June 1996. The evaporator was modeled to be capable of running at 100 percent when the calciner is down and 50 percent with the calciner operating. It is assumed in the model that the evaporator is no longer used once the WIF process is on line. The evaporator operational efficiency has recently been reviewed and is thought to be less than modeled for this study. However, the modeling showed that the evaporator was shut down a considerable amount of time once it caught up with the existing backlog of dilute solution currently stored in the Tank Farm and the lower efficiency should cause no long-term problem.

Freeze Crystallization (FC)

The freeze crystallization process separates approximately 66% of the sodium from the waste stream; this low-activity fraction is grouted or could be recycled using electrohydrolysis if productive uses of the solutions are found. The NWCF flowsheet used was calculated based on the expected high-activity product from the freeze crystallizer. Aluminum nitrate is still required in a reduced quantity to meet the sodium plus potassium mole percent limit.

Neutralization

By adding the proper proportion of NaOH (or other neutralizing agent), the transuranic (TRU) elements, heavy metals (Hg, Pb, Cd, etc.), and most of the transition elements are precipitated. The sodium, cesium, and some strontium remain soluble in the liquid phase. The liquid is separated from the solid and processed to remove Cs and Sr. Electrohydrolysis is used to recycle some of the NaOH and the remainder is grouted. The resulting high-activity fraction is calcined without aluminum nitrate additives. Although calcination was modeled, it may be more practical to store this high-activity fraction and immobilize it when WIF begins operation.

Calciner Reforming

The calciner would be modified to allow the sodium waste to be solidified onto silicon oxide (SiO_2) particles in a steam reforming process. The silica would then be used as a frit material for the vitrification step.

4.2 Case Descriptions

The cases were developed to understand how each case would empty the Tank Farm and treat the wastes. Table I is a summary of the cases that were evaluated. Figures 1 through 12 contain graphical depictions of the waste processing cases used in the computer simulations.

Case 0a (Figure 1) This case examines the potential for calcination, with the help of the HLLWE, to completely process the Tank Farm waste prior to the dates agreed to in the NON Consent Order. The flowsheet used for this case produces a calcine with 8.4 mole percent sodium plus potassium. The WIF is not brought on line until 2015 to place its startup beyond the heelout schedule for the Tank Farm. The HLLWE is started in June 1996 and the NWCF in November of 1996. The NWCF processes for 18 months and then goes through a mini-turnaround for 12 months. This cycle repeats until the NWCF has performed three campaigns; at this point, the NWCF goes through a major 36-month turnaround.

Case 0b (Figure 2) This case was added after the investigation started and is a modification of Case 0a. The change examines the effectiveness of bringing a glass-ceramic plant on line to process the calcine instead of a WIF-type process. The glass-ceramic plant comes on line in 2015 in place of the WIF in Case 0a. The glass-ceramic plant only processes calcine and is not designed to process liquid at this time. Due to the limited NWCF throughput, unprocessed liquid remains in the tanks in 2029 when the modeling was terminated

Case 1 (Figure 3) This case examines the potential of bringing WIF into operation at an earlier date. If a 1998 project is approved by DOE, hot operation would begin in 2008. In addition to the WIF process, the HLLWE and the NWCF would be used at the maximum rate between 1996 and 2008 which includes four, 18-month calcination campaigns. Bin Set 7 is needed.

Case 2a (Figure 4) In this case, as in Case 1, WIF is brought on line in 2008. The difference lies in what occurs between now and 2008. In this case, the waste is collected in the Tank Farm and neither the HLLWE or the NWCF are operated. Once the WIF comes on line in 2008, the liquid is processed first and then calcine processing begins once the Tank Farm is emptied.

Case 2b (Figure 4) The only difference between this case and 2a was to put WIF off until 2015. This basically shows the accumulative waste generation until 2015 without any depletion due to running and maintaining the NWCF and HLLWE.

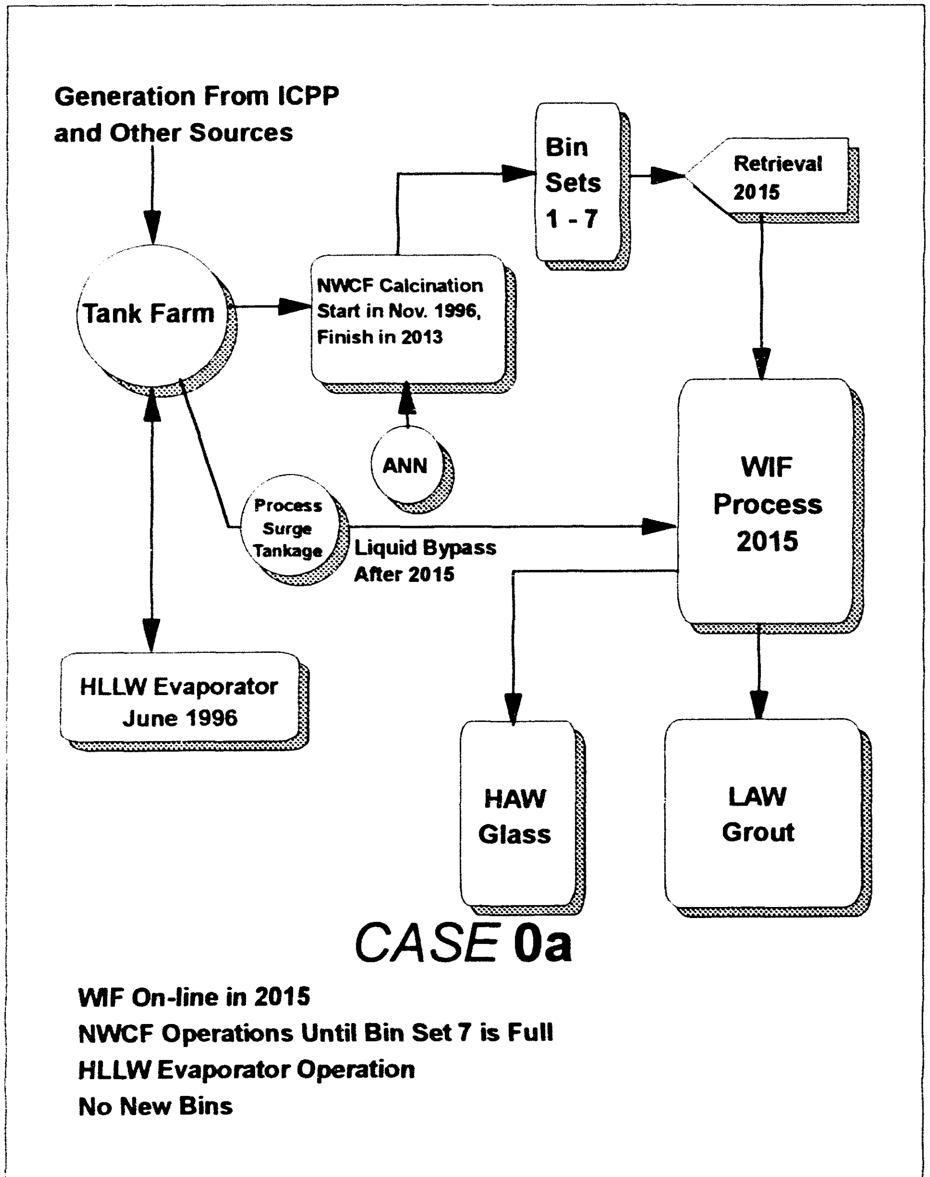

Figure 1. Case 0a

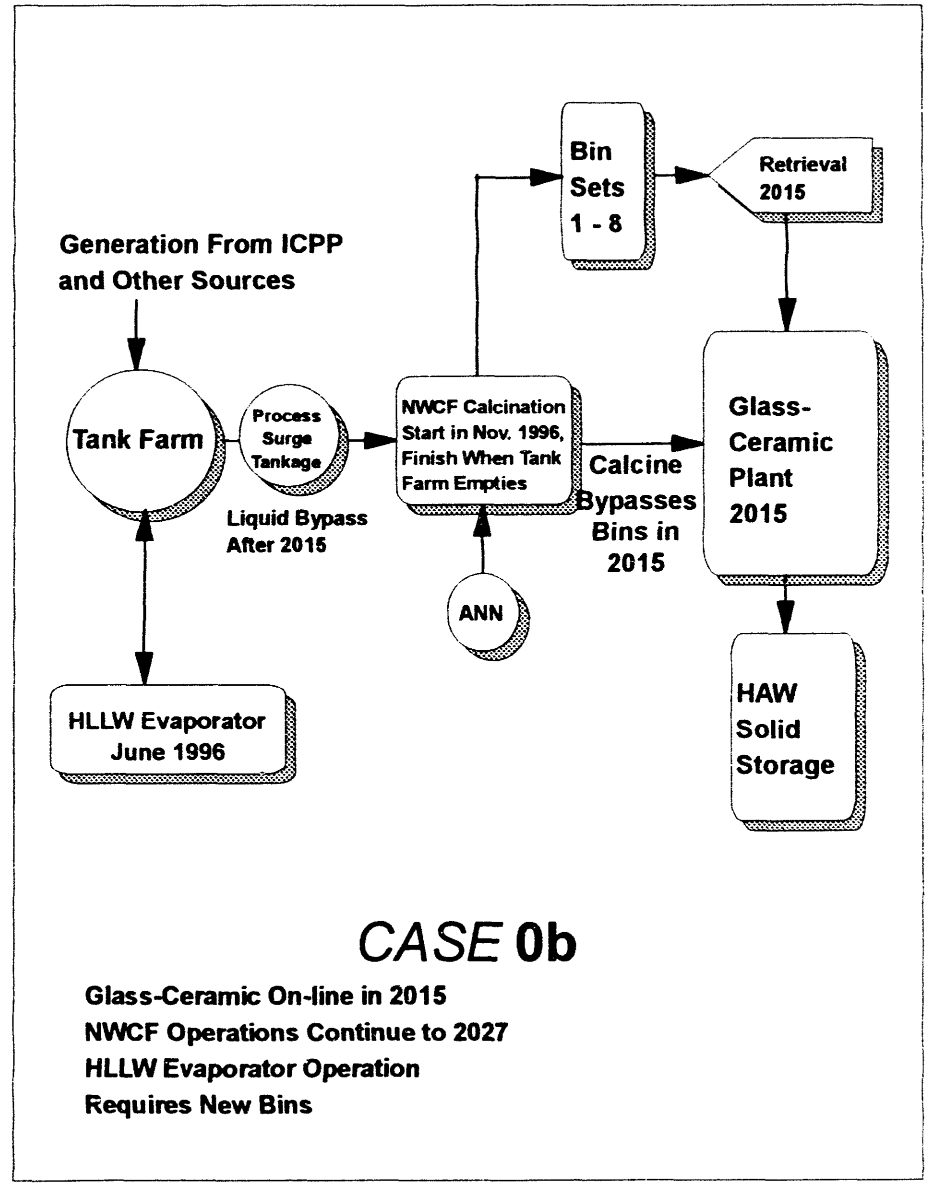

Figure 2. Case 0b

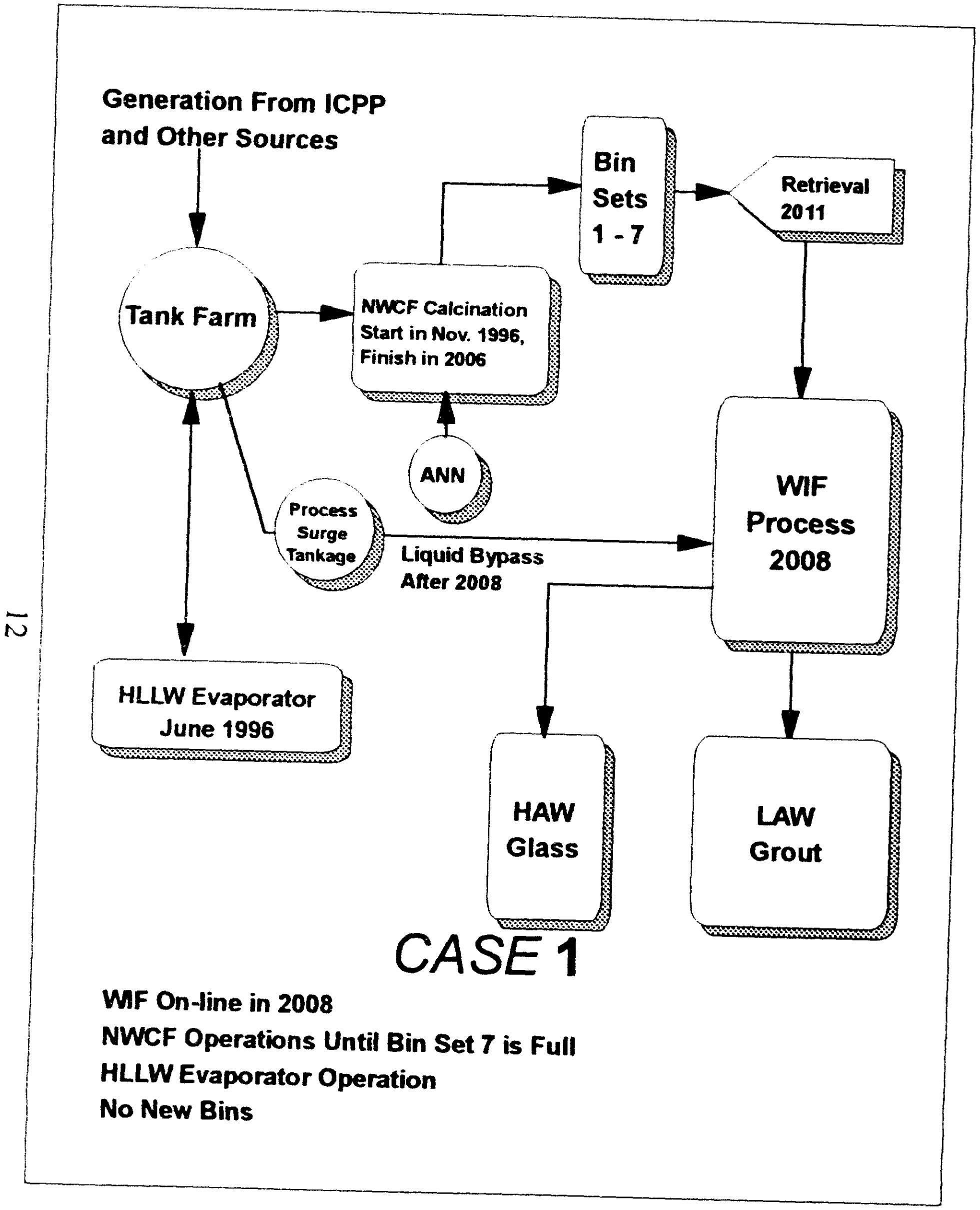

Figure 3. Case 1

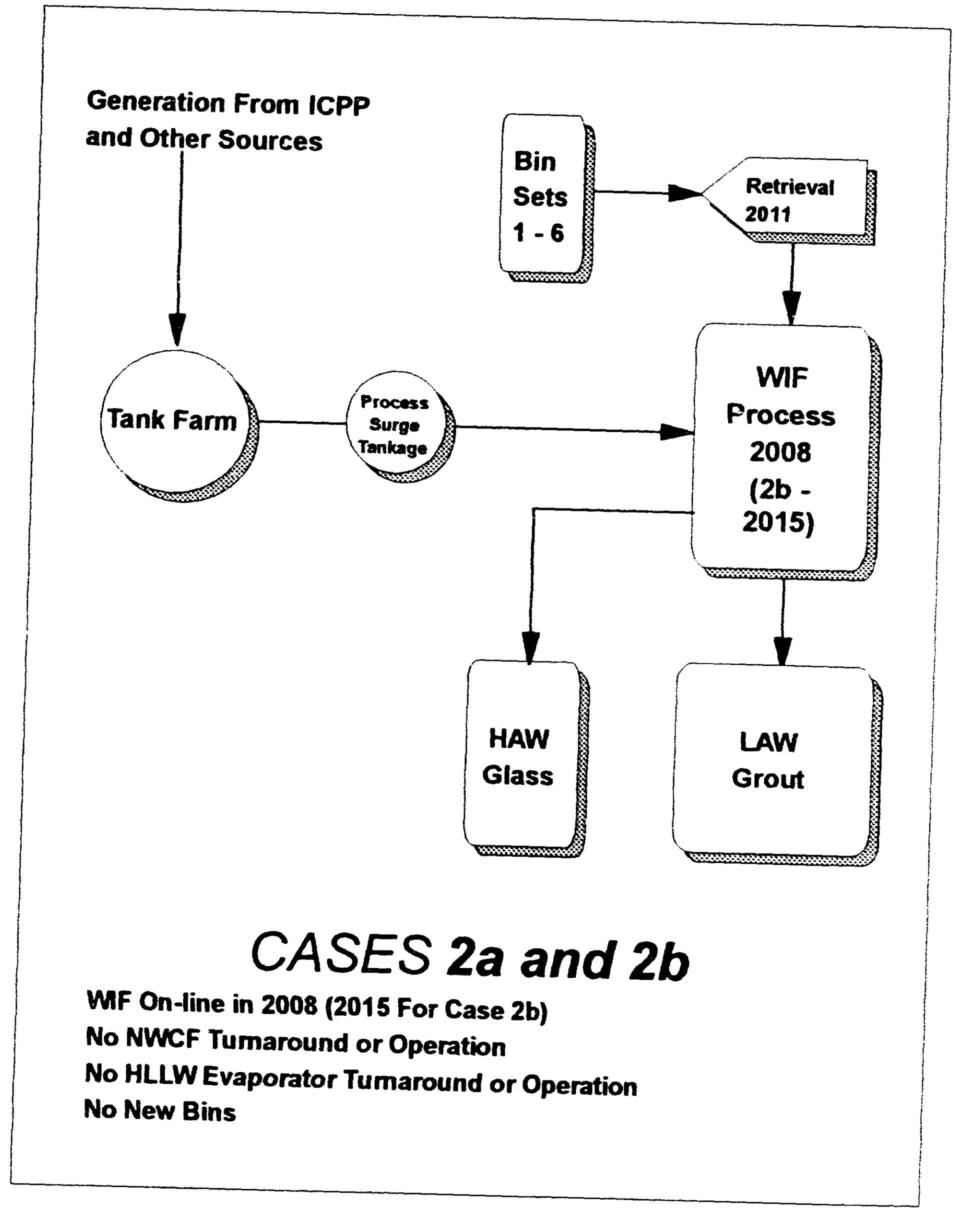

Figure 4. Cases 2a and 2b

Case 3 (Figure 5) This case follows Case 2a except that the HLLWE is installed and operated from 1996 until 2008. As in Cases 2a and 2b, no calcination is performed.

Case 4a (Figure 6) This case is very similar to Case 1. The difference is the number of NWCF calciner campaigns that are performed. In this case, only two NWCF campaigns are completed after 1996. This will ensure calcine never enters Bin Set 7. WIF still comes on line in this case in 2008 and the HLLWE operates as in Case 1.

Case 4b (Figure 6) This case is an extension of Case 4a above. After running the two NWCF calcining campaigns, it was observed there still remained enough space in Bin Set 6 to hold calcine from one more NWCF campaign. Thus, this case has three calcination campaigns and fills Bin Set 6, but does not use Bin Set 7.

Case 5a (Figure 7) In this case, a freeze crystallizer is brought on line in 2005 and the remaining Tank Farm solution is processed through it. During the 1994 - 2005 time frame, NWCF operates for three sodium waste campaigns and the HLLWE processes any solution requiring concentration. WIF comes on line in 2015 to begin the conversion of the calcine and also processes any new liquid generation as required. Freeze crystallization does not operate after WIF comes on line.

Case 5b (Figure 8) Precipitation by neutralization is used in this case as the accelerated sodium separation method. In 2015, the WIF will begin to process the liquid and calcine and the neutralizer and NWCF will be shut down. The evaporator also runs from 1996 to 2015.

Case 6 (Figure 9) This case was examined to determine if optimizing the NWCF to allow calcining sodium waste at the 11.5 mole percent sodium plus potassium level could, by itself, support the NON Consent Order. The NWCF and HLLWE operate as discussed in Case 0a. The only difference is the resulting higher throughput of the NWCF due to the greater sodium and potassium concentration in the feed.

Case 7 (Figure 10) This case modifies the NWCF to allow the sodium waste to be solidified onto silicon oxide particles in a steam reforming process. In this case, the NWCF is modified from 2003 to 2006 to handle the new processing methodology. The NWCF is used for three normal campaigns prior to the modification and the evaporator is used until the WIF comes on line in 2015. WIF operations would require retrieval to feed calcine to the WIF process and another retrieval unit to feed segregated calcine, containing the silica, directly to the vitrification plant.

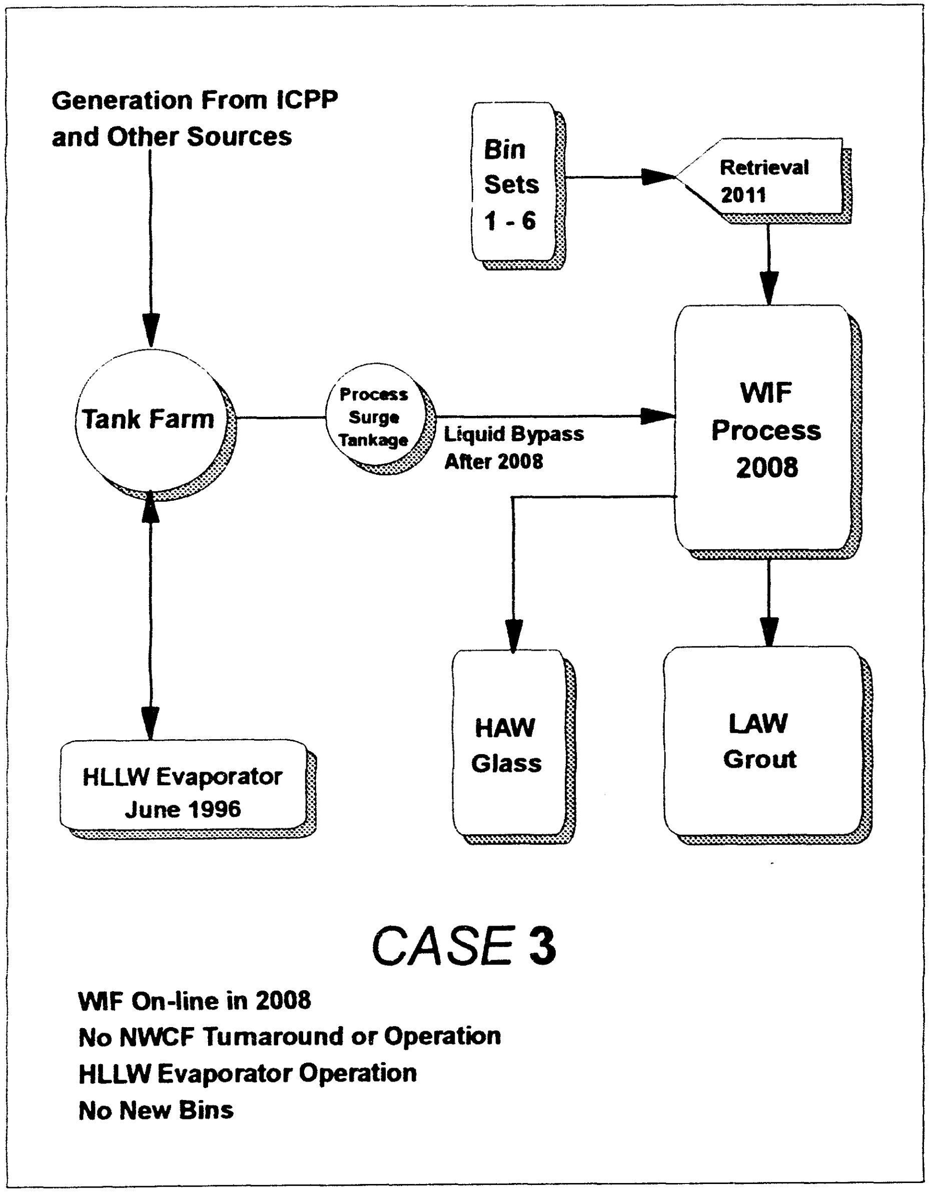

Figure 5. Case 3

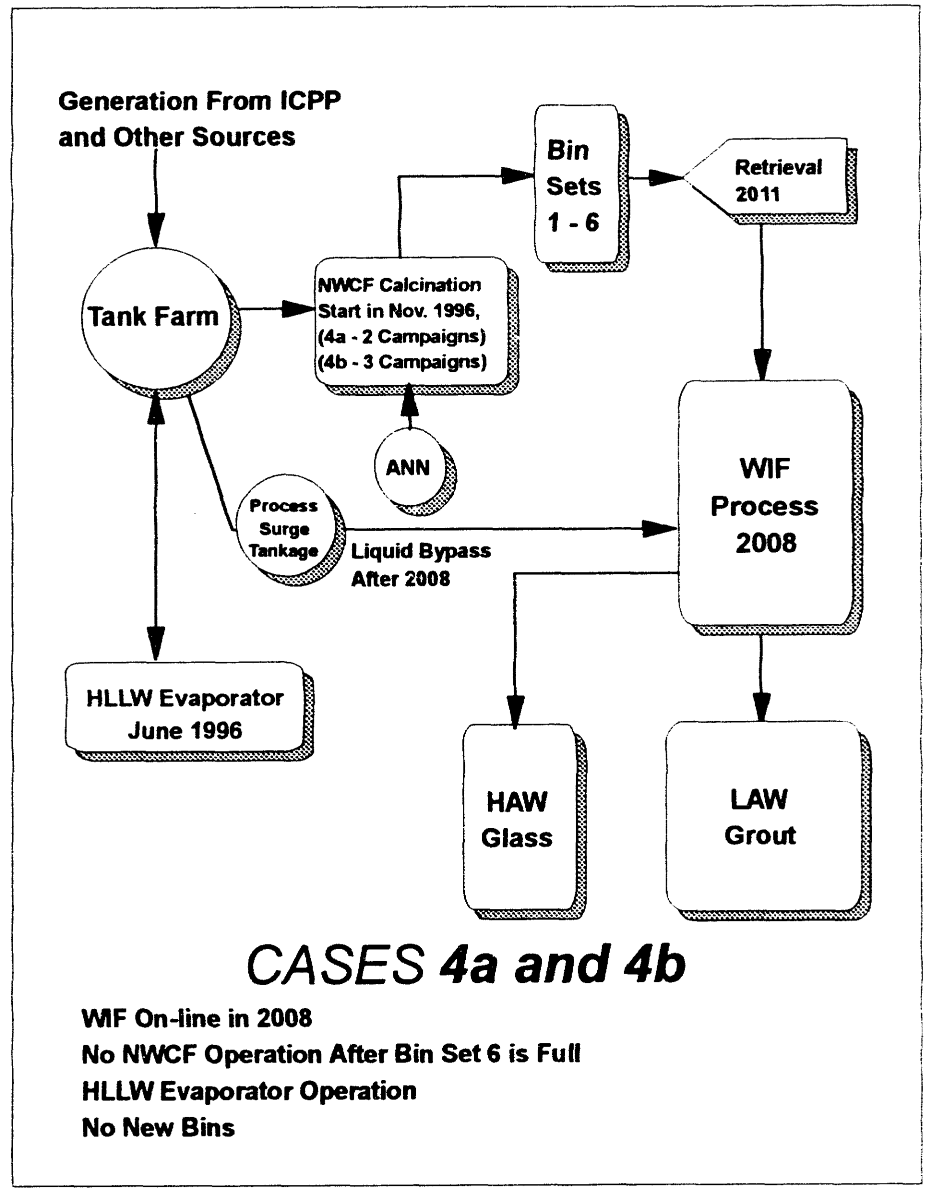

Figure 6. Cases 4a and 4b

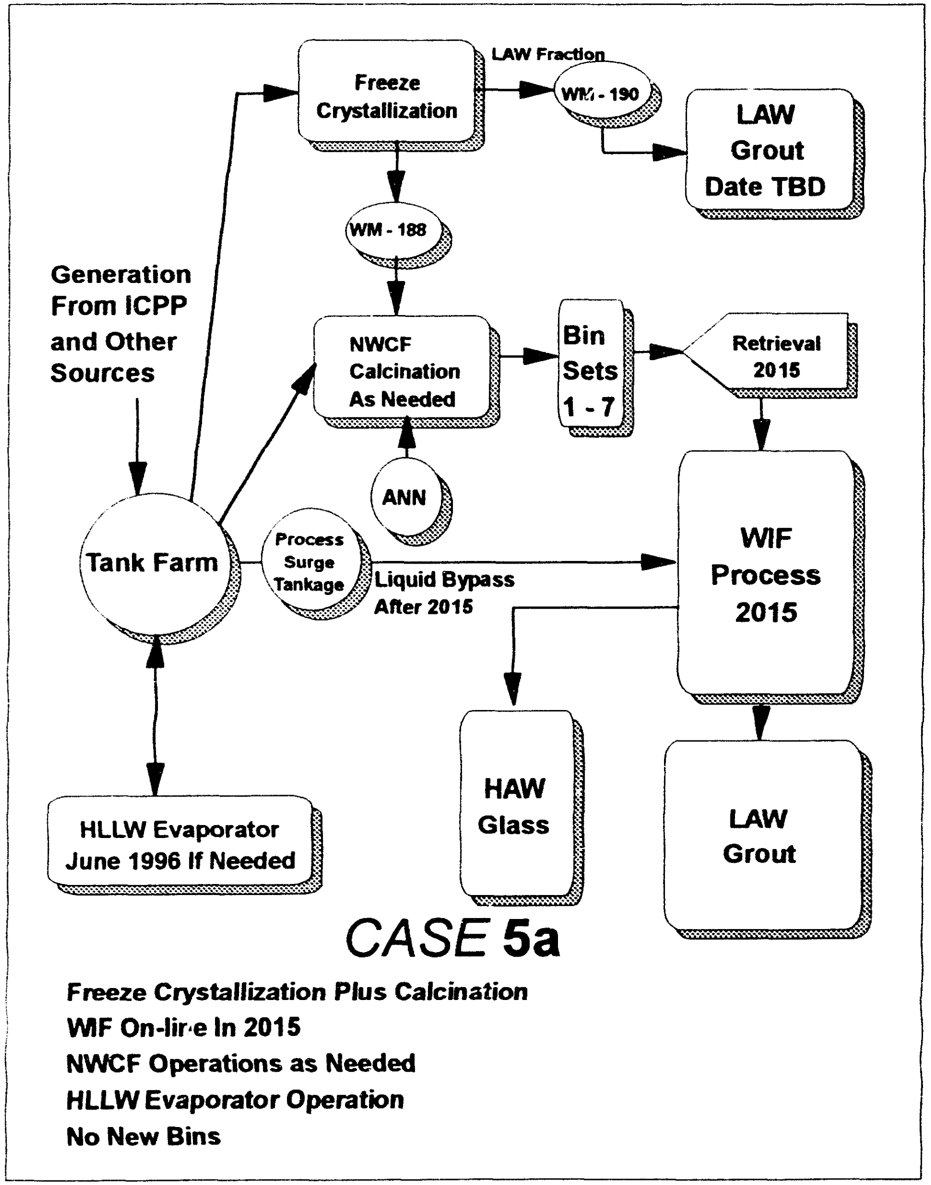

Figure 7. Case 5a

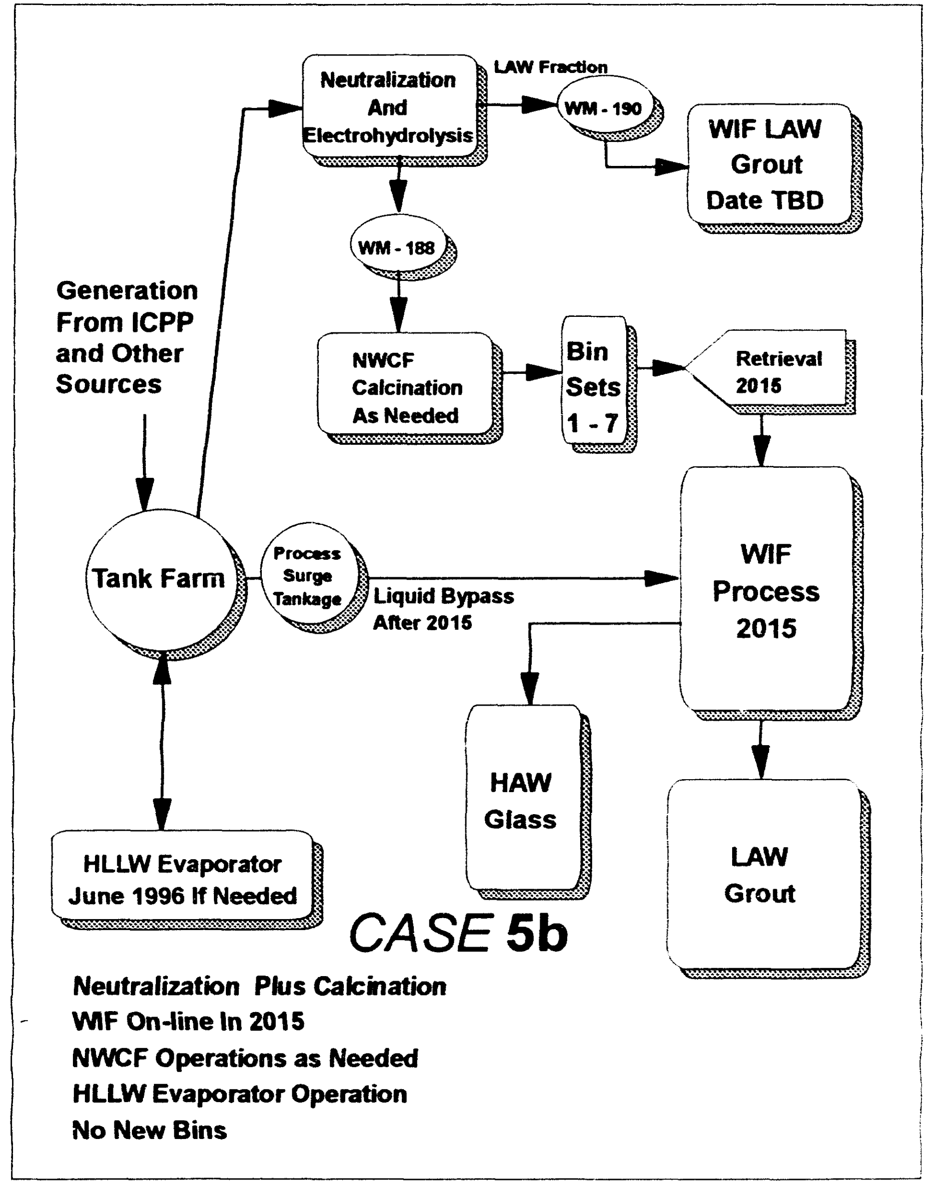

Figure 8. Case 5b

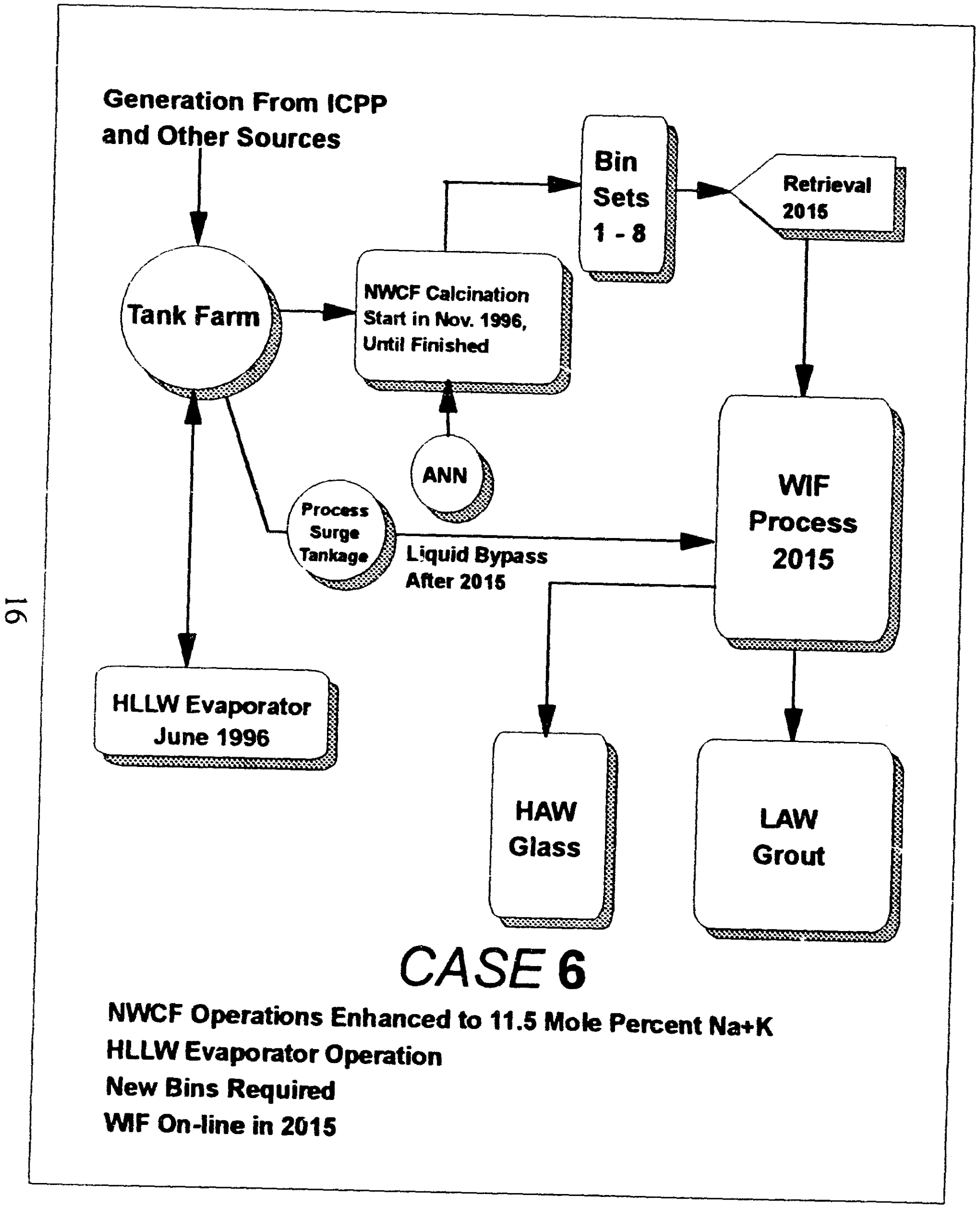

Figure 9. Case 6

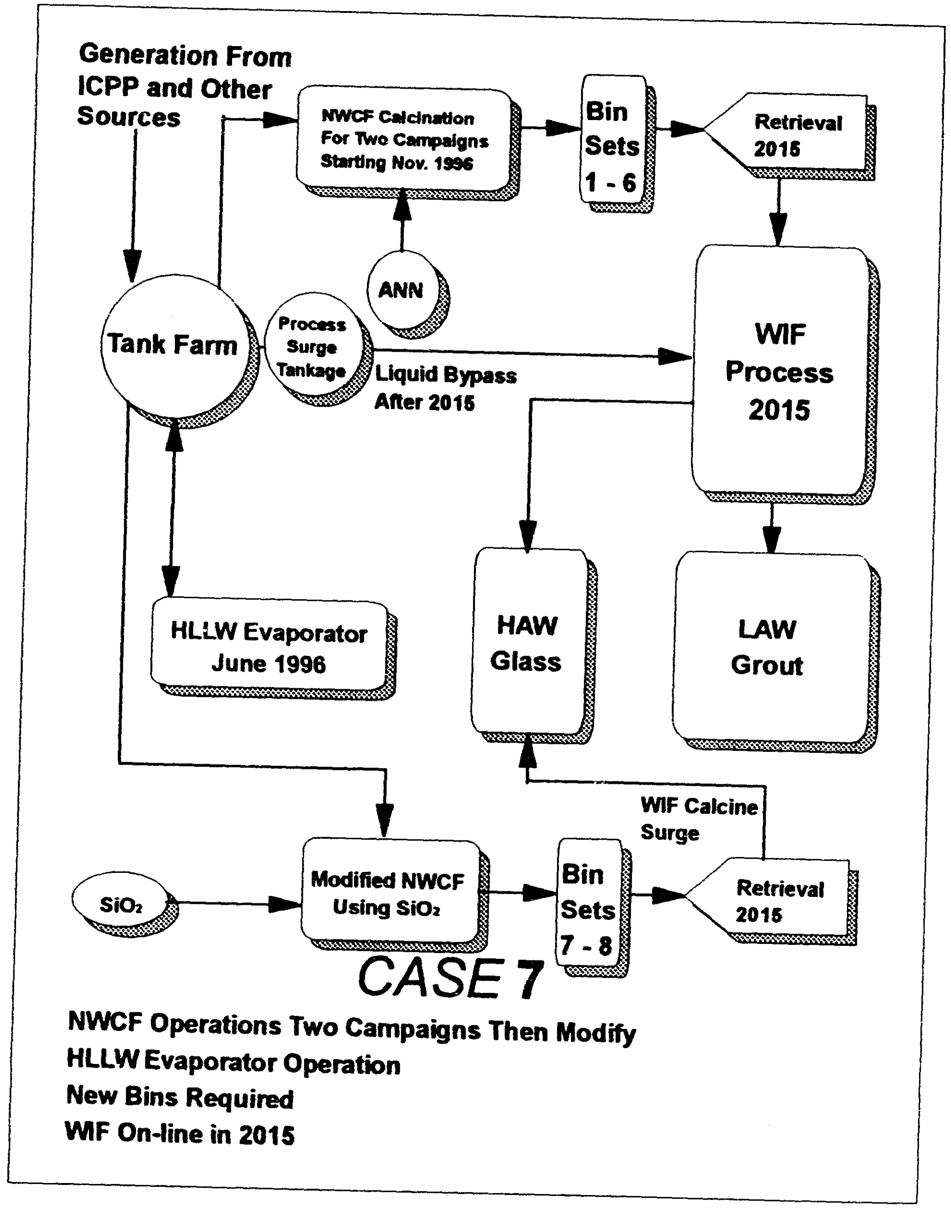

Figure 10. Case 7

Case 8a (Figure 11) This case utilizes the phased-in approach of the WIF. The NWCF and evaporator operate as in Case 4b, filling Bin Set 6. A glass plant is brought on line in 2008 where the remaining liquid is processed into glass. It is believed that since the sodium waste is not high-level waste, that the glass could possibly be disposed of as mixed transuranic (TRU) waste potentially at a reduced cost. In 2015, the rest of WIF is phased in to handle the calcine and any generated liquid.

Case 8b (Figure 12) This case was modified from Case 8a to show what the cost-effectiveness would be if the glass plant was used to vitrify the calcine directly instead of bringing on the second phase of WIF. In 2015, the retrieval equipment would begin to feed calcine into the glass plant where high-activity glass would be made. All liquid waste is directly vitrified.

4.3 Computer Model

A computer simulation model was used to perform time-dependent inventory modeling of the Tank Farm and the waste treatment processes chosen for this study.

The CPP Simulation Model (CPPSIM) uses an object oriented approach and discrete event simulation techniques to model the existing and future processes at the ICPP. The CPPSIM model has the capability of tracking the waste type and waste stream composition and then making decisions on where the waste is stored and how it is processed in the HLLWE and NWCF based on the waste attributes. The model also has the capability to track the calcine composition by bin set and vary the conversion factors used for glass and grout production based on calcine types. It also has the potential of tracking curie content and heat load of the wastes through the system.

The computer model contains a graphical user interface so that inventories and process options can be viewed during program operation. Simulation run output can also be plotted in many different ways for individual case analysis or for comparison of multiple cases. Video tapes have been produced from selected cases for meetings and presentations.

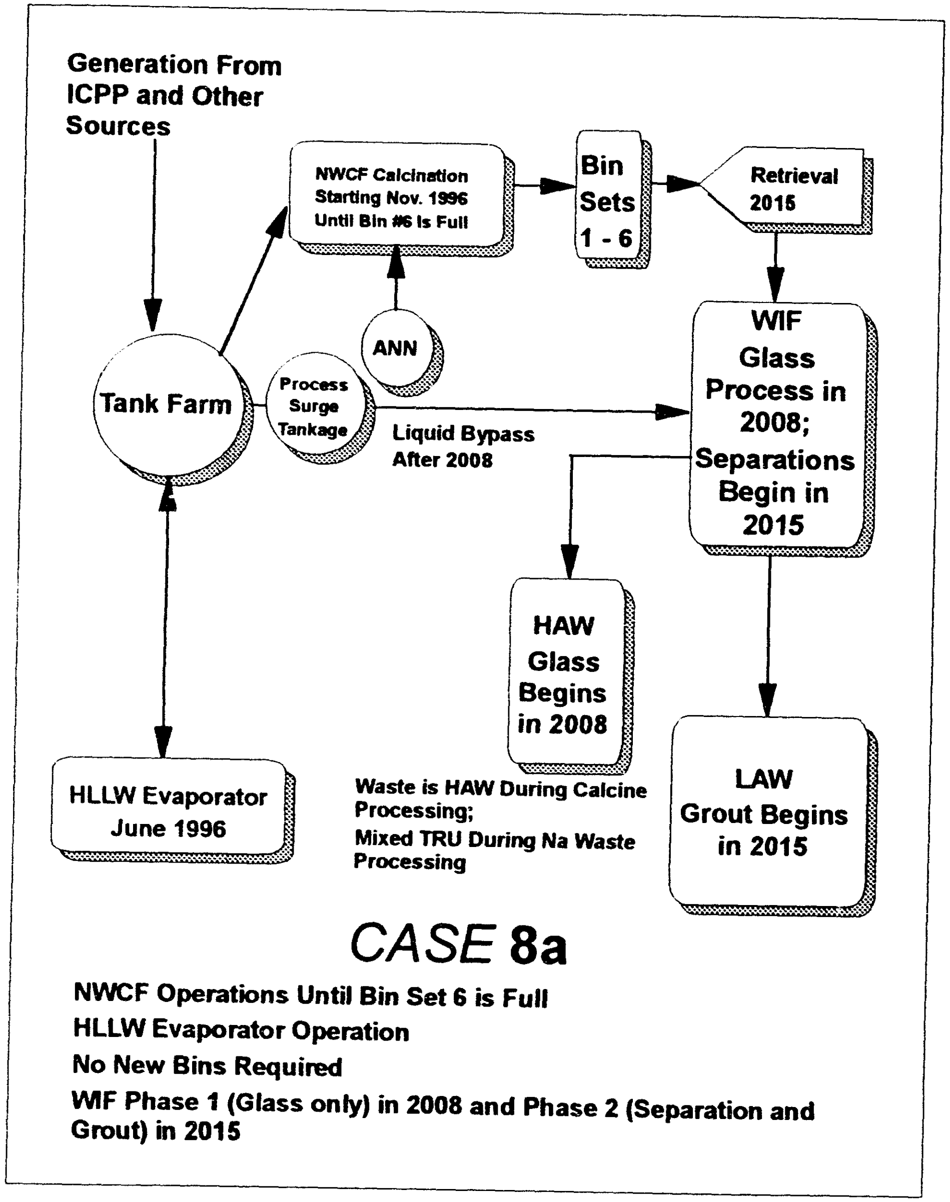

Figure 11. Case 8A

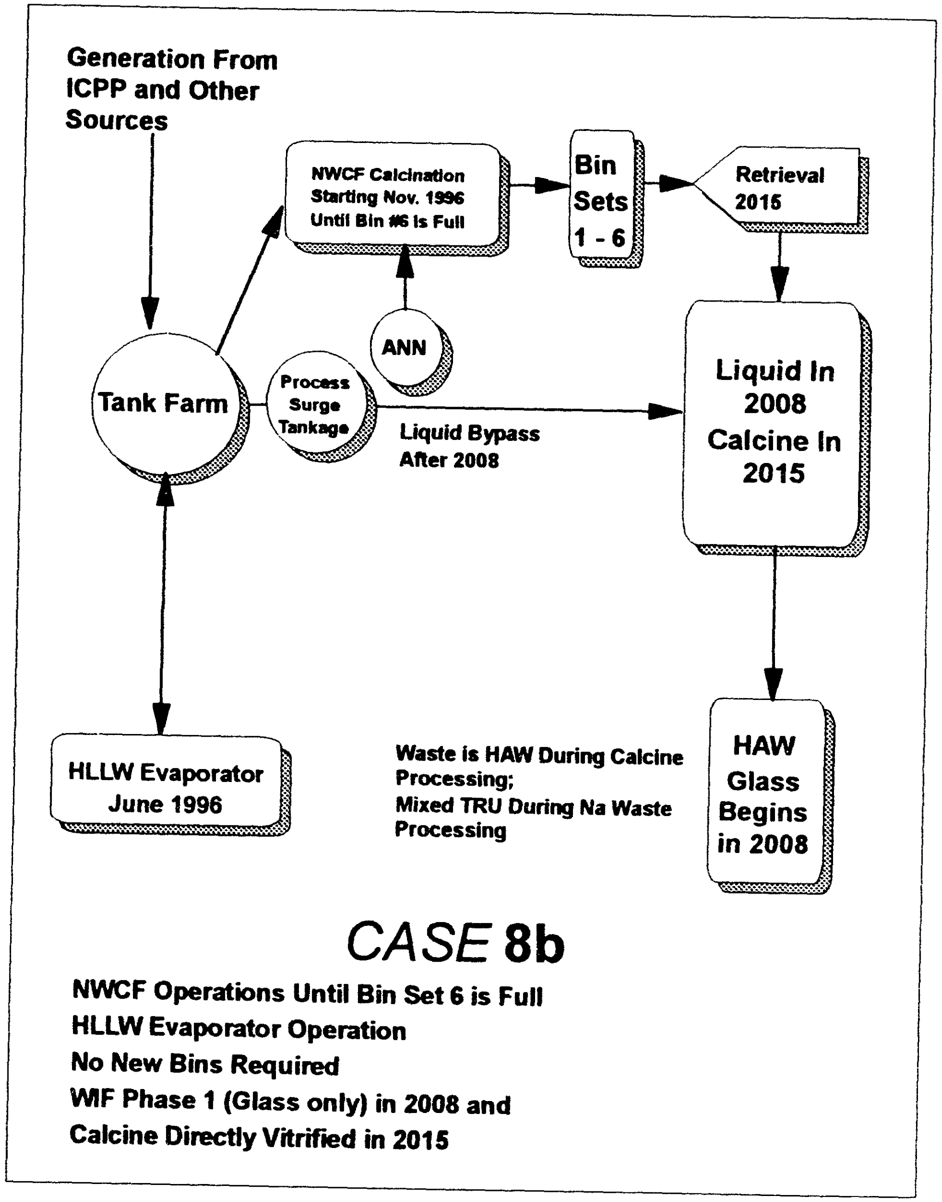

Figure 12. Case 8b

In this study, the model maintains a record over time of the Tank Farm capacity, manages the waste types for each tank to assure proper segregation of the liquid waste, manages the waste generation, and has time sequences for operating processes such as the NWCF, HLLWE, and WIF. It tracks calcine produced, stores the calcine in the bin sets and retrieves the calcine for WIF processing when needed. The program is used to show the amount of new tank volume required due to the phasing out of the existing Tank Farm, how much calcine is produced, the resulting number and timing of bin sets required, how many campaigns could be processed, how much glass and grout the waste would create, and how long the WIF or other final vitrification process would need to operate to complete processing of the waste.

To normalize all of the cases, a consistent heel removal schedule was used that met the NON Consent Order dates. Any liquid that did not fit into the existing in-service tanks went into an extra tank where the new tank volume needs were monitored.

5. **Evaluation and Optimization**

5.1 Modeling and Analysis

The results from the modeling of each case provide tank volume and timing needs, high- and low-activity waste quantities to immobilize, and the number of years to process using the same size immobilization plant. The waste volumes include all the existing calcine, any calcine made prior to ultimate processing, and all the liquid in storage and generated during the simulation. Advantages and disadvantages are also given in the following discussion.

Liquid Waste Volume and Storage Requirements

The modeling used waste generation assumptions developed based on input from the most knowledgeable personnel in each specific area. These assumptions were customized for each modeling case as necessary to simulate the conditions described in the case. For example, appropriate liquid generation was accounted for when the calciner was operating and when turnaround decontamination liquid was produced between the calcination campaigns. The basic waste generation assumptions are given in Attachment B. Each case begins with the same volume and the volume is monitored and recorded throughout the simulation for comparison with surge capacity of the current Tank Farm.

To support the heel removal schedule, the Tank Farm capacity was phased out one tank at a time beginning in 2002 and was finished in 2013. The heel removal schedule[6] used in this simulation required a tank to be empty for a year while all the equipment was installed and tank modifications were performed. In the second year, the actual heel removal and rinsing were performed along with isolation of the tanks. The heel removal schedule imposed on every case was nearly identical and assumed the 2009 and 2015 NON Consent Order dates for cease use of the tanks.

Figure 13 shows the comparison between the Tank Farm capacity and the needed capacity for Case 4b as an example of some of the modeling results which were an important result of this analysis. This particular case assumed both the HLLWE and NWCF operated.

Without evaporation or calcination (Case 2a), the existing Tank Farm inventory will begin to exceed its capacity in 1999 as can be seen in Figure 14. The need for new tank capacity can be deferred to 2003 by installing the HLLWE and beginning to operate it in 1996. To extend beyond 2003, new technology, calcination, removing waste sources, or new tank capacity is necessary. The model assumed there were no new tanks available and just recorded the volume that did not fit into the existing Tank Farm

The values shown in Figure 15 are the maximum volumes recorded during each case's simulation. The need date shown is the earliest date where the volume required exceeds the available capacity. In about one-half of the cases, the volume shortfall is relatively small; the maximum volume required occurs from 2 to 15 years after the initial shortfall occurs. (See Attachment C for detailed graphs of liquid storage volume needs as a function of time for each case.) Even though Figure 15 shows that no new tank volume is needed for Case 1, the volume contingency is small. In addition, new process surge capacity of 150,000 to 300,000[7] gallons is required for all cases, including this one, to provide for feed characterization and process downtime when WIF comes on line. As a general rule, the date new tankage is required can be extended one year for each NWCF campaign which is completed. Optimum NWCF processing was based on fuel reprocessing raffinates. Sodium waste reprocessing is less efficient and requires more chemical additives, which create more waste for final disposal. The NWCF sodium calcination campaigns help maintain the liquid inventory at the current levels, instead of letting it increase,

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[6]see Footnote 2.

[7]This volume is an estimate. The exact volume and configuration will be determined during WIF conceptual design. The requirements will include sufficient volume to support a 2-year downtime and enough separate tanks to provide simultaneous waste collection, segregation, characterization, and feed to WIF.

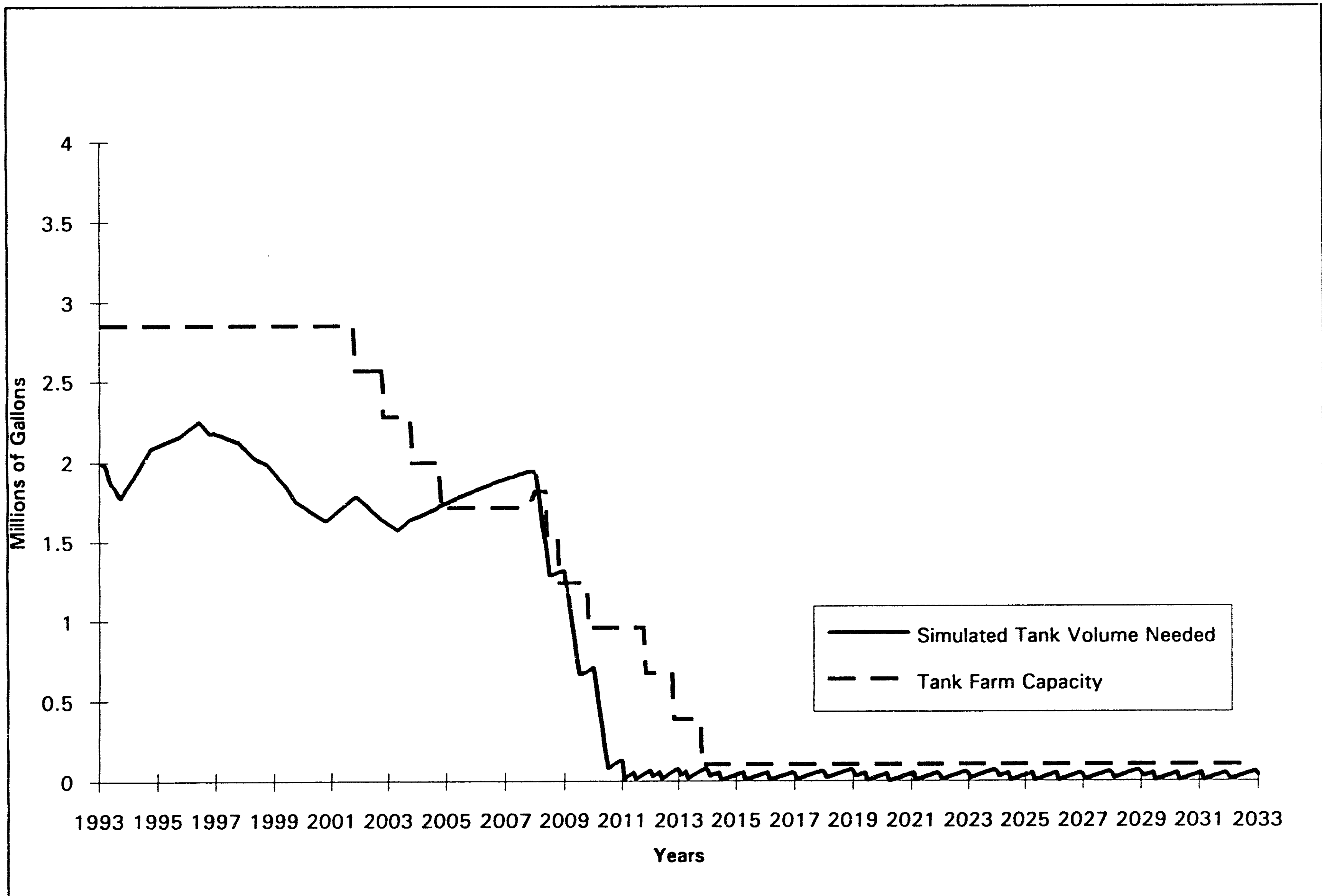

Figure 13. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 4b
(HLLWE and NWCF operate; WIF on line in 2008)

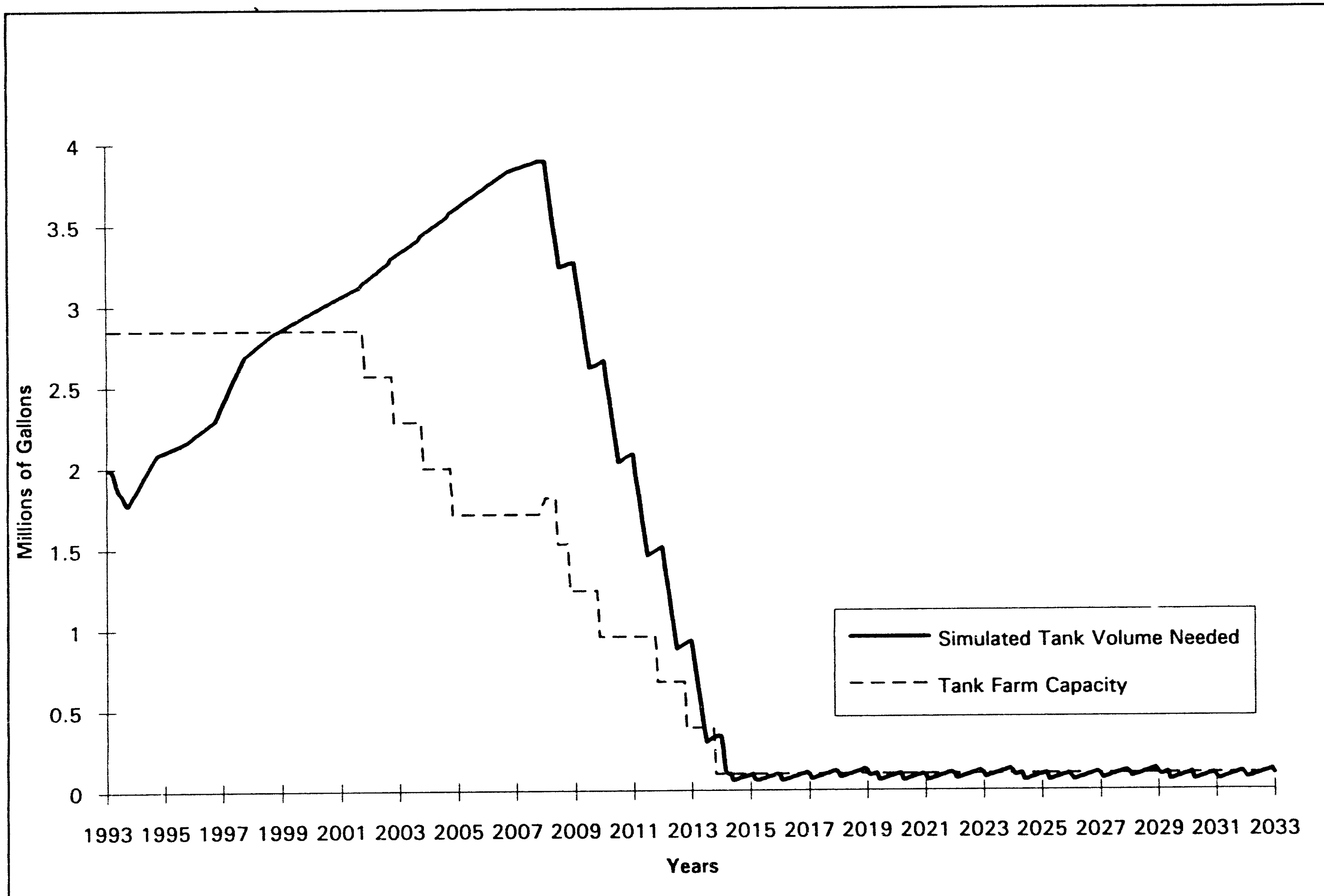

Figure 14. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 2a
(No HLLWE or NWCF Operation; WIF on line in 2008)

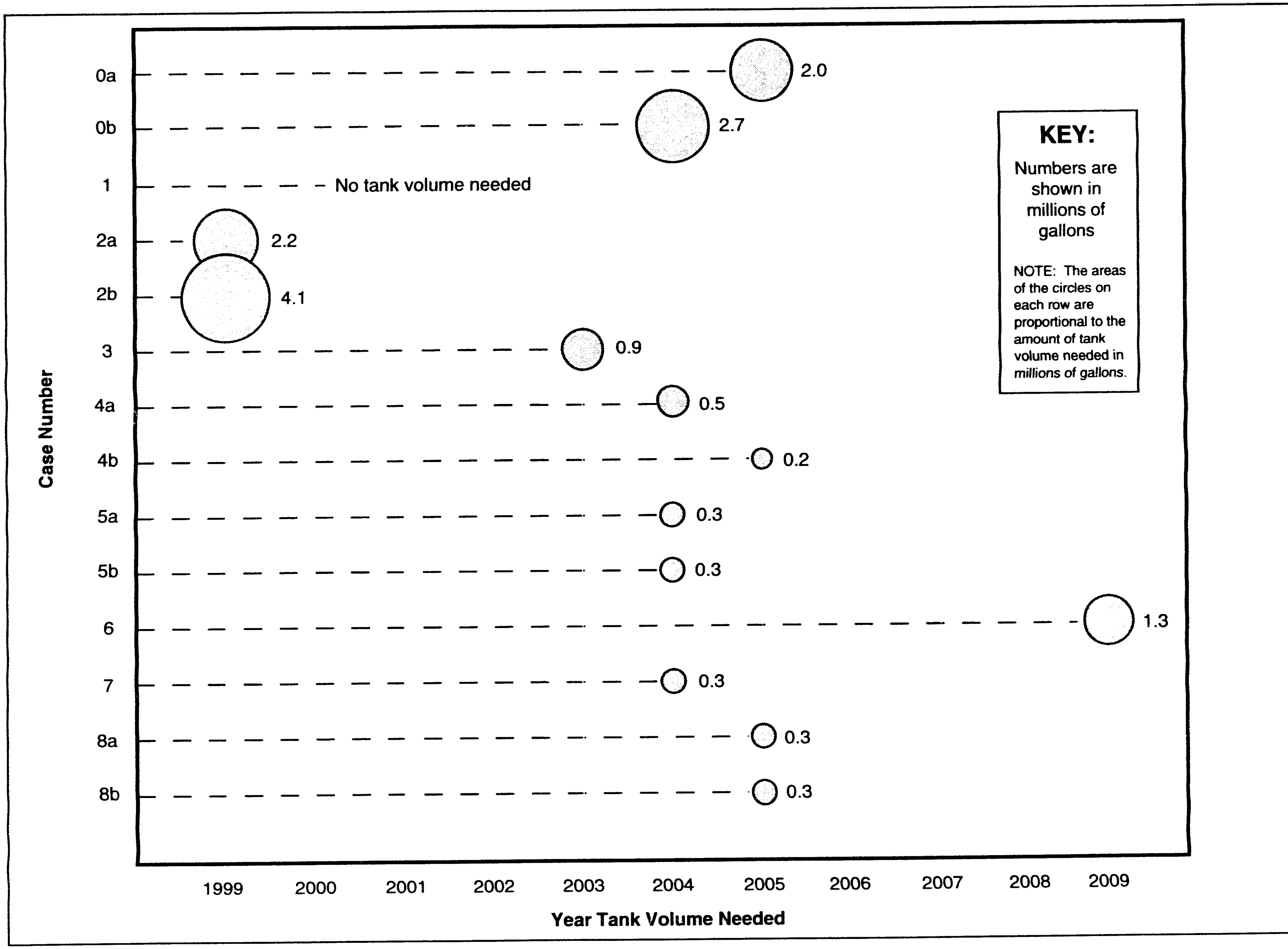

Figure 15. Predicted Tank Farm Requirements.

which ultimately lessen the tank volume needs once the Tank Farm is out of service. The volume needs for the cases ranged from zero to over 4 million gallons.

An interesting effect of increasing the sodium plus potassium loading in the calcine was seen when comparing Case 0a to Case 6 where the only difference was the mole percent of sodium and potassium in the calcine. By increasing this loading, the net NWCF processing rate was increased which resulted in delaying the need for any new tanks to 2009. Even though the tank volume needs are high in Case 6, these volumes were only necessary after 2009. If this flowsheet could be accomplished and a new WIF or other technology could be bought on line by this point, new tanks beyond process feed surge capacity may not be needed. The increased loading also results in a significant reduction in the final amount of waste requiring immobilization.

Calcining allows more time for either new tanks or new technology to come on line; however, this advantage must be weighed against the cost of calcination and the increase in the amount of waste requiring immobilization. Calcining sodium waste with aluminum nitrate makes a calcine that when processed through WIF, produces nearly five times more high-activity waste and five times more low-activity waste than if the liquid sodium waste was immobilized directly.

Not all possible waste processing scenarios were examined by the team due to the short schedule required for the Tank Farm systems analysis. The cases examined in detail were chosen to bound all possible combinations as much as possible. The tank volume figures in Attachment C (Figures C-1 through C-12) can be used quite readily to examine the impacts of other operating conditions such as delays in schedules or increases (or decreases) in waste generation rates.

Waste Quantity To Immobilize

The waste quantities that result from each case take into consideration the existing calcine, any additional calcine produced, existing liquid inventory, and any additional liquid generated during the cases' simulation times. Each case has a customized liquid generation table according to the technologies and their operation schedule. High-activity waste and low-activity waste are reported in metric tones of metal oxides that must be immobilized so the cases can be compared directly without the bias of differing immobilization technologies. (Approximately 40 kgs of metal oxides result from 100 gallons of sodium waste.) For the life-cycle costs, the waste form that was discussed in each case was used to convert the solid into an immobilized form.

These data, as shown in Figure 16, reveal the smallest waste quantities (the smallest circles) for those cases where no additional calcination occurred (Cases 2a, 2b, and 3). Because the liquid waste was not calcined, aluminum nitrate was not added to the waste, thus the metal oxides requiring immobilization were less. However, these three cases have the earliest new tank volume requirements and Cases 2a and 2b have the largest new tank volume requirements based upon meeting the NON Consent Order commitments (see Figure 15).

Figure 17 shows the sensitivity of the high- and low-activity waste to the technologies used in the cases. Here, the calcine fraction that accounts for only the existing calcine has been subtracted out because it is generally constant depending on the separation or non-separation method used. The actual changes to the metal oxides as a result of processing the liquids will show the greatest variation. In this graph, the waste quantity is proportional to the area of the circle. Thus, a tradeoff exists between the number of calciner campaigns, the amount of waste to ultimately immobilize, and the timing for new tanks or new technology.

Many of the cases utilize the same ultimate separation and immobilization technology to process the existing calcine. This calcine contains a large percentage of the total metal oxides that require treatment, and the amount of solids created from an additional calciner campaign is small in comparison. To be able to see the significance of calcination and other methods used to treat the liquid waste, the two waste streams were separated. Figure 17 gives the waste quantities for each case with both high-activity and low-activity waste shown for liquid and calcine. For example, a comparison can be made between Cases 1 and 2a; Case 1 has four NWCF campaigns and Case 2a has none. This example shows that both the high- and low-activity waste streams are increased when the calciner is used to solidify the liquid waste. Thus, it is important to use the calciner as efficiently as possible to minimize the amount of waste ultimately requiring immobilization.

Cases where the liquid is all processed by calcination (Cases 0b and 6) are by far the highest in waste quantities to be immobilized. The reason Case 6 is larger in quantity comes from the higher processing rate the 11.5 mole percent sodium plus potassium flowsheet can perform. As a result, the calciner is capable of processing more waste from the Tank Farm, whereas Case 0b's rate failed to deplete the Tank Farm below 2 million gallons by 2029 when the simulation was terminated. Case 6's volume also includes some chemicals required to obtain the separation of the waste into high- and low-activity fractions.

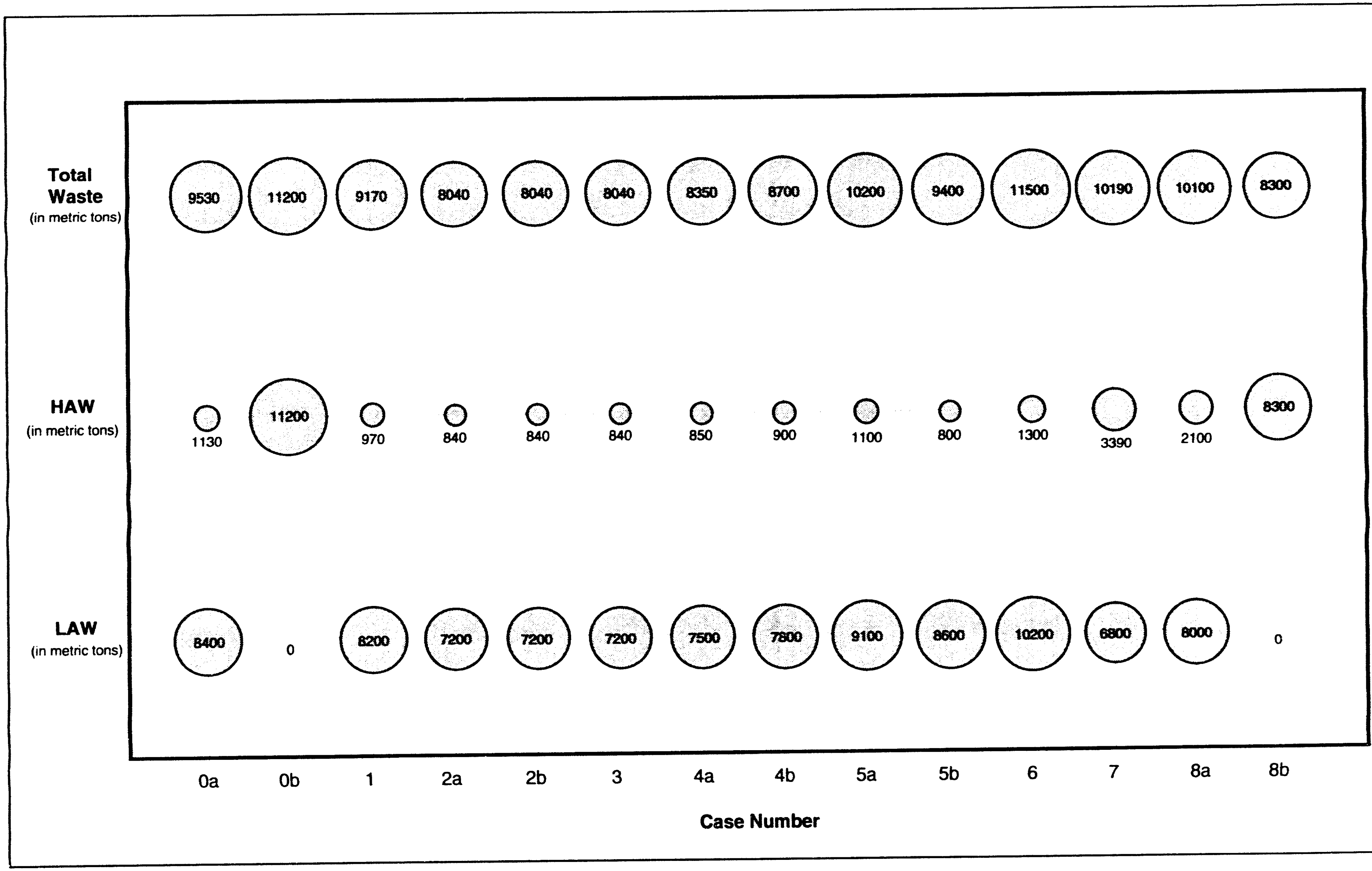

Figure 16. Waste Quantities from Processing by Cases.

NOTE: The areas of the circles on each row are proportional to the amount of waste in metric tons of metal oxides.

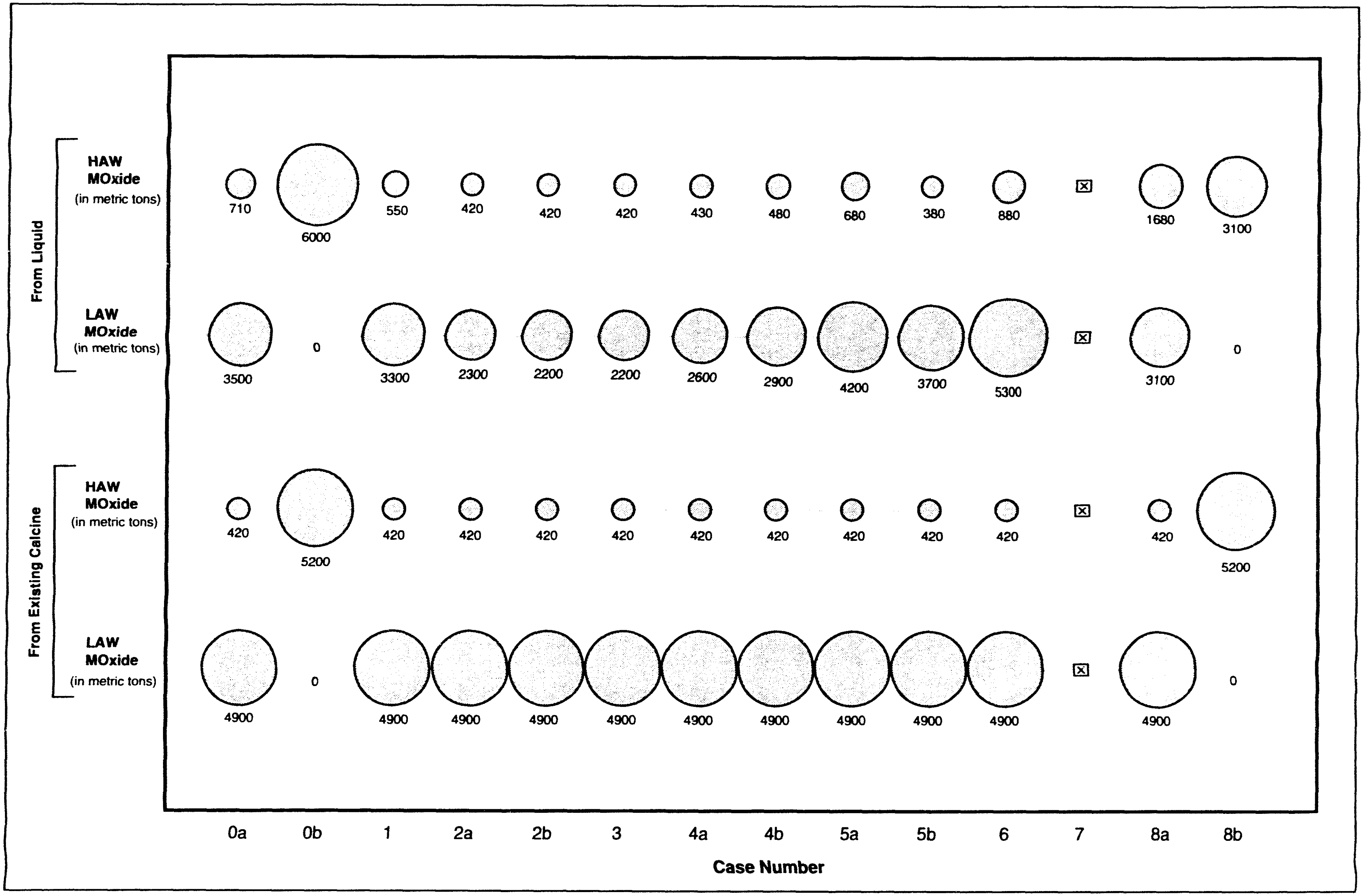

Figure 17. Waste Quantities From Both Liquid and Existing Calcine

☒ Option 7 combines liquid & calcine during processing which makes dividing effects on individual streams impossible.

NOTE: The areas of the circles on each row are proportional to the amount of waste in metric tons of metal oxides.

Operational Timing of New Technology

Each case uses new technology to process the liquid and/or the calcine waste. The startup timing for the new technology in each case was described in Section 3. Most cases brought on the new technology in one phase; however, Cases 5a, 5b, 7, and 8a brought on the new technology in two phases. The first phase more efficiently deals with the liquid waste than the calcining alternative, then the second phase processes either the calcine or both the calcine and liquid, including immobilization. The process completion time, that is listed in Table II, is defined as the time when all the calcine inventory is processed, including existing and any additional calcine created. In general, the amount of liquid inventory at the time the new technology process comes on line delays the startup of processing calcine. This can be best seen between Cases 2a and 3. Here the evaporator reduces the liquid inventory in Case 2a sufficiently that the new WIF process can start on calcine two years earlier than in Case 3. Each calcination campaign appears to require one more year of WIF processing as shown between Cases 4a and 4b. Table C-III in Attachment C contains the calcine retrieval operational schedules from the simulation which are incorporated into the schedules in Attachment F.[8]

Cases 5b and 7 were not simulated in detail due to problems related to either little or no data on how the process would operate (Case 7) or how to realistically operate the calciner (Case 5b). Case 7 employs a technology that is immature in testing; thus, design data to be fed into the model do not yet exist. As data are gathered, modeling can be performed at a later date and results compared with those of this analysis. Case 5b creates a high-activity waste stream that is so efficiently processed by the calciner, that it would take most of the Tank Farm solution to be processed and stored to generate enough feed to operate the NWCF for one campaign. This would mean that the calciner would be held in standby for 4-7 years while the product was being produced and stored. It is unacceptable to maintain a facility and personnel for such extended periods without operating; thus, this case was not simulated. However, all other data were calculated for comparison purposes.

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[8]Currently, Bin Set 1 is being evaluated to determine the seismic qualification of the bins and vault. Based on this study, retrieval of calcine from Bin Set 1 and transporting it to Bin Set 6 or the WIF for processing, could be required. The volume in Bin Set 1 is small relative to other bin sets and should not significantly affect the modeling results.

Table II. Processing Time For New Technologies

Case	Processing Years	Number of Total Years
0a	1994-2045	51
0b	1994-2049	55
1	1994-2034	40
2a	1994-2030	36
2b	1994-2038	44
3	1994-2028	32
4a	1994-2031	37
4b	1994-2032	38
5a	1994-2044	50
5b	1994-2044	50
6	1994-2048	54
7	1994-2044	50
8a	1994-2036	42
8b	1994-2045	51

Summary of Tradeoff Studies

1) Minimizing waste to be immobilized requires the earliest and largest new tank volume or an accelerated new technology.

2) The less money spent on calcination or evaporation, the earlier and larger the new tank volume that would be required.

3) Calcination campaigns can be used to delay the need for new tanks or new technology to a point, but each campaign lengthens the amount of time the final process must operate to immobilize the calcine, increases the quantity of waste needing final immobilization, and thereby increases life-cycle costs.

The bottom line to meeting the NON Consent Order appears to have five options: 1) new technology, 2) new tanks, 3) a combination of new technology with adequate early surge capacity, 4) a combination of new technology and minimal calcination, or 5) renegotiation of the NON Consent Order in the form of an extension.

5.2 Life-Cycle Cost Analysis

Life-cycle costs include generation, transportation, storage, research and development, technical support, disposal and facility closure and monitoring activities. Costs already incurred are considered sunk costs and are not included in this analysis. Construction and ongoing capital costs of existing facilities are examples of sunk costs.

The life-cycle costs are developed in five major subsections: 1) development costs; 2) design, construction, and startup costs; 3) lifetime operations costs; 4) decontamination and decommissioning costs; and 5) disposal costs for the waste that has to be immobilized for disposal. Development costs are the expenses required to complete the technical development of the waste processing options in support of a facility title design. Design, construction, and startup costs are the expenses required to construct calcine retrieval and waste processing facilities needed to immobilize wastes for final disposition. The lifetime operating costs include the operations personnel and the materials and utilities required to operate the waste processing facilities. Disposal costs are the costs incurred to send the wastes to an approved, licensed, disposal site. Two sites license and publish costs for receipt of low-activity waste. High-activity wastes do not yet have a disposal site and the costs used for disposal are from the latest published, projected costs for the waste.

The costs for each of the categories were calculated for the year that the estimated cost was incurred. Project costs were escalated from the 1993 construction cost estimates using the appropriate INEL and DOE guides and factors. The other costs in the estimates were not escalated because of the time duration of the cost projections. If the operating costs are escalated at the low escalation rate guidelines that DOE published this year, by the end of the study period, one year of operating costs will equal about one half of the total projects costs. This great disparity in the cost totals resulted in a decision to eliminate the escalation of the costs other than the project costs that have published standards and rates for escalations. Without the operations and development escalations, it is easier to understand the relative costs of the various processing options. The costs for the first five years of operation and the life-cycle costs for all cases are presented in Table III.

Attachment D contains the projects cost estimates, including the basis of the construction costs taken from a current feasibility study for a spent fuel reprocessing facility. Attachment F contains the detailed costs spreadsheets that were prepared for each of the operating options. The detailed cost sheets show the five major costs subsections divided into several smaller sub-cost elements that make up the major costs subsections. The assumptions that comprise the costs estimates are also detailed in Attachment F. The timing requirements for the activities costed in the estimates are also detailed in the attachment along with pert chart schedules of the activities. In the attachment, the schedule impacts of environmental permitting and the costs incurred for the permitting are defined in detail. Detailed figures showing cost as a function of time for each case are provided in Attachment F.

The D&D costs for all the cases were added to the last year of the operations, because the duration of the activity is unknown and the cost is a significant factor relative to the facility costs for processing the wastes. The costs for waste disposal are calculated and costed the year that the waste volume is prepared for final disposal. Two waste costs are used for the disposal calculations. The first is for the low-activity waste that is prepared as a grout or cementations waste form and the costs are accrued at $10,000 per cubic meter requiring disposal. The second cost is for the high-activity waste that is prepared as glass or glass ceramic waste, with the glass costs accrued at $530,000 per cubic meter, and the glass ceramic waste form costed at $675,000 per cubic meter, because the glass ceramic form allows a higher radioisotope waste loading than the glass form.

Table III. Five-Year and Life-Cycle Costs

Case	Five Year Costs $M	Life-Cycle Costs $M
0a	288	7000
0b	266	9400
1	497	5800
2a	691	5410
2b	661	6260
3	433	4950
4a	497	5370
4b	494	5520
5a	297	7620
5b	297	7450
6	266	7320
7	300	9240
8a	321	6750
8b	430	8540

5.3 Alternatives Evaluation

Once the modeling was completed, it was clear that the problem and resolutions could be simplified. Specifically, it was clear that the only options (which are or could be made available to meet the NON Consent Order date of 2009) were to build new tanks or operate NWCF and the HLLWE. During the next time segment (2009 - 2015), new tanks or new technology are required to meet the NON Consent Order. Operating the NWCF alone, without new tanks or new technology, cannot empty the tanks. The needs of the final time segment (beyond 2015), can only be met by new technology. New tanks cannot meet these needs, since regulations require waste to be immobilized during these out years.

To analyze the cases in more detail, each was compared to the functional requirements in Section III.2. Figure 18 shows the ranking from best to worst of the cases based how well each meets a single functional requirement. Figure 19 shows the same data plotted by case. In both figures, smaller circles indicate a more desirable condition.

To rank the various cases, the systems analysis team assigned weighted values to each of these requirements to reflect their relative importance in the final decision. Life-cycle cost was judged the most significant criterion worth 29 percent of the total, and new tank volume was judged the least significant at 7 percent. The other requirements received weighting factors somewhere between these two extremes to reflect the team's judgment of their relative importance. These weighting factors were then multiplied with a normalized value which measured how well each case met the given requirement. (See Attachment G for additional information on how this calculation was performed.) The values for each requirement were added together for each case; the cases were then ranked based on their total points.

Although risk is listed as a functional requirement, a detailed risk analysis was not done for each case. The measure of risk used in this evaluation is the technical maturity of each of the alternatives. Some processes reflected in the alternatives have a longer history of success than others. Technical maturity values were determined by process experts from WINCO's Applied Technology Department. Figure 18 gives a summary of the technical maturity values calculated for each of the cases. The larger the value, the higher the probability that the technologies have of being successfully joined as planned. The value takes into consideration the level of development of each technology and the added complication that occurs when multiple technologies are linked together. In this way, mature technology and simplicity of operation were given preference. Safety was not a functional requirement used in the evaluation of risk because no facility will be designed nor built which does not comply with all safety requirements. A rigorous operational readiness review will be conducted (regardless of the process selected) to assure that safety requirements are met. Likewise, environmental compliance was not used as a functional requirement because all alternatives will comply with environmental

Meets Regulations	0a 5.0	0b 5.0	1 5.0	4a 5.0	4b 5.0	5a 5.0	5b 5.0	6 5.0	7 5.0	8a 5.0	8b 5.0	2a 3.1	2b 3.1	3 3.1
Completion Time	3 2.1	2a 1.7	4a 1.6	4b 1.5	1 1.4	8a 1.2	2b 1.0	5a 0.5	5b 0.5	7 0.5	0a 0.4	8b 0.4	6 0.1	0b 0.0
New Tank Volume	1 5.0	4b 4.8	8b 4.6	5b 4.6	8a 4.6	7 4.6	5a 4.6	4a 4.4	3 3.9	6 3.4	0a 2.6	2a 2.3	0b 1.7	2b 0.0
Technical Maturity	8b 3.39	0b 2.42	2a 1.58	2b 1.58	3 1.58	4b 1.51	4a 1.51	1 1.51	0a 1.51	8a 1.27	6 1.1	5a 1.06	7 0.95	5b 0.89
Total Waste	3 1.5	2a 1.5	2b 1.5	8b 1.4	4a 1.4	4b 1.2	1 1.0	5b 0.9	0a 0.9	8a 0.6	7 0.6	5a 0.6	0b 0.1	6 0.0
High Activity Waste	4a 4.6	4b 4.6	5b 4.6	2a 4.6	2b 4.6	3 4.6	1 4.5	5a 4.5	0a 4.5	6 4.4	8a 4.0	7 3.4	8b 1.2	0b 0.0
Low Activity Waste	0b 5.0	8b 5.0	7 1.7	2a 1.5	2b 1.5	3 1.5	4a 1.3	4b 1.2	8a 1.1	1 1.0	0a 0.9	5b 0.8	5a 0.5	6 0.0
5-Year Cost	0b 3.1	6 3.1	0a 2.9	5a 2.8	5b 2.8	7 2.8	8a 2.7	3 1.9	8b 1.9	4b 1.4	1 1.4	4a 1.4	2b 0.2	2a 0.0
Life-Cycle Cost	3 2.4	4a 2.2	2a 2.1	4b 2.1	1 1.9	2b 1.7	8a 1.4	0a 1.3	6 1.1	5b 1.1	5a 1.0	8b 0.5	7 0.1	0b 0.0
Compatible with future wastes	All cases are compatible with current wastes and expected future waste types													

NOTE: The numbers shown are on a normalized scale (1-5) from the actual values.

Figure 18. Ranking of the Cases Based on Meeting Functional Requirements

requirements. Any new facility is required to be designed, built, and operated to meet approved permit conditions. This approach must not be misunderstood. Safety and environmental compliance were not weighted, because at WINCO these are not negotiable. All cases reflect safe and environmentally sound operations.

Except for technical risk, measurement of most of the other requirements is straight forward. Life-cycle and 5-year costs are simply calculated dollar values. Total waste quantity is also a calculated value. However, the reader must understand that the total waste value is used to simply account for the negative perception that additional waste creates; the value does not include the dollar cost of additional waste (that is accounted for in the life-cycle cost). Completion time is simply measured in years. Tank volume is similar to waste quantity in that this value simply accounts for the negative perception that additional tankage creates; the cost is accounted for in life-cycle and 5-year costs.

If each functional requirement is given equal weight, and the cases are ranked from best to worst, the following results:

4b, 4a, 1, 8b, 8a, 3, 5b, 5a, 7, 0a, 6, 2a, 0b, 2b

Unfortunately, the simple linear approach is inadequate since each individual or group of individuals weighs each criterion differently based on their personal perceptions and concerns. For example, the team applied their personal weighting factors to the requirements and arrived at the following ranking which is different from what the simplified ranking process provided:

4a, 4b, 1, 3, 8a, 8b, 0a, 5b, 5a, 6, 2a, 7, 0b, 2b

(See Figure 20 for a graphical presentation of these two rankings.)

Other groups of people with different perceptions and concerns will also apply different weighting factors to each requirement and arrive at a different ranking.

Cases 4a, 4b, and 1 are highly ranked using either approach. All of these cases require NWCF operation (Case 4a - 2 campaigns, Case 4b - 3 campaigns, and Case 1 - 4 campaigns). The primary benefits of these cases is that by operating the NWCF a sufficient amount of time and by bringing WIF on line in 2008, new tankage can be avoided. However,the penalty is the life-cycle costs, final waste quantity, and waste treatment time each increase incrementaly with each additional NWCF campaign.

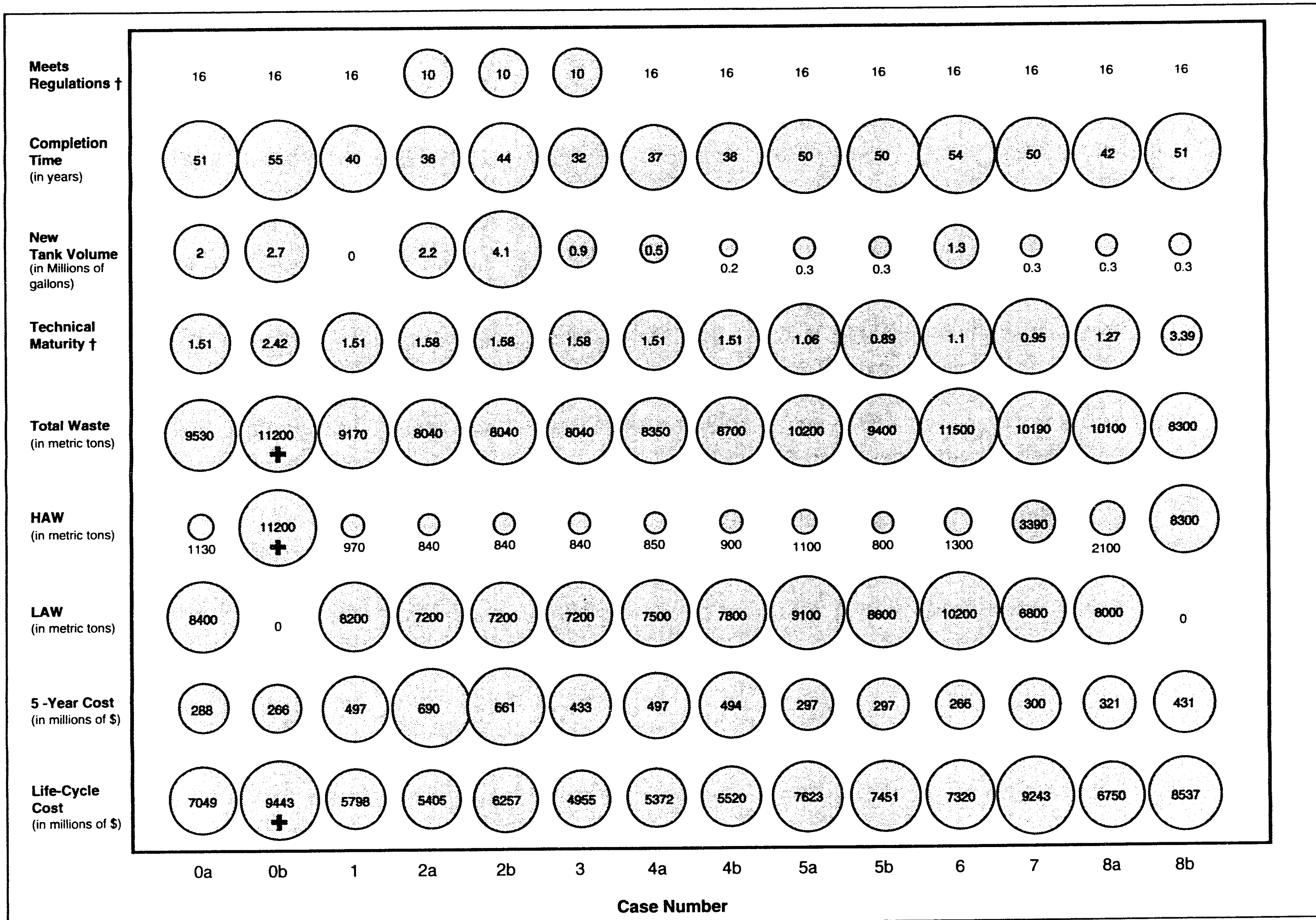
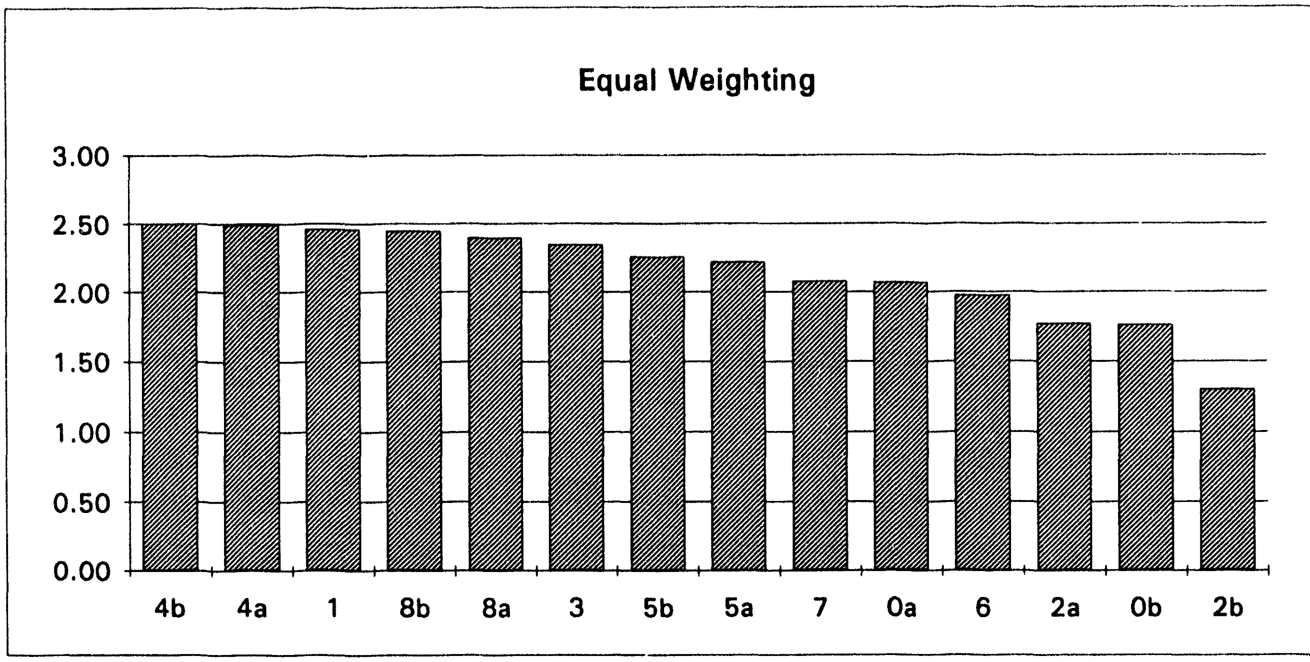


Figure 19. Results of How Well Each Case Meets the Functional Requirements.

✚ The actual number is larger than this. The computer model stopped calcination at 2027, leaving unprocessed liquid.

† These numbers are inversely proportional to the area of the circle to show that smaller is better.

NOTE: The areas of the circles on each row are proportional to the corresponding numbers. In order to get good resolution, the normalization scale is different for each row of data.



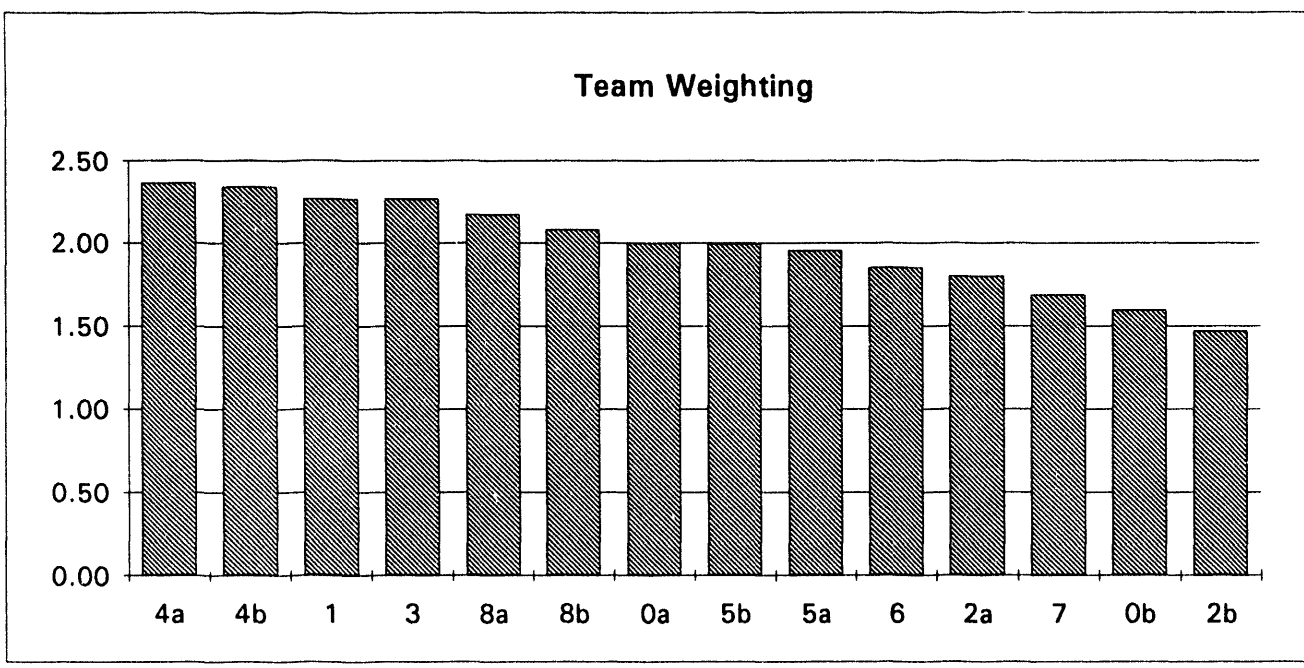


Figure 20. Case Ranking

Cases 8a and 8b also rank relatively high using either the linear or team-weighted ranking. These cases use a WIF approach where the vitrification portion of WIF is brought on line in 2008 and the remainder in 2015 (Case 8a) or continue direct vitrification of calcine in 2015 (Case 8b). The primary benefit of Case 8a is it shows that some flexibility exists in building WIF in that it does not necessarily need to be constructed all at once, but could be brought on line in a phased manner. Although only two phases were used in the model (1. vitrification and 2. the balance of the facility), the process could actually consist many combinations (such as: 1. FPR safety upgrades, 2. waste transfer lines, 3. separations, 4. vitrification, and 5. grouting). However, the penalty is that life-cycle and final waste quantity increase significantly with this approach. Of particular concern is that the amount of HAW is 2.5 times greater. (Compare Case 8a and Case 4b; they are identical except for the phased WIF in Case 8a). This case is desirable only if WIF cannot be funded and constructed as a single project.

The primary benefit of Case 8b is that it is a simple process. However, the penalty is that since there is no separations process, all of the waste is immobilized as a high-level glass and will ultimately be required to be stored in a geologic repository.

Case 3 ranks relatively high using the team-weighted approach. The primary benefits of this case are that by building new tanks, not operating the NWCF, and bringing the WIF on line in 2008, life-cycle costs, final waste quantity, and waste treatment time are minimized. The penalties are that it does not meet all regulatory requirements and the new tank volume required is relatively high (900,000 gallons).

As the team evaluated these results and the assumptions used in creating the cases, it became clear that since the conditions used in the modeling (waste generation rates, NWCF throughput, HLLWE performance, WIF funding and construction schedule, etc.), could change significantly during the years covered in the modeling, an additional consideration should be applied to the final decision-making process: flexibility. This requirement is the ability of the chosen case to respond to changes in conditions as they depart from those conditions which were modeled.

It was clear to the team that NWCF operation provided significant flexibility and building new tanks provided little flexibility. For example, if improvements in dry decontamination techniques in 1998 reduced liquid waste generation significantly from that predicted for the following years, the volume provided by the new tanks could not change and some of it would remain unused. However, the NWCF operation could be curtailed by the appropriate amount at any time. Conversely, if liquid waste generation increased, the NWCF could be operated for additional incremental time. However, the tank volume could not be increased without a major project, which would require several years to implement.

Based on the relatively high potential for actual conditions to change from those were modeled over the 20+ years, operation of the NWCF, with its greater ability to respond to those changes, is preferred by the team over building new tanks.

IV. Tankage Options

During the brainstorming step described in the Alternatives Determination section, several ideas for alternate means of supplying process tankage were proposed. These ideas were briefly discussed and the viable ones were evaluated in more detail. Although this additional tankage is not a solution to the overall waste problem by itself, this tankage may provide part of the answer in terms of alternate tank volume or process surge capacity for any new processes.

Five options were identified, four options using modified, existing facilities and the fifth option of building new tanks. The results of this study are summarized in Table IV. The estimated costs for modifying existing facilities do not include ancillary systems for monitoring tank contents and inspecting for tank integrity; costs may need to be increased if these systems are required. The estimated cost for the new facility includes the cost of the ancillary monitoring and inspection equipment needed to meet current DOE requirements. Additional details are provided in Attachment E.

Table IV. Tank Liquid Storage Options and Cost

Tank Option	Total Volume (gallons)	Estimated Cost (1993 dollars)	Cost per Unit Volume ($/gal)
VES-WM-103, 104, 105 & 106	120,000	30,000,000	250
FPR cells 1, 2, & 3	153,000	12,000,000[1]	78
VES-WM-190	260,000	52,000,000	200
Bin Set 7	450,000	37,000,000	82
New Tanks Facility	500,000 1,000,000 2,000,000	110,000,000 150,000,000 178,000,000	220 150 89

1 Cost assumes FPR has been upgraded in all safety requirements and common utilities, HVAC, etc., are in operation.

V. Conclusions and Recommendations

This systems analysis study evaluated fourteen bounding cases for addressing the issues associated with the ICPP Tank Farm. (Other cases exist as variations of these fourteen, but their results can be projected via comparison with the most similar bounding cases.) As presented, all fourteen cases satisfy the functional requirements specified by the study (except for regulatory drivers for Cases 2a, 2b and 3). This is accomplished by providing the necessary volume of tankage for each case; thus, the specified tankage requirements are inherent to each option. However, each case differs by the manner in which five variables are addressed. The variables include:

1. Implementation of the HLLWE,

2. Implementation of early new technology (freeze crystallization or neutralization)

3. Implementation of the WIF,

4. Operation of the NWCF, and

5. Generation rates of radioactive liquid waste.

Final selection of cases can be made using the functional requirements as a tool for case comparison. The decision then becomes dependent upon how well the cases meet the functional requirements and the relative weighting given each of the functional requirements. As discussed in Section III.5.3, the cases involving the HLLWE, the NWCF, and a 2008 WIF appear to best resolve the problem as defined. Final selection of a case, however, must follow a detailed and informed assignment of weighting values to the functional requirements by those charged with making the final decision.

Regardless of the case chosen, this study demonstrates the importance associated with certain activities. Specifically:

- Rapid installation and operation of the HLLWE is necessary.

- Radioactive liquid waste generation must be minimized.

- Either continued operation of the NWCF or construction of new tankage is required to meet NON Consent Order requirements for 2009.

- Implementation of the WIF or equivalent facility by 2008 or earlier is necessary. If this window is missed, additional new tanks must be supplied to meet the NON Consent Order requirements for 2015.

- Implementation of a mechanism for assessing stakeholder values should be carried out. Final selection of a case is dependent upon the subjective weighting assigned the functional requirements.

Based on the desire to minimize life-cycle costs and the final amount of waste, while meeting all regulations and providing maximum process flexibility, operation of the NWCF was chosen by the team as the preferred approach. This results in the following recommendations:

o Install and operate the HLLWE.

o Minimize liquid waste generation as much as possible within the constraints of required ICPP operational, safety, and environmental commitments.

o Bring a Waste Immobilization Facility on line by 2008 or earlier.

o Operate NWCF as required to alleviate the need for new tank capacity (except for WIF process surge).

o Maximize the concentration of sodium plus potassium in the calcine to minimize the final amount of waste requiring immobilization.

o Avoid using Bin Set 7 for calcine storage, if at all possible, to reduce future calcine retrieval and D&D costs.

o Use WM-190 for liquid waste storage and one of the pillar and panel vaulted tanks as the spare.

Operation of the HLLWE and the NWCF, if combined with waste minimization, should allow DOE to meet the NON Consent Order requirement to cease use of the pillar and panel tanks by 2009. Feeding the maximum mole percent sodium plus potassium possible to the calciner (again, with waste minimization) should alleviate the need to put calcine in Bin Set 7, which will be a significant future cost savings for calcine retrieval and D&D of the facility. Bringing the new Waste Immobilization Facility on line as soon as possible should allow DOE to meet the NON Consent Order requirement to cease use of the remaining Tank Farm tanks by 2015. Replacement Tank Farm tanks should not be required with this proposed action.

However, new tank capacity of 150,000 to 300,000 gallons will need to be installed to provide for normal process surge capacity and feed receiving needs when WIF comes on line.

This recommendation is best modeled by Case 4b. However, one of the main advantages of this recommendation is that the NWCF can be operated for either more or fewer campaigns than modeled to respond to changing conditions in waste generation or other variables. Case 4b, as modeled in this report, requires approximately 200,000 gallons of new tankage to met the 2009 NON Consent Order date. However, preliminary results indicate that careful selection and blending of the HLLWE and NWCF feeds during the next campaign can alleviate this shortfall. This more detailed modeling is not yet complete and is not included herein. It will be reported at a later date when the analyses are completed.

Although the recommendations given above are based on a carefully derived model of ICPP waste management, the assumptions and risks associated with this plan must be emphasized. They are:

- Liquid waste generation rates will not exceed those used in the model.
- The HLLWE will come on line as scheduled and operate as predicted.
- The NWCF will operate as predicted.
- WIF will be funded, come on line by 2008 or earlier, and operate as predicted.
- The cease use dates for the Tank Farm and the NWCF operating requirement in the NON Consent Order are not negotiable.
- The requirement to calcine all high-level liquid waste by 1998, per the Amended Court Order, is not negotiable.

To maximize the probability of success of this approach, the following should be done:

- A detailed, long-term waste management plan for ICPP should be developed and followed. Liquid waste generation should be specifically planned for, tracked, and carefully controlled. Any departure from the plan, particularly increases, should not be permitted without careful review and approval, with the realization that increases may jeopardize meeting the NON Consent Order. The plan should be updated at least annually, using the same detailed modeling techniques as used in this study.

- o The HLLWE and NWCF must receive appropriate priority during their construction, turnarounds and operation. Turnarounds must be carefully planned and monitored to assure start-up schedules are met.

- o A funding commitment for WIF must be made and continued.

If, due to failures in any of the above items, the schedule slips, fall-back positions are available:

- o Continue NWCF operation. (However, this action alone will not meet the 2015 NON Consent Order).

- o Renegotiate the NON Consent Order.

- o Build new tanks, if time allows.

Although the team, as a whole, prefers this recommendation over other possible scenarios, other stakeholders may rank the cases differently than the team, due to giving higher or lower weighting to the various functional requirements. If a different, final recommendation results from the interaction of the various stakeholders, this is acceptable to the team since all of the cases described in the report lead to acceptable final waste treatment and storage conditions. Each case takes a somewhat different path to the end point and each case has its specific advantages and disadvantages.

Additional actions, not based on assumptions used in the model, which should be considered, are:

- o Approach the State on the possibility of renegotiating the NON Consent Order to eliminate the requirement for operation of the NWCF every 3 consecutive years and to extend both cease use dates for the Tank Farm by approximately five years.

- o Approach the District Court on the possibility of revising the Amended Order Modifying Order of June 28, 1993 to eliminate the requirement to remove all high-level liquid waste (that waste currently in WM-189) from the Tank Farm by 1998.

If successful, these actions would eliminate the need to operate NWCF or build new tanks and would ultimately save hundreds of millions of dollars. The high-level liquid waste evaporator and the 2008 Waste Immobilization Facility would still be required with this course of action.

Attachment A

Regulatory, Schedule, and Cost Information Related to Permitting

Regulatory Issues

Several regulatory constraints will have a direct and significant bearing on the need for hazardous and radioactive (mixed) waste storage and treatments at the Idaho Chemical Processing Plant (ICPP). Primary regulatory constraints are the Notice of Noncompliance (NON) Consent Order between the Idaho Department of Health and Welfare (IDHW) and the Department of Energy (DOE) signed April 3, 1992; the Federal Facilities Compliance Act (FFCA) signed into law on October 6, 1992; the Amended Order Modifying Order of June 28, 1993, signed by the District Court for the State of Idaho on December 22, 1993; and the applicable Resource Conservation and Recovery Act (RCRA) operating and permitting requirements. The following sections describe those constraints and identify several other regulatory requirements.

1. Notice of Noncompliance Consent Order

The NON Consent Order between DOE and IDHW defines several actions to be taken by DOE in response to a NON issued by the Environmental Protection Agency (EPA) on January 28, 1990. In the NON, EPA (and later IDHW) contended that the eleven tanks in the ICPP Tank Farm and much of their associated valves and piping were not in compliance with the secondary containment requirements set forth in Idaho Administrative Procedures Act (IDAPA) § 16.01.5009 (Volume 40, Code of Federal Regulations (CFR), Part 265.193). The NON Consent Order allows continued operation of the existing Tank Farm and certain piping provided the NON Consent Order compliance schedule is met. The NON Consent Order does not, however, make any allowances for operation, if RCRA interim status is lost as discussed in Section 11.

The NON Consent Order outlines a strict compliance schedule for the completion of several tasks that will ultimately result in the required permanent cessation of use of the 5 pillar and panel tank vaults[9] containing tanks WM-182, WM-183, WM-184, WM-185, and WM-186 on or before March 31, 2009; and the remaining 6 monolithic vaults containing tanks WM-180, WM-181, WM-187, WM-188, WM-189, and WM-190 on or before June 30, 2015, among other provisions. These dates were based on previously planned new tanks being available in 1996 with hot use starting in 1997. The NON Consent Order also requires that operation of

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[9] The waste tank vaults surrounding the tanks consist of three separate designs. The pillar and panel vaults are the vaults enclosing tanks WM-182 to WM-186. These vaults are precast reinforced concrete construction. Sixteen columns are distributed around the octagonal vault perimeter. Six-inch thick vertical precast wall panels are clipped to these columns. The monolithic vaults enclose tanks WM-180, WM-181, and WM-187 to WM-190. The vaults enclosing tanks WM-180 and WM-181 are octagonal in plan and were constructed completely of cast-in-place concrete. Tanks WM-187 to WM-190 are laid out on a 2 X 2 grid and are enclosed by a single rectangular vault with partition walls separating the tanks. The exterior and partition walls are integral with the mat.

the NWCF not be discontinued for more than 3 consecutive years. Working a reasonable schedule backward from these compliance deadlines, it is clear that efforts to discontinue use of the tanks must be started by the late 1990s in order to meet the deadlines.

For purposes of compliance with the NON Consent Order, "cease use" has been interpreted by WINCO to mean removal of all liquid heel so that any remaining material within the tank contains no free liquids per EPA method 9095 (Paint Filter Liquid Test). Removal of all free liquids places tanks in compliance within RCRA tank system requirements of 40 CFR 265.190(a) (which does not require secondary containment) where the tanks are located on impermeable floors. When the requirements of 265.190(a) are met, the secondary containment requirements of 265.193 are not applicable. Alternatively, recent discussions between DOE and IDHW suggest that the "cease use" dates could be changed to reflect emptying the tanks to liquid heel and that closure should deal with the liquid and solid heel. It appears there is a basis for negotiation and consensus with the state on this issue.

The ability to comply with the current NON Consent Order milestones or establish new milestones is contingent upon a number of activities. Among these are operation of the NWCF calciner; rate of depletion of both high-activity waste and sodium-bearing waste from the Tank Farm; waste generation that would add to the Tank Farm inventory[10]; installation and operation of the NWCF evaporator tank system (HLLWE); availability of new tankage; deployment of new technologies for processing high-activity waste, sodium-bearing waste, and decontamination waste; deployment of new decontamination techniques; and the possible imposition of the RCRA Subpart O requirements for incinerators on NWCF calciner operations.

<u>2. Amended Order Modifying Order of June 28, 1993, signed by the District Court for the State of Idaho on December 22, 1993</u>

On June 28, 1993, the United States District Court for the District of Idaho issued an Order Granting Motion for Summary Judgment, Injunction and Administratively Terminating Action. This court order prohibits further transportation, receipt, processing, and storage of spent nuclear fuel at the Idaho National Engineering Laboratory (INEL) until the DOE issues a record of decision (ROD) based upon an environmental impact statement (EIS) for those actions, and any challenges to the ROD are resolved. On August 9, 1993, the Governor of the State of Idaho and the Secretaries for the DOE and the Department of the Navy signed an agreement that had additional stipulations on nuclear fuel and waste management activities at the INEL. On December 22, 1993, the District Court for the State of Idaho signed an

[10] Examples of waste generation that would add to the tank farm inventory are decontamination for maintenance, decontamination for decommissioning, NWCF calciner bed dissolution, NWCF scrub solution deep recycle, high-efficiency particulate air filter leaching, Process Equipment Waste evaporator operations, and Liquid Effluent Treatment and Disposal facility operations.

Amended Order Modifying Order of June 28, 1993, incorporating the terms of the agreement.

The amended order requires that DOE accelerate activities relating to the treatment, storage, and disposal of high-level radioactive wastes. It provides milestones for drafting and obtaining a ROD on an EIS, for completing calcining high-level liquid waste, for evaluating the need for new tank capacity and construction of such capacity, for selecting treatment technologies for processing sodium liquid waste and calcine, renegotiating the NON Consent Order (dated April 3, 1992) addressing secondary containment issues in the ICPP Tank Farm. Table A-I gives deadlines for waste management related actions required by the amended order.

3. Federal Facilities Compliance Act

The FFCA waives DOE's sovereign immunity from civil and administrative fines and penalties assessed under the Solid Waste Disposal Act. It allows a 3-year delay in the waiver of sovereign immunity for DOE for the land disposal restrictions (LDR) storage prohibitions (40 CFR 268.50) "so long as such waste is managed in compliance with all other applicable requirements." Section 3021(b) of the FFCA requires a compliance plan (site treatment plan) that addresses development of "treatment capacities and technologies to treat all of the facilities' mixed waste regardless of the time they were generated...". The FFCA provides for the state within which a DOE facility resides to review, consider public comment, and approve the site treatment plan. Upon state approval, the state will issue a consent order.

The schedule for submittal of the inventories and the site treatment plans is given in Table A-II. The final proposed site treatment plan is to be submitted by February, 1995, before the EIS ROD. The FFCA is independent of the National Environmental Policy Act (NEPA) decision process discussed below.

The site treatment plans will be submitted to host states, EPA regions, and the National Governors' Association for review and to resolve issues in regard to matching treatment capabilities to waste streams across the DOE complex and disposition of treatment waste forms and residues. (This is referred to as equity issue resolution.) In this way, Idaho, and other states in which DOE facilities reside, can be involved in determining waste management alternatives and be instrumental in choosing the preferred alternative for ICPP. Equity issue resolution will have a strong role in determining compliance paths in Idaho and in a broader, Complex-wide context.

To implement the preferred technology, an LDR equivalency determination or treatability variance from EPA that may be required for those waste codes that may not be treated by the selected technology (i.e., require additional treatment via another technology) to meet LDR standards must be obtained before operation. In addition, approval from the EPA to exclude, or "delist," such waste streams from regulation may be sought.

Table A-I. Deadlines Relating to Waste Management in the Amended Order Modifying Order of June 28, 1993

Section	Action	Deadline
2.a	Issue a document that describes the scope of, and sets forth the plan for preparing the EIS	November 1, 1993 (complete)
2.b	Complete a draft EIS	June 30, 1994
2.c	Complete a final EIS	April 30, 1995
2.d	Issue a record of decision based upon the final EIS	June 1, 1995
5.a	Calcine all high-level radioactive waste that does not contain sodium[1]	January 1, 1998
5.b	Calcine or otherwise process as much sodium-bearing high-level liquid radioactive waste (sodium liquid waste) as DOE and the State of Idaho mutually agree is practicable[1]	January 1, 1998
5.c	Identify a limited number of potential technologies to calcine or process sodium liquid waste	November 15, 1993 (complete)
5.d	Select a technology for calcining or processing sodium liquid waste, including a pretreatment technology (if appropriate)	June 1, 1995[2]
5.e	Select a technology for converting calcined waste into an appropriate form for disposal	June 1, 1995[2]
5.f	Construct facilities necessary to implement the technologies selected for calcining or processing sodium liquid waste and for converting calcined waste into an appropriate form for disposal	In accordance with a schedule to be negotiated with the State of Idaho
6.(1)	Complete all necessary preparatory work to be able to begin, and to begin construction of replacement tanks[3]	Close of the construction season of 1996
6.(2)	Complete vault construction and initiate tank erection[3]	October 1, 1998
6.(3)	Complete construction[3]	Close of the 1999 construction season, but in no event later than four years after commencement of construction.
8	Complete negotiations to modify the Notice of Noncompliance Consent Order (April 3, 1992) to accelerate activities related to the treatment, storage and disposal of high-level radioactive wastes	March 1, 1994[4]

[1] In the context of the proposed order, sodium liquid waste stored in the Tank Farm is included as liquid high-level waste, although it may not ultimately be defined to be high-level radioactive waste.

[2] In conjunction with the record of decision (ROD) for the final EIS. (Legal counsel has determined that these decisions should be part of the EIS ROD.)

[3] If the record of decision for the EIS determines a need to construct replacement capacity.

[4] Unless the parties mutually agree upon extensions of time for concluding the negotiations.

Table A-II. FFCA Submittal Schedule

Activity	Submittal Date
Mixed Waste Inventory, Treatment Capacity and Technology Report	April 5, 1993 (180 days from enactment of the FFCA) (completed)
Conceptual Site Treatment Plan	October 1993 (completed)
Draft Site Treatment Plan	August 1994
Final Proposed Site Treatment Plan	February 1995
Delay from waiver of sovereign immunity ends. If mixed waste NON Consent Order is not agreed to by State, enforcement may begin	October 6, 1995

4. Secondary Containment and Release Detection (40 CFR 165.193)

Unless a tank contains no free liquids and is located in a building with impermeable floors, secondary containment and release detection are required. Secondary containment systems must be designed, installed, and operated to prevent the migration of liquid out of the tank system, and to detect and collect any releases that do occur. The secondary containment for tanks must be a liner (external to the tank), a lined or interior coated vault, a double-walled tank, or an equivalent device as approved by IDHW.

The hazardous waste tank system standards provide for two types of variances: technology-based variance, or risk-based variance. Alternately, the state may approve an equivalent secondary containment device petition as allowed in 265.193(d)(4). The petition would have to demonstrate that the device satisfies all of the performance criteria established in Section 265.193 for a secondary containment system. However, the current NON Consent Order clearly indicates in Section 6.20(D) that DOE will not pursue either an equivalency demonstration or a variance.

5. Closure and Post Closure

Hazardous waste residues and contaminated soil must be removed or decontaminated at the time of closure. If removal or decontamination to satisfactory levels is not practically possible, the tank system must be closed following the requirements for landfills.

Once the Tank Farm has received the last known volume of waste, the status of the units changes under RCRA and the closure requirements are triggered (40 CFR 265, Subparts G and J describe the closure actions). The date on which an owner or operator expects to begin closure is either no later than 30 days after the date on which any hazardous waste management unit receives the known final volume of hazardous waste, or one year after the date of receipt of the most recent volume of hazardous wastes. Since the Tank Farm tanks do not comply with the interim status requirements regarding secondary containment, they are not eligible for an extension to the 1-year limit.

Upon removal of the liquid heel from a Tank Farm tank, the tank will be considered empty, but the formal closure process will still be required, and this will involve removal or decontamination of waste residues and contaminated soil. This process will be described in a RCRA closure plan that is currently planned to be submitted to IDHW by June 30, 1995, in accordance with the INEL RCRA work plan.

The method to demonstrate that the closure performance standard is met for the Tank Farm tanks will be negotiated with IDHW through the closure plan approval process. It is likely that the method proposed will be a clean debris surface (tank/pipe/vault) demonstrated by visual inspection, similar to that allowed for debris treatment. Enough water flushing, acid flushing, or dry decontamination will be done such that a clean debris surface is achieved. The flush solutions or decontamination residuals may be managed as hazardous waste, because they will be deemed mixed with the listed hazardous waste contamination. (There are several regulatory actions underway that may affect this issue.)

The regulations impose deadlines for undertaking these closure activities. Removal or decontamination of hazardous waste or hazardous constituents from the facility must be completed within 90 days after receiving the final known volume of hazardous waste or within 90 days after the approval of the closure plan. Closure activities must be completed within 180 days after receiving the final known volume of hazardous waste or within 180 days after the approval of the closure plan. Extension to the 180-day clock is available under 265.113(b) and will be addressed in the closure plan. (IDHW is aware that closure within 180 days of initiating closure is unrealistic for a mixed waste facility and may extend these closure deadlines in specific cases.) A registered, professional engineer must certify that the conditions and procedures described in the approved plan were adhered to during closure activities.

Thus, the initiation of closure activities is prescribed by RCRA as is the time frame allowed to complete closure activities. Extension of these schedule constraints is available under the law or as part of the approved work and closure plan, but strict criteria outlined in the law must be met and approval from the state must be obtained.

6. RCRA Permitting

Owners or operators of facilities that treat, store, or dispose of hazardous waste must obtain an operating permit under Subtitle C of RCRA. A permit defines a facility's requirements under Subtitle C. These requirements consist of all the general and technical standards, as well as requirements for corrective action.

6.1 Types of Hazardous Waste Permits

Several categories of permits are issued under the RCRA Subtitle C program. Each category defines operating requirements and various provisions specific to the permitting need. The types of permits most applicable to the ICPP are briefly discussed as follows:

- Treatment, Storage, and Disposal Permits - Most commonly, RCRA permits are issued for treatment, storage, and disposal (TSD) units. The units are containers, tank systems, surface impoundments, waste piles, land treatment units, landfills, incinerators, and miscellaneous units. These methods are the most common way to treat, store, and dispose of hazardous waste. Minimum national standards have been promulgated for each of these methods in 40 CFR Part 264.

- Research, Development, and Demonstration Permits - EPA encourages the use of alternate treatment technologies by issuing research, development, and demonstration (RD&D) permits for promising innovative and experimental treatment technologies.

  National standards must not exist for the treatment technology. Permits are issued for one year, and they may be renewed up to three times. RD&D facilities can receive only those wastes that are necessary to determine the efficacy of the treatment technology.

  Issuance of RD&D permits follows a more streamlined process than a standard RCRA permit. The EPA may modify or waive the usual permit application and issuance requirements, with the exception of financial responsibility and public participation, as long as the agency maintains consistency with its mandate to protect human health and the environment.

Table A-III gives the average time and cost of obtaining a RCRA TSD or RD&D permit, as well as for Clear Air Act (CAA) permits, and NEPA approvals discussed in Sections 7 and 8, respectively.

6.2 Permit Administration

Once issued, RCRA permits are valid for up to ten years. During the term of a permit, situations may arise which may cause the permit to be modified, revoked and reissued, or terminated.

Table A-III. Environmental Permitting or NEPA Approval Costs and Schedules

Permit or Document Type	Permit or Document	Average Time (months)	Average Costs ($)
National Environmental Policy Act (NEPA)	Categorical Exclusion (CX)	6	3,000
	Environmental Assessment (EA)	18	80,000
	Facility Environmental Impact Statement (EIS)[1,2]	24	2,000,000
Resource Conservation and Recovery Act (RCRA)	Treatability Study	3	10,000
	Research Development and Demonstration (RD&D) Permit	18	100,000
	Treatment, Storage, and Disposal (TSD) Permit[1]	36	250,000
Clean Air Act (CAA)	Air Permitting Applicability Questionnaire	1	2,000
	Below Regulatory Concern (BRC)	3	6,000
	Permit to Construct (PTC)	9	40,000
	PTC/Prevention of Significant Deterioration (PSD)	15	50,000
	PTC/PSD/National Emission Standards for Hazardous Air Pollutants (NESHAP)	15	65,000

1 This document or permit is required for a mixed waste treatment facility.

2 Site-wide EIS is on a fixed schedule (to be completed by June 1, 1995) and is not included in this table.

6.3 Permit Modification

Permits may need modification for a number of reasons, including substantial alterations or additions to the facility, new information about the facility becomes available, or new statutory or regulatory requirements affect existing permitted activities. Changes to or additions of waste management processes at the ICPP may be accomplished through the permit modification process, including upgrades to existing processes and the addition of new processes.

EPA has categorized selected permit modifications into three classes and established administrative procedures for approving modifications in each class.

The permit modification regulations provide owners and operators the flexibility to change permit conditions, expand public notification and participation opportunities, and allow for expedited approval, if no public concern exists for a proposed modification.

The classes are defined as:

Class 1: Changes that are necessary to correct minor errors in the permit, to upgrade plans and records maintained by the facility, or to make routine changes to the facility or its operation. They do not substantially alter the permit conditions or significantly affect the overall operation of the facility.

Class 2: Changes that are necessary to enable a permittee to respond, in a timely manner, to (i) common variations in the types and quantities of the waste managed under the facility permit, (ii) technological advancements, and (iii) regulatory changes, where such changes can be implemented without substantially altering the design specifications or management practices prescribed by the permit.

Class 3: Major changes that substantially alter the facility or its operations.

Table IV gives the average time and cost to submit a permit modification request and receive needed approvals.

In addition to establishing permit modification classes and administrative procedures, this regulation also gives EPA the authority to grant temporary authorization for facilities to respond promptly to changing conditions.

Table A-IV. Average Time and Cost to Submit a Permit Modification Request and Receive Needed Approvals.

Class	Average Time (Months)	Average Cost ($)
1[1]	0.25	2,200
1[2]	1.5	4,400
2[3]	6	30,000
3	36	250,000

[1] Notification must be received within 7 days of implementing change

[2] Requires regulator approval prior to implementing changes

[3] Construction may begin 60 days after submitting modification request

7. Clean Air Act

Any decision to construct replacement capacity for the Tank Farm or to construct or modify other storage or treatment units would trigger CAA permit requirements. Construction of a stationary source of air pollution is prohibited without first obtaining a Permit-to-Construct (PTC) or approval (e.g., an exemption) from IDHW. In addition, the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standards (NSPS) must be reviewed to evaluate their applicability to the planned sources. A new Major Facility or Major Modification, such as upgrading the Tank Farm, in an attainment or unclassified area (e.g., the INEL) for any air contaminant must comply with IDAPA §§16.01.1012.04.a.iii, 16.01.1012.05 and 16.01.1012.07. (See Table A-III for the average time and cost for obtaining CAA permits).

8. National Environmental Policy Act

Any significant action undertaken by a Federal agency must undergo a review in accordance with the NEPA to identify and evaluate potential environmental impacts.

To meet the requirements of NEPA (40 CFR § 1500), the DOE NEPA Regulations (10 CFR §1021), DOE Order 5440.1E, and other DOE direction, existing environmental documentation must be reviewed, and if necessary, appropriate new documentation must be prepared and processed for all facility modifications, general plant projects, and new programs or development projects.

Tank Farm upgrades to secondary containment, heel removal equipment, and replacement for the capacity in tanks WM-182 through WM-186 are the subject of an Environmental Assessment (EA) which received a Finding of No Significant Impact (FONSI) on June 4, 1993. This FONSI limited activities to the proposed upgrades only and required additional NEPA review if DOE proposes to proceed with the tank replacement project as specified in the EA.

Although numerous studies are being performed to evaluate alternatives to allow "cease use" of the Tank Farm tanks to occur at the earliest possible dates, the selection of the preferred alternative will involve the NEPA decision process. Per the Amended Order Modifying Order of June 28, 1993, this decision would be on or before June 1, 1995, much later than the required renegotiation of the NON Consent Order (March 1, 1994). The proposed order ties selection of the preferred technology for converting calcine into a final form for disposal to the EIS ROD, as well as the determination of the need for new tank capacity.[11] Technology alternatives would need to be identified by November 1994 to be included in the final EIS.

Upon receiving a NEPA decision, Title II design can begin for deployment of the preferred technology. Table A-V shows a typical schedule for any new project based on a 1995 NEPA decision, and assuming funding is requested by October 1994. It is unlikely that any new technology could be implemented (including facility construction) prior to fiscal year 2008.

To implement the new technology may require a tiered NEPA decision. That is, the EIS might only describe in general the new technology and the alternative, and additional NEPA documentation may be needed that includes additional information not available at the time the EIS was prepared. It may be determined that the most extensive level of NEPA analysis is required - in this case a facility-specific EIS. Reviews and approvals consistent with the chosen level of NEPA analysis and documentation will be required. (See Table A-III for the average time and cost for obtaining NEPA approval).

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[11] Although the agreement only required that the decisions on the technology for immobilizing calcine be done in conjunction with the EIS ROD, legal counsel has determined that this decision should be part of the ROD.

Table A-V. New Major Process Project Schedule Based on 1995 NEPA Decision

Activity	Fiscal Year	Notes
Request operating funds for conceptual design	1994	
Start Conceptual Design	1994	
Submit Short Form Data Sheet	1995	By October 1, 1994, for FY-1998 Title Design start
Initial NEPA Decision	1995	June 1, 1995 or prior to start of Title II Design
Start Title I Design	1998	October 1, 1997 for FY-1995 short form data sheet, assume 2 years
Start Title II Design	2000	Assume 2 years
Start Construction	2002	Assume 5 years
Startup	2007	Assume 2 years
Operation	2009	

9. Comprehensive Environmental Response, Compensation, and Liability Act

Ten areas of known or suspected releases of hazardous and/or radioactive substances have been identified within the Tank Farm operable unit at the ICPP as described in the Federal Facilities Agreement/NON Consent Order (FFA/CO), which is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) instrument. The action plan for the FFA/CO identifies the tasks to be completed and the schedule to be maintained in implementing the FFA/CO.

The areas identified in the FFA/CO are limited to releases from valves and piping, because the tanks or the associated vaults have no record of leakage. Characterization of these releases cannot be completed without incurring the inherent risk of drilling in and around an operational tank farm. The presence of radioactive waste in the tanks limits remedial efforts to remove highly contaminated soils from the area. The risks and potential exposure presented by large-scale excavation or drilling in a operational tank farm thus restricts the scope of the remedial investigation/feasibility study to the placement of an impermeable cap over the area. A tank project would offer some opportunity to do some remediation in conjunction with construction of the cap.

In addition to the Tank Farm, other sites with known releases of hazardous and/or radioactive substances have been identified throughout the INEL. Environmental restoration projects developed to mitigate these releases could generate substantial volumes of liquid hazardous waste as a result of activities such as debris decontamination, soil washing, et cetera. The liquid wastes generated during the remediation of these releases may be regulated as hazardous waste and, as such, would require that they be handled in a manner similar to the liquid wastes generated by decontamination and decommissioning. Failure to provide capacity for storage or treatment of the liquid wastes generated by restoration activities could be interpreted as non-compliance with the FFA/CO.

10. Department of Energy Orders

DOE Order 6430.1A, General Design Criteria, presents the seismic requirements that must be met by new units in a tank farm. Currently, the pillar and panel vaults for five of the tanks (WM-182 through WM-186) in the Tank Farm cannot be shown, with current analytical techniques, to meet these seismic requirements. This deficiency has provided the priority that these tanks be removed from service first. Additionally, a seismic analysis of the monolithic vaults for tanks WM-187 through -190 has not been concluded, but it is likely that they will meet the seismic standards. The monolithic vaults for tanks WM-180 and -181 meet the required seismic standards.

In addition to DOE Order 6430.1A, DOE has established orders to implement all of the regulations discussed previously. Other regulatory constraints are established in DOE Order 5400.1, General Environmental Protection Program; DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements; DOE-ID Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements; DOE Order 5440.1E, Implementation of the National Environmental Policy Act; DOE Order 5400.4, and Comprehensive Environmental Response, Compensation, and Liability Act Requirements; and DOE Order 4700.1, Project Management System.

11. RCRA Penalty Provisions

Section 3008(d) of RCRA addresses civil penalties for any past or current violations under Subtitle C of RCRA and criminal penalties for persons convicted of knowing violations in terms of transportation, generation, storage, treatment, disposal, export, or otherwise handling hazardous waste. Selected RCRA related requirements are discussed in Sections 1 through 6 above.

Attachment B

Liquid Waste Generation Assumptions

LIQUID WASTE VOLUME GENERATION ASSUMPTIONS

The following is a review of the current estimates and plans for liquid waste generation and processing rates for the existing equipment and processes at ICPP. These liquid wastes will need to be stored in the existing ICPP Tank Farm or some other interim storage vessels until they can be converted into a solid waste form.

Estimates are also given for potential waste volume reductions if improved methods, consistent oversight, increased sampling and analysis, or rule changes occur that will allow additional options. Waste sources marked with an * will continue to be reviewed as new technologies become available. These waste sources have a high potential for further reduction, but further analysis is needed to ensure proper waste storage and segregation. Cost trade off studies are also needed, since the methods to reduce the volumes will increase the cost of operation.

The waste generated (including high-efficiency particulate air (HEPA) filters) by any future waste processing or fuel conditioning operations is not part of this review. The storage and treatment requirements of any waste generated by processes not now operating at ICPP will have to be part of the development of the future work.

NWCF and HLLWE Operating Times - Use June 1, 1996 for the startup of HLLWE and November 1, 1996 for the startup of NWCF. Use 18 months on and 12 months off for NWCF operations. For this planning, a 3-year shutdown should be scheduled after every third NWCF campaign. Depending on how the 3-year outage fits with the other plans and upgrades, it could be scheduled after 2 or 4 NWCF campaigns, if it fits better into that time frame. The 3-year shutdown is needed for major upgrades to the existing equipment, repairs that cannot be done during the 6-8 month maintenance window of the 12 month shutdowns, and changes in the process required by the future processing options/decisions.

NWCF Processing Rates - The NWCF net feed rate (based on Tank Farm depletion) for fuel reprocessing raffinates in NWCF is 3,000 gallons per day, which equates to 4300 to 4500 gallons per day gross feed rate. If a gross feed rate of 4300 gallons per day (~180 gallons per hour) is used for sodium type waste, then the net feed rate should be 3500 gallons per day. For the sodium waste processing model, the net feed rate includes the sodium waste and the aluminum nitrate additive and is not equivalent to Tank Farm depletion, since each tank has a different specific calculated depletion rate.

During actual operations, the following parameters should be used in the model:

1. Average recycle rate equal to 15% of the gross feed rate. Individual batches will be much different, but this should be an acceptable average for a normal campaign.

2. Maximum NOx release rate equal to 472 lbs/hr. This NOx rate assumes that the proposed permit increase is approved and should allow operation of NWCF at 180 gallons per hour. The presently approved permit has a maximum NOx rate of 388 lbs/hr, which would limit the NWCF operation to 150 gallons per hour.

3. Sodium plus potassium concentration in calcine of 8.4 mole % for the aluminum nitrate/sodium waste blend. This assumes that the pilot plant work supports this change, NWCF can actually operate at this concentration, and the present Technical Standard limit of 5.3 mole % is increased. The highest concentration attained during past NWCF campaigns averaged 5.2 mole %.

4. On-stream time during the operating period of 75%. This allows for equipment failure and replacement shutdowns.

5 For calcium nitrate addition, use a 0.7 calcium-to-fluoride mole ratio. The actual volume of calcium nitrate added for sodium waste processing will be small since the fluoride concentration is very low in the sodium waste.

6. For boric acid addition, use a 0.15 M boron concentration in the final gross feed volume.

NOTE: For ease of the modeling, an average of 100 gallons per feed batch can be used for the combined calcium nitrate and boric acid additions.

HLLWE Processing Rates - The Tank Farm depletion rate and operating parameters to be used in the model for the HLLWE during concentration of the existing Tank Farm waste are as follows:

1. For net Tank Farm depletion, use 1,000 gallons per day for the existing sodium waste and 1400 gallons per day if WM-189 and WM-183 are blended. (Some studies indicate that this rate could be as high as 2200 gallons per day.) This takes into account the transfer time, start up and shut down time, operating time, sampling time and cool down time. The actual boil-off rate during the operating time is 200 gallons per hour.

2. For on-stream time, use 70% on-stream time during NWCF turnaround activities (allows outage time for maintenance work on the HLLWE and supporting systems), 50% on-stream time during NWCF decon activities (allows time for processing the NWCF decon waste and additional transfers), and 30% during NWCF operation (allows for additional time for transfers, sample results, and normal NWCF operations). Additionally, the HLLWE can only operate during NWCF operation, if the NCC-101 tank is not being used for feed blending operations or the waste being blended and fed to NWCF can also be concentrated in HLLWE.

3. The waste acceptance criteria for evaporation in HLLWE is: less than 1.3 specific gravity (SpG) (cold), 4 M Na+K+3Al, 5 M nitric acid and 0.1 M fluoride. The maximum allowable bottoms concentration after evaporation is: 1.3 SpG (hot), 8 M nitric acid and 6 M Na+K+3Al. The SpG and Na+K+Al molar limits are for precipitation concerns, the fluoride limit is for corrosion control, and the nitric acid limits are for corrosion and temperature control.

   An additional limit during operation of the HLLWE may be the chloride and fluoride concentrations in the overhead condensate. Since the Process Equipment Waste Evaporator (PEWE) and Liquid Effluent Treatment and Disposal (LET&D) acceptance criteria will have to be met, the chloride and fluoride levels may dictate the HLLWE operating rates. This effect will not stop the concentration operation; it will just affect the rate at which the HLLWE condensate can be sent to the PEWE. This model will assume all the condensate generated will be processed in PEWE since the HLLWE/PEWE/LET&D model is still being prepared.

4. The presently recommended order for the tanks to be processed by the HLLWE is WM-189 blended between 1:1 and 2:1 with WM-183 (WM-189 cannot be concentrated unless it is blended with a low fluoride tank), WM-186, WM-184 (after it is filled from the PEWE operation), WM-185 (if blended or diluted with other low fluoride waste), dilute waste generated and stored in WM-182, WM-187, WM-188, or WM-190 prior to the HLLWE being operational, and WM-181 last (since WM-181 may not be able to be refilled after it is emptied due to RCRA concerns with the inlet lines). The solution in WM-180 is at a high enough concentration that further evaporation will not be effective.

   Since WM-189 is the last tank that is considered to contain fuel reprocessing waste, it has to be processed by January 1, 1998 per the Amended Order Modifying Order of June 28, 1993. If WM-189/-183 are blended at a 1:1 ratio and the blend is concentrated for the 5 months between HLLWE startup and NWCF startup, approximately 285,000 gallons of the blend can be processed. This will provide 168,000 gallons of sampled feed for NWCF operation. The remaining 275,000 gallons of blended waste will be concentrated during NWCF operation and take up to 9 months to process into 165,000 gallons of NWCF feed. Depending on the assumptions, the NWCF and HLLWE operation may not be able to meet the January 1, 1998 date to have WM-189 emptied if the maximum volume of waste is processed. With effective blending, both WM-189 and WM-183 can be empty by the end of NWCF Campaign H-4, and possibly by the January 1, 1998 date, if the HLLWE and NWCF operations are managed appropriately.

5. A tank needs to be available to receive the concentrate from the HLLWE operation. Without a tank to receive the concentrated solution, the efficiency of the HLLWE will be less than 10% due to the configuration of the inlet and outlet lines in the Tank Farm tanks. For the model, a separate tank needs to be available for the concentrate

from the WM-189/-183 blend, but the concentrate from the other sodium operations can be stored in any tank that contains concentrated sodium waste.

The additional operating parameters to be used in the model for the HLLWE during concentration of new sodium and non-sodium acid decon wastes are as follows:

1. Use a processing rate of 200 gallons per hour during the operating time. If this waste is collected and processed soon after it is generated, the collection and operation times will be limiting, so the transfer time, start up and shut down time, sampling time, and cool down time can be ignored. If the new waste is stored with existing Tank Farm waste, then the 1000 gallons per day processing rate should be used.

2. Concentration factors - The proposed concentration factors will be given in the sections where the waste generation is discussed. The same limits from above will still apply. If acid stripping operations are developed (forces the nitric acid and possibly some fluoride and chloride into the condensate) for both the PEWE and the HLLWE, then the volumes for the non-sodium acid decon waste will about 50% less than shown. Acid stripping should not be included in this analysis, since the development work has not been completed.

3. Additional tankage (prior to the Tank Farm) will need to be available to collect and segregate the different kinds of waste prior to concentration in the HLLWE. Two Tank Farm tanks will need to be available to collect the concentrated sodium and non-sodium acid decon waste after concentration in HLLWE. These two types of waste may need to be segregated in the Tank Farm to optimize the blending required for NWCF operation. If the blending ratios and techniques are developed prior to generation so the waste would be properly blended and mixed, a single Tank Farm tank may be acceptable to collect the new waste.

NWCF Operating Waste* - Use 3000 gallons per month during operating periods. This waste volume includes the deep recycle from the off-gas quench/scrub system, absorber washing operations and leak collection systems. This waste will be sent to the Tank Farm since the nitric acid, fluoride, chloride, radioactivity, and possibly mercury concentrations will not allow it to be sent to PEWE or HLLWE. Since sodium waste will be processed, this waste will be sent to the sodium waste tanks. With the NWCF off-gas system functioning properly and if a method to improve the fluoride, chloride, and mercury retention in the calcine is developed, this volume could be decreased to 1000 gallons per month. (The NWCF operation during 1993 actually generated about 24,000 gallons of waste during the almost 8 months of operation for an average of about 3,000 gallons per month.)

NWCF Bed Dissolution* - Use 25,000 gallons per bed dissolution. One in FY-94 and 3 during each following campaign (2 during and 1 at the end). Nitric acid will be used for the dissolution, but since sodium waste will be processed, the first 50% of this waste will be sent to the sodium waste tanks. The remaining 50% of this waste will be sent to the acid-decon waste tank when this becomes available. With relatively easily made changes, this volume could be decreased to 20,000 gallons per bed dissolution. Additionally, if the ruthenium volatility concerns and the associated Technical Requirement are eliminated, stronger nitric acid (13 M) could be used and this volume decreased to 12,000-15,000 gallons. This change should be accomplished since the sodium waste is low in ruthenium. (The recently completed NWCF bed removal operation created about 23,000 gallons of waste with the last 3,000 gallons being reused for other decontamination work.) [The model used for the initial analysis sent all 25,000 gallons to acid-decon waste.]

NWCF Decon work* - Use 150,000 gallons for the decon in FY-94, due to the extent of the decon work. Fifty percent will go to the Tank Farm directly and 50% will go to the PEWE with a 10:1 reduction, followed by a 2:1 reduction later in the HLLWE. For future 12-month shutdown decontamination work after HLLWE is on line, use 80,000 gallons with 25% to the Tank Farm, 30% to the HLLWE with a 3:1 reduction, and 45% to the PEWE with a 10:1 reduction followed by a 2:1 reduction later in the HLLWE. For the future 3-year shutdowns, use 120,000 gallons (use 150,000 gallons if major changes are made, such as installing new or replacing old equipment like the calciner vessel, scrub tank or blend/hold tank) with 25% to the Tank Farm, 30% to the HLLWE with a 3:1 reduction, and 45% to the PEWE with a 10:1 reduction followed by a 2:1 reduction later in the HLLWE. The waste sent directly to the Tank Farm will be non-sodium acid decon waste. The waste to the Tank Farm from HLLWE will be 25% sodium and 75% non-sodium acid decon waste. The waste sent to the Tank Farm from the PEWE is sodium due to the other PEWE feed streams and sodium-containing chemicals. [The initial model used different concentration factors and different splits for the waste segregation, but the final waste volume in the Tank Farm is only about 4,000 gallons greater than present model.]

The waste sent directly to the Tank Farm will be a 5-6 M nitric acid waste with fluoride and chloride contamination. This solution cannot be evaporated in the HLLWE or PEWE due to temperature limits and high corrosion rates. The reasons for the reduced 3:1 and 10:1 reductions used for the HLLWE and PEWE is again due to the nitric acid concentration, other corrosive chemicals and the temperature limits on these evaporators.

NWCF HEPA Filter Leach - The operating parameters to be used in the model for the NWCF Filter Leach operation are as follows:

1. Filter processing rate - Process 16 filters in FY-94, 50 filters in FY-95, and 75 filters per year in FY-96 and beyond until the back log is finished. Presently, NWCF has about 180 filters in storage (including the Process Atmospheric Protection System (PAPS) filters), the Fluorinel Dissolution Process (FDP) has 100 filters (processed 6 at a time) in storage, the Waste Calcining Facility (WCF) has 10 larger filters for processing, LET&D has 3 filters in storage, and the Radioactive Waste Management Complex (RWMC) has about 30 old NWCF filters in storage. NWCF operation will generate an average of 2 filters every 10 days; during the shutdown periods, assume no filters are generated. The Vessel Off-Gas (VOG) system will generate 1 filter per

year, the PAPS will generate 5 filters per year and LET&D will generate 8 filters per year. Additionally, the Ventilation Atmospheric Protection System (VAPS) filters will be mixed hazardous waste when they are changed out. For planning, assume these 104 filters will be changed out in 1998. All of these HEPA filters must be processed by the NWCF HEPA filter leach system, since they are mixed waste.

Any filters from future operations such as WIF and any of the present filters (NWCF ventilation, FAST ventilation, etc.) that are considered only LLW will have to be evaluated if they eventually need to be processed. A larger process may be needed if additional filters need to be processed.

2. HEPA Filter Leach operating volumes - Five 1.0 M nitric acid washes of 60 gallons each, followed by two water rinses of 60 gallons each.

3. During the leaching of the existing NWCF, WCF and FDP filters, the first 2 acid washes (120 gallons) will go to the Tank Farm directly due to the high radioactivity and fluoride levels. The last 3 acid washes and the 2 water rinses will go to the PEWE. Use a 10:1 reduction for the acid washes (18 gallons to the Tank Farm) and a 30:1 reduction for the water rinses (4 gallons to the Tank Farm). A total of 142 gallons will go to the Tank Farm per filter wash.

4. During the leaching of the additional filters that are generated, the first 2 acid washes will go to the HLLWE with a 10:1 reduction (12 gallons to the Tank Farm), the last 3 acid washes can go to either the PEWE or HLLWE with a 10:1 reduction (18 gallons to the Tank Farm) and the 2 water rinses will go to the PEWE with a 30:1 reduction (4 gallons to the Tank Farm). A total of 34 gallons will go to the Tank Farm per future filter wash.

5. For planning, the first 2 acid washes will be sodium waste, all solutions sent to the PEWE will be sodium waste, and if the last 3 acid washes are sent to the HLLWE it would be non-sodium acid decon waste. During actual operation, the waste could be sampled and possibly more of it could go to non-sodium acid waste or the HLLWE, thus reducing the sodium waste generated.

PEWE Bottoms and Decon* - Use 25,000 gallons per year into the Tank Farm until the HLLWE comes on line. After the HLLWE is operating, use an additional reduction factor of 2:1 for this input into the Tank Farm. These volumes are all sodium waste and include all of the normal plant operations that are required to maintain ICPP within the safety envelope. Some of these operations are: PEWE operation and decon work, LET&D operation and decon work, Tank Farm sump water removal, CPP-603 and -666 fuel storage basin water treatment, off-gas systems operation in CPP-601, -604, -649 and -659, decon facility waste (including routine decon work and the new debris treatment operations), routine waste from other sites (Test Reactor Area (TRA), Test Area North (TAN), etc.), waste diversion system operation and tests, pilot plant waste, Tank Farm valve leaks and decon work, cell and corridor floor drains in CPP-601, -602, -604, -633, -640, -659 and -666, lab drains from analytical work in CPP-602, -627, -630 and -684, RCRA Well sampling operations and routine decon work for routine cleaning and maintenance of all facilities.

PEWE Feed Direct to Tank Farm* - Use 30,000 gallons per year in FY-94, 20,000 gallons per year in FY-95 and beyond due to reduced operations. This waste will eventually be concentrated in the HLLWE with a 2:1 reduction factor. This waste stream comes from the CPP-601 deep tanks, CPP-641 west side waste tanks (from pilot plants), tank truck from other sites, and the fuel storage basins. This waste normally is sent to the PEWE, but sometimes must be sent directly to the Tank Farm due to uranium, radioactivity, nitric acid, fluoride, chloride, or sulfate levels above the limits for PEWE.

Tank Farm Sumps Direct to Tank Farm - Use 500 gallons per year until December 31, 1995, then 100 gallons per year. Most of the sump water is sent to the PEWE and is part of the PEWE bottoms routinely sent to the Tank Farm. This direct to the Tank Farm volume is from sumps that cannot be sent to the PEWE due to the piping arrangement or high activity in the water from valve leaks.

Tank Farm Line/Valve Flushes - Use 5000 gallons per year until December 31, 1995, then 500 gallons per year. The high volumes generated in 1994 and 1995 are due to the Tank Farm upgrade work. Once the upgrade work is finished, the flushing operations will use reduced volumes. This water will go directly to the Tank Farm and be modeled as sodium waste.

Tank Farm Heelout/Flushes* - (see attached heelout description)
{This item was deleted in the minimum waste model.}

LET&D Upset/Decon* - Use 4,000 gallons per year for solutions that cannot be used in acid recycle due to decon work or upset conditions in LET&D. After January 1, 1996 when the direct route to the Tank Farm is available, this will be non-sodium acid decon waste since it cannot be further concentrated. [The initial model used 5,000 gallons for this input.]

LET&D Normal Process* - LET&D will produce 10,000 to 20,000 gallons per year of 10-12 M nitric acid; for this model, use 15,000 gallons per year. The majority of this solution will be used by NWCF via the acid recycle system. If NWCF does not operate, this waste will go to the Tank Farm after the 20,000 gallon recycle tank is full, since the other planned usages are very small. This waste will be sodium waste until January 1, 1996 when the direct route to the Tank Farm is available, then it will be non-sodium acid decon waste. Due to the acid concentration, this waste cannot be further concentrated by the HLLWE.

For this model during FY-94, use 7,500 gallons to the Tank Farm as sodium waste and 7,500 gallons to the acid recycle tank. During FY-95, assume 5,000 gallons was used for various NWCF decon operations so all 15,000 gallons can be sent to the acid recycle tank. During FY-96 assume 2,500 gallons was used for various NWCF decon operations so 5,000 gallons can be sent to the acid recycle tank and 10,000 gallons sent to the Tank Farm as non-sodium acid decon waste. For FY-97 and beyond, assume all of the acid is sent to the acid recycle tank and used in NWCF until NWCF is shut down.

When NWCF is shut down for the last time, assume the bed will be removed using this acid and it will take 2 years of LET&D operation to refill the acid recycle tank. After the acid recycle tank is refilled, all 15,000 gallons per year will be sent to the Tank Farm non-sodium acid decon waste. When the WIF is operational and dissolving calcine, all of the LET&D acid will be used for that operation. [The initial model used an average of 3,000 gallons per year to the Tank Farm since the future operations had not been defined. This new model gives a volume increase over the initial model for the first 6 years, then it gives a volume decrease.]

CPP-601 Operations and phaseout - Use 16,000 gallons of non-sodium waste from second and third cycle operations and the uranium sweep down in CPP-601. This waste will be sent directly to the Tank Farm in FY-94 and probably stored in WM-102 until NWCF is restarted. The remaining CPP-601 phaseout operations will use 42,000 gallons during FY-94/-95. Ten percent will be sent directly to the Tank Farm as non-sodium acid decon waste and eventually sent to the HLLWE for a 10:1 volume reduction. The remainder will be sodium waste processed by the PEWE with a 30:1 reduction; an additional 2:1 reduction factor can be obtained after the HLLWE comes on line.

CPP-603 Empty/Flush* - Use 12,000 gallons per year sodium waste to the Tank Farm for the 2001 to 2004 time frame. Since the Amended Order Modifying Order of June 28, 1993 requires fuel removal and cease use of CPP-603 by 2000, the basin water emptying operation is assumed to start by 2001. Use 50,000 gallons transferred to the PEWE per month with a 50:1 reduction factor. Operate in this mode until 2,000,000 gallons have been processed. The volume sent to the Tank Farm will have a further reduction of 2:1 by processing it in the HLLWE. This waste volume includes both the water in the basins and any solutions needed to remove the sludge.

D&D CPP-709 - Use 0 gallons, this is part of the normal PEWE operations and bottoms solution and the plan is to use minimal water.

D&D CPP-734 - Use 0 gallons, this is part of the normal PEWE operations and bottoms solution and the plan is to use minimal water.

D&D CPP-740 - Use 5000 gallons to PEWE with a 10:1 reduction for 500 gallons of sodium waste to the Tank Farm in 1997. [The model used 2,000 gallons to the Tank Farm.] {This item was deleted in the minimum waste model.}

D&D CPP-756 VAPS prefilter - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015.

D&D CPP-601* - Use 20,000 gallons total for FY-97 and FY-98 with the first 30% to the HLLWE with a 10:1 reduction as non-sodium acid decon waste and the final 70% to the PEWE with a 30:1 reduction. Use 50,000 gallons total for FY-99 to FY-09 to PEWE with a 30:1 reduction. The waste from PEWE will be sodium waste and have a further volume reduction of 2:1 in the HLLWE. {This item was deleted in the minimum waste model.}

D&D CPP-602 - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015.

D&D CPP-603* - Use 50,000 gallons to PEWE with a 10:1 reduction for 5,000 gallons to the Tank Farm in 2004-2005. This will be sodium waste and have a further volume reduction of 2:1 in the HLLWE. {This item was deleted in the minimum waste model.}

D&D CPP-604 Rare Gas Plant - Use 0 gallons, this is part of the normal PEWE operations and bottoms solution and the plan is to use minimal water.

D&D CPP-604 PEWE - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015.

D&D CPP-604 waste tanks - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015. This includes the WM-100, WM-101, WM-102, WL-101, WL-102, WL-132, and WL-133 tanks.

D&D CPP-631 - Use 0 gallons, this is part of the normal PEWE operations and bottoms solution and the plan is to use minimal water.

D&D CPP-633* - Use 9,000 gallons total to PEWE with a 20:1 reduction for FY-94 and FY-95. Use 150,000 gallons total for FY-96, FY-97, and FY-98 with the first 20% going to the Tank Farm as non-sodium acid decon waste, 30% to the HLLWE with a 10:1 reduction as non-sodium acid decon waste, and the final 50% to the PEWE with a 20:1 reduction. Use 30,000 gallons total for FY-99 to FY-02 to PEWE with a 20:1 reduction. The waste from PEWE will be sodium waste and have a further volume reduction of 2:1 in the HLLWE. {This item was deleted in the minimum waste model.}

D&D CPP-640 - Use 20,000 gallons total to PEWE with a 20:1 reduction for FY-99 to FY-03. This waste will be sodium waste and have a further volume reduction of 2:1 in the HLLWE. {This item was deleted in the minimum waste model.}

D&D CPP-659 - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015, if NWCF continues to operate.

The RCRA closure requirements may require the removal of all hazardous materials within a year after the NWCF is no longer planned to operate. This may be important on the options that shut NWCF down before 2015. From the present understanding, these flushes will be water and each vessel and line, which is not going to be used again, may have to be flushed with 3 volumes of water. If the HLLWE is operated, then the vessels and equipment used for that operation will not have to be flushed until it is no longer used. For the no NWCF and no HLLWE cases, use 80,000 gallons with 30% to the Tank Farm and the remainder to the PEWE with a 30:1 reduction. For the no NWCF only cases, use 20,000 gallons with 30% to the HLLWE with a 10:1 reduction and the remainder to the PEWE with a 30:1 reduction.

D&D CPP-666 Fuel Storage Area - Use 0 for the model. The plans are not fully developed and this work will not be done until after 2015.

D&D CPP-666 FDP - Use 150,000 gallons for the FY-97 cleanout with the first 30% going to the Tank Farm as non-sodium acid decon waste, 30% going to the HLLWE with a 10:1 reduction as non-sodium acid decon waste, and the final 40% to the PEWE with a 30:1 reduction. Use 20,000 gallons total for FY-98 to FY-02 to PEWE with a 30:1 reduction. The waste from PEWE will be sodium waste and have a further volume reduction of 2:1 in the HLLWE. {This item was deleted in the minimum waste model.}

TRA Pond water - Use 0 for the model. The plans are not fully developed and a reasonable estimate is not available.

TAN Water - Use 0 for the model. The plans are not fully developed and a reasonable estimate is not available.

Future Fuel Conditioning and Waste Processing Operations - Use 0 for the model; this is not included in this study.

The model used the actual Tank Farm data at the end of October 1993 as the starting volumes. The actual volume increases since that time have very closely followed the model simulation.

Tank Farm Heel Removal Plan

Table B-I summarizes the types of waste and the volumes of waste expected to be generated during Tank Farm heel removal. The current plan is to heel out one tank at a time and then move the heel removal equipment to the next tank. This plan was determined by telephone calls and discussions with M. J. Beer, C. M. Cole, and M. Christensen on November 8 and 9, 1993. This plan is described below.

1. Empty tank as low as possible with existing transfer systems.
2. Install the new mixing and transfer equipment.
3. Wash walls with dilute aluminum nitrate solution.
4. Slurry solids in heel with dilute sodium waste using mixing pumps.
5. Transfer slurried solids and waste to receiving tank.
6. Repeat solids slurrying with dilute sodium waste and transfer to receiving tank.
7. Repeat solids slurrying with dilute decon solution and transfer to receiving tank.
8. Prior to Steps 4, 6, and 7, flush and clean piping, sump, encasement and valve boxes.
9. Wash ceiling, wall, and floor with water and transfer to receiving tank.
10. Concentrate waste collected in receiving tank in the HLLWE or PEWE, as appropriate.

Table B-I. TANK FARM HEEL REMOVAL SUMMARY

PROCESS STEP	SOLUTION TYPE	INITIAL VOLUME	PROCESS METHOD	FINAL VOLUME TO TANK FARM
FIRST WALL WASH	DILUTE ALUMINUM NITRATE	1,800 GAL	HLLWE	O (WITH FIRST HEEL SLURRY)
FIRST HEEL SLURRY	DILUTE SODIUM WASTE	43,200 GAL	HLLWE	29,250 GAL (35% VOLUME REDUCTION)
SECOND HEEL SLURRY	DILUTE SODIUM WASTE	45,000 GAL	HLLWE	29,250 GAL (35% VOLUME REDUCTION)
THIRD HEEL SLURRY	DILUTE DECON SOLUTION	45,000 GAL	HLLWE OR PEWE	4,500 GAL (10 TO 1 VOL REDUCTION)
FINAL WALL WASH	WATER	5,000 GAL	PEWE	160 GAL (30 TO 1 VOL REDUCTION)
TOTAL VOLUMES		140,000 GAL		63,160 GAL
TOTAL TANK FARM VOLUME INCREASE				5,830 GAL (ACTUAL VOLUME INCREASE)

Attachment C

Detailed Modeling Results

Detailed Modeling Results for Each Case

Tables C-I and C-II give detailed information used in the modeling for the calcination and immobilization flowsheets.

Table C-III gives a summary of when the calcine would be retrieved from each of the bin sets. Retrieval projects would precede the window of operation given in this table.

Figures C-1 through C-12 show tank volume requirements versus the available Tank Farm capacity. The maximum differential between the requirements and the capacity is given in Figure 15 in the body of the report.

Figures F-2 through F-15 in Attachment F give the schedules that resulted from the simulation for each case. These schedules show the interaction between the calciner, the evaporator, new accelerated technology, and an immobilization plant.

Table C-I. Calcination Flowsheets Used In Simulation

OPTION	LIQUID WASTE VOLUME	VOLUME OF ADDITIVES*	VOLUME OF CALCINE	# OF CALCINE RUNS	BIN SETS	NEW TECH DATE
0a	1 m^3	3.96 m^3	0.47 m^3	5	1 - 7	2015
0b	1 m^3	3.96 m^3	0.47 m^3	11 - 12	1 - 8	2015
1	1 m^3	3.96 m^3	0.47 m^3	5	1 - 7	2008
2a	No	Calcination	N/A	0	1 - 6	2008
2b	No	Calcination	N/A	0	1 - 6	2015
3	No	Calcination	N/A	0	1 - 6	2008
4a & 4b	1 m^3	3.96 m^3	0.47 m^3	2 for 4a and 3 for 4b	1 - 6	2008
5a	1 m^3	2.8 m^3	0.53 m^3	3 Regular Na & 3FC Product	1 - 6	2005 and 2015
5b	1 m^3	0	0.097 m^3	3 Regular Na & 1 PPT Product	1 - 6	2005 and 2015
6	1 m^3		0.315 m^3	5	1 - 8	2015
7	1 m^3	3.96 m^3	0.42 m^3 Na - SiO_2	Number of Runs Not Analyzed Due to Immaturity of Technology	7 - 8	2006 and 2015
	1 m^3	343 kgs SiO_2	0.47 m^3 Aluminum Calcine	3	1 - 6	2006 and 2015
8a	1 m^3	3.96 m^3	0.47 m^3 Aluminum Calcine	3	1 - 6	Glass in 2008 and Full WIF in 2015
8b	1 m^3	3.96 m^3	0.47 m^3 Aluminum Calcine	3	1 - 6	2008 and Retrieval in 2015

*Aluminum nitrate is used as the additive, unless indicated otherwise.

Table C-II. Waste Immobilization Flowsheets Used In Simulation

OPTION	LIQUID IN	SOLID IN	GLASS OUT	GROUT OUT	DATE STARTED
0a	1m³	N/A	0.024 m³	0.35 m³	2015
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2015
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2015
0b		1m³ Aluminum Calcine	0.49 m³	N/A	2015
		1m³ Zirconium Calcine	0.62 m³	N/A	2015
1	1m³	N/A	0.024 m³	0.35 m³	2008
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2008
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2008
2a	1m³	N/A	0.024 m³	0.35 m³	2008
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2008
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2008
2b	1m³	N/A	0.024 m³	0.35 m³	2015
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2015
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2015
3	1m³	N/A	0.024 m³	0.35 m³	2008
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2008
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2008
4a & 4b	1m³	N/A	0.024 m³	0.35 m³	2008
		1m³ Aluminum Calcine	0.208 m³	3.6 m³	2008
		1m³ Zirconium Calcine	0.104 m³	4.4 m³	2008

Table C-II. Waste Immobilization Flowsheets Used in Simulation (Continued)

5a	1m^3	N/A	N/A	0.094m^3	2006
	lm^3	N/A	0.024 m^3	0.35m^3	2015
		1m^3 Aluminum Calcine	0.208 m^3	3.6m^3	2015
		1m^3 Zirconium Calcine	0.104 m^3	4.4m^3	2015
5b	1m^3	N/A	N/A	0.29 m^3	2006
	1m^3	N/A	0.024 m^3	0.35 m^3	2015
		1m^3 Aluminum Calcine	0.208 m^3	3.6 m^3	2015
		1m^3 Zirconium Calcine	0.104 m^3	4.4 m^3	2015
6	1m^3		0.024 m^3	0.35 m^3	2015
		1m^3 Aluminum Calcine	0.208 m^3	3.6 m^3	2015
		1m^3 Zirconium Calcine	0.104 m^3	4.4 m^3	2015
7	1m^3 Na	0.056 m^3 $NaSiO_2$	0.038 m^3	0.35 m^3	2006
		1m^3 Aluminum Calcine +0.49 m^3 $NaSiO_2$	0.34 m^3	3.5 m^3	2015
		1m^3 Zirconium Calcine +0.17 m^3 $NaSiO_2$	0.12 m^3	4.4 m^3	2015
8a	1m^3	N/A	0.114 m^3	N/A	2008
	1 m^3	N/A	0.024 m^3	0.35 m^3	2015
		1 m^3 Aluminum Calcine	0.208 m^3	3.6 m^3	2015
		1m^3 Zirconium Calcine	0.104 m^3	4.4 m^3	2015
8b	1m^3	N/A	0.114 m^3	N/A	2008
	1m^3	N/A	0.114 m^3	N/A	2015
		1m^3 Aluminum Calcine	1..28 m^3	N/A	2015
		1m^3 Zirconium Calcine	1.63 m^3	N/A	2015

Table C-III. Bin Set Calcine Retrieval Schedule Requirements for Each Case

Bin Set	Case 0a	Case 0b	Case 1	Case 2a	Case 2b	Case 3	Case 4a	Case 4b	Case 5a	Case 6	Case 8a	Case 8b
1 Start	1/2018	2/2015	3/2010	3/2014	2/2022	2/2012	4/2011	2/2011	1/2015	5/2016	1/2015	1/2015
1 End	1/2019	1/2016	3/2011	2/2015	1/2023	2/2013	3/2012	1/2012	5/2015	5/2017	5/2015	3/2016
2 Start	1/2019	1/2016	4/2011	3/2015	2/2023	3/2013	4/2012	1/2012	1/2016	5/2017	5/2015	3/2016
2 End	4/2022	1/2019	2/2015	5/2018	4/2026	6/2016	3/2016	5/2015	5/2019	4/2021	4/2019	3/2021
3 Start	4/2022	2/2019	3/2015	5/2018	4/2026	6/2016	3/2016	5/2015	5/2019	4/2021	4/2019	3/2021
3 End	2/2027	2/2023	5/2019	3/2023	2/2013	3/2021	5/2020	3/2020	1/2024	1/2026	1/2024	5/2027
4 Start	2/2027	3/2023	5/2019	3/2023	2/2031	3/2021	5/2020	3/2020	2/2024	1/2026	1/2024	5/2027
4 End	2/2029	2/2025	5/2021	4/2025	2/2033	4/2023	5/2022	3/2022	10/2025	1/2028	1/2026	5/2030
5 Start	2/2029	3/2025	5/2021	4/2025	2/2033	4/2023	5/2022	3/2022	1/2026	1/2028	1/2026	5/2030
5 End	1/2033	5/2028	5/2025	3/2029	1/2037	14/2027	5/2026	2/2026	1/2030	5/2031	1/2030	3/2036
6 Start	1/2033	5/2028	5/2025	3/2029	2/2037	4/2027	1/2027	1/2027	1/2030	5/2031	1/2030	3/2036
6 End	4/2029	4/2035	2/2032	3/2030	2/2038	3/2028	5/2031	5/2032	4/2036	3/2038	4/2036	5/2045
7 Start	4/2039	5/2035	2/2032						4/2036	3/2038		
7 End	5/2045	3/2042	3/2034						1/2044	1/2046		
8 Start		3/2042								1/2046		
8 End		2/2049								3/2048		
C Start	11/1996	11/1996	11/1996				11/1996	11/1996	11/1996	11/1996	11/1996	11/1996
C End	9/2012	2/2015	9/2005				9/2000	4/2003	8/2012	4/2011	4/2003	4/2003
W Start	1/2015	1/2015	1/2008	1/2015	1/2008	1/2008	1/2008	1/2008	1/2015	1/2015	1/2015	1/2015
W End	5/2045	2/2049	3/2034	3/2030	2/2038	3/2028	5/2031	5/2032	1/2044	3/2048	4/2036	5/2045

C stands for Calcine Operations and W represents WIF Operations

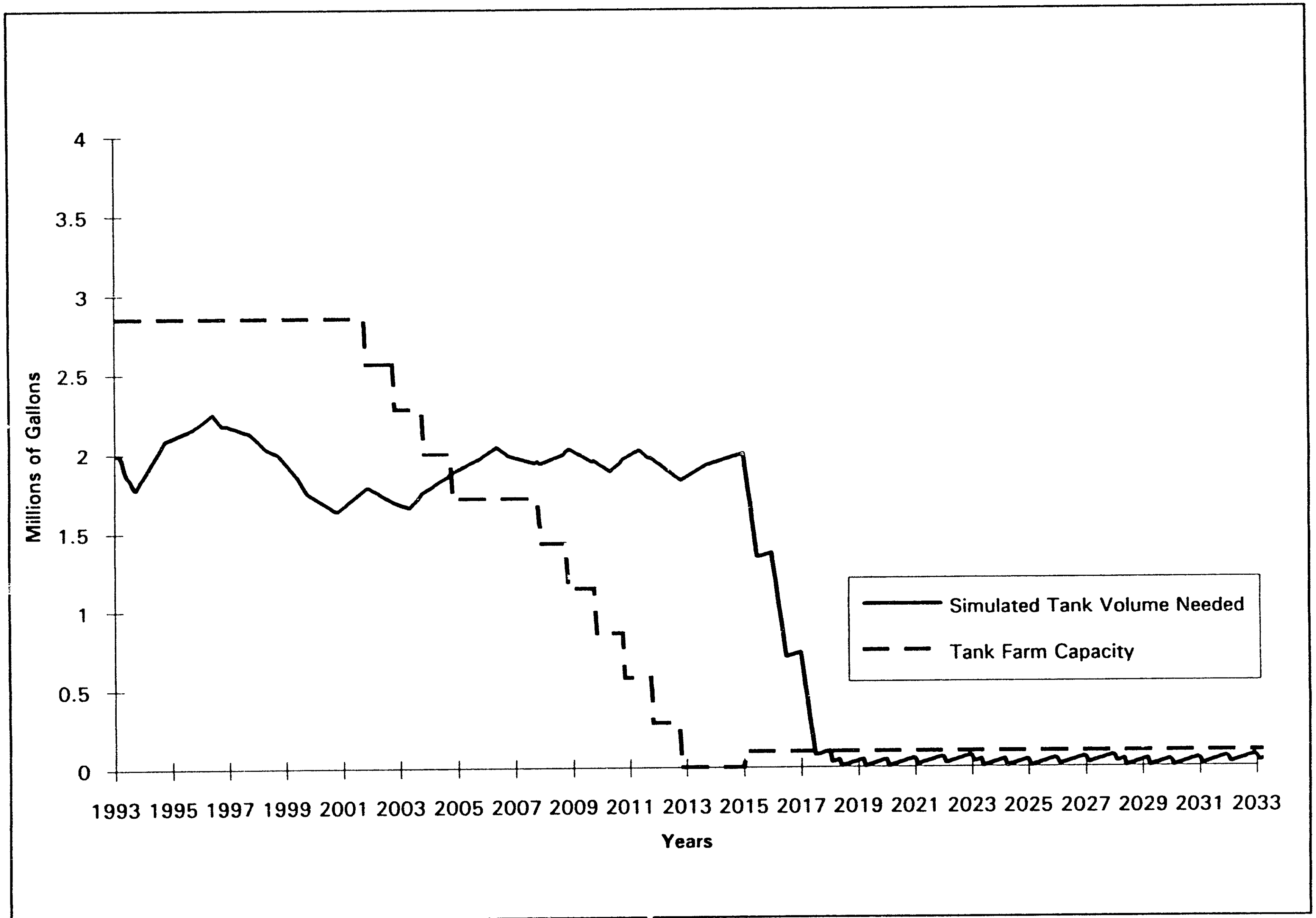


Figure C-1. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 0a

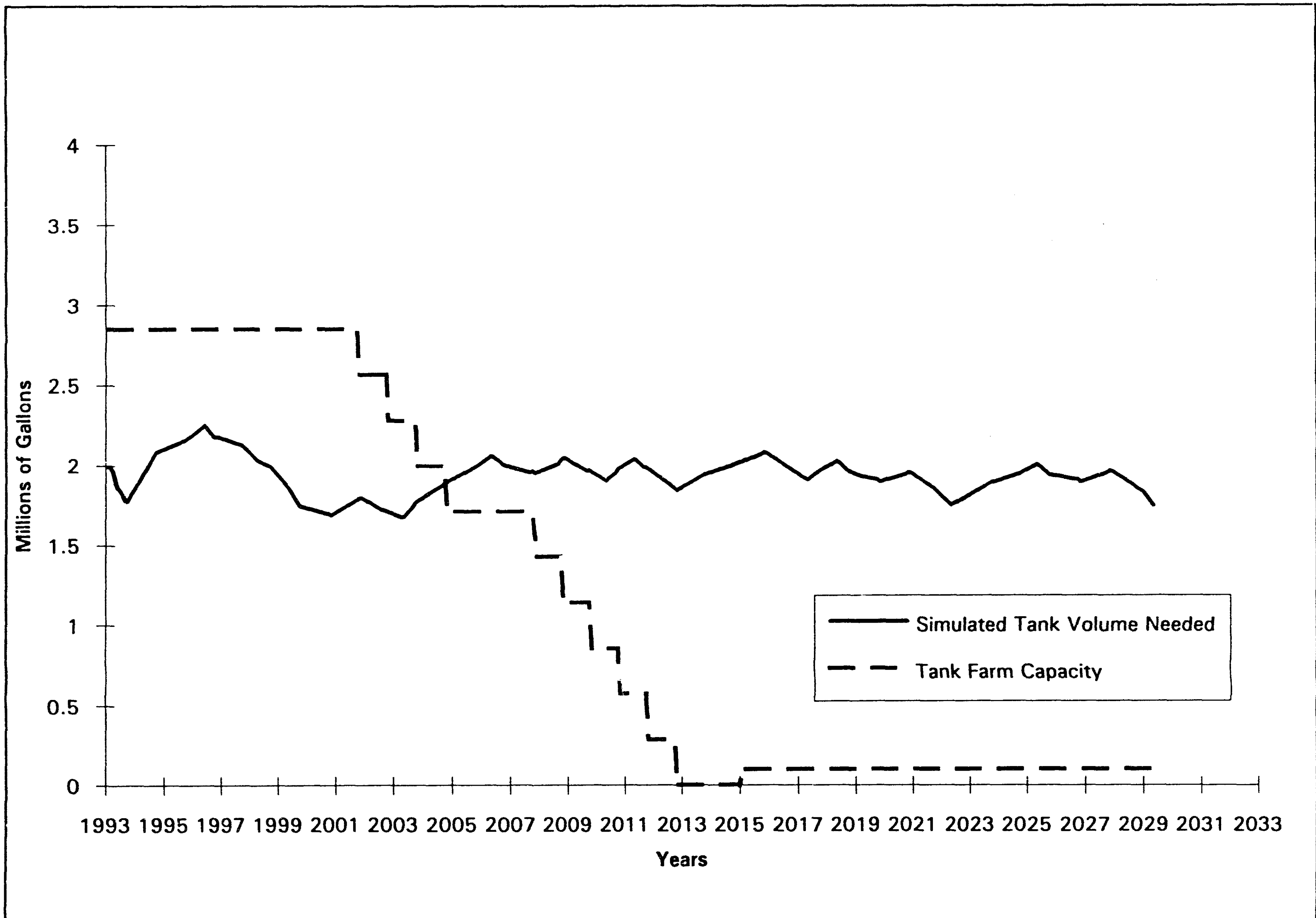


Figure C-2. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 0b

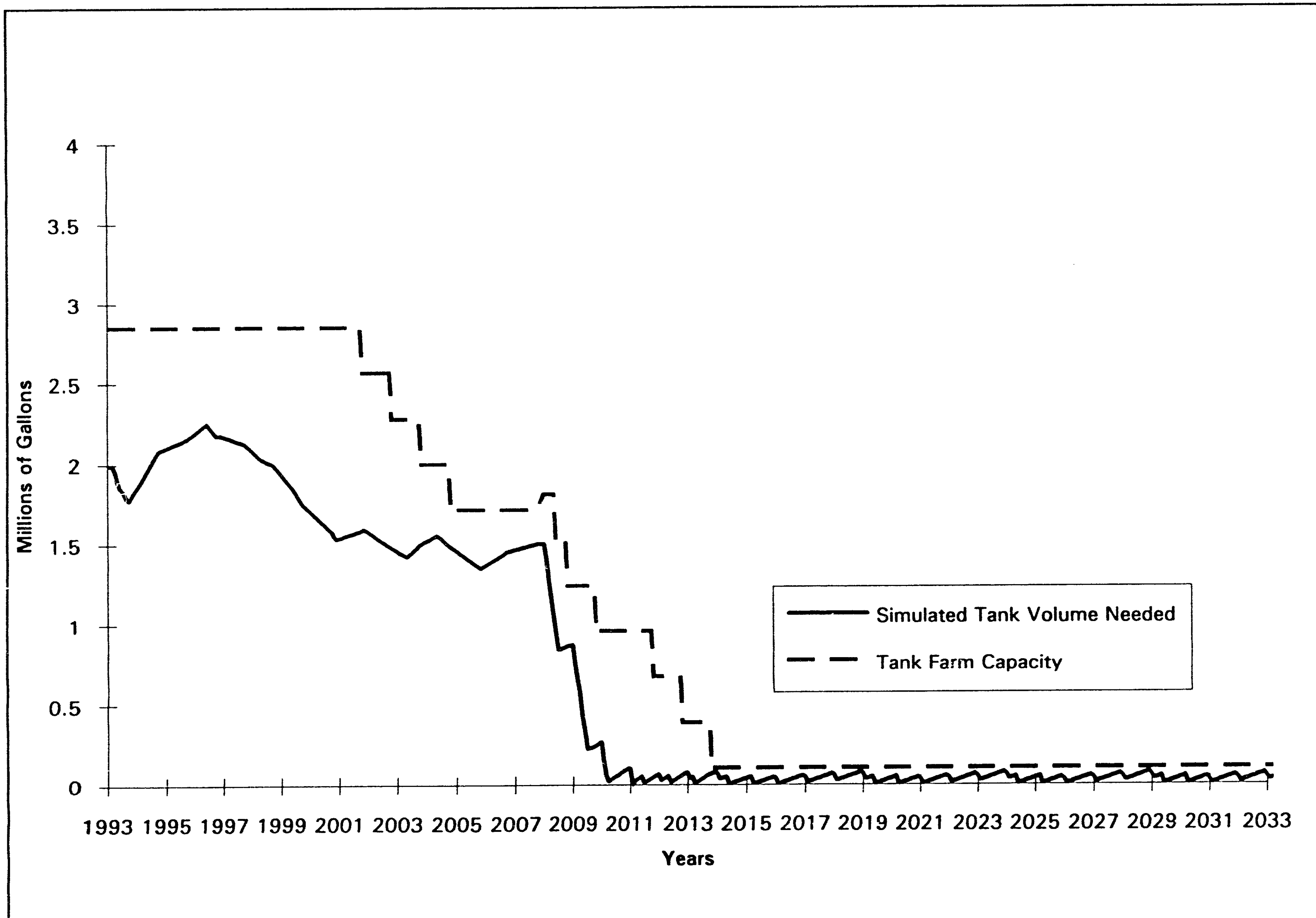


Figure C-3. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 1

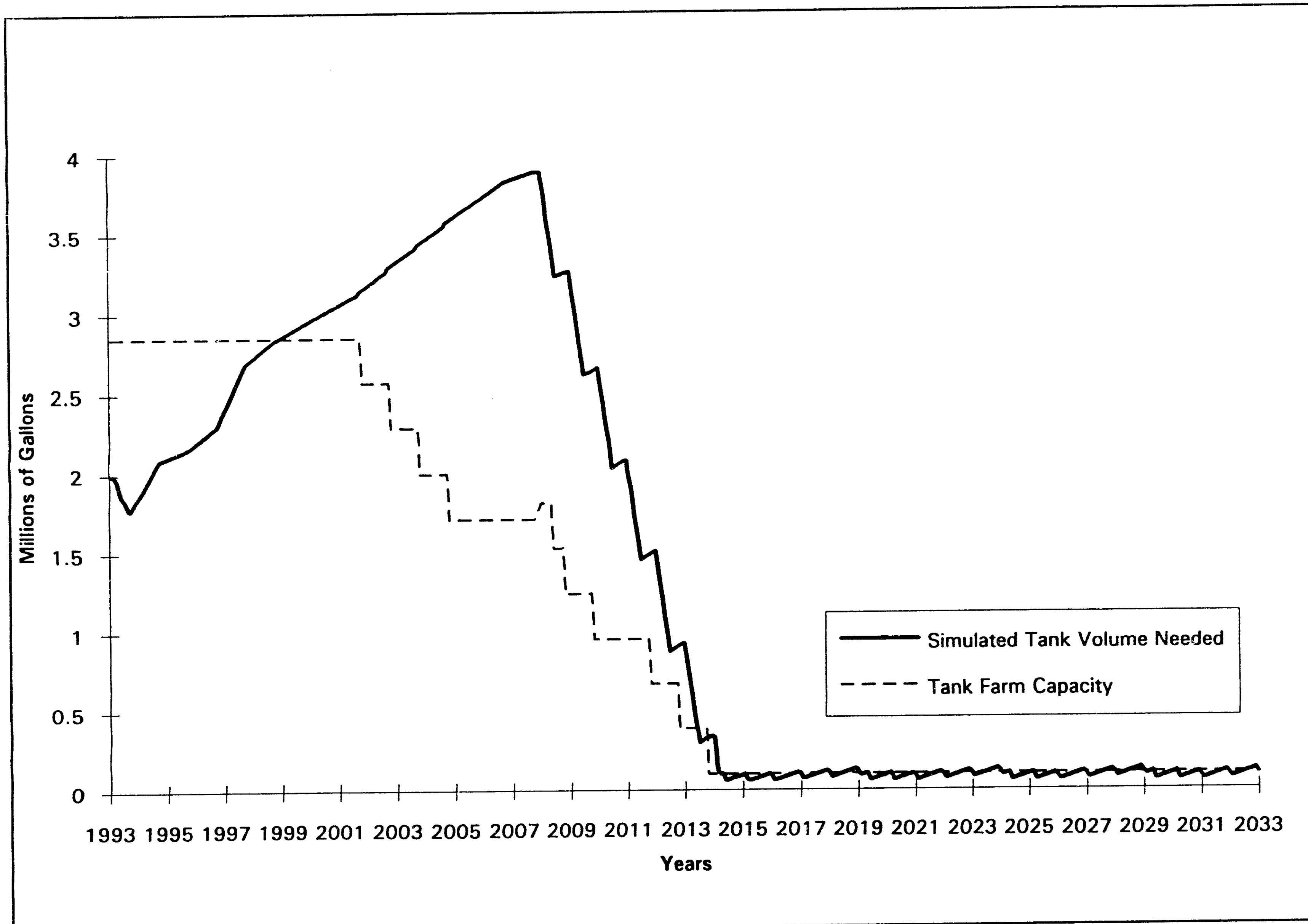


Figure C-4. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 2a

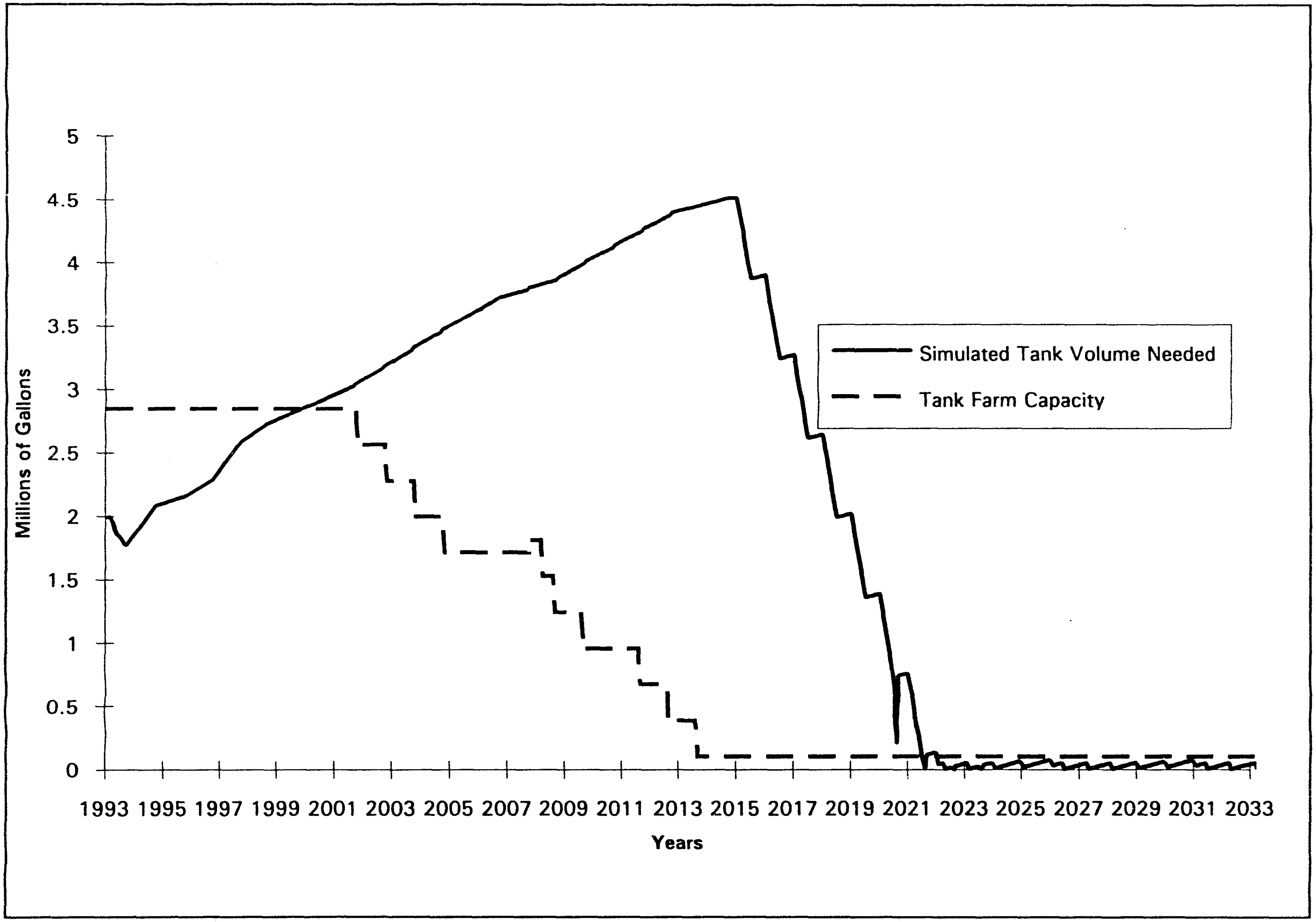


Figure C-5. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 2b

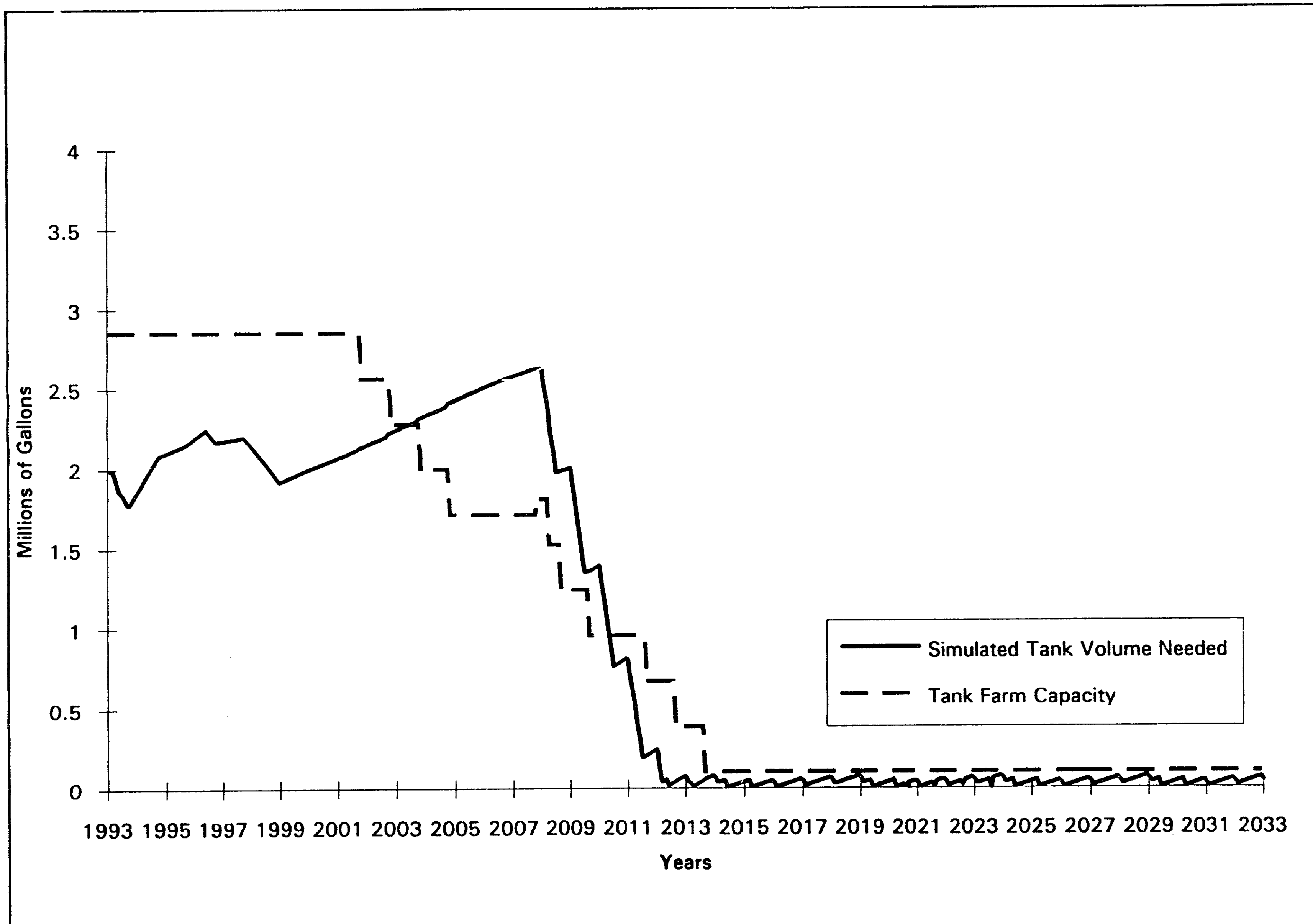


Figure C-6. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 3

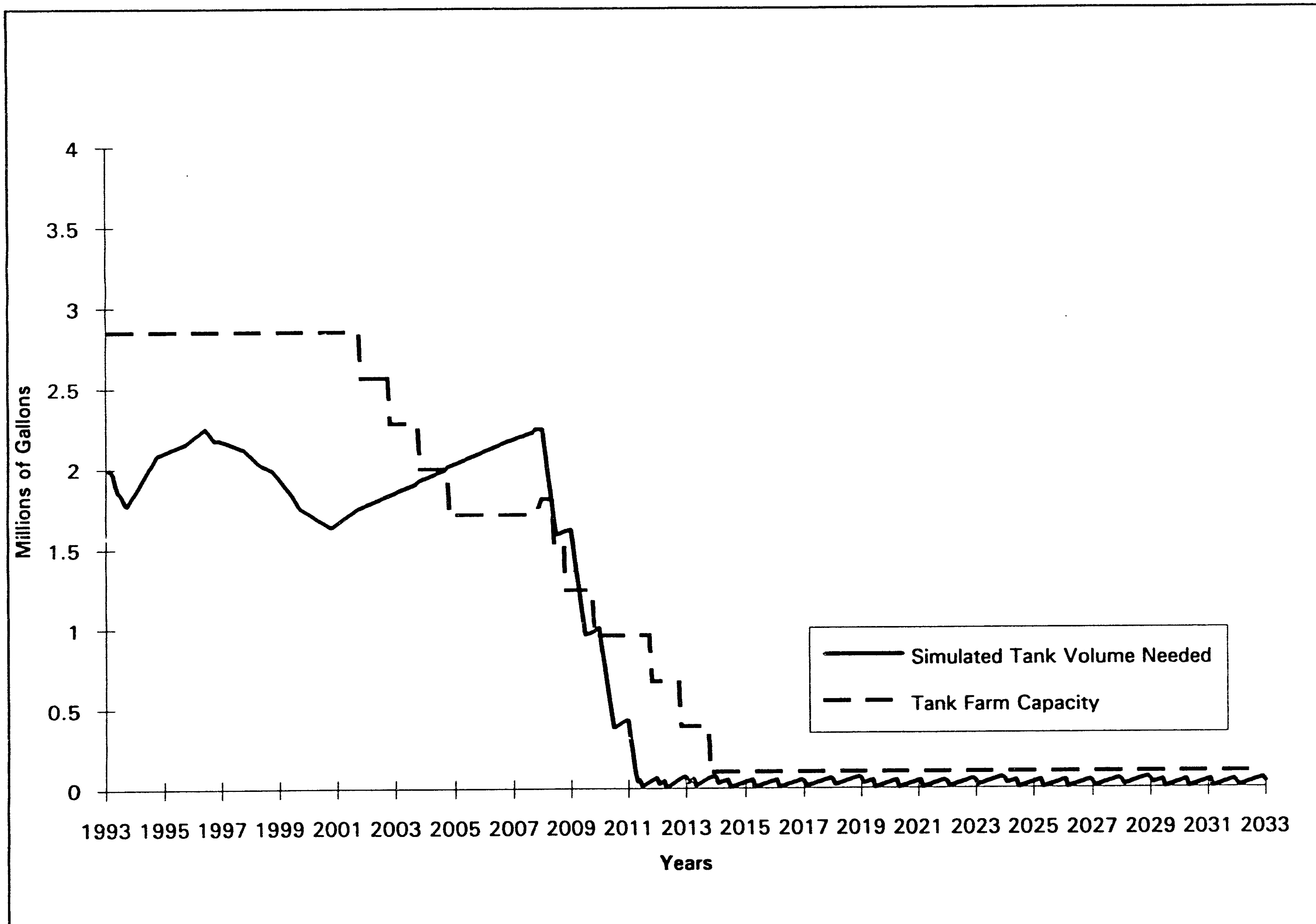


Figure C-7. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 4a

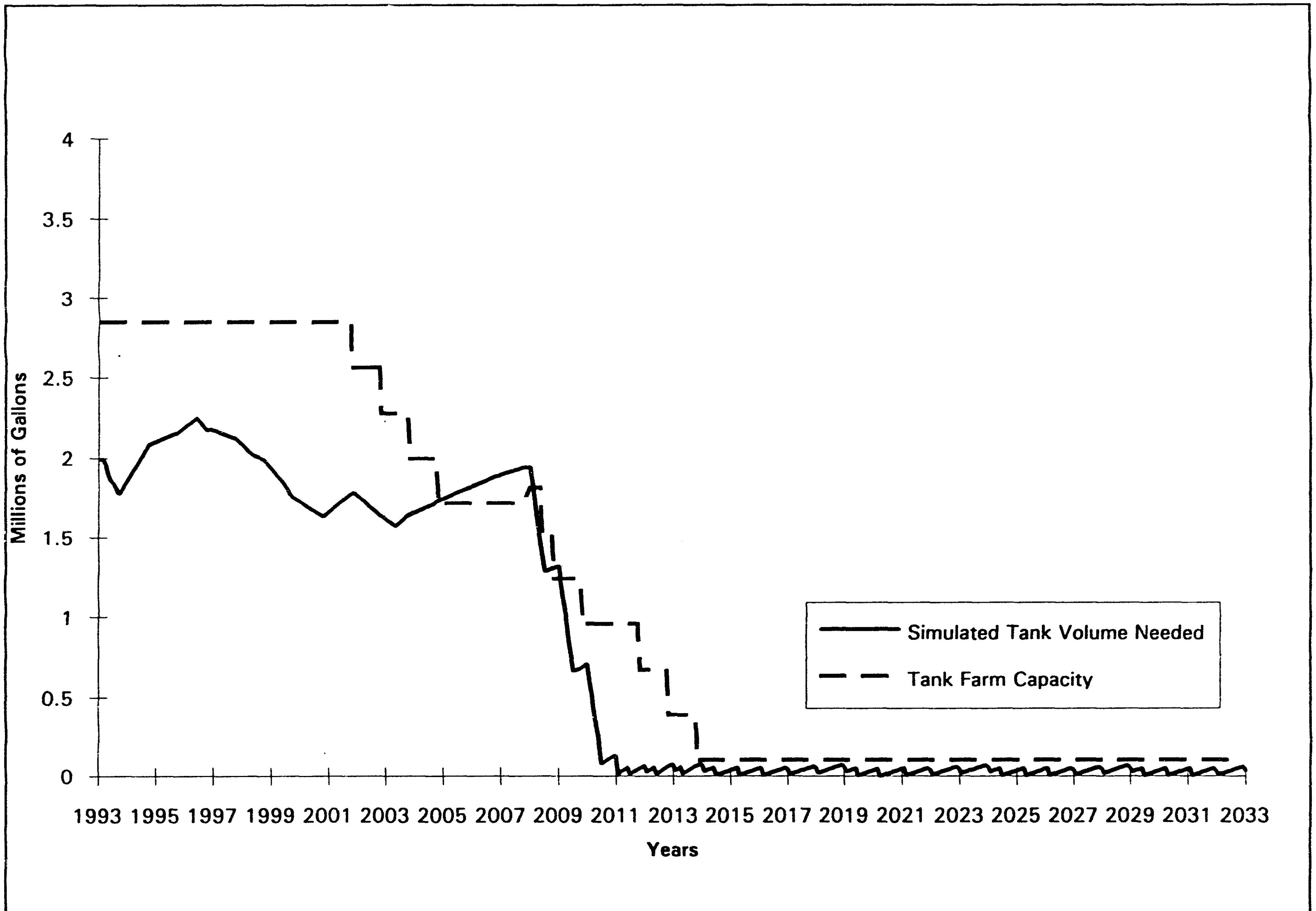


Figure C-8. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 4b

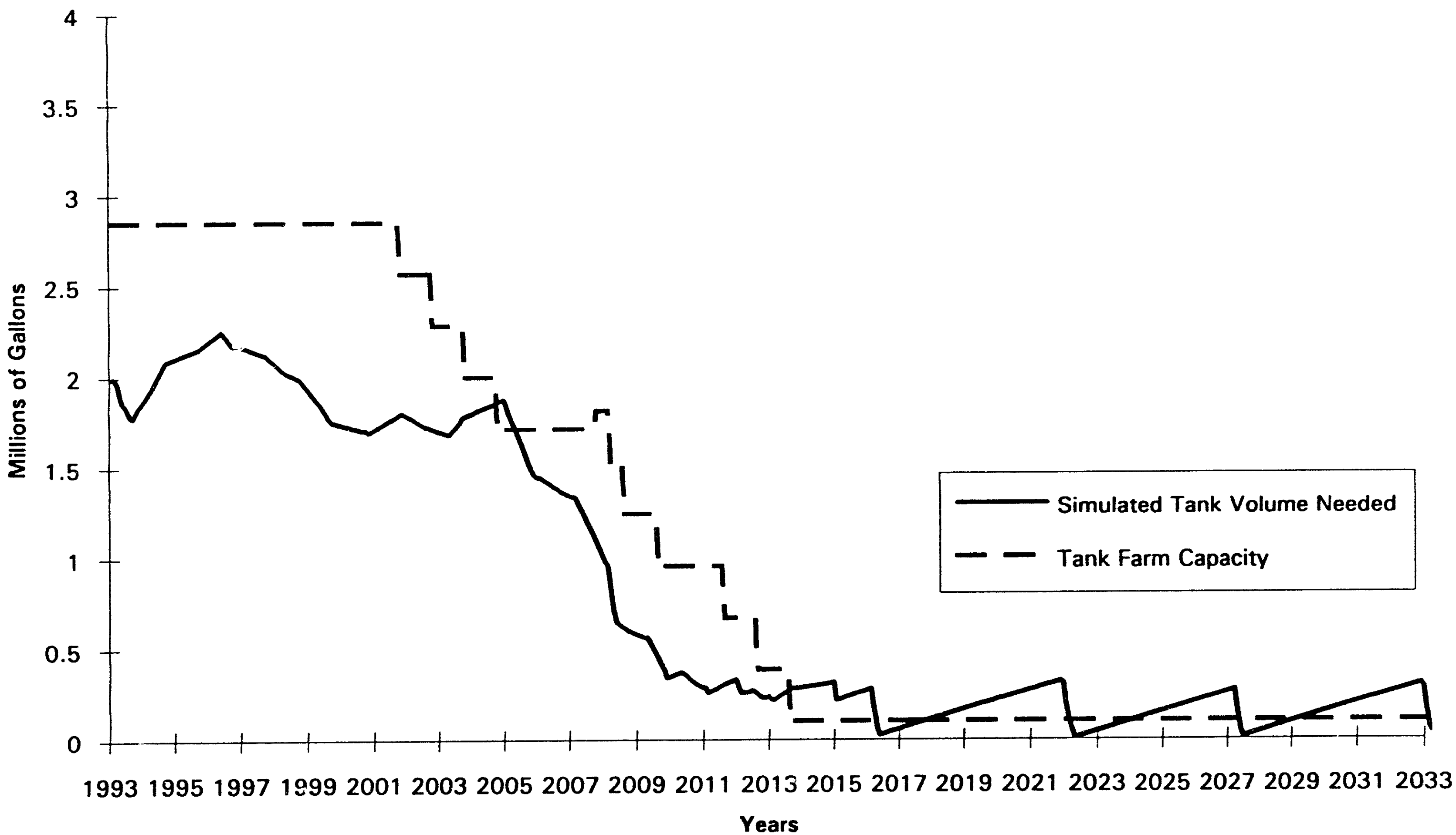


Figure C-9. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 5a

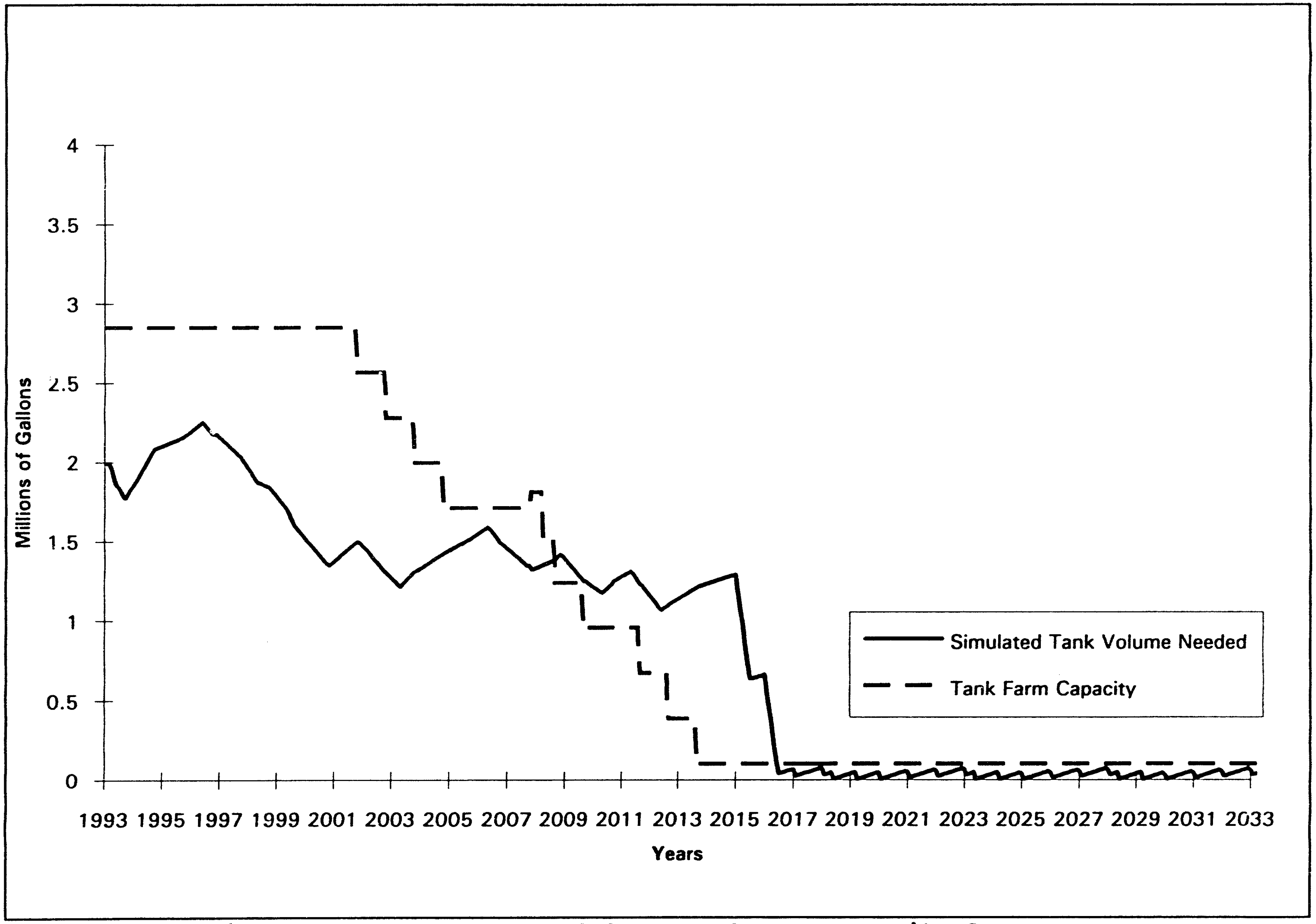


Figure C-10. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 6

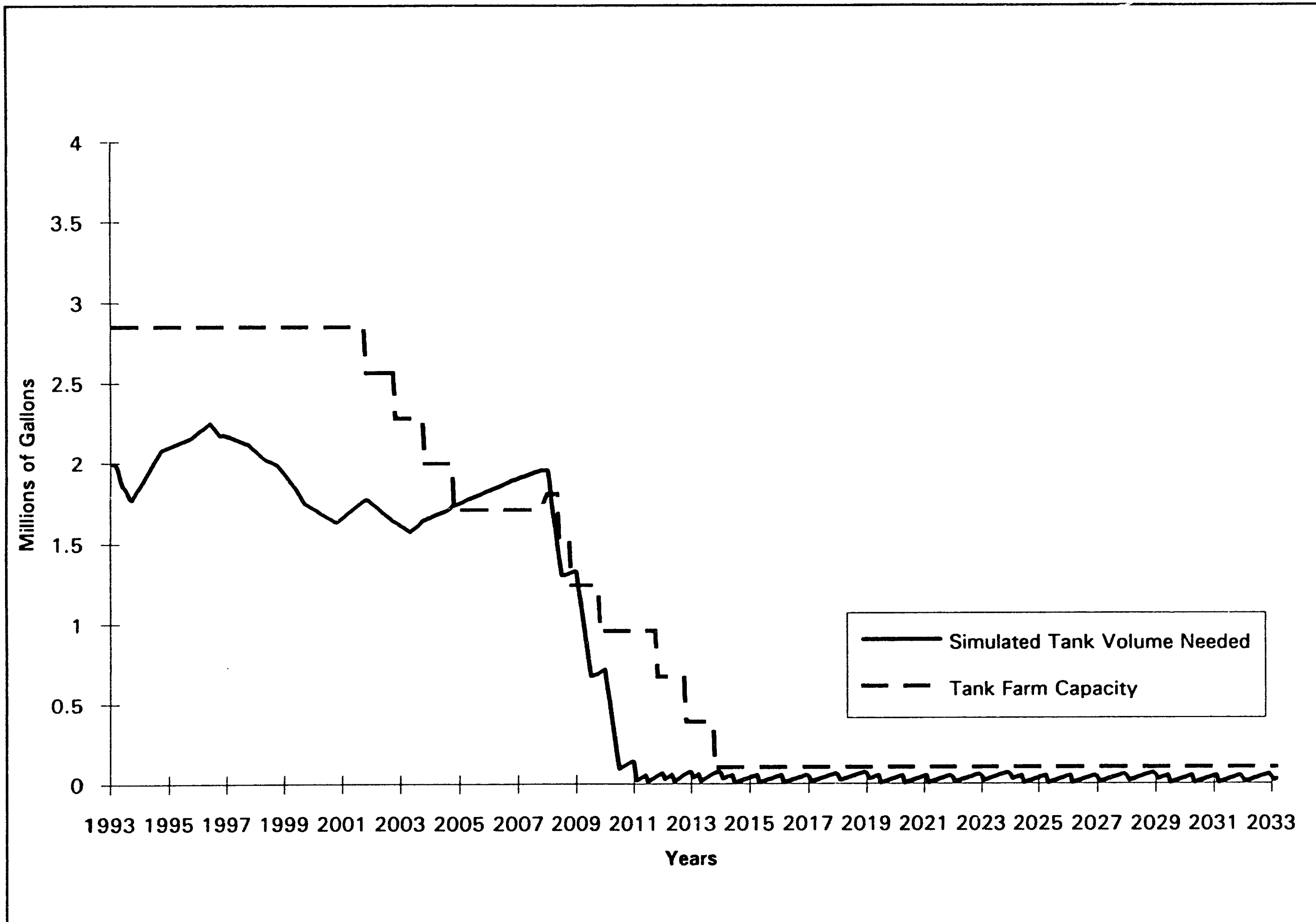


Figure C-11. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 8a

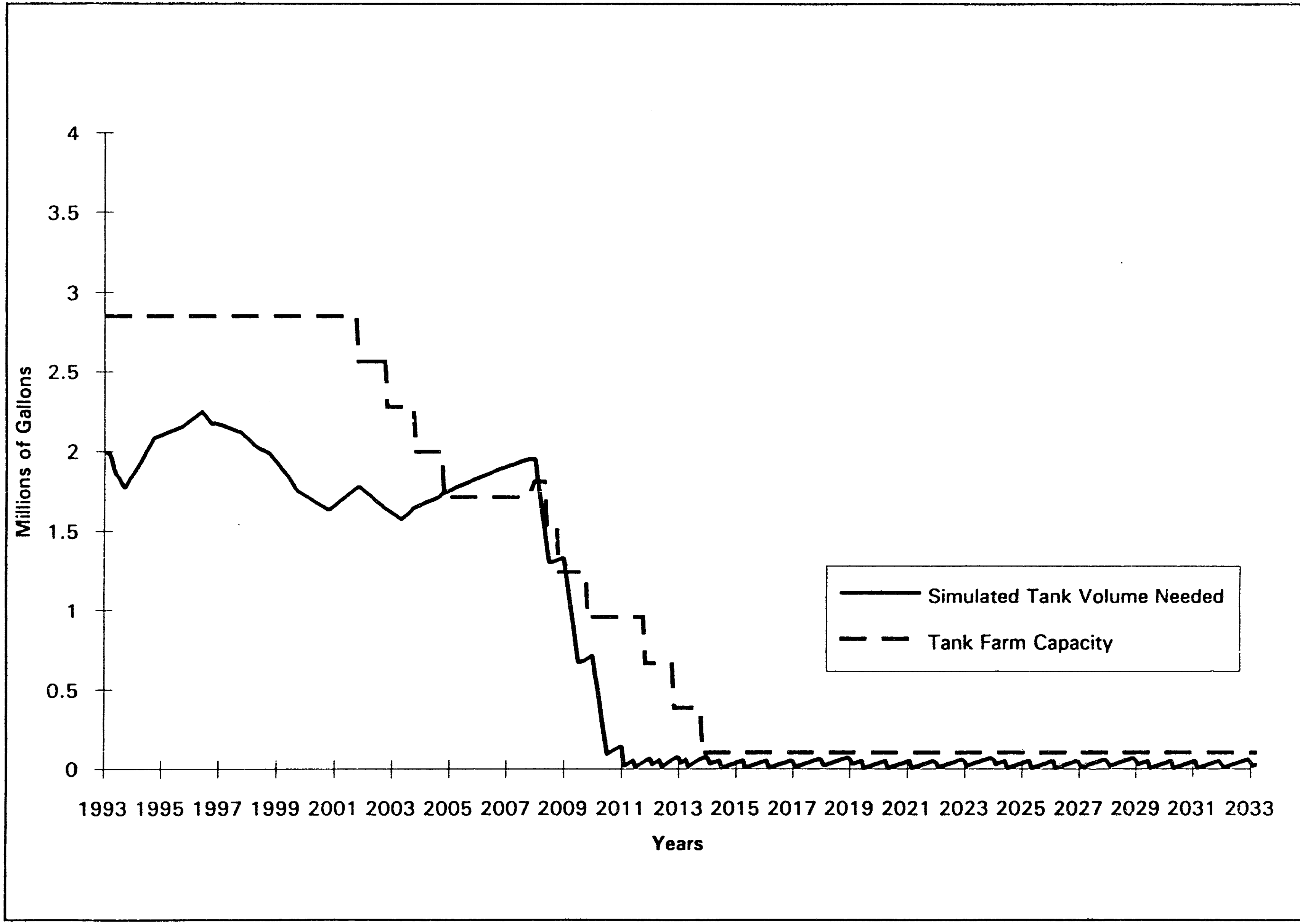


Figure C-12. Simulated Tank Volume Needed Vs. Tank Farm Capacity for Case 8b

Attachment D

Alternatives Project Cost Estimating

PROJECT COST AND SCHEDULE APPROACH AND ASSUMPTIONS

1. All costs were estimated on a 1993 basis and then escalated to time of performance. Escalation of costs was per published DOE guidelines. This approach has one problem; the published escalation rates cover a short period. Projections in the future are usually based on the last year of published rates. Since the period of performance covers so many years, the low escalation factors that are now being experienced are not representative of escalation experienced historically over such long periods of time. These guidelines have been converted from FY to CY basis.

   The escalation percentages and cost multipliers were:

YEAR	PERCENT	MULTIPLIER
1994	2.9	1.029
1995	3.3	1.059
1996	3.4	1.096
1997	3.4	1.133
1998	3.3	1.171
1999	3.4	1.210
2000	3.4	1.252
2001	3.4	1.294
2002	3.4	1.338
2003	3.4	1.380
2004	3.4	1.430
2005	3.4	1.479
2006	3.4	1.530
2007	3.4	1.582
2008	3.4	1.635
2009	3.4	1.691
2010	3.4	1.748
2011	3.4	1.808
2012	3.4	1.869
2013	3.4	1.933
2014	3.4	1.999
2015	3.4	2.066
2016	3.4	2.136
ETC, ETC		
2043	3.4	5.268

2. Contingency applied to the estimates was within the guidelines of the INEL Estimating Manual and the "Cost Estimating Guide for Application of Contingency by Steering team on Contingency".

3. All estimates were based on either actual costs of previous projects, information from Short Form Data Sheets, or estimates prepared by estimating organizations.

4. The Cost Estimate Summary sheets for the individual projects define the estimate basis for each estimate.

5. For work in contaminated areas, the cost of decontamination is not included in the project costs.

6. Schedule durations are based on past schedule experience, based on schedules contained in Short Form Data Sheets, or from schedules established by this exercise.

7. Calcine Retrieval estimates for Bin Sets 2 through 7 were estimated on Case 1 schedule basis only. This approach does include a small error to the life-cycle costs of other cases, but this error is well within the error limits of using a low escalation factor for a 38-year period.

COST ESTIMATE SUMMARY

PROJECT: CALCINE RETRIEVAL, BIN SET 1 DATE 12/08/93

ESTIMATE BASIS: Estimate is based on information contained in a Short Form Data Sheet, dated 12/15/93. The Data Sheet is based on operation in 1st QTR FY 2008.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION			$ 7,000,000
CONSTRUCTION			$28,000,000
PROJECT MANAGEMENT			INCL. IN ABOVE
MANAGEMENT RESERVE			
SUBTOTAL			$35,000,000
ESCALATION (included in above)			
CONTINGENCY			$15,000,000
TOTAL ESTIMATED COST			$50,000,000
OTHER PROJECT COST			$15,000,000
TOTAL PROJECT COST[1]			$65,000,000

[1] The retrieval cost estimate for Bin Set 1 is substantially greater than for the other bin sets because Bin Set 1 was not designed for retrieval.

FUNDING REQUIREMENTS

	PROJECT: CALCINE RETRIEVAL, BIN SET 1						**REV. 1**	
	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL				$5,000,000	$5,000,000	$10,000,000	$20,000,000	SUB TOT OP
OPERATING	$650,000	$1,451,000	$1,778,000	$1,121,000	$1,000,000	$1,000,000		$7,000,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL	$10,000,000	$10,000,000	$5,000,000	$5,000,000			$30,000,000	SUB TOT OP
OPERATING	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000		$6,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$1,000,000	$1,000,000						$2,000,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$50,000,000	$15,000,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 2 DATE 12/16/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-1 and a retrieval start date of 2011.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$1,606,000	$ 1,020,000	$ 2,626,000
CONSTRUCTION	$7,722,000	$ 5,776,000	$13,498,000
PROJECT MANAGEMENT	$ 618,000	$ 462,000	$ 1,080,000
MANAGEMENT RESERVE	$ 772,000	$ 577,000	$ 1,349,000
SUB FOTAL		$10,718,000	$18,553,000
ESCALATION (included in above)			$ 7,835,000
CONTINGENCY			$ 4, 468,000
TOTAL ESTIMATED COST			$23,191,000
OTHER PROJECT COST			$ 3,524,000
TOTAL PROJECT COST			$26,715,000

FUNDING REQUIREMENTS

	PROJECT: CALCINE RETRIEVAL, BIN SET 2							
	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	SUB TOT CAP	
CAPITAL				$3,000,000	$10,000,000	$10,191,000	$23,191,000	SUB TOT OP
OPERATING			$500,000	$500,000	$500,000	$500,000		$2,000,000
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$1,524,000							$1,524,000
	FY 2017	FY 2018	FY 20019	FY 2020	FY 2021	FY 2022	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY2028	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$23,191,000	$3,524,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 3 DATE 12/16/93

ESTIMATE BASIS: Costs are based on a feasibility/planning estimate No. 93181-1 and a retrieval start date of 2015.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 1,606,000	$ 1,396,000	$ 3,002,000
CONSTRUCTION	$ 7,722,000	$ 7,706,000	$15,428,000
PROJECT MANAGEMENT	$ 618,000	$ 616,000	$ 1,234,000
MANAGEMENT RESERVE	$ 772,000	$ 770,000	$ 1,542,000
SUBTOTAL	$10,718,000		$21,206,000
ESCALATION (included in above)		$10,488,000	
CONTINGENCY			$ 5,301,000
TOTAL ESTIMATED COST			$26,507,000
OTHER PROJECT COST			$ 4,028,000
TOTAL PROJECT COST			$30,535,000

FUNDING REQUIREMENTS

PROJECT: CALCINE RETRIEVAL , BIN SET 3

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING						$600,000		$600,000
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	SUB TOT CAP	
CAPITAL	$3,200,000	$11,000,000	$12,307,000				$26,507,000	SUB TOT OP
OPERATING	$600,000	$600,000	$600,000	$1,628,000				$3,428,000
	FY 2017	FY 2018	FY 20019	FY 2020	FY 2021	FY 2022	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY2028	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$26,507,000	$4,028,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 4 DATE 12/16/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-1 and a retrieval start date of 2019.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 1,606,000	$ 1,825,000	$ 3,431,000
CONSTRUCTION	$ 7,722,000	$ 9,912,000	$17,634,000
PROJECT MANAGEMENT	$ 618,000	$ 792,000	$ 1,410,000
MANAGEMENT RESERVE	$ 772,000	$ 991,000	$ 1,763,000
SUBTOTAL	$10,718,000		$24,238,000
ESCALATION (included in above)		$13,520,000	
CONTINGENCY			$ 6,059,000
TOTAL ESTIMATED COST			$30,297,000
OTHER PROJECT COST			$ 4,604,000
TOTAL PROJECT COST			$34,901,000

FUNDING REQUIREMENTS

PROJECT: CALCINE RETRIEVAL, BIN SET 4

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	SUB TOT CAP	
CAPITAL					$3,400,000	$13,000,000	$16,400,000	SUB TOT OP
OPERATING				$700,000	$700,000	$700,000		$2,100,000
	FY 2017	FY 2018	FY 20019	FY 2020	FY 2021	FY 2022	SUB TOT CAP	
CAPITAL	$13,897,000						$13,897,000	SUB TOT OP
OPERATING	$700,000	$1,804,000						$2,504,000
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY2028	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$30,297,000	$4,604,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 5 DATE 12/16/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-1 and a retrieval start date of 2021.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 1,606,000	$ 2,062,000	$ 3,668,000
CONSTRUCTION	$7,722,000	$11,129,000	$18,851,000
PROJECT MANAGEMENT	$ 618,000	$ 889,000	$ 1,507,000
MANAGEMENT RESERVE	$ 772,000	$ 1,113,000	$ 1,885,000
SUBTOTAL	$10,718,000		$25,911,000
ESCALATION (included in above)		$15,193,000	
CONTINGENCY			$ 6,477,000
TOTAL ESTIMATED COST			$32,288,000
OTHER PROJECT COST			$ 4,922,000
TOTAL PROJECT COST			$37,310,000

FUNDING REQUIREMENTS

PROJECT: CALCINE RETRIEVAL , BIN SET 5

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING						$800,000		$800,000
	FY 2017	FY 2018	FY 20019	FY 2020	FY 2021	FY 2022	SUB TOT CAP	
CAPITAL	$3,500,000	$13,500,000	$15,388,000				$32,388,000	SUB TOT OP
OPERATING	$800,000	$800,000	$800,000	$1,722,000				$4,122,000
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY2028	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$32,388,000	$4,922,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 6 DATE 12/16/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-1 and a retrieval start date of 2025.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 1,606,000	$ 2,587,000	$ 4,193,000
CONSTRUCTION	$ 7,722,000	$13,825,000	$21,547,000
PROJECT MANAGEMENT	$ 618,000	$ 1,105,000	$ 1,723,000
MANAGEMENT RESERVE	$ 772,000	$ 1,383,000	$ 2,155,000
SUBTOTAL	$10,718,000		$29,618,000
ESCALATION (included in above)		$18,900,000	
CONTINGENCY			$ 7,403,000
TOTAL ESTIMATED COST			$37,021,000
OTHER PROJECT COST			$ 5,626,000
TOTAL PROJECT COST			$ 42,647,000

FUNDING REQUIREMENTS

PROJECT: CALCINE RETRIEVAL, BIN SET 6

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2017	FY 2018	FY 20019	FY 2020	FY 2021	FY 2022	SUB TOT CAP	
CAPITAL					$4,000,000	$14,500,000	$18,500,000	SUB TOT OP
OPERATING				$900,000	$900,000	$900,000		$2,700,000
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY2028	SUB TOT CAP	
CAPITAL	$18,521,000						$18,521,000	SUB TOT OP
OPERATING	$900,000	$2,026,000						$2,926,000
						TOTAL	$37,021,000	$5,626,000

COST ESTIMATE SUMMARY

PROJECT: Calcine Retrieval, Bin Set 7 DATE 12/16/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-1 and a retrieval start date of 2032.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 1,606,000	$ 3,517,000	$ 5,123,000
CONSTRUCTION	$7,722,000	$18,618,000	$26,340,000
PROJECT MANAGEMENT	$ 618,000	$ 1,490,000	$ 2,108,000
MANAGEMENT RESERVE	$ 772,000	$ 1,861,000	$ 2,633,000
SUBTOTAL	$10,718,000		$36,204,000
ESCALATION (included in above)		$25,486,000	
CONTINGENCY			$ 9,275,000
TOTAL ESTIMATED COST			$45,479,000
OTHER PROJECT COST			$ 6,877,000
TOTAL PROJECT COST			$52,356,000

FUNDING REQUIREMENTS

PROJECT: CALCINE RETRIEVAL, BIN SET 7

							SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
							SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
							SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY2032	SUB TOT CAP	
CAPITAL		$5,000,000	$19,000,000	$21,479,000			$45,479,000	SUB TOT OP
OPERATING	$1,200,000	$1,200,000	$1,200,000	$1,200,000	$2,077,000			$6,877,000
						TOTAL	$45,479,000	$6,877,000

COST ESTIMATE SUMMARY

PROJECT: 8th BIN SET DATE 12/01/93

ESTIMATE BASIS: The total cost of the Seventh Calcined Solids Storage Facility, as reported on Construction Project Final Cost Report, was escalated from 1987 (mid point of the project) to 1993 using the Engineering News Records (ENR) index of October 87 = 2568 and October 93 = 3016. The project was then escalated to 2005 (mid point of the project) using published DOE escalation guidelines. Contingency was estimated at 25%, since design is fairly standard; however, the contingency was increased by 10% to cover new requirements since the original Seventh Calcined Solids Storage Facility project start date of October 1984.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 2,839,000	$ 1,360,000	$ 4,199,000
CONSTRUCTION	$ 9,376,000	$ 4,491,000	$13,867,000
PROJECT MANAGEMENT	INCL	INCL	INCL
MANAGEMENT RESERVE	$ 1,221,000	$ 585,000	$ 1,806,000
SUBTOTAL	$13,436,000	$ 6,436,000	$19,872,000
ESCALATION (included in above)		$ 8,045,000	
CONTINGENCY	$ 3,359,000	$ 1,609,000	$ 4,968,000
TOTAL ESTIMATED COST	$16,795,000		$24,840,000
OTHER PROJECT COST			$ 4,968,000
TOTAL PROJECT COST			$29,808,000

FUNDING REQUIREMENTS

	PROJECT: 8TH BIN SET							
	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL				$4,840,000	$10,000,000	$10,000,000	$24,840,000	SUB TOT OP
OPERATING		$200,000	$500,000	$500,000	$500,000	$800,000		$2,500,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$1,000,000	$1,000,000	$468,000					$2,468,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$24,840,000	$4,968,000

COST ESTIMATE SUMMARY

PROJECT: WIF operational in year 2008 DATE 12/08/93

ESTIMATE BASIS: Estimate is based on Estimates for the Multifunction Pilot Plant and Production Development Facility Feasibility Study Task as performed by Raytheon Engineers & Constructors, Inc., dated 11/22/93

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$108,700,000	$ 26,500,000	$ 135,200,000
CONSTRUCTION	$433,200,000	$164,600,000	$ 597,800,000
PROJECT MANAGEMENT	$ 29,000,000	$ 11,000,000	$ 40,000,000
MANAGEMENT RESERVE	$ 42,500,000	$ 16,100,000	$ 58,600,00
SUBTOTAL	$613,400,000		$ 831,600,000
ESCALATION (included in above)		$218,200,000	
CONTINGENCY			$ 249,500,000
TOTAL ESTIMATED COST			$1,081,000,000
OTHER PROJECT COST			$ 212,000,000
TOTAL PROJECT COST			$1,293,100,000

FUNDING REQUIREMENTS

PROJECT: WIF OPERATIONAL IN 2008

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL					$50,000,000	$50,000,000	$100,000,000	SUB TOT OP
OPERATING		$40,000,000	$40,000,000	$40,000,000	$6,000,000	$6,000,000		$132,000,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL	$50,000,000	$300,000,000	$200,000,000	$168,000,000	$160,000,000	$103,100,000	$981,100,000	SUB TOT OP
OPERATING	$6,000,000	$6,000,000	$7,000,000	$8,000,000	$8,000,000	$8,000,000		$43,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$12,000,000	$15,000,000	$10,000,000					$37,000,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$1,081,100,000	$212,000,000

COST ESTIMATE SUMMARY

PROJECT: WIF (vitrification in 2008 only) DATE 12/09/93

ESTIMATE BASIS: Estimate is based on estimates for the Multifunction Pilot Plant and Production Development Facility Feasibility Study Task as performed by Raytheon Engineers & Constructors, Inc., dated 11/22/93. The estimate includes vitrification facility, vitrification equipment, sodium conveyance system, support facilities, support facilities equipment, and balance of plant utilities upgrades. These costs DO NOT include completion of the rest of the WIF facilities.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 58,868,000	$ 16,34,000	$ 75,210,000
CONSTRUCTION	$234,593,000	$ 89,145,000	$323,738,000
PROJECT MANAGEMENT	$ 15,698,000	$ 5,965,000	$ 21,633,000
MANAGEMENT RESERVE	$ 23,019,000	$ 8,747,000	$ 31,766,000
SUBTOTAL	$355,198,000		$452,377,000
ESCALATION (included in above)		$120,199,000	
CONTINGENCY			$135,714,000
TOTAL ESTIMATED COST			$588,091,000
OTHER PROJECT COST			$120,000,000
TOTAL PROJECT COST			$708,091,000

FUNDING REQUIREMENTS

PROJECT: VITRIFICATION IN 2008 ONLY

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL						$30,000,000	$30,000,000	SUB TOT OP
OPERATING		$2,000,000	$3,000,000	$5,000,000	$30,000,000			$40,000,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL	$35,000,000	$30,000,000	$200,000,000	$180,000,000	$113,091,000		$558,091,000	SUB TOT OP
OPERATING	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$15,000,000		$55,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$15,000,000	$10,000,000						$25,000,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$588,091,000	$120,000,000

COST ESTIMATE SUMMARY

PROJECT: WIF (vitrification in 2008 rest of WIF Facilities only) DATE 12/09/93

ESTIMATE BASIS: Estimate is based on estimates for the Multifunction Pilot Plant and Production Development Facility Feasibility Study Task as performed by Raytheon Engineers & Constructors, Inc., dated 11/22/93. The estimate includes chemical processing and grouting facilities. The estimate is based on WIF in 2015 reduced by cost of vitrification in 2008 only, with a 10% factor added for phasing and inefficiencies. These costs DO NOT include vitrification completed in 2008.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION			$87,137000
CONSTRUCTION			$397,679,000
PROJECT MANAGEMENT			$ 26,622,000
MANAGEMENT RESERVE			$ 38,944,000
SUBTOTAL			$550,382,000
ESCALATION (included in above)		$241,100,000	
CONTINGENCY			$269,914,000
TOTAL ESTIMATED COST			$820,914,000
OTHER PROJECT COST			$820,296,000
TOTAL PROJECT COST			$982,828,000

FUNDING REQUIREMENTS

	PROJECT: PHASED WIF-REST OF WIF IN 2015-DOES NOT INCLUDE VIT.							
	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL					$45,000,000	$80,000,000	$125,000,000	SUB TOT OP
OPERATING	$2,000,000	$15,000,000	$25,000,000	$25,000,000	$6,000,000	$7,000,000		$80,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL	$200,000,000	$180,000,000	$150,000,000	$100,000,000	$65,296,000		$695,296,000	SUB TOT OP
OPERATING	$7,000,000	$7,000,000	$7,000,000	$7,000,000	$7,532,000	$15,000,000		$50,532,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$12,000,000	$10,000,000	$10,000,000					$32,000,000
						TOTAL	$820,296,000	$162,532,000

COST ESTIMATE SUMMARY

PROJECT: High Level Liquid Waste Evaporator DATE 12/06/93

ESTIMATE BASIS: Estimate is based on actual project costs, budgets, estimates to complete, and published project schedule.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION			$ 1,281,694
CONSTRUCTION			$ 4,076,079
PROJECT MANAGEMENT			$ 823,976
MANAGEMENT RESERVE			$ 518,251
SUBTOTAL			$ 6,700,000
ESCALATION (included in above)			
CONTINGENCY			
TOTAL ESTIMATED COST			$ 6,700,000
OTHER PROJECT COST			$ 625,500
TOTAL PROJECT COST			$ 7,325,500

FUNDING REQUIREMENTS

PROJECT: HIGH LEVEL LIQUID WASTE EVAPORATOR

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL	$6,700,000						$6,700,000	SUB TOT OP
OPERATING	$325,500	$300,000						$625,500
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$6,700,000	$625,500

COST ESTIMATE SUMMARY

PROJECT: Freeze Crystallization DATE 12/08/93

ESTIMATE BASIS: Estimate is based on discussions with individuals involved in the development of the technology. It is assumed that the direct construction cost is $60,000,000.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 28,106,000	$ 5,498,000	$ 33,604,000
CONSTRUCTION	$111,626,000	$ 32,818,000	$144,444,000
PROJECT MANAGEMENT	$ 7,495,000	$ 2,203,000	$ 9,698,000
MANAGEMENT RESERVE	$ 10,763,000	$ 3,164,000	$ 13,927,000
SUBTOTAL	$157,990,000		$201,673,000
ESCALATION (included in above)		$ 43,683,000	
CONTINGENCY			$ 60,502,000
TOTAL ESTIMATED COST			$262,175,000
OTHER PROJECT COST			$53,000,000
TOTAL PROJECT COST			$315,175,000

FUNDING REQUIREMENTS

PROJECT: FREEZE CRYSTALLIZATION

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL					$20,000,000	$60,000,000	$80,000,000	SUB TOT OP
OPERATING	$200,000	$1,000,000	$8,000,000	$8,000,000	$2,500,000	$2,500,000		$22,200,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL	$100,000,000	$82,175,000					$182,175,000	SUB TOT OP
OPERATING	$2,500,000	$2,300,000	$10,000,000	$10,000,000	$6,000,000			$30,800,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
						TOTAL	$262,175,000	$53,000,000

COST ESTIMATE SUMMARY

PROJECT: Calciner Modifications (Case 7) DATE 12/08/93

ESTIMATE BASIS: Costs are based on historical data for tasks described in the documents accompanying the estimate request and estimate No. 93181-2. Assumes that existing equipment and vessels do not have to be cut up for disposal. Estimate does not include costs for decon.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN AND INSPECTION	$ 2,453,000	$ 578,000	$ 3,031,000
CONSTRUCTION	$ 7,666,000	$ 2,913,000	$10,579,000
PROJECT MANAGEMENT	$ 1,226,000	$ 466,000	$ 1,692,000
MANAGEMENT RESERVE	$ 767,000	$ 291,000	$ 1,058,000
SUBTOTAL	$12,112,000		$16,360,000
ESCALATION (included in above)		$ 4,248,000	
CONTINGENCY			$ 7,363,000
TOTAL ESTIMATED COST			$23,722,000
OTHER PROJECT COST			$ 5,766,000
TOTAL PROJECT COST			$29,397,000

FUNDING REQUIREMENTS

PROJECT: CALCINER MODIFICATIONS

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB T C	
CAPITAL					$2,000,000	$2,000,000	$4,000,000	SUB T O
OPERATING	$100,000	$200,000	$500,000	$500,000	$500,000	$500,000		$2,300,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB T C	
CAPITAL	$2,000,000	$6,000,000	$6,000,000	$4,000,000	$1,722,000		$19,722,000	SUB T O
OPERATING	$300,000	$500,000	$300,000	$300,000	$300,000	$1,000,000		$2,700,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB T C	
CAPITAL							$0	SUB T O
OPERATING	$675,000							$675,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB T C	
CAPITAL							$0	SUB T O
OPERATING								$0
						TOTAL	$23,722,000	$5,675,000

COST ESTIMATE SUMMARY

PROJECT: WIF operational in year 2015 DATE 12/09/93

ESTIMATE BASIS: Estimate is based on estimates for the Multifunction Pilot Plant and Production Development Facility Feasibility Study Task as performed by Raytheon Engineers & Constructors, Inc., dated 11/22/93. Contingency has been increased by 10% from WIF operational in year 2008 due to the low escalation rate (3.4%) used from 1999 through 2015.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$108,700,000	$ 45,700,000	$ 154,400,000
CONSTRUCTION	$433,200,000	$252,100,000	$ 685,300,000
PROJECT MANAGEMENT	$ 29,000,000	$ 16,900,000	$ 45,900,000
MANAGEMENT RESERVE	$ 42,500,000	$ 24,700,000	$ 67,200,000
SUBTOTAL	$613,400,000		$ 952,800,000
ESCALATION (included in above)		$339,400,000	
CONTINGENCY			$ 381,100,000
TOTAL ESTIMATED COST			$1,333,900,000
OTHER PROJECT COST			$ 267,800,000
TOTAL PROJECT COST			$1,601,700,000

FUNDING REQUIREMENTS

PROJECT: WIF OPERATIONAL IN 2015

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING						$45,000,000		$45,000,000
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL			$70,000,000	$80,000,000	$80,000,000	$320,000,000	$550,000,000	SUB TOT OP
OPERATING	$45,000,000	$45,000,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000		$118,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL	$270,000,000	$210,000,000	$178,000,000	$125,900,000			$783,900,000	SUB TOT OP
OPERATING	$9,000,000	$9,000,000	$9,000,000	$10,000,000	$15,000,000	$15,000,000		$67,000,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$15,000,000	$12,800,000	$10,000,000					$37,800,000
						TOTAL	$1,333,900,000	$267,800,000

COST ESTIMATE SUMMARY

PROJECT: Glass Ceramic Plant in 2015 DATE 12/09/93

ESTIMATE BASIS: Estimate is based on estimates for the Multifunction Pilot Plant and the Production Development Facility Feasibility Study Task as performed by Raytheon Engineers & Constructors, Inc., dated 11/22/93. WINCO's Applied Technology Department reviewed the preliminary work as performed by Raytheon and concluded that a glass ceramic plant is very similar in size and complexity to a glass vitrification plant. The estimate includes the glass ceramic facility, equipment, calcine conveyance system, support facilities, support facilities equipment, and balance of plant utilities upgrades. Contingency has been increased by 10% to compensate for low (3.4%) escalation rate from 1999 to 2015.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$ 61,800,000	$ 26,600,000	$ 88,400,000
CONSTRUCTION	$246,300,000	$156,400,000	$420,700,000
PROJECT MANAGEMENT	$ 16,500,000	$ 10,500,000	$27,000,000
MANAGEMENT RESERVE	$ 24,200,000	$15,400,000	$ 39,600,000
SUBTOTAL	$348,800,000		$557,700,000
ESCALATION (included in above)		$208,900,000	
CONTINGENCY			$223,000,000
TOTAL ESTIMATED COST			$780,700,000
OTHER PROJECT COST			$160,000.000
TOTAL PROJECT COST			$940,700,000

FUNDING REQUIREMENTS

PROJECT: GLASS CERAMIC PLANT IN 2015

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING								$0
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING		$2,000,000	$3,000,000	$5,000,000	$20,000,000	$30,000,000		$60,000,000
	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	SUB TOT CAP	
CAPITAL	$50,000,000	$50,000,000	$230,000,000	$180,000,000	$150,000,000	$120,700,000	$780,700,000	SUB TOT OP
OPERATING	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000		$60,000,000
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	SUB TOT CAP	
CAPITAL							$0	SUB TOT OP
OPERATING	$15,000,000	$15,000,000	$10,000,000					$40,000,000
						TOTAL	$780,700,000	$160,000,000

Attachment E

Alternatives for Supplying Additional Process Tankage

Tank Option 1

Use existing Tank Farm vessels VES-WM-103, -104, -105 and -106 for surge capacity.

Description:

VES-WM-103, -104, -105 and -106 are direct buried tanks that are not currently being used because they do not meet RCRA secondary containment requirements. These four vessels were designed to store high-level waste and are of thick-walled stainless steel construction. They have been emptied and flushed and are currently not in use. Before these tanks could be used, a vault would have to be built to house the tanks and provide RCRA secondary containment. The tanks would then have to be dug up and installed in the vault. Transfer lines exist for these tanks, but they have been cut and capped. The outlet transfer lines do not meet RCRA secondary containment requirements because the secondary containment drains into an unlined vault. Each of the four tanks has a capacity of 30,000 gallons.

Costs:

1. Excavate and remove all four tanks and the outlet transfer lines.

2. Demolish existing concrete pads.

3. Build a stainless steel lined concrete cell large enough to hold all four tanks.

4. Install tanks, instrumentation, and samplers.

5. Install connections to existing outlet line. Modify the outlet lines so that the secondary containment drains into a lined valve box.

6. Reconnect inlet line.

Assumptions:

1. The tanks can be decontaminated enough to do the necessary modifications.

2. The existing six-inch access ports are sufficient to allow for sampling and new instrumentation.

3. The existing VOG system is adequate.

4. ASME code stamp is not required.

COST ESTIMATE SUMMARY

PROJECT: Modify VES-WM-103, -104, -105, & -106 for Liquid Waste Storage — DATE 12/08/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-5.

	Unescalated	Escalation	Totals
ENGINEERING, DESIGN, AND INSPECTION	$1 3,306,000		
CONSTRUCTION	$11,477,000		
PROJECT MANAGEMENT	$ 1,836,000		
MANAGEMENT RESERVE	$1,148,000		
SUBTOTAL	$17,767,000		
ESCALATION (included in above)			
CONTINGENCY	$ 7,138,000		
TOTAL ESTIMATED COST	$24,905,000		
OTHER PROJECT COST	$ 4,981,000		
TOTAL PROJECT COST	$29,886,000		

Tank Option 2

Place three, ten-foot-diameter, thirty-foot-tall vessels in FPR cells 1, 2 and 3 (9 vessels in all).

Description:

FPR cells one, two, and three are currently not being used. The opening in the hatches of these cells is large enough to allow the installation of a ten-foot-diameter vessel. The cells are large enough to accommodate three vessels in each cell. The total capacity would be approximately 153,000 gallons.

Costs:

1. Nine, ten-foot-diameter, thirty-foot-tall stainless steel vessels.

2. Instrumentation for level, temperature, density, etc.

3. Inlet and outlet transfer piping. (The transfer line(s) from NWCF/Tank Farm is included in the estimate for WIF and is not included here).

Assumptions:

1. Costs for vessel off gas systems, solution transfer lines, and any necessary FPR upgrades are included in the WIF estimate and need not be considered here.[12]

[12] If the need for the tankage occurs prior to WIF construction and this tankage option is used, this part of the WIF construction will need to be done at an earlier date. THis will not result in a singnificant life-cycle cost impact, but shortterm costs will be increased.

COST ESTIMATE SUMMARY

PROJECT: Liquid Waste Tanks in FPR DATE 12/08/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-7. The estimate assumes that the FPR has been upgraded to all safety requirements and common utilities, HVAC, etc. are in operation. This option can only be justified if WIF is included in the FPR structure. Otherwise, the cost of upgrading FPR, the vessel off-gas system, and the waste lines to and from the tanks make this option not justifiable.

	Unescalated	Escalation	Totals
ENGINEERING, DESIGN, AND INSPECTION	$ 1,340,000		
CONSTRUCTION	$ 5,582,000		
PROJECT MANAGEMENT	$ 670,000		
MANAGEMENT RESERVE	$ 558,000		
SUBTOTAL	$ 8,150,000		
ESCALATION (included in above)			
CONTINGENCY	$ 2,098,000		
TOTAL ESTIMATED COST	$10,248,000		
OTHER PROJECT COST	$ 1,537,000		
TOTAL PROJECT COST	$11,785,000		

Tank Option 3

Use existing vessel VES-WM-190 as secondary containment for a new liquid waste storage vessel.

Description:

VES-WM-190 is a 300,000-gallon high-level liquid waste storage tank that has been reserved as a spare. It has not been used to store radioactive waste, but has been slightly contaminated by drainage from transfer line encasements. The WM-190 vault is one of four adjacent vaults that house similar tanks. Another tank could be fabricated inside VES-WM-190 that would use VES-WM-190 for secondary containment. The new tank would have a capacity of approximately 260,000 gallons.

Costs:

1. Excavate down to and remove the roof from the VES-WM-190 vault.

2. Cut the dome off the existing vessel and fabricate another vessel inside it.

3. Install necessary instrumentation and sampling capabilities in both tanks.

4. Replace vault roof and back fill.

Assumptions:

1. Radiation fields inside VES-WM-190 can be made low enough by decontamination and shielding from adjacent vaults to allow the fabrication of the new vessel.

COST ESTIMATE SUMMARY

PROJECT: Modify WM-190 for Liquid Waste Tank DATE 12/08/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-6.

	Unescalated	Escalation	Total
ENGINEERING, DESIGN, AND INSPECTION	$6,181,000		
CONSTRUCTION	$19,313,000		
PROJECT MANAGEMENT	$ 3,090,000		
MANAGEMENT RESERVE	$ 1,931,000		
SUBTOTAL	$30,515,000		
ESCALATION (included in above)			
CONTINGENCY	$12,466,000		
TOTAL ESTIMATED COST	$42,981,000		
OTHER PROJECT COST	$ 8,596,000		
TOTAL PROJECT COST	$51,577,000		

Tank Option 4

Convert Bin Set 7 to a liquid storage facility.

Description:

Bin Set 7 contains 7 vessels currently designed for calcined solids storage and is ready for operation, but has not been placed in service. This modification would involve installing a stainless steel liner in the vault, building solution transfer lines to the bin set and putting a transfer station in the NWCF.

The existing instrument room, off-gas filter room, cyclone cell and fan room would be used to house the inlet and outlet piping manifold that would allow any vessel to be filled or emptied individually. The valves would be remotely operated electronically or by the use of extension handles. The seven bins would have a total capacity of approximately 450,000 gallons.

Costs:

1. Install a stainless steel liner approximately 10 feet tall to hold the contents of one vessel.

2. Remove all solids fill piping from the cyclone to the bins.

3. Remove and discard all equipment located in the cyclone cell, instrument room and off-gas filter room. The equipment in the fan room would have to be removed and reinstalled in a new area to be added on top of Bin Set 7.

4. Remove equipment and buildings on top of Bin Set 7 to make room for a 12-foot extension to be added on top of Bin Set 7. This new addition would contain an instrument room, vault ventilation equipment (removed from the original fan room) and a small vessel off-gas system. The vessel off-gas system would consist of a demister, heater and double set of HEPA filters. The existing pressure and vacuum relief system would need to be moved and installed on the vessel off-gas system.

5. Add an inlet and outlet pipe to each of the seven vessels.

6. Add required instrumentation to the vessels for level monitoring. Modify the existing spare transport line (3-inch schedule 80) to transfer liquid from Bin Set 7 to NWCF.

7. Install a line from the blend and hold cell to connect the existing tank farm feed lines to the return jet cubicle and to the existing spare transport line. This line should run via the valve cubicle so a pump or jet, if practicable, could be installed to provide about 120 feet of lift needed to transport to Bin Set 7.

Assumptions:

1. The bins would handle the seismic liquid storage loads.

2. An ASME Section III code stamp is not required.

3. Bin Set 7 would never be needed for calcine storage.

COST ESTIMATE SUMMARY

PROJECT: Convert Bin Set 7 to Liquid Waste Storage DATE 12/08/93

ESTIMATE BASIS: Costs are based on feasibility/planning estimate No. 93181-3. It was assumed that Bin Set 7 was never used for calcine storage prior to this project.

	Unescalated	Escalation	Totals
ENGINEERING, DESIGN, AND INSPECTION	$ 4,040,000		
CONSTRUCTION	$16,834,000		
PROJECT MANAGEMENT	$ 2,020,000		
MANAGEMENT RESERVE	$ 1,683,000		
SUBTOTAL	$24,577,000		
ESCALATION (included in above)			
CONTINGENCY	$ 6,353,000		
TOTAL ESTIMATED COST	$30,930,000		
OTHER PROJECT COST	$ 6,186,000		
TOTAL PROJECT COST	$37,116,000		

Tank Option 5

Design and Construct a New Tanks Facility

Description:

A new tanks facility will be constructed immediately north of the existing tank farm. The new facility will include four new tanks along with transfer, ventilation, monitoring, and inspection equipment needed to safely store hazardous and radioactive waste. Three alternatives are evaluated:

- four 125,000 gallon tanks
- four 250,000 gallon tanks
- four 500,000 gallon tanks

Costs:

1. New tanks and vaults with secondary containment
2. Transfer piping, remotely-maintainable valves, and valve cubicles
3. Remote sampling system
4. Ventilation and cubicles
5. Instrumentation and controls
6. Remote inspection equipment
7. Security provisions

COST ESTIMATE SUMMARY

PROJECT: New Tanks Facility DATE 12/13/93

ESTIMATE BASIS: Costs are derived from the new tanks restart planning information. All costs are unescalated.

	Costs (1993 Dollars)		
	4 TANKS @ 125,000 gal each = 500,000 gal	4 TANKS @ 250,000 gal each = 1,000,000 gal	4 TANKS @ 500,000 gal each = 2,000,000 gal
	Unescalated	Escalation	Totals
ENGINEERING, DESIGN, AND INSPECTION	$ 16,800,000	$ 23,100.000	$ 27,400,000
CONSTRUCTION	$ 55,500,000	$ 76,100,000	$ 90,000,000
PROJECT MANAGEMENT	$ 9,400,000	$ 12,900,000	15,200,000
MANAGEMENT RESERVE	0 (incl above)	0 (incl above)	0 (incl above)
SUBTOTAL	$ 81,700,000	$112,100,000	$132,600,000
CONTINGENCY	$ 18,000,000	$ 24,600,000	29,200,000
TOTAL ESTIMATED COST	$ 99,700,000	$136,700,000	$161,800,000
OTHER PROJECT COST	$ 10,000,000	$ 13,700,000	$16,200,000
TOTAL PROJECT COST	$109,700,000	$150,400,000	$178,000,000

Attachment F

Schedule and Cost Information Related to Life-Cycle Cost Determination

Schedule and Cost Information Related to
Life-Cycle Cost Determination

1.0 Schedule

The total time (TT) for development, design, construction and operations for the new technologies were determined by adding critical path time (T_{crit}) to beginning of operations time (O_t) for processing the liquid and calcine waste inventory. (See Equation 1).

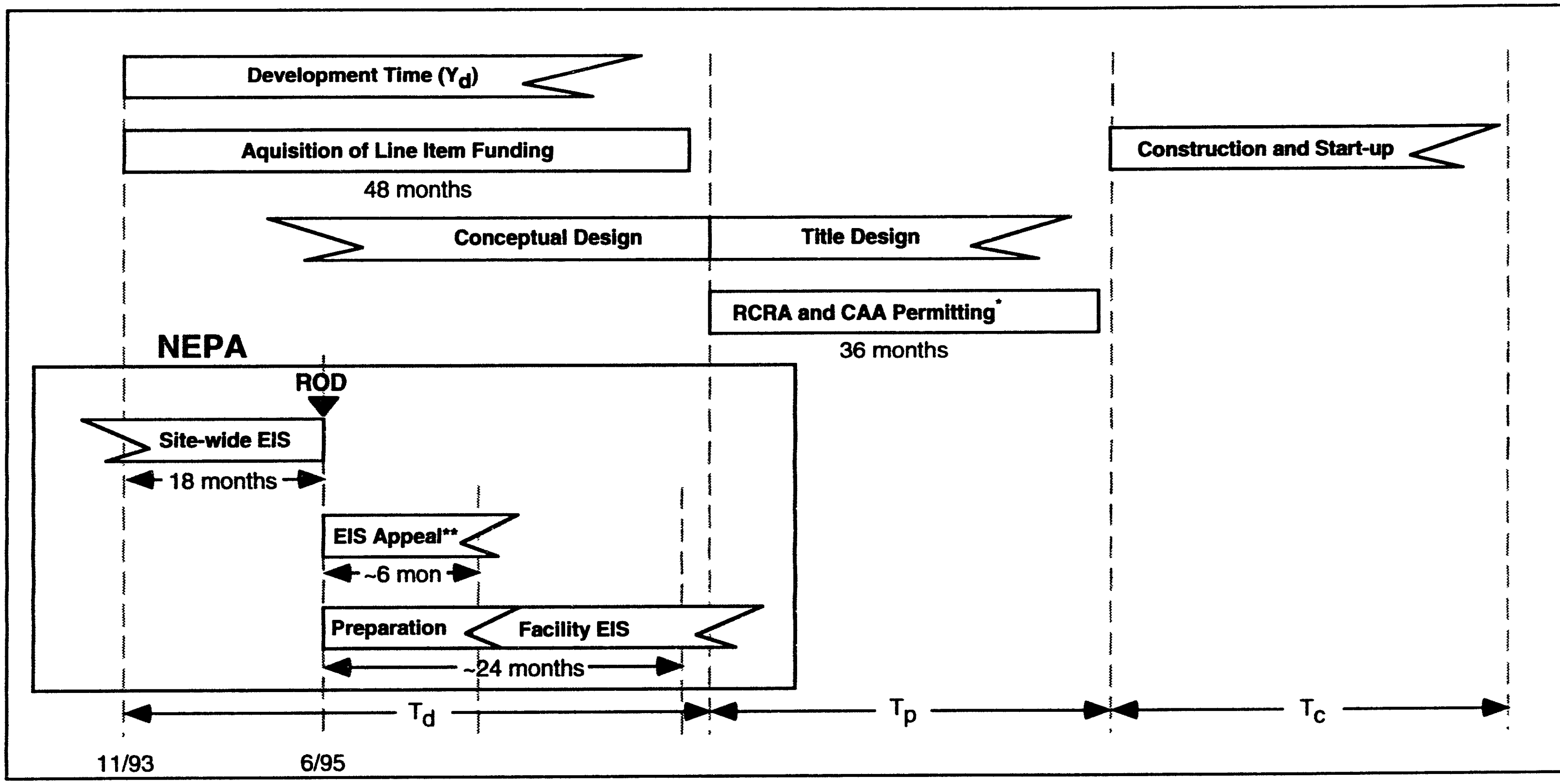
$$TT = T_{crit} + O_t \qquad (1)$$

The critical path time to beginning of operations were determined from the development time, the permitting time, and the construction and start up time. Figure F-1 shows general project and permitting time frames and how they form a potential critical path. Figures F-2 through F-15 provide detailed schedule information for each case. From Figure F-1, it can be seen that the critical path time to the beginning of operations determined according to Equation 2. Table F-I gives the development time for the new technologies under consideration, Table F-II gives the estimated project time frames, Table F-III gives the time for environmental (Resource Conservation and Recovery Act (RCRA) and Clean Air Act (CAA)) permitting and National Environmental Policy Act (NEPA) approvals, and Table F-IV gives the time needed to complete title design based on estimated design, construction, and start-up costs.

$$T_{crit} = T_d + T_p + T_c \qquad (2)$$

Where:

T_d	=	The greater of Y_d (per Table F-I), Line Item Funding Time (48 months per Table F-II), or NEPA (24 months per Table F-III). Note that under normal circumstances, T_d will be 5 years since any process will require development of either Glass or Glass-ceramic technologies (both of which have a Y_d of 5 years).
T_p	=	The greater of RCRA Permitting Time (36 months per Table F-III) or Title Design Time (TD)(per Table F-IV)
T_c	=	Construction and Start-up Time (per Table F-II)



T_{crit} = $T_d + T_p + T_c$

T_d = the greater of y_d (per Table F-I), Line Item Funding Time (per Table F-II), or NEPA (per Table F-III)

T_p = the greater of RCRA permiting time (per Table F-III) or Title Design Time (Table F-II)

T_c = Construction and Start-up Time (per Attachment D)

* Assumes all data needed for permit applications are available immediately following conceptual design. For this reason, a 12-month window is required to complete conceptual design after development work is complete. RCRA and CAA permitting must be complete prior to construction.

** EIS appeal time may be extended if political or public resistance is significant. Any delays will postpone submittal of facility EIS and may make NEPA the critical path (T_{crit}).

Figure F-1. Project and Permitting Time Frame

Table F-I. Sodium Processing Units Model Data

Process Units	Development Years[1]			Advanced Testing[2] (Mockups)		Advance Testing Costs ($)	Materials Cost Factor[3] (C_m)	# of Operators Per Shift[3]
	Y_p	Y_e	Y_d	Cold	Hot			
High Level Evaporator	0	0	0	√		0	0.5	2
Calcine Retrieval	2	5	5	√		1,000,000	0.5	2
Neutralization	1	3	3	√		500,000	1	4
Freeze Crystallization	2	4	4		√	1,000,000	1	4
TRUEX	1	1	1	√		500,000	0.5	4
CsIX	1	1	2	√		500,000	0.5	2
SrEX	2	1	2	√		500,000	0.5	4
Glass LAW	2	5	5	√		500,000	1	5
Grout LAW (Class A)	2	3	3	√		500,000	1	5
Grout LAW (> Class A)	2	3	3	√		500,000	1	7
Calcination	1	0	1	Mockup Already Constructed		200,000 [4]	0.5	4
Calciner Reforming	2	4	4	√		500,000	0.5	4
Glass HAW	2	5	5	√		500,000	1	5
Glass Ceramic	2	5	5	√		500,000	1	6

[1] Y_p is the time required to develop the process chemistry.
Y_e is the time required to develop the process equipment.
Y_d is the time required to develop candidate process units (the sum of Y_p and Y_e for CsIX, and the greater of Y_p or Y_e for all other process units).
[2] Testing required beyond lab-scale testing.
[3] Based on 500 liters/hr throughput (calciner throughput)
[4] Testing cost still required for process chemistry.

Table F-II. Estimated Project Time Frames

Line Item Funding Time	48 months	Dictated by DOE Order 4700.1B (Draft)
Construction and Start-up Time	See Figures F-2 through F-15 for Schedules	Time determined from recent ICPP construction projects (NWCF, Main Stack Upgrade, and CPP-666).
Title Design Time	36 months if $\leq$ 2 process units 60 months if > 2 process units	Time determined from recent ICPP construction projects (NWCF, Main Stack Upgrade, and CPP-666).

Table F-III. Environmental Permitting and NEPA Approval Costs and Schedules

Permit or Document Type	Permit or Document	Average Time (in months)	Average Costs (in $)
National Environmental Policy Act (NEPA)	Categorical Exclusion (CX)	6	3,000
	Environmental Assessment (EA)	18	80,000
	Facility Environmental Impact Statement (EIS) [1,2]	24	2,000,000
Resource Conservation and Recovery Act (RCRA)	Treatability Study	3	10,000
	Research Development and Demonstration (RD&D) Permit	18	100,000
	Treatment, Storage, and Disposal (TSD) Permit [1]	36	250,000
Clean Air Act (CAA)	Air Permitting Applicability Questionnaire	1	2,000
	Below Regulatory Concern (BRC)	3	6,000
	Permit to Construct (PTC)	9	40,000
	PTC/Prevention of Significant Deterioration (PSD)	15	50,000
	PTC/PSD/National Emission Standards for Hazardous Air Pollutants (NESHAP)	15	65,000

1 This document or permit is required for a mixed waste treatment facility

2 Site-wide EIS is on a fixed schedule (to be completed by June 1, 1995) and is not included in this table.

1.1 Effects of Environmental Permitting and Approvals on Critical Path

Based on regulatory requirements and projected scope for implementation of the project, an evaluation of RCRA, CAA, and NEPA was conducted. RCRA and CAA regulations, respectively, dictate that a RCRA permit and a National Emissions Standards for Hazardous Air Pollutants (NESHAP) approval/Idaho Permit to Construction an Air Pollution Emitting Source (PTC)-Prevention of Significant Deterioration (PSD) permit must be obtained prior to construction. Schedule projections for each were obtained by comparison with past permitting at the ICPP. Of most significance however, is that the RCRA and CAA permitting processes cannot begin until sufficient information is available about the facility (typically Title II Design level information) and that construction cannot begin prior to obtaining these permits.

Similarly NEPA is likely to impact the schedule; historically, Title II Design Funding is not approved until completion of the NEPA process. Implementation of the new technology may require a tiered NEPA decision. (The site-wide EIS might only describe, in general, the new technology and the alternative. Additional NEPA documentation may be needed that includes information on the specific facility that was not available at the time the EIS was prepared.) It may be determined that the most extensive level of NEPA analysis is required - in this case, a facility-specific EIS. Reviews and approvals consistent with the chosen level of NEPA analysis and documentation will be required. The schedule is dictated primarily by the Amended Order Modifying Order of June 28, 1993.

The facility specific EIS cannot begin the public participation process until all appeals associated with the June 1, 1995 ROD are resolved. Although the length of the appeal process is unknown, a time of 6 months is assumed.

2.0 Cost

Total Program Cost (TP_c) was determined by adding Development, Design, Construction, Start-up, Permitting, Operations, D&D, and Disposal Costs per Equation 3.

$$TP_c = DV_c + DCS_c + P_c + TO_c + DD_c + D_c \qquad (3)$$

Where:

DV_c	=	Development Costs (Section 2.1)
DCS_c	=	Design, Construction, and Start-up Costs (Attachment D)
P_c	=	Permitting Costs (Table F-III)
TO_c	=	Total Operating Costs (Section 2.3)
DD_c	=	Decontamination and Decommissioning Costs (Section 2.4)
D_c	=	Disposal Costs (Section 2.5)

2.1 Development Costs

Development costs included all development and any needed environmental permits through initiation of Title II Design. To determine the Development Costs (DV_c), per process unit, Equation 4 was used.

$$DV_c = (3{,}000{,}000\ \frac{\$}{yr})\,(Y) + AT \qquad (4)$$

Where:

Y	=	$Y_p + Y_e$ (see Table F-I)
AT	=	Advanced Testing Costs (see Table F-I)

The development cost equation was determined as follows:

- $3,000,000/yr for each development activity is a cost factor based on the historical annual average of programmatic expenditures for the pilot plant development programs and non-pilot plant development activities that the ICPP has conducted, such as: NO_x abatement, calcination, fuel processing restoration, and fountain dissolver development.

- Y is the sum of process chemistry development time (Y_p) and process equipment development time (Y_e) and may be greater than total development time (Y_d - see Table F-I) since development processes may run concurrently. Y_p and Y_e are based on developmental averages for solvent extraction, calcination, and off-gas treatment processes.

- Advanced Testing Costs (AT) are based on prior experience with cold (fountain dissolver, NO_x abatement) and hot (fuel dissolution, fluorinel, solvent extraction) mockup testing performed at the ICPP.

2.2 Environmental Permitting and NEPA Approval Cost

Table F-III provides information on the average NEPA approval and environmental permitting costs. Costs for a facility-specific EIS were projected from the time estimated to complete a "follow-up" EIS to the current site-wide EIS. (The EIS Costs for the Special Isotope Separation Project were used as a basis for comparison.) The remainder of the NEPA and permitting cost estimates were established using cost-time analysis and comparison with recent activities.

2.3 Total Operating Costs

To determine the Total Operating Costs (TO_c) per process unit, Equation 5 was used.

$$TO_c = (O_c)(O_t) \qquad (5)$$

Where:

O_c = Operations costs from equation 6 below
O_t = Operating Time (determined by modeling)

2.3.1 Operations Costs

Operations cost (O_c) was calculated based on Equation 6.

$$O_c = B_l + B_m \qquad (6)$$

Where:

B_l = base labor cost from below equation
B_m = base material cost from below equation

The Operations cost equation was determined as follows:

- o Material costs are scaled from actual labor-to-material cost ratios from FY-93 NWCF operating costs.

To determine base labor costs (B_l), Equation 7 was used.

$$B_l = [N_0 \left(\frac{\$38}{hr}\right) + (3)(N_0)\left(\frac{\$60}{hr}\right)] \left(8760\frac{hr}{yr}\right) \qquad (7)$$

Where:

N_o = number of operators per shift (see Table F-I)

The Base labor costs equation was determined as follows:

- o Number of operators per shift (N_o), for any unit process being performed to process waste, is based on the unit operations and similarity to operation of the existing calcining and dissolution/extraction facilities.
- o Average support person ratio, per shift operator, is 3:1 [(3)(N_o)] based on current operator/support person ratios at the ICPP.
- o Total possible work hours per year (8760 hr/yr) is determined at 24 hrs/day for 365 days.
- o Labor costs per person ($38/hr for hourly and $60/hr for exempt employees) are based on current production labor and support services costs at the ICPP for FY 93.

To determine the base materials cost (B_m) Equation 8 was used.

$$B_m = (B_l)(C_m) \qquad (8)$$

Where:

B_l = base labor costs (from Equation 7)
C_m = Materials costs factor (see Table F-I)

The Base materials cost equation was determined as follows:

- o Material, chemical, and energy costs were estimated as a fraction (C_m) of the labor costs. For labor intensive processes, such as separations and calcining, C_m was set to 0.5. For energy/chemical intensive processes, C_m was set to 1.0. These figures are based on NWCF operating dollars for FY 93.

2.4 Decontamination and Decommissioning (D&D) Costs

There has been considerable work carried out recently to determine what D&D costs should be. Currently, without any clear direction or requirements that define the final level of D&D that is acceptable to DOE, the State, and the public a percentage of the facility costs was used. The escalated total facility costs for the case were multiped by 18% to determine the D&D costs for the new facilities that have been constructed to carry out the case operations. The percentage was derived from current estimates being used for D&D of the Waste Calcining Facility. The other existing plant facilities that will require D&D were left out of the comparison because the costs will be the same for all cases and add no value to the evaluation of the options.

2.5 Disposal Costs

Disposal Costs are shown in Table F-IV. These costs are for disposal of commercial nuclear wastes and, as applicable, include base charges with surcharges. Filling level averages are assumed to be 91% for Class A, B, and C drums; 90% for greater than class C (GTCC) glass drums; and 71.1% for GTCC Glass-Ceramic drums. Shipments are limited to either 40 drums or 1000 Ci per shipment, depending on the radioactivity of the drums.

Table F-IV. Disposal Costs

Waste Class	($\$/m^3$)
Class A	10,000
Class B	20,000
Class C	110,000
GTCC (Glass)	530,000
GTCC (Glass-Ceramic)	675,000

Disposal Costs Estimation (August 1, 1993 Barnwell Low-Level Radioactive Waste Management Facility Rate Schedule)

2.5.1 Basis for Disposal Cost Estimates

Base Charges:
$\$59/ft^3$ Standard Waste
$\$2.80/ft^3$ Extended Care Fund
$\$6.00/ft^3$ South Carolina Low-Level Radioactive Waste Disposal Fee
$\$0.89/ft^3$ Southeast Regional Compact Fee

This equals $\$68.69/ft^3$, or $\$2426/m^3$.

Class A Surcharges: (40 drums per shipment, 0.25 Ci per drum)

\$0/container for a 600 pound drum (0.27 m^3 at 2.0 g/cc)
\$117/container for a curie surcharge for shielded shipments
2.4% Barnwell surcharge on total

The Base + Surcharge totals \$2,500 per 0.27 m^3 square drum containing Class A waste, or \$10,000/m^3 (only 0.246 m^3 is filled with grout).

Class B Surcharges: Assumptions: 40 containers per shipment and 25 Ci per drum. (The per drum limit is about 54 Ci/m^3)

\$0/container for the 600 pound container
\$934/container for curie surcharge for shielded shipments
\$1458/container for class B/C waste surcharge
\$45/container for cask handling
2.4% Barnwell surcharge on total

The Base + Surcharge totals \$4,900/0.27 m^3 square drum containing Class B waste, or \$20,000/m^3 (only 0.246 m^3 is filled with grout)

Class C Surcharges: Assumptions: 4 containers per shipment and 250 Ci/container (the Barnwell limit (1000 Ci/shipment) without specialized permission).

\$0/container for the 600 pound container
\$9,340/container for curie surcharge for shielded shipments
\$14,580/container for Class B/C Curie Surcharge
\$450/container for cask handling
2.4% Barnwell surcharge on total

The Base + Surcharge totals \$27,500/0.27 m^3 square drum containing Class C waste, or ~\$110,000/m^3 (Only 0.246 m^3 is filled with grout)

Greater-than-Class C Surcharges: \$500,000/canister or, assuming a 1.04 m^3 canister size and a 71.1% filling capacity, equals \$675,000/m^3 (if Glass-Ceramic) or \$530,000/m^3 (if glass with a filling capacity of 90%).

2.6 Detailed Costs

This section contains all of the detailed cost information. There is a "Summary Cost Roll Up Table" that shows a clear comparison of each case and its five major cost drivers. It allows easy comparison of the total costs, five-year costs, or comparison of any of the five drivers.

Each case has a year cost table that defines the five major costs for each of the drivers, and five-year and total case cost summaries. Also, each case has a five-year cost plot and a life-cycle cost plot that show the per year costs.

Summary Cost Roll Up Table for Tank Farm Systems Analysis Study 1993

	(Dollars in Millions)													
	Case 0a	Case 0b	Case 1	Case 2a	Case 2b	Case 3	Case 4a	Case 4b	Case 5a	Case 5b	Case 6	Case 7	Case 8a	Case 8b
Development Costs	261.42	240.42	306.42	339.42	275.42	306.42	306.42	306.42	358.42	358.42	240.42	300.42	306.42	183.42
Design, Construction, Startup	2107.44	2031.03	1597.95	1838.19	2369.26	1683.91	1645.60	1615.60	2449.96	2449.96	2239.95	2139.54	2037.03	1246.34
Lifetime Operations	3356.69	3521.69	2732.80	2159.44	2427.56	1984.13	2349.18	2489.43	3410.19	3410.19	3078.65	3523.63	2498.59	1235.85
(Includes Environ. Permitting)														
D&D	379.34	365.59	287.63	330.87	426.47	303.10	296.21	290.81	440.99	440.99	403.19	385.12	366.67	224.34
Disposal	944.37	3283.88	872.80	736.85	758.48	677.90	774.56	817.49	963.06	791.01	1357.53	2894.38	1541.32	5146.37
Total Life Cycle Cost	7049.26	9442.61	5797.60	5404.77	6257.19	4955.46	5371.97	5519.75	7622.62	7450.58	7319.74	9243.09	6750.03	8036.32
Five Year Total Cost	287.81	265.82	496.83	690.45	660.65	433.36	497.41	493.60	297.07	297.07	266.40	300.07	320.94	266.94

Case 0a

		1993 Case 0a Calcination with the WIF and Glass HLW					Base Case 0a		
		FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
	A.	Waste Reprocessing (EM 30)							
		Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
		Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
		General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
		Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
	B.	Capital Costs							
		Waste Immobilization Facility	0.00	0.00	0.00	0.00	0.00	45.00	45.00
		Additional Tank Storage	0.00	0.00	0.00	0.00	1.23	2.76	29.41
		Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
		Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
		Subtotal Capital Costs	7.13	0.50	0.50	0.50	3.73	50.26	76.71
	C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D.	Waste Disposal Costs (EM ??)							
		Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
	F.	Development Costs (EM 30)	28.00	28.92	20.50	20.50	24.50	24.50	24.50
	G.	TOTAL ICPP COSTS	61.05	56.20	42.66	42.66	49.89	96.42	123.45

Case 0a

Base operating costs are extrapolated from the 1993 actual budget data.										
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.00	135.90	15.00	15.00
57.80	59.40	8.10	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
109.30	142.70	99.40	94.52	328.00	279.68	219.00	187.00	135.90	15.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	22.00	22.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	0.00
153.54	186.84	144.41	121.24	354.68	305.33	243.66	211.66	160.56	39.66	36.66

Case 0a

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	20.05	20.05	80.21	80.21	80.21	86.89	86.89	86.89	86.89	86.89
0.60	0.60	0.60	2.41	2.41	2.41	2.61	2.61	2.61	2.61	2.61
1.00	1.00	1.00	4.01	4.01	4.01	4.34	4.34	4.34	4.34	4.34
21.66	21.66	21.66	86.62	86.62	86.62	93.84	93.84	93.84	93.84	93.84
15.00	12.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.70	4.80	17.80	28.29	17.20	6.10	14.30	16.19	2.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.00	12.80	10.70	4.80	17.80	28.29	17.20	6.10	14.30	16.19	2.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
0.00	0.00	0.00	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48
0.00	0.00	0.00	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36.66	34.46	32.36	122.90	135.90	146.39	142.52	131.42	139.62	141.51	127.94

Case 0a

	(Dollars in Millions)									
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	20.62	8.23	20.20	22.68	3.28	6.20	19.20	22.68	2.08
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	20.62	8.23	20.20	22.68	3.28	6.20	19.20	22.68	2.08
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48
31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
130.22	140.72	145.94	133.55	145.52	148.00	128.60	131.52	144.52	148.00	127.40

Case 0a

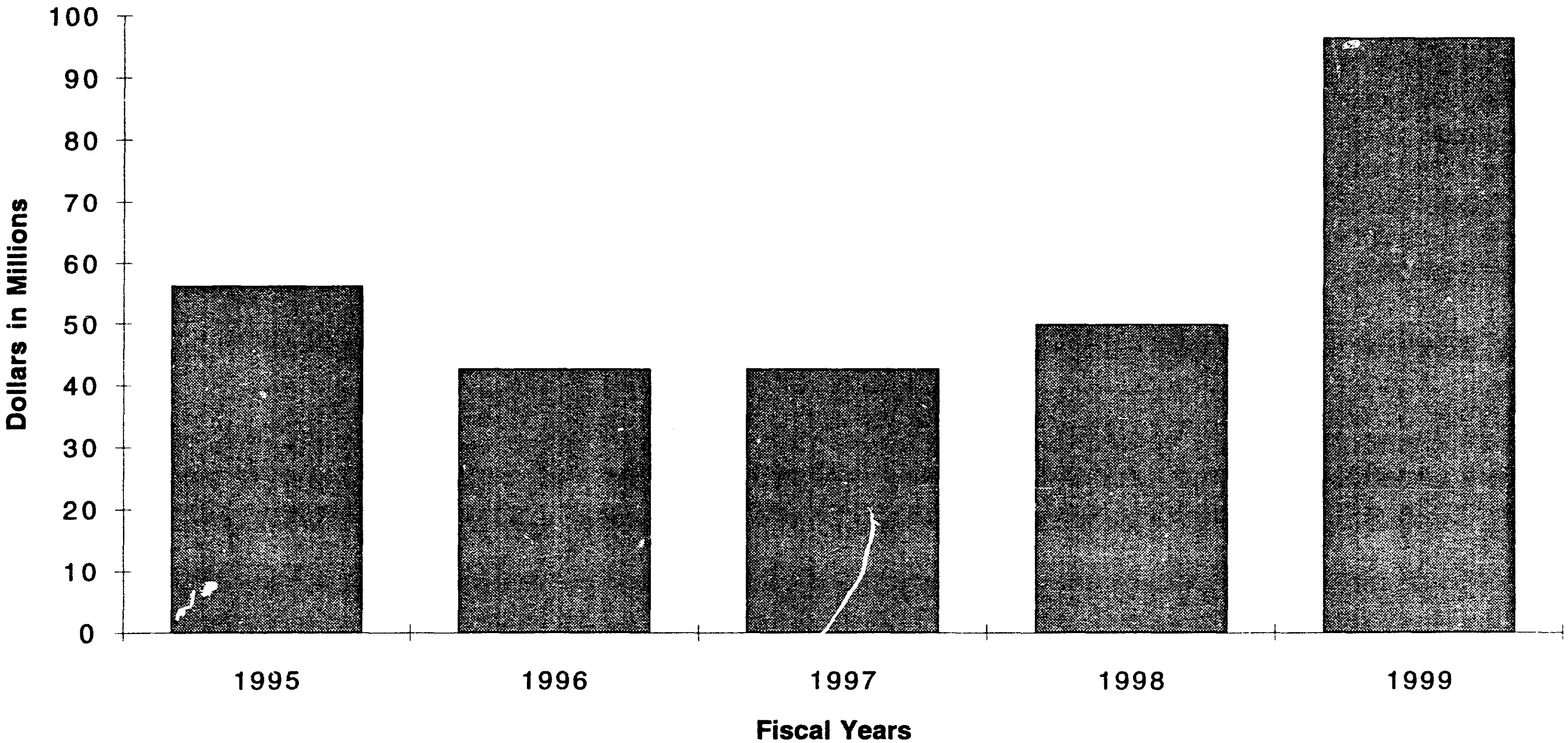
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.20	6.20	19.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.20	6.20	19.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	379.34
9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00
22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	22.48	0.00
31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	31.48	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
126.52	131.52	144.52	148.00	127.40	125.32	125.32	125.32	125.32	125.32	125.32	473.18

Case 0a

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94		
Total	Total	Total	Total	Total	Grand Total		
189.15	200.52	715.18	868.90	1129.58	3103.33		
5.67	6.02	21.46	26.07	33.89	93.10		
9.46	10.03	35.76	43.45	56.48	155.17		
204.29	216.56	772.39	938.42	1219.94	3351.59		
212.00	1366.90	22.80	0.00	0.00	1601.70		
150.60	13.60	0.00	0.00	0.00	164.20		
0.00	0.00	108.00	143.38	53.43	304.82		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
21.40	8.00	0.00	0.00	0.00	29.40		
391.33	1388.50	130.80	143.38	53.43	2107.44		
0.00	0.00	0.00	0.00	379.34	379.34		
0.00	0.00	71.97	89.97	107.96	269.90		
0.00	0.00	179.86	224.83	269.79	674.48		
0.00	0.00	251.83	314.79	377.75	944.37		
1.65	3.44	0.00	0.00	0.00	5.10		
215.42	46.00	0.00	0.00	0.00	261.42		
812.69	1654.50	1155.02	1396.59	2030.46	7049.26	Five Year Costs	287.81

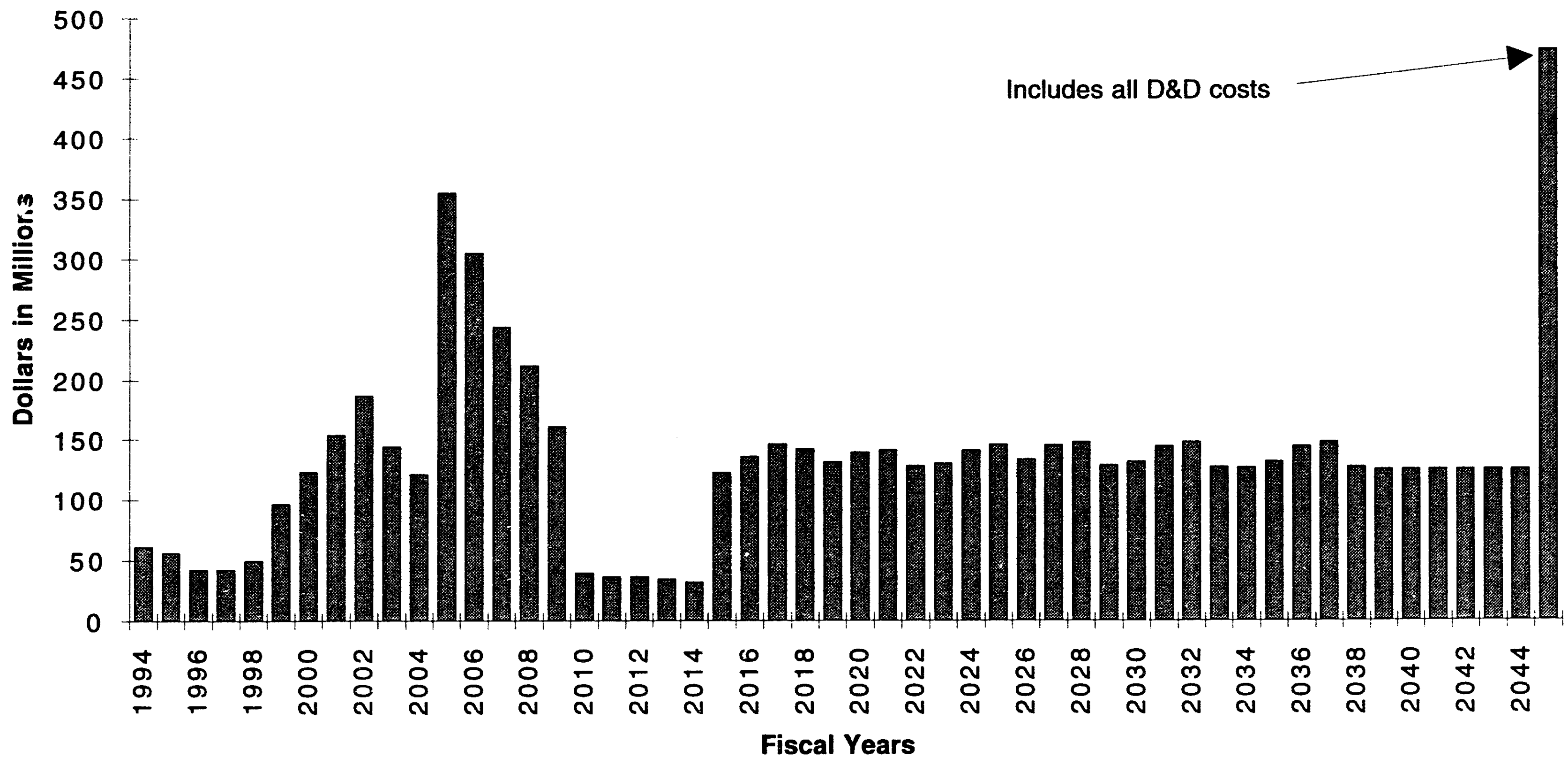
Case 0a Five Year Costs

Five Year Total = $287.81 M



1/25/94

Case 0a Life Cycle Costs



1/25/94

Case 0b

	1993 Case 0b Calcination with the WIF and Glass Ceramic						**Base Case 0b**	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	0.00	0.00	0.00	0.00	45.00	45.00
	Additional Tank Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
	Subtotal Capital Costs	7.13	0.50	0.50	0.50	2.50	47.50	47.30
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	17.50	17.50	18.50	18.50	18.50
G.	TOTAL ICPP COSTS	61.05	56.20	39.66	39.66	42.66	87.66	88.04

Case 0b

Base operating costs are extrapolated from the 1993 actual budget data.										
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.00	135.90	15.00	15.00
0.20	0.50	5.34	10.50	10.80	1.00	1.00	0.47	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	4.40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.50	5.34	10.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
51.70	83.80	96.64	99.52	338.80	280.68	220.00	187.67	136.40	20.94	29.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
16.00	16.00	13.00	10.00	7.00	7.00	6.00	6.00	3.00	3.00	3.00
89.94	121.94	132.65	132.24	368.48	309.33	247.66	215.32	161.06	45.60	54.56

Case 0b

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	20.05	20.05	85.94	85.94	85.94	85.94	85.94	85.94	85.94	85.94
0.60	0.60	0.60	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
1.00	1.00	1.00	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
21.63	21.66	21.66	92.81	92.81	92.81	92.81	92.81	92.81	92.81	92.81
15.00	12.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.40	24.51	15.24	5.73	13.70	14.60	2.60	4.30	15.20	21.09	17.12
10.80	1.00	1.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41.20	38.31	26.24	6.20	13.70	14.60	2.60	4.30	15.20	21.09	17.12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
0.00	0.00	0.00	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65.86	59.96	47.89	192.83	200.34	201.23	189.24	190.94	201.84	207.72	203.76

Case 0b

	(Dollars in Millions)									
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
85.94	85.94	85.94	85.94	85.94	85.94	85.94	76.86	76.86	76.86	76.86
2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.31	2.31	2.31	2.31
4.30	4.30	4.30	4.30	4.30	4.30	4.30	3.84	3.84	3.84	3.84
92.81	92.81	92.81	92.81	92.81	92.81	92.81	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.62	8.23	20.20	22.68	2.08	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.62	8.23	20.20	22.68	2.08	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
207.26	194.86	206.84	209.31	188.71	186.64	186.64	178.04	183.04	197.04	199.52

Case 0b

2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86
2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31
3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	1.20	6.20	20.20	22.68	2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	1.20	6.20	20.20	22.68	2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83	93.83
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
178.92	176.84	178.04	183.04	197.04	199.52	178.92	176.84	176.84	176.84	176.84

Case 0b

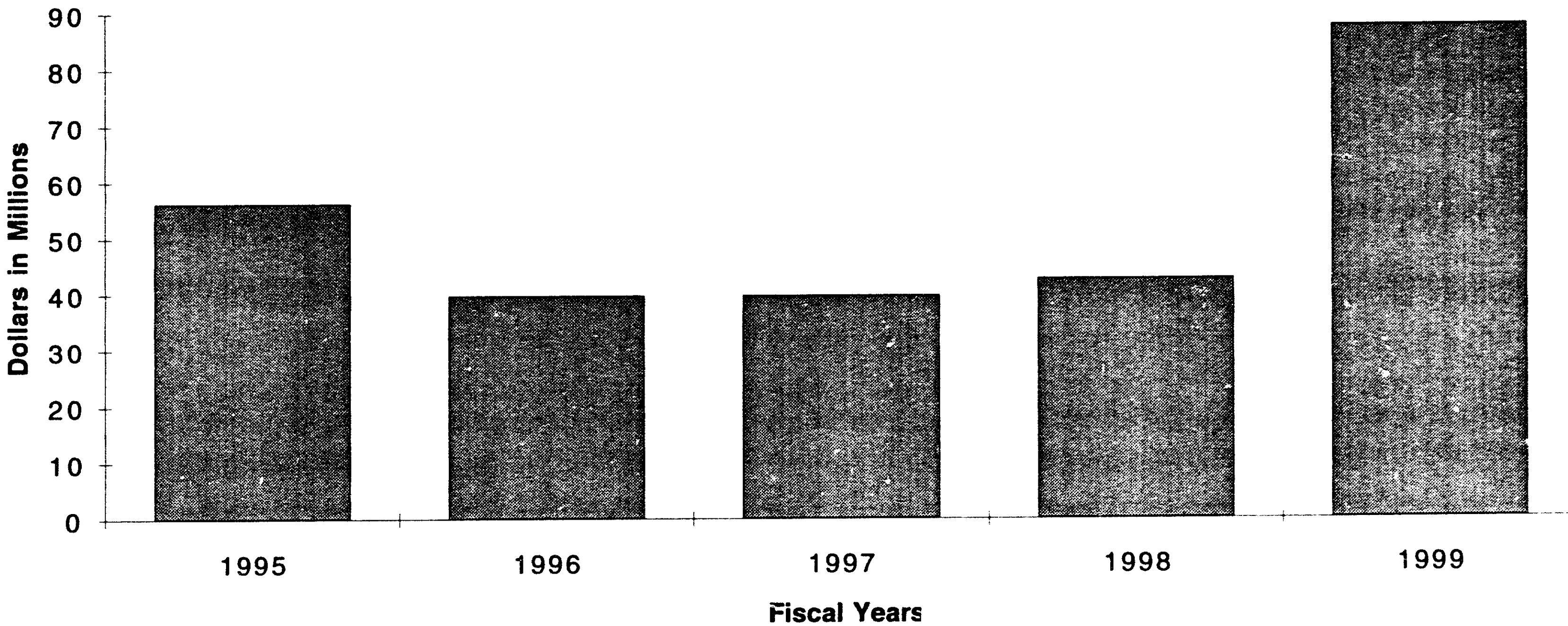
2045	2046	2047	2048	2049
76.86	76.86	76.86	76.86	76.86
2.31	2.31	2.31	2.31	2.31
3.84	3.84	3.84	3.84	3.84
83.01	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	365.59
0.00	0.00	0.00	0.00	0.00
93.83	93.83	93.83	93.83	93.83
93.83	93.83	93.83	93.83	93.83
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
176.84	176.84	176.84	176.84	542.42

Case 0b

Page 1	Page 2	Page 3	Page 4	Page 5	Page 6	25-Jan-94		
Total	Total	Total	Total	Total	Total	Grand Total		
149.05	220.57	747.64	909.01	845.51	384.32	3256.10		
4.47	6.62	22.43	27.27	25.37	11.53	97.68		
7.45	11.03	37.38	45.45	42.28	19.22	162.80		
160.97	238.21	807.45	981.73	913.15	415.07	3516.59		
						0.00		
						0.00		
90.00	1473.90	37.80	0.00	0.00	0.00	1601.70		
0.00	29.81	0.00	0.00	0.00	0.00	29.81		
0.00	5.00	149.48	124.08	54.43	0.00	333.00		
0.00	16.54	13.27	0.00	0.00	0.00	29.81		
7.33	0.00	0.00	0.00	0.00	0.00	7.33		
8.60	20.80	0.00	0.00	0.00	0.00	29.40		
105.93	1546.05	200.55	124.08	54.43	0.00	2031.03		
						0.00		
0.00	0.00	0.00	0.00	0.00	365.59	365.59		
						0.00		
						0.00		
0.00	0.00	0.00	0.00	0.00	0.00	0.00		
0.00	0.00	750.60	1032.08	1032.08	469.13	3283.88		
0.00	0.00	750.60	1032.08	1032.08	469.13	3283.88		
						0.00		
0.58	4.51	0.00	0.00	0.00	0.00	5.10		
						0.00		
147.42	90.00	3.00	0.00	0.00	0.00	240.42		
						0.00		
414.91	1878.77	1761.60	2137.89	1999.66	1249.78	9442.60	Five Year Costs	265.82

Case 0b Five Year Costs

Five Year Total = $269.81 M



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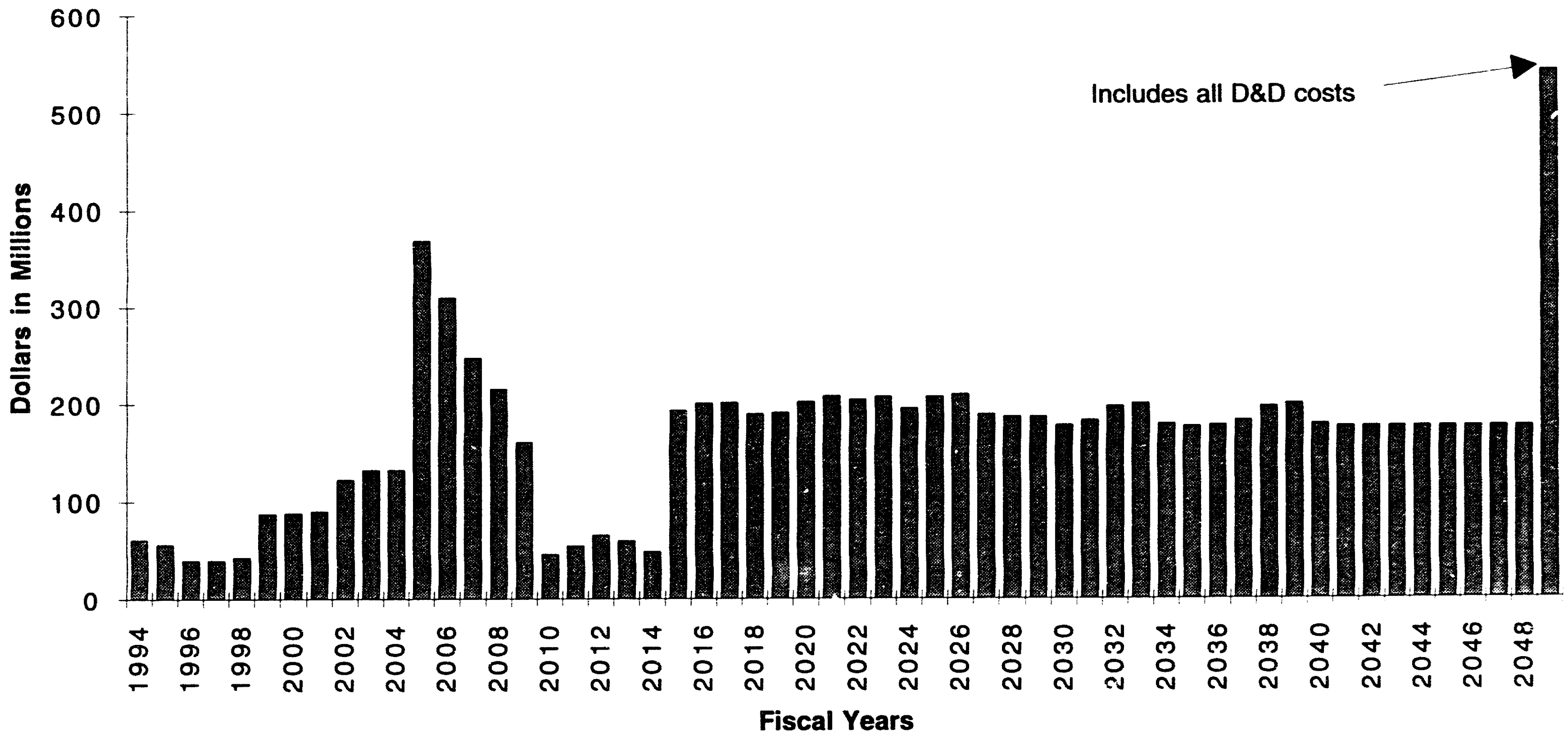
Case Ob Life Cycle Costs



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	1993 Case One Calcination with the WIF and Glass HLW				Case One		
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	40.84	40.84	40.84	56.84	56.84	56.84
	Additional Tank Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Retrieval	0.00	0.00	0.65	1.45	1.78	6.12	6.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	7.03	41.14	41.49	42.29	58.62	62.96	62.84
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	26.50	26.50	27.50	27.50	24.50
G.	TOTAL ICPP COSTS	60.95	96.84	89.65	90.45	107.78	112.12	109.58

Case One

Base operating costs are extrapolated from the 1993 actual budget data.										
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	14.32	14.32	68.75	68.75	74.48	74.48
0.60	0.60	0.60	0.60	0.60	0.43	0.43	2.06	2.06	2.23	2.23
1.00	1.00	1.00	1.00	1.00	0.72	0.72	3.44	3.44	3.72	3.72
21.66	21.66	21.66	21.66	21.66	15.47	15.47	74.25	74.25	80.44	80.44
306.84	207.84	176.84	168.84	111.94	12.84	15.84	10.84	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.00	11.00	11.00	6.00	6.00	1.00	1.50	3.50	10.50	11.29	5.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
317.84	218.84	187.84	174.84	117.94	13.84	17.34	14.34	10.50	11.29	5.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.17	10.17	10.17	10.17
0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.15	22.15	22.15	22.15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.33	32.33	32.33	32.33
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
19.00	19.00	19.00	13.00	13.00	13.00	6.00	6.00	3.00	3.00	3.00
359.08	259.98	229.85	210.56	153.62	42.31	38.81	126.92	120.07	127.05	121.09

Case One

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
74.48	74.48	74.48	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.23	2.23	2.23	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
3.72	3.72	3.72	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
80.44	80.44	80.44	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.60	12.91	2.33	4.10	14.50	18.90	16.10	16.19	0.90	4.90	15.40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.60	12.91	2.33	4.10	14.50	18.90	16.10	16.19	0.90	4.90	15.40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17
22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15
32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
124.36	125.67	115.09	130.27	140.67	145.06	142.27	142.36	127.07	131.07	141.57

Case One

	(Dollars in Millions)									
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.0[illegible]	0.00	0.00	0.00	0.00	0.00	0.00
19.42	2.03	0.00	0.00	1.2[illegible]	6.20	20.20	22.68	2.08	0.00	0.00
0.00	0.00	0.00	0.00	0.0[illegible]	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19.42	2.03	0.00	0.00	1.20	6.20	20.20	22.68	2.08	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17	10.17
22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15	22.15
32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33	32.33
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
145.59	128.19	126.17	126.17	127.37	132.37	146.37	148.85	128.24	126.17	126.17

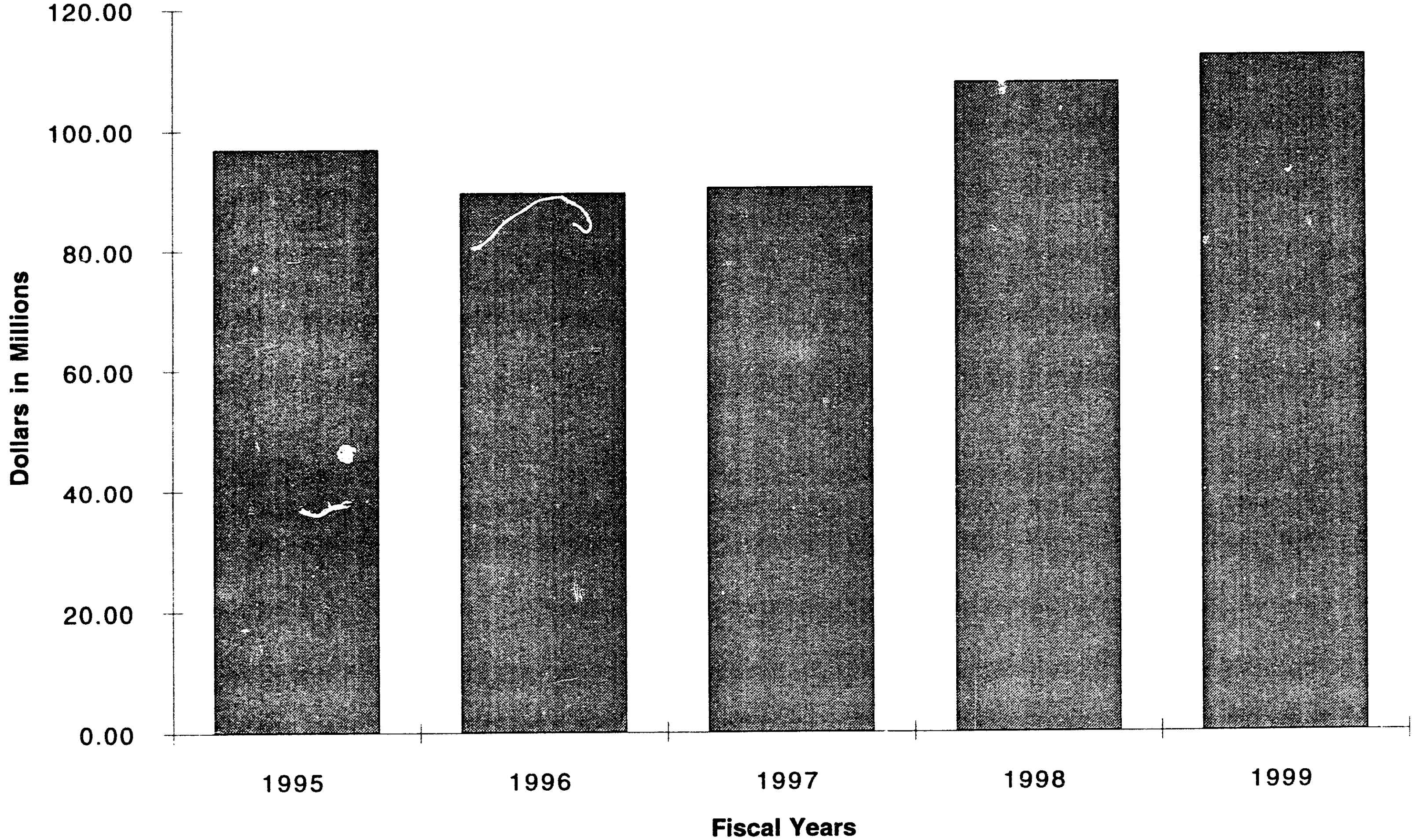
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
287.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
413.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case One

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94		
Total	Total	Total	Total	Total	Grand Total		
189.15	449.73	844.08	868.90	173.78	2525.65		
5.67	13.49	25.32	26.07	5.21	75.77		
9.46	22.49	42.20	43.45	8.69	126.28		
204.29	485.71	911.60	938.42	187.68	2727.70		
807.73	497.15	0.00	0.00	0.00	1304.89		
0.00	0.00	0.00	0.00	0.00	0.00		
38.00	67.72	106.22	73.80	0.00	285.74		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
853.06	564.87	106.22	73.80	0.00	1597.95		
0.00	0.00	0.00	0.00	287.63	287.63		
0.00	50.86	101.72	101.72	20.34	274.64		
0.00	110.77	221.54	221.54	44.31	598.16		
0.00	161.63	323.26	323.26	64.65	872.80		
1.65	3.44	0.00	0.00	0.00	5.10		
227.42	79.00	0.00	0.00	0.00	306.42		
1286.42	1294.65	1341.09	1335.48	539.97	5797.60	Five Year Costs	496.83

Case One Five Year Costs

Five Year Total = $496.83



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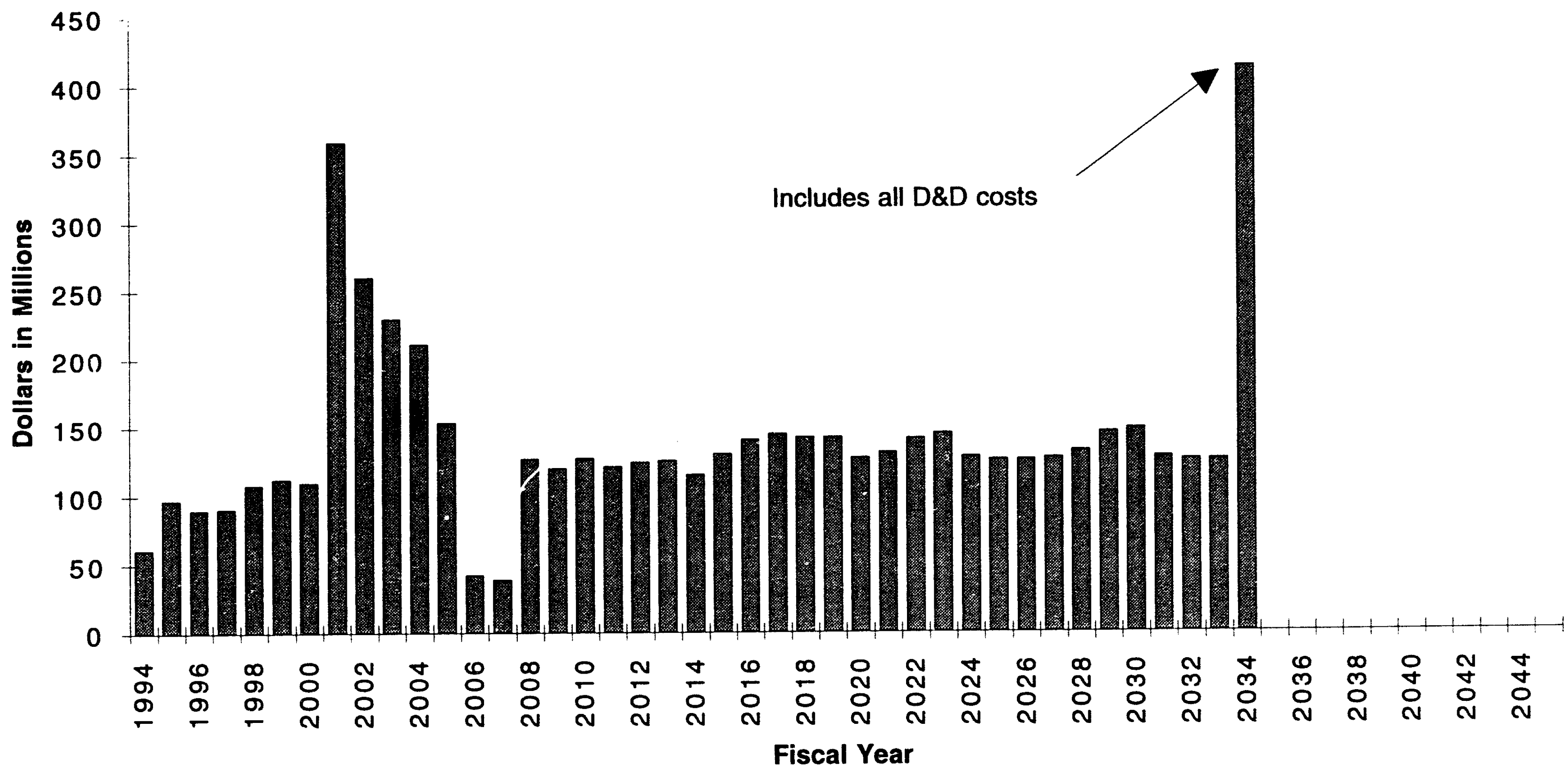
Case One Life Cycle Costs



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Case 2a

	1993 Case 2a WIF and Glass HLW					Case 2a		
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	5.73	5.73	5.73	5.73	5.73
	Capital Equipment	0.72	0.74	0.17	0.17	0.17	0.17	0.17
	General Plant Projects	1.20	1.24	0.29	0.29	0.29	0.29	0.29
	Subtotal Operations Costs	25.92	26.78	6.19	6.19	6.19	6.19	6.19
B.	Capital Costs							
	Waste Immobilization Facility	0.00	40.00	40.00	40.00	56.00	56.00	56.00
	Additional Tank Storage	0.00	45.00	70.00	90.00	50.00	27.00	0.00
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.65
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	0.00	85.00	110.00	130.00	106.00	83.00	56.65
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	24.50	24.50	27.50
G.	TOTAL ICPP COSTS	53.92	140.70	139.69	159.69	136.69	113.69	90.92

Case 2a

Base operating costs are extrapolated from the 1993 actual budget data.										
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
5.73	5.73	5.73	5.73	5.73	5.73	5.73	68.75	68.75	68.75	68.75
0.17	0.17	0.17	0.17	0.17	0.17	0.17	2.06	2.06	2.06	2.06
0.29	0.29	0.29	0.29	0.29	0.29	0.29	3.44	3.44	3.44	3.44
6.19	6.19	6.19	6.19	6.19	6.19	6.19	74.25	74.25	74.25	74.25
306.00	207.00	176.00	168.00	111.00	12.00	15.00	10.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.00	1.60	4.80
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
307.45	208.78	182.12	174.00	122.00	23.00	26.00	16.00	6.00	1.60	4.80
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.31	10.31	10.31	10.31
0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.73	21.73	21.73	21.73
0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.04	32.04	32.04	32.04
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	22.00	22.00	16.00	16.00	16.00	9.00	9.00	6.00	6.00	6.00
336.22	237.45	211.66	197.25	145.21	45.19	41.19	131.29	118.29	113.89	117.09

Case 2a

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
68.75	68.75	74.48	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.06	2.06	2.23	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
3.44	3.44	3.72	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
74.25	74.25	80.44	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.60	13.91	2.33	4.10	13.70	14.60	1.80	0.90	4.90	16.30	34.82
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.60	13.91	2.33	4.10	13.70	14.60	1.80	0.90	4.90	16.30	34.82
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
21.73	21.73	21.73	21.73	21.73	21.73	21.73	21.73	21.73	21.73	21.73
32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121.89	123.19	117.80	129.98	139.58	140.48	127.68	126.78	130.78	142.18	160.70

Case 2a

	(Dollars in Millions)									
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	0.00	0.00	0.00
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	0.00	0.00	0.00
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	0.00	0.00	0.00
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.45	2.03	1.20	6.20	20.20	22.68	2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.45	2.03	1.20	6.20	20.20	22.68	2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	330.87	0.00	0.00	0.00
10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	0.00	0.00	0.00
21.73	21.73	21.73	21.73	21.73	21.73	21.73	21.73	0.00	0.00	0.00
32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.33	127.90	127.08	132.08	146.08	148.56	127.96	456.75	0.00	0.00	0.00

Case 2a

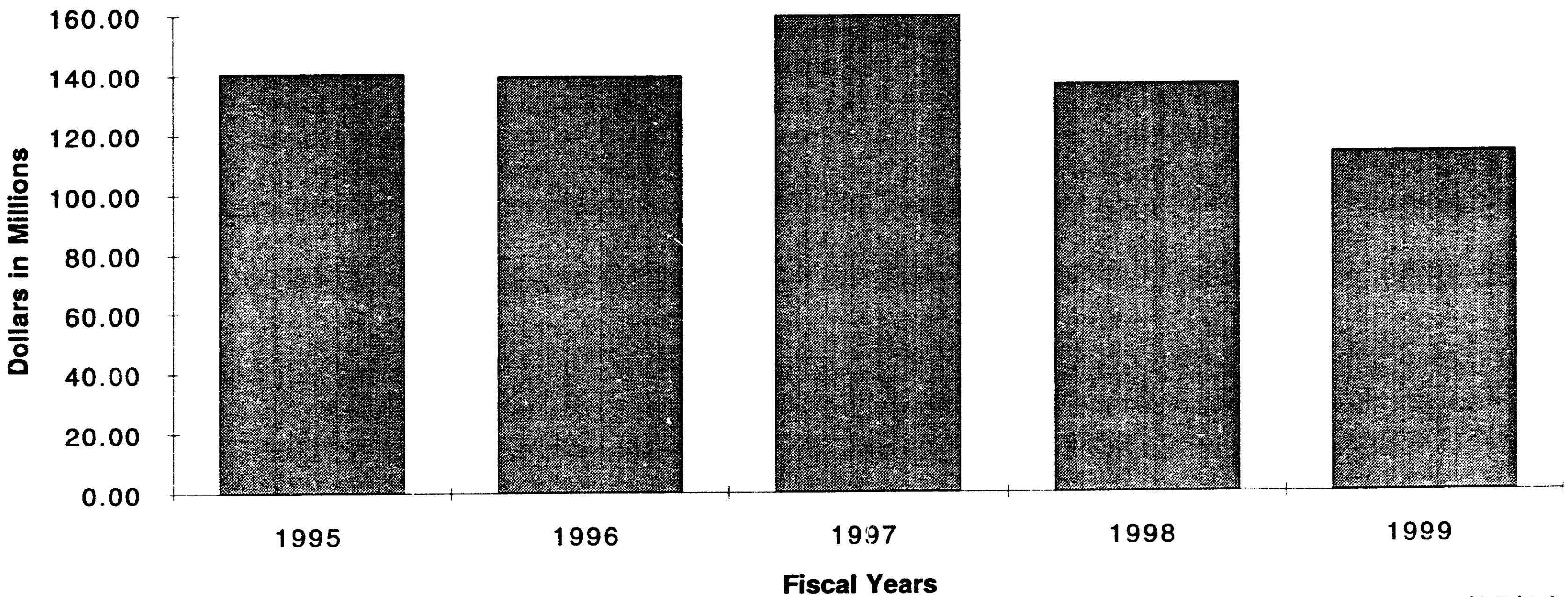
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case 2a

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94		
Total	Total	Total	Total	Total	Grand Total		
88.90	372.39	838.35	695.12	0.00	1994.76		
2.67	11.17	25.15	20.85	0.00	59.84		
4.44	18.62	41.92	34.76	0.00	99.74		
96.01	402.18	905.42	750.73	0.00	2154.34		
801.00	492.00	0.00	0.00	0.00	1293.00		
282.00	0.00	0.00	0.00	0.00	282.00		
38.00	42.00	107.36	75.83	0.00	263.19		
0.00	0.00	0.00	0.00	0.00	0.00		
0.00	0.00	0.00	0.00	0.00	0.00		
0.00	0.00	0.00	0.00	0.00	0.00		
1086.88	568.12	107.36	75.83	0.00	1838.19		
0.00	0.00	0.00	330.87	0.00	330.87		
0.00	51.54	103.07	82.46	0.00	237.06		
0.00	108.65	217.30	173.84	0.00	499.79		
0.00	160.19	320.37	256.30	0.00	736.85		
1.65	3.44	0.00	0.00	0.00	5.10		
224.42	109.00	6.00	0.00	0.00	339.42		
1408.96	1242.93	1339.14	1413.73	0.00	5404.77	Five Year Costs	690.45

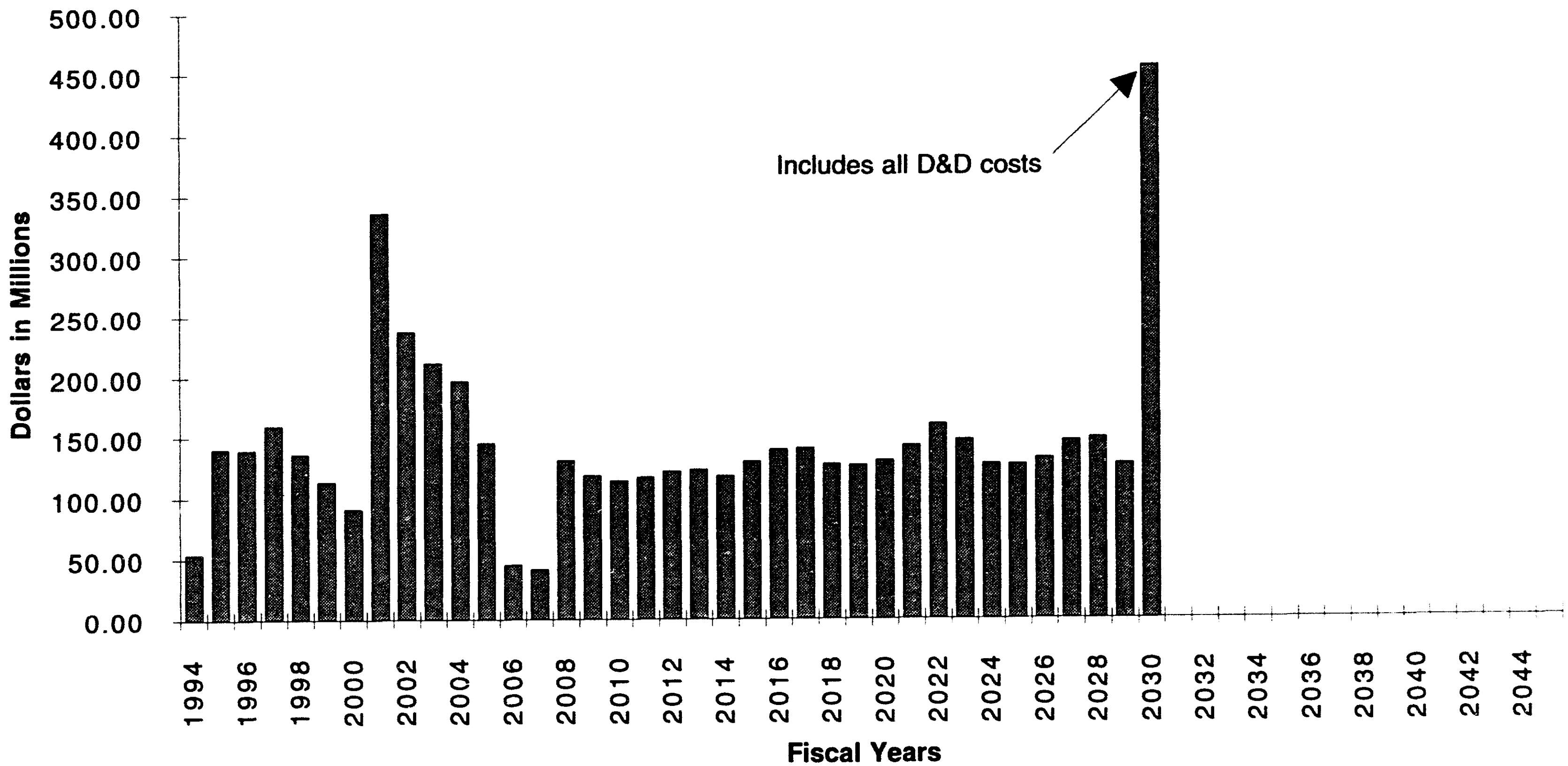
Case 2a Five Year Costs

Five Year Total = $690.45 M



1/25/94

Case 2a Life Cycle Costs



1/25/94

	1993 Case 2b WIF and Glass HLW				Case 2b		($in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	5.73	5.73	5.73	5.73	5.73
	Capital Equipment	0.72	0.74	0.17	0.17	0.17	0.17	0.17
	General Plant Projects	1.20	1.24	0.29	0.29	0.29	0.29	0.29
	Subtotal Operations Costs	25.92	26.78	6.19	6.19	6.19	6.19	6.19
B.	Capital Costs							
	Waste Immobilization Facility	0.00	0.00	0.00	0.00	0.00	45.00	45.00
	Additional Tank Storage	0.00	72.00	112.00	144.00	80.00	43.20	0.00
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Liquid Evap.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	0.00	72.00	112.00	144.00	80.00	88.20	45.00
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	20.50	20.50	21.50	21.50	21.50
G.	TOTAL ICPP COSTS	53.92	127.70	138.69	170.69	107.69	115.89	73.27

Case 2b

Base operating costs are extrapolated from the 1993 actual budget data.								($in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73
0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.00	135.90	15.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	1.45	1.78	6.12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.65	137.35	16.78	21.12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
19.00	19.00	19.00	4.00	4.00	4.00	8.50	8.50	5.50	5.50	3.50
70.77	102.67	113.54	98.25	338.21	289.19	233.69	202.34	149.04	28.47	30.81

Case 2b

								($in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
5.73	5.73	5.73	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
0.17	0.17	0.17	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
0.29	0.29	0.29	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
6.19	6.19	6.19	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
15.00	12.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	11.00	11.00	11.00	6.00	6.00	1.00	1.90	14.90	16.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.00	23.80	21.00	11.00	6.00	6.00	1.00	1.90	14.90	16.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07
0.00	0.00	0.00	21.53	21.53	21.53	21.53	21.53	21.53	21.53	21.53
0.00	0.00	0.00	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.50	3.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.69	32.99	30.19	139.44	131.44	131.44	126.44	127.34	140.34	141.84	145.77

Case 2b

									($in Millions)	
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	2.03	1.20	6.20	21.40	28.88	22.28	23.88	8.28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	2.03	1.20	6.20	21.40	28.88	22.28	23.88	8.28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07
21.53	21.53	21.53	21.53	21.53	21.53	21.53	21.53	21.53	21.53	21.53
31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.37	140.84	144.87	127.47	126.64	131.64	146.84	154.32	147.72	149.32	133.72

Case 2b

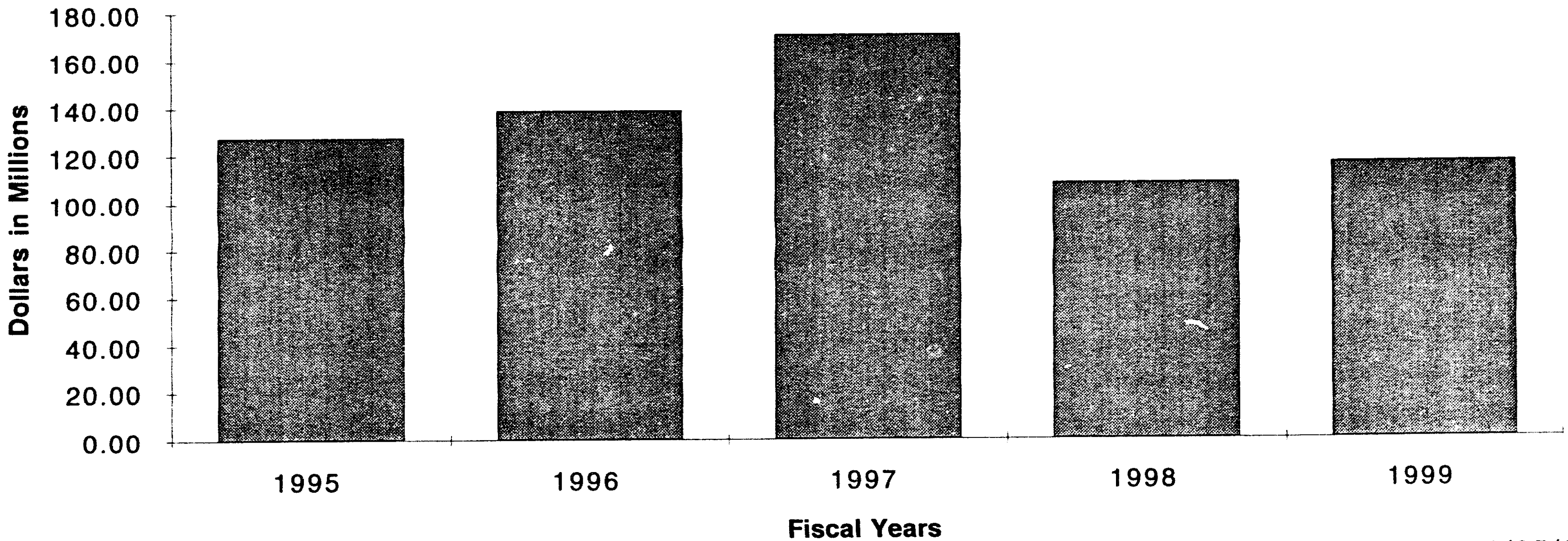
									($in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	86.89	86.89	86.89	86.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.61	2.61	2.61	2.61	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.34	4.34	4.34	4.34	4.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93.84	93.84	93.84	93.84	93.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	426.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.07	10.07	10.07	10.07	10.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.53	21.53	21.53	21.53	21.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31.60	31.60	31.60	31.60	31.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
145.64	148.12	127.52	125.44	551.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case 2b

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($in Millions)	
Total	Total	Total	Total	Total	Grand Total		
88.90	57.29	706.58	868.90	521.34	2243.01		
2.67	1.72	21.20	26.07	15.64	67.29		
4.44	2.86	35.33	43.45	26.07	112.15		
96.01	61.87	763.11	938.42	563.05	2422.46		
212.00	1366.90	22.80	0.00	0.00	1601.70		
451.20	0.00	0.00	0.00	0.00	451.20		
3.88	74.92	36.72	147.61	53.23	316.36		
0.00	0.00	0.00	0.00	0.00	0.00		
0.00	0.00	0.00	0.00	0.00	0.00		
0.00	0.00	0.00	0.00	0.00	0.00		
663.20	1382.90	122.32	147.61	53.23	2369.26		
0.00	0.00	0.00	0.00	426.47	426.47		
0.00	0.00	80.58	100.72	60.43	241.73		
0.00	0.00	172.25	215.31	129.19	516.75		
0.00	0.00	252.83	316.03	189.62	758.48		
1.65	3.44	0.00	0.00	0.00	5.10		
200.42	66.00	9.00	0.00	0.00	275.42		
961.28	1514.22	1147.26	1402.06	1232.37	6257.18	Five Year Costs	660.65

Case 2b Five Year Costs

Five Year Total = $660.65 M



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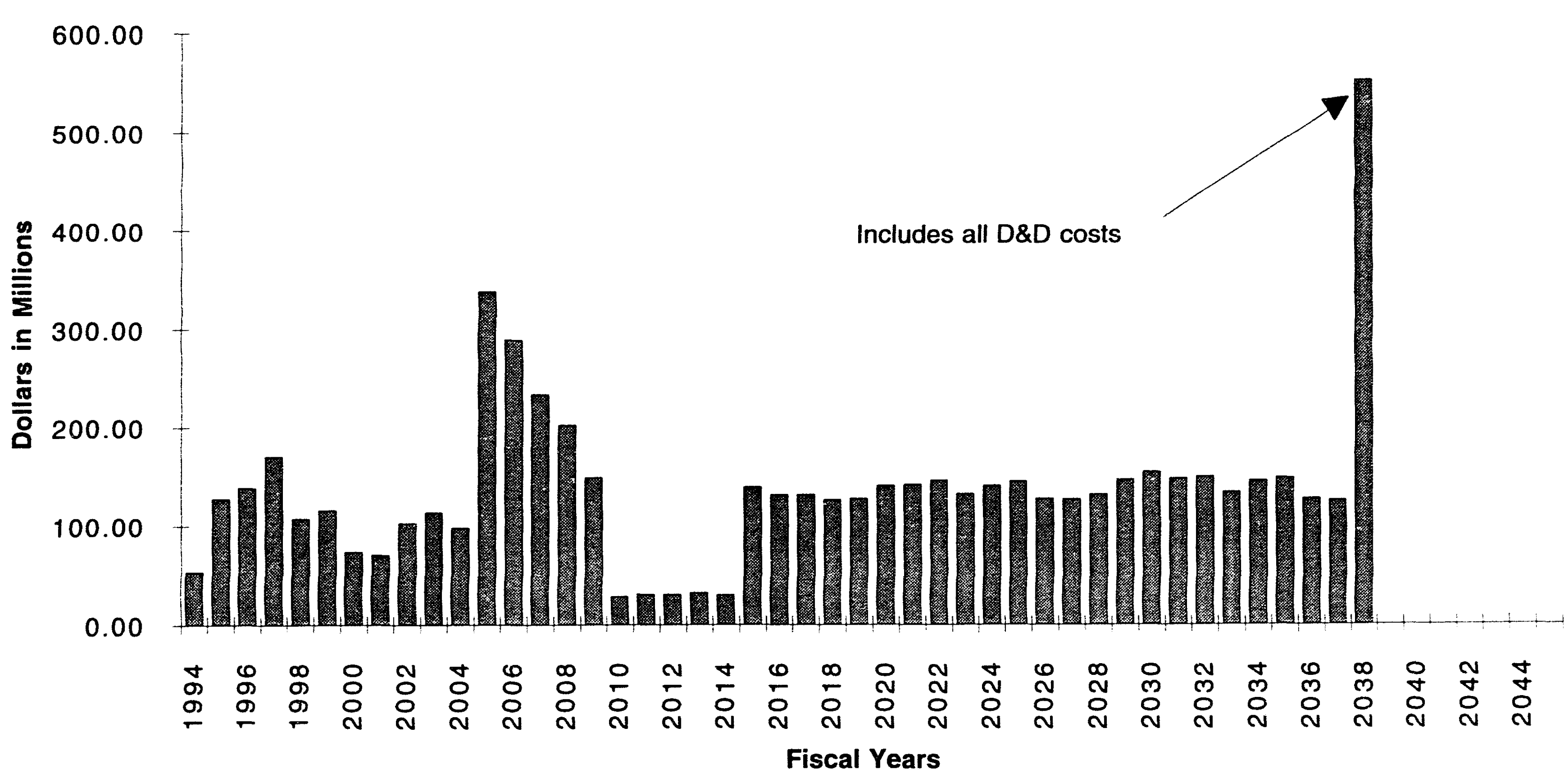
Case 2b Life Cycle Costs



1/25/94

Case 3

	1993 Case 3 HLLWE with the WIF and Glass HLW				Case Three		($in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	5.73	5.73	5.73	5.73	5.73
	Capital Equipment	0.72	0.74	0.17	0.17	0.17	0.17	0.17
	General Plant Projects	1.20	1.24	0.29	0.29	0.29	0.29	0.29
	Subtotal Operations Costs	25.92	26.78	6.19	6.19	6.19	6.19	6.19
B.	Capital Costs							
	Waste Immobilization Facility	0.00	40.00	40.00	40.00	56.00	56.00	56.00
	Additional Tank Storage	0.00	0.08	0.42	3.33	3.33	9.35	25.96
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.65	1.45	1.78
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	7.03	40.38	40.42	43.33	59.98	66.80	83.74
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	27.50	27.50	27.50
G	TOTAL ICPP COSTS	60.95	96.08	70.11	73.02	93.67	100.49	118.01

Case 3

Base operating costs are extrapolated from the 1993 actual budget data.								($in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
5.73	5.73	5.73	5.73	5.73	5.73	5.73	68.75	68.75	68.75	68.75
0.17	0.17	0.17	0.17	0.17	0.17	0.17	2.06	2.06	2.06	2.06
0.29	0.29	0.29	0.29	0.29	0.29	0.29	3.44	3.44	3.44	3.44
6.19	6.19	6.19	6.19	6.19	6.19	6.19	74.25	74.25	74.25	74.25
306.00	207.00	176.00	168.00	111.00	12.00	15.00	10.00	0.00	0.00	0.00
39.07	37.57	9.30	2.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.12	6.00	11.00	11.00	11.00	6.00	6.00	1.00	1.50	4.50	11.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
351.19	250.57	196.30	181.49	122.00	18.00	21.00	11.00	1.50	4.50	11.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.87	10.87	10.87	10.87
0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.41	21.41	21.41	21.41
0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.28	32.28	32.28	32.28
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	19.00	19.00	13.00	13.00	13.00	6.00	6.00	3.00	3.00	3.00
379.97	276.24	222.84	201.74	142.21	37.19	33.19	123.53	111.03	114.03	121.03

Case 3

								($in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
74.48	74.48	74.48	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.23	2.23	2.23	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
3.72	3.72	3.72	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
80.44	80.44	80.44	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.29	5.32	11.60	12.91	2.43	4.30	14.30	15.20	6.62	15.40	20.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.29	5.32	11.60	12.91	2.43	4.30	14.30	15.20	6.62	15.40	20.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.87	10.87	10.87	10.87	10.87	10.87	10.87	10.87	10.87	10.87	10.87
21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.41
32.28	32.28	32.28	32.28	32.28	32.28	32.28	32.28	32.28	32.28	32.28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
124.01	118.04	124.32	139.03	128.55	130.42	140.42	141.32	132.74	141.52	146.74

Case 3

								($in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	0.00	0.00	0.00	0.00	0.00
2.61	2.61	2.61	2.61	2.61	2.61	0.00	0.00	0.00	0.00	0.00
4.34	4.34	4.34	4.34	4.34	4.34	0.00	0.00	0.00	0.00	0.00
93.84	93.84	93.84	93.84	93.84	93.84	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.23	20.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.23	20.20	22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	303.10	0.00	0.00	0.00	0.00	0.00
10.87	10.87	10.87	10.87	10.87	10.87	0.00	0.00	0.00	0.00	0.00
21.41	21.41	21.41	21.41	21.41	21.41	0.00	0.00	0.00	0.00	0.00
32.28	32.28	32.28	32.28	32.28	32.28	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
134.35	146.32	148.80	128.20	126.12	429.23	0.00	0.00	0.00	0.00	0.00

Case 3

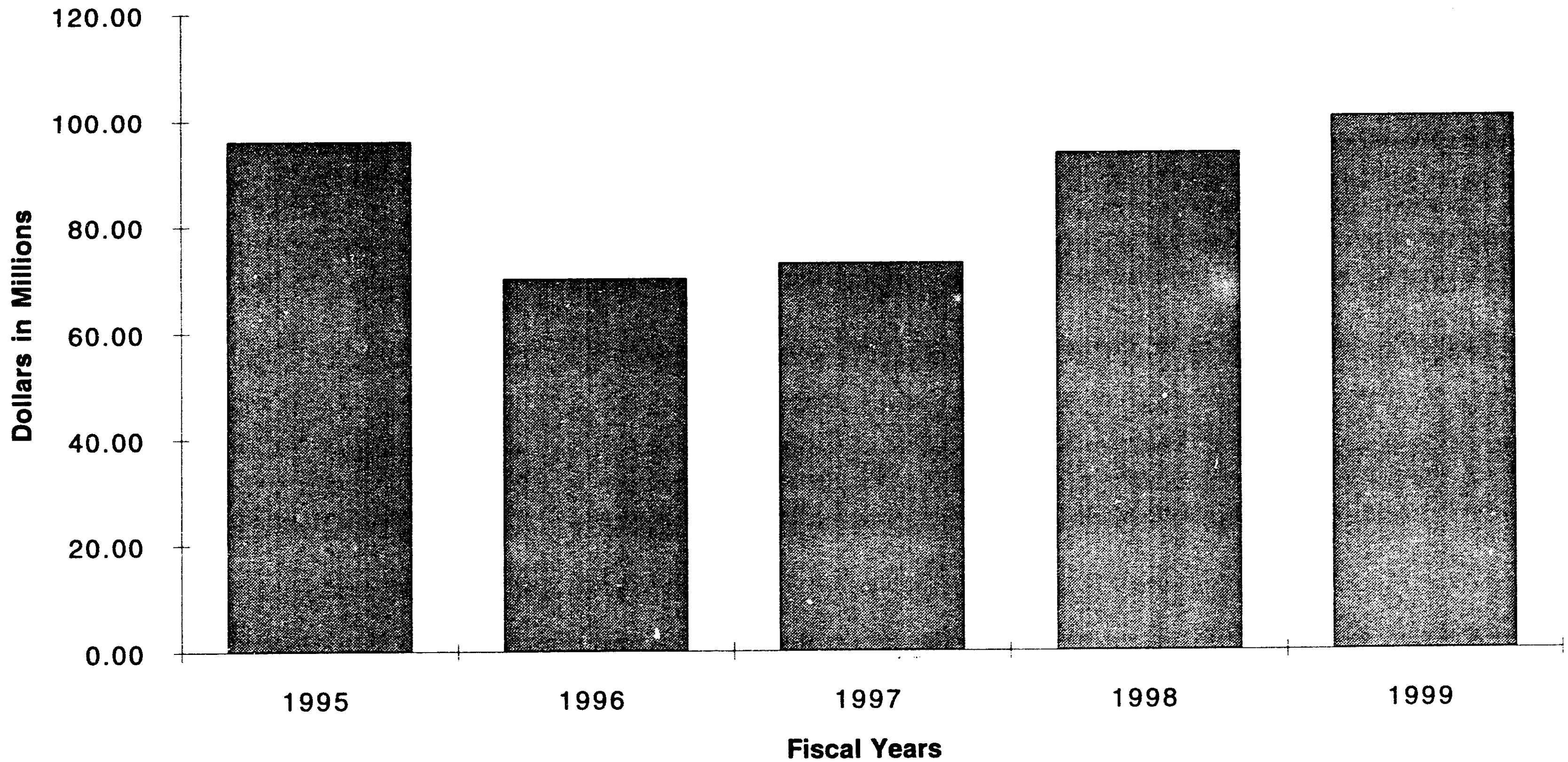
									($in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case 3

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($in Millions)	
Total	Total	Total	Total	Total	Grand Total		
88.90	378.12	844.08	521.34	0.00	1832.43		
2.67	11.34	25.32	15.64	0.00	54.97		
4.44	18.91	42.20	26.07	0.00	91.62		
96.01	408.37	911.60	563.05	0.00	1979.03		
801.00	492.00	0.00	0.00	0.00	1293.00		
119.12	11.79	0.00	0.00	0.00	130.91		
38.00	69.72	120.20	24.76	0.00	252.68		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
943.44	578.58	108.70	53.18	0.00	1683.91		
0.00	0.00	0.00	303.10	0.00	303.10		
0.00	54.35	108.69	65.21	0.00	228.25		
0.00	107.06	214.12	128.47	0.00	449.65		
0.00	161.41	322.81	193.69	0.00	677.90		
1.65	3.44	0.00	0.00	0.00	5.10		
227.42	79.00	0.00	0.00	0.00	306.42		
1268.52	1230.79	1343.12	1113.02	0.00	4955.46	Five Year Costs	433.36

Case 3 Five Year Costs

Five Year Total = $433.36 M



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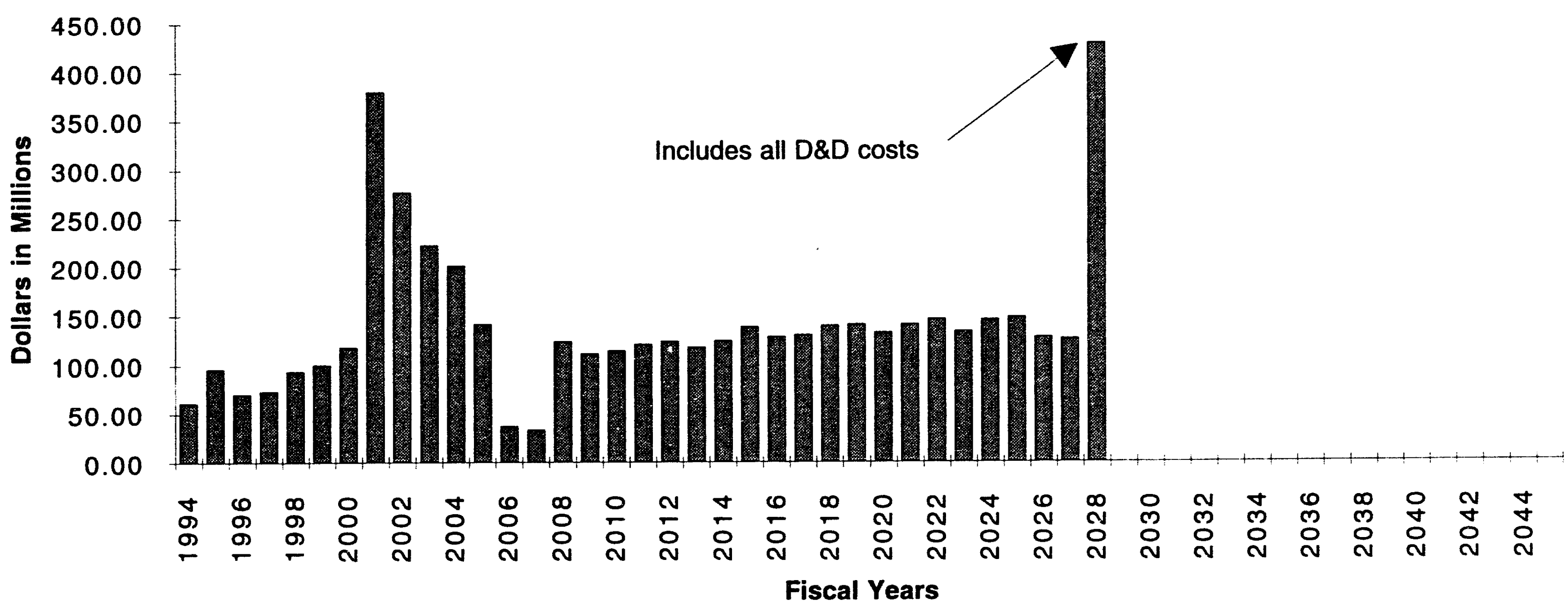
Case 3 Life Cycle Costs



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		1993 Case 4a Calcination with the WIF and Glass HLW					Case 4a	($ in Millions)	
		FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
	A.	Waste Reprocessing (EM 30)							
		Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
		Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
		General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
		Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
	B.	Capital Costs							
		Waste Immobilization Facility	0.00	40.84	40.84	40.84	56.84	56.84	56.84
		Additional Tank Storage	0.00	0.06	0.32	2.56	2.56	7.20	20.00
		Calcine Retrieval	0.00	0.00	0.00	0.65	1.45	1.78	6.12
		Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
		Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Subtotal Capital Costs	7.03	41.20	41.16	44.05	60.85	65.82	82.96
	C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D.	Waste Disposal Costs (EM ??)							
		Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
	F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	27.50	27.50	27.50
▫	G.	TOTAL ICPP COSTS	60.95	96.90	86.32	89.21	110.01	114.98	132.70

Case 4a

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
5.73	5.73	5.73	5.73	5.73	5.73	5.73	68.75	68.75	68.75	74.48
0.17	0.17	0.17	0.17	0.17	0.17	0.17	2.06	2.06	2.06	2.23
0.29	0.29	0.29	0.29	0.29	0.29	0.29	3.44	3.44	3.44	3.72
6.19	6.19	6.19	6.19	6.19	6.19	6.19	74.25	74.25	74.25	80.44
306.84	207.84	176.84	168.84	111.94	12.84	15.84	10.84	0.00	0.00	0.00
30.08	28.90	6.40	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	11.00	11.00	11.00	6.00	6.00	1.00	1.50	3.50	10.50	11.29
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
342.92	247.74	194.24	181.76	117.94	18.84	16.84	12.34	3.50	10.50	11.29
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.39	10.39	10.39	10.39
0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.88	21.88	21.88	21.88
0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.27	32.27	32.27	32.27
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	19.00	19.00	13.00	13.00	13.00	6.00	6.00	3.00	3.00	3.00
371.69	273.41	220.79	202.01	138.16	38.03	29.03	124.86	113.02	120.02	127.00

Case 4a

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
74.48	74.48	74.48	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.23	2.23	2.23	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
3.72	3.72	3.72	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
80.44	80.44	80.44	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.32	11.60	12.91	2.33	4.10	13.70	15.40	6.10	14.30	16.19	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.32	11.60	12.91	2.33	4.10	13.70	15.40	6.10	14.30	16.19	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39
21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88
32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118.03	124.31	125.62	128.44	130.21	139.81	141.51	132.22	140.41	142.30	127.01

Case 4a

	(Dollars in Millions)							($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	0.00	0.00
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	0.00	0.00
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	0.00	0.00
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	19.42	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	19.42	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	296.21	0.00	0.00
10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39	10.39	0.00	0.00
21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	0.00	0.00
32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27	32.27	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
131.01	141.51	145.54	128.14	126.11	126.11	126.11	126.11	422.32	0.00	0.00

Case 4a

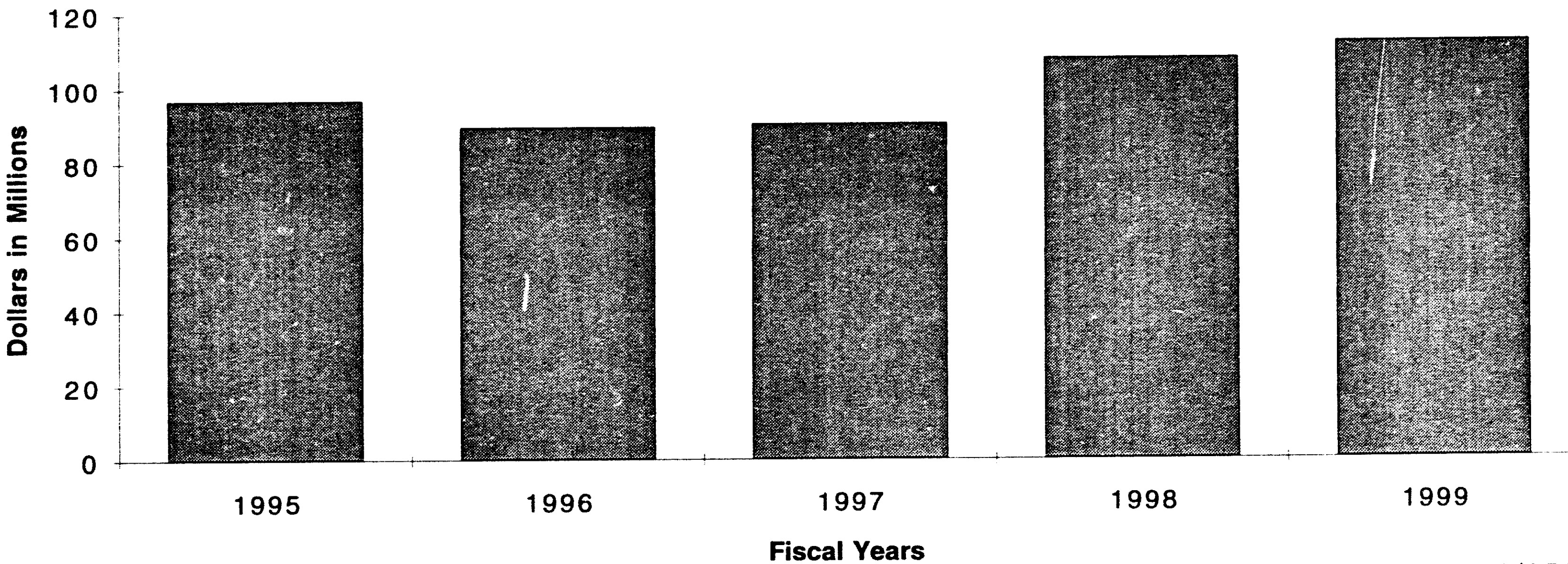
									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case 4a

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
160.51	383.85	844.08	782.01	0.00	2170.45		
4.82	11.52	25.32	23.46	0.00	65.11		
8.03	19.19	42.20	39.10	0.00	108.52		
173.35	414.55	911.60	844.58	0.00	2344.08		
807.73	497.15	0.00	0.00	0.00	1304.89		
91.68	8.32	0.00	0.00	0.00	100.00		
38.00	67.72	90.82	36.85	0.00	233.39		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
933.74	572.59	97.52	41.75	0.00	1645.60		
0.00	0.00	0.00	296.21	0.00	296.21		
0.00	51.95	103.90	93.51	0.00	249.35		
0.00	109.42	218.84	196.95	0.00	525.21		
0.00	161.37	322.73	290.46	0.00	774.56		
1.65	3.44	0.00	0.00	0.00	5.10		
227.42	79.00	0.00	0.00	0.00	306.42		
1336.16	1230.95	1331.86	1472.99	0.00	5371.97	Five Year Costs	497.41

Case 4a Five Year Costs

Five Year Total = $497.41 M



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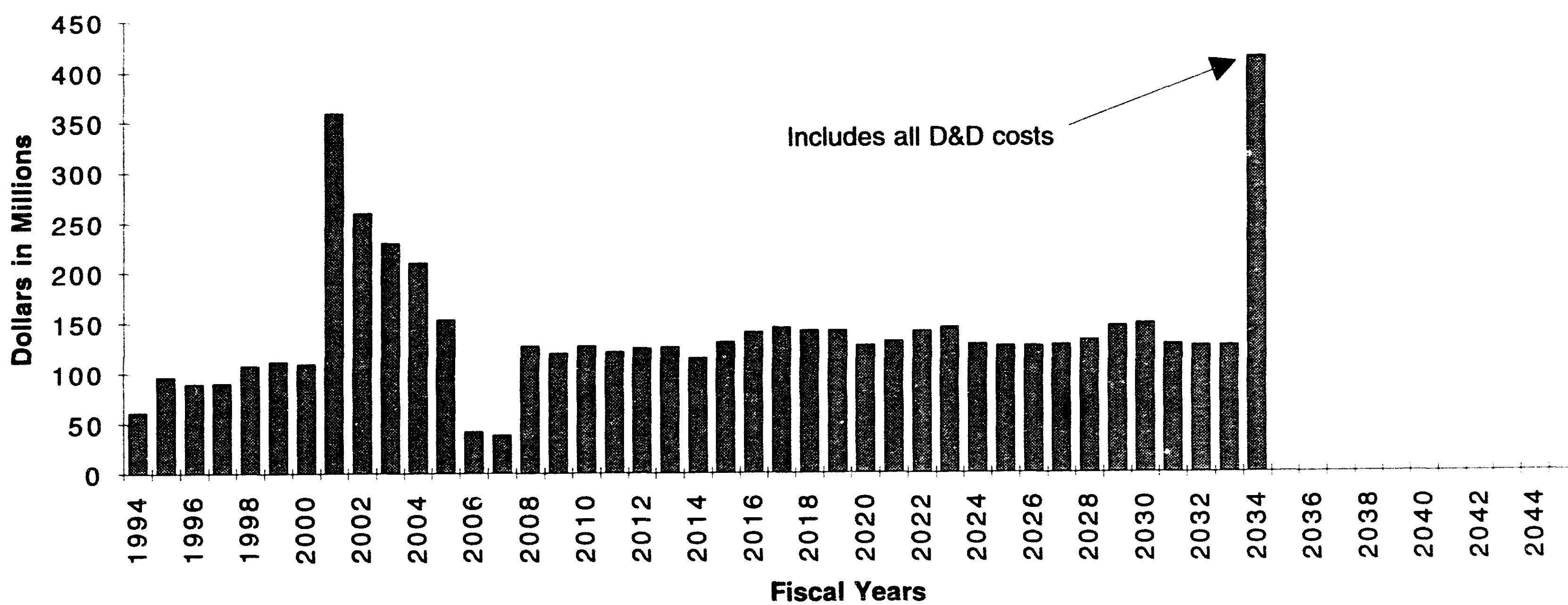
Case 4a Life Cycle Costs



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Case 4b

	1993 Case 4b Calcination with the WIF and Glass HLW					Case 4b	($ in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	40.84	40.84	40.84	56.84	56.84	56.84
	Additional Tank Storage	0.00	0.04	0.22	1.79	1.79	5.04	14.00
	Calcine Retrieval	0.00	0.00	0.00	0.65	1.45	1.78	6.12
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	7.03	41.18	41.07	43.28	60.08	63.66	76.96
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	27.50	27.50	27.50
G	TOTAL ICPP COSTS	60.95	96.88	86.22	88.44	109.24	112.82	126.70

Case 4b

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	5.73	5.73	5.73	5.73	68.75	68.75	68.75	74.48
0.60	0.60	0.60	0.17	0.17	0.17	0.17	2.06	2.06	2.06	2.23
1.00	1.00	1.00	0.29	0.29	0.29	0.29	3.44	3.44	3.44	3.72
21.66	21.66	21.66	6.19	6.19	6.19	6.19	74.25	74.25	74.25	80.44
306.84	207.84	176.84	168.84	111.94	12.84	15.84	10.84	0.00	0.00	0.00
21.06	20.23	4.48	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	11.00	11.00	11.00	6.00	6.00	1.00	1.50	3.50	10.50	11.29
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
333.90	239.07	192.32	181.19	117.94	18.84	16.84	12.34	3.50	10.50	11.29
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.42	10.42	10.42	10.42
0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.28	22.28	22.28	22.28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.70	32.70	32.70	32.70
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	19.00	19.00	13.00	13.00	13.00	6.00	6.00	3.00	3.00	3.00
378.14	280.21	234.33	201.43	138.16	38.03	29.03	125.29	113.45	120.45	127.43

Case 4b

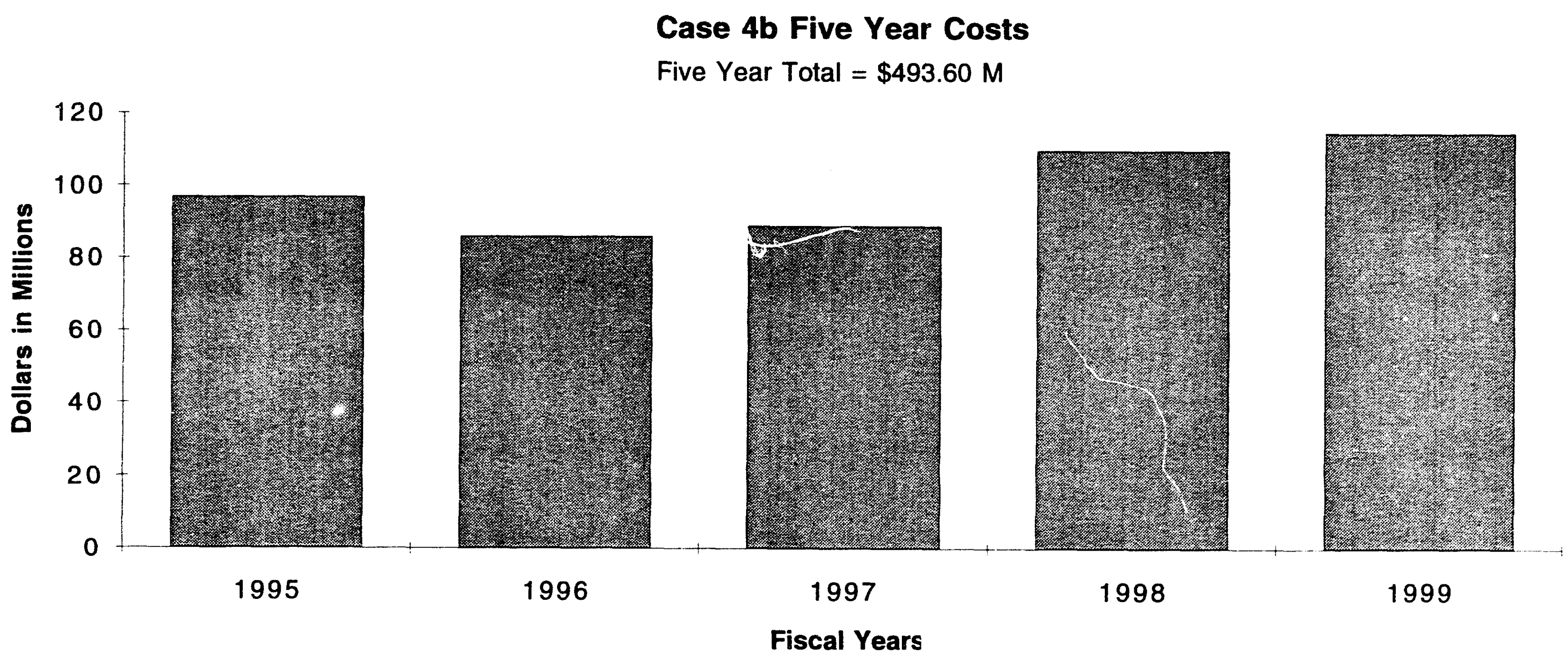
								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
74.48	74.48	74.48	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.23	2.23	2.23	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
3.72	3.72	3.72	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
80.44	80.44	80.44	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.32	11.60	12.91	2.33	4.10	13.70	15.40	6.10	14.30	16.19	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.32	11.60	12.91	2.33	4.10	13.70	15.40	6.10	14.30	16.19	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42
22.28	22.28	22.28	22.28	22.28	22.28	22.28	22.28	22.28	22.28	22.28
32.70	32.70	32.70	32.70	32.70	32.70	32.70	32.70	32.70	32.70	32.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118.46	124.74	126.04	128.87	130.64	140.24	141.94	132.65	140.84	142.73	127.44

Case 4b

									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

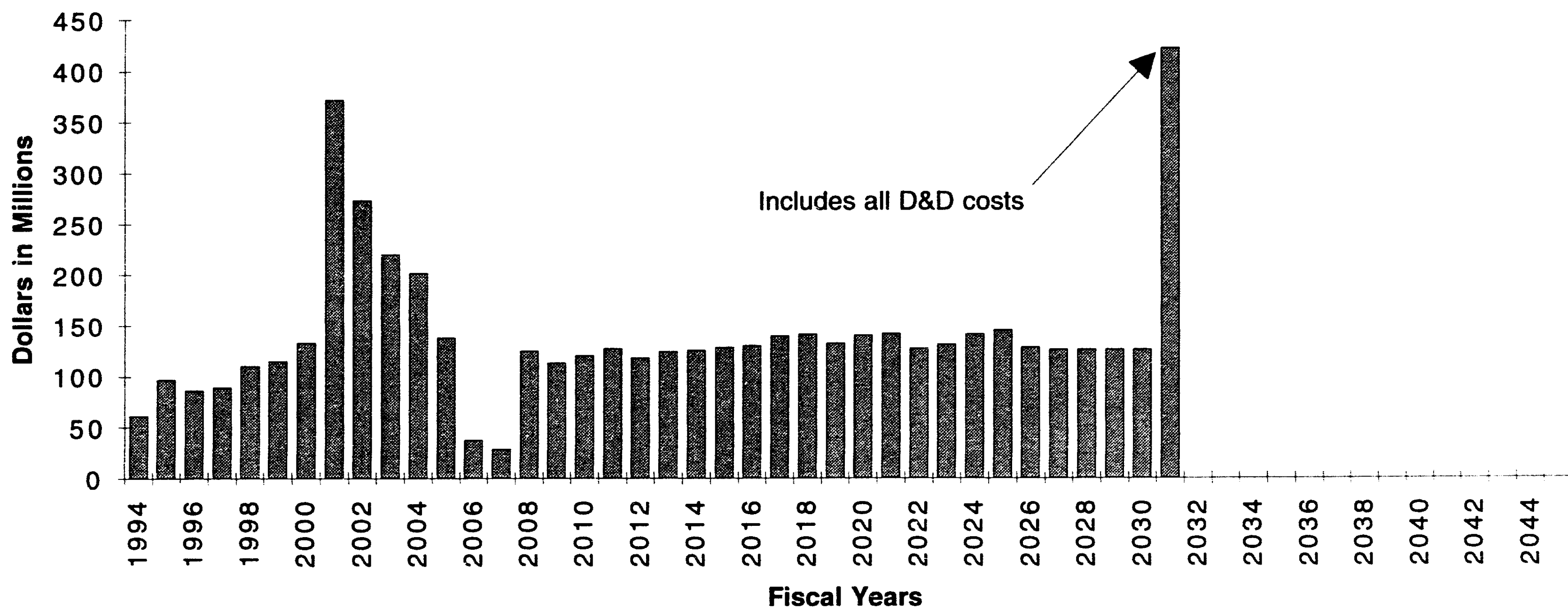
Case 4b

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
189.15	398.17	844.08	868.90	0.00	2300.30		
5.67	11.95	25.32	26.07	0.00	69.01		
9.46	19.91	42.20	43.45	0.00	115.02		
204.29	430.02	911.60	938.42	0.00	2484.33		
807.73	497.15	0.00	0.00	0.00	1304.89		
64.18	5.82	0.00	0.00	0.00	70.00		
38.00	67.72	90.82	36.85	0.00	233.39		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
906.24	570.09	97.52	41.75	0.00	1615.60		
0.00	0.00	0.00	290.81	0.00	290.81		
0.00	52.09	104.18	104.18	0.00	260.46		
0.00	111.41	222.81	222.81	0.00	557.03		
0.00	163.50	327.00	327.00	0.00	817.49		
1.65	3.44	0.00	0.00	0.00	5.10		
227.42	79.00	0.00	0.00	0.00	306.42		
1339.60	1246.05	1336.12	1597.97	0.00	5519.75	Five Year Costs	493.60


Case 4b Five Year Costs
Five Year Total = $493.60 M
Dollars in Millions
120
100
80
60
40
20
0
1995
1996
1997
1998
1999
Fiscal Years

1/25/94

Case 4b Life Cycle Costs



1/25/94

		1993 Case 5a Calcination, Freeze Crystal., WIF, and Glass HLW				Case 5a	($ in Millions)	
		FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
	A.	Waste Reprocessing (EM 30)							
		Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
		Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
		General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
		Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
	B.	Capital Costs							
		Waste Immobilization Facility	0.20	1.00	8.00	8.00	22.50	62.50	104.50
		Additional Tank Storage	0.00	0.05	0.26	2.07	2.07	5.81	16.14
		Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
		Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
		Subtotal Capital Costs	7.33	1.55	8.76	10.57	27.07	70.81	122.94
	C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D.	Waste Disposal Costs (EM ??)							
		Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
	F.	Development Costs (EM 30)	28.00	28.92	8.50	8.50	9.50	9.50	9.50
▫	G.	TOTAL ICPP COSTS	61.25	57.25	38.91	40.72	58.22	101.97	154.68

Case 5a

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	31.51	31.51	31.51	31.51	31.51	31.51	31.51
0.60	0.60	0.60	0.60	0.95	0.95	0.95	0.95	0.95	0.95	0.95
1.00	1.00	1.00	1.00	1.58	1.58	1.58	1.58	1.58	1.58	1.58
21.66	21.66	21.66	21.66	34.03	34.03	34.03	34.03	34.03	34.03	34.03
107.48	38.00	40.00	87.00	117.00	250.00	225.00	365.00	295.00	193.92	30.00
24.27	23.32	5.16	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.65	1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.00	1.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
138.90	69.07	51.24	96.69	124.00	261.68	236.00	376.00	301.00	199.92	31.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.59	0.55	0.55
9.50	9.50	9.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	16.00
170.64	100.71	83.75	140.91	180.56	317.21	291.53	431.53	357.12	256.00	82.18

Case 5a

($ in Millions)

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
31.51	31.51	31.51	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
0.95	0.95	0.95	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
1.58	1.58	1.58	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
34.03	34.03	34.03	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
27.00	20.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.80	12.60	14.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31.80	32.60	24.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16
0.00	0.00	0.00	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94
0.00	0.00	0.00	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10
0.19	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.00	16.00	10.00	10.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00
82.02	82.70	68.64	141.67	142.64	143.54	130.75	126.84	130.84	141.34	146.26

Case 5a

								($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	3.28	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	3.28	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16
21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94
32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.87	141.34	145.36	129.17	132.14	146.14	148.62	129.22	132.14	146.14	148.62

Case 5a

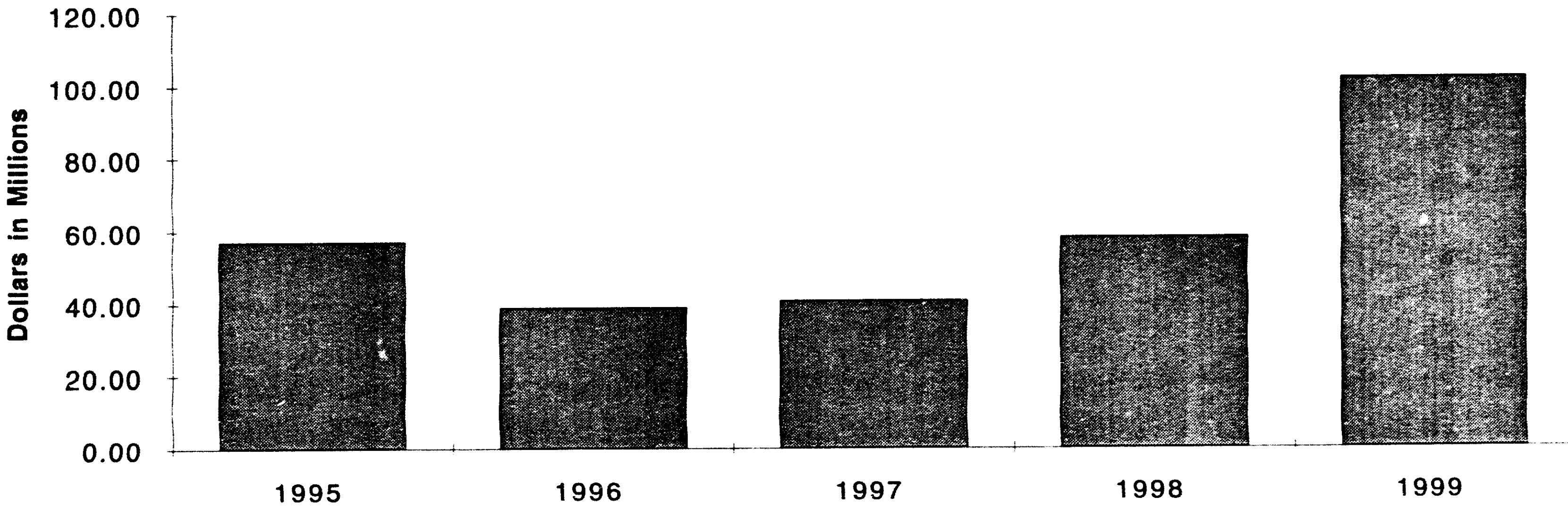
									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	0.00
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	0.00
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	0.00
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	440.99	0.00
10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	10.16	0.00
21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	21.94	0.00
32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	32.10	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
128.02	125.94	125.94	125.94	125.94	125.94	125.94	125.94	125.94	125.94	566.94	0.00

Case 5a

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
189.15	292.18	758.14	868.90	1042.69	3151.07		
5.67	8.77	22.74	26.07	31.28	94.53		
9.46	14.61	37.91	43.45	52.13	157.55		
204.29	315.56	818.79	938.42	1126.10	3403.15		
352.18	1629.92	30.00	0.00	0.00	2012.09		
73.99	6.71	0.00	0.00	0.00	80.70		
2.10	65.30	104.56	123.73	24.76	320.44		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
21.40	8.00	0.00	0.00	0.00	29.40		
456.99	1709.93	134.56	123.73	24.76	2449.96		
0.00	0.00	0.00	0.00	440.99	440.99		
0.00	0.00	81.28	101.60	121.92	304.80		
0.00	0.00	175.54	219.42	263.30	658.26		
0.00	0.00	256.82	321.02	385.22	963.06		
1.65	5.32	0.07	0.00	0.00	7.04		
121.42	192.00	45.00	0.00	0.00	358.42		
784.35	2222.80	1255.24	1383.17	1977.07	7622.63	Five Year Costs	297.07

Case 5a Five Year Costs

Five Year Total = $297.07



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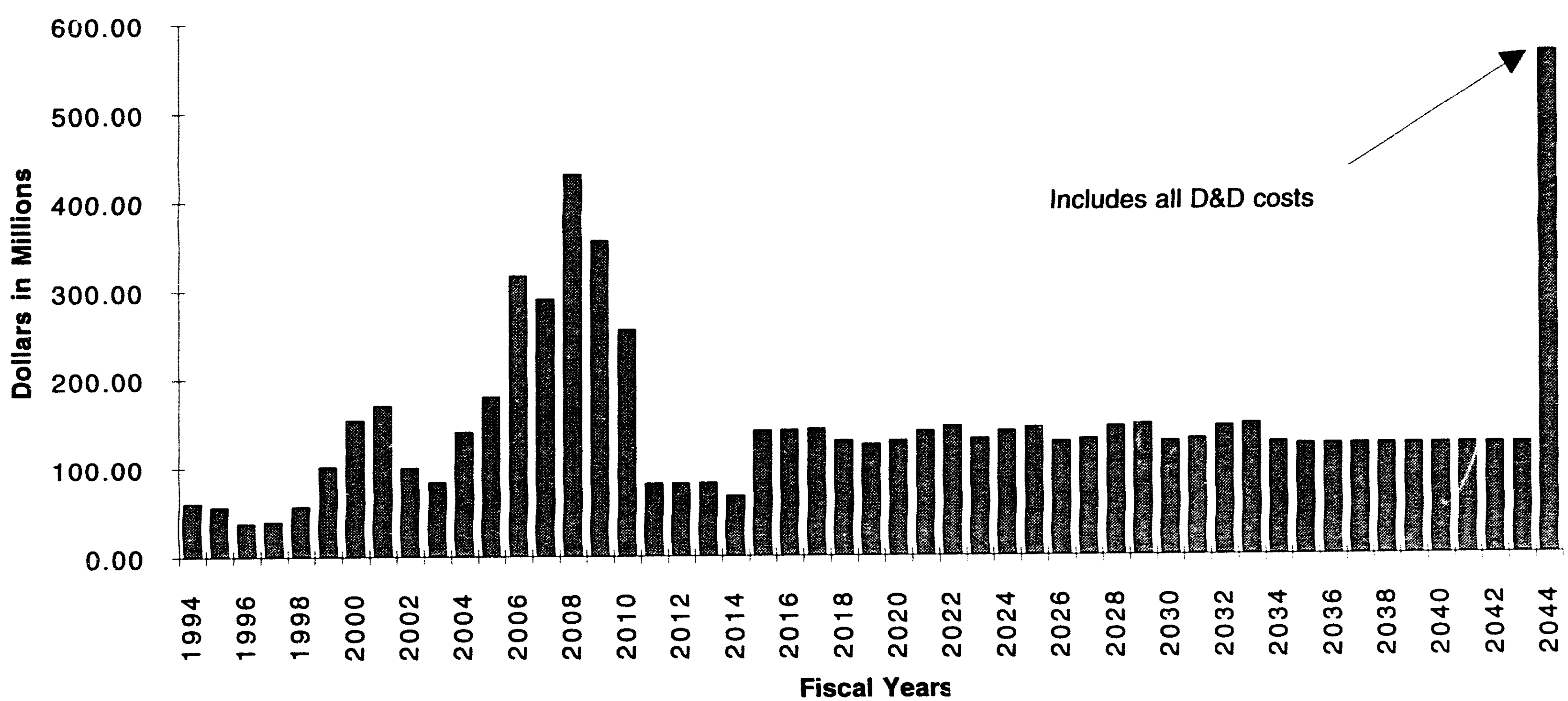
Case 5a Life Cycle Costs



1/25/94

	1993 Case 5b Calcination, Neutralization, WIF and Glass HLW					Case 5b	($ in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.20	1.00	8.00	8.00	22.50	62.50	104.50
	Additional Tank Storage	0.00	0.05	0.26	2.07	2.07	5.81	16.14
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
	Subtotal Capital Costs	7.33	1.55	8.76	10.57	27.07	70.81	122.94
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	0.58
F.	Development Costs (EM 30)	28.00	28.92	8.50	8.50	9.50	9.50	9.50
G.	TOTAL ICPP COSTS	61.25	57.25	38.91	40.72	58.22	101.97	154.68

Case 5b

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	31.51	31.51	31.51	31.51	31.51	31.51	31.51
0.60	0.60	0.60	0.60	0.95	0.95	0.95	0.95	0.95	0.95	0.95
1.00	1.00	1.00	1.00	1.58	1.58	1.58	1.58	1.58	1.58	1.58
21.66	21.66	21.66	21.66	34.03	34.03	34.03	34.03	34.03	34.03	34.03
107.48	38.00	40.00	87.00	117.00	250.00	225.00	365.00	295.00	193.92	30.00
24.27	23.32	5.16	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.65	1.45	1.78	5.12	6.00	11.00	11.00	11.00	6.00	6.00	1.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
138.90	69.07	51.24	96.69	124.00	261.68	236.00	376.00	301.00	199.92	31.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.59	0.55	0.55
9.50	9.50	9.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	16.00
170.64	100.71	83.75	140.91	180.56	317.21	291.53	431.53	357.12	256.00	82.18

Case 5b

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
31.51	31.51	31.51	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
0.95	0.95	0.95	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
1.58	1.58	1.58	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
34.03	34.03	34.03	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
27.00	20.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.80	12.60	14.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31.80	32.60	24.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57
0.00	0.00	0.00	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80
0.00	0.00	0.00	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37
0.19	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.00	16.00	10.00	10.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00
82.02	82.70	68.64	135.94	136.91	137.81	125.01	121.11	125.11	135.61	140.53

Case 5b

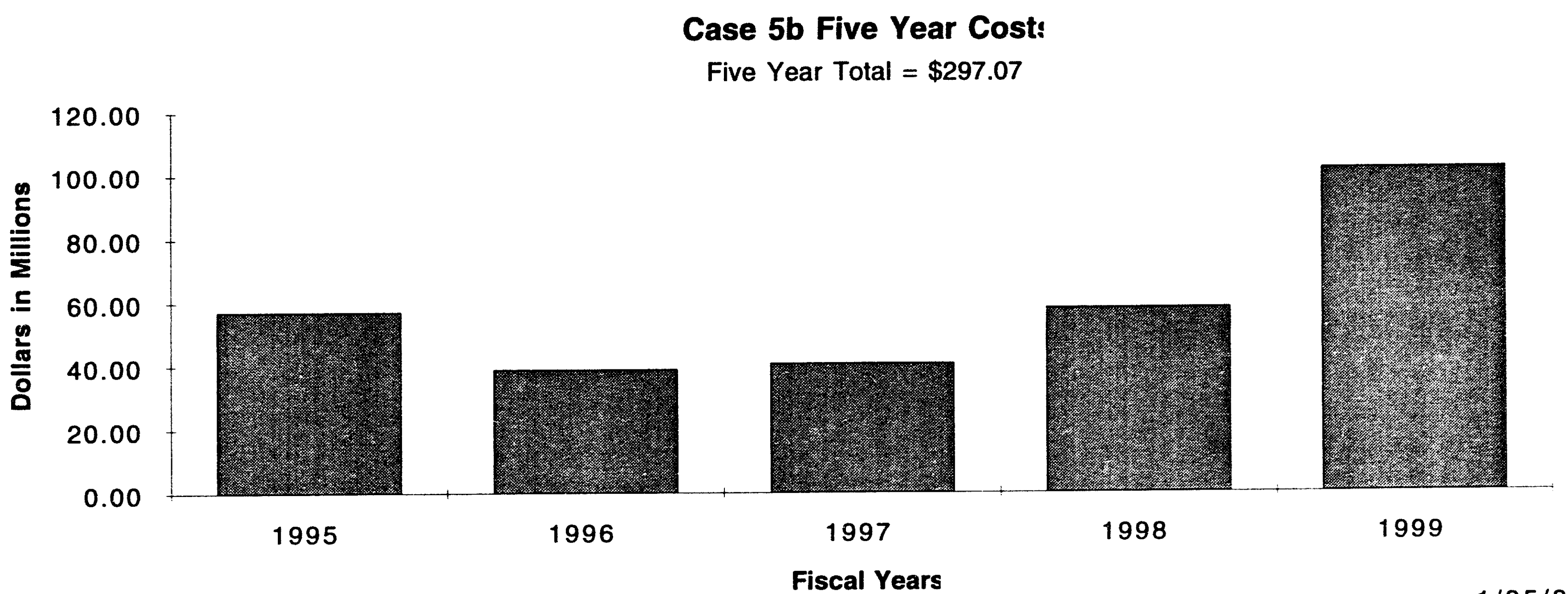
								($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	3.28	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	3.28	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57
16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80
26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.13	135.61	139.63	123.43	126.41	140.41	142.89	123.49	126.41	140.41	142.89

Case 5b

									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	0.00
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	0.00
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	0.00
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	440.99	0.00
9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	0.00
16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	0.00
26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	26.37	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.29	120.21	120.21	120.21	120.21	120.21	120.21	120.21	120.21	120.21	561.20	0.00

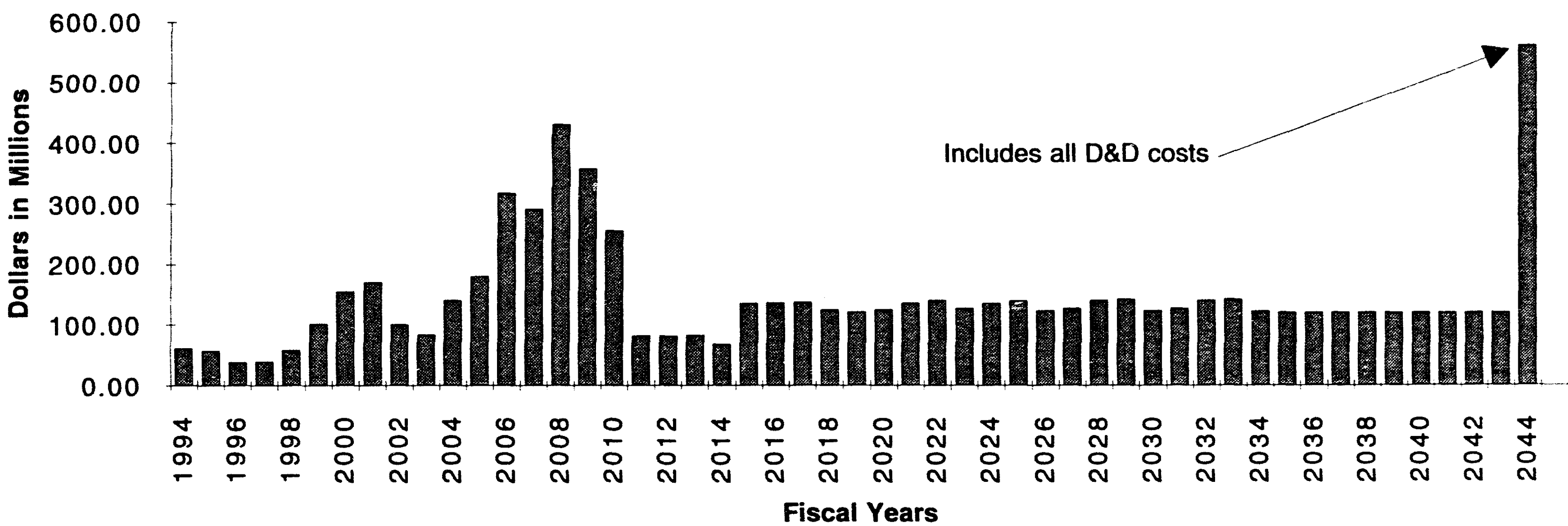
Case 5b

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
189.15	292.18	758.14	868.90	1042.69	3151.07		
5.67	8.77	22.74	26.07	31.28	94.53		
9.46	14.61	37.91	43.45	52.13	157.55		
204.29	315.56	818.79	938.42	1126.10	3403.15		
352.18	1629.92	30.00	0.00	0.00	2012.09		
73.99	6.71	0.00	0.00	0.00	80.70		
2.10	65.30	104.56	123.73	24.76	320.44		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
21.40	8.00	0.00	0.00	0.00	29.40		
456.99	1709.93	134.56	123.73	24.76	2449.96		
0.00	0.00	0.00	0.00	440.99	440.99		
0.00	0.00	76.53	95.66	114.79	286.98		
0.00	0.00	134.41	168.01	201.61	504.03		
0.00	0.00	210.94	263.67	316.40	791.01		
1.65	5.32	0.07	0.00	0.00	7.04		
121.42	192.00	45.00	0.00	0.00	358.42		
784.35	2222.80	1209.36	1325.82	1908.25	7450.58	Five Year Costs	297.07


Case 5b Five Year Cost:
Five Year Total = $297.07
Dollars in Millions
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1995
1996
1997
1998
1999
Fiscal Years

1/25/94

Case 5b Life Cycle Costs



1/25/94

	1993 Case 6 Enhanced Calc. with WIF and Glass HLLW				Case 6	($ in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	0.00	0.00	0.00	0.00	45.00	45.00
	Additional Tank Storage	0.00	0.00	0.00	0.00	0.09	0.48	3.87
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
	Subtotal Capital Costs	7.13	0.50	0.50	0.50	2.59	47.98	51.17
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	1.17
F.	Development Costs (EM 30)	28.00	28.92	17.50	17.50	18.50	18.50	18.50
G.	TOTAL ICPP COSTS	61.05	56.20	39.66	39.66	42.75	88.14	92.50

Case 6

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.00	135.90	15.00	15.00
3.87	10.89	30.26	45.51	43.73	9.68	2.90	0.00	0.00	0.00	0.00
0.00	0.65	1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.60
0.20	0.50	5.34	10.50	10.80	1.00	1.00	0.47	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
55.57	95.34	128.35	146.81	388.65	296.36	233.90	198.47	146.90	21.00	21.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.14	1.04	1.54	1.13	1.03	0.00	0.00	0.00	0.00	0.00	0.00
16.00	16.00	13.00	10.00	7.00	7.00	6.00	6.00	3.00	3.00	3.00
94.37	134.04	164.55	179.60	418.33	325.01	261.56	226.12	171.56	45.66	46.26

Case 6

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	5.73	5.73	60.15	65.88	65.88	65.88	65.88	65.88	65.88	65.88
0.60	0.17	0.17	1.80	1.98	1.98	1.98	1.98	1.98	1.98	1.98
1.00	0.29	0.29	3.01	3.29	3.29	3.29	3.29	3.29	3.29	3.29
21.66	6.19	6.19	64.97	71.15	71.15	71.15	71.15	71.15	71.15	71.15
15.00	12.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.60	4.80	12.60	14.61	5.73	13.70	14.60	2.60	4.30	15.20	21.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.60	17.60	22.60	14.61	5.73	13.70	14.60	2.60	4.30	15.20	21.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01
0.00	0.00	0.00	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92
0.00	0.00	0.00	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41.26	23.79	28.79	119.50	116.81	124.78	125.68	113.69	115.38	126.28	132.17

Case 6

	(Dollars in Millions)							($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
65.88	65.88	65.88	65.88	65.88	65.88	65.88	76.86	76.86	76.86	76.86
1.98	1.98	1.98	1.98	1.98	1.98	1.98	2.31	2.31	2.31	2.31
3.29	3.29	3.29	3.29	3.29	3.29	3.29	3.84	3.84	3.84	3.84
71.15	71.15	71.15	71.15	71.15	71.15	71.15	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.12	20.62	8.23	20.20	23.88	8.28	20.20	22.68	2.08	0.00	1.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.12	20.62	8.23	20.20	23.88	8.28	20.20	22.68	2.08	0.00	1.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01
29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92
39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
128.20	131.70	119.31	131.28	134.96	119.36	131.28	145.62	125.02	122.94	124.14

Case 6

($ in Millions)

2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86
2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31
3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.20	20.20	22.68	2.08	0.00	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.20	20.20	22.68	2.08	0.00	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.01
29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92	29.92
39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93	39.93
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
129.14	143.14	145.62	125.02	122.94	122.94	122.94	124.14	129.14	143.14	145.62

Case 6

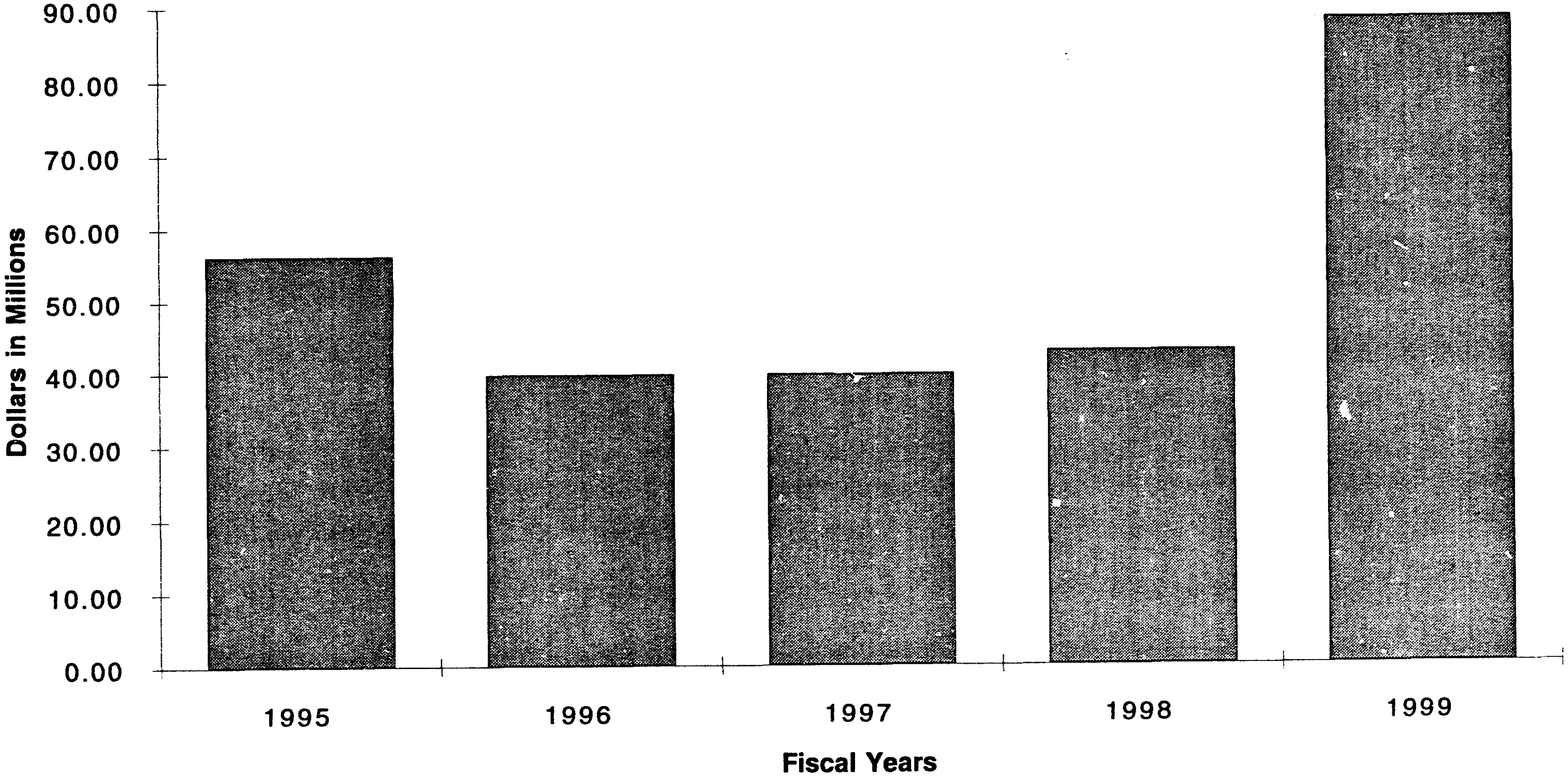
2045	2046	2047	2048	2049
76.86	76.86	76.86	76.86	0.00
2.31	2.31	2.31	2.31	0.00
3.84	3.84	3.84	3.84	0.00
83.01	83.01	83.01	83.01	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	403.19	0.00
10.01	10.01	10.01	10.01	0.00
29.92	29.92	29.92	29.92	0.00
39.93	39.93	39.93	39.93	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
125.02	122.94	122.94	526.13	0.00

Case 6

Page 1	Page 2	Page 3	Page 4	Page 5	Page 6	26-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Total	Grand Total		
149.05	220.57	552.85	768.65	845.51	307.46	2844.09		
4.47	6.62	16.59	23.06	25.37	9.22	85.32		
7.45	11.03	27.64	38.43	42.28	15.37	142.20		
160.97	238.21	597.08	830.14	913.15	332.06	3071.61		
90.00	1473.90	37.80	0.00	0.00	0.00	1601.70		
4.45	146.85	0.00	0.00	0.00	0.00	151.30		
0.00	61.60	110.82	144.48	101.44	2.08	420.42		
0.00	29.81	0.00	0.00	0.00	0.00	29.81		
7.33	0.00	0.00	0.00	0.00	0.00	7.33		
8.60	20.80	0.00	0.00	0.00	0.00	29.40		
110.37	1732.96	148.62	144.48	101.44	2.08	2239.95		
0.00	0.00	0.00	0.00	0.00	403.19	403.19		
0.00	0.00	80.09	110.13	110.13	40.05	340.39		
0.00	0.00	239.33	329.08	329.08	119.66	1017.14		
0.00	0.00	319.42	439.20	439.20	1 9.71	1357.53		
1.17	5.87	0.00	0.00	0.00	0.00	7.04		
147.42	90.00	3.00	0.00	0.00	0.00	240.42		
419.94	2067.04	1068.12	1413.82	1453.79	897.03	7319.75	Five Year Costs	266.40

Case 6 Five Year Costs

Five Year Total = $266.40 M



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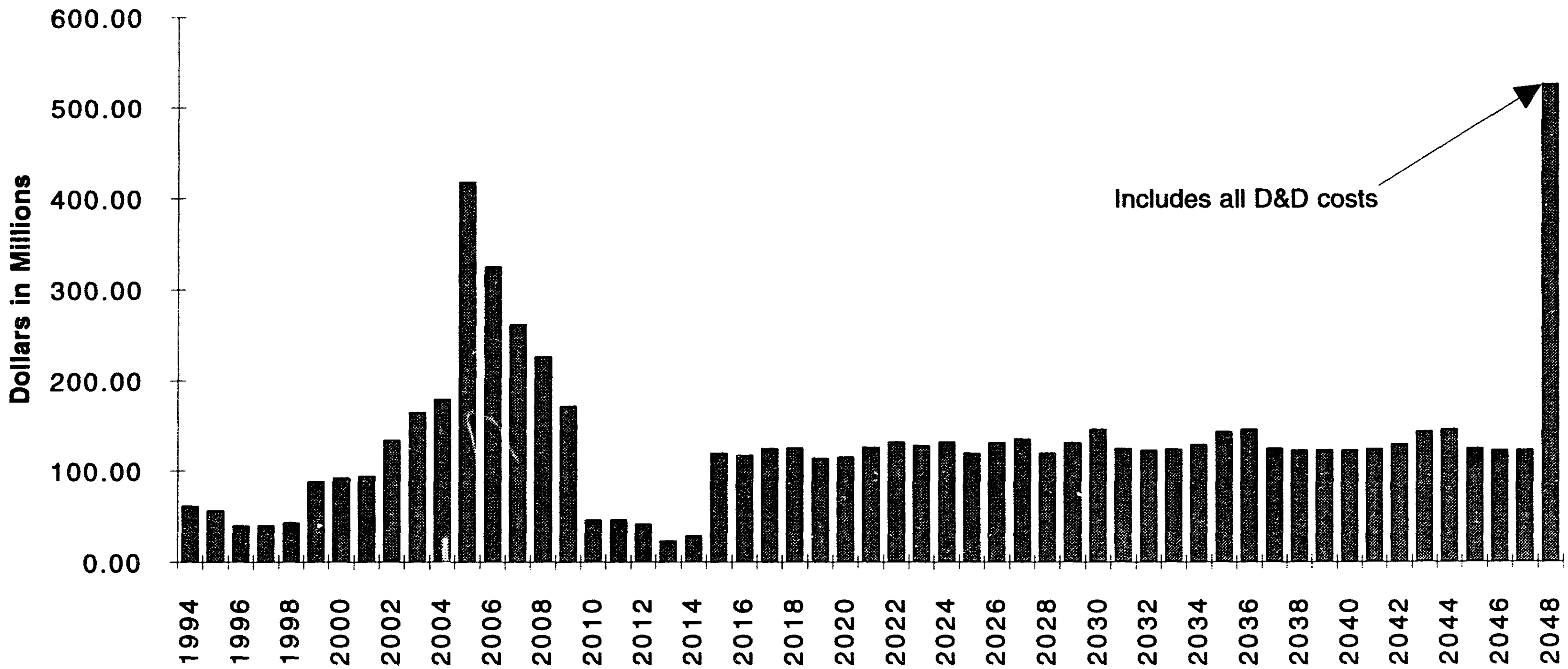
Case 6 Life Cycle Costs



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Case 7

		1993 Case 7 Calciner Reform, WIF and Glass HLLW					Base Case 7		($ in Million
		FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
	A.	Waste Reprocessing (EM 30)							
		Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
		Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
		General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
		Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
	B.	Capital Costs							
		Waste Immobilization Facility	0.00	0.00	0.00	0.00	0.00	45.00	45.00
		Additional Tank Storage	0.00	0.05	0.26	2.07	2.07	5.81	16.14
		Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
		Waste Calciner Upgrade	0.10	0.20	0.50	0.50	2.50	2.50	2.30
		Subtotal Capital Costs	7.13	0.55	0.76	2.57	4.57	53.31	63.44
	C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D.	Waste Disposal Costs (EM ??)							
		Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E.	Environmental Permitting	0.00	0.00	0.00	0.00	0.00	0.00	1.17
	F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	24.50	24.50	24.50
▫	G.	TOTAL ICPP COSTS	61.05	56.25	45.91	47.72	50.72	99.47	110.77

Case 7

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66
45.00	77.00	87.00	87.00	327.00	279.00	219.00	187.00	135.90	15.00	15.00
24.27	23.32	5.16	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.65	1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.50	6.30	4.30	2.02	1.00	0.68	0.00	0.00	0.00	0.00	0.00
75.77	107.27	97.92	92.35	334.12	285.68	230.00	198.00	146.90	21.00	21.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.14	1.04	1.54	1.13	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	22.00	16.00	16.00	13.00	10.00	6.00	6.00	3.00	3.00	3.00
120.57	151.97	137.11	131.14	369.80	317.33	257.66	225.66	171.56	45.66	46.26

Case 7

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	20.05	20.05	85.94	85.94	85.94	85.94	85.94	85.94	85.94	85.94
0.60	0.60	0.60	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
1.00	1.00	1.00	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
21.66	21.66	21.66	92.81	92.81	92.81	92.81	92.81	92.81	92.81	92.81
15.00	12.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.60	4.80	12.60	14.61	5.73	13.70	14.60	2.60	4.30	15.20	21.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.60	17.60	22.60	14.61	5.73	13.70	14.60	2.60	4.30	15.20	21.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44
0.00	0.00	0.00	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25
0.00	0.00	0.00	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41.26	39.26	44.26	190.11	181.23	189.21	190.10	178.11	179.81	190.71	196.59

Case 7

								($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
85.94	85.94	85.94	85.94	85.94	85.94	85.94	76.86	76.86	76.86	76.86
2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.31	2.31	2.31	2.31
4.30	4.30	4.30	4.30	4.30	4.30	4.30	3.84	3.84	3.84	3.84
92.81	92.81	92.81	92.81	92.81	92.81	92.81	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.12	20.62	8.23	20.20	23.88	8.28	20.20	22.68	2.08	0.00	1.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.12	20.62	8.23	20.20	23.88	8.28	20.20	22.68	2.08	0.00	1.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44
76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25
82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
192.63	196.13	183.73	195.71	199.39	183.78	195.71	188.39	167.79	165.71	166.91

Case 7

									($ in Millions)	
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86	76.86
2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31
3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.20	20.20	22.68	2.08	0.00	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.20	20.20	22.68	2.08	0.00	0.00	0.00	1.20	6.20	20.20	22.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44
76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25
82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70	82.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
171.91	185.91	188.39	167.79	165.71	165.71	165.71	166.91	171.91	185.91	188.39

Case 7

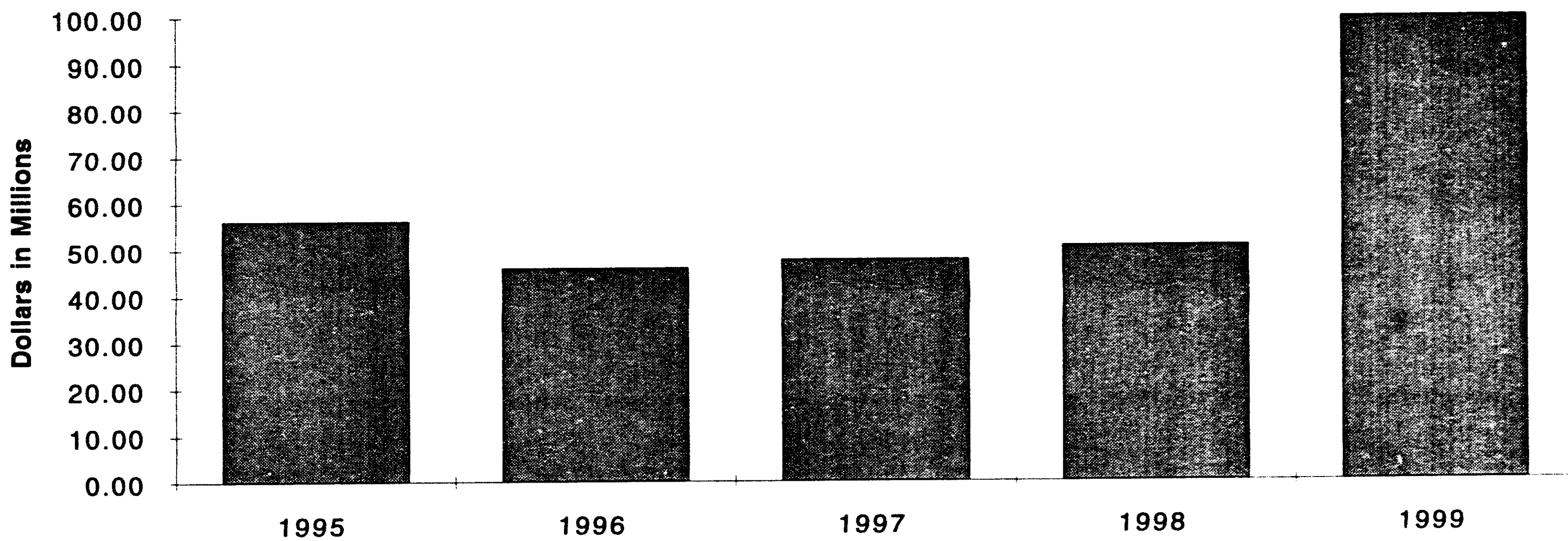
			($ in Millions)	
2045	2046	2047	2048	2049
76.86	76.86	76.86	76.86	76.86
2.31	2.31	2.31	2.31	2.31
3.84	3.84	3.84	3.84	3.84
83.01	83.01	83.01	83.01	83.01
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
2.08	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	385.12
6.44	6.44	6.44	6.44	6.46
76.25	76.25	76.25	76.25	76.25
82.70	82.70	82.70	82.70	82.71
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
167.79	165.71	165.71	165.71	550.84

Case 7

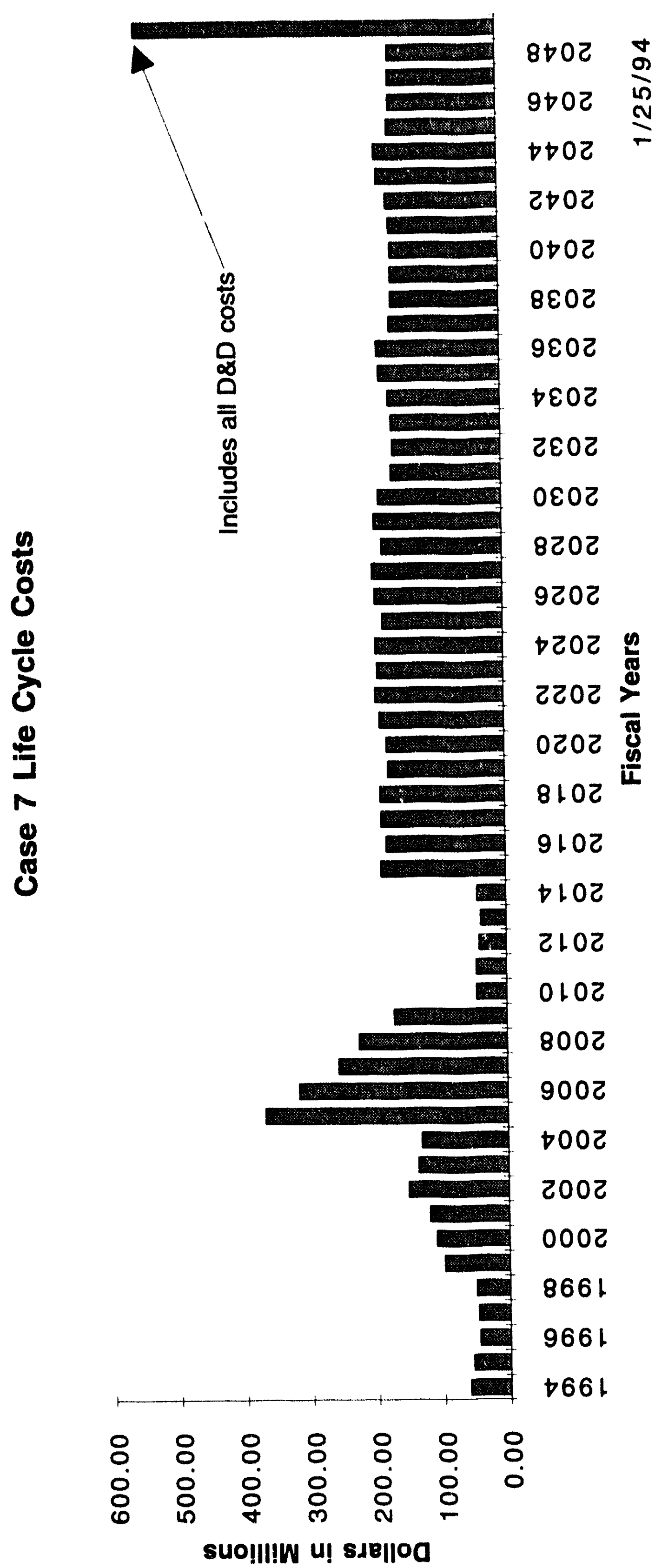
Page 1	Page 2	Page 3	Page 4	Page 5	Page 6	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Total	Grand Total		
149.05	220.57	747.64	909.01	845.51	384.32	3256.10		
4.47	6.62	22.43	27.27	25.37	11.53	97.68		
7.45	11.03	37.38	45.45	42.28	19.22	162.80		
160.97	238.21	807.45	981.73	913.15	415.07	3516.59		
90.00	1473.90	37.80	0.00	0.00	0.00	1601.70		
26.39	54.31	0.00	0.00	0.00	0.00	80.70		
0.00	61.60	110.82	144.48	101.44	2.08	420.42		
0.00	0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	0.00	7.33		
8.60	20.80	0.00	0.00	0.00	0.00	29.40		
132.31	1610.61	148.62	144.48	101.44	2.08	2139.54		
0.00	0.00	0.00	0.00	0.00	385.12	385.12		
0.00	0.00	51.53	70.85	70.85	32.22	225.46		
0.00	0.00	610.04	838.80	838.80	381.27	2668.92		
0.00	0.00	661.57	909.66	909.66	413.50	2894.38		
1.17	5.87	0.00	0.00	0.00	0.00	7.04		
177.42	120.00	3.00	0.00	0.00	0.00	300.42		
471.88	1974.69	1620.64	2035.86	1924.24	1215.76	9243.09	Five Year Costs	300.07

Case 7 Five Year Costs

Five Year Total = $300.07 M



1/25/94


Case 7 Life Cycle Costs
Includes all D&D costs
Dollars in Millions
600.00
500.00
400.00
300.00
200.00
100.00
0.00
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
Fiscal Years
1/25/94

	1993 Case 8a Calcining with Phased WIF Seperations to Glass HLWCase 8a					($ in Millions)		
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	2.00	3.00	5.00	30.00	30.00	45.00
	Additional Tank Storage	0.00	0.00	0.05	0.26	2.07	2.07	5.81
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	7.03	2.30	3.05	5.26	32.07	32.07	50.81
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	Environmental Permitting	0.00	0.00	0.00	0.00	1.14	0.74	0.65
F.	Development Costs (EM 30)	28.00	28.92	23.50	23.50	27.50	27.50	27.50
G.	TOTAL ICPP COSTS	60.95	58.00	48.20	50.41	82.36	81.96	100.62

Case 8a

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	11.46	11.46	11.46	11.46	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.34	0.34	0.34	0.34	0.60	0.60	0.60	0.60
1.00	1.00	1.00	0.57	0.57	0.57	0.57	1.00	1.00	1.00	1.00
21.66	21.66	21.66	12.37	12.37	12.37	12.37	21.66	21.66	21.66	21.66
53.00	233.00	213.00	162.09	102.00	222.00	197.00	157.00	107.00	72.83	15.00
16.14	24.27	23.32	5.16	1.55	0.00	0.00	0.00	0.00	0.00	0.00
0.65	1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.00	1.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69.79	258.73	238.10	173.38	109.55	233.00	208.00	168.00	113.00	78.83	16.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.16	9.16	9.16	9.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.99	43.99	43.99	43.99
0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.15	53.15	53.15	53.15
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
22.00	19.00	19.00	13.00	13.00	13.00	6.00	6.00	3.00	3.00	3.00
114.03	299.87	280.11	199.81	135.95	258.37	226.37	248.80	190.80	156.63	94.40

Case 8a

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	20.05	20.05	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
0.60	0.60	0.60	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
1.00	1.00	1.00	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
21.66	21.66	21.66	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
12.00	10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.80	12.60	14.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.80	22.60	24.61	5.73	13.70	14.60	1.80	0.90	4.90	15.40	20.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16
43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99
53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91.60	97.40	99.41	152.72	160.69	161.59	148.79	147.89	151.89	162.39	167.31

Case 8a

	(Dollars in Millions)							($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89	86.89
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84	93.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	2.08	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.93	15.40	19.42	3.23	6.20	20.20	22.68	2.08	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16
43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99	43.99
53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15	53.15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
153.92	162.39	166.41	150.22	153.19	167.19	169.67	149.07	146.99	146.99	146.99

Case 8a

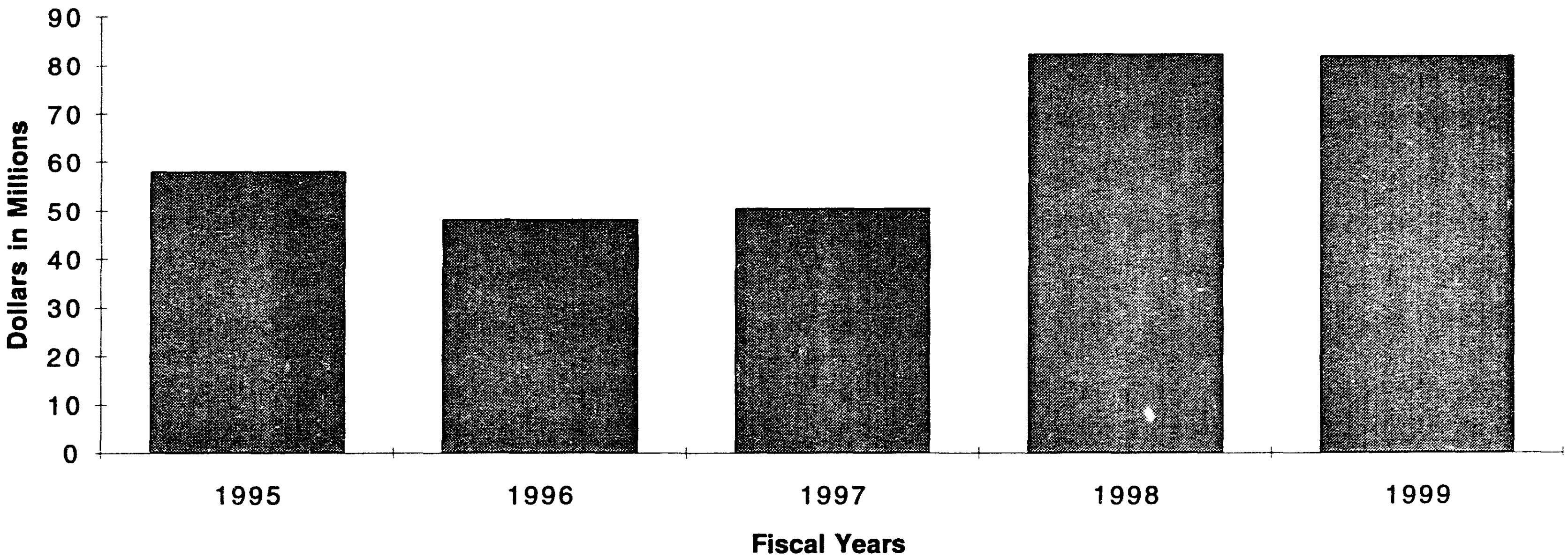
									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
86.89	86.89	86.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.61	2.61	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.34	4.34	4.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93.84	93.84	93.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	366.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.16	9.16	9.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43.99	43.99	43.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53.15	53.15	53.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
146.99	146.99	513.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Case 8a

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
189.15	166.14	735.23	868.90	347.56	2306.99		
5.67	4.98	22.06	26.07	10.43	69.21		
9.46	8.31	36.76	43.45	17.38	115.35		
204.29	179.43	794.04	938.42	375.37	2491.55		
401.00	1259.92	20.00	0.00	0.00	1680.92		
50.66	30.04	0.00	0.00	0.00	80.70		
3.88	76.12	98.89	89.20	0.00	268.09		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
461.09	1355.25	124.56	96.13	0.00	2037.03		
0.00	0.00	0.00	0.00	366.67	366.67		
0.00	45.79	91.59	91.59	36.64	265.61		
0.00	219.95	439.90	439.90	175.96	1275.71		
0.00	265.74	531.49	531.49	212.60	1541.32		
3.60	3.44	0.00	0.00	0.00	7.04		
227.42	79.00	0.00	0.00	0.00	306.42		
896.40	1882.88	1450.09	1566.04	954.63	6750.03	Five Year Costs	320.94

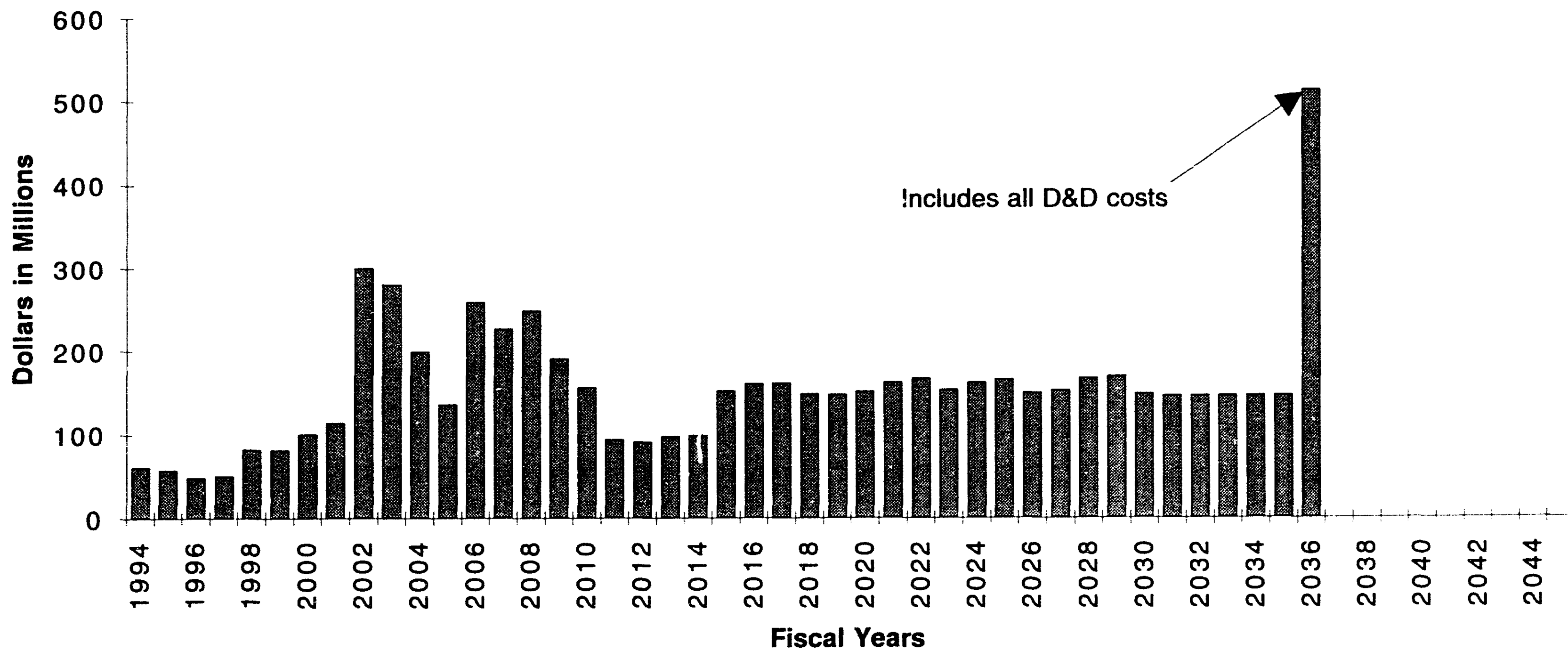
Case 8a Five Year Costs

Five Year Total = $320.94



1/25/94

Case 8a Life Cycle Costs



1/25/94

	1993 Case 8b Calcining with WIF Direct to Glass HLW				Case 8b	($ in Millions)	
	FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
A.	Waste Reprocessing (EM 30)							
	Plant Operations	24.00	24.79	20.05	20.05	20.05	20.05	20.05
	Capital Equipment	0.72	0.74	0.60	0.60	0.60	0.60	0.60
	General Plant Projects	1.20	1.24	1.00	1.00	1.00	1.00	1.00
	Subtotal Operations Costs	25.92	26.78	21.66	21.66	21.66	21.66	21.66
B.	Capital Costs							
	Waste Immobilization Facility	0.00	40.00	40.00	40.00	56.84	56.84	56.84
	Additional Tank Storage	0.00	0.00	0.05	0.26	2.07	2.07	5.81
	Calcine Retrieval	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Calcine Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HLLW Evaporator	7.03	0.30	0.00	0.00	0.00	0.00	0.00
	Waste Calciner Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Capital Costs	7.03	40.30	40.05	40.26	58.91	58.91	62.65
C.	D&D Costs (EM 60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D.	Waste Disposal Costs (EM ??)							
	Low Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High Level Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal Waste Disposal Cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E.	Environmental Permitting	0.00	0.00	0.00	0.00	1.14	0.74	0.65
F.	Development Costs (EM 30)	28.00	28.92	11.50	11.50	12.50	12.50	12.50
G.	TOTAL ICPP COSTS	60.95	96.00	73.20	73.41	94.20	93.80	97.46

Case 8b

Base operating costs are extrapolated from the 1993 actual budget data.								($ in Millions)		
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
20.05	20.05	20.05	20.05	20.05	11.46	11.46	20.05	20.05	20.05	20.05
0.60	0.60	0.60	0.60	0.60	0.34	0.34	0.60	0.60	0.60	0.60
1.00	1.00	1.00	1.00	1.00	0.57	0.57	1.00	1.00	1.00	1.00
21.66	21.66	21.66	21.66	21.66	12.37	12.37	21.66	21.66	21.66	21.66
306.84	207.84	176.84	168.84	111.94	12.84	15.84	10.84	0.00	0.00	0.00
16.14	24.27	23.32	5.16	1.55	0.00	0.00	0.00	0.00	0.00	0.00
0.65	1.45	1.78	6.12	6.00	11.00	11.00	11.00	6.00	6.00	1.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
323.63	233.57	201.94	180.13	119.49	23.84	26.84	21.84	6.00	6.00	1.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.43	135.43	135.43	135.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.43	135.43	135.43	135.43
0.58	0.48	1.36	1.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00
10.00	10.00	10.00	10.00	10.00	7.00	3.00	3.00	3.00	0.00	0.00
355.87	265.71	234.95	212.84	152.17	43.22	42.22	181.93	166.09	163.09	158.69

Case 8b

								($ in Millions)		
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20.05	20.05	20.05	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39
0.60	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
1.00	1.00	1.00	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
21.66	21.66	21.66	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.80	12.60	13.91	1.63	0.80	4.30	14.30	16.19	1.72	0.00	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.80	12.60	13.91	1.63	0.80	4.30	14.30	16.19	1.72	0.00	0.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
161.89	169.69	170.99	162.32	161.50	165.00	175.00	176.88	162.42	160.70	161.60

Case 8b

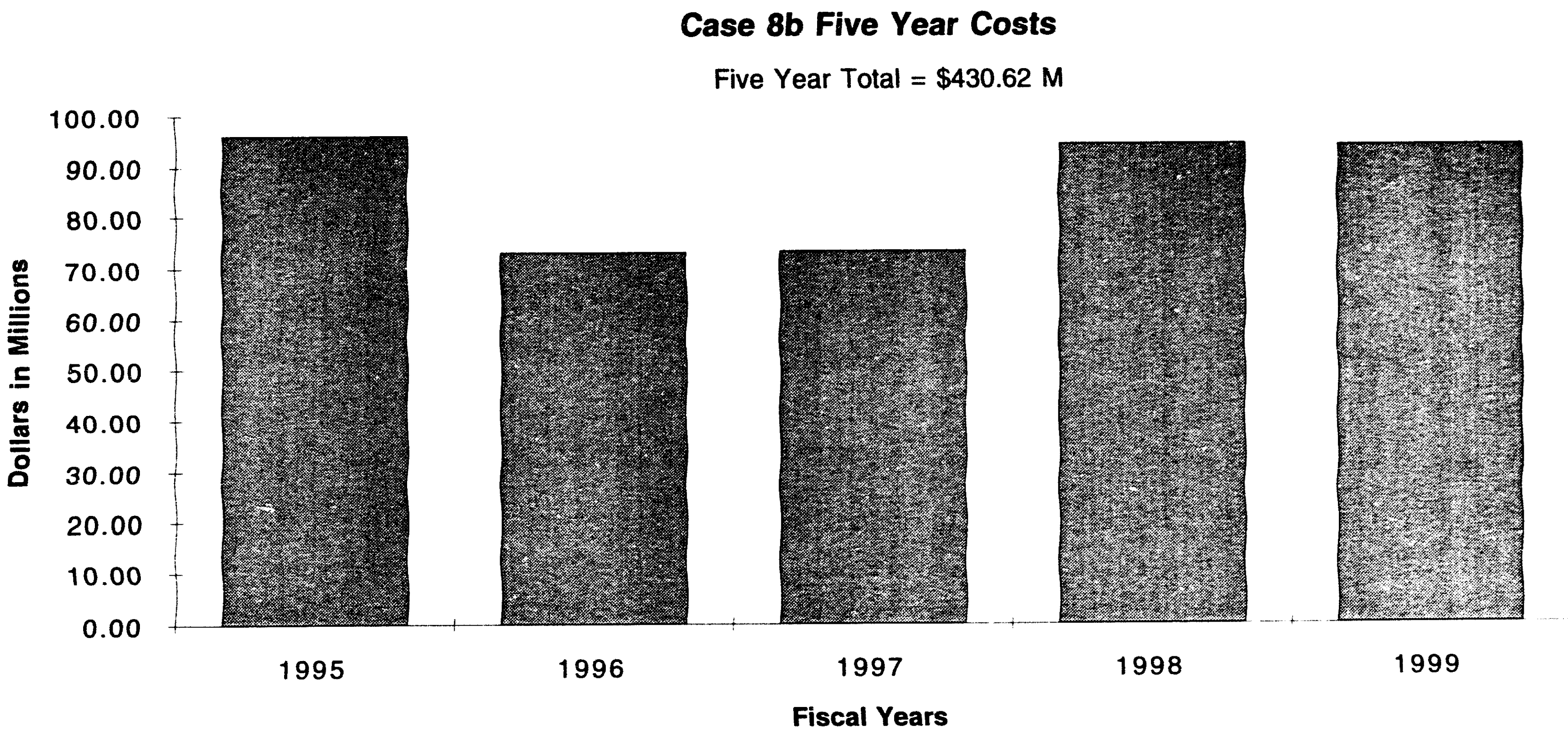
	(Dollars in Millions)							($ in Millions)		
2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39
0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	19.42	3.23	6.20	20.20	22.68	2.08	1.20	6.20	20.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.90	15.40	19.42	3.23	6.20	20.20	22.68	2.08	1.20	6.20	20.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
165.60	176.10	180.12	163.92	166.90	180.90	183.37	162.77	161.90	166.90	180.90

Case 8b

									($ in Millions)		
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39	23.39
0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27	25.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.68	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	300.71
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43	135.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
183.37	162.77	160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70	461.40

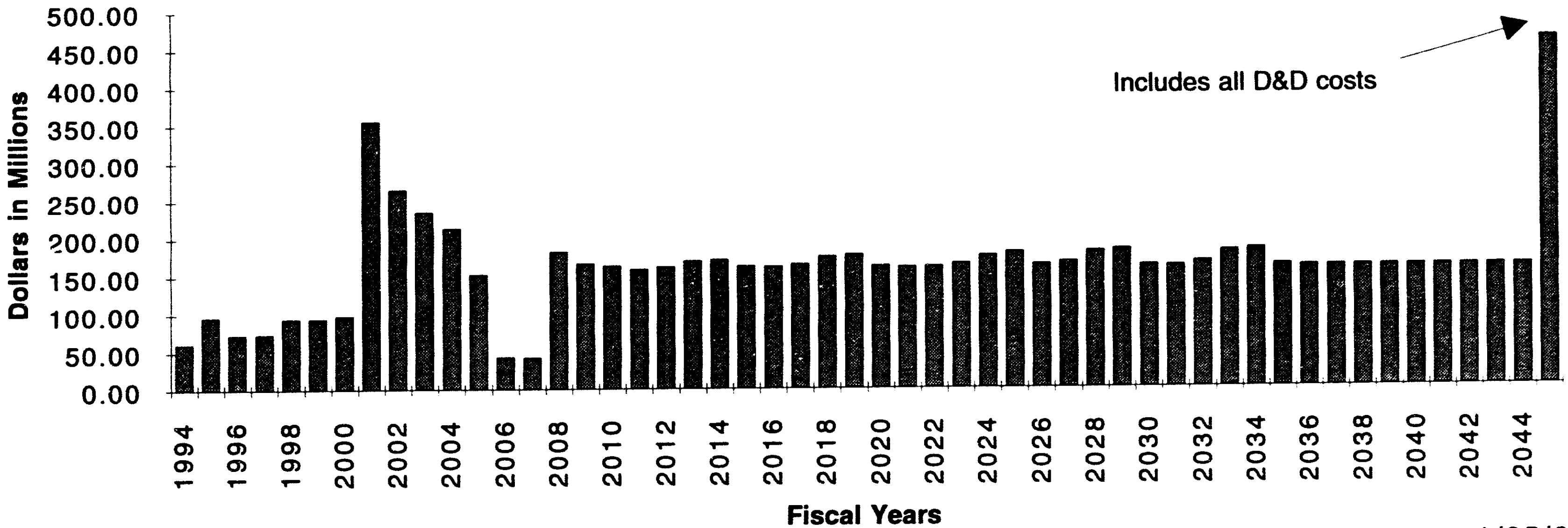
Case 8b

Page 1	Page 2	Page 3	Page 4	Page 5	25-Jan-94	($ in Millions)	
Total	Total	Total	Total	Total	Grand Total		
189.15	183.33	227.25	233.94	304.12	1137.79		
5.67	5.50	6.82	7.02	9.12	34.13		
9.46	9.17	11.36	11.70	15.21	56.89		
204.29	198.00	245.43	252.65	328.45	1228.81		
805.21	497.15	0.00	0.00	0.00	1302.36		
50.66	30.04	0.00	0.00	0.00	80.70		
3.88	76.12	58.65	96.60	44.96	280.20		
0.00	0.00	0.00	0.00	0.00	0.00		
7.33	0.00	0.00	0.00	0.00	7.33		
0.00	0.00	0.00	0.00	0.00	0.00		
865.30	592.49	66.35	101.50	44.96	1670.59		
0.00	0.00	0.00	0.00	300.71	300.71		
0.00	0.00	0.00	0.00	0.00	0.00		
0.00	677.15	1354.31	1354.31	1760.60	5146.37		
0.00	677.15	1354.31	1354.31	1760.60	5146.37		
3.60	3.44	0.00	0.00	0.00	7.04		
137.42	46.00	0.00	0.00	0.00	183.42		
1210.61	1517.08	1666.09	1708.46	2434.71	8536.94	Five Year Costs	430.62


Case 8b Five Year Costs
Five Year Total = $430.62 M
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Dollars in Millions
1995
1996
1997
1998
1999
Fiscal Years

1/25/94

Case 8b Life Cycle Costs



1/25/94

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTIONO
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30SEP12
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
106	WIF DESIGN		01OCT00	30SEP05
132	PROCESS ENVIRONMENTAL PERMITTING		01OCT01	30SEP05
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP08	30SEP13
114	CALCINE RETRIEVAL DESIGN		01OCT09	30SEP13
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT13	30JAN18
128	WIF HOT OPERATIONS		31JAN15	31MAY45
162	START LIQUID BYPASS		01FEB15	01FEB15
138	BIN SET 1 RETRIEVAL OPERATION		31JAN18	15JAN19
140	BIN SET 2 RETRIEVAL OPERATION		16JAN19	15APR22
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		17JUN19	14APR22
142	BIN SET 3 RETRIEVAL OPERATION		16APR22	15FEB27
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		15FEB24	14FEB27
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		19MAR26	14FEB29
144	BIN SET 4 RETRIEVAL OPERATION		16FEB27	15FEB29
146	BIN SET 5 RETRIEVAL OPERATION		16FEB29	15JAN33
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		18DEC29	14JAN33
148	BIN SET 6 RETRIEVAL OPERATION		16JAN33	15APR39
126	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		14MAR36	14APR39
150	BIN SET 7 RETRIEVAL OPERATION		16APR39	31MAY45

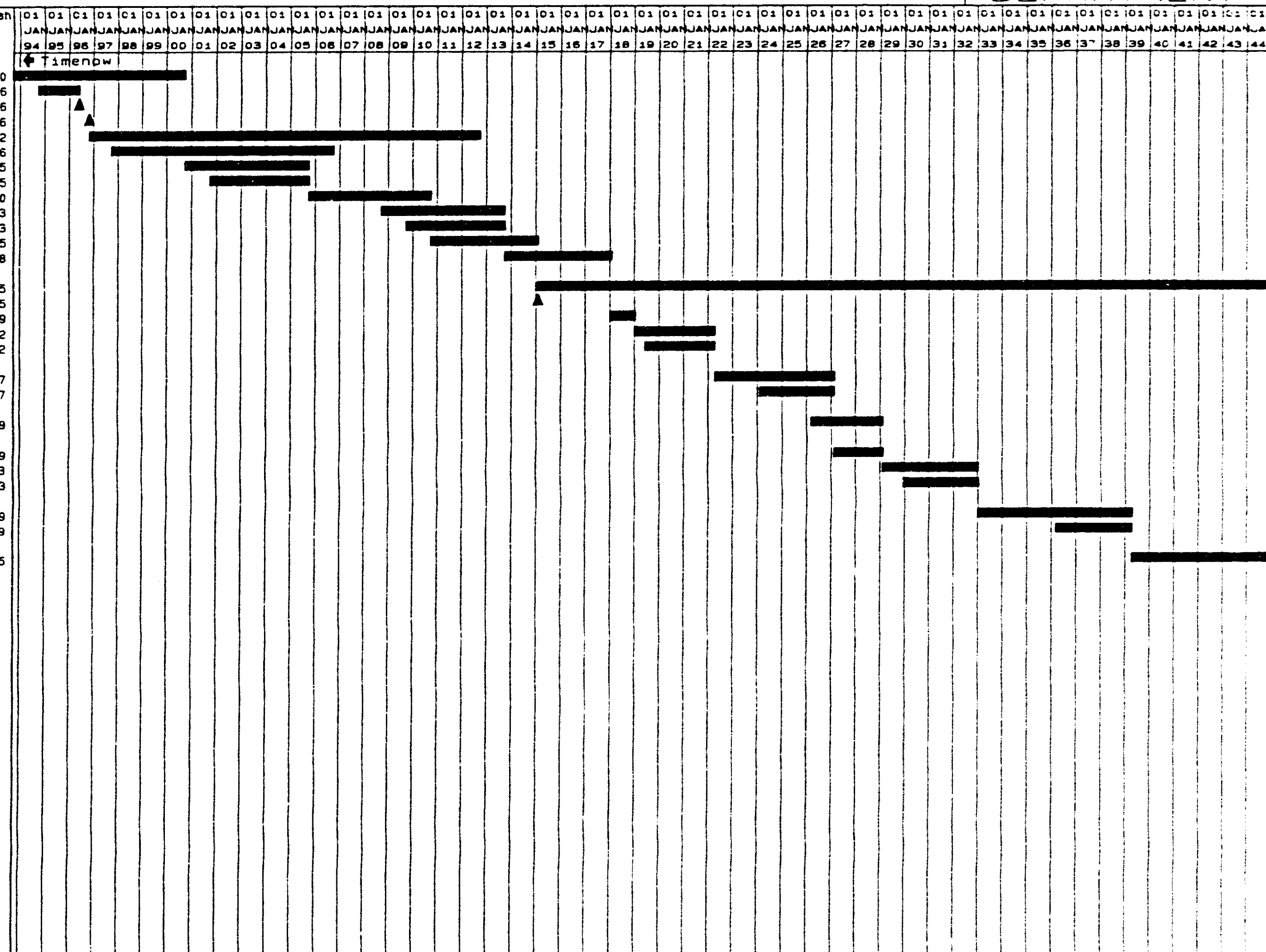


Figure F-2 Schedule Data for Case 0a

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTIONOM
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	28FEB29
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
106	WIF DESIGN		01OCT00	30SEP05
132	PROCESS ENVIRONMENTAL PERMITTING		01OCT01	30SEP05
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	30SEP10
114	CALCINE RETRIEVAL DESIGN		01OCT06	30SEP10
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT10	30JAN15
128	WIF HOT OPERATIONS		31JAN15	31MAY49
138	BIN SET 1 RETRIEVAL OPERATION		01FEB15	15JAN16
140	BIN SET 2 RETRIEVAL OPERATION		16JAN16	31JAN19
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		04APR16	31JAN19
142	BIN SET 3 RETRIEVAL OPERATION		01FEB19	28FEB23
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		02MAR20	28FEB23
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		01APR22	28FEB25
144	BIN SET 4 RETRIEVAL OPERATION		01MAR23	28FEB25
146	BIN SET 5 RETRIEVAL OPERATION		01MAR25	15MAY28
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		15APR25	15MAY28
148	BIN SET 6 RETRIEVAL OPERATION		16MAY28	30APR35
126	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		30MAR32	30APR35
150	BIN SET 7 RETRIEVAL OPERATION		01MAY35	15MAR42
152	BIN SET 8 RETRIEVAL CONSTRUCTION/TESTING/ORR		29NOV38	14MAR42
154	BIN SET 8 RETRIEVAL OPERATION		16MAR42	28FEB49

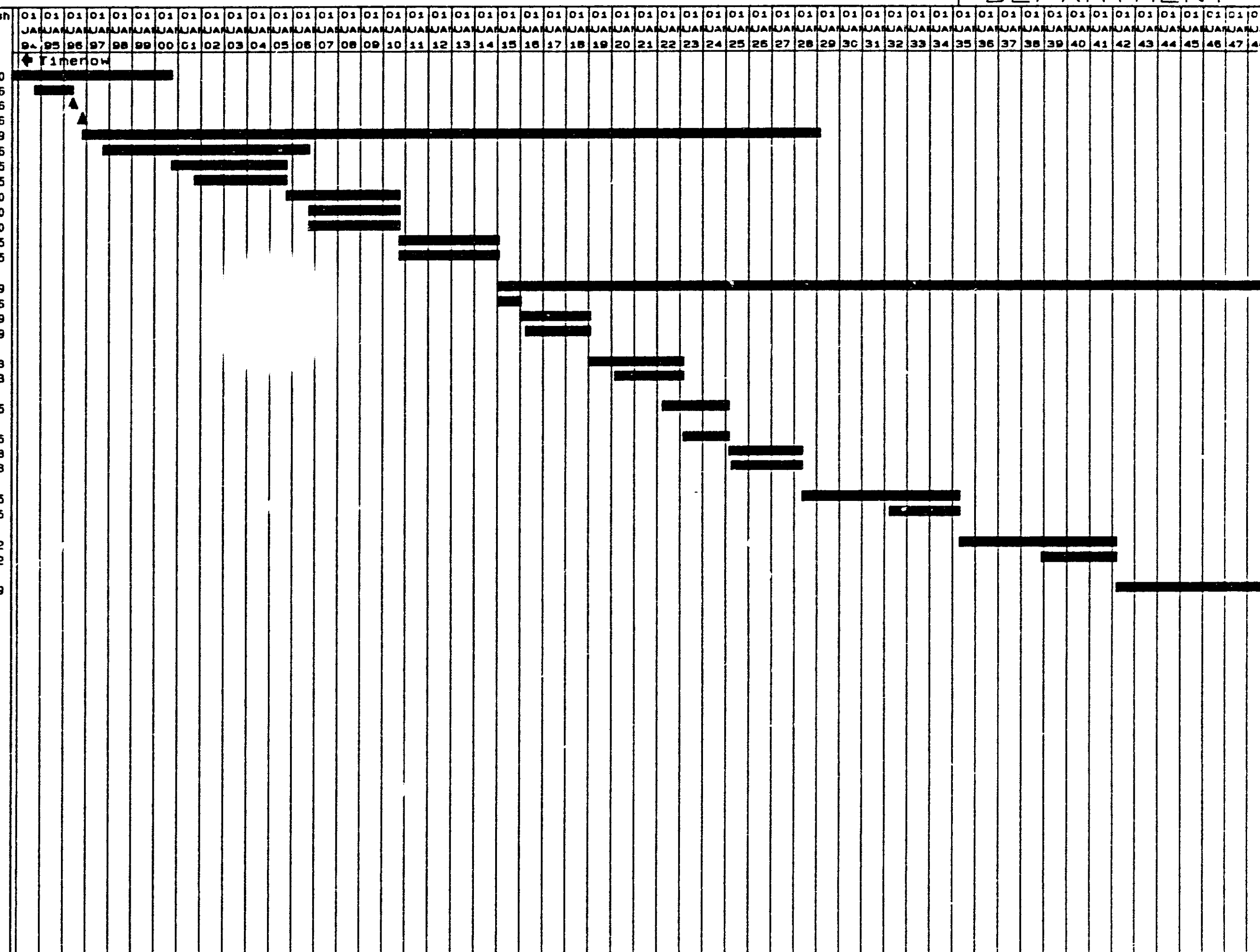


Figure F-3 Schedule Data for Case Ob

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION1
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
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TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP96
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP96	30SEP00
106	WIF DESIGN		01OCT96	30SEP00
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30SEP05
108	WIF CONSTRUCTION		01OCT00	30SEP05
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP03	30SEP07
114	CALCINE RETRIEVAL DESIGN		01OCT03	30SEP07
110	WIF TESTING & ORR REVIEW		01OCT05	30JAN08
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		30OCT06	30JAN10
128	WIF HOT OPERATIONS		31JAN08	31MAR34
162	START LIQUID BYPASS		01FEB08	01FEB08
138	BIN SET 1 RETRIEVAL OPERATION		01FEB10	31MAR11
140	BIN SET 2 RETRIEVAL OPERATION		01APR11	28FEB15
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		01MAY12	28FEB15
142	BIN SET 3 RETRIEVAL OPERATION		01MAR15	15MAY19
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		13MAY16	15MAY19
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		18JUN18	15MAY21
144	BIN SET 4 RETRIEVAL OPERATION		16MAY19	15MAY21
146	BIN SET 5 RETRIEVAL OPERATION		16MAY21	15MAY25
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		18APR22	15MAY25
148	BIN SET 6 RETRIEVAL OPERATION		16MAY25	15FEB32
126	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		15JAN29	15FEB32
150	BIN SET 7 RETRIEVAL OPERATION		16FEB32	31MAR34

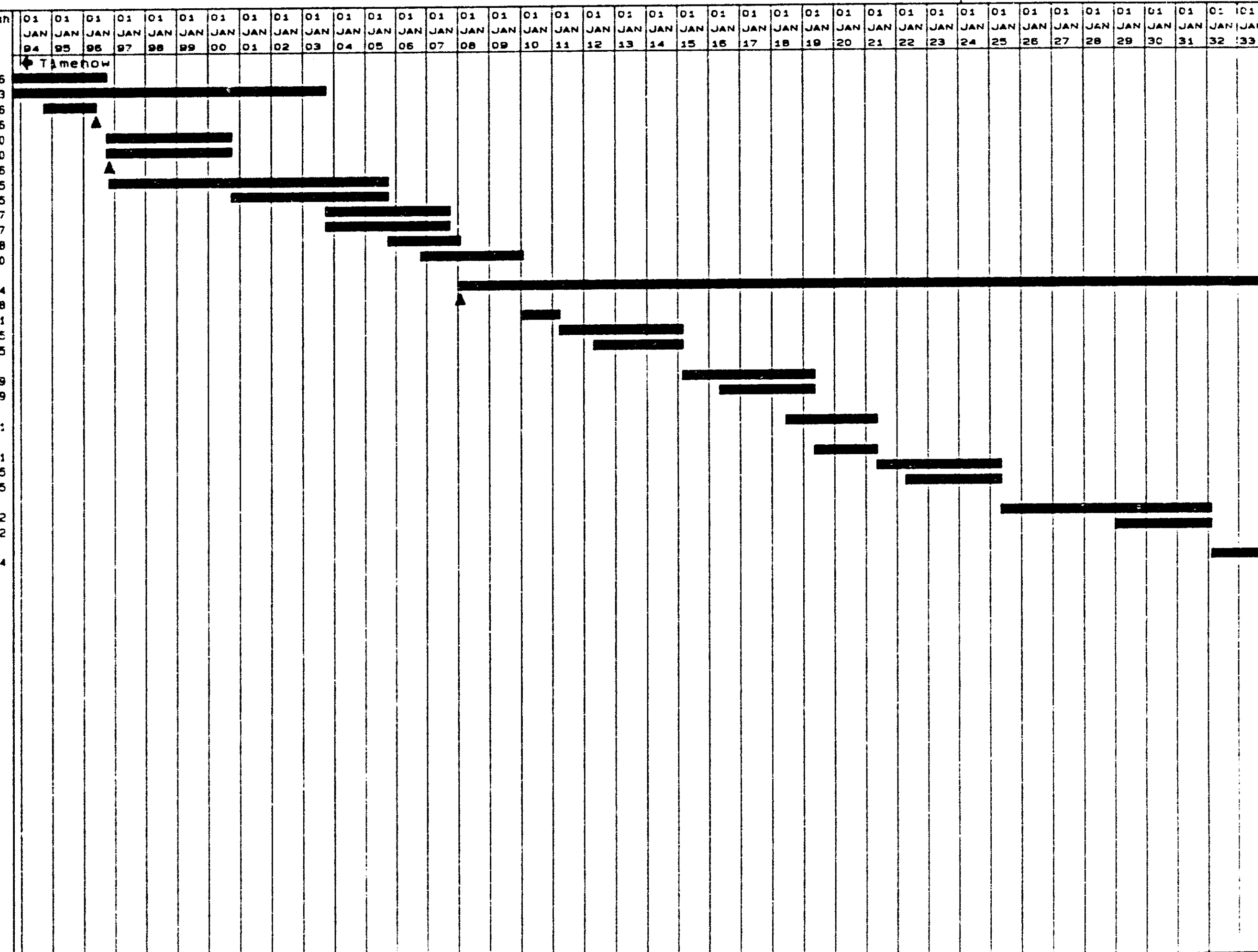

Figure F-4 Schedule Data for Case 1

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION2A
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP96
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP96	30SEP00
106	WIF DESIGN		01OCT96	30SEP00
108	WIF CONSTRUCTION		01OCT00	30SEP05
110	WIF TESTING & ORR REVIEW		01OCT05	30JAN08
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	30SEP10
114	CALCINE RETRIEVAL DESIGN		01NOV06	30OCT10
128	WIF HOT OPERATIONS		31JAN08	31MAR30
162	START LIQUID BYPASS		01FEB08	01FEB08
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01NOV10	28FEB14
138	BIN SET 1 RETRIEVAL OPERATION		01MAR14	28FEB15
140	BIN SET 2 RETRIEVAL OPERATION		01MAR15	15MAY18
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		16JUL15	15MAY18
142	BIN SET 3 RETRIEVAL OPERATION		16MAY18	15MAR23
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		13MAR20	15MAR23
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		04MAY22	15APR25
144	BIN SET 4 RETRIEVAL OPERATION		16MAR23	15APR25
146	BIN SET 5 RETRIEVAL OPERATION		16APR25	15MAR29
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		16FEB26	15MAR29
148	BIN SET 6 RETRIEVAL OPERATION		16MAR29	31MAR30

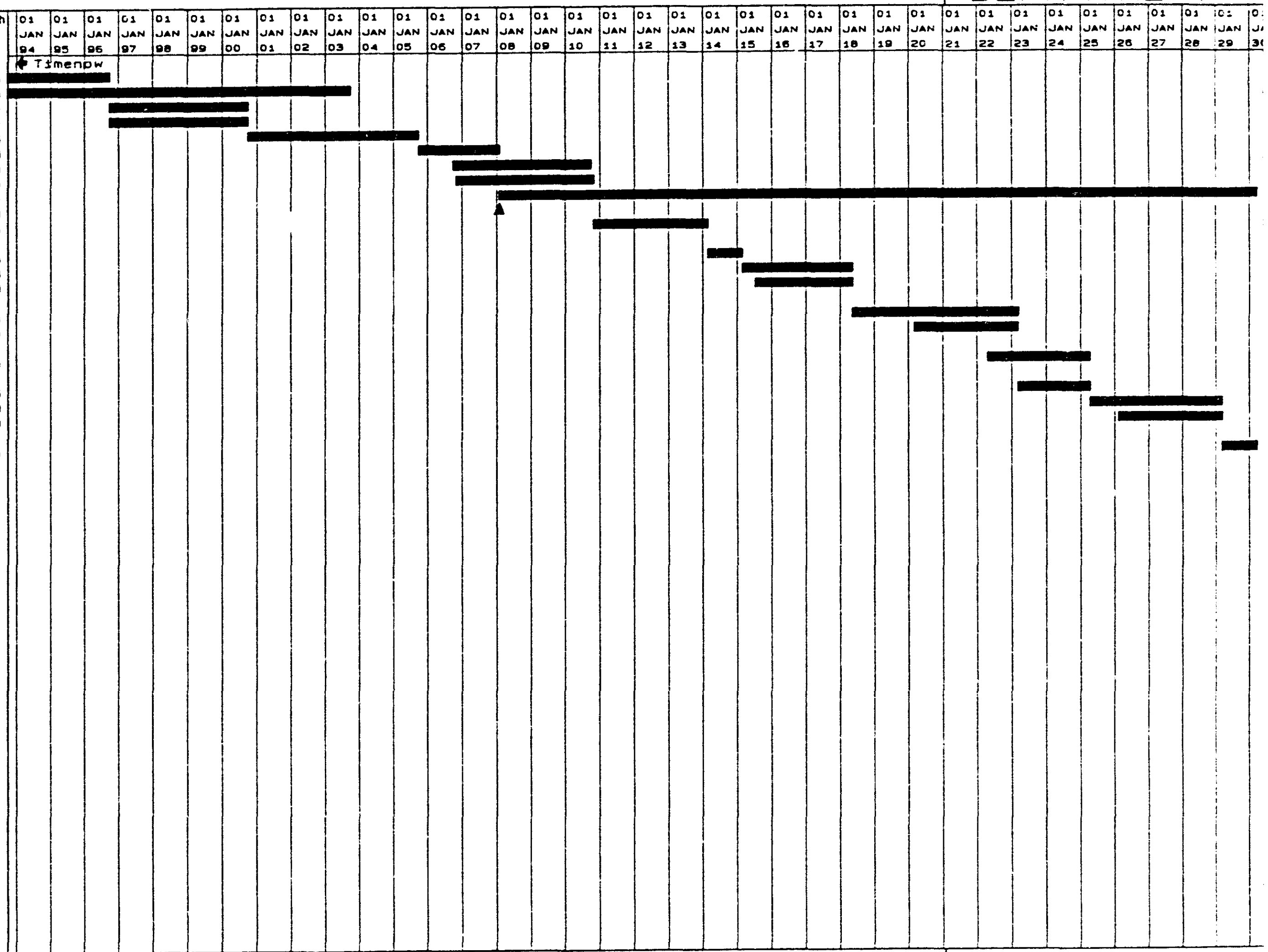

Figure F-5 Schedule Data for Case 2a

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION2B
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
106	WIF DESIGN		01OCT00	30SEP05
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP01	30SEP05
108	WIF CONSTRUCTION		01OCT05	30SEP10
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP14	30SEP18
114	CALCINE RETRIEVAL DESIGN		01OCT14	30SEP18
128	WIF HOT OPERATIONS		31JAN15	28FEB38
162	START LIQUID BYPASS		01FEB15	01FEB15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		02OCT18	31JAN22
138	BIN SET 1 RETRIEVAL OPERATION		01FEB22	31JAN23
140	BIN SET 2 RETRIEVAL OPERATION		01FEB23	15APR26
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		16JUN23	15APR26
142	BIN SET 3 RETRIEVAL OPERATION		16APR26	15FEB31
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		15FEB28	15FEB31
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		20MAR30	15FEB33
144	BIN SET 4 RETRIEVAL OPERATION		16FEB31	16FEB33
146	BIN SET 5 RETRIEVAL OPERATION		16FEB33	31JAN37
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		03JAN34	31JAN37
148	BIN SET 6 RETRIEVAL OPERATION		01FEB37	28FEB38

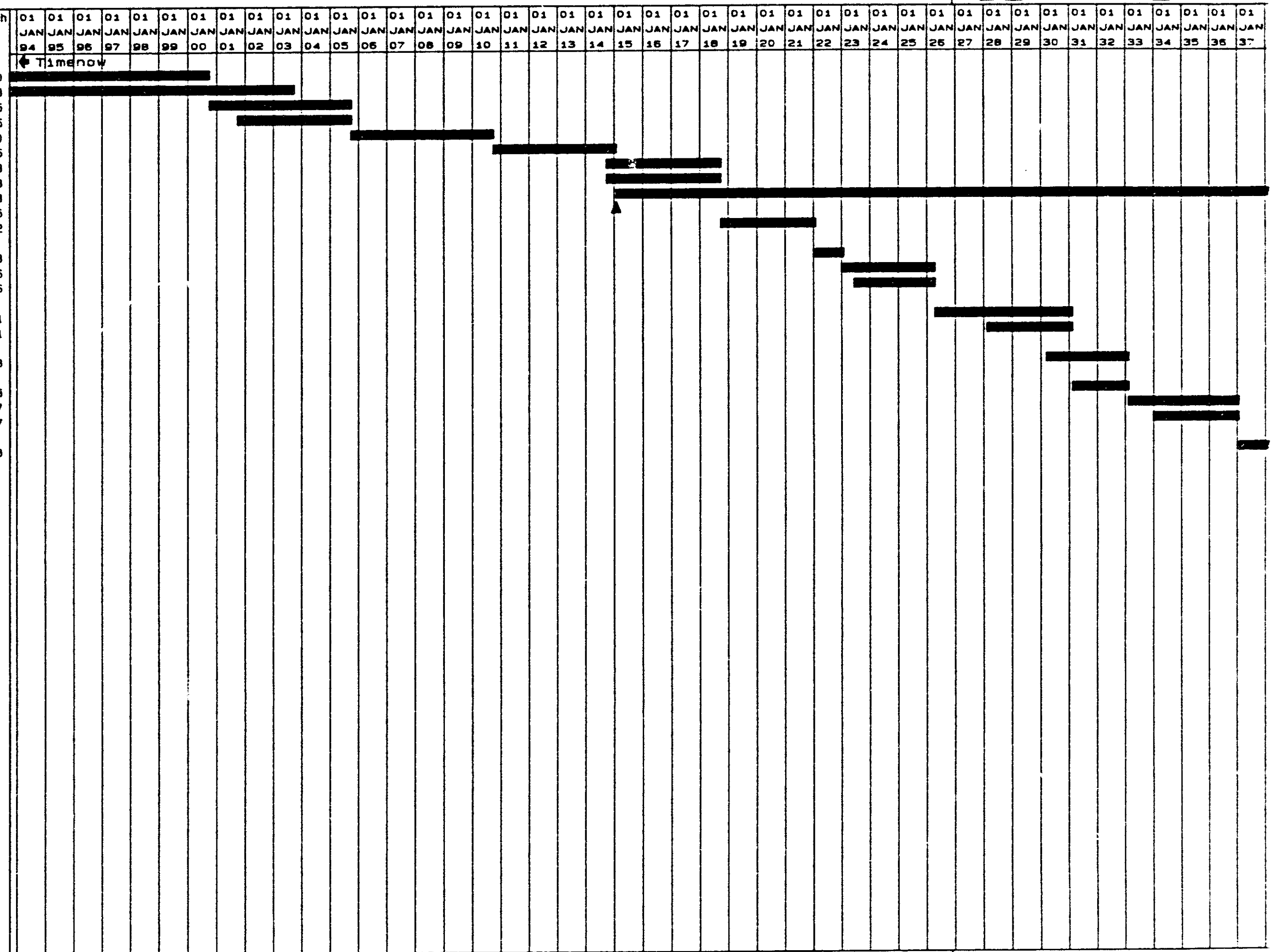

Figure F-6 Schedule Data for Case 2b

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION3
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP96
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP96	30SEP00
106	WIF DESIGN		01OCT96	30SEP00
108	WIF CONSTRUCTION		01OCT00	30SEP05
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP03	30SEP07
114	CALCINE RETRIEVAL DESIGN		01OCT03	30SEP07
110	WIF TESTING & ORR REVIEW		01OCT05	30JAN08
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT07	31JAN12
128	WIF HOT OPERATIONS		31JAN08	31MAR28
162	START LIQUID BYPASS		01FEB08	01FEB08
138	BIN SET 1 RETRIEVAL OPERATION		01FEB12	28FEB13
140	BIN SET 2 RETRIEVAL OPERATION		01MAR13	05JUN16
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		15AUG13	15JUN16
142	BIN SET 3 RETRIEVAL OPERATION		16JUN16	12MAR21
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		01APR17	15APR23
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		02APR19	15MAR21
144	BIN SET 4 RETRIEVAL OPERATION		16MAR21	15APR23
146	BIN SET 5 RETRIEVAL OPERATION		16APR23	15APR27
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		18MAR24	15APR27
148	BIN SET 6 RETRIEVAL OPERATION		16APR27	31MAR28

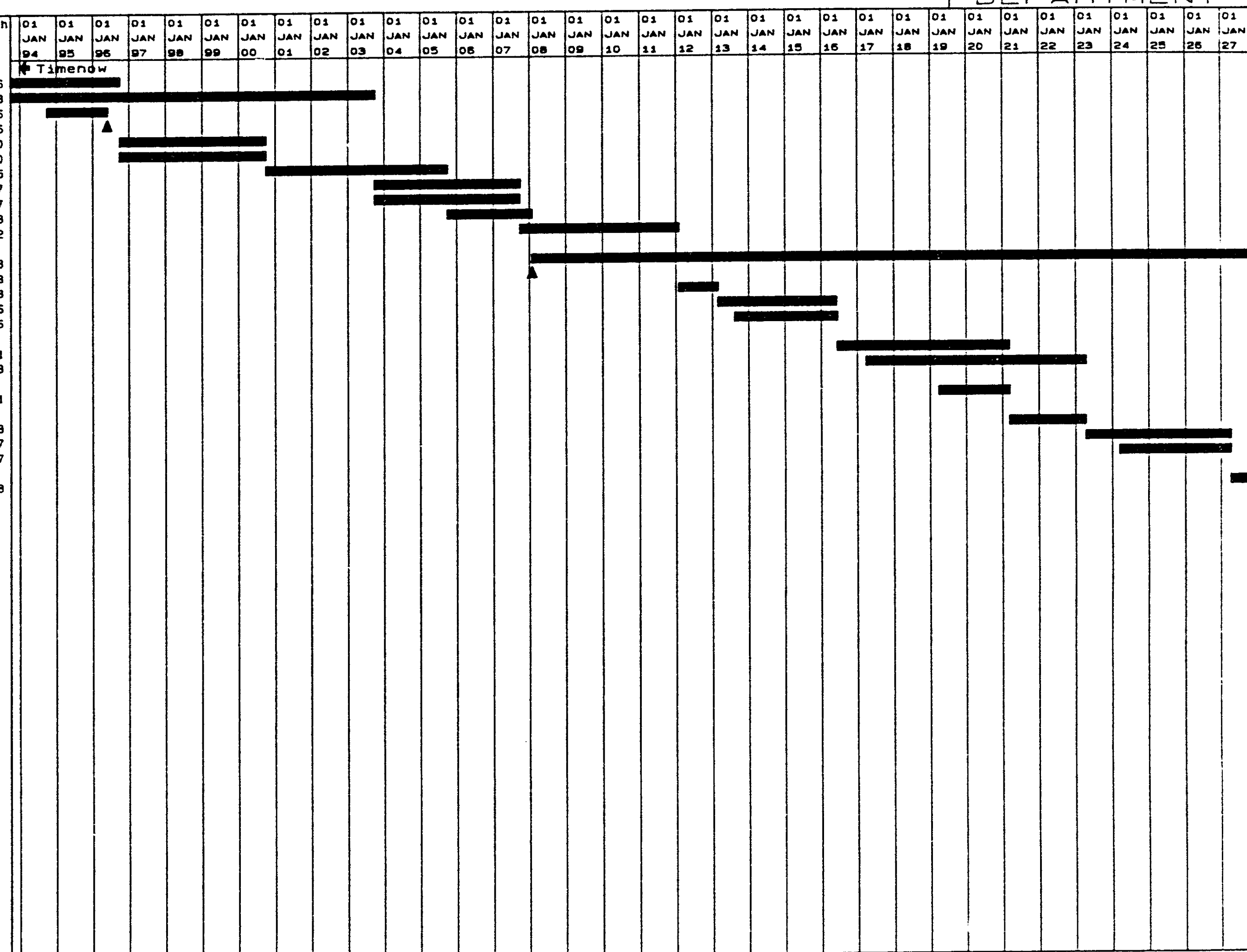

Figure F-7 Schedule Data for Case 3

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION4
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP96
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP96	30SEP00
106	WIF DESIGN		01OCT96	30SEP00
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30SEP00
108	WIF CONSTRUCTION		01OCT00	30SEP05
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP03	30SEP07
114	CALCINE RETRIEVAL DESIGN		01OCT03	30SEP07
110	WIF TESTING & ORR REVIEW		01OCT05	01FEB08
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		30NOV07	31MAR11
128	WIF HOT OPERATIONS		31JAN08	31MAY31
162	START LIQUID BYPASS		01FEB08	01FEB08
138	BIN SET 1 RETRIEVAL OPERATION		01APR11	31MAR12
140	BIN SET 2 RETRIEVAL OPERATION		01APR12	15MAR16
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		16MAY13	15MAR16
142	BIN SET 3 RETRIEVAL OPERATION		16MAR16	15MAY20
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		16MAY17	15MAY20
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		17JUN19	15MAY22
144	BIN SET 4 RETRIEVAL OPERATION		16MAY20	15MAY22
146	BIN SET 5 RETRIEVAL OPERATION		16MAY22	15MAY26
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		04DEC23	31DEC26
148	BIN SET 6 RETRIEVAL OPERATION		01JAN27	31MAY31

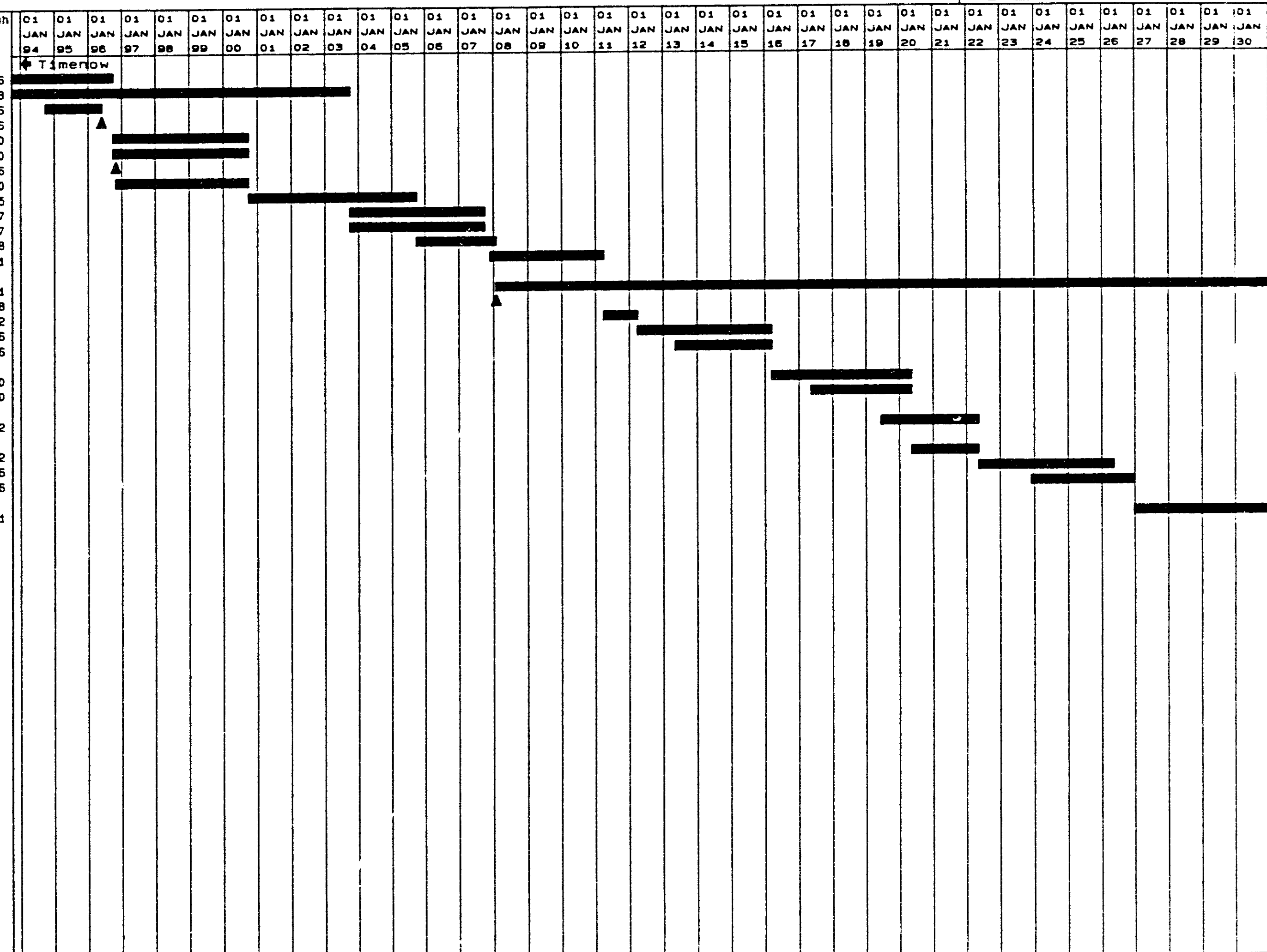

Figure F-8 Schedule Data for Case 4a

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION4B
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP96
112	CALCINE RETRIEVAL RESEARCH		01OCT93	30SEP03
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP94	31JAN01
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
106	WIF DESIGN		01OCT96	30SEP00
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30APR03
108	WIF CONSTRUCTION		01OCT00	30SEP05
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP02	31JAN05
114	CALCINE RETRIEVAL DESIGN		01OCT03	30SEP07
110	WIF TESTING & ORR REVIEW		01OCT05	30JAN08
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		02OCT07	31JAN11
162	START LIQUID BYPASS		31JAN08	31JAN08
128	WIF HOT OPERATIONS		31JAN08	31MAY32
138	BIN SET 1 RETRIEVAL OPERATION		01FEB11	15JAN12
140	BIN SET 2 RETRIEVAL OPERATION		16JAN12	15MAY15
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		17JUL12	15MAY15
142	BIN SET 3 RETRIEVAL OPERATION		16MAY15	15MAR20
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		14MAR17	15MAR20
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		17APR19	15MAR22
144	BIN SET 4 RETRIEVAL OPERATION		16MAR20	15MAR22
146	BIN SET 5 RETRIEVAL OPERATION		16MAR22	31MAR26
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		01DEC23	30DEC26
148	BIN SET 6 RETRIEVAL OPERATION		01JAN27	31MAY32

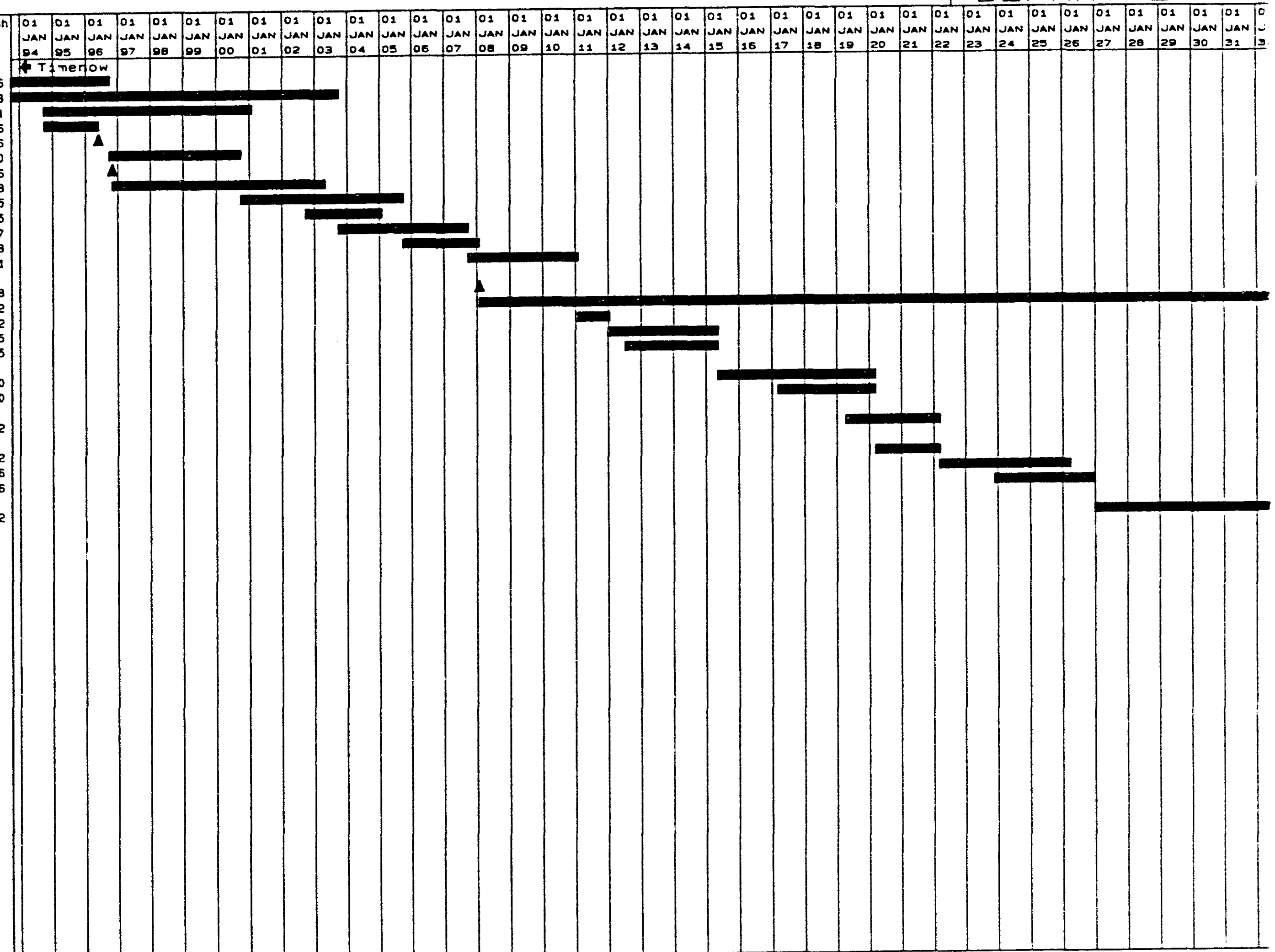

Figure F-9 Schedule Data for Case 4b

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION5A
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
164	FREEZE CRYSTALLIZATION RESEARCH		01OCT93	30SEP96
104	WIF RESEARCH		01OCT93	30SEP00
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
132	PROCESS ENVIRONMENTAL PERMITTING		01OCT95	30SEP05
102	START HLLW EVAPORATOR		31MAY96	31MAY96
166	FREEZE CRYSTALLIZATION DESIGN		01OCT96	30SEP99
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	31AUG12
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
168	FREEZE CRYSTALLIZATION CONSTRUCTION/TESTING/ORR		01OCT99	31DEC01
106	WIF DESIGN		01OCT00	30SEP05
170	FREEZE CRYSTALLIZATION HOT OPERATION		01JAN02	30SEP15
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	31AUG10
114	CALCINE RETRIEVAL DESIGN		01OCT06	31AUG10
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01SEP10	31DEC14
110	WIF TESTING & ORR REVIEW		01OCT10	30SEP15
138	BIN SET 1 RETRIEVAL OPERATION		31JAN15	31MAY15
128	WIF HOT OPERATIONS		31JAN15	31JAN44
162	START LIQUID BYPASS		01FEB15	01FEB15
140	BIN SET 2 RETRIEVAL OPERATION		01JAN16	15MAY19
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		15JUL16	15MAY19
142	BIN SET 3 RETRIEVAL OPERATION		16MAY19	31JAN24
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		02FEB21	31JAN24
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		02FEB23	31DEC25
144	BIN SET 4 RETRIEVAL OPERATION		01FEB24	31OCT25
146	BIN SET 5 RETRIEVAL OPERATION		01JAN26	15JAN30
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		17DEC26	15JAN30
148	BIN SET 6 RETRIEVAL OPERATION		16JAN30	15APR36
174	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		18APR33	15APR36
172	BIN SET 7 RETRIEVAL OPERATION		16APR36	31JAN44

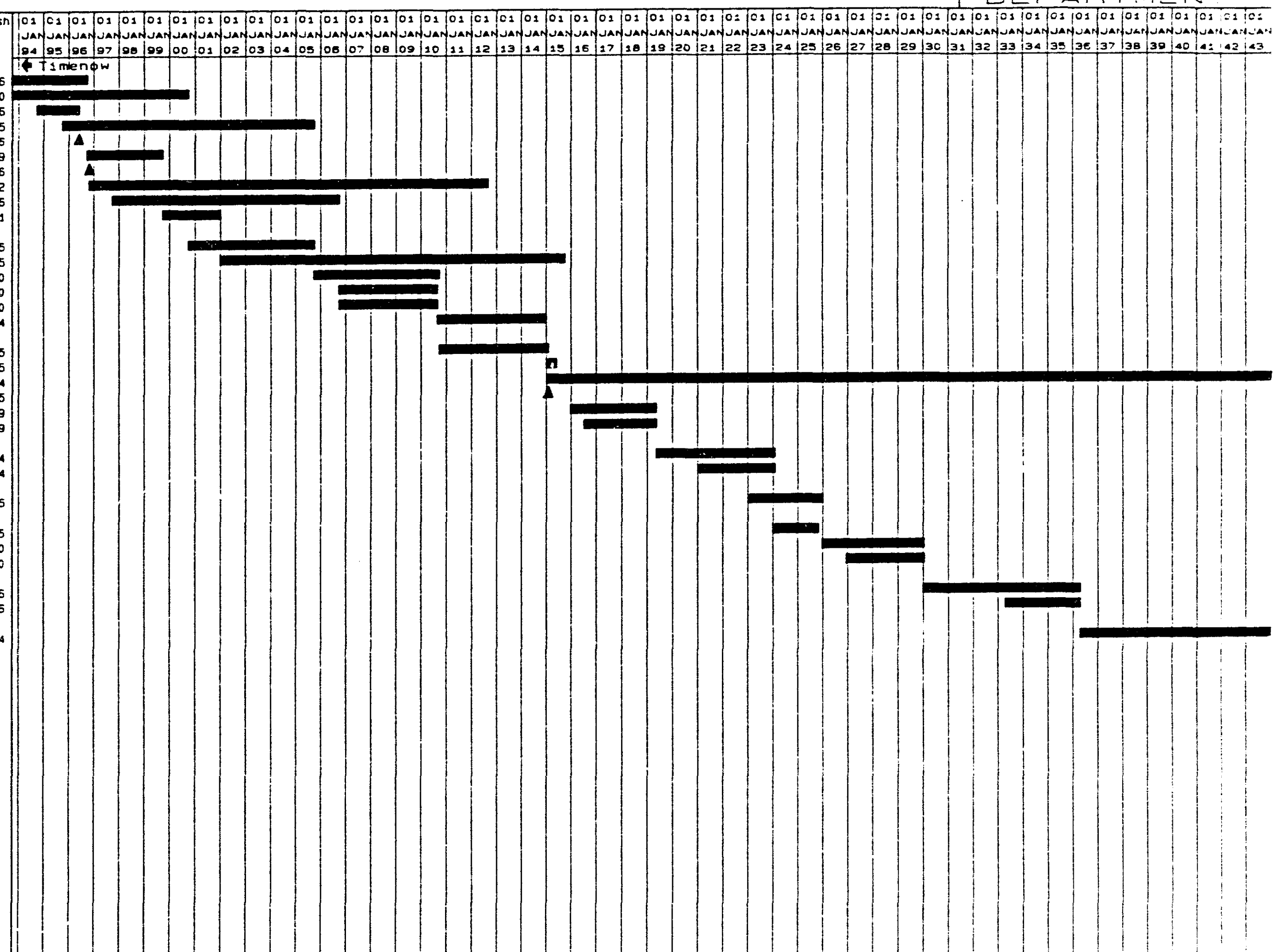

Figure F-10 Schedule Data for Case 5a

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION5B
Time Now: 01OCT93
Date: 05JAN94
Page: 1

WINCO
APPLIED
TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
164	NEUTRALIZATION RESEARCH		01OCT93	30SEP96
104	WIF RESEARCH		01OCT93	30SEP00
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
166	NEUTRALIZATION DESIGN		01OCT96	30SEP99
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	31AUG12
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
169	NEUTRALIZATION CONSTRUCTION/TESTING/ORR		01OCT99	31DEC01
106	WIF DESIGN		01OCT00	30SEP05
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP01	30SEP05
170	NEUTRALIZATION HOT OPERATION		01JAN02	30SEP15
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		31AUG06	31AUG10
114	CALCINE RETRIEVAL DESIGN		01OCT06	31AUG10
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01SEP10	31DEC14
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
138	BIN SET 1 RETRIEVAL OPERATION		31JAN15	31MAY15
162	START LIQUID BYPASS		01FEB15	01FEB15
128	WIF HOT OPERATIONS		01FEB15	31JAN44
140	BIN SET 2 RETRIEVAL OPERATION		01JAN16	15MAY19
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		15JUL16	15MAY19
142	BIN SET 3 RETRIEVAL OPERATION		16MAY19	31JAN24
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		02FEB21	31JAN24
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		02FEB23	31DEC25
144	BIN SET 4 RETRIEVAL OPERATION		01FEB24	31OCT25
146	BIN SET 5 RETRIEVAL OPERATION		01JAN26	15JAN30
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		17DEC26	15JAN30
148	BIN SET 6 RETRIEVAL OPERATION		16JAN30	15APR36
174	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		18APR33	15APR36
172	BIN SET 7 RETRIEVAL OPERATION		16APR36	31JAN44

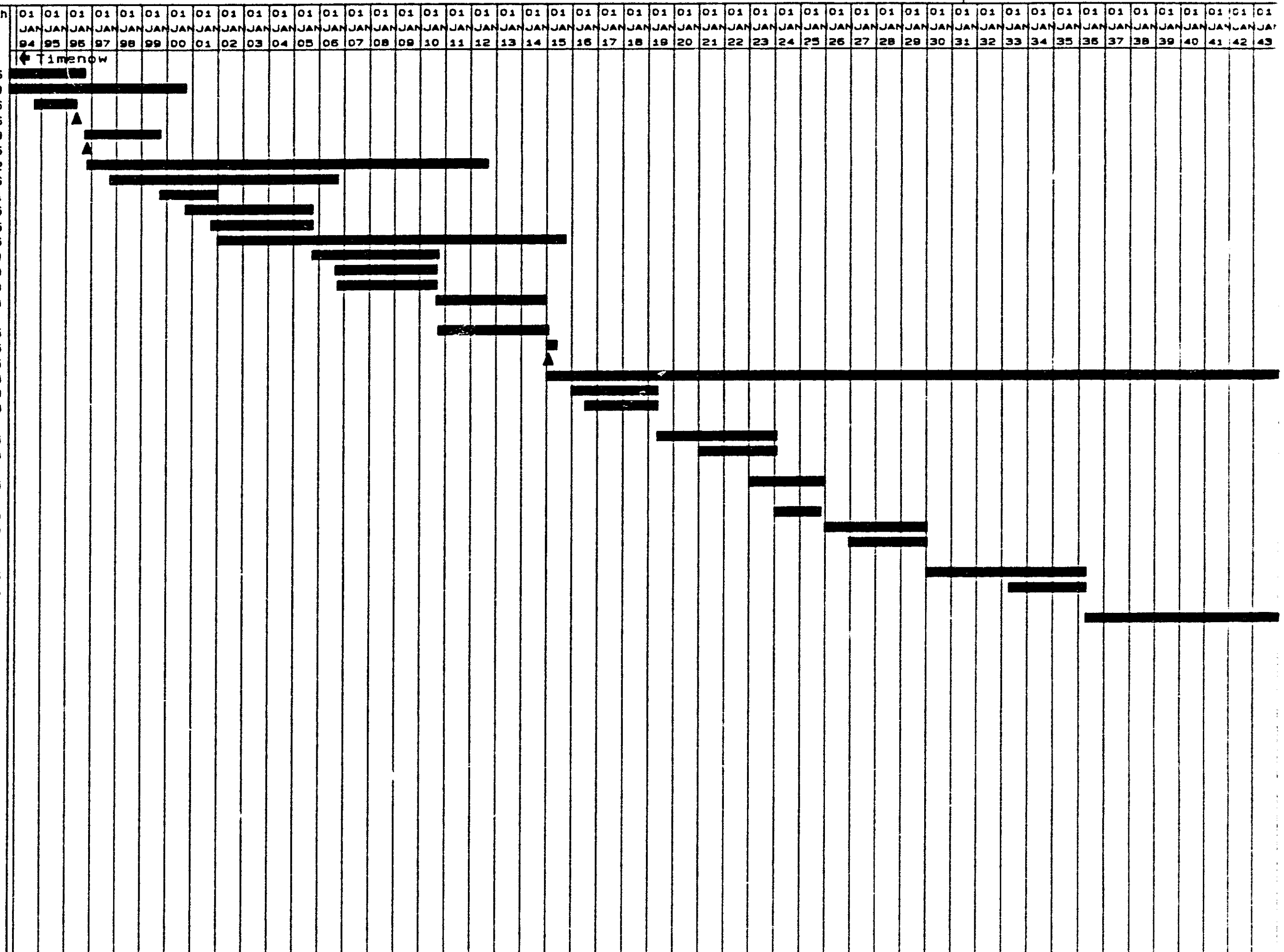

Figure F-11 Schedule Data for Case 5b

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION6
Time Now: 10CT93
Date: 5JAN94
Page: 1

WINCO APPLIED TECHNOLOGY DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30APR11
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
106	WIF DESIGN		01OCT00	30SEP05
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP01	30SEP05
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	30SEP10
114	CALCINE RETRIEVAL DESIGN		01OCT06	30SEP10
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		30DEC11	30APR16
128	WIF HOT OPERATIONS		31JAN15	31MAR48
162	START LIQUID BYPASS		01FEB15	01FEB15
138	BIN SET 1 RETRIEVAL OPERATION		01MAY16	15MAY17
140	BIN SET 2 RETRIEVAL OPERATION		16MAY17	15APR21
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		18JUN18	15APR21
142	BIN SET 3 RETRIEVAL OPERATION		16APR21	01JAN26
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		18JAN23	15JAN26
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		17FEB25	15JAN28
144	BIN SET 4 RETRIEVAL OPERATION		16JAN26	15JAN28
146	BIN SET 5 RETRIEVAL OPERATION		16JAN28	15MAY31
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		17APR28	15MAY31
148	BIN SET 6 RETRIEVAL OPERATION		16MAY31	15MAR38
126	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		13FEB35	15MAR38
150	BIN SET 7 RETRIEVAL OPERATION		16MAR38	15JAN46
178	BIN SET 8 RETRIEVAL CONSTRUCTION/TESTING/ORR		01JUN40	15JAN46
180	BIN SET 8 RETRIEVAL OPERATION		16JAN46	31MAR48

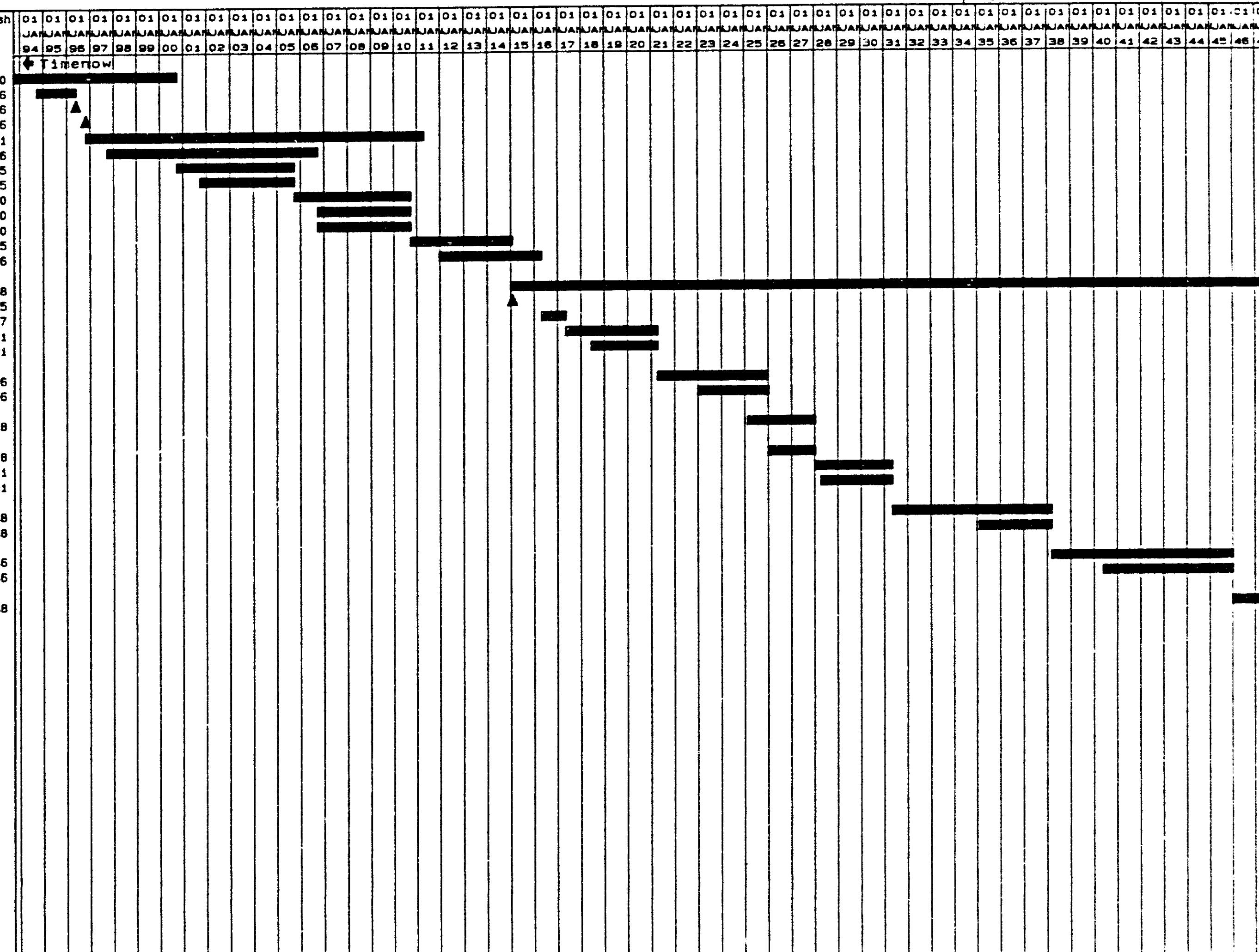

Figure F-12 Schedule Data for Case 6

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION7
Time Now: 01OCT93
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TECHNOLOGY
DEPARTMENT

Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
182	MODIFIED NWCF RESEARCH		01JAN94	31DEC98
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP94	31JAN05
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	31DEC00
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
184	MODIFIED NWCF DESIGN		01JAN98	31DEC00
106	WIF DESIGN		01OCT00	30SEP05
186	MODIFIED NWCF CONSTRUCTION/TESTING/ORR		01JAN01	31DEC05
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP02	31JAN05
108	WIF CONSTRUCTION		01OCT05	30SEP10
188	MODIFIED NWCF HOT OPERATION		01JAN06	30JAN15
114	CALCINE RETRIEVAL DESIGN		01OCT06	30SEP10
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT10	30JAN15
126	BIN SET 7 RETRIEVAL CONSTRUCTION/TESTING/ORR		01JAN12	30JAN15
138	BIN SET 1 RETRIEVAL OPERATION		31JAN15	31JUL15
150	BIN SET 7 RETRIEVAL OPERATION		31JAN15	30MAY23
128	WIF HOT OPERATIONS		31JAN15	02SEP44
162	START LIQUID BYPASS		01FEB15	01FEB15
140	BIN SET 2 RETRIEVAL OPERATION		01AUG15	31JUL18
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT15	31JUL18
142	BIN SET 3 RETRIEVAL OPERATION		01AUG18	31MAY22
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		01JUN19	31MAY22
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		01APR21	28FEB24
144	BIN SET 4 RETRIEVAL OPERATION		01JUN22	28FEB24
146	BIN SET 5 RETRIEVAL OPERATION		01MAR24	31JAN28
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		01JAN25	31JAN28
148	BIN SET 6 RETRIEVAL OPERATION		01FEB28	31JAN35
178	BIN SET 8 RETRIEVAL CONSTRUCTION/TESTING/ORR		01JAN32	31JAN35
180	BIN SET 8 RETRIEVAL OPERATION		01FEB35	02SEP44

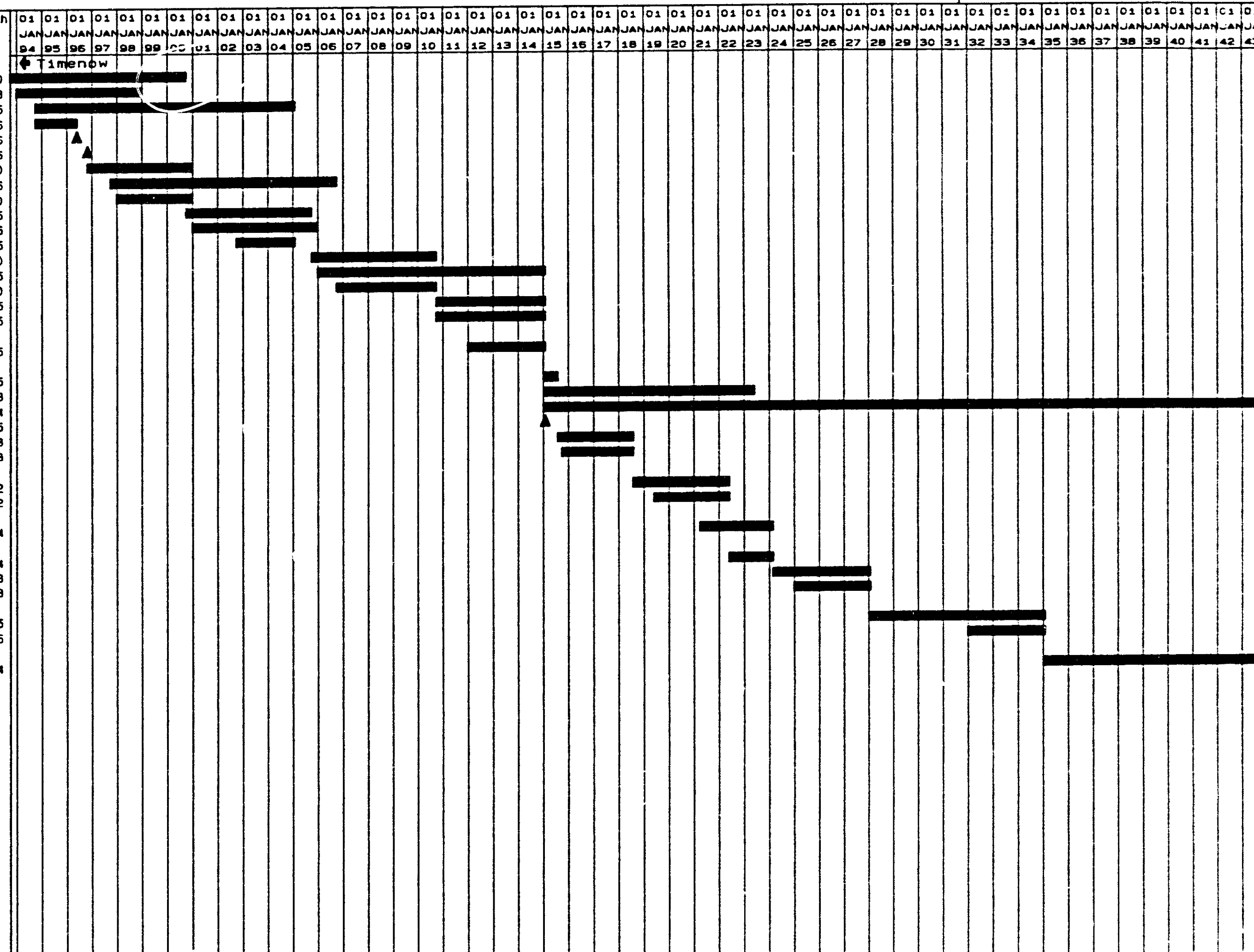

Figure F-13 Schedule Data for Case 7

WINCO APPLIED TECHNOLOGY DEPARTMENT

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION8
Time Now: 01OCT93
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Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
190	WIF PHASE 1 RESEARCH		01JAN94	31DEC97
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30APR03
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
192	WIF PHASE 1 DESIGN		01JAN98	31DEC01
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP98	30SEP05
106	WIF DESIGN		01OCT00	30SEP05
194	WIF PHASE 1 CONSTRUCTION/TESTING/ORR		01JAN02	31DEC07
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	30SEP10
114	CALCINE RETRIEVAL DESIGN		01OCT06	30SEP10
162	START LIQUID BYPASS		01JAN08	01JAN08
196	WIF PHASE 1 HOT OPERATION		01JAN08	30JAN15
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT10	30JAN15
118	BIN SE` 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		15JUN12	15APR19
138	BIN SET 1 RETRIEVAL OPERATION		31JAN15	15MAY15
128	WIF HOT OPERATIONS		31JAN15	30APR36
140	BIN SET 2 RETRIEVAL OPERATION		16MAY15	15APR19
142	BIN SET 3 RETRIEVAL OPERATION		16APR19	15JAN24
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		15JAN21	15JAN24
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		17FEB23	15JAN26
144	BIN SET 4 RETRIEVAL OPERATION		16JAN24	15JAN26
146	BIN SET 5 RETRIEVAL OPERATION		16JAN26	15JAN30
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		17DEC26	15JAN30
148	BIN SET 6 RETRIEVAL OPERATION		16JAN30	30APR36

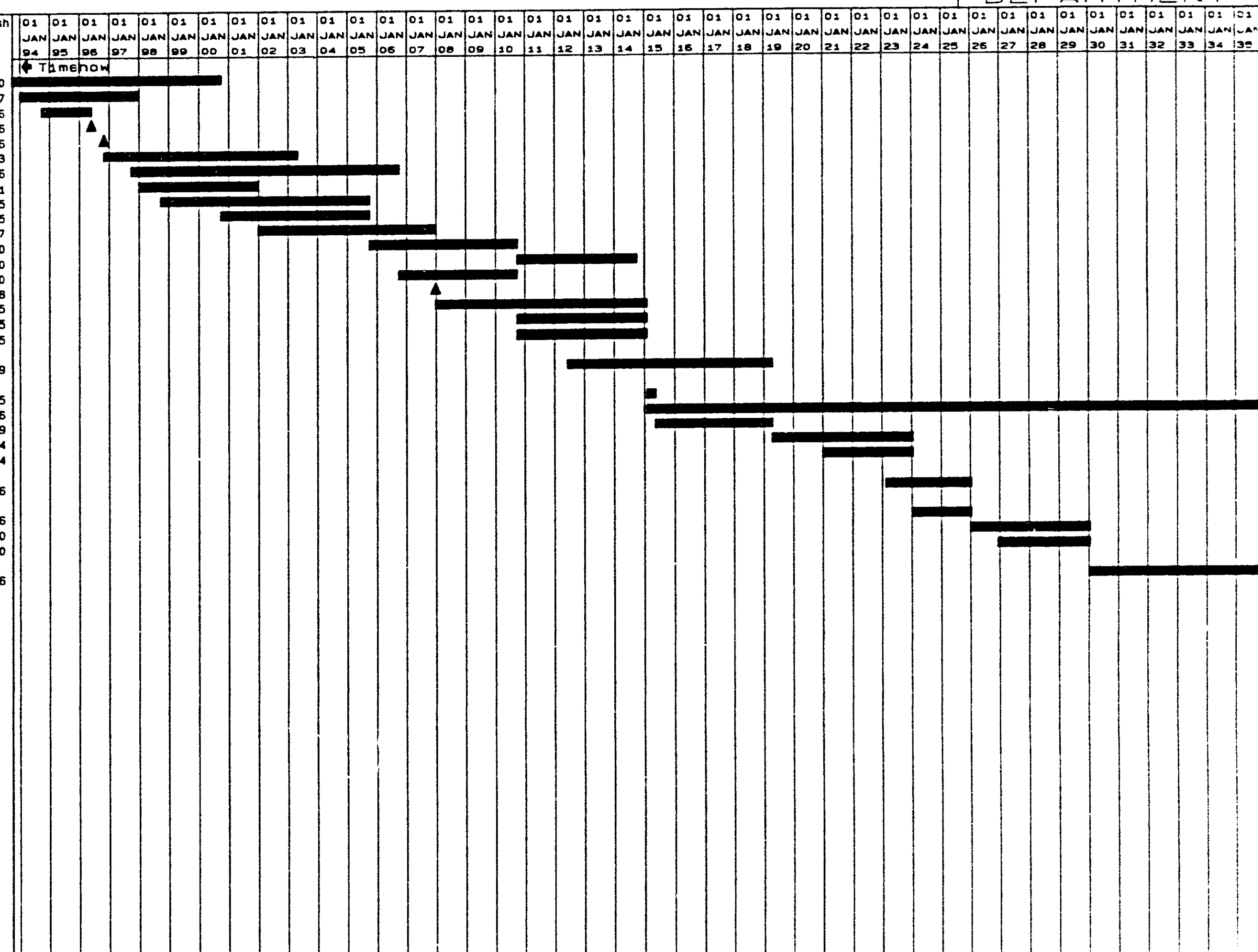

Figure F-14 Schedule Data for Case 8a

OPEN PLAN (R)

Report: XGRAFBAR
Project: OPTION8B
Time Now: 01OCT93
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Act	Description	WBS	Start	Finish
104	WIF RESEARCH		01OCT93	30SEP00
190	WIF PHASE 1 RESEARCH		01JAN94	31DEC97
136	INSTALL HLLW EVAPORATOR		01OCT94	30MAY96
102	START HLLW EVAPORATOR		31MAY96	31MAY96
100	START NWCF CALCINATION		01NOV96	01NOV96
134	NWCF CALCINATION		01NOV96	30APR03
112	CALCINE RETRIEVAL RESEARCH		01OCT97	30SEP06
192	WIF PHASE 1 DESIGN		01JAN98	31DEC01
132	PROCESS ENVIRONMENTAL PERMITTING		30SEP98	30SEP05
106	WIF DESIGN		01OCT00	30SEP05
194	WIF PHASE 1 CONSTRUCTION/TESTING/ORR		01JAN02	31DEC07
108	WIF CONSTRUCTION		01OCT05	30SEP10
130	CALCINE RETRIEVAL ENVIRONMENTAL PERMITTING		30SEP06	30SEP10
114	CALCINE RETRIEVAL DESIGN		01OCT06	30SEP10
162	START LIQUID BYPASS		01JAN08	01JAN08
196	WIF PHASE 1 HOT OPERATION		01JAN08	30JAN15
110	WIF TESTING & ORR REVIEW		01OCT10	30JAN15
116	BIN SET 1 & 2 RETRIEVAL CONSTRUCTION/TESTING/ORR		01OCT10	30JAN15
118	BIN SET 3 RETRIEVAL CONSTRUCTION/TESTING/ORR		16MAY14	15MAR21
138	BIN SET 1 RETRIEVAL OPERATION		31JAN15	15MAR16
128	WIF HOT OPERATIONS		31JAN15	31MAY45
140	BIN SET 2 RETRIEVAL OPERATION		16MAR16	15MAR21
142	BIN SET 3 RETRIEVAL OPERATION		16MAR21	15MAY27
120	BIN SET 4 RETRIEVAL CONSTRUCTION/TESTING/ORR		16MAY24	15MAY27
144	BIN SET 4 RETRIEVAL OPERATION		15MAY27	15MAY30
122	BIN SET 5 RETRIEVAL CONSTRUCTION/TESTING/ORR		17JUN27	15MAY30
146	BIN SET 5 RETRIEVAL OPERATION		16MAY30	15MAR36
124	BIN SET 6 RETRIEVAL CONSTRUCTION/TESTING/ORR		15FEB33	15MAR36
148	BIN SET 6 RETRIEVAL OPERATION		16MAR36	31MAY45

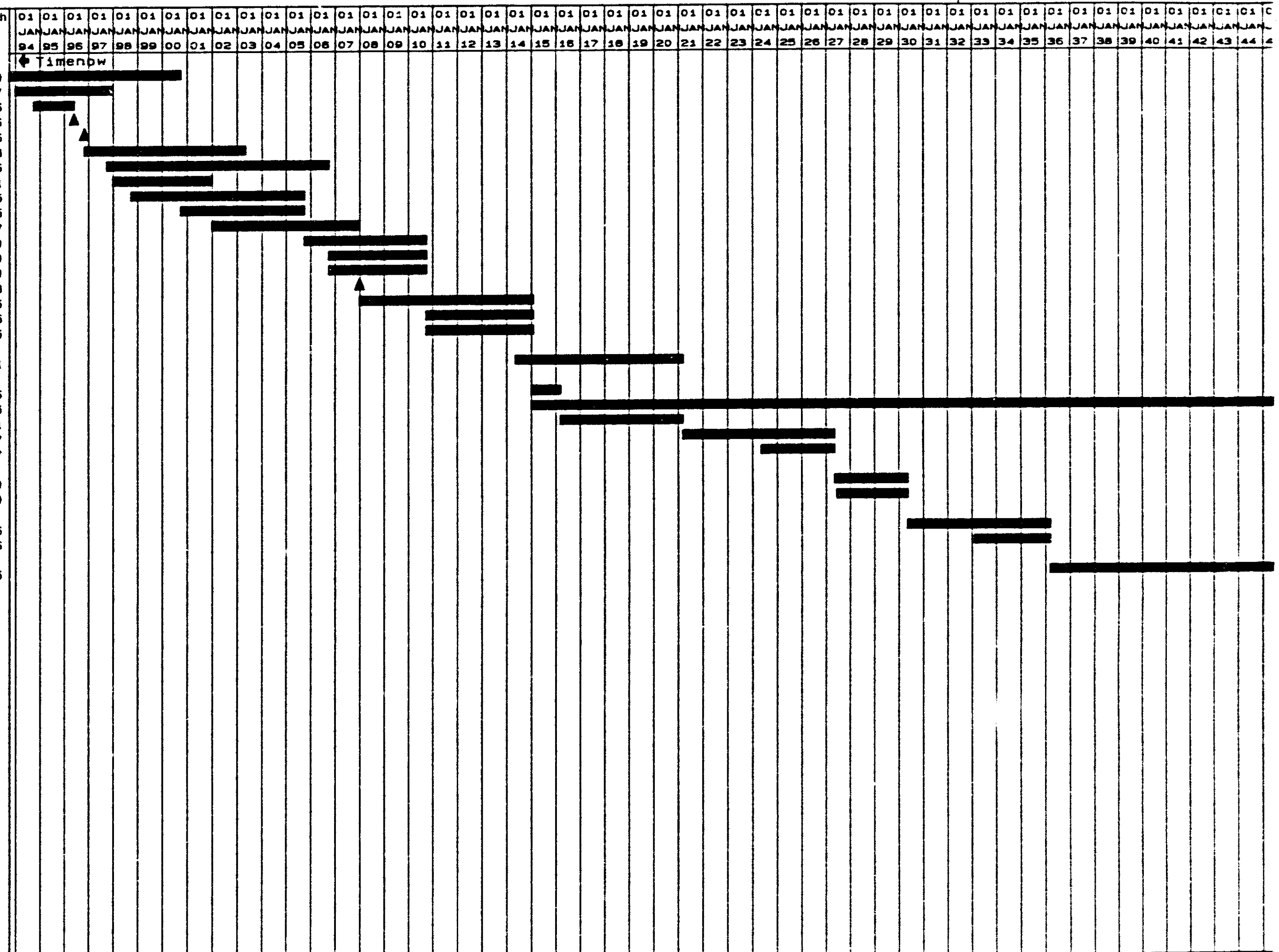

Figure F-15 Schedule Data for Case 8b

Attachment G

Use of Functional Requirements Weighting to Determine Case Ranking

Use of Functional Requirement Weighting to Determine Case Ranking

This attachment provides a model for the method used to rank the cases. In each case, the specific functional requirement values are normalized using a scale from zero to five, with the more attractive condition being assigned a higher value. The actual, unscaled values are given in Figure 19 in the body of the report. For example, Case 1 does not require any new tank capacity, so it is assigned the maximum value of five points. In the same way, Case 0b takes the maximum time to completion, so it is assigned a value of zero.

Weighting factors were generated for each of these criteria by the team. These consensus-derived weights reflect the relative importance of the specific functional requirements to the team.

A case's score is a sum of the functional requirement weight times its specific normalized value for each case. For example, Case 4b's overall ranking is derived from the product of its technical maturity value (1.51) times the weighting factor for technical maturity (0.135), plus the life-cycle cost value (2.1) times the weighting factor for life cycle (0.291), plus the total waste value (1.2) times the weighting factor for total waste (0.120), plus the tank volume value (4.8) times the weighting factor for tank volume (0.065), plus the 5-year cost value (1.4) times the weighting factor for 5-year costs (0.139), plus the completion time value (1.5) times the weighting factor for completion time (0.107), plus the meets regulations value (5.0) times the weighting factor of meets regulations (0.143).

Case 4b score = 2.34 =
(1.51 x 0.135) + (2.1 x 0.291) + (1.2 x 0.120) + (4.8 x 0.065) + (1.4 x 0.139) + (1.5 x 0.107) + (5.0 x 0.143)

Each of the other 13 cases are scored similarly. Based on these weighting factors, the case ranking is:

Case	Score
4a	2.37
4b	2.34
1	2.27
3	2.27
8a	2.17
8b	2.08
0a	2.00
5b	2.00
5a	1.95
6	1.85
2a	1.80
7	1.69
0b	1.60
2b	1.47

Different weighting factors will result in the cases being ranked differently. Readers may reevaluate the case rankings based on their own personal weighting factors.

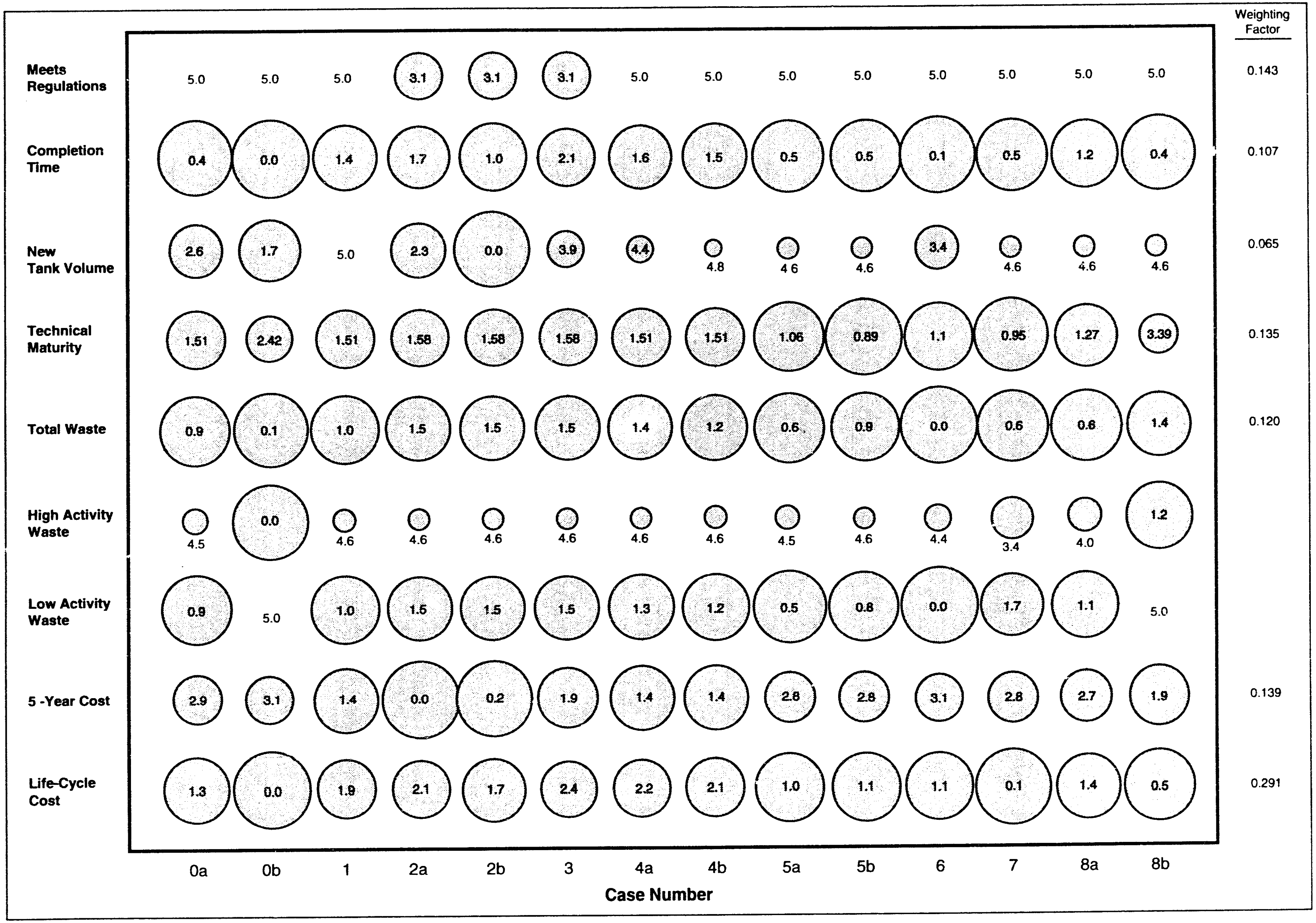

Figure G-1. Ranking Model.

NOTE: The areas of the circles on each row are inversely proportional to the corresponding numbers. In order to get good resolution, the normalization scale is different for each row of data.

DATE FILMED

4/20/94

END