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ROCKY FLATS SOLAR POND PROJECT

ANALYSIS OF COST AND SCHEDULE IMPACTS OF VARIOUS OPTIONS

FOR THE

REMEDIATION OF THE SOLAR PONDS

FINAL REPORT

Performed by ICF Kaiser Engineers

Under Contract to EG&G Rocky Flats

(Task No 234353GG/MTS No· 225456RR)

Volume I of II

March 18, 1993

ICF KAISER ENGINEERS

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LIST OF ACRONYMS

AIP	Agreement in Principle
ARARs	Applicable or Relevant and Appropriate Requirements
CA	Compliance Agreement
CAMU	Corrective Action Measures Unit
CDH	Colorado Department of Health
CDR/DCR	Conceptual Design Report/Design Criteria Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cu. Ft.	cubic feet
CX	Categorical Exclusion
DNFSB	Defense Nuclear Facility Safety Board
DOE	Department of Energy
DOE-HQ	Department of Energy-Headquarters
DOE-ONS	Department of Energy-Office of Nuclear Safety
DOE-RFO	Department of Energy-Rocky Flats Office
EA	Environmental Assessment
EC	Environmental Checklist
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Environmental Restoration
FONSI	Finding of No Significant Impacts
FR	Federal Register
FSAD	Final Safety Analysis Document
FY	Fiscal Year
HDPE	High Density Polyethylene
HNUS	Haliburton NUS
IAG	Inter-Agency Agreement
IAW	In Accordance With
IM/IRA	Interim Measures/Interim Remedial Actions
ITS	Interceptor Trench System
LCC	Life Cycle Costs
LDR	Land Disposal Restrictions
LLMW	Low Level Mixed Waste
M	million
NEPA	National Environmental Policy Act
NPL	National Priority List
NRC	Nuclear Regulatory Committee
NTP	Notice to Proceed
NTS	Nevada Test Site
OU	Operable Unit
PA	Protected Area
PRA	Probabilistic Risk Assessment
PSAD	Preliminary Safety Analysis Document
QA	Quality Assurance
RA	Readiness Assessment
RAD	Readiness Assessment Document
RCRA	Resource Conservation and Recovery Act

RCRA TSDF	RCRA Treatment, Storage, Disposal Facility
RFI/CMS	RCRA Facility Investigation/Corrective Measures Study
RFP	Rocky Flats Plant
RFO	Rocky Flats Office
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Studies
ROD	Record of Decision
ROM	Rough Order of Magnitude
RR	Readiness Review
SA	Safety Analysis
SAD	Safety Analysis Document
SO	System Operation
SPRP	Solar Pond Remediation Process
SWEIS	Site Wide Environmental Impact Statement
VE	Value Engineering
VERT	Venture Evaluation Review Technique
WAC	Waste Acceptance Criteria

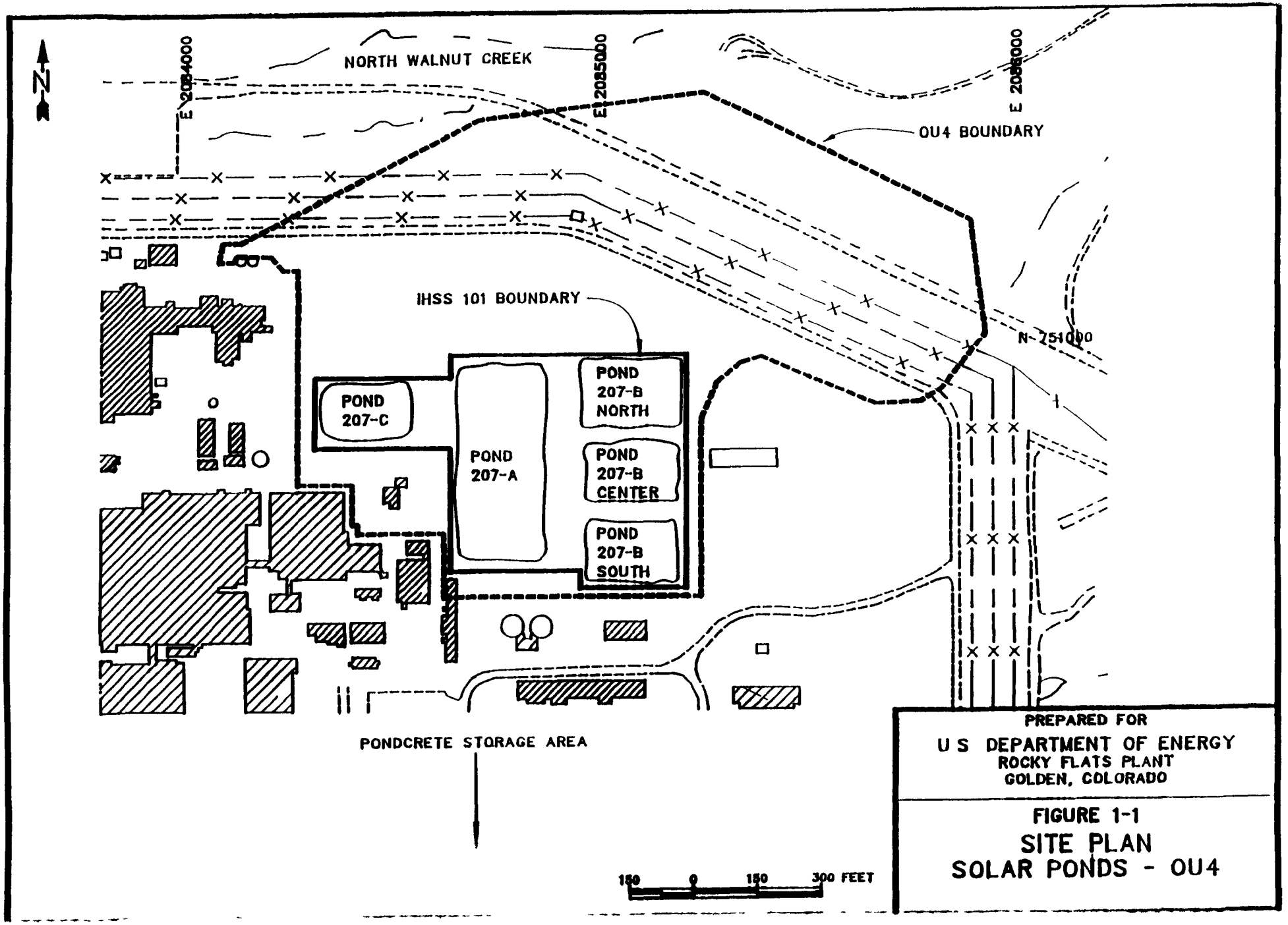
OPTIONS ANALYSIS SUPPORT REPORT

SPRP

March 18, 1993

1.0 INTRODUCTION AND BACKGROUND

Various waste stream storage, processing and disposal options have been postulated for the clean out and stabilization of the liquids and sludges present in the Solar Pond Complex (Ponds 207 A, B South, B Center, B North, C Pond Clarifier), shown in **Figure 1-1**, the restabilization of the existing stocks of out of specification treated wastes (pondcrete and saltcrete), and the final disposal of the entire stock of stabilized wastes The objective of the task summarized in this report is to analyze the various options with respect to technical maturity, regulatory feasibility, political practicality, schedule and cost and to determine the most viable approach for accomplishing the Solar Pond Remediation Program (SPRP) and proved input to the EG&G and DOE managers and decision makers responsible for the SPRP To enhance their ability to cope with uncertainty, the managers must use a reasoned, systematic approach to the decision making process For this task, a systems analysis technique entitled Probablistic Risk Analysis (PRA) was selected since it provides the decision-maker with a sophisticated tool to manipulate and analyze available information needed in making such decisions However, it should be emphasized that there is much more to making quality decisions than manipulating data, no matter how sophisticated the analysis. Quality decision making also includes· (1) carefully defining or framing the decision to be made, (2) generating creative, achievable alternatives, (3) developing meaningful, reliable information, and (4) applying logically correct reasoning in the PRA. These objectives were achieved though full interaction of EG&G staff knowledgeable in all of the activities and requirements associated with conducting a major environmental restoration project at Rocky Flats


N
E 2084000
NORTH WALNUT CREEK
E 2085000
E 2086000
OU4 BOUNDARY
IHSS 101 BOUNDARY
N-751000
POND 207-C
POND 207-A
POND 207-B NORTH
POND 207-B CENTER
POND 207-B SOUTH
PONDCRETE STORAGE AREA
150 0 150 300 FEET
PREPARED FOR
U S DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO
FIGURE 1-1
SITE PLAN
SOLAR PONDS - OU4

The first of the Solar Ponds was constructed in December 1953 to store and evaporate low-level radioactive process wastes Additional ponds were constructed at various times thereafter with the last pond (C Pond) constructed and put into operation in 1970 The ponds were removed from active use in 1986, except for Interceptor Trench System (ITS) water, as part of a compliance agreement between the Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Colorado Department of Health (CDH) Clean out and stabilization of the residual liquids and sludges began in the same year, and some of the stabilized wastes were shipped to Nevada Test Site (NTS) for disposal. In 1988 stabilization of pond contents was halted as process problems became apparent. The liquids and sludges became classified as mixed wastes in 1990 and disposal at NTS was concurrently halted since it was not licensed for mixed waste disposal. Since that time, the stabilized wastes in many of the containers have continued to exhibit signs of matrix failure, such as free liquids, and many of the containers are deteriorating In the early 1980's, the ITS was installed downgradient of the Solar Ponds and the intercepted groundwater was pumped back into the ponds for storage and treatment. A project was initiated in late 1990 to remove and stabilize the remaining liquids and solids in the ponds and to restabilize the stores of previously treated wastes In October 1992 this project was slowed due to cost overrun. Concurrently, a major effort was initiated by DOE and EG&G Rocky Flats, Inc., to identify treatment, storage and disposal options that might result in significant cost savings or an accelerated schedule for the clean out and closure of the ponds. As part of that effort, this task was initiated to apply probabilistic risk analysis techniques to compare the proposed options and determine which is the most realistic in terms of cost and schedule and has the highest probability of meeting the SPRP objectives

- Minimize impact on final Operable Unit (OU) 4 remediation schedule as stipulated in the Inter-Agency Agreement (IAG),

- Eliminate the Solar Ponds as a source of soil and groundwater contamination as soon as possible,
- Store and dispose of waste in accordance with all applicable regulations and waste disposal site acceptance criteria,

as well as conforming to regulatory or program constraints including

- Diversion of water recovered from the ITS from the ponds,
- Suspension of any further expenditures for the design, construction or operation of waste storage or processing facilities or for waste disposal until FY94, or until requested funds are made available.

This report evaluates the project Baseline and ten processing and storage options

- Baseline - Use existing contract with Haliburton/NUS (HNUS) to complete process trains and process C Pond and clarifier contents by October 1994, A/B Pond contents by October 1995, and begin reprocessing the stored pondcrete and saltcrete after the NTS repository is available
- Option 1 - Same as the Baseline except disposal would be at a commercial low level mixed waste facility Remix processing could proceed sooner.
- Option 2A - Reconstruct two of the ponds to meet Resource Conservation and Recovery Act (RCRA) standards, transfer pond contents into the two reconstructed ponds (segregating the C Pond and clarifier contents from the other wastes), store until a disposal site is available, then process to the waste acceptance criteria of that site.
- Option 2B - Construct two modular tanks inside the Protected Area (PA) near the ponds, transfer pond contents into the tanks (segregating pond contents as in Option 2A), store until a disposal site is available, then process to the waste

acceptance criteria of that site

- Option 2C - Construct two modular tanks outside the PA, transfer, store, and treat as in Option 2B
- Option 2D - Reline two B Pond cells (waiver of RCRA requirement for a clay liner), transfer pond contents into the two reconstructed ponds (segregating the C Pond and clarifier contents from the other wastes), install cover over the cells, store until disposal site is available, then process to the waste acceptance criteria of that site
- Option 2E - Use existing D-231 tanks to store pond contents until a disposal site is available.
- Option 3 - Use evaporator and spray dryer in Building 374 to process pond contents and store resultant dry solids as a waste pile until a disposal site is available
- Option 4 - Construct a RCRA landfill using B North, B Center and ½ of A Pond, remove pond contents, treat and place in cell and construct a RCRA cap (RCRA closure) Remixed pondcrete and saltcrete to be disposed in the RCRA deposited in the RCRA landfill.
- Option 4A - Stabilization and disposal of C Pond and A/B Pond wastes on-site in a RCRA landfill. Remixed pondcrete and saltcrete to be disposed in an off-site repository
- Option 4A - Treatment and off-site disposal of C Pond contents and the stored pondcrete/saltcrete and in-situ treatment and disposal of A/B Pond contents

This report also evaluates three disposal options off-site disposal at NTS, off-site disposal at the Envirocare commercial disposal facility in Utah, and on-site disposal. NTS is the proposed

disposal site for the Baseline Options 2A-2E, 3, 4A, and 4B, Option 1 is based upon disposal at Envirocare and Options 4, 4A and 4B are evaluated in conjunction with construction of a RCRA landfill.

A more detailed description of each option including the key assumptions, the major environmental impacts/benefits and the added cost elements is presented in Section 3

The following sections of this report summarize the findings and conclusions (Section 2), describe the technical approach (Section 3) and discuss the development and evaluation of the project schedule for each option (Section 4) These sections are followed by Section 5 which describes the cost estimate and evaluation for each option. The concluding section then provides the results of the probabilistic risk analysis of each option being completed within the schedule and for the estimated budget.

1.1 Regulatory Setting

Presented in this section is a discussion of regulatory matters related to the Solar Ponds. Information is presented on not only existing laws, regulations, and agreements but also certain proposed or draft regulations that have not yet been promulgated. While an attempt has been made to discuss and evaluate all pertinent regulations, detailed regulatory requirements are subject to interpretation and negotiation.

The text includes references to the Code of Federal Regulations (CFR) and the Federal Register (FR) where appropriate Federal regulatory citations are provided where Colorado regulations are equivalent to federal regulations or where a Colorado agency has enforcement authority for federal programs

1 1 1 Overview of Solar Pond Regulatory Status

The Solar Ponds are considered in this report to be a single RCRA interim status unit undergoing site characterizations and, potentially, remediation activities in response to both RCRA "closure" and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements A RCRA Part A Permit application in November 1980 established interim status for the Solar Ponds The first regulatory document that addressed closure and remediation of the Solar Ponds was the Compliance Agreement (CA) signed on July 31, 1986, by the EPA, CDH and DOE. The Solar Ponds were also the subject of a 1989 Agreement in Principle (AIP) signed by the Governor of the State of Colorado and by the Secretary of the DOE. The AIP required that all sludge be removed from the Solar Ponds, as well as shipping all pondcrete off-site, by October 1991 It has not been possible for Rocky Flats Plant (RFP) to comply with the schedule for sludge removal and pondcrete shipment identified in the AIP.

In January 1991, the CA and the documents required by it, were superseded by the IAG signed by the EPA, CDH, and DOE. The IAG creates a unique blending of RCRA and CERCLA requirements for interim status closure units outside the buildings, the IAG required that the site characterization work be broken up into two phases. Phase I characterizes soils and sources of contamination and determines the risk associated with the source of contamination at each interim status closure unit external to buildings. Following these Phase I characterization activities, an Interim Measures/Interim Remedial Actions (IM/IRA) decision document is to be prepared in accordance with Paragraphs 15 and 150 of the IAG The IM/IRA decision provides the information necessary to recommend an alternative consistent with the CDH closure regulations and address cleanup of all hazardous substance source areas with risk levels greater than 10^{-6} measured at the source Phase II site characterization and remediation activities address ground water contamination at these interim status closure units outside of buildings

Closure activities at the Solar Ponds have been ongoing since approximately August 1985 when activities related to sludge removal and treatment began on a nearly full-time basis Consistent with the desire to close the Solar Ponds, and consistent with the terms of the 1986 CA, a RCRA interim status closure plan for the Solar Ponds was submitted to EPA and CDH in August 1986 A slightly revised RCRA interim status closure plan for the Solar Ponds was submitted to the agencies in November 1986 An interim status closure plan, revised to address written and verbal comments received from CDH on the earlier closure plans, was submitted to the agencies in July 1, 1988. This final closure plan contained revisions in response to written and verbal comments from CDH and EPA regarding the March 1987 closure plan. None of the closure plans were approved by the agencies.

The first remedial action for the Solar Ponds was a 1992 IM/IRA. This IM/IRA addresses the design and construction of storage tanks and evaporators to store and treat contaminated groundwater collected in the Solar Pond area and is currently ongoing.

1 1.2 RCRA Interim Status Closure Regulations

RCRA regulations are much more specific and stringent than the CERCLA regulations and will, therefore, govern closure activities at the Solar Ponds The general requirements for closure of an interim status unit are identified in the RCRA interim status regulations (40 CFR 265.110 to 265.120). More specifically for interim status surface impoundments, the closure requirements are identified in 40 CFR 265.228. In general, the existing interim status closure regulations require that a unit must be closed in a manner that

- minimizes the need for further maintenance (40 CFR 265.111(a)),
- controls, minimizes or, eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous waste

constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere (40 CFR 265 111(b)), and

- allows completion of closure activities within 180 days after receiving the final olume of hazardous wastes at the hazardous waste management unit or facility or within 180 days after approval of the closure plan if that is later (40 CFR 265 113(b))

Extensions to the 180-day closure period are allowed if it is demonstrated that the closure activities will, of necessity, take longer than 180 days (40 CFR 265 113(b)(1)(i)), and all steps are taken to prevent threats to human health and the environment from the unclosed but not operating hazardous waste management unit, including compliance with all applicable interim status regulations (40 CFR 265 113(b)(2))

More specifically for closure of interim status surface impoundments, the regulations require that the closure either meet the requirements for a "clean closure" or the requirements for closure as a disposal unit (also known as a non-clean or "dirty closure") Clean closure is achieved through removal and decontamination of all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate The materials removed or decontaminated must be properly handled and disposed of, including potentially disposing of the materials as a hazardous waste (40 CFR 2665 228(a)(1)) Standards used to identify removal of all waste and contaminated materials are typically identified on a case-by-case basis. However, the following classes of soils are adequately "clean" to allow "clean closure"

- soils remaining in place that have no contaminants derived from the closing unit associated with them,

- soils remaining in place that contain background levels of contaminants (typically identified in Colorado as the mean background concentration plus or minus two standard deviations),
- soils remaining in place that are demonstrated through a risk assessment to pose a risk of less than 1 in 1,000,000, or,
- soils remaining in place that are demonstrated to meet some other soil standard protective of human health and the environment.

Closure as a disposal unit essentially requires that the surface impoundment area be closed in a similar manner as a landfill. Closure as a disposal unit requires that any free liquids present in the surface impoundments either be removed or solidified (40 CFR 265 228(a)(2)(i)), remaining wastes be stabilized to a bearing capacity sufficient to support final cover for the unit (40 CFR 256 228(a)(2)(ii), and, the surface impoundment be provided with a final cover (40 CFR 265.228(a)(2)(iii) In order to meet the requirements identified in 40 CFR 265 228(a)(2)(iii), the final cover must.

- provide long-term minimization of the migration of liquids through the closed impoundment,
- function with minimum maintenance,
- promote drainage and minimize erosion or abrasion of the cover,
- accommodate settling and subsidence so that the cover's integrity is maintained, and
- have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

The activities required to meet the above objectives are to be described in a written closure plan (40 CFR 265 112(a)) that is amended whenever changes are identified that affect the

closure plan (40 CFR 265.112(c)) Additionally, if the unit is to be closed as a disposal unit, a post-closure care and monitoring plan is also required (40 CFR 265 110(b))

1 1 3 CERCLA Requirements

CERCLA requirements are much more performance driven and, therefore, have fewer specific technical requirements associated with them when compared to the RCRA regulations. CERCLA clean-up standards applicable to federal facilities are set forth in Section 121 of CERCLA. For sites on the National Priorities List (NPL), the requirements are relatively clear. All legally Applicable or Relevant and Appropriate Requirements (ARARs) of federal environmental laws, and those requirements contained in state or local environmental laws that are more stringent than federal ARARs, must be applied to remedial actions at federal sites The ultimate determination of clean-up standards is discretionary and typically involves selection of the most stringent clean-up standard based upon an evaluation of both ARARs and a risk assessment that is completed for the site Since most of the activities identified under the CERCLA requirements have an equivalent counterpart identified in the RCRA regulations to which specific requirements are attached, further discussion of CERCLA requirements will not be presented in this document. One significant difference between CERCLA requirements and RCRA regulations is that under CERCLA, EPA has the authority to regulate the clean-up of radionuclides RCRA does not grant this authority to the EPA nor has Colorado adopted any rule which gives the CDH the authority to regulate radionuclides under the state RCRA regulations.

1 1 4 NEPA Integration with RCRA/CERCLA

The National Environmental Policy Act (NEPA) requires that federal facilities consider the

impact of their actions on human health and the environment. NEPA requirements are intended to ensure that reasonable alternative courses of action are identified and that the environmental consequences of proposed actions are investigated. NEPA requires that an Environmental Assessment (EA) be prepared for all activities that significantly impact the environment and that an environmental Impact Statement (EIS) be published for all major Federal projects At Rocky Flats Plant (RFP), the Solar Ponds are currently covered by the 1980 RFP EIS DOE has published its intent to prepare a EIS on the overall operations at RFP in the March 13, 1991, Federal Register The EIS will identify and assess potential impacts and present a full evaluation of the cumulative environmental impacts of all current operations and future actions, including proposed near-term environmental restoration activities at RFP

In addition, an evaluation is made of the potential environmental impacts of individual projects or action at DOE facilities in accordance with DOE order. For minor actions the completion of an environmental checklist (EC) is usually sufficient to establish that the action is covered by a categorical exclusion (CX) and no further NEPA documentation is required. For actions that have a greater potential for environmental impact, either an EA or an EIS will be completed. The decision to prepare an EIS rather than an EA is generally based upon the extent of the impacts and the degree of public interest.

NEPA requirements for the ER program are met by conducting an EA for OUs that may require a remedial action and integration of these EAs with the new facility EIS, which has been initiated by DOE. As stipulated in the IAG, NEPA documentation is prepared on portions of the remediation program that are ready for decision making in order to prevent any impact on the schedule for completion of Remedial Investigation/Feasibility Studies (RI/FS) and RCRA Facility Investigation/Corrective Measure Studies (RFI/CMSs) The environmental impact of the entire program will be included in the new RFP EIS. Further ER program EAs will be tiered from this

2.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of an analysis of the approach, schedule, cost, regulatory factors and political acceptability of a variety of options for treatment and disposal of the Solar Pond contents and stockpile The options analyses were based upon a PRA approach. First, discussions were held with EG&G staff and some of their subcontractors to develop 11 options that were evaluated in detail These 11 were subdivided as follows three options involved treatment and shipment off-site, four involve pumping the wastes to better containment vessels and storing until an off-site repository is available to accept all of the treated Solar Pond wastes (C Pond, A/B Pond and stockpiles), one option places all wastes in a RCRA landfill on-site, and two options use both an on-site RCRA landfill and off-site disposal. The three options relating to establishment of an on-site RCRA landfill were developed to provide bounding associations for cost. Other variations of treatment and disposal techniques are possible as part of the plan for an on-site RCRA landfill, but their costs are judged to fall within the bounds of Options 4, 4A and 5 The significant details of each option are presented in **Table 2-1.** For off-site disposal, two options were considered NTS and commercial disposal facility Next, engineering studies were undertaken to assess the technical feasibility of the options Those that were shown not to be technically viable were eliminated. This included Option 2E where the existing D231 tanks already have five feet of sludge in the bottom which cannot be reclaimed and Option 3 where evaporating/spray drying the A/B Pond contents using B374 facilities was not feasible because of the hazards created as well as clogging problems. The remaining processing, storage and disposal alternatives were then combined into a series of options for more detailed analysis and project schedules drafted.

The next assessment was of the extent and timeliness by which the options met the three major objectives of the Solar Pond Remediations Program (SPRP)

- Minimize impact on final OU4 remediation schedule as stipulated in the IAG,
- Eliminate the Solar Ponds as a source of either soil or groundwater contamination as soon as possible,
- Store and dispose of waste in accordance with all applicable regulations and waste disposal site acceptance criteria.

The results of the analyses of the options schedules, as summarized in **Table 2-2**, show the dates for key milestones for the nine remaining options which were used to further reduce the number of viable options For example, analysis of the schedule for Option 2C, pump/store current pond contents in two new above ground tanks outside the PA, showed it would require 2 years and 5 months longer than the Baseline and 18 months longer than the next longest option to completely eliminate the ponds as a source Therefore, it was decided by EG&G that no further work need be done on that option.

The information needed to assess each option was gathered through extensive interaction and interviews with EG&G experts in various activities such as processing, storage, RCRA permits, NEPA, Systems Operational (SO) Testing, readiness assessment (RA) and disposal. Each activity was subdivided into its various components and the ICF KE and EG&G team then assigned the most likely time duration and a probability of meeting that time duration. Thus, the probabilities of completing the activities are based upon the knowledge and experience of individuals who have been involved in these activities at Rocky Flats. The proababilities were substantiated by review by personnel with experience with the same activities at other DOE facilities Thus, the probabilities are subjective but are based upon historical experience. The data was used with additional information to generate schedule, costs and probability for the key activities and the complete option. In addition, the potential impacts upon OU4 remediation were assessed.

Once the schedule, costs and probabilities for each option were derived, checked and judged realistic, then the schedule for each option was evaluated to identify the critical elements or approaches that could result in significant changes in either cost or schedule. The elements and approaches determined to be most critical to the SPRP are:

- Date of off-site disposal site availability;
- RCRA permitting options (Part B or IM/IRA),
- NEPA process - level of environmental analysis required,
- Systems Operational Testing,
- Readiness Assessment,
- Funds availability,

and to a lesser degree,

- Delisting,
- Impact of F039 waste classification,
- Possible changes in waste acceptance criteria.

TABLE 2-1
SUMMARY OF SOLAR POND REMEDIATION PROJECT OPTIONS

- Baseline - Use existing contract with Haliburton/NUS (HNUS) to complete process trains and process C Pond and clarifier contents by October 1994, A/B Pond contents by October 1995 and begin reprocessing the stored pondcrete and saltcrete after the NTS repository is available

- Option 1 - Same as the Baseline except disposal would be at a commercial low level mixed waste facility Remix processing could proceed sooner.

- Option 2A - Reconstruct two of the ponds to meet Resource Conservation and Recovery Act (RCRA) standards, transfer pond contents into the two reconstructed ponds (segregating the C Pond and clarifier contents from the other wastes), store until a disposal site is available, then process to the waste acceptance criteria of that site.

- Option 2B - Construct two modular tanks inside the Protected Area (PA) near the ponds, transfer pond contents into the tanks (segregating pond contents as in Option 2A), store until a disposal site is available, then process to the waste acceptance criteria of that site.

- Option 2C - Construct two modular tanks outside the PA, transfer, store, and treat as in Option 2B.

- Option 2D - Reline two B Pond cells (waiver of RCRA requirement for a clay liner), transfer pond contents into the two reconstructed ponds (segregating the C Pond and clarifier contents from the other wastes), install cover over the cells, store until disposal site is available, then process to the waste acceptance criteria of that site.

- Option 2E - Transfer Solar Pond contents to the D213 tanks and store until an off-site repository is available

- Option 3 - Use evaporator and spray dryer in Building 374 to process pond contents and store resultant dry solids as a waste pile until a disposal site is available.

- Option 4 - Construct a RCRA disposal cell using B North, B Center and ½ of A Pond, remove pond contents, treat and place in cell and construct a RCRA cap (permanent on-site disposal).

- Option 4A - Stabilization and disposal of C Pond and A/B Pond wastes on-site is a RCRA disposal call Remixed pondcrete and saltcrete to be disposed in an off-site repository.

- Option 4B - Treatment and off-site disposal of C Pond contents and the stored pondcrete/saltcrete and in-situ disposal of A/B Pond contents.

TABLE 2-2

MILESTONES ASSOCIATED WITH OPTIONS
NTS DISPOSAL SITE

MILESTONES	DATE MILESTONE ACHIEVED								
	OPTION								
	Baseline	1 (Comm)	2A (NTS)	2B (NTS)	2C (NTS)	2D (NTS)	4	4A (NTS)	5
Notice to Proceed	10/93	10/93	10/93	10/93	10/93	10/93	10/93	12/93	10/93
* Ponds Eliminated as a Source									
- C Pond	11/94	11/94	5/96	7/96	1/98	5/96	7/96	7/96	11/94
- B Pond	11/95	11/95	8/96	10/96	4/98	8/96	10/96	10/96	8/96
* Sludge Treatment Comp									
- C Pond	11/94	11/94	11/98	11/98		11/98	11/99	5/99	11/94
- A/B Pond	11/95	11/95	11/99	11/99		11/99	11/00	11/99	2/00
- Remix	12/99	12/98	1/02	1/02		1/02	6/02	10/99	7/99
* Repository Available	12/97	10/95	12/97	12/97	12/97	12/97	10/98	10/98[1]	10/98[2]
Disposal In Repository Complete	2/00	5/98	4/02	4/02		4/02	6/02	4/00	2/00
* Start Phase I Rem.-OU4	2/97	2/97	2/97	2/97		2/97	2/97	2/97	2/97
End Phase I Rem.-OU4	2/99	2/99	2/00	2/00		2/00	2/00	2/00	2/00
* Start Phase II Rem.-OU4	2/00	2/00	2/00	2/00		2/00	2/00	2/00	2/00

* KEY MILESTONES

[1] On-site repository date/opening date for NTS is 12/97
[2] On site repository date No impact on schedule whether off-site repository is NTS or ENVIROCARE.

The approaches that have the most potential impact on the schedules of the various options are the NEPA and the RCRA permitting process. The impact of changes in the critical assumptions for these two areas on each remaining option is presented in **Table 2-3** The major impact is on Options 2A or 2D where the successful use of the IM/IRA permitting approach under RCRA also supports the reduction of the NEPA requirement from an EA to a CX thereby reducing the time required to eliminate the ponds as a source by a year.

The Life Cycle Costs (LCC) for each of the major elements of each option and for the complete options were estimated based upon the most likely schedule. A summary of the LCC's is provided in **Table 2-4** The cost for the options based upon the most likely schedule ranges from $376 million (M) for Option 4A to about $540M for Options 2A and 2D In addition, an assessment of the probability of public/political/regulatory acceptance/approval of the options was conducted and an overall probability of success established for each option. A PRA model, Venture Evaluation and Review Technique (VERT), was then used to determine the probable ranges in schedules and costs for those options with the highest probability for success.

Finally, all of this information was used to conduct a comparison of the three major elements for each option: cost, schedule and probability for success. This comparison is presented in **Table 2-5**

TABLE 2-3
CHANGES IN IMPACT OF CRITICAL ASSUMPTIONS ON KEY MILESTONES

CRITICAL ASSUMPTIONS						ASSOCIATED KEY MILESTONES					
						PONDS ELIMINATED AS SOURCE		TREATMENT COMPLETED			
OPTION	DISPOSAL OPTION	NEPA (STORAGE)	NEPA (SH,DISP)	RCRA	R.A.	C	A/B	C	A/B	REMIX	REPOSITORY AVAILABLE
Baseline	NTS	EA	–	Part B	EG&G only	11/94	11/95	11/94	11/95	12/99	12/97
	NTS	CX	–	IM/IRA	EG&G only	11/94	11/95	11/94	11/95	12/99	12/97
1	EC	EA	EA	Part B	EG&G only	11/94	11/95	11/94	11/95	12/98	10/95
	EC	CX	EA	IM/IRA	EG&G only	11/94	11/95	11/94	11/95	12/98	10/95
2A/2D	NTS	EA	–	Part B	EG&G only	05/96	08/96	11/98	11/99	01/02	12/97
	NTS	CX	–	IM/IRA	EG&G only	05/95	08/95	11/98	11/99	01/02	12/97
	EC	EA	EA	Part B	EG&G only	05/96	08/96	11/95	11/96	01/99	10/95
	EC	CX	EA	IM/IRA	EG&G only	05/96	08/96	11/95	11/96	01/99	10/95
2/B	NTS	EA	–	Part B	EG&G only	07/96	10/96	11/98	11/99	01/02	12/97
	NTS	CX	–	IM/IRA	EG&G only	01/96	04/96	11/98	11/99	01/02	12/97
	EC	EA	EA	Part B	EG&G only	07/96	10/96	11/95	11/96	01/99	10/95
	EC	CX	EA	IM/IRA	EG&G only	07/96	10/96	11/95	11/96	01/99	10/95
2C Deleted											
3 Deleted											

TABLE 2-3
CHANGES IN IMPACT OF CRITICAL ASSUMPTIONS
ON KEY MILESTONES

CRITICAL ASSUMPTIONS						ASSOCIATED KEY MILESTONES					
						PONDS ELIMINATED AS SOURCE		TREATMENT COMPLETED			
OPTION	DISPOSAL OPTION	NEPA (STORAGE)	NEPA (SH,DISP)	RCRA	R.A.	C	A/B	C	A/B	REMIX	REPOSITORY AVAILABLE
4	IN-SITU	EA	EIS	Part B	EG&G only	07/96	10/96	11/99	11/00	06/02	12/97
	IN-SITU	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	11/00	11/01	06/02	12/97
4A	IN-SITU/ NTS	EA	EIS	Part B	EG&G only	07/96	10/96	05/99	11/99	11/99	12/97
	IN-SITU/ NTS	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	05/99	11/99	11/99	12/97
	IN-SITU/ EC	EA	EIS	Part B	EG&G only	07/96	10/96	05/99	11/99	07/98	10/95
	IN-SITU EC	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	05/99	11/99	07/98	10/95
5	IN-SITU/ NTS	EIS	--	Part B	EG&G only	11/94	08/96	11/94	11/01	12/99	10/98 (12/97 NTS)
	IN-SITU/ EC	EIS	EA	Part B	EG&G only	11/94	08/96	11/94	11/01	03/97	10/98 (10/95 EC)

TABLE 2-4 SUMMARY OF LIFE CYCLE COST COMPARISON ($000)

OPTION/DESCRIPTION	PROCESS	WATER MANAGEMENT	REMEDIATE SOIL	PAD OPTS & STORAGE	TECH SUPPORT	PROJECT SUPPORT	SUB TOTAL	CONTINGENCY	ESC	TOTAL
BASELINE/NTS	$173,429	$25,500	$44,397	$108,248	$1,911	$16,191	$369,658	$56,485	$74,188	$500,331
BASELINE/ENVIROCARE	167,512	25,500	44,379	81,760	1,911	16,191	337,253	52,948	53,957	444,158
2A/RECEIVE PONDS - RCRA	171,812	25,500	44,399	112,068	2,321	19,041	375,121	56,735	108,495	540,351
2B/MODULAR TANKS - IN PA	171,809	25,500	44,379	108,823	2,321	19,041	371,876	56,411	108,328	536,615
2C/MODULAR TANKS - OUT PA										
2D/RELINE PONDS - NON RCRA	171,809	25,500	44,379	111,468	2,321	19,041	374,521	56,675	108,435	539,631
3/374 SPRAY DRYER	180,812	25,500	44,379	106,199	2,457	20,809	380,156	57,339	105,638	543,132
4/ON-SITE DISPOSAL	124,127	25,500	44,379	86,680	21,84	17,382	300,252	45,573	82,078	427,903
4A/PARTIAL ON-SITE DISPOSAL	96,630	25,500	44,379	84,184	1,911	16,191	268,795	44,283	63,230	376,308
5/PARTIAL ON-SITE DISPOSAL	139,779	25,500	44,379	107,371	1,911	16,191	335,131	51,350	70,752	457,233

TABLE 2-5 COMPARISON OPTIONS

OPTION	COST $ MILLION MIN	COST $ MILLION MOST LIKELY	COST $ MILLION MAX	SCHEDULE PROB FOR ACHIEVING SCHEDULE	SCHEDULE WORST CASE SCHEDULE SLIP (MONTHS)	PROBABILITY FOR SUCCESS	ISSUES RELATED TO PROBABILITY FOR SUCCESS
BASELINE/NTS	$485	$500	$538	85%	18	75%	Availability of NTS degradation of waste drums
BASELINE/EC (1)	432	444	584	80%	12	65%	Licensing of Envirocare for Pu completion of new procedure
2A	529	540	575	85%	18	85%	NTS opening on time, cost, EA sufficient.
2B	523	537	560	80%	18	60%	Removal of sludge from tanks
2D	529	540	575	85%	18	20%	Permitting of non-RCRA storage pond
4	414	428	460	80%	18	30%	Public and political restrictions to on-site disposal
4A	362	376	410	70%	18	30%	Public and political resistance to on-site disposal
5	443	457	491	80%	12	30%	Public and political resistance to on-site disposal

2.1 Conclusions

Evaluation of all of the potential options for the SPRP indicates the following

1) The least risk option is Option 2A. Relocating the C Pond and A/B Pond contents to fully compliant RCRA storage cells eliminates the Solar Ponds as a source almost as expediently as the Baseline (quicker if the IM/IRA approach is used for RCRA permitting) Further, the risk of added reprocessing caused by long term storage or changes in WAC is minimized since treatment is not started until the disposal site is available and all agreements, constraints, and permits are in place It also has less regulatory risk than any of the options except the Baseline. Finally, this option supports the continued consideration of an on-site RCRA landfill with minimal impact to the processing train.

2) The least cost option (4A) is not necessarily the best choice since all of the options that include on-site disposal are given a low probability for success due to the antipathy of the public and politicians toward leaving any contamination in any condition at Rocky Flats. In fact, this is why EIS is expected to be required for any on-site disposal option.

3) The second best option (Option 1), is to proceed with the Baseline and ship to Envirocare if the issues related to the Envirocare license and the changes in WAC can be resolved quickly (before October 1993) This option will virtually eliminate the risk of reprocessing since material will be shipped as soon as it is stabilized. However, any significant differences in the WAC as compared those to NTS would cause unacceptable delays and cost growth for process redesign, procedures re-work, etc. Also, there would be a $100M, cost impact if it is determined that DOE had to pay a higher disposal fee (an additional $120/cubic feet) because of the interstate compact relationships This would make Option 1 the most expensive

4) For the Baseline case and Options 1 through 2D, it was noted that actions or activities associated with obtaining additional storage could probably be classified under the IM/IRA process in accordance with the IAG It was determined that classification under the IM/IRA process could reduce by a year the scheduled time durations for activities requiring a RCRA Part B permit modification. In addition, NEPA/RCRA/CERCLA integration could eliminate the need for an EA, an EC and subsequent CX would suffice. In this case, the scheduled time duration could be decreased by 12-14 months For these options, it was also determined that Safety Analysis (SA)/NEPA integration could have an

impact on NEPA requirements In this case, the Safety Analysis Documents (SADs) would be initiated prior to the NEPA process and could provide the justification needed to classify the action under a CX.

5) The major risk for the Baseline case, and for all of the options that utilize the processing trains in the same sequence as the Baseline case, is the feasibility of accomplishing the SO Testing and approvals followed by the process train operations which must be done in a series within the 7 - 7 ½ months available time slot across warm weather If processing cannot be completed then, there will be between 6 months and a year delay in the schedule for completing either the C Pond processing or the A/B Pond processing. In fact, there could be delays in both, slipping the project schedules by 1 to 2 years total. This delay would add costs of about $11M to $23M for each occurrence

6) Slippage in the opening date for the off-site disposal facility could add about $23M per year in costs due to extended pad operations (storage) for any option that ships everything off-site Conversely, earlier opening dates for NTS (or other disposal options) would generate equivalent savings

7) The cost estimate for the OU4 Remediation is no better than Rough Order of Magnitude (ROM) since the remedial investigation (RI) process is not yet complete and the feasibility study has yet to be started. The costs are based on assumptions of no excavation of soils under the ponds. This assumption has a low probability for being valid.

8) Project schedules provided to ICF KE were reviewed and found to be inconsistent with respect to the appropriate sequence and scheduled time durations for similar RCRA and NEPA activities. In some cases (Baseline schedule), NEPA and RCRA were lumped together. In others there were regulatory flaws such as the definitive design preceding the completions of the NEPA documentation. This indicates that there is a need for the EG&G, NEPA, and RCRA personnel to provide briefings to the ER program staff about the NEPA and RCRA permit process.

9) Delisting is a critical activity with regards to options which involve shipping of treated waste to NTS for disposal. The probability of the delisting petition being approved by the regulators by 1995 is about 10 percent. It was determined in Section 4 1 that disposal to Envirocare may be a viable option by October 1995 Consequently, delisting becomes a less critical activity after 1995 if Envirocare is available. In addition, the probability of the delisting petition being approved by 1998 is only about 50 percent. Delisting becomes

even less critical after 1997 when the probability that any or all three repositories would be licensed to accept waste is better than 80 percent.

10) Options analysis comparable to this effort should be applied at the early stages of all environmental restoration (ER) projects at RFP

2.2 Recommendations

The most effective approach for the successful completion of the SPRP should consider the following.

1) It is recommended that EG&G and DOE initiate a project to construct two RCRA compliant storage cells at RFP and transfer the contents of C Pond Clarifier and A/B Pond into these cells This is the front end of Option 2A. This will provide maximum feasibility within the SPRP to continue with Option 2A or to shift any of the on-site disposal options should the probability for success for those options increase It would also meet the objective of closing the ponds as a source and reduce the risk of additional reprocessing.

2) Top priority also should be given to resolution of the licensing, waste acceptance criteria and compact questions associated with the Envirocare facility If Envirocare is able to accept SPRP treated waste by late 1995 and if there are no interstate compact charges, then the basic objectives are met and the Life Cycle Cost (LCC) is at least $50M less than Baseline If NTS is preferred, the same emphasis should be given to making it available as soon as possible.

3) The SO testing and subsequent approval process must be streamlined or decoupled from the operations schedule (done the previous summer) to assure success in meeting the processing schedule.

4) High level meetings should be held with the Governor of Colorado, the affected Congressional delegation, the Secretary of Energy, DOE Administrator, and EPA, at a minimum, to gauge the probability of approval of an on-site repository.

5) Adopting the IM/IRA permitting approach immediately for this project and all other ER projects in order to expedite schedule and reduce costs.

3.0 TECHNICAL APPROACH

The approach for this option analysis is based upon the identification of all of the critical

assumptions, activities, and events that are required to remove, treat, store, and dispose of the contents of the Solar Ponds as well as to remix the existing stockpiled solidified wastes for the Baseline case as well as the ten options These activities and events were assembled into a project schedule for each case. Analysis of each activity and event was conducted to ascertain the probability of each activity or event being completed either within the time duration estimated or by the planned schedule date Once the probability of achieving a given schedule was determined, the costs for achieving that schedule were estimated and the probability of exceeding or underrunning the most likely costs were determined. In addition, the probability was addressed of being allowed or authorized to proceed with each option within the present political, public and regulatory environment.

3.1 Discussion of Options Being Evaluated

A project Baseline and 10 processing and storage options were evaluated to determine the optimum approach for managing Solar Pond remediation activities. The activities associated with project Baseline and options are described in this section. With the exception of Options 1, (ship to a commercial facility), 4, 4A, and 5 (which require either an on-site RCRA landfill or a combination of both on-site and off-site disposal), the disposal option used is the NTS repository. In developing the option for an on-site RCRA landfill, an extensive series of alternatives were evaluated to the treatment and desposal techniques available and applicable to the four waste streams C Pond, A/B Pond, pondcrete, and saltcrete. The treatment techniques ranged from full cementation to in-situ drying for the pond contents and from liquid volume and reduction to small-size aggregate to recementation for the pondcrete and saltcrete. The disposal schedule considerations included either having all of the waste streams placed in the new on-site RCRA landfill or various waste streams such as C Pond on the pondcrete or saltcrete or both being

stabilized and sent to off-site disposal.

As the analysis progressed, it became apparent that for many of the alternatives within the on-site RCRA landfill option the difference in costs were less than the accuracy limits of the estimates so were statistically insignificant. For example, the alternative for cementation and placement onto the on-site RCRA landfill of all of the waste streams had a basic cost of about $225M ± 15% (± $33 75M). When compared to another alternatives such as reducing the pondcrete to a small size aggregate instead of reprocessing, the savings in the cementation element is basically off-set by the added costs due to the need (labor intensive) to strip-off and separate the wood and plastic and the transfer of the crushed pondcrete and saltcrete from the pads to the ponds. Thus, the possible cost differences for that alternative were much less than the estimate range (± $33 75M) Therefore it was agreed that it was not beneficial at this time to conduct detailed analyses on all possible alternatives. Instead, three options were developed that are believed to bound the possible costs of establishing a new RCRA landfill in conjunction with treating and sending either none or as many as three of the waste streams off-site. These options are included in this option analysis as Options 4, 4A and 5

The schedule for the key elements of all of the options are presented sequentially in Figure 3 1 1 at the end of this section.

3 1 1 Project Baseline

Currently, there are about 600,000 gallons of liquids and sludges in C Pond and clarifier and about 400,000 gallons of sludge in the three B Pond cells - South, Central and North. A Pond is empty Additionally, about 8,000 billets [about 216,000 cubic feet] of pondcrete and 2,600 billets [about 70,200 cubic feet] of saltcrete are in storage awaiting reprocessing An additional 15 billets of saltcrete are added to the stockpile every 3 weeks because of continual evaporation of

selected RFP waste streams The project Baseline consists of the following major elements·

- Treatment and solidification of C Pond and clarifier sludge and liquid.
- Treatment and solidification of A/B Pond sludge and liquid.
- Reprocessing of existing billets of saltcrete and pondcrete
- Storage of the resultant waste forms pending availability of a disposal site

After the ponds are emptied, pond closure would be accomplished as part of the OU4 Remediation. The summary Baseline project schedule is shown in **Figure 3.1.1.a.** The detailed Baseline schedule, showing all activities, is included as **Figure A-1** in Appendix A.

3 1 1 1 Key Assumptions

The project Baseline schedule and costs are based upon the following assumptions·

- Treated waste forms will satisfy waste acceptance criteria for NTS
- A categorical exclusion will suffice for the NEPA requirements associated with providing additional storage space
- CDH will approve requests for RCRA Part B permit modifications for the Remix process and additional storage.
- Funding will be available in FY 94 and be continuous through the duration of activities.
- The C Pond and clarifier contents will not be classified as F039 wastes. A/B Pond contents may be classified as F039 wastes, but this will not impact the schedule.

3 1 1 2 Comparison to Program Objectives

- Minimizes impact in OU4 remediation schedule
- Eliminates the Solar Pond as a source by October 1995

- Stores wastes in accordance with (IAW) applicable regulations
- Contains moderate risk that treated waste may not be disposable when repository becomes available due to either regulatory changes to Land Disposal Restrictions (LDR) or failure of treated waste while in storage.

3 1 1 3 Major Environmental Impacts/Benefits

- Schedule slips could impact OU4 Remediation.
- Removes source of soil/groundwater contamination

3 1 1 4 Cost

The most likely LCC, including contingency and escalation for the Baseline option with OU4 remediation, is approximately $500M. The cost of treatment and disposal of the Solar Pond contents and the stockpiled pondcrete/saltcrete, including the operation, maintenance, and inspection of the stored treated wastes, is approximately 80 percent of the LCC. The balance is associated with Water Management and OU4 remediation. A detailed discussion of the Baseline cost estimate is provided in Section 5 1 1

3 1.2 Option 1 Project Baseline Modified for Disposal at Commercial Facility

Option 1 consists of the following major elements.

- Treatment and solidification of C Pond and clarifier sludge and liquid.
- Treatment and solidification of A/B Pond sludge and liquid.
- Reprocessing of existing billets of saltcrete and pondcrete
- Storage of the resultant waste forms from the C Pond process pending availability of the Envirocare disposal site in October 1995. Processed wastes from the A/B

Pond and Remix would be shipped directly to the disposal site.

After the ponds are emptied, pond closure would be accomplished as part of the OU4 Remediation The Option 1 summary project schedule is shown in **Figure 3.1.1.b.**

3 1 2.1 Key Assumptions

The Option 1 schedule and costs are based upon the following assumptions

- Treated waste forms will satisfy waste acceptance criteria for the Envirocare facility. No major changes will be required in the pondcrete/saltcrete stabilization process.
- An EA will suffice for the NEPA requirements associated with disposal at the Envirocare facility
- CDH will approve requests for RCRA Part B permit modifications for the remix process
- Funding will be available in FY94 and be continuous through the duration of activities
- The C Pond and clarifier contents will not be classified as F039 wastes A/B Pond contents may be classified as F039 wastes, but this will not impact the schedule.

3 1 2.2 Comparison to Program Objectives

- Minimizes impact in OU4 remediation schedule.
- Eliminates the Solar Pond as a source by October 1995.
- Stores wastes IAW applicable regulations
- Slight risk that treated waste may not be disposable when repository becomes available due to either regulatory changes to LDR.

3 1 2.3 Major Environmental Impacts/Benefits

- Schedule slips could impact OU4 Remediation.
- Removes source of soil/groundwater contamination.

3 1 2.4 Cost

The most likely LCC including contingency and escalation for Option 1 including OU4 remediation is approximately $444M. The cost of treatment and disposal of the Solar Pond contents and the stockpiled pondcrete/saltcrete, including the operation, maintenance, and inspection of the currently stored wastes, is approximately 82 percent of the LCC The balance is associated with Water Management and OU4 remediation. A detailed discussion of the Option 1 cost estimate is provided in Section 5 1 2.

3 1 2.4 1 Cost Additives (Over Baseline)

- Cost for disposal at Envirocare is about 33 percent higher than at NTS
- Low probability that DOE would have to pay interstate compact costs of $120/cubic foot (currently not in estimate).

3 1 2.4 2 Cost Savings (Compared to Baseline)

- Over two years of pad operations costs eliminated.
- Cost of additional pad and tents might be eliminated depending on timing.

3 1.3 Option 2A. Pump/Store Current Pond Contents in Relined (Meeting RCRA Standards) Ponds Until Repository Available

The contents of B North and B Center are being consolidated into B South which has the

newest/best liner Precipitation residuals collected in A Pond, B North, and B Center will continue to be pumped to B South. Once emptied, the area under and around B North and B Center will be sampled for subsoil contamination. It is assumed that the subsoils will be sufficiently clean to not require removal of the ponds and liners. The two cells will then be relined to RCRA standards Once the relining is finished and a leak test completed satisfactorily, the contents of C Pond and Clarifier would be transferred to B North and the contents of B South transferred to B Center The contents would remain in these ponds, covered by liquid, until a repository becomes available At that time, the contents would be withdrawn and treated as necessary for shipment and acceptance by the repository The B North contents would be processed first using the C Pond process train (see Baseline case), then the B Center contents would be processed using the A/B Pond processing train. The existing billets would be remixed. Closure of the empty ponds, pads, and process areas would occur as a part of the OU4 remediation. The summary project schedule for Option 2A is presented in **Figure 3.1.1.c. Figure A-3** in Appendix A, is the detailed project schedule

3 1 3 1 Key Assumptions

The schedule and associated cost estimated for Option 2A are based on the following·

- Title II design cannot start before October 1994 due to budgetary constraints. However, work on preparatory activities such as permit modification, NEPA documentation, and procurement could proceed immediately.
- RCRA Part B permit modification will be received before August 1994 (reasonable estimate of time required to prepare modification and obtain approval is 18 months)
- An EC and a CX will suffice for the NEPA requirements.

- The contents of C Pond and clarifier and A/B Ponds must remain segregated due to RCRA rules and to facilitate stabilization since the contents of each pond requires a different process option.
- Repository not available before December 1997
- The classification of A/B pond contents as F039 wastes will impact neither the schedule nor cost of this option.

3132 Comparison to Program Objectives

- Achieves elimination of the Solar Pond as a source 11 months later than the Baseline (5 months sooner if IM/IRA approach used for permitting)
- No impact on the start date of OU4 remediation but delays completion of Phase I (soils) by 15 months.
- Meets all current storage and closure regulations and requirements.

3133 Major Environmental Impacts/Benefits

- Removes potential of liquids/sludges seeping into soils/groundwater
- Eliminates the risk of being required to reprocess stabilized wastes due to waste acceptance criteria changes.

3134 Cost

The LCC including contingency and escalation for the most likely schedule for Option 2A is approximately $540M. The cost of treatment and disposal of the Solar Pond contents and stockpiled pondcrete/saltcrete is almost 90 percent of the LCC since there is no change in the other major cost activities: Water Management and OU4 remediation. Further discussion of the

LCC is presented in Section 5 1 3

3 1 3 4 1 Cost Additives Over Baseline

- Cost of design/construction of lined ponds
- Transfer costs.
- Costs of demobilizing/remobilizing leased portions and maintaining government owned portions of the process trains.
- Cost of maintaining HNUS contract.
- Closure costs for removal of additional liners.
- Cost of RCRA Part B permit modification process.
- Added inspection and maintenance costs of relined ponds.
- Escalation of pushed out work.

3 1 3 4 2 Cost Savings (Compared to Baseline)

- No additional storage space costs.
- Reduced cost of inspection and maintenance of stored stabilized wastes.

3 1 4 <u>Option 2B Pump/Store Current Pond Contents in Two New Above Ground Modular Tanks Until Repository Available</u>

Two modular tanks will be installed inside the PA, both to the east of B Pond. One tank will be 152 feet in diameter and the other one will be 117 feet in diameter. Both will be 10 feet high and double lined [a 100 mil. high density polyethylene (HDPE) primary liner and 80 mil. HDPE secondary liner] Both will be open (floating cover is an undesirable option) The contents of C Pond and clarifier will be pumped to one of the new tanks and the contents of A/B

Ponds will be pumped to the other new tank. The contents will remain in these tanks until a repository becomes available At that time, the contents would be withdrawn and treated as necessary for shipment and acceptance by the repository The treatment sequence would be identical to the Baseline case (1) the contents from the tank containing the C Pond liquids/sludges would be processed first, (2) the tank containing A/B Pond contents then pumped to the A/B process train for processing, and (3) the stored billets then remixed. Closure of the tanks, pads, and process is identical to the process that would occur as part of the OU4 remediation. The summary schedule for Option 2B is shown in Figure 3 1 1 d. **Figure A-4**, in Appendix A, is the detailed project schedule

3 1 4 1 Key Assumptions

The schedule and cost estimate for Option 2B used in this analysis is based upon the following

- This option would require an EA, which requires at least 18 months for preparation/approval.
- Title II design cannot start until NEPA process is completed.
- A waiver to allow Title I design parallel with the NEPA process will be granted.
- RCRA Part B permit modification can be started concurrently with the NEPA process but cannot be completed until after the Title II design is completed.
- The contents of C Pond and clarifier and A/B Ponds must remain segregated due to RCRA rules and treatability considerations.
- Repository not available before December 1997
- C Pond and A/B process trains will be mostly demobilized/remobilized, with preventive maintenance on purchased equipment.

- The tanks will not be heated, so the sludge is liable to freeze in the winter
- No provisions are made for removing the sludge other than pumping over the sides of the tank. The sludge may solidify and be difficult to remove, which is similar to the current situation.
- The tanks will not be covered.
- Pond B South will serve as a contingency if a tank leaks.
- Bermed containment area not required.
- No impact on cost or schedule if A/B pond contents are classified as F039 wastes

3 1 4 2 Comparison to Program Objectives

- No impact on OU4 remediation start date but delays end date of Phase I by 15 months to accommodate tank removal and possible treatment/excavation of spills under the tank.
- Eleven month delay in elimination of Solar Ponds as a source as compared to Baseline Delay is reduced to 5 months if IM/IRA process is used and if EC/CX is acceptable under NEPA.
- Storage and disposal of treated wastes meet all regulatory requirements

3 1 4 3 Major Environmental Impacts/Benefits

- Eliminates risk of being required to reprocess stabilized wastes due to changes in waste acceptance criteria.
- Leaves liquids/sludges in existing ponds until October 1996 (continuing potential for seepage)

3144 Cost

The LCC including contingency and escalation for the most likely schedule for Option 2B is approximately $537M. The cost of treatment and disposal of the Solar Pond contents and stockpiled pondcrete and saltcrete is almost 90 percent of the LCC since there is no change in the other major cost activities· Water Management and OU4 remediation. Further discussion of the LCC is presented in Section 5 1 4.

31441 Cost Additives (Over Baseline)

- Cost of design/procurement/construction of tanks
- Transfer costs
- Costs of maintaining and demobilization/remobilization of process trains See Option 1
- Closure costs for removal of tanks.
- Cost of EA and permit modifications
- Cost of relocating C Pond front end equipment.
- Cost of inspection/maintenance of tanks

31442 Cost Savings (Compared to Baseline)

- No additional storage costs.
- Reduced cost of inspection/maintenance of stored stabilized wastes.

315 Option 2C Pump/Store Current Pond Contents in Two New Above Ground Modular Tanks Outside The PA

Three modular tanks would be installed outside the PA but within the main plant site.

Two tanks would be used to store the pond contents and the third would be for contingencies Two tanks would be 152 feet in diameter and one would be 117 feet in diameter All three would be 10 feet high and double lined (a 100 mil. HDPE primary liner and 80 mil. HDPE secondary liner) All three tanks would be open (floating cover is an undesirable option.) The contents of C Pond and clarifier will be pumped to one of the new 152 feet tanks and the contents of A/B Ponds will be pumped to the new 117 feet tank. The contents will remain in these tanks until a repository becomes available At that time, the contents would be withdrawn and treated, as necessary, for shipment and acceptance by the repository. The contents from the tank containing the C Pond liquids/sludges would be processed first and the tank containing A/B Pond contents then pumped to the A/B process train for processing (see Baseline case.) Closure of the tanks, pads, and process areas would occur as part of the OU4 remediation. The summary project schedule for Option 2C is shown in **Figure 3.1.1.e.**

3 1 5 1 Key Assumptions

The schedule for Option 2C used in this analysis is based upon the following

- This option would require an amendment to the RFP EIS, which would require at least 36 months for preparation/approval.
- Title II design cannot start until NEPA process is completed.
- RCRA Part B permit modification can be started concurrently with the NEPA process but cannot be completed until after the Title II design is completed.
- The contents of C Pond and clarifier and A/B Ponds must remain segregated due to RCRA rules and treatability considerations.
- Repository not available before December 1997
- C Pond and A/B process trains will be mostly demobilized/remobilized, with

preventive maintenance on purchased equipment.

- The tanks will not be heated, so the sludge could freeze in the winter
- No provisions are made for removing the sludge other than pumping over the sides of the tank. The sludge may solidify and be difficult to remove This is similar to the Baseline situation or to Option 2A or 2B
- The tanks will not be covered.
- All of the Solar Ponds would be RCRA closed as soon as the units are transferred to the new tanks
- Bermed containment area is not required since the tanks are double lined.

3 1.5 2 Comparison to Program Objectives

- Delays OU4 remediation start date by 1 to 4 months.
- Thirty-two month delay in elimination of Solar Ponds (finally empty in April 1998) as a source compared to Baseline. Removal from ponds actually not completed until after the projected opening date of NTS repository (December 1997)
- Storage and disposal of treated wastes meet all regulatory requirements

3 1 5 3 Major Environmental Impacts/Benefits

- Eliminates risk of being required to reprocess stabilizes wastes due to changes in waste acceptance criteria.
- Leaves liquids/sludges in existing ponds until April 1998 (continuing potential for seepage)

3154 Cost

The estimated LCC cost for Option 2C is $538.5M. However, this option is deemed non-practical due to time constraints associated with preparation of an EIS and the likelihood that the EIS would not be approved. The LCC cost for this option would include the costs associated with Option 2B plus costs for preparing an EIS (approximately $1M) and costs for maintenance and pad operations pending approval of the EIS.

31541 Cost Additives (Over Baseline)

- Cost of design/procurement/construction of tanks.
- Transfer costs.
- Costs of maintaining government equipment and demobilization/remobilization of leased equipment indicated in the process trains.
- Costs of extending HNUS contract.
- Closure costs for removal of tanks.
- Cost of EA and permit mods
- Cost of relocating both process trains to outside the PA.

31542 Cost Savings (Compared to Baseline)

- No additional storage, maintenance, or instruction costs for stabilizes waste form.

316 Option 2D Pump/Store Current Pond Contents in Modified Relined Ponds (No Clay Liner Required)

This Option is identical to Option 2A described in Section 3.1.3 above except both cells will only require installation of an additional liner and leak detection system. The clay liner

requirement specified by RCRA is anticipated to be waived by the EPA and CDH. Once the relining is finished and a leak test completed (passed) the contents of C Pond and the clarifier would be transferred to B North and the contents of B South transferred to B Center Floating covers with runoff collection/diversion systems would be installed in each cell. At that time, the contents would be withdrawn and treated, as necessary, for shipment and acceptance by the repository The B North contents would be processed first using the C Pond process train (see Baseline case), then the B Center contents would be processed using the A/B processing train. After the ponds were empty, closure would occur as part of the OU4 remediation. The summary project schedule for Option 2D is presented in **Figure 3.1.1.f.** The detailed schedule is shown in **Figure A-5** in Appendix A.

3 1 6 1 Key Assumptions·

The schedule and associated cost estimated for Option 2D are based on the following

- Title II design cannot start before October 1994 due to budgetary constraints However, work on preparatory activities such as permit modification, NEPA documentation and procurement could proceed immediately
- RCRA Part B permit modification will be received before August 1994 (reasonable estimate of time required to prepare modification and get approval is 18 months).
- An environmental checklist and a categorical exclusion will suffice for the NEPA requirements.
- The contents of C Pond and clarifier and A/B Ponds must remain segregated due to RCRA rules
- Repository not available by December 1997

- The classification of the A/B Pond contents as F039 wastes will not impact the implementation schedule for this option.
- Floating covers can be designed and installed that will not be affected by either high winds or snow loads

3 1 6 2 Comparison to Program Objectives

- Achieves elimination of the Solar Pond as a source 11 months later than the Baseline (5 months sooner than the Baseline schedule if IM/IRA approach is used for permitting)
- No impact on the start date of OU4 remediation but delays completion of Phase I (soils) by 15 months to accommodate removal/closure of emptied B Pond cells
- Meets all current storage and closure regulations and requirements

3 1 6.3 Major Environmental Impacts/Benefits

- Removes potential of liquids/sludges seeping into soils/groundwater
- Eliminates the risk of being required to reprocess stabilized wastes due to waste acceptance criteria changes.

3 1 6 4 Cost

- The LCC including contingency and escalation for the most likely schedule for Option 2D is approximately $540M. The cost of treatment and disposal of the Solar Pond contents and stockpiled pondcrete and saltcrete is almost 90 percent of the LCC since there is no change in the other major cost activities: Water Management and OU4 remediation. Further discussion of the LCC is presented

in Section 5 1.5

3 1 6 4 1 Cost Additives (Over Baseline)

- Cost of design/construction of lined ponds
- Transfer costs
- Costs of maintaining government owned equipment and demobilization/remobilization of leased equipment from the process trains.
- Costs of extension of HNUS contract.
- Closure costs for removal of covers and additional liners.
- Cost of RCRA Part B permit modification process.
- Inspection and maintenance costs of ponds

3 1 6 4 2 Cost Savings (Compared to Baseline)

- No costs required for additional storage space or for maintenance/inspection of newly produced stabilized wastes

3 1 7 Option 2E Use D231 Tanks for Storage

This option considers the use of the D231 Tanks for storage of sludge, pending a final decision on treatment and disposal. The sludge would be slurry pumped to the tanks. EG&G has evaluated this option and determined it to be unfeasible for technical reasons (1) the tanks currently provide surge capacity for storage of plant liquid waste when the evaporator is out of operation. This capability would be lost if the tanks were used for sludge storage, (2) sludge removal from the tanks would be difficult, (3) chemical reactions could overstress and accelerate corrosion of the tanks. No further analysis was performed for this option.

3 1 8 Option 3 Building 374

This option uses Building 374 evaporator's spray dryer system to process the sludge from C Pond. Sludge from A/B Pond would be processed using the A/B Baseline process because the high level of suspended solids in this sludge make it in compatible with the spray dryer The current inventory of pondcrete and saltcrete would be processed through the Baseline Remix process

Pond sludge would be trucked to Building 374 because a pipeline of the required length would probably clog. The dried salt that would be produced by the spray dryer would be an oxidizer as defined in 49 CFR 173 151 As a result, a new storage facility would have to be constructed that satisfied UBC Group H accident requirements. It would take approximately 5 years to permit and construct this facility Processing time through the spray dryer would be approximately 25 months due to low throughput of the equipment. The total time required, therefore, to eliminate C Pond as a source of contamination would be approximately 7 years for this option. (See the summary project schedule, Figure 3 1.1.g) The total estimated LCC cost for this option is $543M. The overall LCC is high since the dried salts still require final processing for disposal. Included in final processing costs would be up front costs for characterization, treatability, process design and construction. No further analysis was done on this option.

3 1 9 Option 4 In-Situ Disposal

Option 4, in-situ disposal, consists of relining B Ponds North and Center and approximately half of A Pond. Pond sludge will be processed and disposed of in the relined ponds The existing inventory of saltcrete and pondcrete will also be disposed of in the relined ponds. A RCRA cap will be installed over the waste. The summary project schedule is presented in **Figure 3.1.1.h.** The detailed project schedule is **Figure A-6**, Appendix A.

3191 Key Assumptions

The Option 4 schedule and costs are based upon the following assumptions:

- An EIS and a separate RCRA Part B permit will be required.
- Pond sludge will require treatment and stabilization prior to disposal.
- Existing inventories of pondcrete and saltcrete will require reprocessing prior to disposal. The Baseline Remix process will be acceptable.

3192 Comparison to Program Objectives

- Eliminates risk of reprocessing waste due to changes in NTS/Waste Acceptance Criteria (WAC)
- Eliminates the ponds as a source of contamination approximately 4 years later than the project baseline case.
- Impacts OU4 remediation strategy but not the remediation schedule.

3193 Major Environmental Impacts/Benefits

- Establishes a precedent for on-site final disposal of waste at RFP
- Will impact the remediation strategy for OU4
- Removes the source for soil and groundwater contamination.

3194 Costs

The LCC, including contingency and escalation, for the most likely schedule for Option 4 is approximately $516M. The cost of treatment and disposal of the Solar Pond contents and stockpiled pondcrete and saltcrete is almost 80 percent of the LCC since there is no change in the other major cost activities: Water Management and OU4 remediation. Further discussion of

the LCC is presented in Section 5 1 7

3 1 9 4 1 Cost Additives (Over Baseline)

- Costs of design and construction of relined ponds.
- Cost of RCRA Part B process.
- Cost of preparing an EIS.
- Transfer costs
- Cost of maintaining government owned portions and of demobilization/mobilization of leased portions of the process train.
- Costs of extending HNUS contract.

3 1 9 4 2 Cost Savings (Compared to Baseline)

- Transport and disposal costs to NTS
- No costs for additional storage.
- Costs for shipping containers.
- Costs of providing a separate processing train for A/B Ponds (C processing train will be used for both ponds as volume reduction and is not a pressing issue in this scenario)

3 1 10 Option 4A. In-situ Disposal of C Pond and A/B Pond Sludges, Off-Site Disposal of Remix.

Option 4A consists of stabilization and in-situ disposal of C Pond and A/B Pond Sludge. The sludges will be denitrified, dried, and capped in place. Remix material will be processed per the Baseline scenario and shipped to NTS The summary project schedule is shown in **Figure**

3.1.1.i. The detailed schedules are shown in Figure A-7, Appendix A.

3 1 10 1 Key Assumptions

- An EIS and a separate RCRA Part B permit will be required for a disposal facility
- Soils under ponds B North or B Center are sufficiently clean to preclude need for removal as part of OU4 remediation.
- Funding will be available in FY94 and continues through the duration of activities.
- Classification of pond contents as F039 wastes will not impact schedule or cost of this option.

3 1 10.2 Comparison of Program Objectives

- No impact on OU4 Phase I Remediation schedule.
- Eliminates C Pond as a source 21 months later than Baseline. Eliminates A/B Ponds as a source 6 months later than Baseline.

3 1 10 3 Major Environmental Impacts/Benefits

- Establishes a precedent for on-site final disposal for waste at RFP
- Will impact the remediation strategy for OU4.
- Removes the source for soil and groundwater contamination.

3 1 10 4 Cost

The LCC, including contingency and escalation for the most likely schedule, for Option 4A is approximately $376M. The cost of treatment and disposal of the Solar Pond contents and stockpiled pondcrete and saltcrete is almost 70 percent of the LCC since there is no change in

the other major cost activities. Water Management and OU4 remediation. Further discussion of the LCC is presented in Section 5 1 8.

3 1 10 4 1 Cost Additives (Over Baseline)

- Costs of design and construction of relined ponds.
- Cost of RCRA Part B process.
- Cost of preparing an EIS.
- Costs of pond sludge transfer
- Cost to dry sludge
- Costs to renegotiate HNUS contract.

3 1 10 4 2 Cost Savings (Compared to Baseline)

- Reduction and/or elimination of C Pond Clarifier and A/B Pond sludge processing requirements
- Reduction in transportation and disposal costs.

3 1 11 Option 5. Treatment/Off-Site Disposal of C Pond and Stockpiled pondcrete/saltcrete, In-situ Disposal of A/B Pond Contents

For this Option, implementation of the C Pond Reprocessing plan would be initiated in FY94 with the stabilized waste going to storage until an off-site repository is available. Concurrently, work would begin on the EIS for establishment of an on-site repository for the remaining contents of A/B Pond. At the same time either B Center or B North will be relined as discussed in Option 2A and the remaining contents of A/B Ponds transferred into that cell.

The contents would remain in the relined cell, uncovered, until the NEPA and permitting

processes were completed and would then be dried and denitrified in place in the cell which would be closed with a RCRA cap Finally, once an off-site repository becomes available, the stockpiled pondcrete/saltcrete would be remixed and shipped to the repository Closure of the storage pads, processing areas and other ponds would occur as a part of OU4 remediation. The summary project schedule is shown in **Figure 3.1.1.j** and **Figure A-8**, Appendix A, is the detailed schedule

3 1 11 1 Key Assumptions

- Treated C Pond and Remix wastes forms will satisfy the WAC for NTS
- An EIS will be required as well as a separate RCRA Part B permit for a disposal facility
- CDH will approve requests for RCRA Part B permit modifications for the Remix process.
- Funding will be available in FY94 and be continuous through the duration of activities
- Soils under either Pond B North or B Center are sufficiently clean to preclude need for removal as part of OU4 remediation.
- The classification of B North/Pond contents as F039 wastes will not impact schedule or cost of this option.

3 1 11 2 Comparison to Program Objectives

- No impact in OU4 Phase I remediation scheduled start date but delays end date by a year
- Eliminates the C Pond as a source by October 1995 and eliminates A/B Pond as a

source by August 1996 (9 months later than baseline schedule)

- Stores wastes in accordance with applicable regulations.
- Moderate risk that treated waste may not be disposable when repository becomes available due to either regulatory changes to land disposal restrictions (LDR) or failure of treated waste while in storage

3 1 11 3 Major Environmental Impacts/Benefits

- Removes source of soil/groundwater contamination.
- Reduces risks associated with treatment/transport of A/B Pond wastes.
- Requires permanent dedication of one cell as a mixed waste repository

3 1 11 4 Cost

The LCC, including contingency and escalation for the most likely schedule for Option 5, is approximately $457M. The cost of treatment and disposal of the Solar Pond contents and stockpile saltcrete and pondcrete is almost 80 percent of the LCC since there is no change in the other major cost activities· Water Management and OU4 remediation. Further discussion of the LCC is presented in Section 5 1 9

3 1 11 4 1 Cost Additives (Over Baseline)

- Cost of EIS
- Cost of design/construction/inspection/maintenance of relined B Pond Cell. Cost of RCRA closure of B Pond cell used as disposal facility
- Transfer costs (A/B Pond contents to relined cell)
- Costs of RCRA Part B Process

3 1 11 4 2 Cost Savings (Compared to Baseline)

- Cost savings from elimination of need for stabilization of A/B Pond contents
- Reduced costs for additional storage space
- Costs of remediation one B-Pond cell are saved.
- Costs of shipping/disposal of A/B pond contents.

3.2 Discussion of Basic Concepts of PRA as Applied to Decision Making

A manager is often faced with extremely complex decisions when important information is unavailable or is associated with uncertainty and when the outcome of the decision may not be known for years The manager's role as a decision-maker is to identify, evaluate, and compare alternative courses of action. Since risk is involved in any activity, successful managers must be able to identify possible risks associated with alternatives and then assess the likelihood that one or more of these risks will occur To enhance their ability to cope with uncertainty, the managers must use a reasoned, systematic approach to the decision making process. For this task, a systems analysis technique entitled Probablistic Risk Analysis (PRA) was selected since it provides the decision-maker with a sophisticated tool to manipulate and analyze available information needed in making such decisions However, it should be emphasized that there is much more to making quality decisions than manipulating data, no matter how sophisticated the analysis. Quality decision making also includes (1) carefully defining or framing the decision to be made, (2) generating creative, achievable alternatives, (3) developing meaningful, reliable information, and (4) applying logically correct reasoning in the PRA. These objectives were achieved though full interaction of EG&G staff knowledgeable in all oh the activities and requirements associated with conducting a major environmental restoration project at Rocky Flats

The first step in any PRA is to build a model. This model should include consideration of all the possible activities required in achieving various goals and milestones. Consideration should be given to the cost, time, and performance variables associated with each of these activities. The uncertainties in these variables is taken into account by assignment of probabilities. Each activity is linked to other activities by use of logic chains.

After the model is constructed, experiments are conducted using random numbers and Monte Carlo techniques to test out the consequences of various aspects of the model. During

this process the analyst gains insights concerning key aspects that are needed in refining the understanding of the task being modeled. After the model has been tested and refined, the consequences predicted by the model are analyzed and used by the decision maker in determining the appropriate trade offs between time, cost, and performance The analysis is used as a basis for selecting a particular course of action.

For this Options Analysis task, the PRA software, Venture Evaluation Review Technique (VERT), was selected. VERT was originally developed for the U S Army Logistics Command but has been extensively used by other Federal agencies. Recently, for example, VERT was used for a PRA of the cost and schedule for the Hanford Waste Vitrification Plant. Results of the PRA conducted during this task are presented in Section 6.0 Output from the model is included in Appendix D

3.3 Discussion of Basic Concepts of Activities and Logic Chains

DOE projects normally are planned, funded, and implemented under the guidelines of DOE 4700 1 This document requires that project funding be obtained through approval of a progression of design and cost/schedule estimates. The progression starts with the definition of the problem and the subsequent development of a feasibility study. This study derives a budgetary estimate for the development of a feasible approach to solving the problem. Based on the feasibility study, funding is obtained to develop a functional design criteria which DOE normally approves. The criteria is then used as the basis for the development of a conceptual design report. This report contains the detailed cost estimate which becomes the basis for congressional funding of capital projects or in this case as input to the development of the operations budget for the entire project. The estimate is required to delineate all costs design, construction, licensing, project management, operations as well as the contingency and escalation

estimates based on the projected project schedule

Complimentary to the design/funding process set forth in DOE Order 4700 1 are the supporting and controlling activities such as NEPA review, permits/licensing approvals, procurement, plant operations, safety analysis, and readiness assessments. The extent of involvement of these activities must be defined in terms of both cost and schedule in order to develop realistic baseline schedules and cost estimates for the entire project. Some activities, such as NEPA review, are critical path activities in that the project cannot proceed to definitive design until the NEPA review is complete. The NEPA process is dependent upon approval by authorities above/outside of DOE and RFO or EG&G Other activities such as procurement are essential and could cause schedule delays but are generally within the management authority and control of EG&G or DOE-RFO

Only after funding approval can a definitive design proceed. Even then the detailed design engineering and licensing (permits), construction and operation efforts are restricted to work within the allowable contingencies of the approved cost and schedules. Any deviation above these values requires new funding approval. DOE 4700 1 requires close monitoring of the project to assure that these cost and schedule guidelines are met.

Using the basic DOE 4700.1 approach, the options analysis team reviewed the SPRP and developed a list of activities to be considered and integrated into the logic chain for each option in order to develop an estimate of the probability of success of completing each option within the currently estimated most likely schedule and associated costs. The list of activities incorporated or considered as part of the logic chain for each option are presented in **Table 3-1** and the logic

Table 3-1
MASTER ACTIVITIES EVALUATED

ACTIVITY	SUBELEMENTS AND ISSUES
Planning Studies	Purpose, objectives, applicable regulations, general criteria
Selection of Appropriate Technology/Process	Feasibility studies, treatability studies, CDR/DCR, technical criteria
NEPA Approval	EC/CX, EA or EIS or amendments to EA's or EIS's
RCRA Approvals	Either Part B permit modifications or IM/IRA modifications, changes in criteria (e.g., F039 ruling)
Design/Engineering	Title I, Title II and value engineering (VE)
Procurement	Preparation of packages, solicitation of bids, award of bids, negotiation of contract.
Safety Analysis	PSAD done before construction starts, FSAD done before processing starts
Readiness Assessment	Procedures documents, training program, cold start/hot start results, FSAD, disposal site application status
Construction	Mobilization, erection, training of erection and operating crews
SO Testing	Cold start, hot start, FSAD, DOE review/approval
Treatment	Weather delays, breakdowns, work stoppages, product failure
Storage	Space, configuration, curing duration
Shipment	Rail, truck or combination
Disposal	Site available (licensed) application/approved, shipping schedule established. Choice of NTS, commercial site or in-situ disposal
Delisting	Petition preparation, negotiations, approval/disapproval, to delist processed water
Budget	Funds available/FY vs Need
Demobilization	Disassemble, cleanout, RAD scans, relocation/removal

chains developed for each option is included in Appendix B. Input data sheets were derived for each activity which addressed all of the factors that could affect the probability of that activity being completed in either a specific time duration or between specified start/end dates. These input data sheets are included in Appendix C

In developing the logic diagrams, major emphasis was placed on identifying the sequential and simultaneous activities which must be completed and how they relate to each other Two examples of this logic are. (1) prior to the completion of the process design activity all of the simultaneous NEPA activities must be completed, and (2) completion of the process design and procurement of equipment activities is required for erection to be completed.

To develop the probabilities that each of the activities listed on the logic diagrams can be performed or accomplished within the approved cost and schedule, many inherent variables unique to that activity were examined with EG&G, HNUS and ICF KE personnel. As an example of the information sought, the following were some of the questions which required examination for the activity of "Design/Engineering"

- Is there an approved design criteria?
- If so, did the criteria define all of the functional requirements?
- Was a conceptual design produced which defined the current project cost and schedules?
- Is funding available to complete the design?
- Has there been adequate validation of the estimates?
- Have all NEPA requirements been satisfied?
- Is the contractor capable of performing the design within the scheduled time and cost?
- What has been set up between the contractor and EG&G to assure that the

criteria is being satisfied?

- What form of documentation and document control is maintained?
- Are there formal Engineering and Project change control systems in place?
- Are there dedicated personnel tracking and making sure regulatory requirements are being satisfied prior to the scheduled need dates?

Using the input from these examinations, probabilities of success were established for each activity shown in the logic diagrams

Each activity was investigated with the person currently responsible for the completion of that activity The currently scheduled start and completion dates, the scope of the activity, as well as possible problems that could affect successful completion were evaluated. Based on these discussions, the subtree logic was created for the individual activities In some instances it was found that events outside the subject activity were essential to the successful completion of that activity For example, because of current storage capacity limitations either some of the C Pond treated waste will have to be shipped to a permanent disposal site or additional pad storage will be required before the A/B process waste can be treated. The probability of shipment of the C Pond treated wastes is very low for the Baseline system, therefore, the additional storage becomes the pacing input to the logic and, hence, controls successful initiation and completion of the activity of "treatment" for A/B Pond process.

These logic diagrams and the associated data about each activity (i.e , the start and finish dates, minimum, most likely and maximum duration, the budgeted cost, the probabilities of successfully meeting these cost and schedules, etc.) are input to the VERT risk analysis program discussed in Section 3.2 which calculates the overall probabilities of each of the numerous sequence of events being completed successfully.

3 3 1 Baseline

The Baseline Process includes the C Pond waste treatment system, the A/B Pond waste treatment system and the Remix system as well as all permitting, storage, shipping, site closure and site restoration. The Baseline Solar Pond project is defined as starting with the identification of the waste streams such as C Pond Waste and ending with OU4 site closure and remediation. However, the options analysis conducted as part of this task only addressed activities associated with the treatment, storage, and disposal of the pond contents and stockpiled solidified wastes and the impact of these options on the OU4 remediation schedule. The project Baseline has been represented by the logic diagrams for C Pond Processing, A/B Pond Processing, and Remix. This Baseline logic is tied together to provide an overall probability of success This probability will be compared to the probability of success of each of the remaining options.

The Baseline Process starts in October 1993 (start of FY94) It begins with the completion of the C Pond process erection which was interrupted due to lack of DOE funding. Some of the normal process logic such as "selecting the appropriate technology" and "process design" have already been completed and are not shown on the diagram. The shown activities correlate to the Baseline project schedule except where there are specific activities such as obtaining any required DOE waivers during erection. These items are shown to reflect that last minute problems occur which require prompt attention or schedule slippage will occur.

After treatment, the C Pond wastes are shown to have three possible dispositions.

1 Some of the half crates could be rejected by Quality Assurance (QA) Those crates will go to storage until the remix process is ready to accept and remix them.

2. A disposal site may be ready which could accept delivery of the treated waste. In this case the waste will be shipped, immediately after curing, to the disposal site.

3 No site is available at this time, and the treated waste must be sent to on-site

storage until a site is available which will accept this treated waste While in storage there is a possibility that the waste acceptance criteria may change creating a need for the stored, treated waste to be reprocessed.

Also shown at the end of the C Pond logic is "demobilization." At this point, some of the C Pond equipment becomes available for use in the A/B Pond process stream, hence, the A/B Pond equipment erection cannot be completed until the C Pond treatment is complete and this equipment is available.

The A/B Pond logic includes one additional step, "process design." Otherwise this logic is the same as that of C Pond logic. The only additions are: (1) that the completion of the erection of the A/B Pond system is dependent on C Pond equipment being available, and (2) that when the A/B Pond equipment is demobilized, some of that equipment is required to complete the Remix process stream.

The Remix logic starts with the completion of the "treatability studies" and has a similar erection interface with A/B Pond demobilization. It does, however, have numerous waste forms (pondcrete, saltcrete, reject C Pond pondcrete, reject A/B Pond pondcrete as well as rejected remix process treated waste) The shipping and storage options are the same as the C Pond and A/B Pond treated waste except for the logic that there may be a change in waste acceptance criteria (WAC) that would require reprocessing before the disposal site would accept this waste form. If this condition occurs, it is possible that the new WAC may or may not be compatible with the Baseline Remix process and packaging system. In this case the logic terminates since the possible changes in WAC are unknown, and there is no logical basis to establish a probability

3 3 2 Option 1

The logic diagram for Option 1 is essentially the same as the Baseline logic diagram

throughout the treatment activity for each of the processes: C Pond, A/B Pond and Remix. However, since there is a high probability that the commercial disposal facility (Envirocare) will be available by October 1995, the disposition of the treated waste from each process is reduced to two

1 Some of the treated wastes is rejected by QA and must be stored pending start of the Remix process line

2. Disposal at the commercial facility immediately after curing

All other elements and activities shown in the Baseline logic diagram, such as demobilization, process design, treatability studies, etc are still valid for Option 1

3 3.3 Option 2A

The logic diagram starts with a Notice to Proceed (NTP) in October 1993 to begin the NEPA approval, RCRA permitting, design, liner construction, and transfer of C Pond and A/B Pond waste into the two newly lined cells of B Pond. After this activity the waste will be stored until the disposal site is available Then the waste will be treated by the Baseline process trains which will be erected and operated with the same logic as before The major change will be that subsequent to treatment the shipping or storage options are reduced to either that of staging and shipping the treated waste directly to the disposal site or to storage of rejected waste billets for later reprocessing.

3.3 4 Option 2B

This option is the same as Option 2A except instead of relining the two solar ponds, lined modular tanks are to be erected near the existing solar ponds and the wastes stored in these tanks until a disposal site is available

The logic is identical to Option 2A except the permitting/licensing activities reflect the logic and time required for an EA as well as a RCRA Part B modification to permit new tanks. This delays the start date of the definitive design in comparison to Option 2A since the NEPA process must be completed before funds can be obligated for design.

3 3.5 Option 2C

This option is the same as Option 2B except three lined modular tanks are to be erected outside the PA where the waste will be stored until a disposal site is available

The logic is identical to Option 2B However, an internal review by EG&G staff determined that this option should be discarded since it would be in violation of the current plant-wide EIS Amending the EIS would require an additional 3-5 years. This schedule delay is considered unacceptable for two reasons. First, it would not eliminate the Solar Ponds as a source until the Spring of 1998 (almost 3 years later than the Baseline schedule) and second, the NTS is projected to open before the tanks could be built and the waste transferred.

3.3 6 Option 2D

This option is the same as Option 2A except the CDH has indicated a willingness to waive the requirement for clay liners under the new Hypalon liners for the two storage cells to be constructed in B Pond. The logic is identical to Option 2D. The potential cost and schedule reduction made possible by elimination of the clay liner, however, is considered offset by the added requirements for floating covers installed over the cells.

3 3 7 Option 4

Option 4 consists of stabilization of waste into relined ponds. The ponds to be relined are

North, Center, and approximately half of A Pond. C Pond and A/B Pond wastes will be transferred to the relined ponds pending completion of an EIS and a RCRA permit which will be required prior to beginning of waste processing. The process will be the same as the Baseline processing system except half crates will not be used. Instead, a process of layering the stabilized sludge (including the remixed pondcrete/saltcrete) in the ponds will be used. The C Pond processing train will be relocated and used for both C and A/B Pond treatment. Shipping and disposal to NTS will not be required.

The logic chain is based on the Option 2A logic chain with the addition of the logic chains for EIS preparation and approval and RCRA Part B permit.

3 3 8 Option 4A

In this option, Pond C and A/B Pond are dewatered, denitrified and disposed on-site in a RCRA cell in the same manner as Option 4 The Remix process proceeds according to the Baseline with the remixed pondcrete and saltcrete being shipped to NTS. As with Option 4, and EIS and a RCRA permit for the on-site disposal probably will be required.

The logic chain starts with the Option 2A schedule to reline the ponds, incorporate the EIS and RCRA Part B logic chain and ends with logic chains for the drying and denitrifying process and disposal and closure of the facility The Remix logic chain is independent of the C and A/B Pond logic chain. It is uncertain whether work can begin in October 1994 or will be delayed due to funding constraints

3.3 9 Option 5

This option calls for the processing of C Pond waste in accordance with the Baseline schedule In addition, an EIS will be initiated for the proposed use of an on-site RCRA landfill

of the A/B Pond contents Concurrently, one of the B Pond cells will be relined and used for interim storage of the A/B Pond contents During the EIS process (estimated to have a most likely duration of 5 years), the NTS repository opens, the treated C Pond wastes are shipped and the stockpiled pondcrete and saltcrete are remixed and shipped to the NTS for disposal. After EIS approval, the B Pond cell contents are denitrified and dried in place, covered and capped as a closed RCRA landfill.

The logic chain couples the Baseline C Pond Processing logic chain with the first part of the logic chain for Option 4 (pond relining through the EIS process) The Baseline Remix logic chain is also incorporated but starts at an earlier date since there is no need to process the A/B Pond contents that were transferred to the relined B Pond cell. The chain also includes the denitrifying/drying process and the cell closure

FIGURE 3 1 1 SUMMARY PROJECT SCHEDULES cont

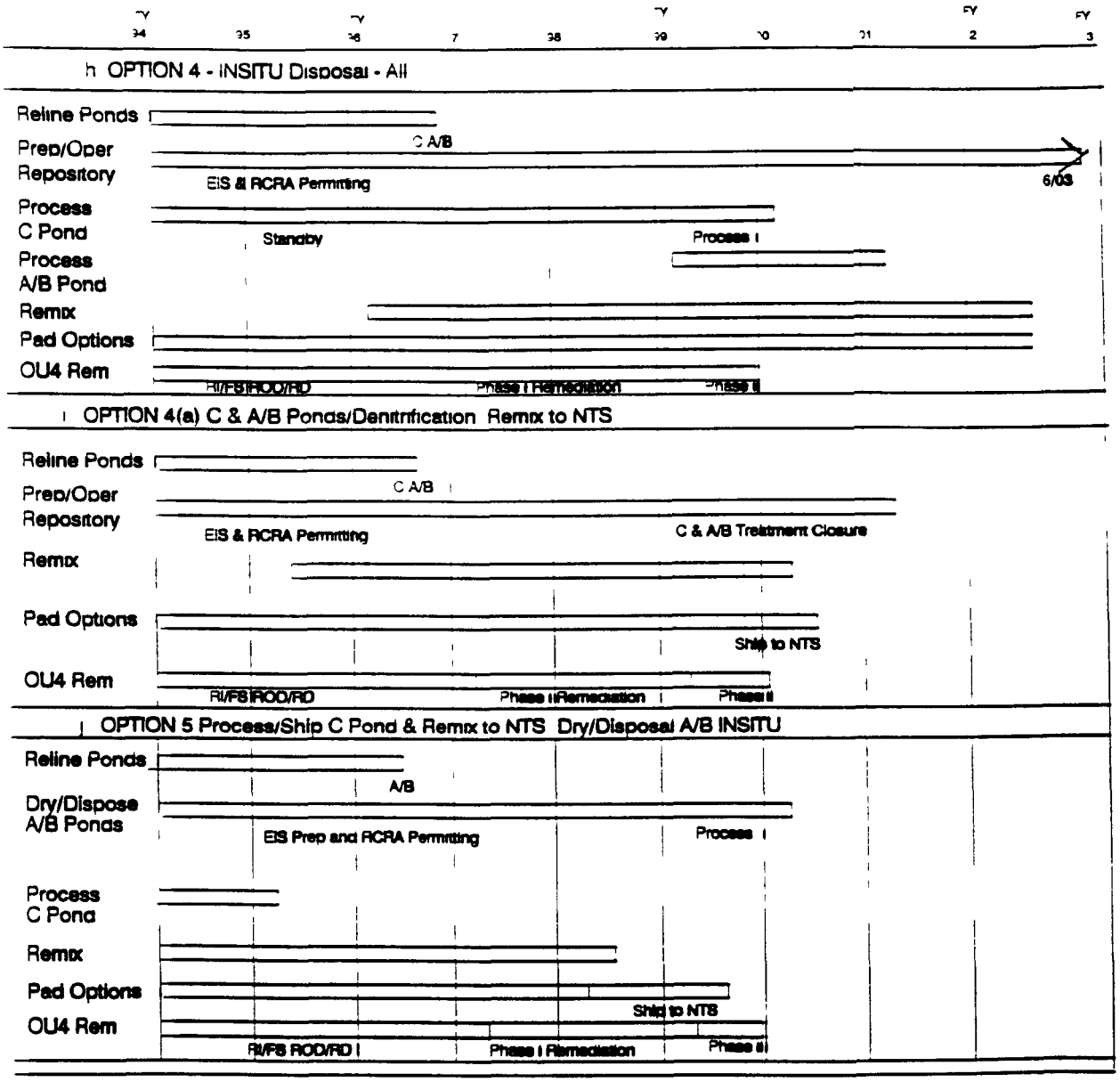


FIGURE 3 1 1 SUMMARY PROJECT SCHEDULE

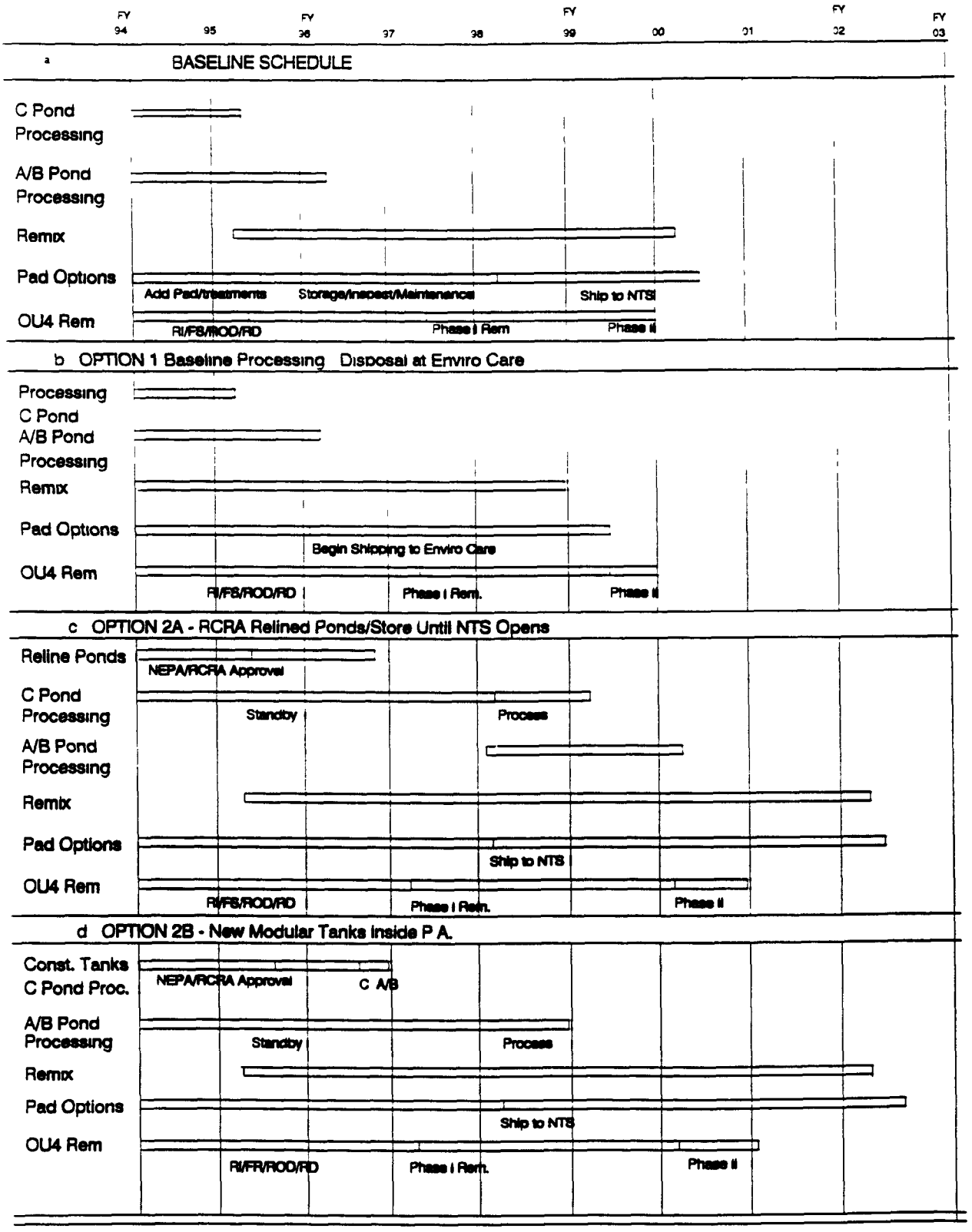
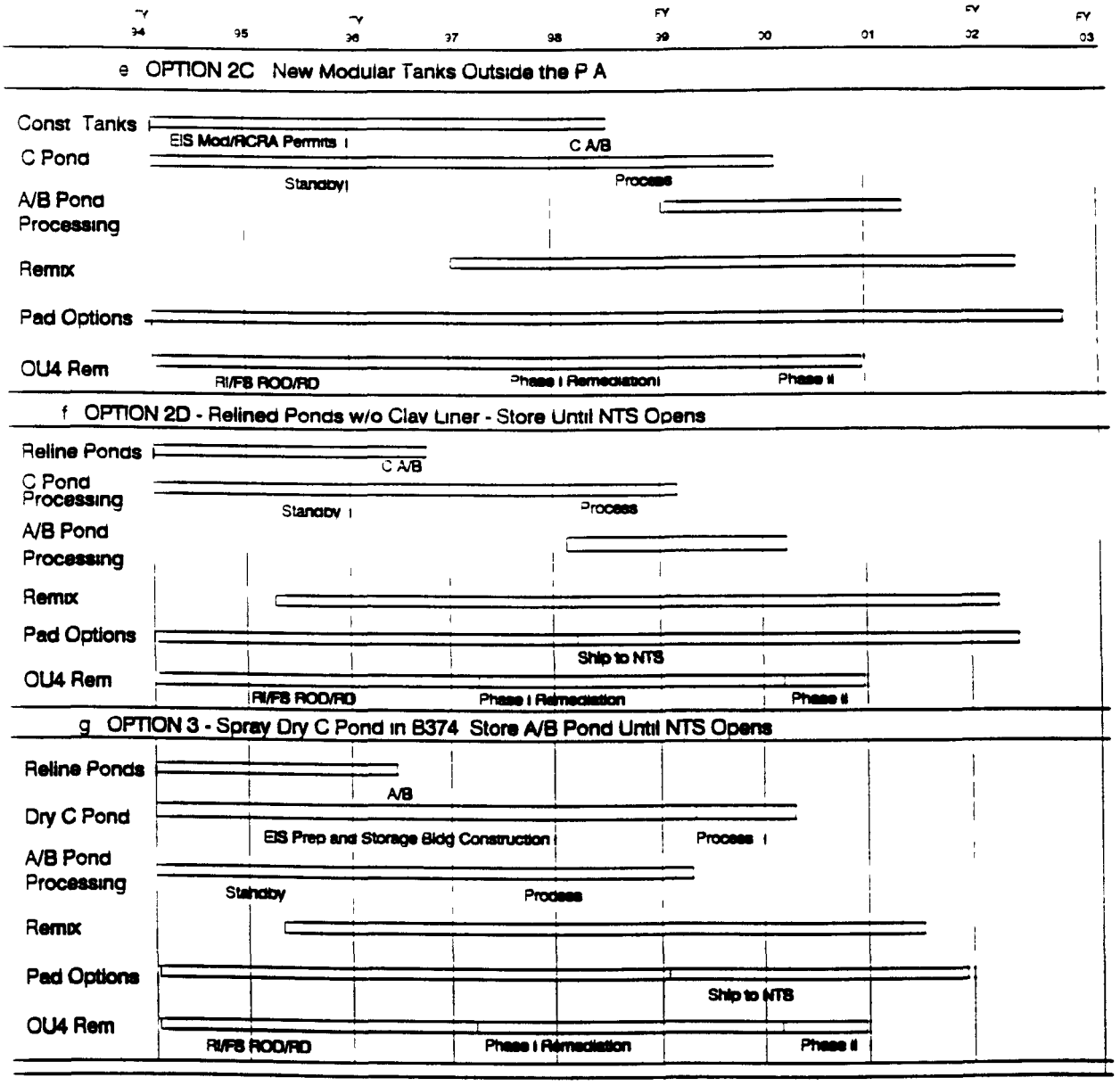


FIGURE 3 1 1 SUMMARY OF PROJECT SCHEDULE. continued



4.0 DEVELOPMENT AND EVALUATION OF SCHEDULE

The initial emphasis of the Baseline and Options Analysis was to review the project schedules, as prepared by EG&G, for completeness (all activities or events impacting the schedule were included) and realism. Realism was assessed by comparing the time duration estimates for each activity provided by EG&G staff to the schedule and adjusting the schedules to reflect the most likely time durations The following sections discuss the key assumptions and associated schedule impact for the Baseline and each option. This is followed by a comparison of the Baseline and option schedules to the objectives of the SPRP

Interviews and discussions were held with EG&G and HNUS personnel. The purpose of these discussions was to establish the critical activities associated with the project Baseline schedule These critical activities were evaluated against a set of factors that could potentially affect the plant's ability to complete an activity For example, the critical activity "Waste Processing" was evaluated against a number of potentially impacting factors that included weather delays, equipment failures, labor disputes, spills, and accidents. This evaluation resulted in the definition of those that have a high likelihood of causing schedule slips. Also, critical sequential activities such as SO Testing and Waste Processing which must be completed together within a 7-month operating season were evaluated together to determine the probability of success

4.1 Evaluation of Key Activities and Associated Assumptions

Project schedules for the nine options discussed in Section 3 were provided to ICF KE by EG&G The schedules were reviewed and key activities were identified. The key activities identified include regulatory analysis, readiness assessment, system operational testing, waste processing, storage, disposal, and delisting These key activities and associated assumptions are discussed in Sections 4 1 1 through 4 1 8 for the Baseline and each of the remaining seven options

Interviews and discussions were held with EG&G and HNUS personnel to make a reasonable estimates of the time durations and costs associated with key activities identified for each of the options. These key activities were evaluated based on factors that could potentially affect the probability of completing the activity In addition to an evaluation, some regulatory activities have been initiated and the status of these activities are also discussed.

4.1.1 Baseline Option

The Baseline schedule is predicated on a full resumption of the HNUS contract in October 1993, C Pond processing starting in July 1994 and finishing in October 1994, A/B Pond processing starting in July 1995 and finishing in October 1995, the Remix process starting operation in October 1999, and NTS being available by December 1997

4 1 1 1 Regulatory Analysis

Regulatory issues and/or activities associated with the Baseline option were identified and evaluated. The regulatory drivers are discussed below with regards to the treatment processes and storage issues associated with the Baseline option.

National Environmental Policy Act (NEPA) - An EA and Finding of No Significant Impacts (FONSI) has been prepared for the processing of the C Pond and A/B Pond sludge. Additional NEPA documentation and approvals would be required for additional storage space (i.e , pad and tent for A/B Pond sludge). This additional documentation should be prepared/approved in parallel with the RCRA approval process (i.e., modification of the RCRA Part B permit for additional storage and modification of interim status for the treatment process) or the IM/IRA process discussed in the following section. It is highly probable (90 percent) that preparation of an EC and a CX would be sufficient assuming that the action is classified as an

IM/IRA in accordance with the IAG. Preparation of the EC and the CX would take approximately 1 month, which would include RFO approval (no DOE-HQ involvement is required)

An EA/FONSI could be required if the action is not classified under the IM/IRA process. In this case, the NEPA process would take approximately 1 5 years (includes review and approval time)

Resource Conservation and Recovery Act (RCRA) - A modification to interim status for the C Pond and A/B Pond treatment processes has not yet been approved by CDH. Assuming that these treatment processes can still be covered via modification under interim status, CDH is expected to give final approval in about 1 month. A modification to the RCRA Part B Permit for the Remix treatment process has also been submitted to CDH. Approval from CDH is expected to take about 1 year A modification to the RCRA Part B permit for storage has been obtained for C Pond pondcrete storage. Currently, there is not sufficient storage space for the A/B pondcrete and additional storage space would require permitting. Additional storage space could be permitted under the RCRA Part B permit or the IM/IRA process in accordance with the IAG (streamlining the decision document) Permitting via a modification to the RCRA Part B permit would require approximately 1.5 years (includes review/approval time) while permitting under the IM/IRA process would require about 6 months (includes review/approval time)

EG&G is currently working on a delisting petition for the pondcrete/saltcrete waste. The status of this activity and probability of the delisting petition being approved by the determination date (February 1995) are discussed Section 4.1 1 7, "Delisting."

DOE Order 6430.1A, Safety Analysis Documents - For this option it is assumed that two Safety Analysis Documents (SADs) would be necessary, one for the treatment processes and one for additional A/B pondcrete storage. The SAD process would take 8 months (includes DOE

approval), assuming there are sufficient resources to prepare two SADs simultaneously It would be advantageous if the SAD for additional storage could be initiated this fiscal year. It might be easier to obtain a NEPA CX for additional storage if the SAD demonstrated that there would be no significant impacts

The NEPA, RCRA, and the SAD processes are not expected to be limiting activities with regards to the Baseline option. It is recommended that the three activities be pursued in parallel.

4 1 1 2 Readiness Assessment

The RA for project Baseline activities will consist of readiness reviews conducted by EG&G and approved by DOE. DOE will not conduct a readiness assessment but will review and approve the results of the EG&G Readiness Assessment.

Cold testing will begin prior to the completion of the readiness review A separate RA will be conducted prior to hot test of C Pond processes, A/B Pond processes, and Remix processes. The readiness review time duration for each of the RA's is as follows

C Pond RA - February 1994 through June 15, 1994,

A/B Pond RA - January 1995 through June 20, 1995,

Remix RA - January 1999 through April 1999.

EG&G personnel are confident that the mechanics of performing the RA (development of criteria, development of assessment methodology and documents, selection of the review team, etc.) will not impact the assessment schedule Additionally, demonstration of equipment readiness and personnel readiness should not be limiting elements for completing the assessment. EG&G has expressed concern that two elements of the assessment could impact the schedule (1) verification of compliance to codes, and (2) approval of safety analysis documentation.

4 1 1 3 System Operational Testing

For the purpose of the analysis provided in this report, SO Testing for the project baseline includes the following activities

- Cold test,
- DOE approval for hot test,
- Hot test,
- DOE hot test evaluation and approval.

The most likely SO Test time duration will be 3.5 months for C Pond processing, A/B Pond processing and Remix operations. This duration is based upon the following assumptions

- Defense Nuclear Facilities Safety Board (DNFSB) and DOE Office of Nuclear Safety Office approval will not be required to initiate hot testing or waste processing.
- SO Testing activities requiring introduction of liquid to the processing trains will be conducted when the potential for freezes is minimized.
- Security measures will be in place that will eliminate the need for EG&G to provide escorts for HNUS operating personnel (L clearances granted to HNUS personnel)
- SO Testing must be done in the same operating season as waste processing.

The SO Testing must start and end no later than the following dates to meet the Baseline schedule.

C Pond SO Test - April 1994 through July 10, 1994,

A/B Pond SO Test - April 1, 1995 through July 15, 1995,

Remix SO Test - January 2, 1999 through July 10, 1999.

EG&G is confident that the schedule durations for the physical aspects of SO Testing (cold test and hot test) are adequate However, they are less confident that the schedule durations for DOE approval for hot test and DOE hot test evaluation and approval are adequate.

The DOE approval process to allow initiation of hot test activities is allocated 3 weeks for completion for each major activity (C Pond processing, A/B Pond processing, and Remix operations) In this 3-week period, the DOE must review and approve the results of the readiness assessment. In addition, the DOE must review the data generated from cold test activities All DOE comments and issues resulting from these reviews must also be resolved and corrective actions (if required) implemented prior to start of hot test activities. The probability for DOE approval and EG&G ability to commence hot test activities on schedule is low even if the DOE approval authority is RFO If entities in addition to RFO (i.e., DNFSB/DOE-NSO) are involved in the approval process, schedule slips that would severely impact start of hot tests can be expected.

4.1.1 4 Waste Processing

The waste processing activities associated with C Pond and A/B Pond cleanup must be conducted during warm weather months in order to minimize the effects of freezing on the process equipment. Remix operations can be conducted in cold weather. The project Baseline schedule for waste processing is based upon the following assumptions:

- Waste Processing operations will be conducted by HNUS personnel. Packaging and storage operations will be conducted by EG&G personnel.
- Waste processing activities will occur when the potential for freezing is minimized.
- Adequate storage capacity exists to support the operation of the treatment processes.

- Materials and manpower will not constrain the waste processing schedules.
- HNUS and EG&G will have adequate resources.

The waste processing must start and end not later than the following dates if the Baseline schedule is to be met:

C Pond Processing - July 1994 through October 1994,

A/B Pond Processing - July 1995 through October 1995,

Remix - April 1999 through November 2000.

For C Pond, 67 processing days are required to accomplish waste treatment. It is anticipated by HNUS that during waste treatment operations, as many as 34 working days could be lost due to weather delays (primarily wind related), mechanical failures, productivity problems, and miscellaneous delays such as spills, accidents, security issues and QA problems The combination of required working days and anticipated delays results in a required processing duration of 101 working days. The processing time allocated on the Baseline schedule is 114 days based on 6-day work week. For A/B Ponds, 87 processing days are required to accomplish waste treatment. HNUS is anticipating that as many as 29 working days will be lost during the processing period. The combination of required processing days and anticipated delays results in a required processing duration of 116 working days. The Baseline schedule duration for A/B Pond processing is the same as for C Pond (114 days) The extra 2 processing days would be accomplished by working 7 day work weeks on a selected basis. The probability of achieving the schedule for C Pond and A/B Pond processing is high.

For Remix, 125 processing days are required to process the saltcrete and pondcrete inventory The scheduled duration is approximately 198 days. HNUS expects minimal weather related delays because operations will be conducted indoors. Delays associated with equipment breakdowns, productivity issues, spills, etc., can easily be accommodated by the slack in the

processing schedule The probability for achieving the Baseline Remix schedule is high.

4 1 1.5 Storage

Storage issues and/or activities associated with the Baseline option were identified and evaluated. Issues and/or activities are discussed in this section with regards to the three process elements of the baseline option.

C Pond Processing - Currently, there is sufficient RCRA permitted storage space available for the C Pond pondcrete.

A/B Pond Processing - As discussed previously, there is insufficient permitted storage space for the A/B pondcrete unless shipping of processed wastes off-site commences by October 1994 There are two permitting approaches for obtaining additional storage space (pad and tent). The approach used to develop the Baseline schedule is permitting additional storage space under a modification to the RCRA Part B permit. This would require approximately 1 5 years (this includes review and approval) The other approach uses the IM/IRA process and would require about 6 months, assuming there are adequate resources. Permitting under the RCRA Part B permit would require that the permitting process begin no later than January 1994, assuming A/B sludge processing would be initiated in June 1995.

Remix Processing - It is assumed that additional storage space will not be needed for the storage of reprocessed pondcrete/saltcrete.

4 1 1 6 Disposal

The off-site disposal option used for the Baseline is NTS The probability that this site will be licensed to receive the pondcrete/saltcrete waste by October 1995 is 20 percent, the probability that the NTS will be licensed to received the pondcrete and saltcrete waste by late

1997 increases to 80 percent. Based on this evaluation, wastes processed in the Baseline option could require on-site storage for at least 3 to 4 years pending shipment to NTS However, a delisting approval for the pondcrete/saltcrete could decrease the storage time significantly This is discussed in the following section.

4 1 1 7 Delisting

The delisting of pondcrete and saltcrete is a critical activity with regards to disposal at NTS. NTS is currently accepting low-level radioactive waste, and RFP has an agreement in place to ship low-level radioactive waste Delisting the pondcrete and saltcrete will render the waste low-level radioactive waste as opposed to low-level mixed waste Preparation of the delisting petition for the pondcrete/saltcrete was initiated in January 1993, and an EPA determination could be made as early as February 1995 (2-year process) If the delisting petition is approved, the treated waste starting with C Pond could be shipped to NTS as early as March 1995

The probability of the delisting petition being approved by the regulators by 1995 is about 10 percent while the probability increases to 50 percent for 1998. The latter should be evaluated closely to determine if it is feasible to pursue the delisting process after 1997 since there is a high probability that NTS will be available by then.

4.1.2 Option 1

Option 1 is the same as the Baseline except that the treated wastes are shipped to the Envirocare facility in Utah for disposal. The Option 1 schedule is predicated on a full resumption of the HNUS contract in October 1993, C Pond processing starting in July 1994 and finishing in October 1994, A/B Pond processing starting in July 1995 and finishing in October 1995, the Remix process starting operation in October 1999, and the Envirocare facility being available

around October 1995

4 1.2.1 Regulatory Analysis

Regulatory issues and/or activities associated with Option 1 were identified and evaluated. The regulatory drivers with regards to the treatment processes and storage issues are almost identical to the baseline option.

National Environmental Policy Act (NEPA) - An EA and FONSI have been prepared for the processing of the C Pond and A\B Pond sludge Additional NEPA documentation and approvals might still be required for additional storage space (i.e , pad and tent for A/B Pond sludge) This additional documentation should be prepared/approved in parallel with the RCRA approval process (i.e., modification of the RCRA Part B permit for additional storage and modification of interim status for the treatment process) or the IM/IRA process discussed in the following section. It is highly probable (90 percent) that preparation of an EC and a CX would be sufficient assuming that the action is classified as an IM/IRA in accordance with the IAG Preparation of the EC and the CX would take approximately 1 month, which would include obtaining RFO approval (no DOE-HQ involvement is required)

An EA/FONSI could be required if the action is not classified under the IM/IRA process. In this case, the NEPA process would take approximately 1.5 years (includes review and approval time)

Resource Conservation and Recovery Act (RCRA) - A modification to interim status for the C Pond and A/B Pond treatment processes has not yet been approved by CDH. Assuming that these treatment processes can still be covered via modification under interim status, CDH is expected to give final approval in about 1 month. A modification to the RCRA Part B permit for the remix treatment process has also been submitted to CDH. Approval from CDH is expected

to take about 1 year A modification to the RCRA Part B permit for storage has been obtained for C Pond pondcrete storage If the Envirocare facility did not open until October 1995 or later, there would not be sufficient storage space for the A/B pondcrete and additional storage space would require permitting Additional storage space could be permitted under the RCRA Part B permit or the IM/IRA process in accordance with the IAG (streamlining the decision document). Permitting via a modification to the RCRA Part B permit would require approximately 1.5 years (includes review/approval time) while permitting under the IM/IRA process would require about 6 months (includes review/approval time)

DOE Order 6430.1A, Safety Analysis Documents - For this option it is assumed that two SADs would be necessary Their purposes and preparation would be identical to the Baseline Option.

The NEPA, RCRA, and the SAD processes are not expected to be limiting activities with regards to this option. It is recommended that the three activities be pursued in parallel.

4 1 2.2 Readiness Assessment

The RA for Option 1 activities will consist of readiness reviews conducted by EG&G and approved by DOE. DOE will not conduct a readiness assessment but will review and approve the results of the EG&G Readiness Assessment.

Cold testing will begin prior to the completion of the readiness review A separate RA will be conducted prior to hot test of C Pond processes, A/B Pond processes, and Remix processes The readiness review time duration for each of the RA's is as follows.

C Pond RA - February 1994 through June 15, 1994,

A/B Pond RA - January 1995 through June 20, 1995,

Remix RA - January 1999 through April 1999

EG&G personnel are confident that the mechanics of performing the readiness assessment (development of criteria, development of assessment methodology and documents, selection of the review team, etc) will not impact the assessment schedule Additionally, demonstration of equipment readiness and personnel readiness should not be limiting elements for completing the assessment. EG&G has expressed concern that two elements of the assessment could impact the schedule. (1) verification of compliance to codes, and (2) approval of safety analysis documentation. In addition, the procedures and documentation relating to the waste acceptance criteria for the Envirocare facility would need to be completed and approved as a part of the RA for Option 1 All indications are that this should not be a limiting element.

4 1.2.3 System Operational Testing

The SO testing for Option 1 is exactly the same as for the Baseline The same concerns about DOE approvals and the participation of the DNFSB exist.

4 1 2.4 Waste Processing

The activities and concerns regarding waste processing are the same for Option 1 as were discussed above for the Baseline project. If the SO tests are approved in time, and there is a high probability that the waste processing will be done on schedule.

4 1.2.5 Storage

The storage issues for Option 1 are essentially identical to those of the Baseline. If Envirocare were to be available for disposal as early as August 1995, the need for an additional pad and tents would not exist. However, given the remaining administrative and regulatory procedures that must be completed before Envirocare can accept SPRP wastes, the plans for

contingent pad and tents should be kept in this option.

4 1 2.6 Disposal

With regards to Envirocare, there are several issues that need to be resolved before the SPRP treated wastes could be shipped there The first is modification of Envirocare's operating license from the State of Utah and Nuclear Regulatory Committee (NRC) to allow disposal of low-level mixed plutonium contaminated wastes This modification process is underway In fact. the probability that the Envirocare facility will be licensed to received the pondcrete/saltcrete waste by October 1995 is 80 percent.

Two other issues are in reference to Envirocare's waste acceptance criteria and waste management practices/controls. Currently, the pondcrete/saltcrete size and shape that would be produced by the C Pond, A/B Pond, and Remix process trains is not in a form that is acceptable to Envirocare's waste acceptance criteria. Therefore, issues concerning reconfiguration of the waste form need to be resolved or an exemption issued to EG&G by Envirocare pending negotiations with the State of Utah. Finally, an EA would be required covering, as a minimum, the environmental impacts associated with shipping the treated wastes to the Envirocare facility and may have to consider the environmental impacts of disposal in the facility. There is sufficient time to complete this EA process if it is started soon. Given such concerns, the current probability of shipping SPRP treated waste to Envirocare by October 1995 is about 50 percent. However, based on conversations with EG&G personnel, this probability could increase significantly (80-90 percent) if the activity were made high priority and adequate resources were allocated.

The probability that this site will be licensed to receive the SPRP treated wastes by late 1997 increases to 90 percent Based on this evaluation, wastes processed in the Option 1 could

require on-site storage for as short as 18 months to as long as 3 to 4 years. However, the most probable scenario is that the treated C Pond wastes would need to be stored on-site for 18 months and the A/B Pond treated wastes for less than a year.

4 1 2.7 Delisting

Based on the discussion in the "Disposal" section above, it is possible that EG&G could have the option of shipping waste to Envirocare by October 1995 With this in mind, the delisting process becomes less critical after 1995 as the Envirocare option becomes more probable

The probability of the delisting petition being approved by the regulators by 1995 is about 10 percent while the probability increases to 50 percent for 1998. The latter should be evaluated closely to determine if it is feasible to pursue the delisting process after 1995 given that the Envirocare option appears more viable after 1995.

4.1.3 Option 2A

The schedule for Option 2A consists of temporary storage of A/B Pond and C Pond slurry in two relined ponds (B North and Center) followed by processing of the pond contents pending licensing and approval of an off-site disposal. For this option, full resumption of the HNUS contract is scheduled in August 1997, C Pond processing starting in July 1998 and ending by November 1998, A/B processing starting in July 1999 and ending by November 1999; and the Remix processing starting in June 2001 and ending by January 2002.

SO testing, readiness assessment, and waste processing activities for Option 2A have the same schedule time durations as the project Baseline activities. The projected start and end dates for these activities can be obtained from the schedule for this option given in Figure A-3 in Appendix

A. The probability for success for these key activities is identical to those described in Section 4 1 1 for the Baseline option.

4 1 3 1 Regulatory Analysis

Regulatory activities and/or issues associated with Option 2A were identified and evaluated. The regulatory drivers are discussed in this section with regards to the treatment processes and storage issues associated this option.

National Environmental Policy Act (NEPA) - NEPA documentation and approval would be required for reconstruction/relining of the ponds. The documentation should be prepared in parallel with the RCRA permitting process or the IM/IRA process in accordance with the IAG (streamlining the decision documents) for this option as discussed in the following section. It is likely that an EC and a CX would be sufficient (90 percent if RCRA/CERCLA approvals were granted), assuming the action is classified as an IM/IRA in accordance with the IAG (streamlining the decision document). Preparation of the EC and the CX would take approximately 1 month, which would include obtaining RFO approval.

An EA/FONSI could be required if the action is not classified under the IM/IRA process. In this case, the NEPA process would take approximately 1.5 years (includes review and approval time) The EA could be prepared during Title 1 design if a variance is obtained from DOE. According to DOE NEPA requirements, NEPA documentation should be prepared prior to Title 1 engineering design although variances can be granted.

Resource Conservation and Recovery Act (RCRA) - Relining of B North and Center ponds for temporary storage would require permitting of the ponds under a RCRA Part B permit modification or using the IM/IRA process in accordance with the IAG (streamlining the decision document) as the permitting vehicle. Permitting via a modification to the RCRA Part B permit

would require approximately 1.5 years (includes review/approval time) while permitting under the IM/IRA process would require about 6 months (include review/approval time), assuming there are adequate resources.

A RCRA Part B permit modification for the Baseline Remix process is currently being reviewed by CDH. Final approval for this process is expected to take about 1 year. However, the Remix process associated with Option 2A may require a re-evaluation with regards to RCRA Part B permit requirements. The current RCRA Part B permit is effective through the Fall of 1996, EG&G will have to re-apply for a new permit prior to this permit deadline. The Remix processing associated with this option is not scheduled to start until June 2001. Therefore, the process would need to be re-evaluated for potential permit modification requirements upon completion of the Remix design phase. It is assumed that the C Pond and A/B Pond processing would not be affected since they are covered under a modification to RCRA Interim Status for the Solar Ponds.

EG&G is currently working on a delisting petition for the pondcrete/saltcrete waste. The status of this activity and probability of the delisting petition being approved by the determination date (February 1995) are discussed Section 4 1 1 "Delisting"

DOE Order 6430.1A, Safety Analysis Documents - For this option it is assumed that two SADs would be necessary; one for the treatment processes and one for relining the ponds The SAD process would take about 8 months, assuming there are sufficient resources to prepare two SADs simultaneously It would be advantageous if the SAD for the relining of the ponds could be initiated this fiscal year. If the Final SAD demonstrated that there would be no significant impacts, it might be easier to obtain a NEPA CX (i.e., an EA might not be required) The NEPA, RCRA, and SAD processes are not expected to limit activities with regards to this option. It is recommended that these three activities be pursued in parallel.

4 1 3 2 Storage

In this option, the relined ponds would be used for temporary storage until a repository was open to receive the treated waste As discussed in the regulatory analysis section, permitting of the ponds under the IM/IRA process would require about 6 months as opposed to 1.5 years via a modification to the RCRA Part B permit. Permitting under the latter would require that the permitting process begin no later that October 1993, assuming that pumping of pond slurry from B Pond South and C Pond to the relined B North and Center ponds, respectively, would be initiated in April 1996.

4 1.3 3 Disposal

Two off-site disposal options were identified and evaluated for the disposal of pondcrete/saltcrete. These disposal sites are discussed in Section 4 1.1., "Disposal" Based on this discussion, Envirocare could become a more viable disposal option by October 1995. By October 1995, relining/reconstruction of ponds would be underway If the Envirocare option is pursued, it is possible that the relined ponds may never be used if waste is shipped to Envirocare Consequently, this option may not be feasible in the event shipping of pondcrete/saltcrete to Envirocare is pursued. On the other hand, if shipping of waste to Envirocare is not pursued, the ponds would be used for temporary storage of pond slurry for at least 1.5 to 2 years. This is based on the delisting discussion below

4 1.3 4 System Operational Testing

The SO testing for Option 2A is exactly the same as for the Baseline. The same concerns about DOE approvals and the participation of the DNFSB exist.

4 1 3.5 Waste Processing

The activities and concerns regarding waste processing are the same for Option 2A as were discussed above for the Baseline project. If the SO tests are approved in time, then there is a high probability that the waste processing will be done on schedule.

4 1.3.6 Delisting

The delisting of pondcrete/saltcrete is a critical activity with regards to disposal at NTS As discussed in Section 4.1.1., "Delisting", the probability of delisting being approved by 1995 and 1998 are 10 percent and 50 percent, respectively. Based on this evaluation, it appears that pursuing delisting would have no impact on the schedule since there is a high probability that disposal off-site to NTS will occur by December 1997

4.1.4 Option 2B

The schedule for Option 2B consists of temporary storage of A/B Pond and C Pond slurry in two modular tanks followed by processing of the tank contents pending licensing and availability of an off-disposal site. For this option, full resumption of the HNUS contract would be scheduled for August 1997, C Pond processing starting in July 1998 and ending by November 1998, A/B processing starting in July 1999 and ending by November 1999; and Remix processing starting in May 2001 and ending by January 2002.

SO testing, readiness assessment, and waste processing activities for Option 2B have the same schedule time durations as the project baseline activities. The projected start and end dates for these activities can be obtained from the schedule for this option given in Figure A-4 of Appendix A. The probability for success and the major items of concern are identical to those described in Section 4 1 1 for the Baseline option.

4 1 4 1 Regulatory Analysis

Regulatory activities and/or issues associated with Option 2B were identified and evaluated. The regulatory drivers are discussed in this section with regards to the treatment processes and storage issues associated with this option.

National Environmental Policy Act (NEPA) - NEPA documentation and approval would be required for construction and operation of tanks and transfer lines. The documentation should be prepared in parallel with the RCRA permitting process or the IM/IRA process in accordance with the IAG (streamlining the decision document) for this option as discussed in the following section. It is highly probable (about 70 percent of RCRA/CERCLA approvals were granted) that an EC and a CX would be sufficient, assuming that the action is classified as an IM/IRA under RCRA/CERCLA in accordance with the IAG Preparation of the EC and the CX would take approximately 1 month, which would include obtaining RFO approval.

An EA/FONSI could be required if the action is not classified under the IM/IRA process. In this case, the NEPA process would take approximately 1.5 years (includes review and approval time) The EA could be prepared during Title 1 design if a variance is obtained from DOE. According to DOE NEPA requirements, NEPA documentation should be prepared prior to Title I engineering design, although variances can be granted.

Resource Conservation and Recovery Act (RCRA) - The modular tanks would require permitting via a RCRA Part B permit modification or under the IM/IRA process in accordance with the IAG (streamlining the decision document) Permitting via a modification to the RCRA Part B permit would require approximately 1.5 years (includes review/approval time) while permitting under the IM/IRA process would require about 6 months (includes review/approval time), assuming there are adequate resources.

The RCRA Part B modification for the Baseline Remix process discussed in Section 4.1.1

is currently being reviewed by CDH. However, this option like Option 2B, may also require a re-evaluation with regards to RCRA Part B permit requirements for the Remix processing (see Section 4 1 2 "RCRA" discussion) The Remix processing associated with this option is not scheduled to start until May 2001 Therefore, the process would have to be re-evaluated for potential permit modifications upon completion of the Remix design phase. It is assumed that the C Pond and A/B Pond processing would not be affected since they are covered under a modification to RCRA Interim Status for the solar ponds.

DOE Order 6430.1A, Safety Analysis Documents - For this option it is assumed that two SADs would be necessary, one for the treatment processes and one for the modular tanks The SAD process would take 8 months, assuming that EG&G had sufficient resources to prepare two SADs simultaneously It would be advantageous if the SAD for the modular tanks could be initiated immediately If the Final SAD demonstrated that there would be no significant impacts, if might be easier to obtain a NEPA CX (i.e , an EA might not be required)

4 1 4 2 Storage

The discussion for Option 2A also applies to Option 2B, Option 2B consists of modular tanks as opposed to relined ponds.

4 1 4 3 Disposal

The discussion for Option 2A, also applies to Option 2B, Option 2B consists of modular tanks as opposed to relined ponds.

4 1 4 4 System Operational Testing, See 4 1.4.3

4145 Waste Processing, See 4143

4146 Delisting

The discussion for Option 2A also applies to Option 2B, Option 2B consists of modular tanks as opposed to relined ponds.

4.1.5. Option 2D

Option 2D consists of the same schedule and activities as Option 2A with the exception of relining of the ponds in accordance with RCRA liner requirements. For this option, it is assumed that a waiver of the RCRA liner requirements for a clay layer would be negotiated with CDH.

Key activities and associated assumptions associated with Option 2D are the same as those discussed for Option 2A in Section 4 1 2.

4.1.6 Option 4

Option 4 consist of stabilization of waste into relined ponds. The ponds to be relined would be B North, Center, and approximately half of A Pond. The C Pond Baseline processing train would be used to process pond sludges. As each waste stream is processed, it would be placed into the relined ponds The ponds would then undergo full RCRA closure.

4161 Regulatory Analysis

Regulatory activities and/or issues associated with Option 4 were identified and evaluated. The regulatory drivers are discussed in this section with regards to the treatment and in-situ stabilization processes.

National Environmental Policy Act (NEPA) - An EIS would be required for in-situ

stabilization of the waste Even if the site meets siting criteria and impacts are not expected to be significant, public/political pressure would most likely require an EIS. The NEPA process could take up to 5 years. In addition, if the process is completed, there would be no guarantee that the facility would be built, public/political opposition could be too great.

Resource Conservation and Recovery Act (RCRA) - It is estimated that it could take at least 5 years (this includes review/approval time) to permit in-situ stabilization as a RCRA hazardous waste landfill. The NEPA and RCRA processes should be conducted in parallel.

DOE Order 6430.1A, Safety Analysis Documents - For this option, it is assumed that two SADs would be necessary, one for the treatment processes and one for the in-situ stabilization or disposal. The SAD process would take about 10 months each and could be done sequentially to give the time necessary for the NEPA and RCRA processes. The SADs would be prepared in parallel with the NEPA and RCRA processes.

4 1 6.2 Readiness Assessment and System Operational Testing

In order to assure safe operation of equipment and systems, EG&G will perform SO tests and conduct RAs EG&G is thoroughly familiar with the performance of these activities, and has demonstrated the ability to successfully start up and operate systems significantly more complex than those planned for spray drying C Pond. Consequently, the probability for successful operation of SO tests and RAs, within schedule constraints, is high for areas under EG&G's control. However, a potential exists for schedule slips due to delay in receiving DOE approval to continue testing (i.e., hot test approval) or to initiate waste processing (i.e., hot test evaluation and approval). In order to reduce the potential for delays, EG&G should reach agreement with the DOE on the following items prior to initiation of SO and RA activities:

- Acceptance criteria for SO tests,

- DOE approval authority for SO test results,
- Level of DOE direct involvement in SO tests (active on-site versus documented review),
- Level of RA (EG&G RA versus DOE RR),
- DNFSB involvement in approval to operate,
- Acceptance criteria for RA,
- DOE approval authority for RA results.

By working aggressively with the DOE to identify and resolve the types of issues defined above, the probability for successful completion of SO testing and the RA within schedule constraints can be significantly increased.

4 1 6.3 Disposal

This section is not applicable for this option.

4 1 6 4 Storage

Additional permitted storage space is not needed, consequently, this section is not applicable to this option.

4 1 6.5 Delisting

As discussed in Section 4 1 1, "Delisting", the probability of delisting being approved by 1995 and 1998 are 10 percent and 50 percent, respectively Delisting might improve the probability for on-site disposal since it would eliminate the need for a RCRA hazardous waste permit and Remix could begin sooner Therefore, the delisting process should be pursued with respect to this option.

4.1.7 Option 4A

Option 4A consists of stabilization of C Pond and A/B Pond waste in place Sludges from C Pond and A/B Pond will be denitrified, dried, and capped in place. C Pond sludge drying would be scheduled to start in April 1999 A/B Pond sludge drying would be scheduled to start by August 1999 Remix material will be reprocessed according to the Baseline process and shipped to NTS. For this option, full resumption of the HNUS contract is scheduled for April 1997 and Remix processing starts in April 1999 and ends by December 1999

4 1 7 1 Regulatory Analysis

Regulatory activities and/or issues associated with Option 4A were identified and evaluated. The regulatory drivers are discussed in this section with regards to the Remix treatment process and in-situ stabilization for this option.

National Environmental Policy Act (NEPA) - An EIS would be required for in-situ stabilization of the waste. Even if the site meets siting criteria and impacts are not expected to be significant, public/political pressure would most assuredly require an EIS. The NEPA process could take up to 5 years. In addition, even if the process is completed, there would be no guarantee that the NEPA Record of Decision (ROD) would allow the facility to be built, public/political opposition could be too great.

Resource Conservation and Recovery Act (RCRA) - CDH is currently reviewing the RCRA Part B permit modification for the baseline remix process. However, this option like Option 2A, 2B, and 3 may require a re-evaluation with regards to RCRA Part B permit requirements for the Remix processing (see Section 4 1.2, "RCRA" discussion) The Remix processing with this option is not scheduled to start until April 1999 Therefore, the process would have to be re-evaluated for potential permit modification requirements upon completion of

the Remix design phase.

In addition, a full RCRA disposal permit would be required for this option. It is estimated that it could take at least 5 years (this includes review/approval time) to permit in-situ stabilization as a RCRA hazardous waste landfill. The NEPA and RCRA processes should be conducted in parallel.

DOE Order 6430.1A, Safety Analysis Documents - For this option, it is assumed that two SADs would be necessary, one for the Remix process and one for the in-situ stabilization or disposal. The SAD process would take about 10 months for each. Since it will take about 5 years to complete the NEPA and RCRA processes, there is no need to prepare the two SADs simultaneously The SADs would be prepared in parallel with the NEPA and RCRA processes.

4 1 7.2 Readiness Assessment and System Operational Testing

In order to assure safe operation of equipment and systems, EG&G will perform SO tests and conduct RAs. EG&G is thoroughly familiar with the performance of these activities, and has demonstrated the ability to successfully start up and operate systems significantly more complex than those planned for spray drying C Pond. Consequently, the probability for successful operation of SO tests and RAs, within schedule constraints, is high for areas under EG&G's control. However, a potential exists for schedule slips due to delay in receiving DOE approval to continue testing (i.e., hot test approval) or to initiate waste processing (i.e., hot test evaluation and approval). In order to reduce the potential for delays, EG&G should reach agreement with the DOE on the following items prior to initiation of SO and RA activities:

- Acceptance criteria for SO tests,
- DOE approval authority for SO test results,
- Level of DOE direct involvement in SO tests (active on-site versus documented

review),

- Level of RA (EG&G RA versus DOE RR),
- DNFSB involvement in approval to operate,
- Acceptance criteria for RA,
- DOE approval authority for RA results.

By working aggressively with the DOE to identify and resolve the types of issues defined above, the probability for successful completion of SO testing and the RA within schedule constraints can be significantly increased.

4 1 7 3 Storage and Disposal

For this option, it is assumed that the reprocessed pondcrete/saltcrete will be shipped to NTS for disposal. Remix processing is not scheduled to be started until April 1999 This date is well after the targeted NTS open date to receive mixed waste (December 1997) As a result, reprocessed pondcrete/saltcrete would not require long-term storage on-site. Consequently, additional permitted storage space would not be needed.

4 1 7 4 Delisting

As discussed in Section 4 1 1, "Delisting", the probability of delisting being approved by 1995 and 1998 are 10 percent and 50 percent, respectively Delisting might improve the probability for on-site disposal since it would eliminate the need for a RCRA hazardous waste permit and Remix could begin sooner Therefore, the delisting process should be pursued with respect to this option. However, there is a low probability that delisting will have no impact on the Remix processing since it appears that disposal off-site to NTS is likely to occur before the delisting decision is made.

4.1.8 Option 5

Option 5 consists of processing C Pond and Remix material per the Baseline process and disposal in NTS A/B Pond waste will be shifted to an on-site RCRA landfill cell as per Option 2A. Once deposited in the cell, the wastes would be dewatered, dried, denitrified and capped in place. A/B Pond sludge drying would be scheduled to start by the summer of 1998. For this option, full resumption of the HNUS contract is scheduled for October 1993 and Remix processing starting in August 1998 and ending by August 1999. NTS would be open by December 1997

4 1 8.1 Regulatory Analysis

Regulatory activities and/or issues associated with Option 5 were identified and evaluated. The regulatory drivers are discussed in this section with regards to the Remix treatment process and in-situ stabilization for this option.

National Environmental Policy Act (NEPA) - An EIS would be required for in-situ stabilization of the waste. Even if the site meets siting criteria and impacts are not expected to be significant, public/political pressure would most assuredly require an EIS The NEPA process could take up to 5 years. In addition, even if the process is completed, there would be no guarantee that the NEPA ROD would allow the facility to be built, public/political opposition could be too great.

Resource Conservation and Recovery Act (RCRA) - CDH is currently reviewing the RCRA Part B permit modification for the Baseline Remix process. However, this option like Option 2A and 2B may require a re-evaluation with regards to RCRA Part B permit requirements for the Remix processing (see Section 4 1.2, "RCRA" discussion) The Remix processing with this option is not scheduled to start until August 1998. Therefore, the process would have to be re-

evaluated for potential permit modification requirements upon completion of the Remix design phase.

In addition a full RCRA disposal permit would be required for this option. It is estimated that it could take at least 5 years (this includes review/approval time) to permit in-situ stabilization as a RCRA hazardous waste landfill. The NEPA and RCRA processes should be conducted in parallel.

DOE Order 6430.1A, Safety Analysis Documents - For this option, it is assumed that two SADs would be necessary, one for the Remix process and one for the in-situ stabilization or disposal. The SAD process would take about 10 months for each. Since it will take about 5 years to complete the NEPA and RCRA processes, there is no need to prepare the two SADs simultaneously The SADs would be prepared in parallel with the NEPA and RCRA processes.

4 1 8.2 Readiness Assessment and System Operational Testing

In order to assure safe operation of equipment and systems, EG&G will perform SO tests and conduct readiness assessments RAD EG&G is thoroughly familiar with the performance of these activities and has demonstrated the ability to successfully start up and operate systems significantly more complex than those planned for this option. Consequently, the probability for successful operation of SO tests and RAS, within schedule constraints, is high for areas under EG&G's control. However, a potential exists for schedule slips due to delay in receiving DOE approval to continue testing (i.e., hot test approval) or to initiate waste processing (i.e., hot test evaluation and approval). In order to reduce the potential for delays, EG&G should reach agreement with the DOE on the following items prior to initiation of SO and RA activities:

- Acceptance criteria for SO tests,
- DOE approval authority for SO test results,

- Level of DOE direct involvement in SO tests (active on-site versus documented review),
- Level of RA (EG&G RA versus DOE RR),
- DNFSB and DOE-ONS involvement in approval to operate,
- Acceptance criteria for RR,
- DOE approval authority for RA results,

By working aggressively with the DOE to identify and resolve the types of issues defined above, the probability for successful completion of SO testing and RAS within schedule constraints can be significantly increased.

4 1 8.3 Storage and Disposal

For this option, it is assumed that the processed wastes from C Pond and the reprocessed pondcrete/saltcrete will be shipped to NTS for disposal. Since there is already sufficient storage space for the processed C Pond wastes and the Remix process will not start until after the target date for opening NTS (December 1997), no additional storage space is required.

4 1 8.4 Delisting

As discussed in Section 4 1 1, "Delisting", the probability of delisting being approved by 1995 and 1998 are 10 percent and 50 percent, respectively Delisting might improve the probability for on-site disposal since it would eliminate the need for a RCRA hazardous waste permit. Therefore, the delisting process should be pursued with respect to this option. However, delisting will have no impact on the C Pond or Remix processing since it appears that disposal off-site to NTS is likely to occur before the delisting decision is made.

4.2 Comparison of Most Likely Schedule for Each Option

Two of the three principal objectives of the SPRP related to the schedule of activities are: minimize impact on final OU4 closure and eliminate the Solar Ponds as a continuing source of contamination as soon as possible. Therefore, it was agreed that a comparison of the schedule for completion of certain critical milestones for each option was a logical prerequisite to conducting the PRA. This comparison of the most likely schedule for each option would indicate which schedules would more expeditiously meet the objectives and should be subject to a PRA. Conversely, the comparison would indicate those options resulted in serious delays in meeting the objectives and would be recommended that DOE give no further consideration to them at this time. The top level milestones deemed most critical to the success of the SPRP were selected after a review of both the objectives and the activities incorporated into the logic chains for the options as discussed in **Section 3.0** They include

- Notice to proceed with SPRP option,
- Ponds eliminated as a source of contamination,
- Sludge treatment complete,
    - C Pond
    - A/B Pond
- Remix complete,
- Repository available,
- Disposal into repository complete,
- Start Phase I construction (soil remediation) - OU4,
- Complete Phase I construction,
- Start Phase II construction (groundwater) - OU4.

The milestones reflect a mixture of fiscal, procedural, operational, and regulatory-based

events The milestone dates for the above activities derived from the most likely timeline for each option are presented in **Table 4-1** Additionally, the schedule for each option were evaluated to determine the impacts of different key elements such as closure of disposal site, EA instead of CX and IM/IRA instead of RCRA Part B modifications. **Table 4-2** compares the impact on schedule caused by changing key elements for all prime options.

TABLE 4-1

MILESTONES ASSOCIATED WITH OPTIONS
NTS DISPOSAL SITE

MILESTONES	DATE MILESTONE ACHIEVED								
	OPTION								
	Baseline	1 (Comm.)	2A (NTS)	2B (NTS)	2C (NTS)	2D (NTS)	4	4A (NTS)	5
Notice to Proceed	10/93	10/93	10/93	10/93	10/93	10/93	10/93	12/93	10/93
* Ponds Eliminated as a Source									
- C Pond	11/94	11/94	5/96	7/96	1/98	5/96	7/96	7/96	11/94
- B Pond	11/95	11/95	8/96	10/96	4/98	8/96	10/96	10/96	8/96
* Sludge Treatment Comp									
- C Pond	11/94	11/94	11/98	11/98		11/98	11/99	5/99	11/94
- A/B Pond	11/95	11/95	11/99	11/99		11/99	11/00	11/99	2/00
- Remix	12/99	12/98	1/02	1/02		1/02	6/02	10/99	7/99
* Repository Available	12/97	10/95	12/97	12/97	12/97	12/97	10/98	10/98[1]	10/98[2]
Disposal In Repository Complete	2/00	5/98	4/02	4/02		4/02	6/02	4/00	2/00
* Start Phase I Rem.- OU4	2/97	2/97	2/97	2/97		2/97	2/97	2/97	2/97
End Phase I Rem -OU4	2/99	2/99	2/00	2/00		2/00	2/00	2/00	2/00
* Start Phase II Rem - OU4	2/00	2/00	2/00	2/00		2/00	2/00	2/00	2/00

* KEY MILESTONES

[1] On-site repository date/opening date for NTS is 12/97

[2] On site repository date No impact on schedule whether off-site repository is NTS or ENVIROCARE.

TABLE 4-2
CHANGES IN IMPACT OF CRITICAL ASSUMPTIONS
ON KEY MILESTONES

CRITICAL ASSUMPTIONS						ASSOCIATED KEY MILESTONES					
						PONDS ELIMINATED AS SOURCE		TREATMENT COMPLETED			
OPTION	DISPOSAL OPTION	NEPA ASSUMP STORAGE	NEPA ASSUMP SH,DISP	RCRA ASSUMP	R.A. ASSUMP	C	A/B	C	A/B	REMIX	REPOSITORY AVAILABLE
Baseline	NTS	EA	--	Part B	EG&G only	11/94	11/95	11/94	11/95	12/99	12/97
1	NTS	CX	--	IM/IRA	EG&G only	11/94	11/95	11/94	11/95	12/99	12/97
	EC	EA	EA	Part B	EG&G only	11/94	11/95	11/94	11/95	12/98	10/95
	EC	CX	EA	IM/IRA	EG&G only	11/94	11/95	11/94	11/95	12/98	10/95
2A/2D	NTS	EA	--	Part B	EG&G only	05/96	08/96	11/98	11/99	01/02	12/97
	NTS	CX	--	IM/IRA	EG&G only	05/95	08/95	11/98	11/99	01/02	12/97
	EC	EA	EA	Part B	EG&G only	05/96	08/96	11/95	11/96	01/99	10/95
	EC	CX	EA	IM/IRA	EG&G only	05/96	08/96	11/95	11/96	01/99	10/95
2/B	NTS	EA	--	Part B	EG&G only	07/96	10/96	11/98	11/99	01/02	12/97
	NTS	CX	--	IM/IRA	EG&G only	01/96	04/96	11/98	11/99	01/02	12/97
	EC	EA	EA	Part B	EG&G only	07/96	10/96	11/95	11/96	01/99	10/95
	EC	CX	EA	IM/IRA	EG&G only	07/96	10/96	11/95	11/96	01/99	10/95
2C Deleted											
3 Deleted											

TABLE 4-2
CHANGES IN IMPACT OF CRITICAL ASSUMPTIONS
ON KEY MILESTONES

CRITICAL ASSUMPTIONS						ASSOCIATED KEY MILESTONES					
OPTION	DISPOSAL OPTION	NEPA (STORAGE)	NEPA (SH,DISP)	RCRA	R.A.	PONDS ELIMINATED AS SOURCE C	PONDS ELIMINATED AS SOURCE A/B	TREATMENT COMPLETED C	TREATMENT COMPLETED A/B	TREATMENT COMPLETED REMIX	REPOSITORY AVAILABLE
4	IN-SITU	EA	EIS	Part B	EG&G only	07/96	10/96	11/99	11/00	06/02	12/97
	IN-SITU	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	11/00	11/01	06/02	12/97
4A	IN-SITU/ NTS	EA	EIS	Part B	EG&G only	07/96	10/96	05/99	11/99	11/99	12/97
	IN-SITU/ NTS	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	05/99	11/99	11/99	12/97
	IN-SITU/ EC	EA	EIS	Part B	EG&G only	07/96	10/96	05/99	11/99	07/96	10/95
	IN-SITU EC	CX	EIS	Part B/ IM/IRA	EG&G only	01/96	04/96	05/99	11/99	07/96	10/95
5	IN-SITU/ NTS	EIS	–	Part B	EG&G only	11/94	08/96	11/94	11/01	12/99	10/96 (12/97 NTS)
	IN-SITU/ EC	EIS	EA	Part B	EG&G only	11/94	08/96	11/94	11/01	03/97	10/96 (10/95 EC)

4.3 Evaluation of Options based upon Overall Project Schedule Requirements

Examination of **Table 4-1** indicates that none of the options would result in the elimination of the pond contents as a source of continuing contamination in the same time frame (± 1 month) as the Baseline option. Option 2A for example, would result in a delay of at least 11 months in the elimination of the ponds as a source. However, if the IM/IRA permitting approach was used for regulatory approval, then the Option 2A schedule for elimination of the ponds as a source could be shortened by as much as 15 months, 4 months earlier than the Baseline schedule. Similarly, Options 2A, 2B and 4 would delay the completion of Phase I remediation of OU4 by about a year which would almost certainly have significant regulatory interest since the completion date for Phase I is not yet incorporated into the IAG In fact, this 1-year delay might effectively be considered a slippage of the start date unless it is demonstrated to the regulators that significant remedial activity will commence on the start date and will be maintained at a reasonably constant and continuous level throughout the construction period. (In other words, it would not be sufficient to establish a construction area support facility and then suspend operations for a year or so until some of the pond contents were transferred to long-term storage)

The schedule for Option 1, disposal at the Envirocare facility has the identical date as the Baseline for elimination of the ponds as a source. However, it would reduce the Remix schedule by a year and would also minimize the risk of additional treated waste failures during storage on-site

Option 5 would eliminate C Pond as a source in the same time as the Baseline and would eliminate A/B Pond as a source about 9 months later than the Baseline. However, the A/B Pond wastes could not be treated and disposed until February 2000, almost 4 ½ years after the Baseline case. Additionally, Option 5 would delay the completion of Phase I remediation by about 4

months.

4.4Estimating Probabilities for Each Option

Probabilities were estimated for both the key elements and activities that comprise each logic chain as well as for the complete options Two probabilities were estimated: (1) the probability that the key elements or activities would be accomplished within the most likely time duration (which were also translated into the probability that the option in its entirety could be completed within the most likely project schedule) and, (2) the probability that the option would be allowed to proceed (i.e., acceptable/approval by the public, political and regulations)
The first set of probabilities, those associated with the key elements and activities, were derived from interviews with one or more EG&G (and sometimes subcontractor) staff who were most knowledgeable about that key elements or activity. In as many cases as possible, several EG&G or subcontractor staff were interviewed in order to develop a better level of confidence in the final probabilities. For example, for the RCRA permitting activity, input was garnered from K. London, P Aguilar and R. Ogg and used to define the most likely time duration for a RCRA Part B permit, RCRA Part B permit modification or a permit using the IM/IRA process. Similarly, establishing the probability of completing the treatment process in the expected schedule was done by discussion with S. Keith of EG&G and with T Bittner of HNUS
Once these probabilities were established, they were assembled in sequence following the logic chain for each option. Since the logic chain shows the dependency of each element of activity upon the proceeding activities or elements, it was then possible to review the chain and identify the limiting probability that the planned schedule could be achieved. For those activities or elements that can not proceed until more than one previous element or activity is combined, such as transfer pond contents A/B as shown in Figure 4.4 1 below, the probability that transferring can

start is the lowest of the probabilities of all controlling (previous) elements or activities (in this case the 85 percent probability that the RA will be completed on time) since the activities are essentially independent.

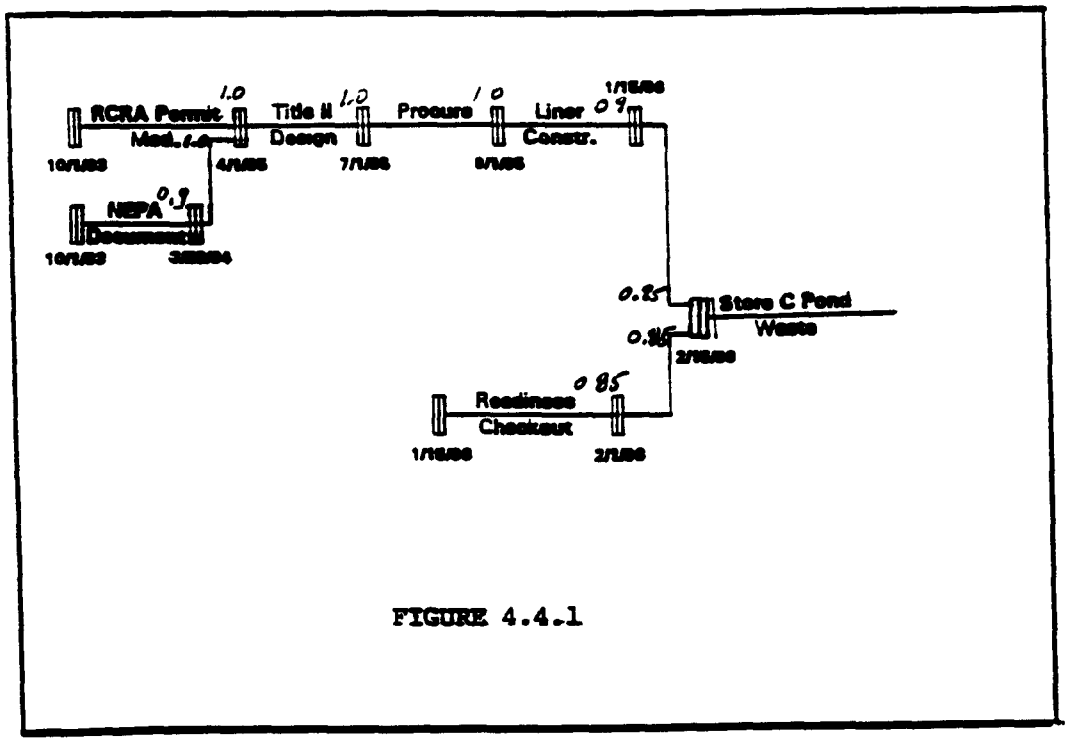


FIGURE 4.4-1

Note that the probabilities for some activities change with time. For example, the probability that the NEPA process will be completed is 90 percent by March 20, 1994, but goes to 100 percent by April 1, 1995, which is when it must be completed since it controls the start date of Title II Design.

The probability that the option will achieve the most likely schedule, then, is the integration of the probabilities of completion of all of the key activities that make up the logic

chain for that option. For example, Figure 4 4 2 shows the key activity logic chain for Option 4, on-site disposal. The probability of achieving the most likely schedule is the sum of multiplying the key element probabilities together. In this case, the key elements and probabilities are the EIS, (9) the on-site disposal operations (which includes the processing of all the SPRP wastes) (8) and final closure (1 0) The probability that the most likely schedule for Option 4 will be achieved is then 0.9 x 0.8 x 1 0 = 0 72 or 72 percent.

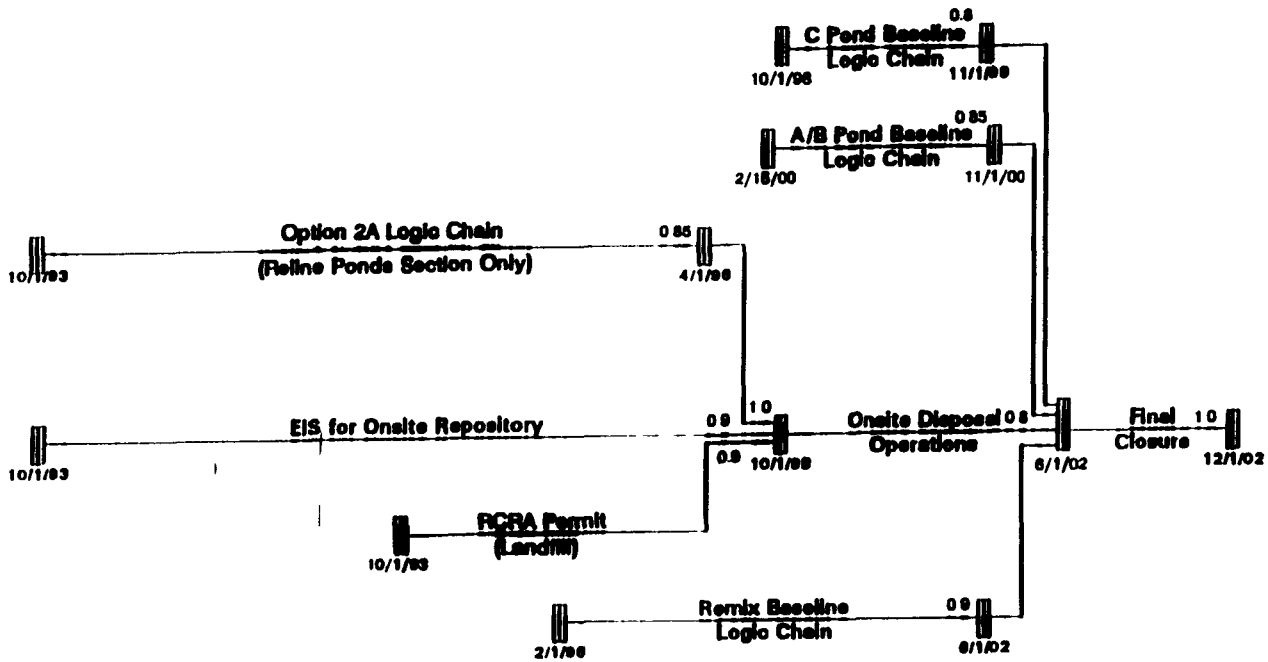
The probabilities developed for each option as discussed above serve as input to the PRA model, VERT. However, given the time constraints for this task and the delays in receiving much of the schedule information, many of the initial VERT runs were made using a simplifying assumption that the probability of achieving the most likely schedule (time duration) for each element and activity was 1 0 However, to create a probability distribution for the schedule, the maximum and minimum time durations for each element or activity were also input. Thus, the program calculated a normal probability distribution for each element or activities using those three time durations: most likely, maximum, and minimum and integrated these distributions across the entire logic chain.

The other probability needed for this analysis is the probability that a given option will be allowed to proceed (succeed). Those probabilities were also established through extensive discussions with EG&G and, in some cases, DOE staff. For example, the probability that NTS would be allowed to accept low level mixed waste (LLMW) is crucial to the Baseline and Options 2A-2D, 4A, and 5. The probability that NTS would be licensed for LLMW was estimated by R. Harris of DOE to be 100 percent, but he also estimated that there was only a 30-percent probability it would occur by October 1995 and 70 percent that it would occur by December 1997 Similarly, given the history of antagonism to RFP by the public, EPA, and state officials, the probability that the EIS ROD for any of the on-site disposal Options (4, 4A, and 5) would

support that option was estimated to be no higher than 30 percent by almost everyone questioned.

The probability of success and the main issues related to that probability are summarized in **Table 4-3.**

OPTION 4 - IN-SITU STABILIZATION



Probability of Achieving
Most Likely Schedule =
EIS x Disposal Operations x Closure
= 0.9 x 0.8 x 1.0 = 0.72

FIGURE 4.4.2 PROBABILITY OF ACHIEVING MOST LIKELY SCHEDULE

TABLE 4-3 ESTIMATES OF PROBABILITY OF SUCCESS

OPTION	PROBABILITY FOR SUCCESS	ISSUES RELATED TO PROBABILITY FOR SUCCESS
Baseline/NTS	75%	Availability of NTS degradation of waste forms
Baseline/(1) EC	65%	Licensing of Envirocare for Pu change in WAC, new procedures
2A	85%	NTS opening on time, cost EA sufficient
2B	60%	Removal of sludge from tanks
2C	30%	Violates plant EIS
2D	20%	Permitting of non-RCRA storage pond
3	30%	Site/construct new building HHH hazardous (oxidized) waste form
4	30%	Public and political resistance to on-site disposal
4A	30%	Public and political resistance to on-site disposal.
5	30%	Public and political resistance to on-site disposal.

5.0 DEVELOPMENT AND EVALUATION OF COST

Cost estimates for each option, based on achieving the most likely schedule, were prepared by Project Time and Cost, Inc This section summarizes the major assumptions that drive the costs for each option and provides an analysis if those costs

5.1 Cost Evaluations

Tables 5-1 through 5-8 provide LCC costs for each pond sludge processing option analyzed. **Table 5-9** summarizes the costs for all options.

Section 5.1.1 below discusses the costs associated with the Baseline/NTS option. Succeeding sections discuss costs associated with other options and identify cost changes as compared to Baseline.

5 1.1 Baseline/NTS

The Baseline/NTS cost estimate (**Table 5-1**) is based on the following activities occurring in the time frame of FY94 through FY02

- Process sludge $193,823,000

  Design, construction and operation of process to treat C Pond sludge and A/B Pond sludge, and the existing inventory of pondcrete and saltcrete

- Water Management $40,519,000

  Treatment of ITS waste with the Building 910 evaporators

- Remediation of OU4 soil $87,288,000

- Pad Operations $76,879,000

  Handling, storage, maintenance, shipment and disposal of waste forms.

- Technical Support $3,805,000

- Project Support $18,977,000

Adding contingency and escalation shown in **Table 5-1**, the total LCC costs for Baseline/NTS is $582,345,000

5 1 2 Option 1 Baseline/Envirocare

The Baseline/Envrocare cost estimate in **Table 5-2**, is similar to the Baseline/ NTS estimate with the following major exception

- Sludge processing and pad operations end 2 years earlier due to disposal site availability Pad operations costs change from $76,879,000 (for Baseline/NTS) to $58,048,000 (for Baseline/Envirocare)

The resultant sub-element of LCC are

- Process sludges $185,409,000
- Water management $40,519,000
- Remediation of OU4 $87,288,000
- Pad operation $58,048,000
- Technical support $3,805,000
- Project Support $18,977,000

Adding contingency and escalation, costs shown in **Table 5-2**, the total LCC for Baseline/Envirocare is $537,022,000

5.1.3 Option 2A (RCRA Lined Ponds for Temporary Storage)

The Option 2A cost estimates (see **Table 5-3**) varies from the Baseline estimate in the following major items

- Pond sludge processing costs are lower ($188,529,000 vs $193,823,000) due to equipment lease costs
- Pad operations costs are higher ($79,564,000 vs $76,879,000) because it includes the costs to reline the ponds and escalate from pushing out work scope.

The resultant sub-element of LCC costs are:

- Process sludge $188,529,000
- Water Management $40,510,000
- Remediation of OU4 soil $87,288,000
- Pad operations $76,564,000
- Technical support $4,622,000
- Project support $23,542,000

Adding contingency and escalation, the total LCC cost for Option 2A is $613,133,000.

5.1.4 Option 2B (Tanks near Ponds for Temporary Storage)

The Option 2B estimate (**Figure 5-4**) varies from the Baseline estimate in the following major items.

- Pond sludge processing costs are lower ($188,520,000 vs $193,823,000) due to equipment lease costs
- Pad operations costs are more ($76,987,000 vs. $76,879,000) because the savings in pad storage (2 less years) is offset by the cost of the modular tanks

The following sub-elements of LCC are

- Process sludge $188,520,000
- Water Management $40,519,000

- Remediation of OU4 soil $87,288,000
- Pad operations and tank construction $76,987,000
- Technical support $4,622,000
- Project support $23,542,000

Adding contingency and escalation, the total LCC cost for Option 2B is $610,260,000

5.1.5 Option 2D (non-RCRA Ponds for Temporary Storage)

Cost elements for this option are identical to those estimated for Option 2A except the construction cost is $600,000 less by omitting the clay liner (see **Table 5-5**)

5.1.6 Option 4 (On-site Disposal)

The Option 4 cost estimate (**Table 5-6**) varies from the Baseline estimate as follows:

- Pond sludge processing costs are lower ($137,881,000 vs $193,823,000) due to the elimination of design, procurement, and construction of A/B Pond processing equipment (C Pond equipment will be used), and elimination of the costs for half crates and bladders.
- Pad operations costs are lower ($61,542,000 vs $76,987,000) due to elimination of costs associated with transport and disposal.

The resultant sub-element of LCC costs are

- Process sludge $137,881,000
- Water Management $40,519,000
- Remediation of OU4 soil $87,288,000
- Pad operations $61,542,000
- Technical support $4,350,000

- Project support $23,042,000

Adding contingency and escalation, the total LCC cost for Option 4 is $515,576,000

5.1.7 Option 4A (Partial On-Site Disposal

The Option 4A cost estimates vary from the Baseline costs in the following major items

- Pond sludge processing costs are lower ($101,830,000 vs $193,823,000) due to elimination of A/B Pond sludge processing requirements.
- Pad operations costs are lower ($59,769,000 vs. $76,879,000) due to partial elimination of transport and disposal costs.

The resultant sub-element of LCC costs are

- Process sludge $101,830,000
- Water Management $40,519,000
- Remediation of OU4 soil $87,288,000
- Pad operations $59,769,000
- Technical support $3,805,000
- Project support $18,977,000

Adding contingency (15 percent) and escalation, the total LCC cost for Option 4A is $455,806,000. See **Table 5-7** for the cost distribution by year.

5.1.9 Option 5 (Partial On-Site Disposal)

The Option 5 costs estimate (**Table 5-8**) varies from the Baseline estimate as follows:

- Pond sludge processing costs are lower ($156,130,000 vs $193,823,000) due to elimination of A/B Pond sludge processing requirements.
- Pad operations costs are lower ($76,230,000 vs $76,879,000) due to partial

elimination of transport and disposal costs.

The resultant sub-element of LCC costs are.

- Process sludge $156,130,000
- Water Management $40,519,000
- Remediation of OU4 soil $87,288,000
- Pad operations $76,230,000
- Technical support $3,805,000
- Project support $18,977,000

Adding contingency (15 percent) and escalation, the total LCC cost for Option 5 is $537,330,000

5.2 DEVELOPMENT OF MINIMUM AND MAXIMUM COSTS

The LCCs were used in two ways to develop the cost range (minimum and maximum) expected for each option. First, the LCCs were used as input to the PRA model, VERT, which computed a cost distribution frequency associated with the time duration ranges developed during the schedule analysis. This cost distribution was examined and the costs associated with the 30 percent and 80 percent frequency selected as reasonable minimums and maximums.

Since the VERT runs did not analyze costs for water management (since that activity is essentially independent of the SPRP and OU4 and those costs are considered to only be ROM) the minimum, most likely,and maximum costs from the VERT runs (30%, 50%, 80%) were used to establish proportions which were then multiplied by the LCC for the system to estimate the associated minimum and maximum cost. For example, for Option 4A the 30/50 percent proportion from the VERT cost run is 0 99 and the 80/50 proportion is 1 01. Thus, the VERT-based minimum and maximum cost for that option (LCC=$376M) would be approximately $372M

and $380M.

Adjustment to these costs were made, if necessary, to account for possible schedule delays or advancements that could not be integrated into the VERT models in the time available This included such events as the failure to complete the SO testing and approval in time to complete processing the same year (which would cause a schedule slippage of 8 months to a year for either C Pond or A/B Pond processing and of 16 months to 2 years if it happened to both) Another event that was factored into the minimum/maximum cost adjustments was changes in the availability for the disposal sites. For example, if the NTS site opening is delayed a year, this adds approximately $23M in costs to each option. Conversely, if NTS opens sooner, comparable savings would be realized. Similarly, the possible cost savings of completing the EIS and RCRA Part B permit needed to establish a RCRA landfill on site sooner was factored into the estimation of minimum costs for some options

The data available within the time frame for this task limited the completion of cost analysis using VERT to the Baseline case and Options 2A, 2D, 4, and 4A for this report. The remaining options are presently being analyzed.

The minimum and maximum costs for each option and the associated worst case schedule are presented in **Table 5-10.**

TABLE 5-9 SUMMARY OF LIFE CYCLE COST COMPARISON ($000)

OPTION/DESCRIPTION	PROCESS	WATER MANAGEMENT	REMEDIATE SOIL	PAD OPTS & STORAGE	TECH SUPPORT	PROJECT SUPPORT	SUB TOTAL	CONTINGENCY	ESC	TOTAL
BASELINE/NTS	$193,823	$40,519	$87,288	$76,879	$3,805	$18,977	$421,291	$87,041	$74,013	$582,345
BASELINE/ENVIROCARE	185,409	40,519	87,288	58,048	3,805	18,977	394,046	84,982	57,994	537,022
2A/RECEIVE PONDS - RCRA	188,520	40,519	87,288	79,564	4,622	23,542	424,055	87,391	101,687	613,133
2B/MODULAR TANKS - IN PA	188,520	40,519	87,288	76,987	4,622	23,542	421,478	87,177	101,605	610,260
2C/MODULAR TANKS - OUT PA										
2D/RELINE PONDS - NON RCRA	187,920	40,519	87,288	79,564	4,622	23,542	423,455	87,391	101,687	612,533
3/374 SPRAY DRYER	201,552	40,519	87,288	75,424	4,892	24,390	434,064	88,138	98,348	620,550
4/ON-SITE DISPOSAL	137,881	40,519	87,288	61,542	4,350	23,042	354,622	78,340	82,614	515,576
4A/PARTIAL ON-SITE DISPOSAL	101,830	40,519	87,288	59,769	3,805	18,977	312,188	77,998	65,620	455,806
5/PARTIAL ON-SITE DISPOSAL	156,130	40,519	87,288	76,230	3,805	18,977	382,949	83,733	70,647	537,330

TABLE 5-10 MINIMUM AND MAXIMUM COSTS

OPTION	COST $ MILLION MIN	MOST LIKELY	MAX.	SCHEDULE PROB FOR ACHIEVING SCHEDULE	WORST CASE SCHEDULE SLIP (MONTHS)
BASELINE/NTS	$485	$500	$536	85%	18
BASELINE/EC (1)	432	444	584	80%	12
2A	529	540	575	85%	18
2B	523	537	560	80%	18
2D	529	540	575	85%	18
4	414	428	460	80%	18
4A	362	376	410	70%	18
5	443	457	491	80%	12

Solar Pond Remediation Project (OU 4)
Baseline Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge										
Project Management	7223	7388	6461	3022	3303	4410	2876	0	0	33683
Contingency (6.8%)	421	431	318	176	193	257	168	0	0	1964
Solidified C Pond/Clarif	26980	16763	0	0	0	0	0	0	0	43743
Contingency (8.75%)	2361	1467	0	0	0	0	0	0	0	3828
Solidified A/B Pond	3415	20841	6840	0	0	0	0	0	0	31096
Contingency (9.58%)	327	1997	655	0	0	0	0	0	0	2979
Remixed Pondcrete/Saltcrete	0	2181	2450	15217	16971	34130	14352	0	0	86301
Contingency (27%)	0	589	662	4109	4582	9215	3876	0	0	23031
Subtotal	40727	51656	16386	22524	25049	48012	21271	0	0	225624
Water Management	6551	5656	5672	5656	5666	5656	5672	0	0	40519
Contingency (6.67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29663	2050	6336	8084	3645	87288
Contingency (51.3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	10476	9457	8215	8472	21834	12481	5944	0	0	76879
Contingency (8.33%)	873	788	684	706	1819	1040	495	0	0	6404
Subtotal	11349	10245	8899	9178	23653	13521	6439	0	0	83283
Technical Support	543	543	545	543	543	543	545	0	0	3805
Contingency (5.83%)	32	32	32	32	32	32	32	0	0	222
Subtotal	575	575	577	575	575	575	577	0	0	4027
Project Support	2710	2710	2717	2710	2710	2710	2710	0	0	18977
Contingency (5.83%)	158	158	158	158	158	158	158	0	0	1106
Subtotal	2868	2868	2875	2868	2868	2868	2868	0	0	20083
Total Cost w/o Contingency	62027	70016	36011	60423	80670	61980	38435	8084	3645	421291
Contingency	6728	8136	4998	18289	22381	12131	8358	4150	1871	87041
Subtotal	68755	78152	41009	78712	103051	74111	46793	12234	5516	508332
Escalation Index	1.031	1.065	1.101	1.138	1.176	1.216	1.258	1.300	1.345	
Escalation	2131	5080	4150	10831	18168	16023	12064	3675	1901	74013
Grand Total	$70,886	$83,231	$45,159	$89,543	$121,219	$90,134	$58,847	$15,908	$7,417	$582,345

TABLE 5-1 REV

Solar Pond Remediation Project (OU 4)
Option 1 (Envirocare) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge										
Project Management	6106	6242	4367	3893	4661	0	0	0	0	25269
Contingency (5 8%)	356	364	255	227	272	0	0	0	0	1473
Solidified C Pond/Clarif	26980	16763	0	0	0	0	0	0	0	43743
Contingency (8 75%)	2361	1467	0	0	0	0	0	0	0	3828
Solidified A/B Pond	3415	20841	6840	0	0	0	0	0	0	31096
Contingency (9 58%)	327	1997	655	0	0	0	0	0	0	2979
Remixed Pondcrete/Saltcrete	12956	15264	10116	31000	15965	0	0	0	0	85301
Contingency (27%)	3498	4121	2731	8370	4311	0	0	0	0	23031
Subtotal	55999	67059	24964	43490	25208	0	0	0	0	216720
Water Management	6551	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6 67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29653	2050	6336	8084	3645	87288
Contingency (51 3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	8025	10316	20002	10339	9366	0	0	0	0	58048
Contingency (8 33%)	668	859	1666	861	780	0	0	0	0	4835
Subtotal	8693	11175	21668	11200	10146	0	0	0	0	62883
Technical Support	543	543	545	543	543	543	545	0	0	3805
Contingency (5.83%)	32	32	32	32	32	32	32	0	0	222
Subtotal	575	575	577	575	575	575	577	0	0	4027
Project Support	2710	2710	2717	2710	2710	2710	2710	0	0	18977
Contingency (5 83%)	158	158	158	158	158	158	158	0	0	1106
Subtotal	2868	2868	2875	2868	2868	2868	2868	0	0	20083
Total Cost w/o Contingency	71415	82812	54370	78944	68554	10959	15263	8084	3645	394046
Contingency	9957	11673	7986	22756	21150	1619	3820	4150	1871	84982
Subtotal	81372	94485	62356	101700	89704	12578	19083	12234	5516	479028
Escalation Index	1 031	1 066	1 101	1.138	1.176	1.216	1.258	1 300	1.345	
Escalation	2623	6142	6310	13994	15815	2719	4918	3675	1901	57994
Grand Total	$83,894	$100,626	$68,666	$115,694	$105,519	$15,298	$23,999	$15,908	$7,417	$537,022

Solar Pond Remediation Project (OU 4)
Option 2A (Reline B Ponds) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge										
Project Management	0	0	0	1867	4690	6262	3419	4403	3565	24206
Contingency (5.8%)	0	0	0	109	273	365	199	257	208	1411
Solidified C Pond/Clarif	1300	1000	1002	1609	28042	14969	0	0	0	47922
Contingency (8.76%)	114	88	88	141	2454	1310	0	0	0	4193
Solidified A/B Pond	0	0	0	413	4030	18390	8258	0	0	31091
Contingency (9.58%)	0	0	0	40	386	1762	791	0	0	2979
Rembxd Pondcrete/Saltcrete	0	0	0	1688	12956	15268	11484	27890	16015	85301
Contingency (27%)	0	0	0	456	3498	4122	3101	7530	4324	23031
Subtotal	1414	1088	1090	6322	56329	62448	27252	40080	24112	220134
Water Management	6561	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6.67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29653	2050	6336	8084	3646	87288
Contingency (51.3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	8248	10694	7100	7136	9276	13111	7100	9391	7508	79564
Contingency (8.33%)	687	891	591	594	773	1092	591	782	625	6628
Subtotal	8935	11585	7691	7730	10049	14203	7691	10173	8133	86192
Technical Support	543	543	545	543	543	543	545	545	272	4622
Contingency (5.83%)	32	32	32	32	32	32	32	32	16	269
Subtotal	575	575	577	575	575	575	577	577	288	4891
Project Support	2710	2710	2717	2710	2710	2710	2710	2710	1855	23542
Contingency (5.83%)	158	158	158	158	158	158	158	158	108	1372
Subtotal	2868	2868	2875	2868	2868	2868	2868	2868	1963	24914
Total Cost w/o Contingency	23481	25080	21147	48425	97656	78959	45524	53023	32880	424056
Contingency	3547	3843	3358	14638	23172	10270	8503	12909	7152	87391
Subtotal	27028	28923	24506	61063	120728	89228	54027	65932	40012	511446
Escalation Index	1 031	1 065	1.101	1 138	1 176	1 216	1 258	1 300	1 345	
Escalation	838	1880	2480	8402	21284	19291	13917	19806	13788	101687
Grand Total	$27,866	$30,803	$26,985	$69,465	$142,012	$108,521	$67,944	$85,737	$53,801	$613,133

TABLE 5-3 REV

Solar Pond Remediation Project (OU 4)
Option 2B (Modular Tanks) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge	0	0	0	1867	4690	6262	3419	4403	3565	24206
Project Management	0	0	0	109	273	365	199	257	208	1411
Contingency (5 8%)	1300	1000	1002	1609	28042	14969	0	0	0	47922
Solidified C Pond/Clanf	114	88	88	141	2454	1310	0	0	0	4193
Contingency (8 75%)	0	0	0	413	4030	18390	8258	0	0	31091
Solidified A/B Pond	0	0	0	40	386	1762	791	0	0	2979
Contingency (9 58%)	0	0	0	1688	12956	15268	11484	27890	16015	85301
Remixed Pondcrete/Saltcrete	0	0	0	456	3498	4122	3101	7530	4324	23031
Contingency (27%)	0	0	0	6322	56329	62448	27252	40080	24112	220134
Subtotal	1414	1088	1090							
Water Management	6551	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6 67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29653	2050	6336	8084	3646	87288
Contingency (51 3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	7206	7592	8667	7136	9276	13111	7100	9391	7508	76987
Contingency (8 33%)	600	632	722	594	773	1092	591	782	625	6413
Subtotal	7806	8224	9389	7730	10049	14203	7691	10173	8133	83400
Technical Support	543	543	545	543	543	543	546	545	272	4622
Contingency (5 83%)	32	32	32	32	32	32	32	32	16	269
Subtotal	575	575	577	575	575	575	577	577	288	4891
Project Support	2710	2710	2717	2710	2710	2710	2710	2710	1855	23542
Contingency (5.83%)	158	158	158	158	158	158	158	158	108	1372
Subtotal	2868	2868	2875	2868	2868	2868	2868	2868	1963	24914
Total Cost w/o Contingency	22439	21978	22714	48425	97566	78959	45524	53023	32860	421478
Contingency	3460	3586	3488	14638	23172	10270	8503	12909	7152	87177
Subtotal	25899	25563	26202	61063	120728	89229	54027	65932	40012	508655
Escalation Index	1.031	1.065	1 101	1.138	1 176	1 216	1 258	1.300	1.345	
Escalation	803	1662	2652	8402	21284	19291	13917	19806	13788	101605
Grand Total	$26,702	$27,224	$28,854	$69,465	$142,012	$108,521	$67,944	$85,737	$53,801	$610,260

TABLE 5-4 REV

Solar Pond Remediation Project (OU 4)
Option 4 (In-Situ) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge										
Project Management	0	0	0	0	0	7366	6560	5582	708	20215
Contingency (5 8%)	0	0	0	0	0	429	382	325	41	1179
Solidified C Pond/Clarif	1300	1000	1003	1000	1000	23090	12224	0	0	40617
Contingency (8 75%)	114	88	88	88	88	2020	1070	0	0	3554
Solidified A/B Pond	0	0	0	0	0	3203	4985	0	0	8188
Contingency (9 58%)	0	0	0	0	0	307	478	0	0	784
Remixed Pondcrete/Saltcrete	0	0	0	0	4854	21319	21890	20189	609	68861
Contingency (27%)	0	0	0	0	1311	5756	5910	5451	164	18592
Subtotal	1414	1088	1091	1088	7252	63490	53499	31547	1523	161990
Water Management	6551	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6 67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29653	2050	6336	8084	3645	87288
Contingency (51 3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	8461	12682	7313	7313	7313	7100	7100	4260	0	61542
Contingency (8 33%)	705	1056	609	609	609	591	591	355	0	5126
Subtotal	9166	13738	7922	7922	7922	7691	7691	4615	0	66668
Technical Support	543	543	545	543	543	543	545	546	0	4350
Contingency (5 83%)	32	32	32	32	32	32	32	32	0	264
Subtotal	575	575	577	575	575	575	577	577	0	4604
Project Support	2710	2710	2717	2710	2710	2710	2710	2710	1355	23042
Contingency (5.83%)	158	158	158	158	158	158	158	158	79	1343
Subtotal	2868	2868	2875	2868	2868	2868	2868	2868	1434	24385
Total Cost w/o Contingency	23694	27068	21361	42025	51729	73036	68022	41370	6317	354622
Contingency	3566	4009	3378	13996	17795	10723	12252	10471	2156	78340
Subtotal	27259	31077	24737	56020	69524	83759	80274	51841	8473	432962
Escalation Index	1.031	1.065	1 101	1 138	1 176	1.216	1.258	1 300	1.345	
Escalation	845	2020	2503	7708	12257	18109	20679	15573	2920	82614
Grand Total	$28,104	$33,097	$27,240	$63,728	$81,781	$101,868	$100,952	$67,414	$11,392	$515,576

TABLE 5-6 REV

Solar Pond Remediation Project (OU 4)
Option 4a (In-Situ Drying) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge										
Project Management	0	0	393	2311	2859	4044	1292	0	0	10899
Contingency (5 8%)	0	0	23	135	167	236	75	0	0	635
Solidified C Pond/Clarif.	600	0	0	0	2100	0	0	0	0	2700
Contingency (8.75%)	53	0	0	0	184	0	0	0	0	236
Solidified A/B Pond	0	0	0	0	2930	0	0	0	0	2930
Contingency (9 58%)	0	0	0	0	281	0	0	0	0	281
Remixed Pondcrete/Saltcrete	0	2181	2450	15217	16971	34130	14352	0	0	85301
Contingency (27%)	0	589	662	4109	4582	9215	3875	0	0	23031
Subtotal	653	2770	3527	21771	30073	47625	19594	0	0	126014
Water Management	6551	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6 67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29663	2050	6336	8084	3645	87288
Contingency (51 3%)	2119	2298	2110	12731	16221	1052	3252	4150	1871	44806
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	8460	10908	7313	7360	7418	10777	7543	0	0	59769
Contingency (8 33%)	705	909	609	612	618	898	628	0	0	4979
Subtotal	9165	11817	7922	7962	8036	11676	8171	0	0	64748
Technical Support	543	543	545	543	543	543	545	0	0	3805
Contingency (5 83%)	32	32	32	32	32	32	32	0	0	222
Subtotal	575	575	577	575	575	575	577	0	0	4027
Project Support	2710	2710	2717	2710	2710	2710	2710	0	0	18977
Contingency (5.83%)	158	158	158	158	158	158	158	0	0	1106
Subtotal	2868	2868	2875	2868	2868	2868	2868	0	0	20083
Total Cost w/o Contingency	22893	26476	23201	58590	70840	59810	38450	8084	3645	312188
Contingency	3503	4362	3972	18154	21619	11968	8399	4150	1871	77998
Subtotal	26496	30837	27173	76744	92459	71878	46849	12234	5516	390186
Escalation Index	1.031	1.065	1.101	1 138	1.178	1 216	1.258	1 300	1 345	
Escalation	821	2004	2750	10680	16301	15540	12068	3675	1901	65620
Grand Total	$27,318	$32,842	$29,923	$87,304	$108,760	$87,418	$58,917	$15,908	$7,417	$455,806

TABLE 5-7 REV

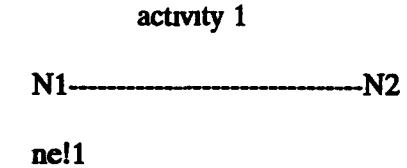
Solar Pond Remediation Project (OU 4)
Option 5 (In-Situ Drying) Cost Summary ($000)

WBS Element	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTALS
Processed Sludge	8197	4160	393	2311	2859	4044	2192	0	0	24156
Project Management	478	243	23	135	167	236	128	0	0	1408
Contingency (5 8%)	26980	16763	0	0	0	0	0	0	0	43743
Solidified C Pond/Clarif	2361	1467	0	0	0	0	0	0	0	3828
Contingency (8 75%)	0	0	0	0	2930	0	0	0	0	2930
Solidified A/B Pond	0	0	0	0	281	0	0	0	0	281
Contingency (9 58%)	0	2181	2450	15217	16971	34130	14352	0	0	85301
Remixed Pondcrete/Saltcrete	0	589	662	4109	4582	9215	3875	0	0	23031
Contingency (27%)	38016	25402	3527	21771	27790	47625	20547	0	0	184678
Subtotal										
Water Management	6551	5656	5672	5656	5656	5656	5672	0	0	40519
Contingency (6 67%)	437	377	378	377	377	377	378	0	0	2703
Subtotal	6988	6033	6050	6033	6033	6033	6050	0	0	43222
Remediated Soil	4129	4477	4111	24803	29653	2050	6336	8084	3645	87288
Contingency (51 3%)	2119	2298	2110	12731	15221	1052	3252	4150	1871	44805
Subtotal	6248	6775	6221	37534	44874	3102	9588	12234	5516	132093
Pad Operations & Storage	8940	12359	10062	10090	16459	10777	7543	0	0	76230
Contingency (8 33%)	745	1030	838	840	1371	898	628	0	0	6350
Subtotal	9685	13389	10900	10930	17830	11675	8171	0	0	82580
Technical Support	543	543	545	543	543	543	545	0	0	3805
Contingency (6 83%)	32	32	32	32	32	32	32	0	0	222
Subtotal	575	575	577	575	575	575	577	0	0	4027
Project Support	2710	2710	2717	2710	2710	2710	2710	0	0	18977
Contingency (5 83%)	158	158	158	158	158	158	158	0	0	1106
Subtotal	2868	2868	2875	2868	2868	2868	2868	0	0	20083
Total Cost w/o Contingency	58060	48849	25950	81330	77781	59910	38350	8084	3645	382949
Contingency	6329	6193	4201	18382	22188	11968	8452	4150	1871	83733
Subtotal	64379	55042	30151	79712	99969	71878	47802	12234	5516	466682
Escalation Index	1.031	1.065	1.101	1.138	1 176	1 216	1.258	1.300	1.345	
Escalation	1996	3578	3051	10968	17626	16540	12314	3675	1901	70647
Grand Total	$66,375	$58,619	$33,203	$90,680	$117,594	$87,418	$60,115	$15,908	$7,417	$537,330

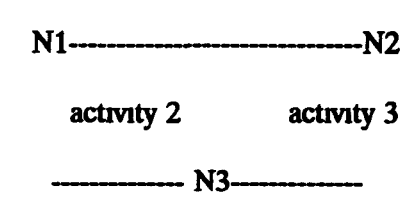
TABLE 5-8 REV

6.0 Probabilistic Risk Analysis

Probabilistic Risk Analysis (PRA) provides a sophisticated tool to manipulate and analyze complex information containing uncertainties The first step in any PRA is to build a model. This model should include consideration of all options for achieving a goal or a milestone and all activities associated with each option. Consideration should be given to the cost and time variables associated with each of the various activities. The uncertainties in these variables is taken into account by selecting a probability distribution around the mean time and cost for a particular activity Each activity is linked to other activities by use of logic chains. All activities are initiated from an input node and terminate at an output node as illustrated below



where N1 is the input node and N2 the output node for activity 1 Contingencies can be accounted for by a separate activity path between the same nodes N1 and N2 as shown below



where activity 2 and activity 3 represent contingent activities that may be required to reach the same goal or node N2.

After the logic chain or model is constructed completed with time, time distribution, cost, and cost distribution, experiments are conducted using random numbers and Monte Carlo techniques to test out the consequences of various aspects of the model for each option. During this process the analyst gains insights concerning key aspect of the model that are needed in refining the

model. After the model has been tested and refined, then the consequences predicted by the model are analyzed and used to compare with the consequences predicted by the models used for the other options under consideration.

6.1 VERT

The analysis of the baseline processing of the Solar Pond sludge using PRA techniques has been performed using the software Venture Evaluation Review Technique (VERT) This software has been widely used for the past 20 years for PRA application and is available from the US Army Logistics Management Center, Ft. Lee, VA. This code can be used to process a complicated logic chain with many simultaneous activities and contingencies. The output of this code provides probability distribution estimates of time and cost associated with major goals.

6.2 BASELINE PROCESSING

The Baseline Processing Logic Chain shown in Figure B-4 was used as the basis for the PRA model. This logic chain show the expected time for each activity Cost estimates for each of these activities were based on detailed cost breakdown information dated March 1, 1993 as supplied by EG&G Rocky Flats, Inc. In the following discussion the VERT PRA model will be described, the input assumptions documented or justified, and the prediction of VERT discussed.

6 2.1 VERT MODEL

The Logic Chain shown in Figure B-4 was used as the basis of the VERT model. This logic chain was broken into three parts C Pond, A/B Pond, and Remix in the actual VERT model in order to simplify the analysis. The output results of C pond were used as input to the A/B Pond model and the output from A/B Pond used as input to the Remix model. In addition,

the cost for HNUS Project Management, Pad Operations, Technical Support, and Program Management that were not clearly associated with a particular activity were lumped together as a single activity with a duration extending for the entire time projected for baseline processing.

6.2.2. Documentation of VERT Input

Considerable judgement is required in establishing the time and cost variables for the model described above. As indicated, the expected time for each activity was obtained the Logic Chain diagram shown in Figure B-4 The probability distribution around this expected time required the selection of a minimum and maximum time as well for completing each activity. These selections were made on the basis of consultation with experienced Rocky Flats personnel and judgement by ICF KE personnel responsible for making these estimates. These estimates are documented on VERT Input Forms and VERT input data presented in Appendix C, and the VERT output presented in Appendix D These estimates can be seen on the DTIME line in the VERT output echo of the input data (generally found on page 2 of the output) as the last three numbers. The first of these numbers is the minimum time estimated to complete the activity, the second is the maximum time, and the last is the expected time to complete the activity.

The cost in units of thousands of dollars/month for each activity is also given in the VERT output on the RCOST line in the form:

$$C(t) = At + K$$

where A and K are constants and t is time in months. The constant A is represented on the RCOST line as SK. If no number appears after SK then the constant A is zero The constant K is zero in most cases. The cost values used for input were obtained by summing up all cost for a particular activity and dividing by the expected time in months required to complete the activity. For example, the C Pond output indicated an expected time of 18.27 months to complete

demobilization and a cost of $27,850 thousands of dollars plus an additional cost $26,040 thousands of dollars for storage and disposal. Therefore, C Pond input to the A/B Pond portion of the logic chain is computed as follows

$$C(t) = (\$27,850/18.27)t + \$26,040$$

which yields

$$C(t) = \$1524.36t + \$26,040$$

as shown on the VERT RCOST line associated with activity A10 (see VERT Run ABPD0302 dated 03-03-93 Cost for other activities are computed in a similar manner but are generally derived by adding up the cost from the detailed cost estimates supplied by EG&G and then dividing by the expected time to complete the activity Therefore, the cost estimate for most activities have a value of zero for the constant K.

The node assignments are also listed in the VERT output on the line preceding the DTIME line. The nodes are generally assigned in order: N01, N02,..., N25, .. The input node is the first node listed and the output node is the second node listed.

The node designations as Initial, All, And, Terminating, and Monte Carlo can be seen by inspecting the node lines which follow the activity lines. These designations are as follows:

- 1 in the 1st column indicates an Initial node
- 2 in the 1st column indicates an All node
- 1 in the 2nd column indicates a terminating node
- 2 in the 2nd column indicates an And node
- 3 in the 2nd column indicates a Monte Carlo node.

6.2.2.1 VERT RESULT OF BASELINE PROCESSING

As indicated above the Baseline Processing option as illustrated by Figure B-4, was divided

into three smaller models: C Pond, A/B Pond, and Remix. The C Pond model included the cost associated with C Pond which were estimated to total $37,186k in the detailed price estimates supplied by EG&G plus $25,146k for specific C Pond Pad Operation Cost for a total of $62,332k. The A/B Pond model included the $29,840k estimated specifically for A/B Pond plus specific pad operation cost for A/B Pond of $6,213k and in addition included the $62,332k cost from C Pond as an input for a total of $98,385k. The Remix model included the $82,689k specifically earmarked for Remix plus $11,804k for pad operations specifically earmarked for Remix plus the $98,385k from the A/B Pond model as an input for a total of $192,878k. A second Remix model was used which also included the following additional cost:

- HNUS Project Management = $ 23,714 thousands
- Non-specific Pad Operation Cost = $ 65,085 "
- Technical Support $ 1,911 "
- Program Management = $ 16,191 "

  Total $106,901 "

Therefore, this second Remix model uses a total of $299,779k of estimated cost. This model which represents the total composite model excludes only Water Management and Assessment & Remediation cost which total $117,599k.

6.2.2.2 RESULTS OF C POND MODEL (VERT Run CPD0302)

This model predicts the following.

- Prepare for Hot Test:

  Time = 9.22 months with std. error of 0.56 months.

  Cost = 11 43 million with std. error of 1.15 million.

- Complete C Pond Treatment

Time = 14 10 months with std. error of 0.96 months.

Cost = 24 89 million with std. error of 2.41 million.

- Storage & Disposal

Time = 59 84 months with std. error of 2.40 months.

Cost = 50.93 million with std. error of 1.91 million.

- Demobilization

Time = 18.27 months with std. error of 0 95 months.

Cost = 27.85 million with std. error of 1.99 million.

It should be noted that the model schedules 16.5 months from project initiation to the completion of demobilization. The VERT model predicts this will take 18.27 months with less than a 10% chance of completion in the 16.5 months scheduled. The cost for C Pond activities from the cost breakdown estimates listed above is $62.332M. This model predicts a cost of $24 89M for all activities through completion of C Pond Treatment, a storage & disposal cost of $26.04M, and a demobilization cost of $2.96M for a total of $53.89M with a std. error of about $2 million. This is $8.44M less than the cost estimate provided by EG&G.

The C Pond results serve as an input to the A/B Pond Model. This input is computed below:

$$C(t) = (\$27\,85/18.27 \text{ million/month})t + \$26.04 \text{ million}$$

$$C(t) = (\$1{,}524.36 \text{ thousand/month})t + \$26{,}040 \text{ thousand}$$

6.2.2.3 Results of A/B Pond Model (VERT Run ABPD0302)

This model predicts the following

- Prepare for Hot Test

Time = 23.83 months with std. error of 1 08 months.

Cost = 65.53 million with std. error of 1 17 million.

- Complete Treatment of Waste

  Time = 28.50 months with std. error of 1.25 months.

  Cost = 79 77 million with std. error of 2.51 million.

- Storage & Disposal

  Time = 41 18 months with std. error of 1.53 months

  Cost = 86.41 million with std. error of 2.43 million.

- Demobilization

  Time = 33.71 months with std. error of 1.26 months.

  Cost = 85.00 million with std. error of 2.56 million.

It should be noted that the model schedules 30.0 months from project initiation to the completion of demobilization of A/B Pond equipment. The VERT model predicts this will take 33 71 months and less than a 1% chance of completion in the 30 months scheduled. The cost for A/B Pond activities from the cost breakdown estimates listed above is $98.385M. This model predicts a cost of $79 77M for all activities through completion of A/B Pond Waste Treatment, a storage and disposal cost of $6.64M, and a demobilization cost of $5.23M for a total of $91 64M. The difference between the detailed cost estimate and the VERT prediction is $6.75M. Again, this output is used to provide input to the Remix model. The computation of this input is given below

$$C(t) = (\$85{,}000/19.5 \text{ thousands/month})t + \$6{,}640 \text{ thousands}$$

$$C(t) = (\$4{,}358.97 \text{ thousands/month})t + \$6{,}640 \text{ thousands}$$

6 2.2.4 Results of Remix Process Model (VERT Run RMIX0303)

This model predicts the following:

- Prepare for Hot Test

  Time = 32.20 months with std. error of 1 09 months

  Cost = 137 73 million with std. error of 2.00 million.

- Complete Treatment of Saltcrete

  Time = 42.87 months with std. error of 1.28 months

  Cost = 178.97 million with std. error of 3.61 million.

- Disposal

  Time = 49 82 months with std. error of 1.47 months.

  Cost = 190.32 million with std. error of 3.77 million.

- Demobilization

  Time = 49.82 months with std. error of 1.47 months.

  Cost = 181.73 million with std. error of 3.54 million.

It should be noted that the model schedules a four month time lag between the demobilization of A/B Pond equipment to the start up of the Remix Process. In addition, the schedule projects 46 months from the start of Remix Process to the completion of demobilization. The VERT model predicts this will take 49 82 months. The cost for Remix Process activities from the cost breakdown estimates listed above is $192.878M. This model predicts a cost of 178.97M for all activities through completion of Remix Process treatment of Saltcrete, a disposal cost of 11.35M, and a demobilization cost of 2.76M for a total of 193 08M. The difference between the detailed cost estimate and the VERT prediction is only 0.202M.

6.2.2.5 Results of Remix Process Composite Model (VERT Run RMIX0304)

The total time between the initiation of C Pond activities through to the demobilization of Remix Process is predicted by VERT to require 83.5 months with a minimum time of 79 4 months

with a 10% probability and maximum time of 86 4 months with a 90% probability The expected time is used in the composite model to determine the monthly cost for the HNUS Project Management, the Non-specific Pad Operation Cost, Technical Support Cost, and Program Management. These cost as totaled above amount to $106 901M. The Cost/month, C(t) is computed below as:

C(t) = ($106,901/83.5 thousands/month)t

C(t) = ($1280.25 thousands/month)t

The Remix Process Composite Model uses this cost for an additional activity that requires and expected time of 83.5 months, a minimum time of 79 4 months and a maximum time of 86.4 months Except for an additional start node and this additional activity, this model is identical to the Remix Process Model.

This model predicts the following

- Prepare for Hot Test:

  Time = 32.43 months with std. error of 1.30 months.

  Cost = 138.09 million with std. error of 2.32 million.

- Complete Remix Process Treatment of Saltcrete:

  Time = 42.69 months with std. error of 1.25 months.

  Cost = 178.50 million with std. error of 2.83 million

- Remix Process Disposal

  Time = 49 82 months with std. error of 1 45 months.

  Cost = 190.25 million with std. error of 3 72 million.

- Remix Process Demobilization

  Time = 83.10 months with std. error of 1.44 million.

  Cost = 288.15 million with std. error of 4.00 million.

It should be noted that the model schedules 80 months from the initiation of C Pond activities through to the completion of demobilization for the Remix Process. The VERT COMPOSITE model predicts this will take 83 1 months. The cost for the entire baseline project based on the detailed cost estimates as indicated above is $299,779 This cost figure excludes only Water Management and Assessment and Remediation cost. The VERT composite model predicts this cost to be $178.5 M for all activities through to the completion of the Remix Process treatment of Saltcrete, a disposal cost of 11 75M, a demobilization cost of 2.76M taken from the first Remix Process model results, and a cost for the HNUS, Pad Ops, Tech Support, and Program Management of $106.89M for a total of $299 9M. The difference between the detailed cost estimate and the VERT prediction is only 0 121M.

6.2.3 CONCLUSIONS

The VERT models described above indicated that the baseline process will require a time duration ranging from 79 4 months to about 86 4 months and a cost ranging from about 285M to 315M. These models can easily be modified to account for contingencies and more precise algorithms for time and cost for the various activities.

6.3 OPTION 2A

The Option 2A Process has been analyzed using the PRA software Venture Evaluation Review Technique (VERT). This analysis includes projected times and cost. In the following discussion the VERT model will be described, the input assumtions documented or justified, and the prediction of VERT discussed.

6.3.1 VERT MODEL

The VERT model was adapted from the projected activity Logic Diagram (Figure B-6, located in Appendix B). VERT may be used to model all projected activities shown in the diagram, however, since only time, cost, and probabilities were available for the main line project activities, the model was restricted to cover only the available information. The VERT model makes use of a minimum, an expected, and a maximum time (in months) for each activity Costs for each activity were divided equally between the number of expected months for that particular activity This information is presented in the VERT input documentation (found in Appendix C) and the VERT runs (located in Appendix D)

The VERT model begins with an initial start node, N01, with 21 separate arcs emanating from the node. A lag time, associated with 17 of these initial activities (NEPA Documentation, procurement, personnel training, equipment integration, procedures and documents, designs, and readiness reviews), was selected for modeling so as not to cause a project delay The specific lag times assumed for the 17 arcs emanating from the initial start node are listed below:

(A01)	Time to start of Erection Personnel Training	48.5 months
(A07)	Time to start of Procurement (C Pond)	48.0 months
(A09)	Time to DOE Waivers	50.0 months
(A11)	Time to start of Operations Personnel Training	51.5 months
(A14)	Time to start of Procedures and Documents (C)	46.0 months
(A16)	Time to DOE Approval for Hot Test (C Pond)	56.0 months
(A25)	Time to start of Readiness Checkout	27.5 months
(A40)	Time to start of Procedures and Documents (A/B)	62.0 months
(A42)	Time to start of Operations Readiness (A/B Pond)	64 0 months
(A30)	Time to start of Designs (A/B Pond)	46.0 months

(A36) Time to start of Procurement (A/B Pond) 49 0 months

(A38) Time to start of Chlorination (A/B Pond) 65.0 months

(A51) Time to start of Treatability Studies (Remix) 43.0 months

(A57) Time to start of Procurement (Remix) 56.0 months

(A63) Time to Operations Readiness (Remix) 85.0 months

(A59) Time to start of Procedures and Documents (R) 67 0 months

(A61) Time to start of Training Operations Personnel 87 0 months

The VERT model uses 79 different arcs, labeled A01 through A79, and 57 different nodes, labeled N01 through N57 Many of the arcs are labeled by the activity name associated with the arc, such as Cold Test (C Pond) for A04 and Erection Stage 1 (A/B Pond) for A32. If the activity associate with the arc has a probability of less than 1.0 of being completed, that probability is also included in the input (for example, DOE Approval for Hot Test (A/B Pond) was judged to have a 0.95 percen chance of completion at A35). The terminal nodes (N07, N22, N35, N36, N48, N52, N56, N57, and N58) are indicated in the VERT run by a T. VERT average output information is indicated for these nodes. For example, N58 requires an average of 71.06 months and a cost of 57,299,320 dollars.

6.3.2 DOCUMENTATION OF VERT INPUT

Considerable judgement is required in establishing the time and cost variables for the model described above. As indicated, the lag time for arcs listed above were selected so that the time would not impact the project schedule. The time for all other activities were selected through consultation with EG&G personnel and documented on VERT Input Forms (Appendix C) by the ICF KE person responsible for assessing the activity

The cost for lag time arcs and terminal arcs (A28, A44, A45, A50, A67, A71, A75 and

A76) are assumed to be zero The cost for all other arcs was obtained from the Option 2A Schedule Activity Costs, dated March 1, 1993 The costs listed in the document were correlated with the arc activities and divided by the expected time for a particular activity For example, the cost of Procurement (C Pond), which is A08, is listed at 1905 thousands of dollars. The expected time of this activity is 2 months. Therefore, the cost for this activity is:

$$C(t) = 1905/2 = 952.5/\text{month in thousands of dollars.}$$

Mathematical formulas for costs were developed in a similar manner for the remaining activities (excluding lag times and terminal arcs) Purchase of equipment which represents a one time cost is included in the VERT math formulas as a constant. The cost of leased equipment is added to all activities taking place while the equipment is being leased. The cost of HNUS Project Management, EG&G Program Management, Pad Storage and Technical Support were distributed over the C pond, A/B pond and Remix activities.

6.4 OPTION 2D

The Option 2D Process has been analyzed using the PRA software Venture Evaluation Review Technique (VERT) This analysis includes projected times and cost. In the following discussion the VERT model will be described, the input assumtions documented or justified, and the prediction of VERT discussed.

6.4.1 VERT MODEL

The VERT model was adapted from the projected activity Logic Diagram (Figure B-8, located in Appendix B). VERT may be used to model all projected activities shown in the diagram, however, since only time, cost, and probabilities were available for the main line project activities, the model was restricted to cover only the available information. The VERT model

makes use of a minimum, an expected, and a maximum time (in months) for each activity. Costs for each activity were divided equally between the number of expected months for that particular activity This information is presented in the VERT input documentation (found in Appendix C) and the VERT runs (located in Appendix D)

The VERT model begins with an initial start node, N01, with 21 separate arcs emanating from the node. A lag time, associated with 17 of these initial activities (NEPA Documentation, procurement, personnel training, equipment integration, procedures and documents, designs, and readiness reviews), was selected for modeling so as not to cause a project delay. The specific lag times assumed for the 17 arcs emanating from the initial start node are listed below:

(A01)	Time to start of Erection Personnel Training	48.5 months
(A07)	Time to start of Procurement (C Pond)	48.0 months
(A09)	Time to DOE Waivers	50.0 months
(A11)	Time to start of Operations Personnel Training	51.5 months
(A14)	Time to start of Procedures and Documents (C)	46 0 months
(A16)	Time to DOE Approval for Hot Test (C Pond)	56.0 months
(A25)	Time to start of Readiness Checkout	27.5 months
(A40)	Time to start of Procedures and Documents (A/B)	62.0 months
(A42)	Time to start of Operations Readiness (A/B Pond)	64.0 months
(A30)	Time to start of Designs (A/B Pond)	46.0 months
(A36)	Time to start of Procurement (A/B Pond)	49.0 months
(A38)	Time to start of Chlorination (A/B Pond)	65.0 months
(A51)	Time to start of Treatability Studies (Remix)	43.0 months
(A57)	Time to start of Procurement (Remix)	56.0 months
(A63)	Time to Operations Readiness (Remix)	85.0 months

(A59) Time to start of Procedures and Documents (R) 67 0 months

(A61) Time to start of Training Operations Personnel 87.0 months

The VERT model uses 79 different arcs, labeled A01 through A79, and 57 different nodes, labeled N01 through N57 Many of the arcs are labeled by the activity name associated with the arc, such as Cold Test (C Pond) for A04 and Erection Stage 1 (A/B Pond) for A32. If the activity associate with the arc has a probability of less than 1 0 of being completed, that probability is also included in the input (for example, DOE Approval for Hot Test (A/B Pond) was judged to have a 0 95 percen chance of completion at A35) The terminal nodes (N07, N22, N35, N36, N48, N52, N56, N57, and N58) are indicated in the VERT run by a T VERT average output information is indicated for these nodes. For example, N58 requires an average of 71.06 months and a cost of 56,454,120 dollars

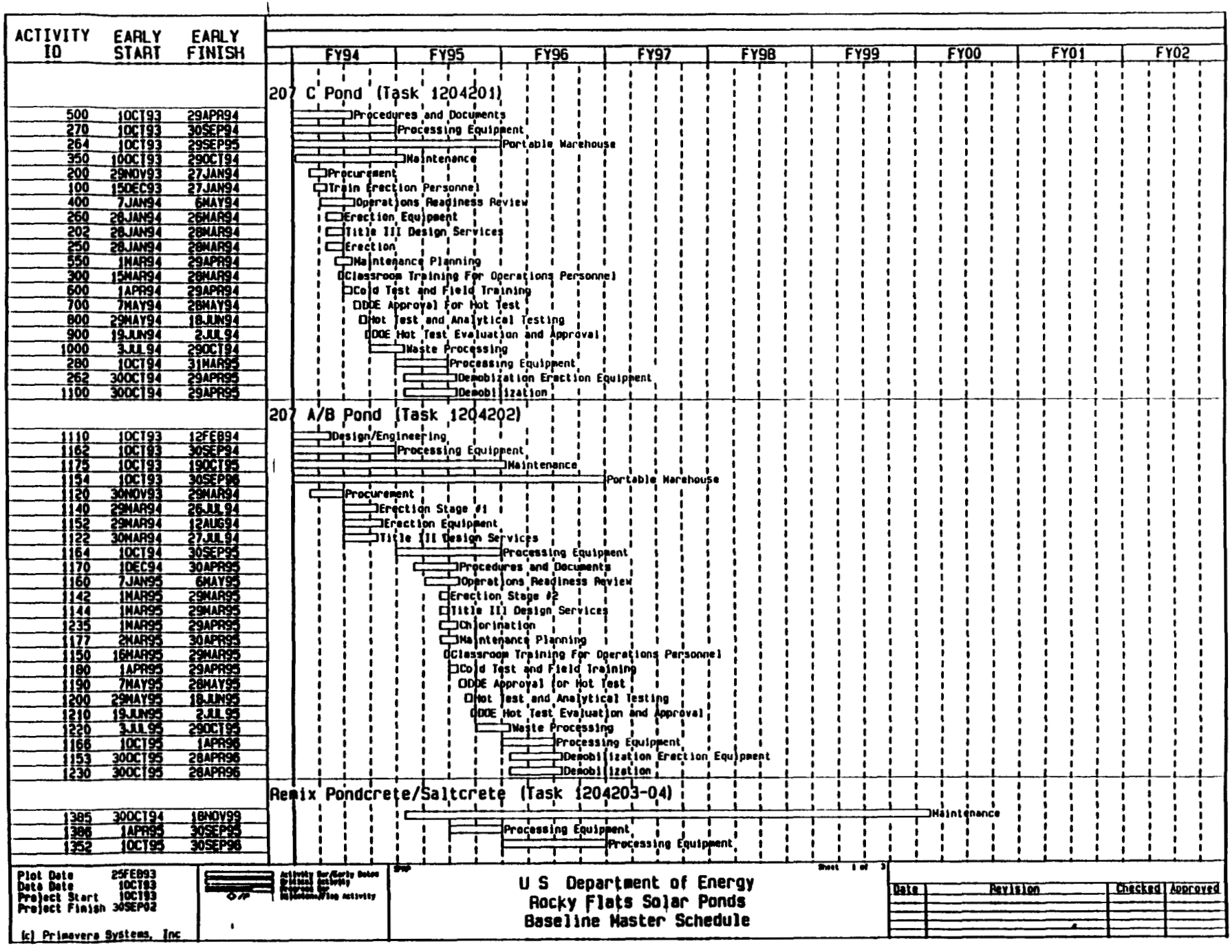
6.4.2 DOCUMENTATION OF VERT INPUT

Considerable judgement is required in establishing the time and cost variables for the model described above. As indicated, the lag time for arcs listed above were selected so that the time would not impact the project schedule. The time for all other activities were selected through consultation with EG&G personnel and documented on VERT Input Forms (Appendix C) by the ICF KE person responsible for assessing the activity

The cost for lag time arcs and terminal arcs (A28, A44, A45, A50, A67, A71, A75 and A76) are assumed to be zero. The cost for all other arcs was obtained from the Option 2D Schedule Activity Costs, dated March 1, 1993 The costs listed in the document were correlated with the arc activities and divided by the expected time for a particular activity For example, the cost of Procurement (C Pond), which is A08, is listed at 1905 thousands of dollars. The expected time of this activity is 2 months. Therefore, the cost for this activity is:

$C(t) = 1905/2 = 952.5$/month in thousands of dollars.

Mathematical formulas for costs were developed in a similar manner for the remaining activities (excluding lag times and terminal arcs) Purchase of equipment which represents a one time cost is included in the VERT math formulas as a constant. The cost of leased equipment is added to all activities taking place while the equipment is being leased. The cost of HNUS Project Management, EG&G Program Management, Pad Storage and Technical Support were distributed over the C pond, A/B pond and Remix activities.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270 10OCT93 30SEP94 Processing Equipment
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260 28JAN94 28MAR94 Erection Equipment
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262 30OCT94 29APR95 Demobization Erection Equipment
1100 30OCT94 29APR95 Demobilization
207 A/B Pond (Task 1204202)
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1162 10OCT93 30SEP94 Processing Equipment
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1352 10OCT95 30SEP96 Processing Equipment
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
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Rocky Flats Solar Ponds
Baseline Master Schedule
Date
Revision
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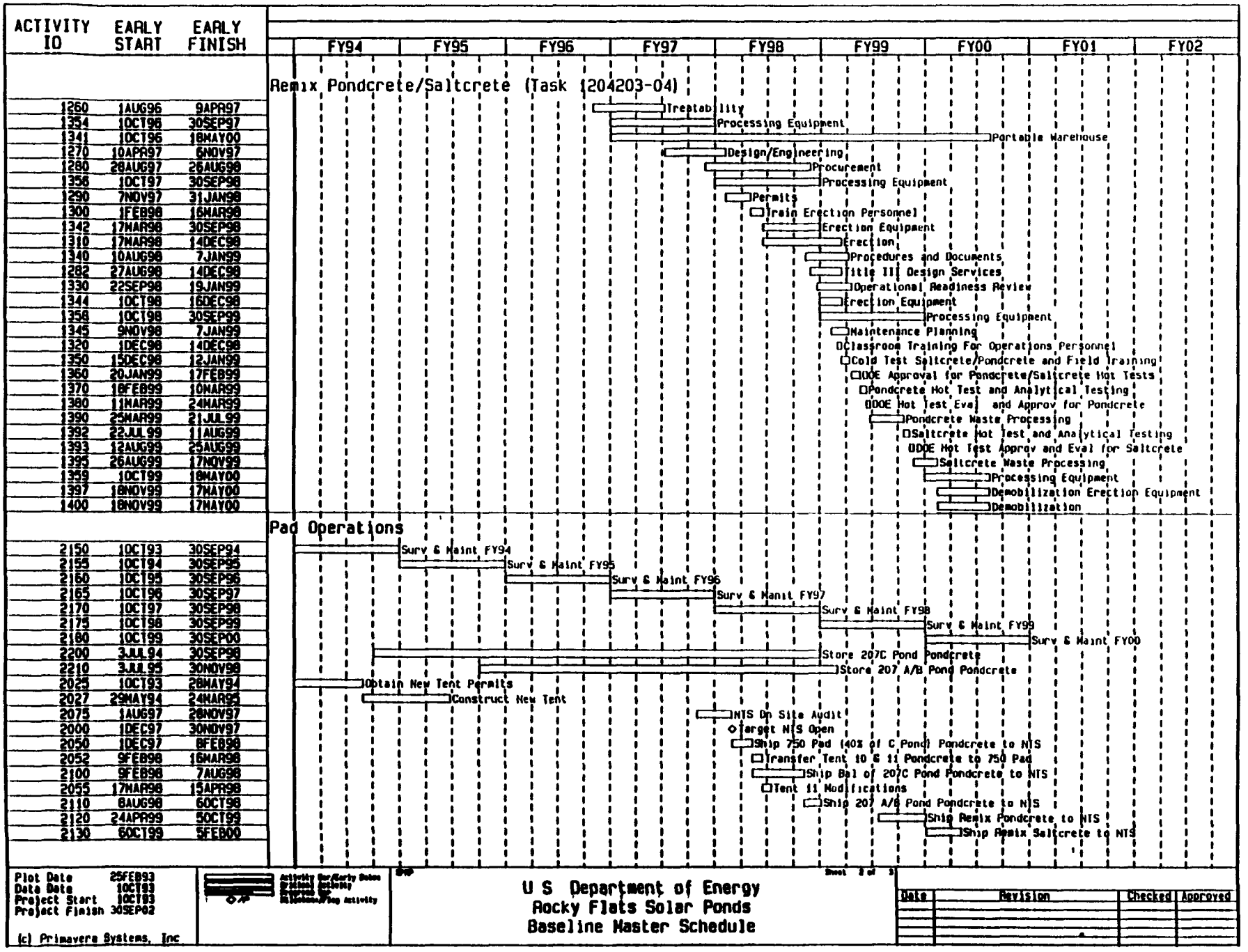
Figure A-1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2110 8AUG98 60CT98 Ship 207 A/B Pond Pondcrete to NTS
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Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
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Sheet 2 of 3
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Rocky Flats Solar Ponds
Baseline Master Schedule
Date
Revision
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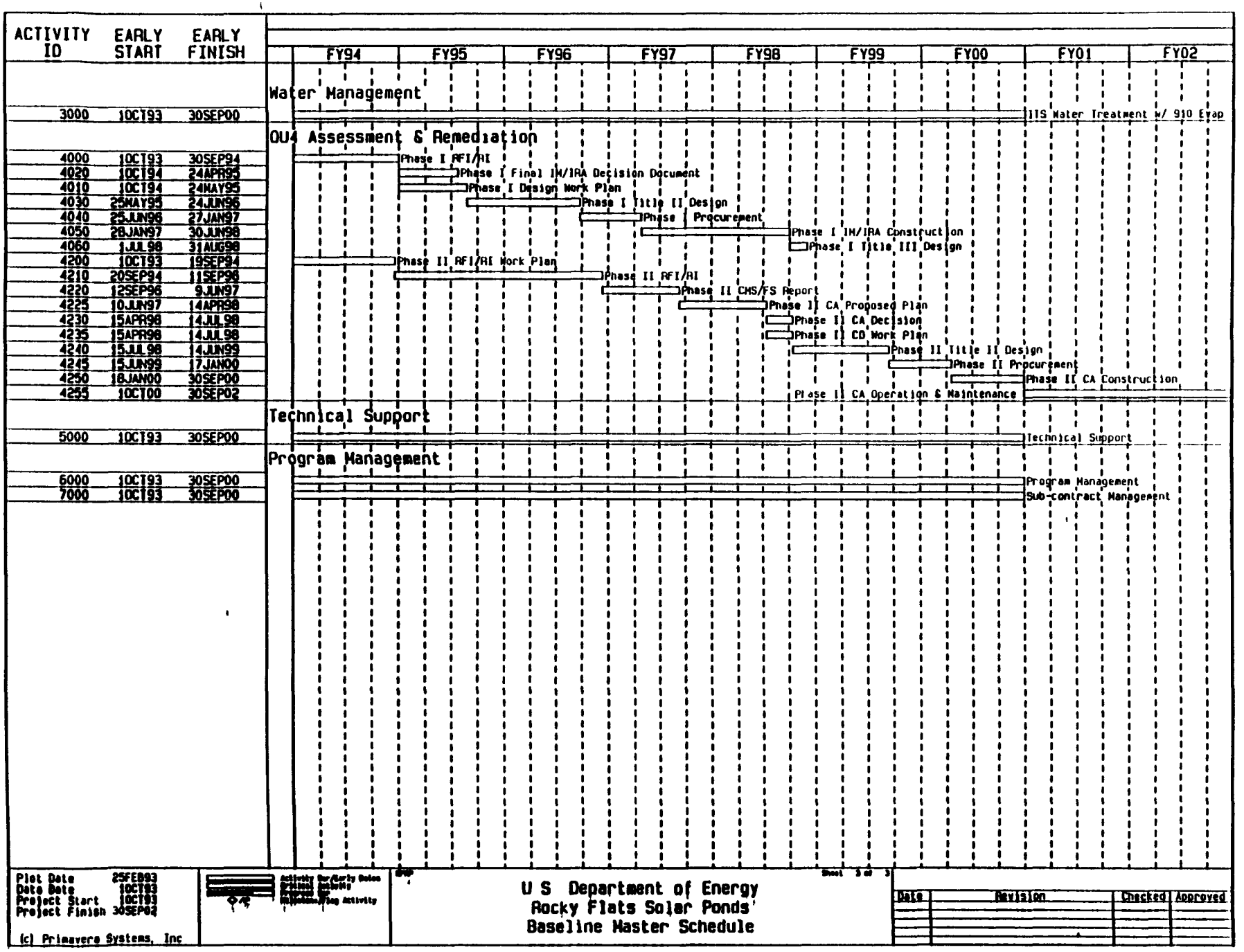
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OU4 Assessment & Remediation
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Phase I Final IM/IRA Decision Document
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Phase I Design Work Plan
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Phase I IM/IRA Construction
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Sub-contract Management
Plot Date 25FEB93
Data Date 10OCT93
Project Start 10OCT93
Project Finish 30SEP02
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Activity Bar/Early Dates
Critical Activity
Milestone/Key Activity
Sheet 3 of 3
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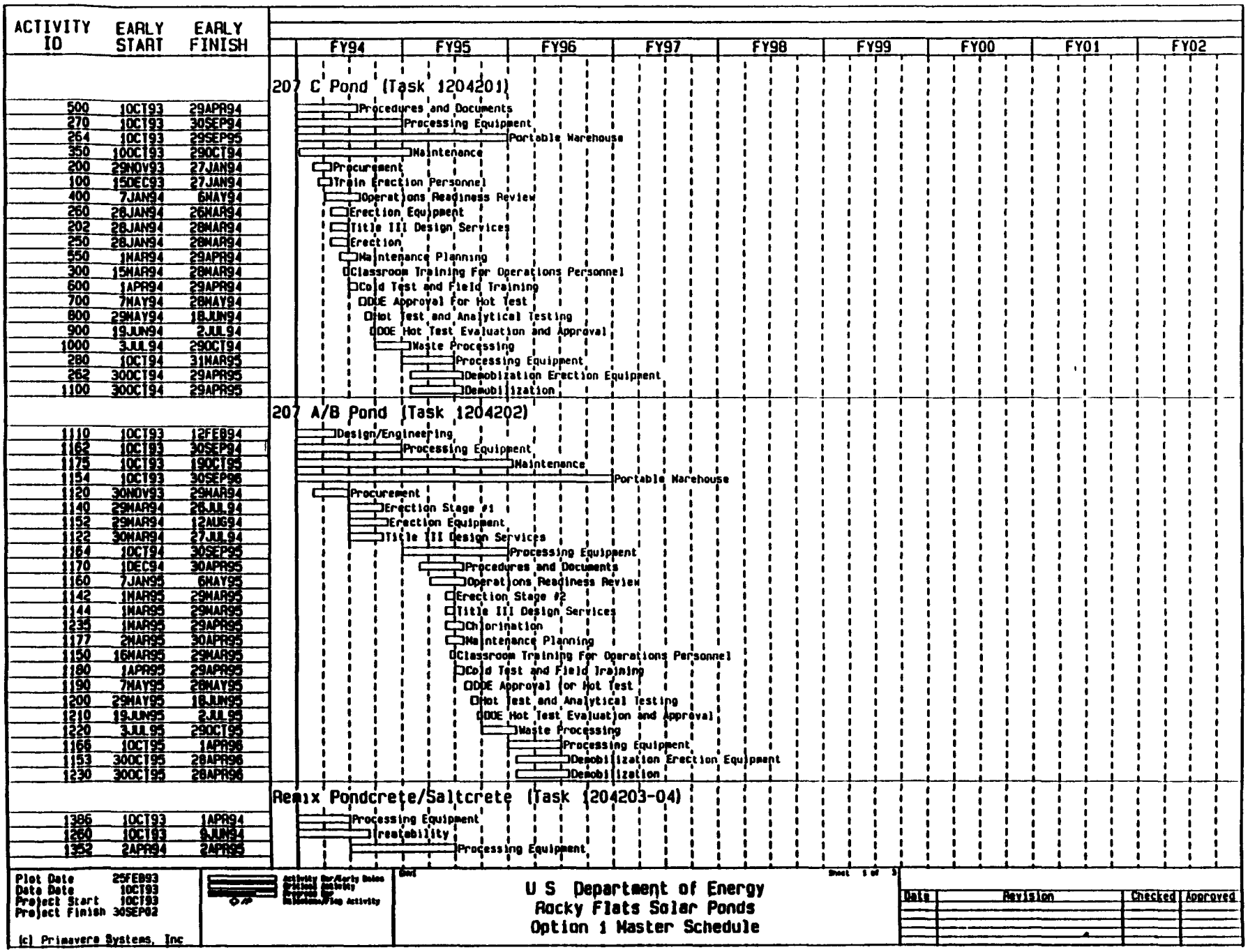
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Project Start 10CT93
Project Finish 30SEP02
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Start
Sheet 1 of 1
U S Department of Energy
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Option 1 Master Schedule
Date
Revision
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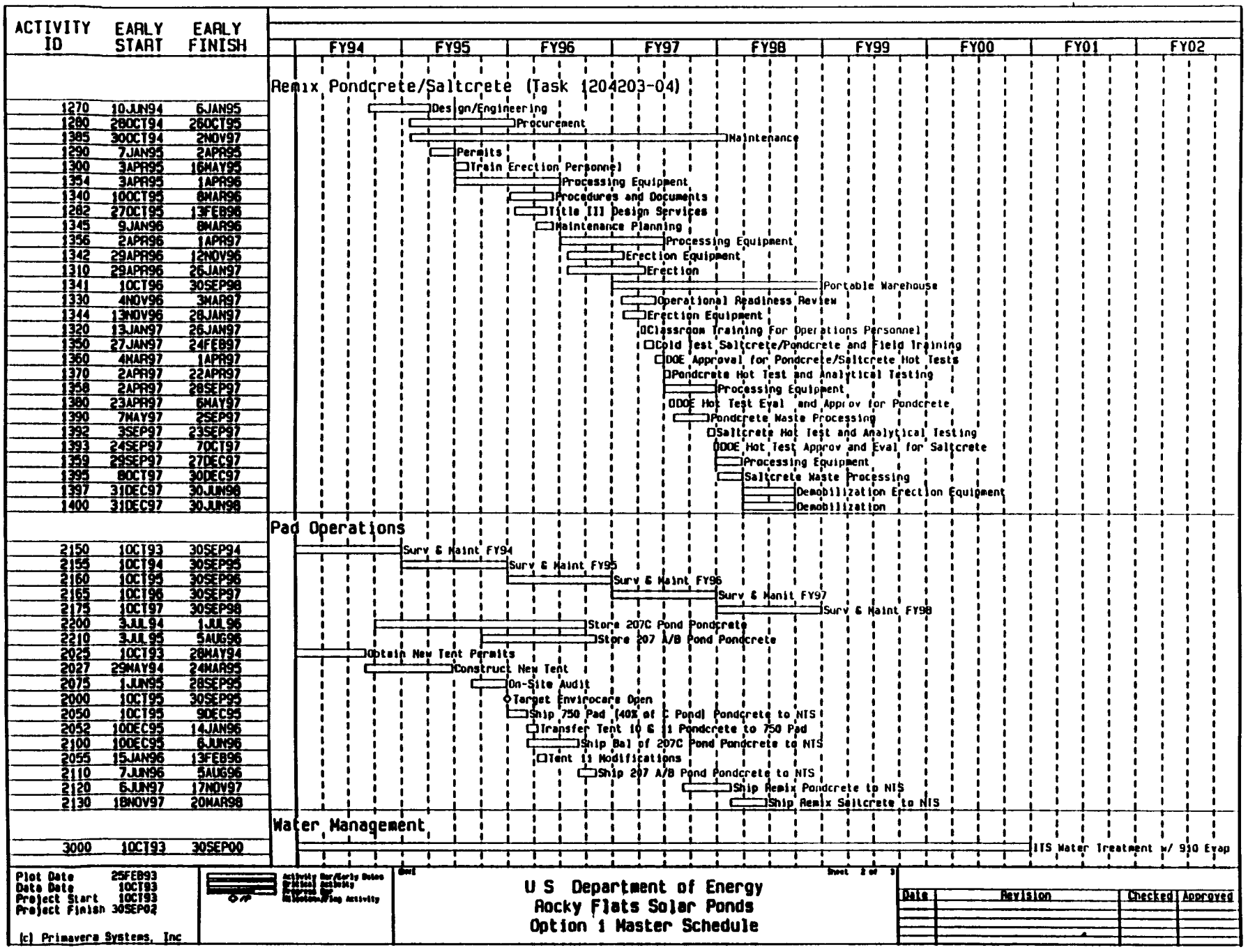
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2210 3JUL95 5AUG96 Store 207 A/B Pond Pondcrete
2025 10CT93 28MAY94 Obtain New Tent Permits
2027 29MAY94 24MAR95 Construct New Tent
2075 1JUN95 28SEP95 On-Site Audit
2000 10CT95 30SEP95 Target Envirocare Open
2050 10CT95 9DEC95 Ship 750 Pad (40% of C Pond) Pondcrete to NTS
2052 10DEC95 14JAN96 Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100 10DEC95 6JUN96 Ship Bal of 207C Pond Pondcrete to NTS
2055 15JAN96 13FEB96 Tent 11 Modifications
2110 7JUN96 5AUG96 Ship 207 A/B Pond Pondcrete to NTS
2120 6JUN97 17NOV97 Ship Remix Pondcrete to NTS
2130 18NOV97 20MAR98 Ship Remix Saltcrete to NTS
Water Management
3000 10CT93 30SEP00 ITS Water Treatment w/ 910 Evap
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
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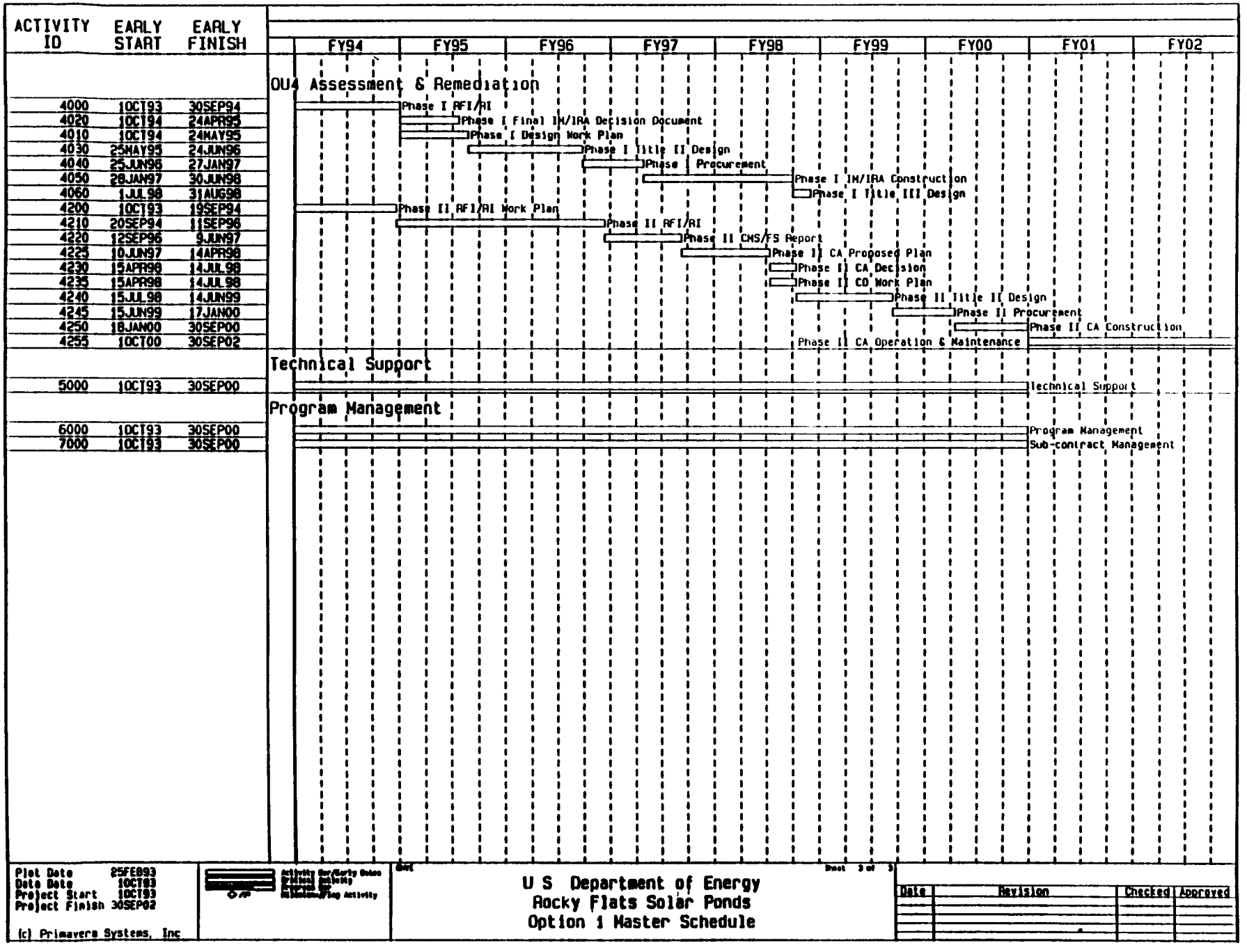
Original Activity
Progress Bar
Milestone/Key Activity
U S Department of Energy
Rocky Flats Solar Ponds
Option 1 Master Schedule
Date
Revision
Checked
Approved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EARLY FINISH
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FY00
FY01
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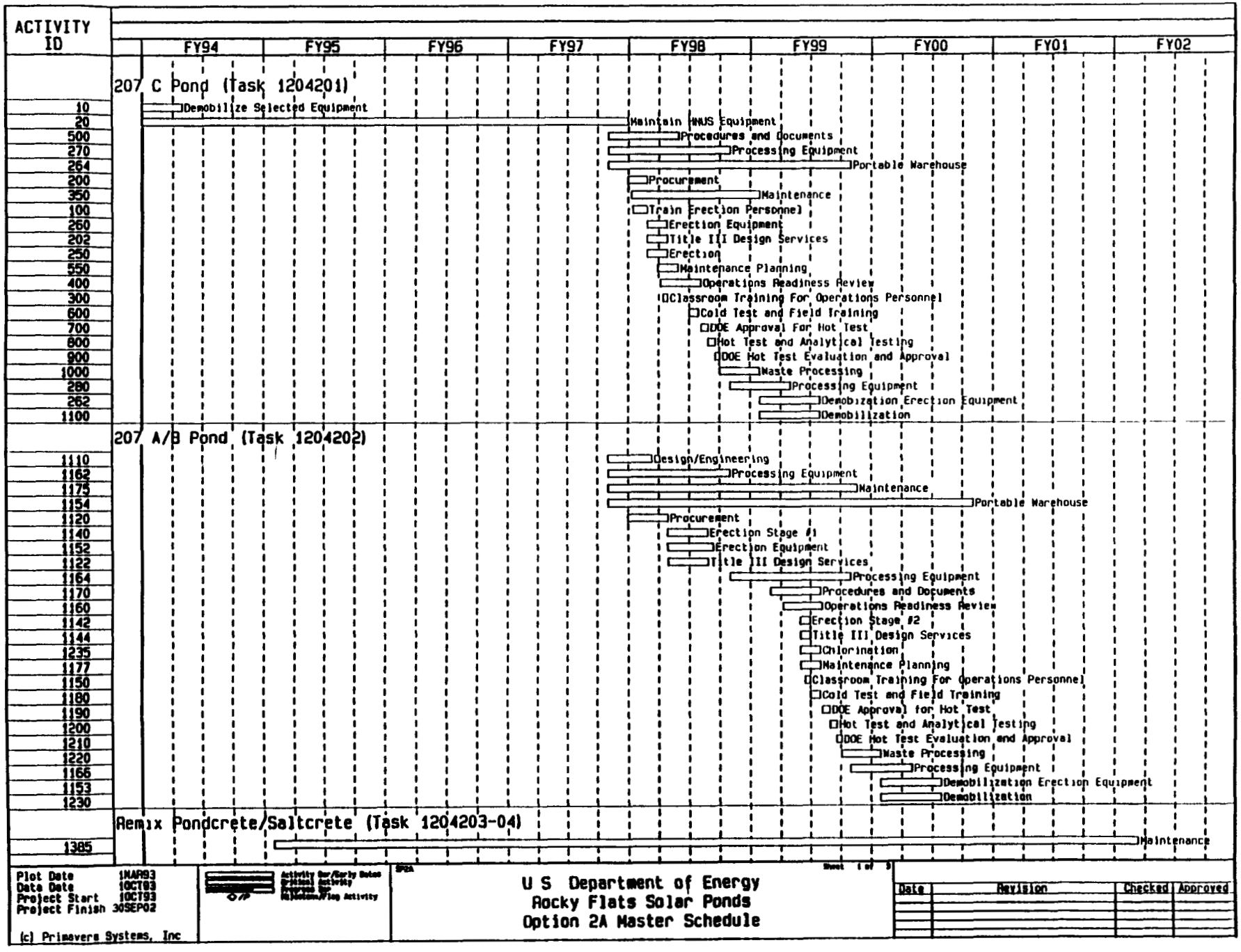
4000 10OCT93 30SEP94 Phase I RFI/RI
4020 10OCT94 24APR95 Phase I Final IM/IRA Decision Document
4010 10OCT94 24MAY95 Phase I Design Work Plan
4030 25MAY95 24JUN96 Phase I Title II Design
4040 25JUN96 27JAN97 Phase I Procurement
4050 28JAN97 30JUN98 Phase I IM/IRA Construction
4060 1JUL98 31AUG98 Phase I Title III Design
4200 10OCT93 19SEP94 Phase II RFI/RI Work Plan
4210 20SEP94 11SEP96 Phase II RFI/RI
4220 12SEP96 9JUN97 Phase II CMS/FS Report
4225 10JUN97 14APR98 Phase II CA Proposed Plan
4230 15APR98 14JUL98 Phase II CA Decision
4235 15APR98 14JUL98 Phase II CD Work Plan
4240 15JUL98 14JUN99 Phase II Title II Design
4245 15JUN99 17JAN00 Phase II Procurement
4250 18JAN00 30SEP00 Phase II CA Construction
4255 10OCT00 30SEP02 Phase II CA Operation & Maintenance
Technical Support
5000 10OCT93 30SEP00 Technical Support
Program Management
6000 10OCT93 30SEP00 Program Management
7000 10OCT93 30SEP00 Sub-contract Management
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
Start
Sheet 3 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 1 Master Schedule
Date
Revision
Checked
Approved


ACTIVITY ID
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
207 C Pond (Task 1204201)
10 Demobilize Selected Equipment
20 Maintain HNUS Equipment
500 Procedures and Documents
270 Processing Equipment
264 Portable Warehouse
200 Procurement
350 Maintenance
100 Train Erection Personnel
260 Erection Equipment
202 Title III Design Services
250 Erection
550 Maintenance Planning
400 Operations Readiness Review
300 Classroom Training For Operations Personnel
600 Cold Test and Field Training
700 DOE Approval For Hot Test
800 Hot Test and Analytical Testing
900 DOE Hot Test Evaluation and Approval
1000 Waste Processing
280 Processing Equipment
262 Demobization Erection Equipment
1100 Demobilization
207 A/B Pond (Task 1204202)
1110 Design/Engineering
1162 Processing Equipment
1175 Maintenance
1154 Portable Warehouse
1120 Procurement
1140 Erection Stage #1
1152 Erection Equipment
1122 Title III Design Services
1164 Processing Equipment
1170 Procedures and Documents
1160 Operations Readiness Review
1142 Erection Stage #2
1144 Title III Design Services
1235 Chlorination
1177 Maintenance Planning
1150 Classroom Training For Operations Personnel
1180 Cold Test and Field Training
1190 DOE Approval for Hot Test
1200 Hot Test and Analytical Testing
1210 DOE Hot Test Evaluation and Approval
1220 Waste Processing
1166 Processing Equipment
1153 Demobilization Erection Equipment
1230 Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
1385 Maintenance
Plot Date 1MAR93
Data Date 1OCT93
Project Start 1OCT93
Project Finish 30SEP02
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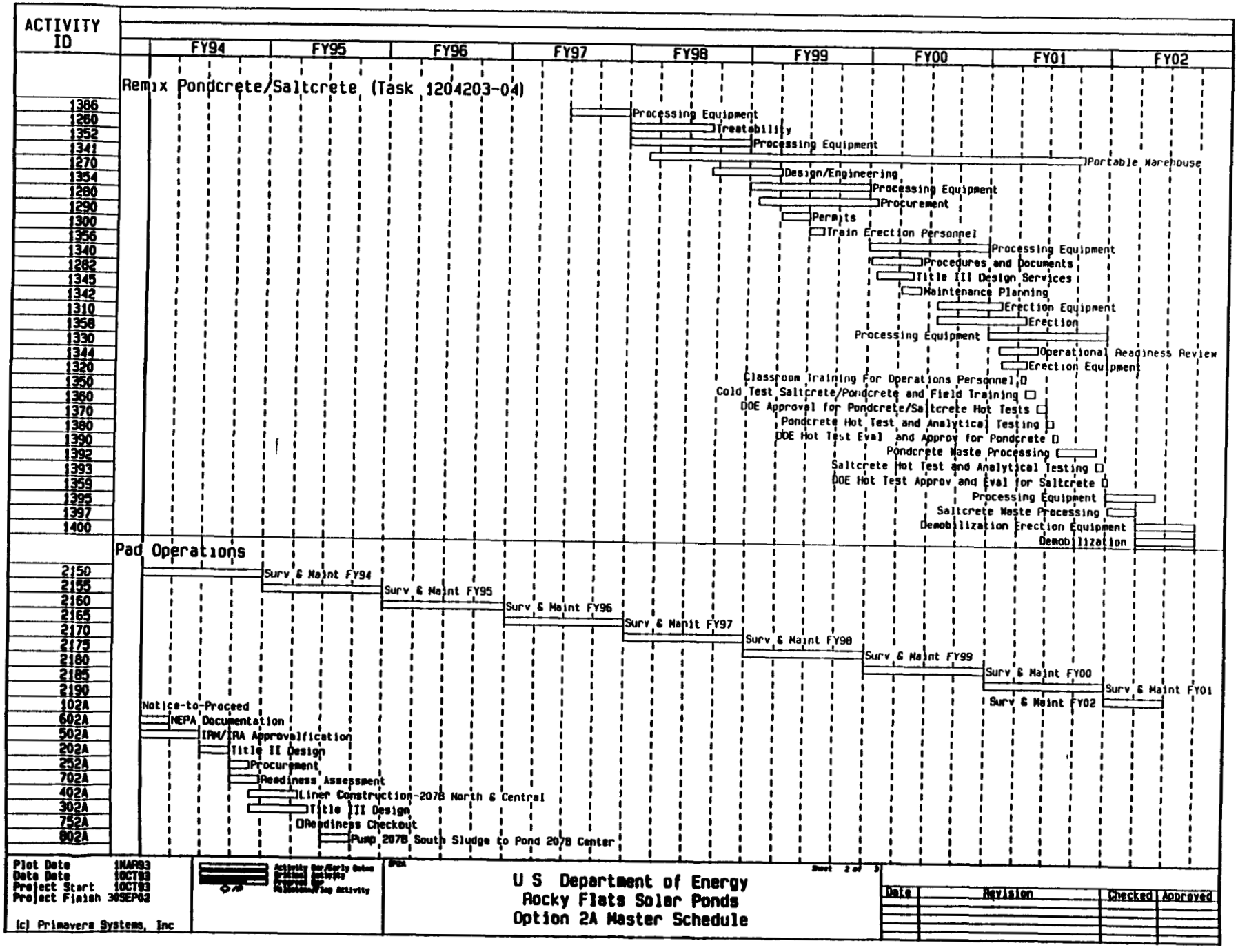
U S Department of Energy
Rocky Flats Solar Ponds
Option 2A Master Schedule
Date
Revision
Checked
Approved

Figure A-3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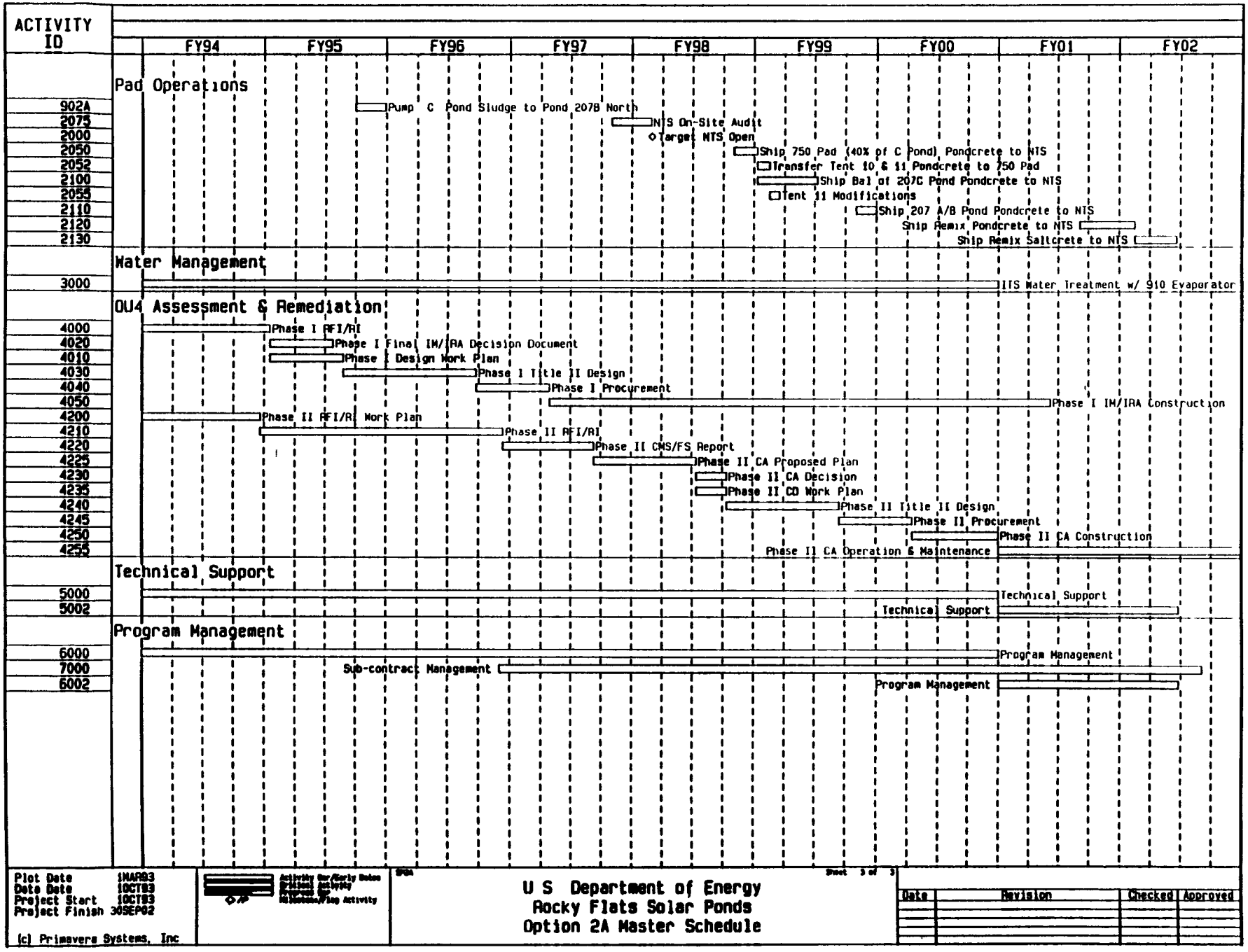
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
Remix Pondcrete/Saltcrete (Task 1204203-04)
1386 Processing Equipment
1260 Treatability
1352 Processing Equipment
1341
1270 Portable Warehouse
1354 Design/Engineering
1280 Processing Equipment
1290 Procurement
1300 Permits
1356 Train Erection Personnel
1340 Processing Equipment
1282 Procedures and Documents
1345 Title III Design Services
1342 Maintenance Planning
1310 Erection Equipment
1358 Erection
1330 Processing Equipment
1344 Operational Readiness Review
1320 Erection Equipment
1350 Classroom Training For Operations Personnel
1360 Cold Test Saltcrete/Pondcrete and Field Training
1370 DOE Approval for Pondcrete/Saltcrete Hot Tests
1380 Pondcrete Hot Test and Analytical Testing
1390 DOE Hot Test Eval and Approv for Pondcrete
1392 Pondcrete Waste Processing
1393 Saltcrete Hot Test and Analytical Testing
1359 DOE Hot Test Approv and Eval for Saltcrete
1395 Processing Equipment
1397 Saltcrete Waste Processing
1400 Demobilization Erection Equipment
Demobilization
Pad Operations
2150 Surv & Maint FY94
2155 Surv & Maint FY95
2160 Surv & Maint FY96
2165 Surv & Maint FY97
2170 Surv & Maint FY98
2175 Surv & Maint FY99
2180 Surv & Maint FY00
2185 Surv & Maint FY01
2190 Surv & Maint FY02
102A Notice-to-Proceed
602A NEPA Documentation
502A IRM/IRA Approval/Certification
202A Title II Design
252A Procurement
702A Readiness Assessment
402A Liner Construction-207B North & Central
302A Title III Design
752A Readiness Checkout
802A Pump 207B South Sludge to Pond 207B Center
Plot Date 1MAR93
Data Date 1OCT93
Project Start 1OCT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
Sheet 2 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 2A Master Schedule
Date
Revision
Checked
Approved


ACTIVITY ID
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FY96
FY97
FY98
FY99
FY00
FY01
FY02
Pad Operations
902A
Pump C Pond Sludge to Pond 207B North
2075
NTS On-Site Audit
2000
◇Target NTS Open
2050
Ship 750 Pad (40% of C Pond) Pondcrete to NTS
2052
Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100
Ship Bal of 207C Pond Pondcrete to NTS
2055
Tent 11 Modifications
2110
Ship 207 A/B Pond Pondcrete to NTS
2120
Ship Remix Pondcrete to NTS
2130
Ship Remix Saltcrete to NTS
Water Management
3000
IIS Water Treatment w/ 910 Evaporator
OU4 Assessment & Remediation
4000
Phase I RFI/RI
4020
Phase I Final IM/IRA Decision Document
4010
Phase I Design Work Plan
4030
Phase I Title II Design
4040
Phase I Procurement
4050
Phase I IM/IRA Construction
4200
Phase II RFI/RI Work Plan
4210
Phase II RFI/RI
4220
Phase II CMS/FS Report
4225
Phase II CA Proposed Plan
4230
Phase II CA Decision
4235
Phase II CD Work Plan
4240
Phase II Title II Design
4245
Phase II Procurement
4250
Phase II CA Construction
4255
Phase II CA Operation & Maintenance
Technical Support
5000
Technical Support
5002
Technical Support
Program Management
6000
Program Management
7000
Sub-contract Management
6002
Program Management
Plot Date 1MAR93
Data Date 1OCT83
Project Start 1OCT83
Project Finish 30SEP02
(c) Primavera Systems, Inc
Activity Bar/Early Dates
Original Activity
Progress Bar
Milestone/Plug Activity
DOE
Sheet 5 of 5
U S Department of Energy
Rocky Flats Solar Ponds
Option 2A Master Schedule
Date
Revision
Checked
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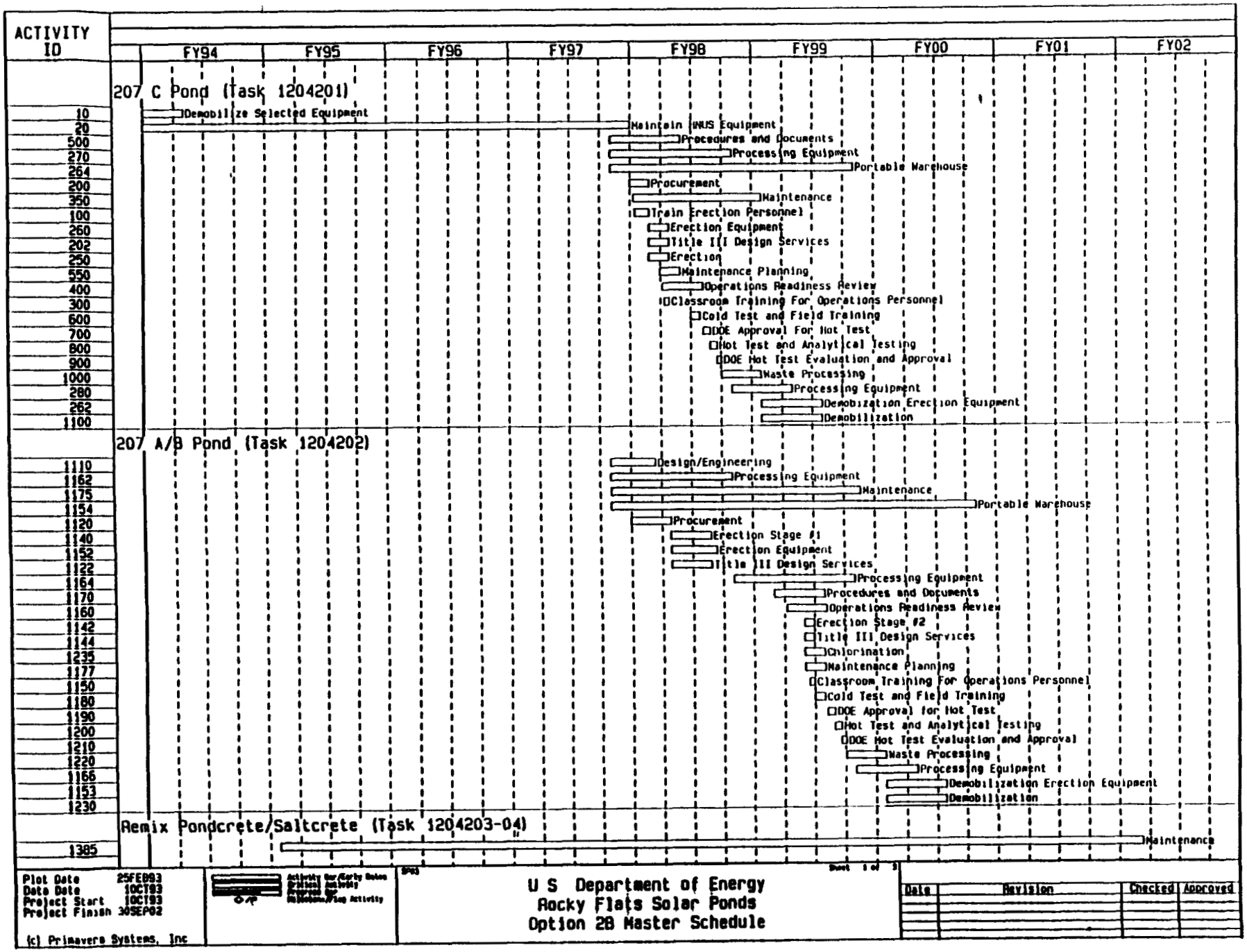
ACTIVITY ID
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FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
207 C Pond (Task 1204201)
10 Demobilize Selected Equipment
20 Maintain HNUS Equipment
500 Procedures and Documents
270 Processing Equipment
264 Portable Warehouse
200 Procurement
350 Maintenance
100 Train Erection Personnel
260 Erection Equipment
202 Title III Design Services
250 Erection
550 Maintenance Planning
400 Operations Readiness Review
300 Classroom Training For Operations Personnel
600 Cold Test and Field Training
700 DOE Approval For Hot Test
800 Hot Test and Analytical Testing
900 DOE Hot Test Evaluation and Approval
1000 Waste Processing
280 Processing Equipment
262 Demobization Erection Equipment
1100 Demobilization
207 A/B Pond (Task 1204202)
1110 Design/Engineering
1162 Processing Equipment
1175 Maintenance
1154 Portable Warehouse
1120 Procurement
1140 Erection Stage #1
1152 Erection Equipment
1122 Title III Design Services
1164 Processing Equipment
1170 Procedures and Documents
1160 Operations Readiness Review
1142 Erection Stage #2
1144 Title III Design Services
1235 Chlorination
1177 Maintenance Planning
1150 Classroom Training For Operations Personnel
1180 Cold Test and Field Training
1190 DOE Approval for Hot Test
1200 Hot Test and Analytical Testing
1210 DOE Hot Test Evaluation and Approval
1220 Waste Processing
1166 Processing Equipment
1153 Demobilization Erection Equipment
1230 Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
1385 Maintenance
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
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U S Department of Energy
Rocky Flats Solar Ponds
Option 2B Master Schedule
Date
Revision
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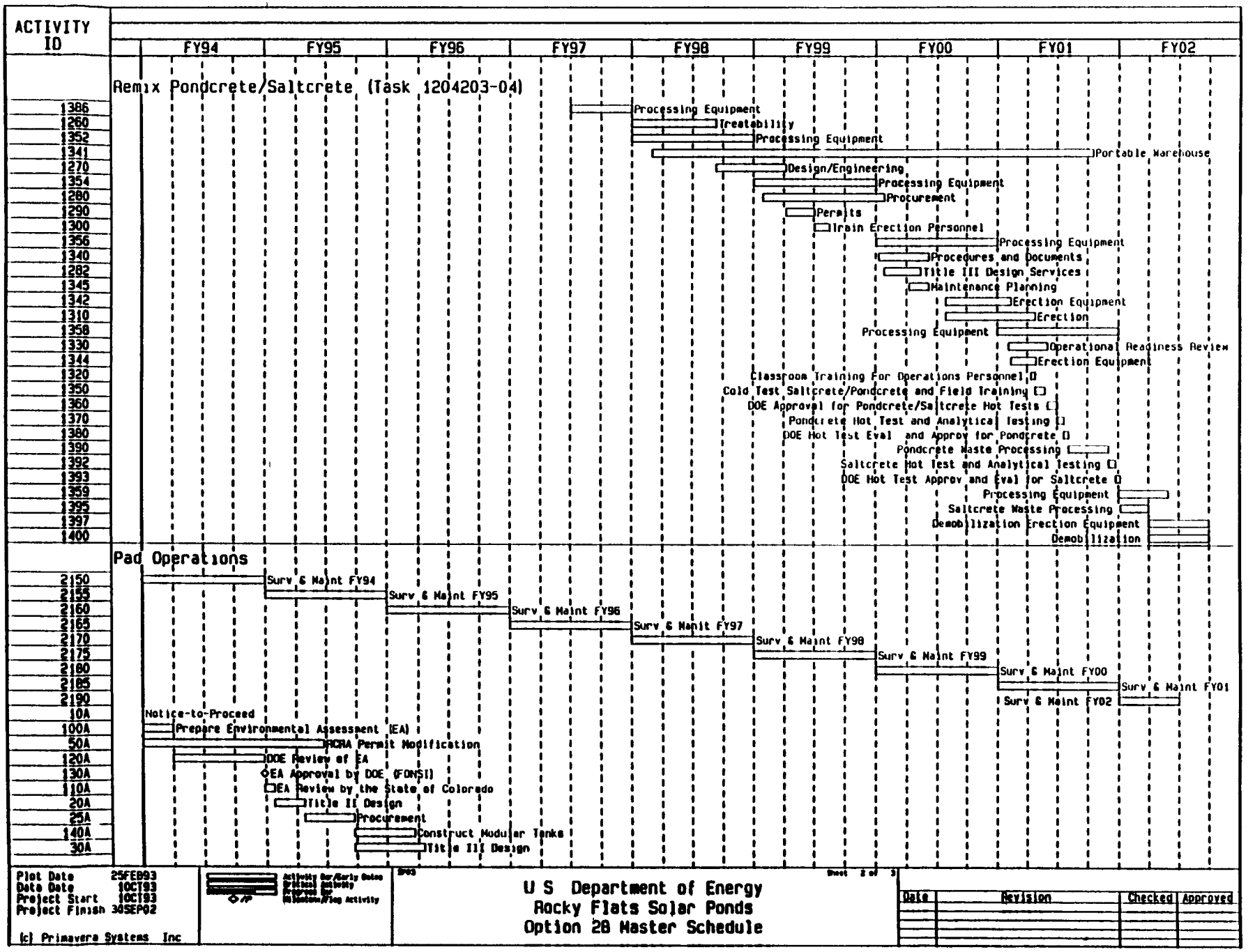
Figure A-4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FY95
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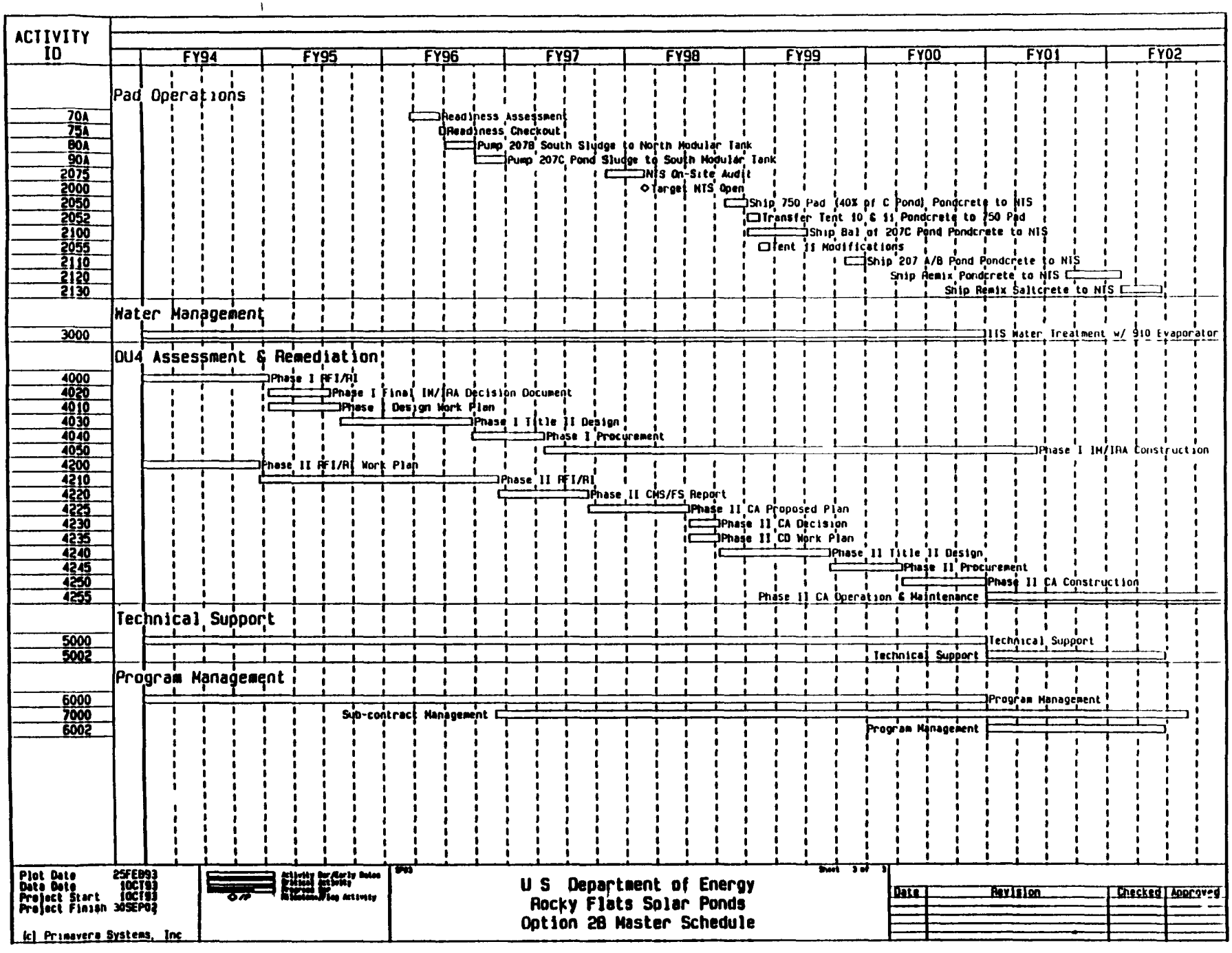
FY97
FY98
FY99
FY00
FY01
FY02
Remix Pondcrete/Saltcrete (Task 1204203-04)
1386 Processing Equipment
1260 Treatability
1352 Processing Equipment
1341 Portable Warehouse
1270 Design/Engineering
1354 Processing Equipment
1280 Procurement
1290 Permits
1300 Train Erection Personnel
1356 Processing Equipment
1340 Procedures and Documents
1282 Title III Design Services
1345 Maintenance Planning
1342 Erection Equipment
1310 Erection
1358 Processing Equipment
1330 Operational Readiness Review
1344 Erection Equipment
1320 Classroom Training For Operations Personnel
1350 Cold Test Saltcrete/Pondcrete and Field Training
1360 DOE Approval for Pondcrete/Saltcrete Hot Tests
1370 Pondcrete Hot Test and Analytical Testing
1380 DOE Hot Test Eval and Approv for Pondcrete
1390 Pondcrete Waste Processing
1392 Saltcrete Hot Test and Analytical Testing
1393 DOE Hot Test Approv and Eval for Saltcrete
1359 Processing Equipment
1395 Saltcrete Waste Processing
1397 Demobilization Erection Equipment
1400 Demobilization
Pad Operations
2150 Surv & Maint FY94
2155 Surv & Maint FY95
2160 Surv & Maint FY96
2165 Surv & Manit FY97
2170 Surv & Maint FY98
2175 Surv & Maint FY99
2180 Surv & Maint FY00
2185 Surv & Maint FY01
2190 Surv & Maint FY02
10A Notice-to-Proceed
100A Prepare Environmental Assessment (EA)
50A RCRA Permit Modification
120A DOE Review of EA
130A EA Approval by DOE (FONSI)
110A EA Review by the State of Colorado
20A Title II Design
25A Procurement
140A Construct Modular Tanks
30A Title III Design
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems Inc
Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Dog Activity
Sheet 8 of 9
U S Department of Energy
Rocky Flats Solar Ponds
Option 2B Master Schedule
Date
Revision
Checked
Approved


ACTIVITY ID
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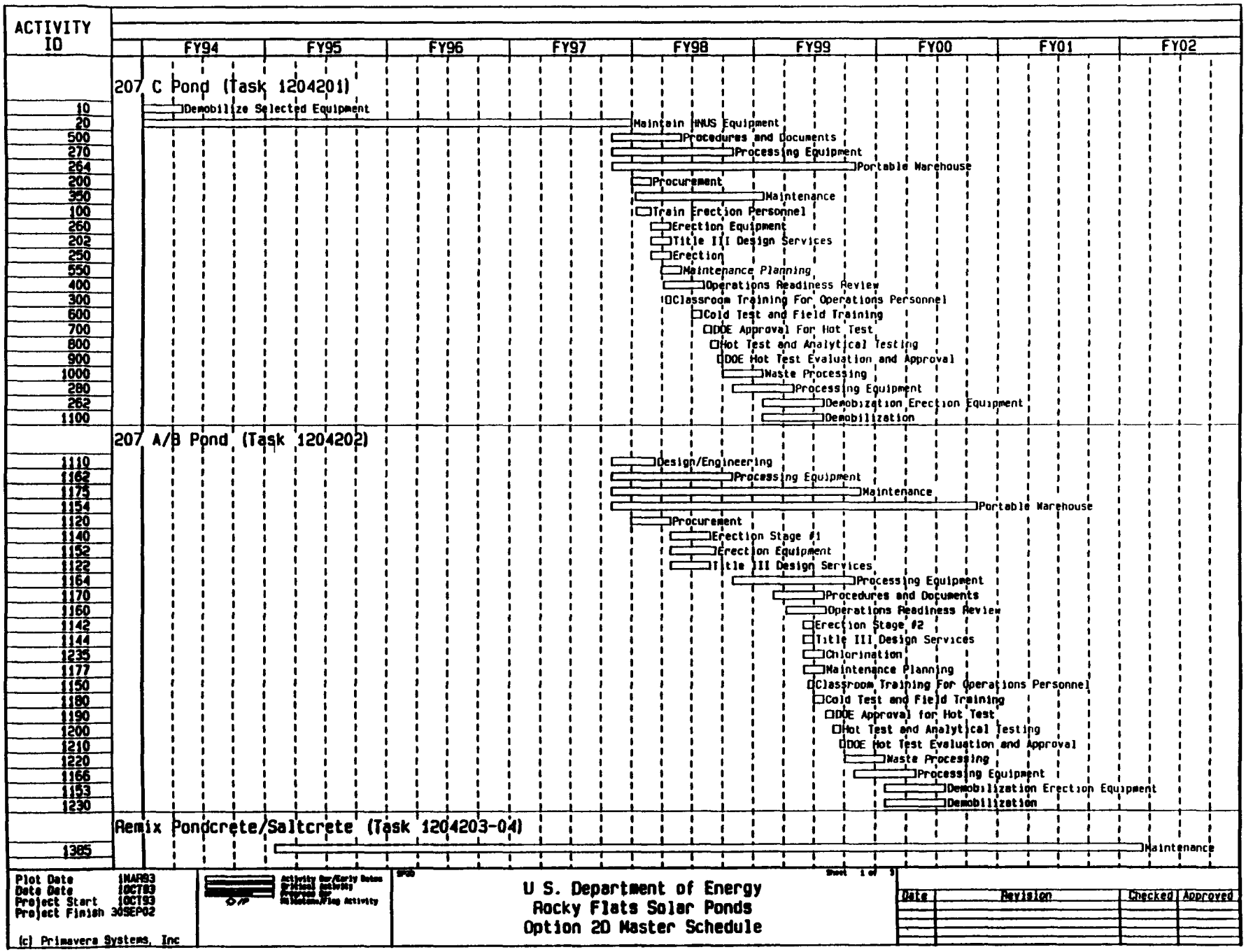
FY96
FY97
FY98
FY99
FY00
FY01
FY02
Pad Operations
70A Readiness Assessment
75A Readiness Checkout
80A Pump 207B South Sludge to North Modular Tank
90A Pump 207C Pond Sludge to South Modular Tank
2075 NIS On-Site Audit
2000 Target NIS Open
2050 Ship 750 Pad (40% of C Pond) Pondcrete to NIS
2052 Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100 Ship Bal of 207C Pond Pondcrete to NIS
2055 Tent 11 Modifications
2110 Ship 207 A/B Pond Pondcrete to NIS
2120 Ship Remix Pondcrete to NIS
2130 Ship Remix Saltcrete to NIS
Water Management
3000 IIS Water Treatment w/ 910 Evaporator
OU4 Assessment & Remediation
4000 Phase I RFI/RI
4020 Phase I Final IM/IRA Decision Document
4010 Phase I Design Work Plan
4030 Phase I Title II Design
4040 Phase I Procurement
4050 Phase I IM/IRA Construction
4200 Phase II RFI/RI Work Plan
4210 Phase II RFI/RI
4220 Phase II CMS/FS Report
4225 Phase II CA Proposed Plan
4230 Phase II CA Decision
4235 Phase II CD Work Plan
4240 Phase II Title II Design
4245 Phase II Procurement
4250 Phase II CA Construction
4255 Phase II CA Operation & Maintenance
Technical Support
5000 Technical Support
5002 Technical Support
Program Management
6000 Program Management
7000 Sub-contract Management
6002 Program Management
Plot Date 25FEB93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Key Activity
Sheet 3 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 2B Master Schedule
Date
Revision
Checked
Approved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500 Procedures and Documents
270 Processing Equipment
264 Portable Warehouse
200 Procurement
350 Maintenance
100 Train Erection Personnel
260 Erection Equipment
202 Title II Design Services
250 Erection
550 Maintenance Planning
400 Operations Readiness Review
300 Classroom Training For Operations Personnel
600 Cold Test and Field Training
700 DOE Approval For Hot Test
800 Hot Test and Analytical Testing
900 DOE Hot Test Evaluation and Approval
1000 Waste Processing
280 Processing Equipment
262 Demobization Erection Equipment
1100 Demobilization
207 A/B Pond (Task 1204202)
1110 Design/Engineering
1162 Processing Equipment
1175 Maintenance
1154 Portable Warehouse
1120 Procurement
1140 Erection Stage #1
1152 Erection Equipment
1122 Title II Design Services
1164 Processing Equipment
1170 Procedures and Documents
1160 Operations Readiness Review
1142 Erection Stage #2
1144 Title III Design Services
1235 Chlorination
1177 Maintenance Planning
1150 Classroom Training For Operations Personnel
1180 Cold Test and Field Training
1190 DOE Approval for Hot Test
1200 Hot Test and Analytical Testing
1210 DOE Hot Test Evaluation and Approval
1220 Waste Processing
1166 Processing Equipment
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1230 Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
1385 Maintenance
Plot Date 1MAR93
Data Date 1OCT93
Project Start 1OCT93
Project Finish 30SEP02
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U S. Department of Energy
Rocky Flats Solar Ponds
Option 2D Master Schedule
Date
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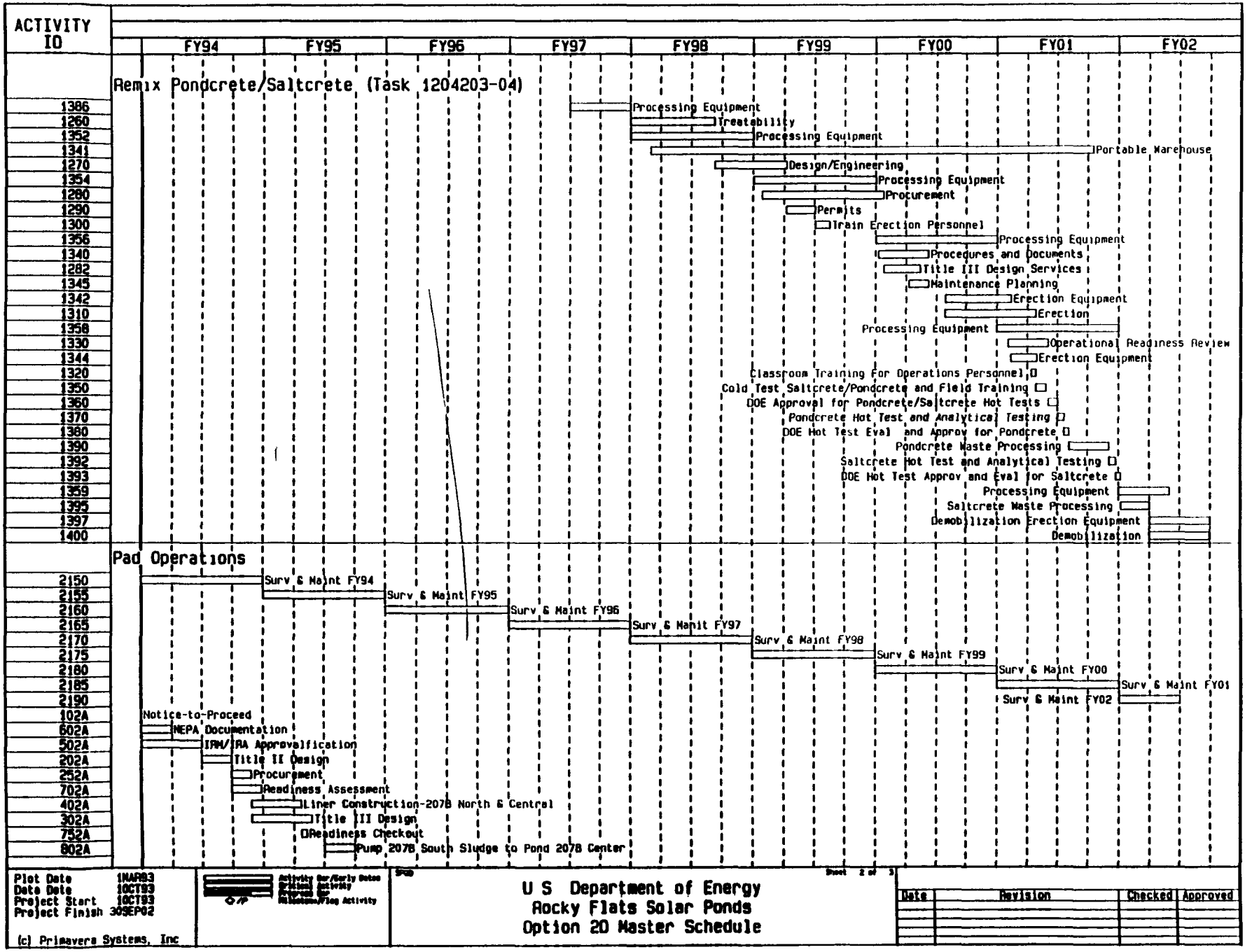
Figure A-5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FY00
FY01
FY02
Remix Pondcrete/Saltcrete (Task 1204203-04)
1386 Processing Equipment
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1352 Processing Equipment
1341 Portable Warehouse
1270 Design/Engineering
1354 Processing Equipment
1280 Procurement
1290 Permits
1300 Train Erection Personnel
1356 Processing Equipment
1340 Procedures and Documents
1282 Title III Design Services
1345 Maintenance Planning
1342 Erection Equipment
1310 Erection
1358 Processing Equipment
1330 Operational Readiness Review
1344 Erection Equipment
1320 Classroom Training For Operations Personnel
1350 Cold Test Saltcrete/Pondcrete and Field Training
1360 DOE Approval for Pondcrete/Saltcrete Hot Tests
1370 Pondcrete Hot Test and Analytical Testing
1380 DOE Hot Test Eval and Approv for Pondcrete
1390 Pondcrete Waste Processing
1392 Saltcrete Hot Test and Analytical Testing
1393 DOE Hot Test Approv and Eval for Saltcrete
1359 Processing Equipment
1395 Saltcrete Waste Processing
1397 Demobilization Erection Equipment
1400 Demobilization
Pad Operations
2150 Surv & Maint FY94
2155 Surv & Maint FY95
2160 Surv & Maint FY96
2165 Surv & Manit FY97
2170 Surv & Maint FY98
2175 Surv & Maint FY99
2180 Surv & Maint FY00
2185 Surv & Maint FY01
2190 Surv & Maint FY02
102A Notice-to-Proceed
602A NEPA Documentation
502A IRM/IRA Approval/fication
202A Title II Design
252A Procurement
702A Readiness Assessment
402A Liner Construction-207B North & Central
302A Title III Design
752A Readiness Checkout
802A Pump 207B South Sludge to Pond 207B Center
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
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Sheet 2 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 2D Master Schedule
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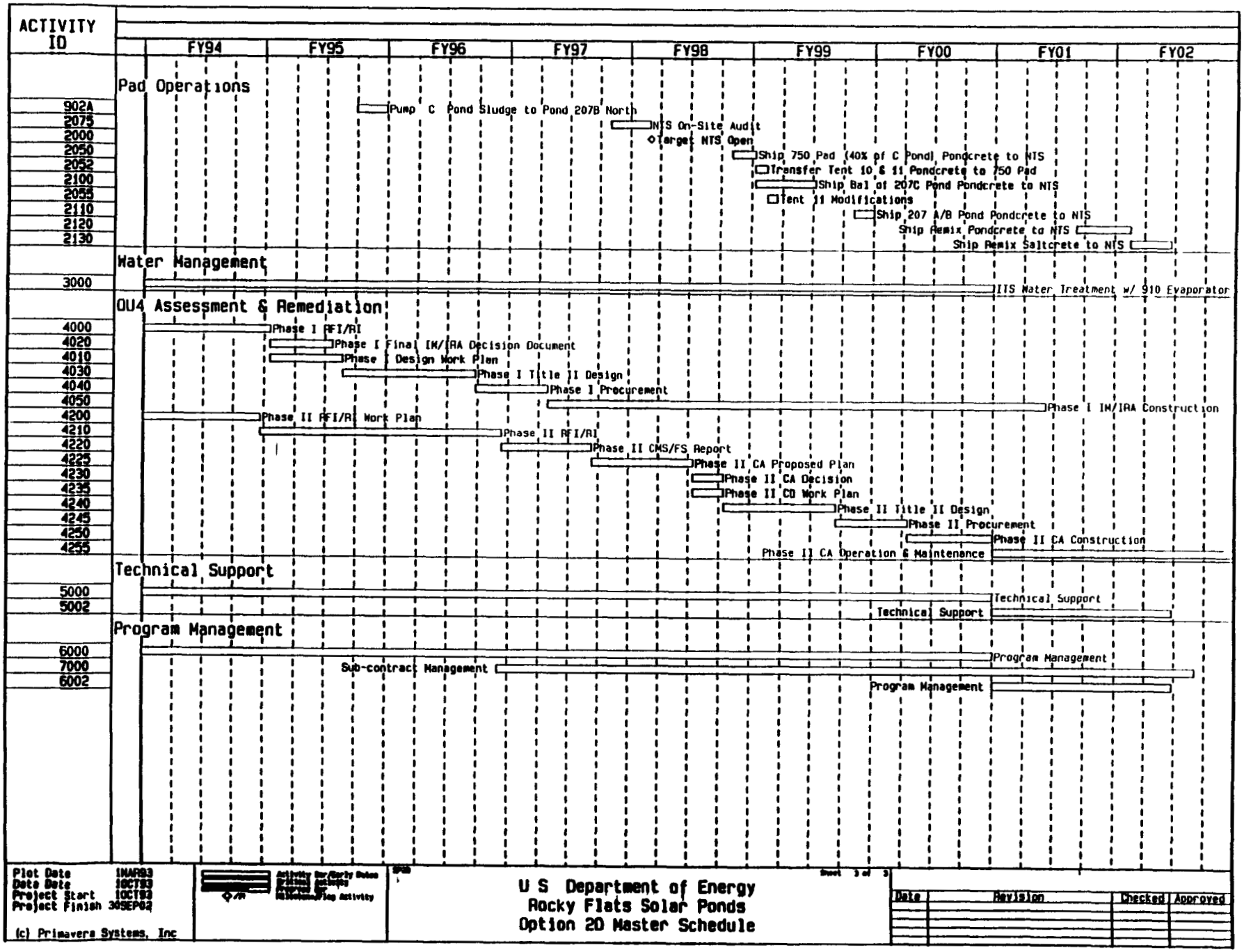
ACTIVITY ID
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FY01
FY02
Pad Operations
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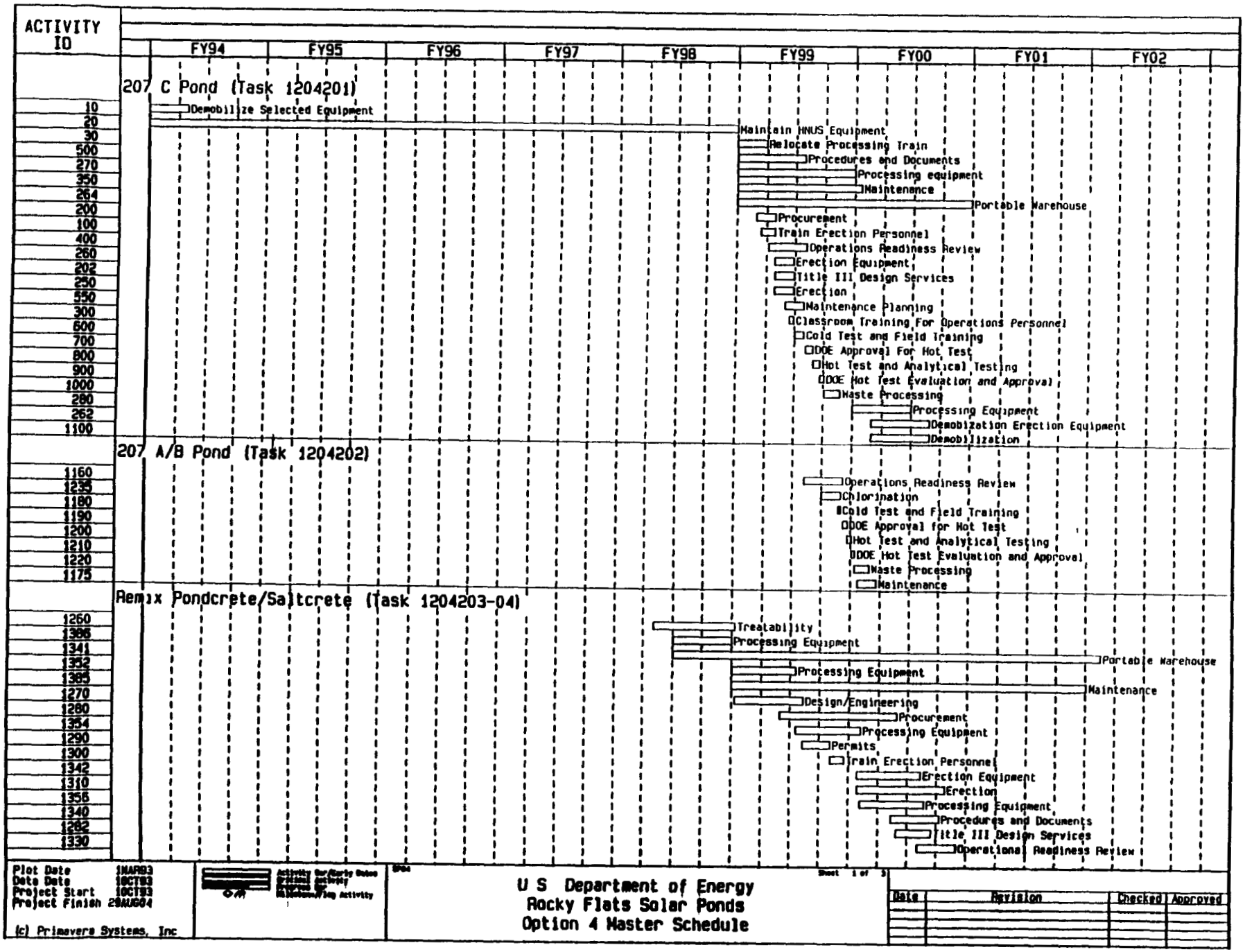
Pump C Pond Sludge to Pond 207B North
2075
NTS On-Site Audit
2000
Target NTS Open
2050
Ship 750 Pad (40% of C Pond) Pondcrete to NTS
2052
Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100
Ship Bal of 207C Pond Pondcrete to NTS
2055
Tent 11 Modifications
2110
Ship 207 A/B Pond Pondcrete to NTS
2120
Ship Remix Pondcrete to NTS
2130
Ship Remix Saltcrete to NTS
Water Management
3000
NTS Water Treatment w/ 910 Evaporator
OU4 Assessment & Remediation
4000
Phase I RFI/RI
4020
Phase I Final IM/IRA Decision Document
4010
Phase I Design Work Plan
4030
Phase I Title II Design
4040
Phase I Procurement
4050
Phase I IM/IRA Construction
4200
Phase II RFI/RI Work Plan
4210
Phase II RFI/RI
4220
Phase II CMS/FS Report
4225
Phase II CA Proposed Plan
4230
Phase II CA Decision
4235
Phase II CD Work Plan
4240
Phase II Title II Design
4245
Phase II Procurement
4250
Phase II CA Construction
4255
Phase II CA Operation & Maintenance
Technical Support
5000
Technical Support
5002
Technical Support
Program Management
6000
Program Management
7000
Sub-contract Management
6002
Program Management
Plot Date 1MAR93
Data Date 1OCT93
Project Start 1OCT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
U S Department of Energy
Rocky Flats Solar Ponds
Option 2D Master Schedule
Sheet 3 of 3
Date
Revision
Checked
Approved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20 Maintain HNUS Equipment
30 Relocate Processing Train
500 Procedures and Documents
270 Processing equipment
350 Maintenance
264 Portable Warehouse
200 Procurement
100 Train Erection Personnel
400 Operations Readiness Review
260 Erection Equipment
202 Title III Design Services
250 Erection
550 Maintenance Planning
300 Classroom Training For Operations Personnel
600 Cold Test and Field Training
700 DOE Approval For Hot Test
800 Hot Test and Analytical Testing
900 DOE Hot Test Evaluation and Approval
1000 Waste Processing
280 Processing Equipment
262 Demobization Erection Equipment
1100 Demobilization
207 A/B Pond (Task 1204202)
1160 Operations Readiness Review
1235 Chlorination
1180 Cold Test and Field Training
1190 DOE Approval for Hot Test
1200 Hot Test and Analytical Testing
1210 DOE Hot Test Evaluation and Approval
1220 Waste Processing
1175 Maintenance
Remix Pondcrete/Saltcrete (Task 1204203-04)
1260 Treatability
1386 Processing Equipment
1341 Portable Warehouse
1352 Processing Equipment
1385 Maintenance
1270 Design/Engineering
1280 Procurement
1354 Processing Equipment
1290 Permits
1300 Train Erection Personnel
1342 Erection Equipment
1310 Erection
1356 Processing Equipment
1340 Procedures and Documents
1282 Title III Design Services
1330 Operational Readiness Review
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 29AUG04
(c) Primavera Systems, Inc
Activity Bar/Early Dates
Critical Activity
Slack
Milestone/Progress Activity
Sheet 1 of 1
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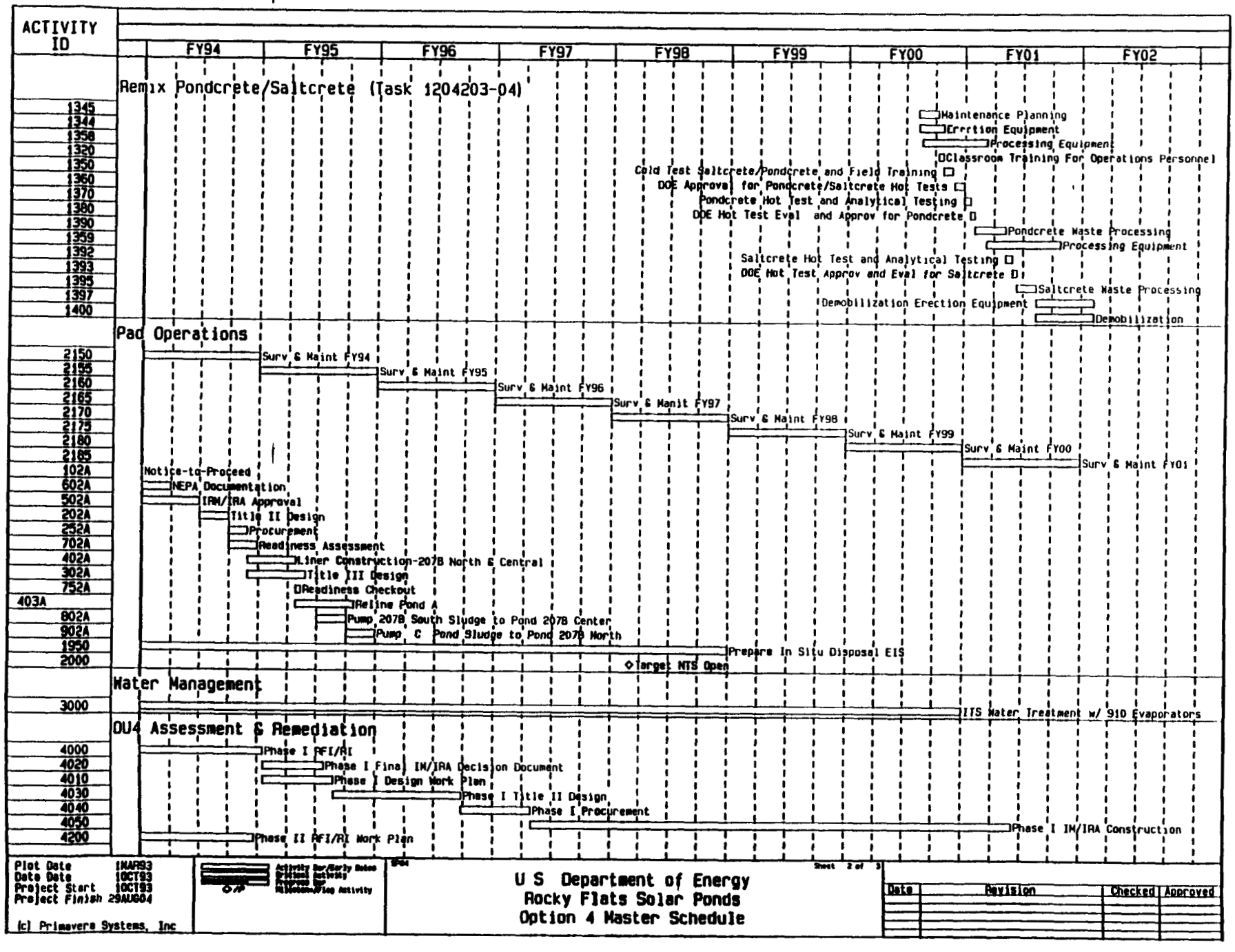
Rocky Flats Solar Ponds
Option 4 Master Schedule
Date
Revision
Checked
Approved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FY00
FY01
FY02
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1345 Maintenance Planning
1344 Erection Equipment
1350 Processing Equipment
1320 Classroom Training For Operations Personnel
1350 Cold Test Saltcrete/Pondcrete and Field Training
1360 DOE Approval for Pondcrete/Saltcrete Hot Tests
1370 Pondcrete Hot Test and Analytical Testing
1380 DOE Hot Test Eval and Approv for Pondcrete
1390 Pondcrete Waste Processing
1359 Processing Equipment
1392 Saltcrete Hot Test and Analytical Testing
1393 DOE Hot Test Approv and Eval for Saltcrete
1395 Saltcrete Waste Processing
1397 Demobilization Erection Equipment
1400 Demobilization
Pad Operations
2150 Surv & Maint FY94
2155 Surv & Maint FY95
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2185 Surv & Maint FY01
102A Notice-to-Proceed
602A NEPA Documentation
502A IRM/IRA Approval
202A Title II Design
252A Procurement
702A Readiness Assessment
402A Liner Construction-207B North & Central
302A Title III Design
752A Readiness Checkout
403A Reline Pond A
802A Pump 207B South Sludge to Pond 207B Center
902A Pump C Pond Sludge to Pond 207B North
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2000 Target NTS Open
Water Management
3000 ITS Water Treatment w/ 910 Evaporators
OU4 Assessment & Remediation
4000 Phase I RFI/RI
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4030 Phase I Title II Design
4040 Phase I Procurement
4050 Phase I IM/IRA Construction
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Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 29AUG04
(c) Primavera Systems, Inc
Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Key Activity
U S Department of Energy
Rocky Flats Solar Ponds
Option 4 Master Schedule
Sheet 2 of 3
Date
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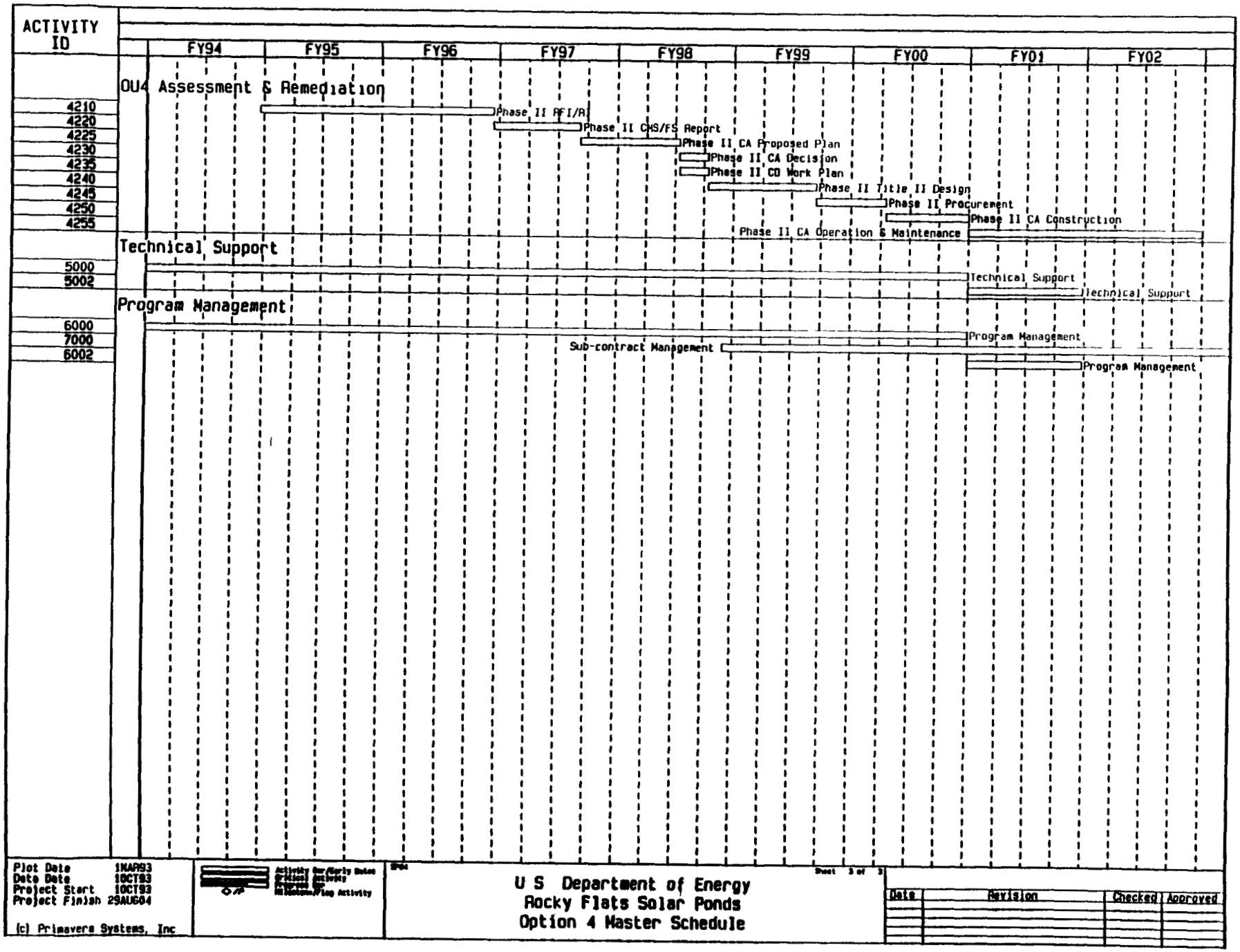
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Phase II CA Proposed Plan
Phase II CA Decision
Phase II CD Work Plan
Phase II Title II Design
Phase II Procurement
Phase II CA Construction
Phase II CA Operation & Maintenance
Technical Support
5000
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Technical Support
Technical Support
Program Management
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6002
Program Management
Sub-contract Management
Program Management
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
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(c) Primavera Systems, Inc
Sheet 3 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 4 Master Schedule
Date
Revision
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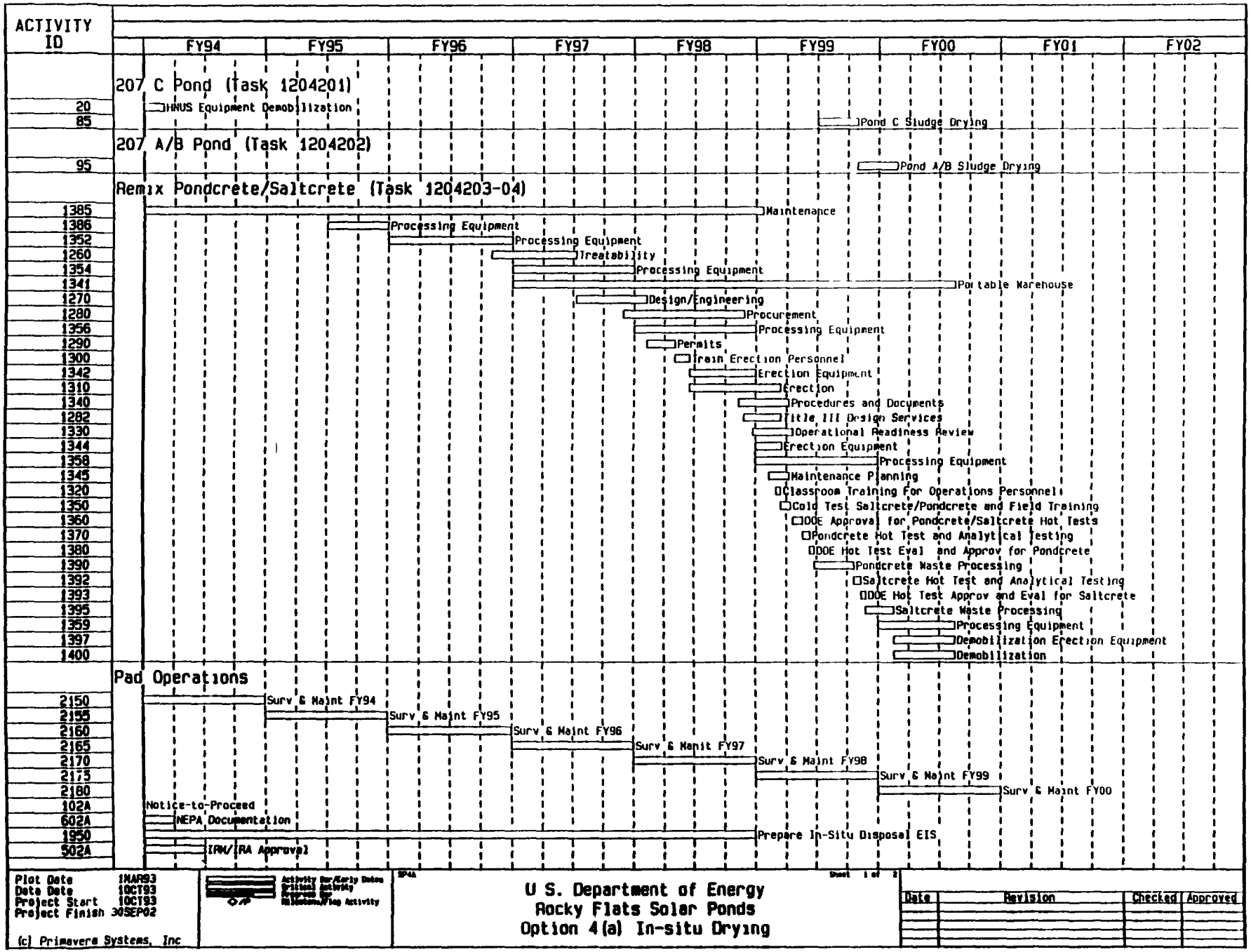
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85 Pond C Sludge Drying
207 A/B Pond (Task 1204202)
95 Pond A/B Sludge Drying
Remix Pondcrete/Saltcrete (Task 1204203-04)
1385 Maintenance
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1352 Processing Equipment
1260 Treatability
1354 Processing Equipment
1341 Portable Warehouse
1270 Design/Engineering
1280 Procurement
1356 Processing Equipment
1290 Permits
1300 Train Erection Personnel
1342 Erection Equipment
1310 Erection
1340 Procedures and Documents
1282 Title III Design Services
1330 Operational Readiness Review
1344 Erection Equipment
1358 Processing Equipment
1345 Maintenance Planning
1320 Classroom Training For Operations Personnel
1350 Cold Test Saltcrete/Pondcrete and Field Training
1360 DOE Approval for Pondcrete/Saltcrete Hot Tests
1370 Pondcrete Hot Test and Analytical Testing
1380 DOE Hot Test Eval and Approv for Pondcrete
1390 Pondcrete Waste Processing
1392 Saltcrete Hot Test and Analytical Testing
1393 DOE Hot Test Approv and Eval for Saltcrete
1395 Saltcrete Waste Processing
1359 Processing Equipment
1397 Demobilization Erection Equipment
1400 Demobilization
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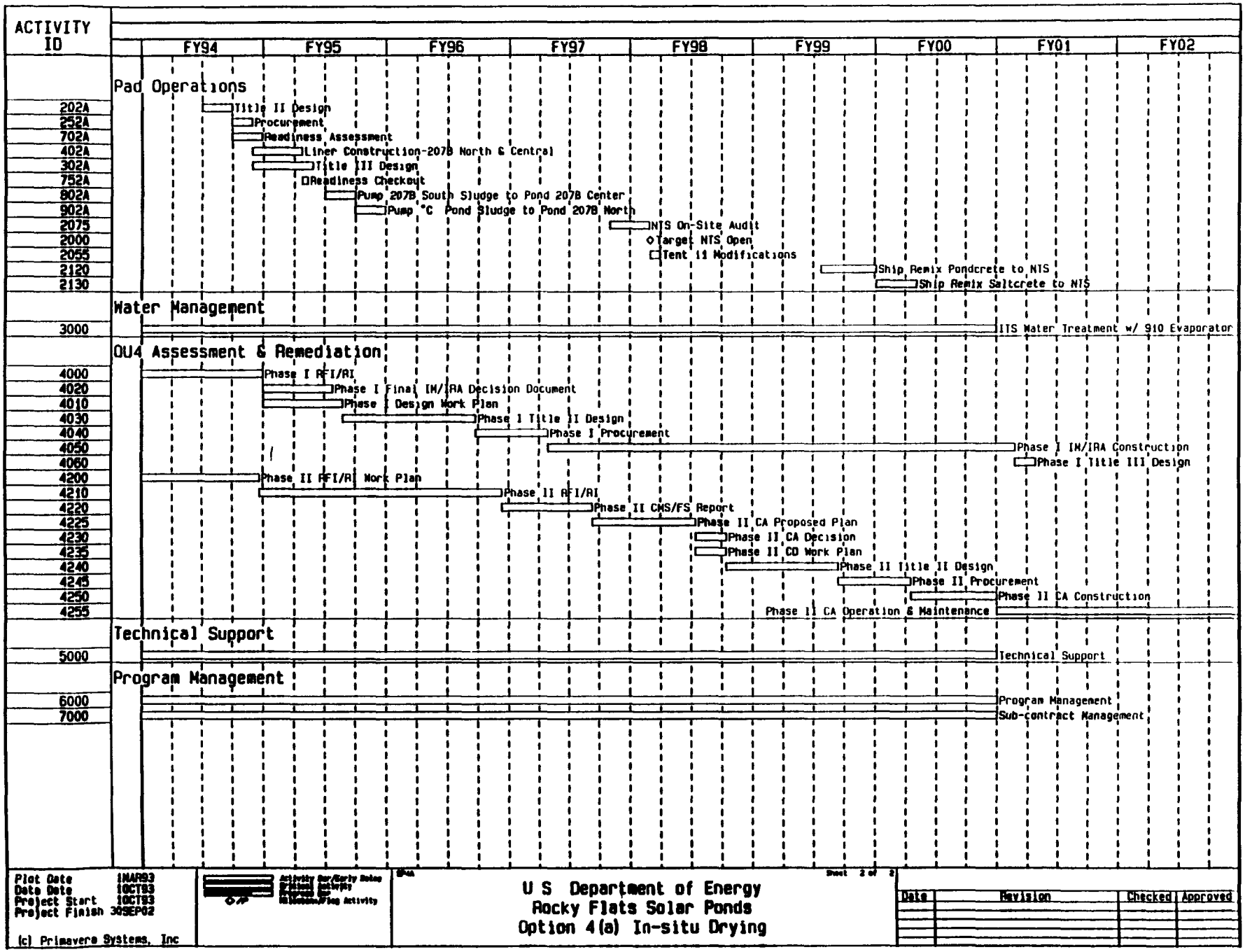
602A NEPA Documentation
1950 Prepare In-Situ Disposal EIS
502A IRM/IRA Approval
Plot Date 1MAR93
Data Date 1OCT93
Project Start 1OCT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
U S. Department of Energy
Rocky Flats Solar Ponds
Option 4(a) In-situ Drying
Date
Revision
Checked
Approved

Figure A-7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252A Procurement
702A Readiness Assessment
402A Liner Construction-207B North & Central
302A Title III Design
752A Readiness Checkout
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902A Pump °C Pond Sludge to Pond 207B North
2075 NTS On-Site Audit
2000 Target NTS Open
2055 Tent II Modifications
2120 Ship Remix Pondcrete to NTS
2130 Ship Remix Saltcrete to NTS
Water Management
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OU4 Assessment & Remediation
4000 Phase I RFI/RI
4020 Phase I Final IM/IRA Decision Document
4010 Phase I Design Work Plan
4030 Phase I Title II Design
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5000 Technical Support
Program Management
6000 Program Management
7000 Sub-contract Management
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
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Sheet 2 of 2
U S Department of Energy
Rocky Flats Solar Ponds
Option 4(a) In-situ Drying
Date
Revision
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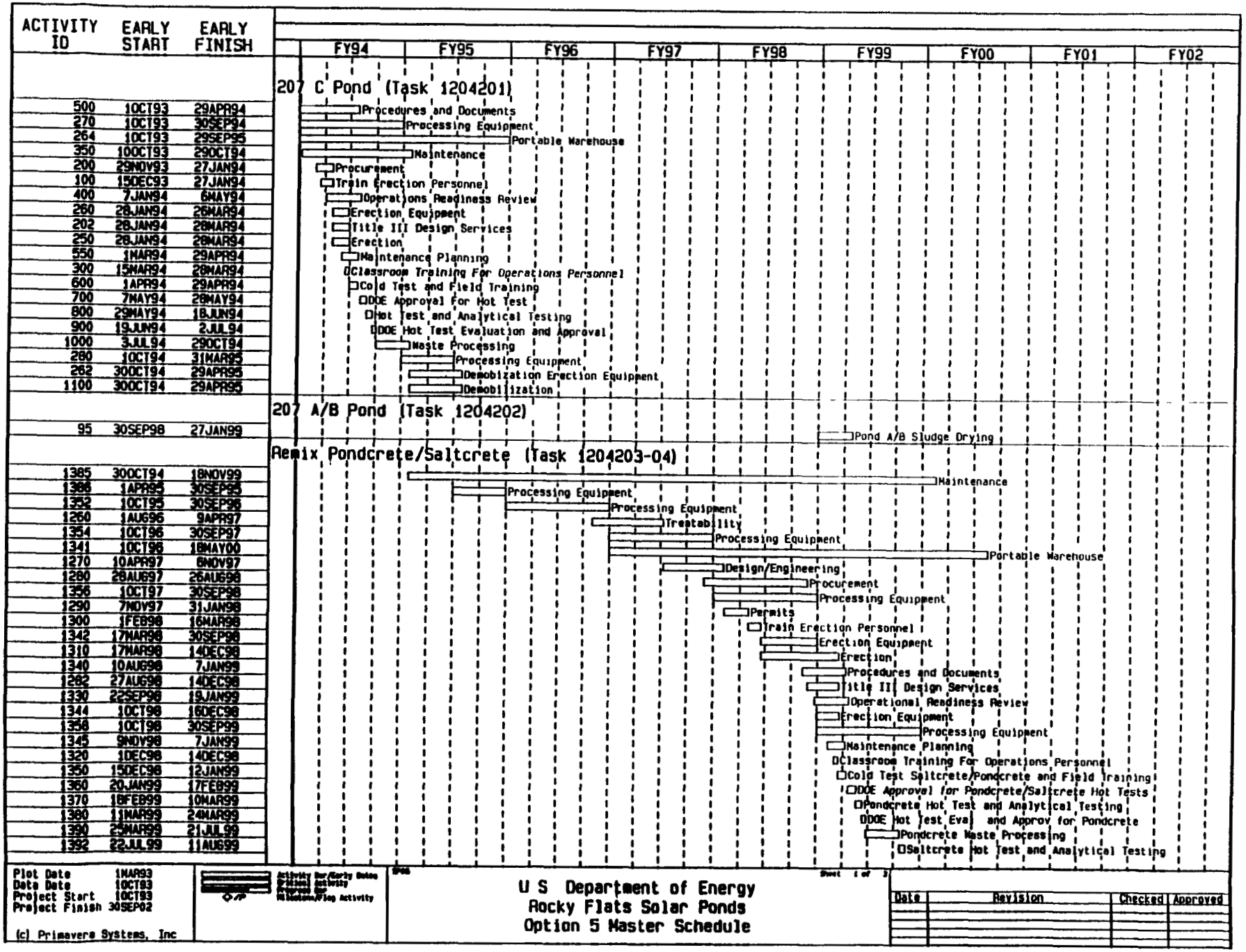
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270 10OCT93 30SEP94 Processing Equipment
264 10OCT93 29SEP95 Portable Warehouse
350 10OCT93 29OCT94 Maintenance
200 29NOV93 27JAN94 Procurement
100 15DEC93 27JAN94 Train Erection Personnel
400 7JAN94 6MAY94 Operations Readiness Review
260 28JAN94 28MAR94 Erection Equipment
202 28JAN94 28MAR94 Title III Design Services
250 28JAN94 28MAR94 Erection
550 1MAR94 29APR94 Maintenance Planning
300 15MAR94 28MAR94 Classroom Training For Operations Personnel
600 1APR94 29APR94 Cold Test and Field Training
700 7MAY94 28MAY94 DOE Approval For Hot Test
800 29MAY94 18JUN94 Hot Test and Analytical Testing
900 19JUN94 2JUL94 DOE Hot Test Evaluation and Approval
1000 3JUL94 29OCT94 Waste Processing
280 10OCT94 31MAR95 Processing Equipment
262 30OCT94 29APR95 Demobization Erection Equipment
1100 30OCT94 29APR95 Demobilization
207 A/B Pond (Task 1204202)
95 30SEP98 27JAN99 Pond A/B Sludge Drying
Remix Pondcrete/Saltcrete (Task 1204203-04)
1385 30OCT94 18NOV99 Maintenance
1398 1APR95 30SEP95 Processing Equipment
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1260 1AUG96 9APR97 Treatability
1354 10CT96 30SEP97 Processing Equipment
1341 10CT96 18MAY00 Portable Warehouse
1270 10APR97 8NOV97 Design/Engineering
1280 28AUG97 26AUG98 Procurement
1356 10CT97 30SEP98 Processing Equipment
1290 7NOV97 31JAN98 Permits
1300 1FEB98 16MAR98 Train Erection Personnel
1342 17MAR98 30SEP98 Erection Equipment
1310 17MAR98 14DEC98 Erection
1340 10AUG98 7JAN99 Procedures and Documents
1282 27AUG98 14DEC98 Title II Design Services
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1380 11MAR99 24MAR99 DOE Hot Test Eval and Approv for Pondcrete
1390 25MAR99 21JUL99 Pondcrete Waste Processing
1392 22JUL99 11AUG99 Saltcrete Hot Test and Analytical Testing
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
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Rocky Flats Solar Ponds
Option 5 Master Schedule
Date
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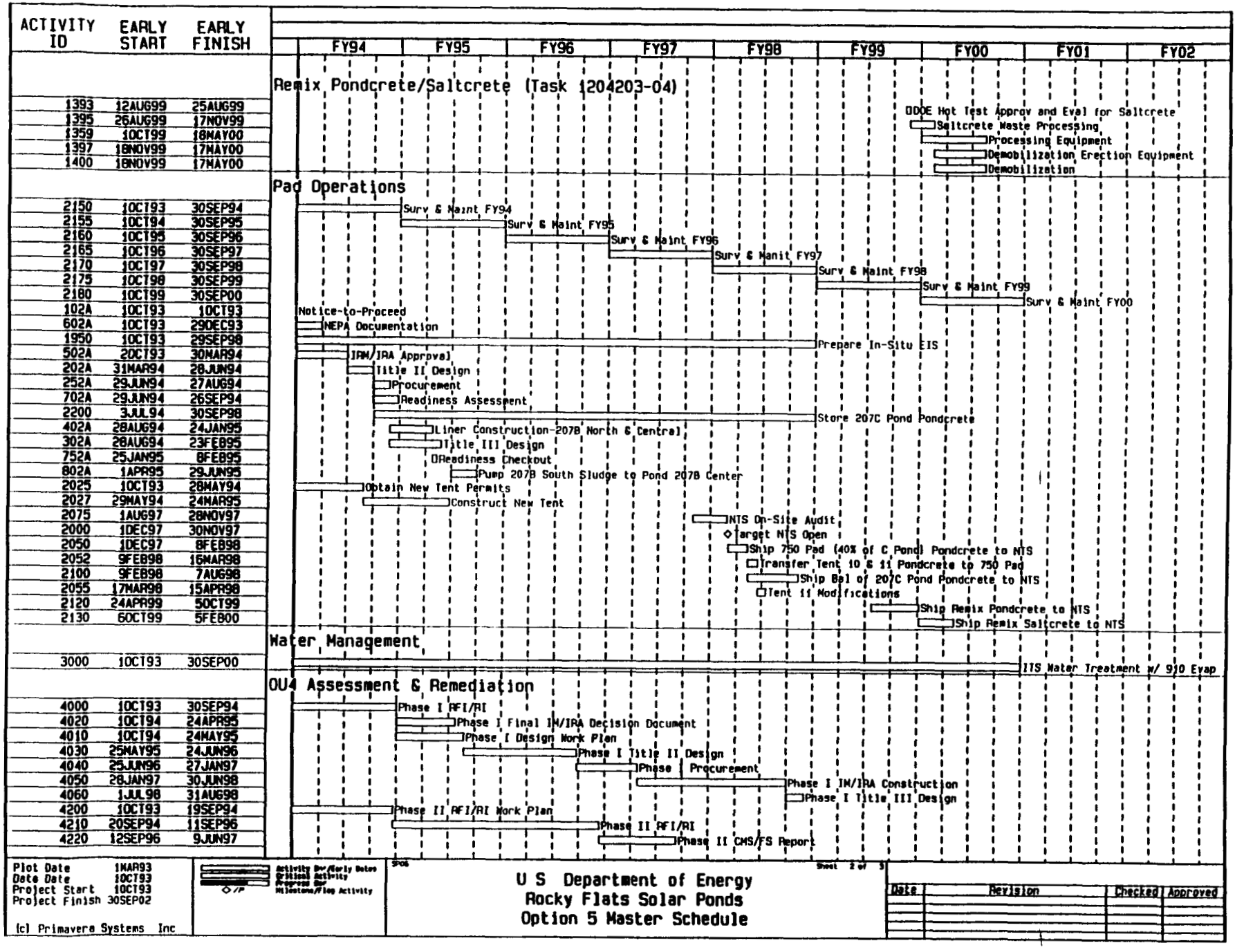
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FY00
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1395 26AUG99 17NOV99 Saltcrete Waste Processing
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1397 18NOV99 17MAY00 Demobilization Erection Equipment
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602A 10CT93 29DEC93 NEPA Documentation
1950 10CT93 29SEP98 Prepare In-Situ EIS
502A 20CT93 30MAR94 IRM/IRA Approval
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252A 29JUN94 27AUG94 Procurement
702A 29JUN94 26SEP94 Readiness Assessment
2200 3JUL94 30SEP98 Store 207C Pond Pondcrete
402A 28AUG94 24JAN95 Liner Construction-207B North & Central
302A 28AUG94 23FEB95 Title III Design
752A 25JAN95 8FEB95 Readiness Checkout
802A 1APR95 29JUN95 Pump 207B South Sludge to Pond 207B Center
2025 10CT93 28MAY94 Obtain New Tent Permits
2027 29MAY94 24MAR95 Construct New Tent
2075 1AUG97 28NOV97 NTS On-Site Audit
2000 1DEC97 30NOV97 Target NTS Open
2050 1DEC97 8FEB98 Ship 750 Pad (40% of C Pond) Pondcrete to NTS
2052 9FEB98 16MAR98 Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100 9FEB98 7AUG98 Ship Bal of 207C Pond Pondcrete to NTS
2055 17MAR98 15APR98 Tent 11 Modifications
2120 24APR99 5OCT99 Ship Remix Pondcrete to NTS
2130 6OCT99 5FEB00 Ship Remix Saltcrete to NTS
Water Management
3000 10CT93 30SEP00 ITS Water Treatment w/ 910 Evap
OU4 Assessment & Remediation
4000 10CT93 30SEP94 Phase I RFI/RI
4020 10CT94 24APR95 Phase I Final IM/IRA Decision Document
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Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems Inc
Activity Bar/Early Dates
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Progress Bar
Milestone/Float Activity
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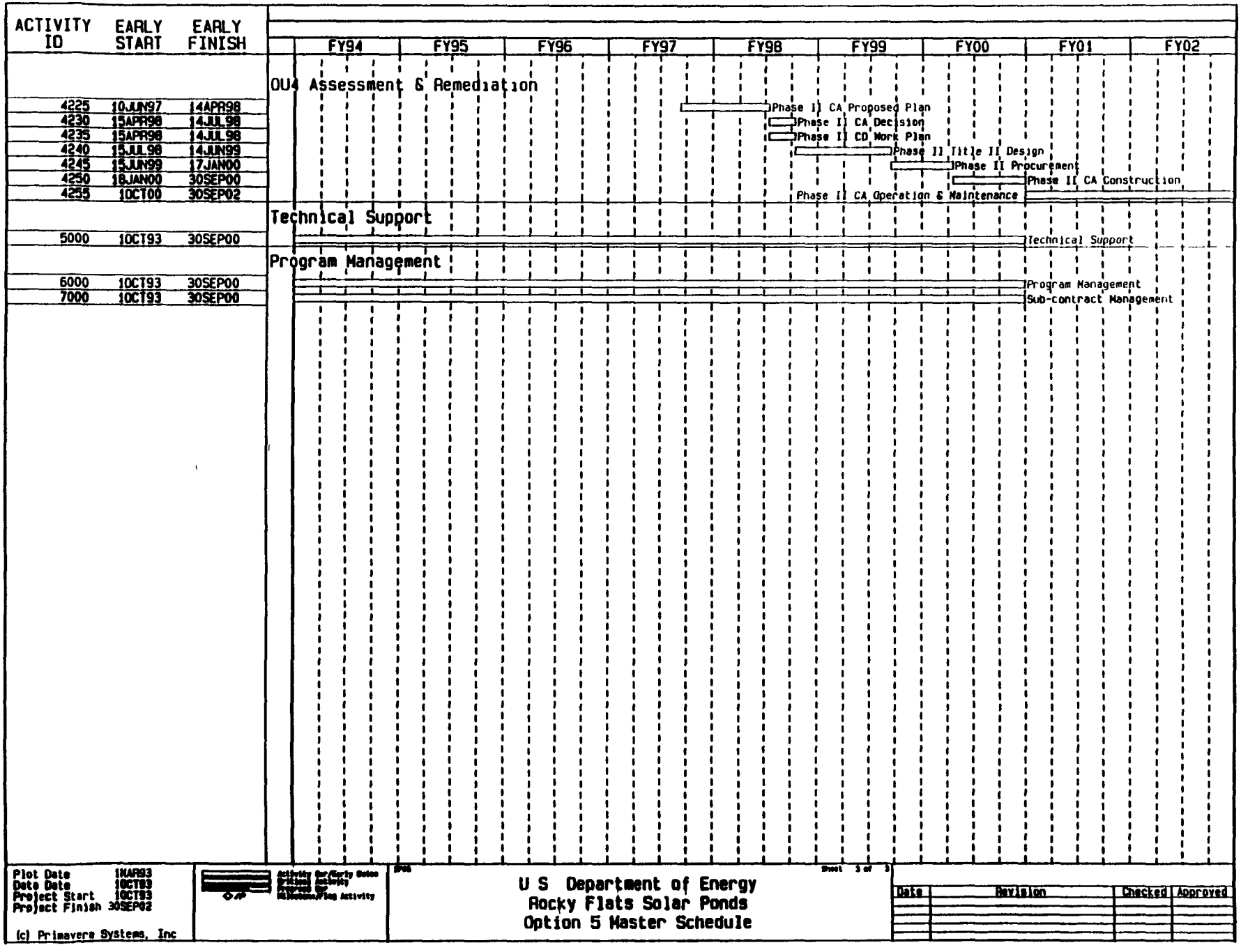
Sheet 2 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 5 Master Schedule
Date
Revision
Checked
Approved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Technical Support
Program Management
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Program Management
Sub-contract Management
Plot Date 1MAR93
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Project Start 10CT93
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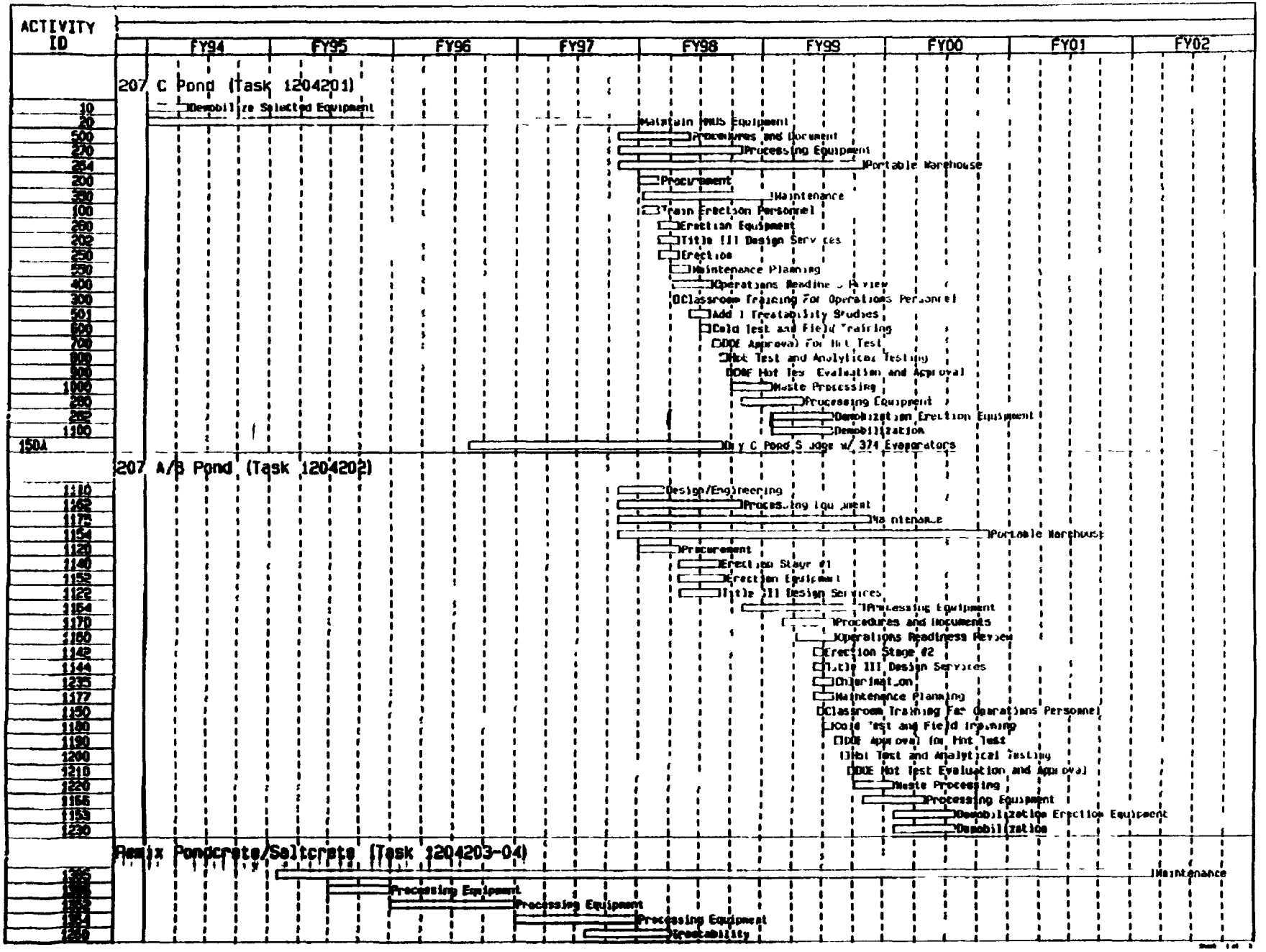
(c) Primavera Systems, Inc
Sheet 3 of 3
U S Department of Energy
Rocky Flats Solar Ponds
Option 5 Master Schedule
Date
Revision
Checked
Approved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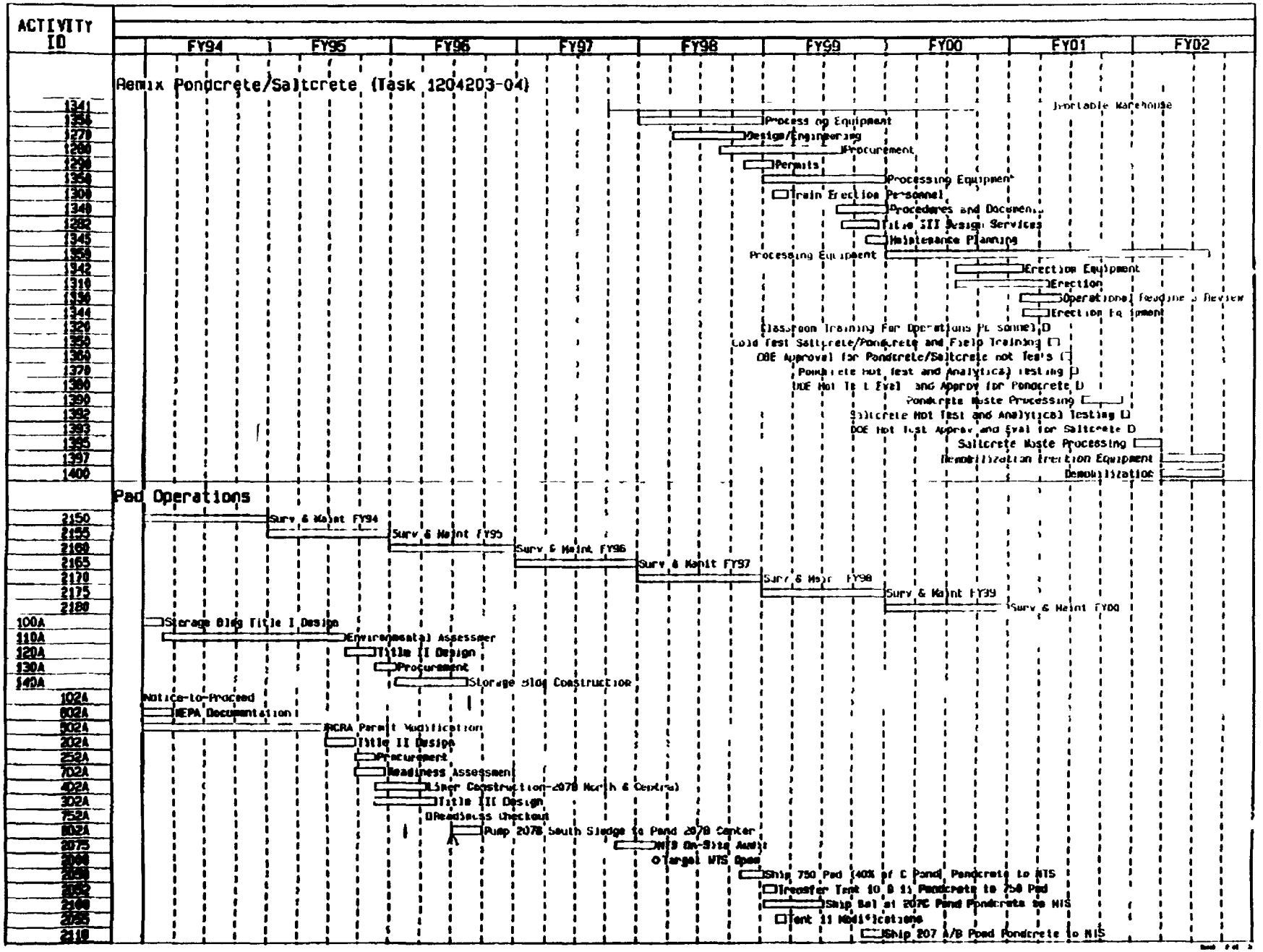
Maintain HWS Equipment
Procedures and Document
Processing Equipment
Portable Warehouse
Procurement
Maintenance
Train Erection Personnel
Erection Equipment
Title III Design Services
Erection
Maintenance Planning
Operations Readine s Review
Classroom Training For Operations Personnel
Add l Treatability Studies
Cold Test and Field Training
DOE Approval for Hot Test
Hot Test and Analytical Testing
DOE Hot Tes Evaluation and Approval
Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
Dry C Pond S Jage w/ 374 Evaporators
207 A/B Pond (Task 1204202)
Design/Engineering
Processing Equipment
Maintenance
Portable Warehouse
Procurement
Erection Stage #1
Erection Equipment
Title III Design Services
Processing Equipment
Procedures and Documents
Operations Readiness Review
Erection Stage #2
Title III Design Services
Chlorination
Maintenance Planning
Classroom Training For Operations Personnel
Cold Test and Field Training
DOE Approval for Hot Test
Hot Test and Analytical Testing
DOE Hot Test Evaluation and Approval
Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
Maintenance
Processing Equipment
Processing Equipment
Processing Equipment
Treatability

OPTION 3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Design/Engineering
Procurement
Permits
Processing Equipment
Train Erection Personnel
Procedures and Documen...
Title III Design Services
Maintenance Planning
Processing Equipment
Erection Equipment
Erection
Operational Readine s Review
Erection Eq ipment
Class-room Training For Operations Pe sonnel D
Cold Test Saltcrete/Pondcrete and Field Training D
DOE Approval for Pondcrete/Saltcrete not Tes's D
Pondcrete Hot Test and Analytical Testing D
DOE Hot Te t Eval and Approv for Pondcrete D
Pondcrete Waste Processing
Saltcrete Hot Test and Analytical Testing D
DOE Hot Test Approv and Eval for Saltcrete D
Saltcrete Waste Processing
Demobilization Erection Equipment
Demobilization
Pad Operations
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Surv & Maint FY95
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Surv & Maint FY99
Surv & Maint FY00
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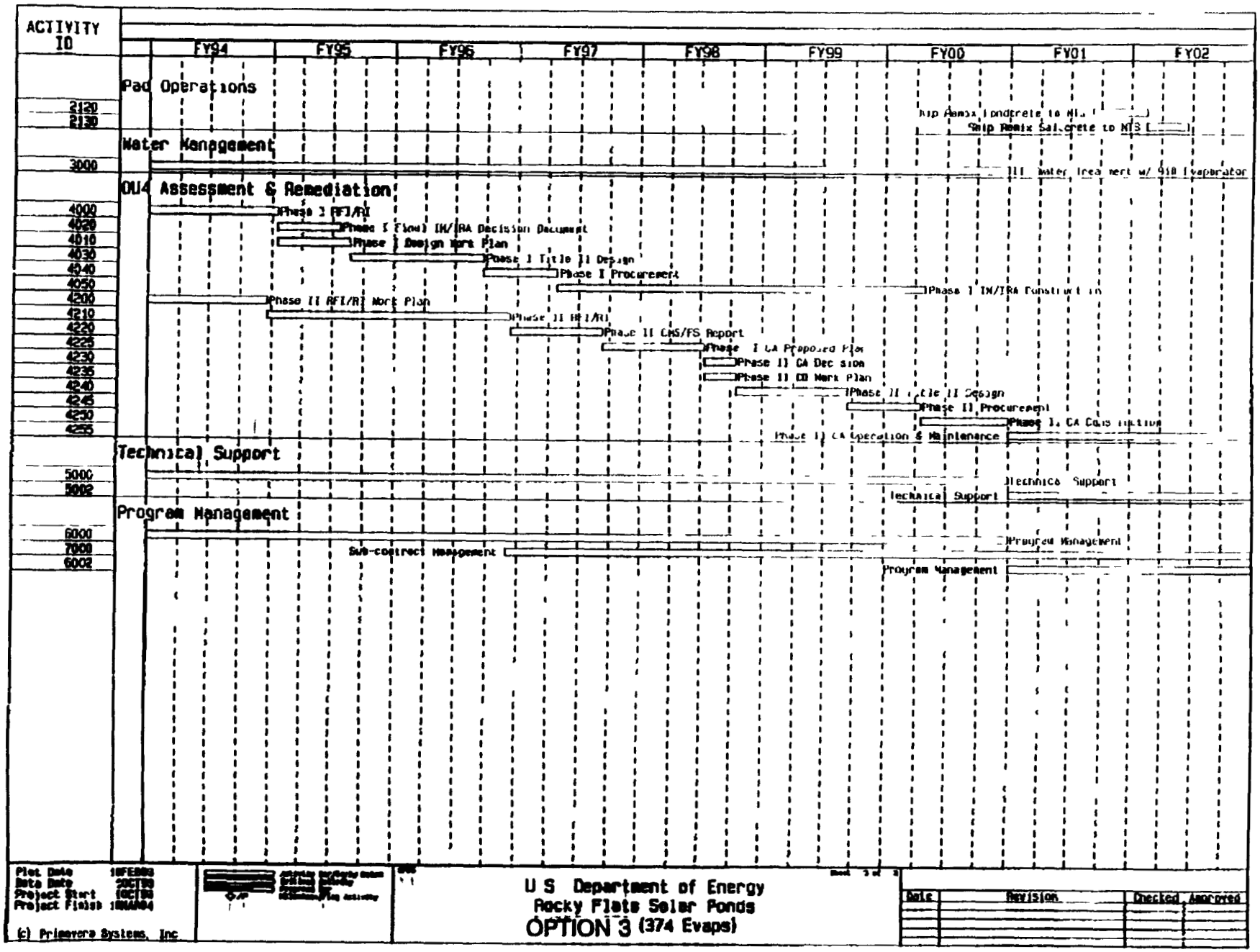
Environmental Assessmer
Title II Design
Procurement
Storage Bldg Construction
Notice-to-Proceed
NEPA Documentation
RCRA Permit Modification
Title II Design
Procurement
Readiness Assessmen
Liner Construction-2070 North & Central
Title III Design
Readiness Checkout
Pump 2078 South Sludge to Pond 2070 Center
NTS On-Site Assess
Target NTS Open
Ship 750 Pad (40% of C Pond) Pondcrete to NTS
Transfer Tent 10 & 11 Pondcrete to 750 Pad
Ship Bal of 207C Pond Pondcrete to NTS
Tent 11 Modifications
Ship 207 A/B Pond Pondcrete to NTS

OPTION 3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FY01
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III Water Treatment w/ 910 Evaporator
OU4 Assessment & Remediation
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Phase I Final IM/IRA Decision Document
Phase I Design Work Plan
Phase I Title II Design
Phase I Procurement
Phase I IM/IRA Construction
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Phase II RFI/RI
Phase II CMS/FS Report
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Phase II CA Decision
Phase II CD Work Plan
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Phase II Procurement
Phase I CA Construction
Phase I CA Operation & Maintenance
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Technical Support
Program Management
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Sub-contract Management
Program Management
Plot Date 18FEB98
Data Date 20OCT89
Project Start 02OCT89
Project Finish 18MAR04
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U S Department of Energy
Rocky Flats Solar Ponds
OPTION 3 (374 Evaps)
Date
Revision
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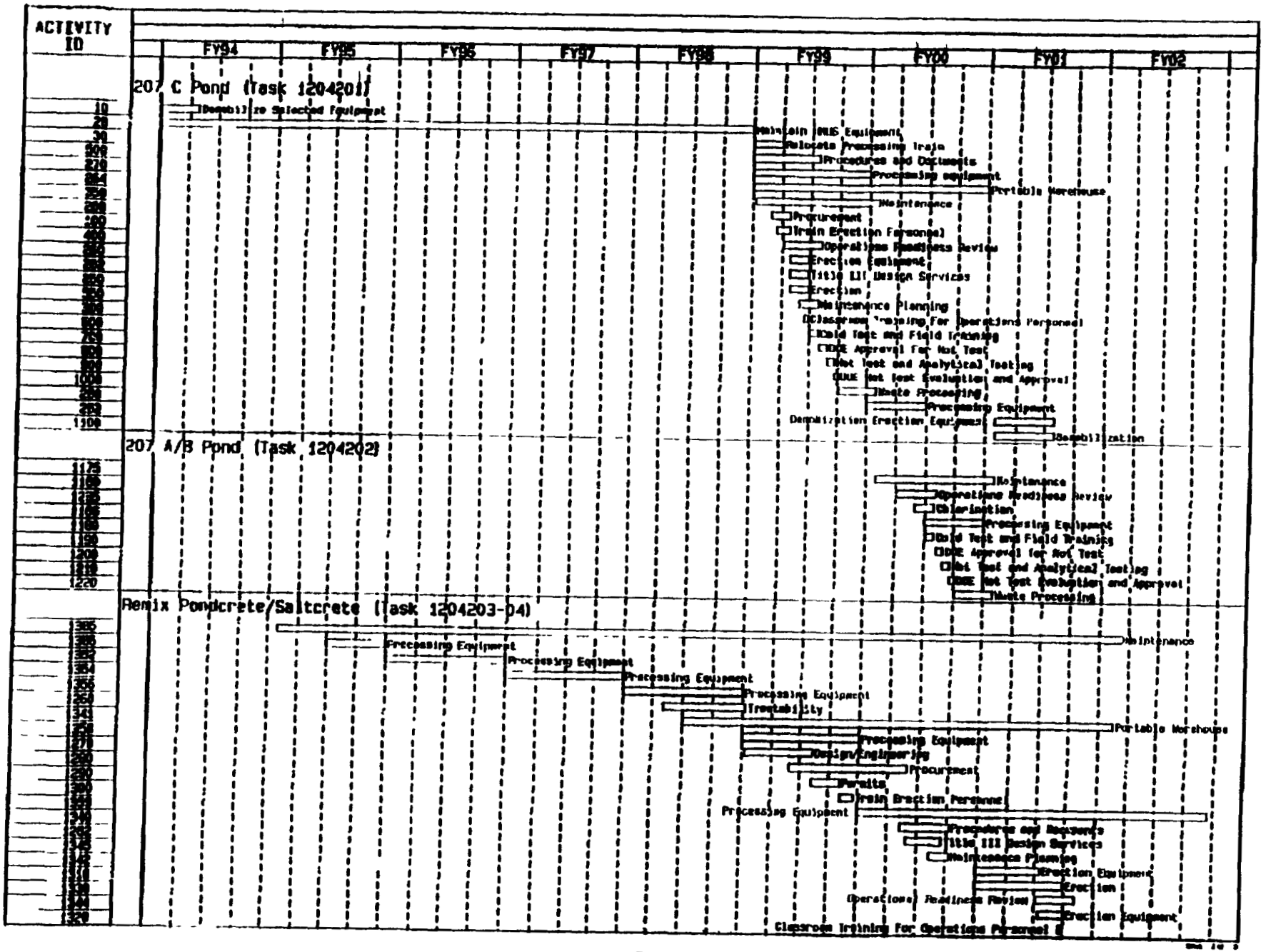
Approved

FIGURE A-6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Relocate Processing Train
Procedures and Documents
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Portable Warehouse
Maintenance
Procurement
Train Erection Personnel
Operational Readiness Review
Erection Equipment
Title III Design Services
Erection
Maintenance Planning
Classroom Training for Operations Personnel
Cold Test and Field Training
DDE Approval For Hot Test
Hot Test and Analytical Testing
DDE Hot Test Evaluation and Approval
Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
207 A/B Pond (Task 1204202)
Maintenance
Operational Readiness Review
Chlorination
Processing Equipment
Cold Test and Field Training
DDE Approval for Hot Test
Hot Test and Analytical Testing
DDE Hot Test Evaluation and Approval
Waste Processing
Remix Pondcrete/Saltcrete (Task 1204203-04)
Maintenance
Processing Equipment
Processing Equipment
Processing Equipment
Processing Equipment
Treatability
Portable Warehouse
Processing Equipment
Design/Engineering
Procurement
Permits
Train Erection Personnel
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Procedures and Documents
Title III Design Services
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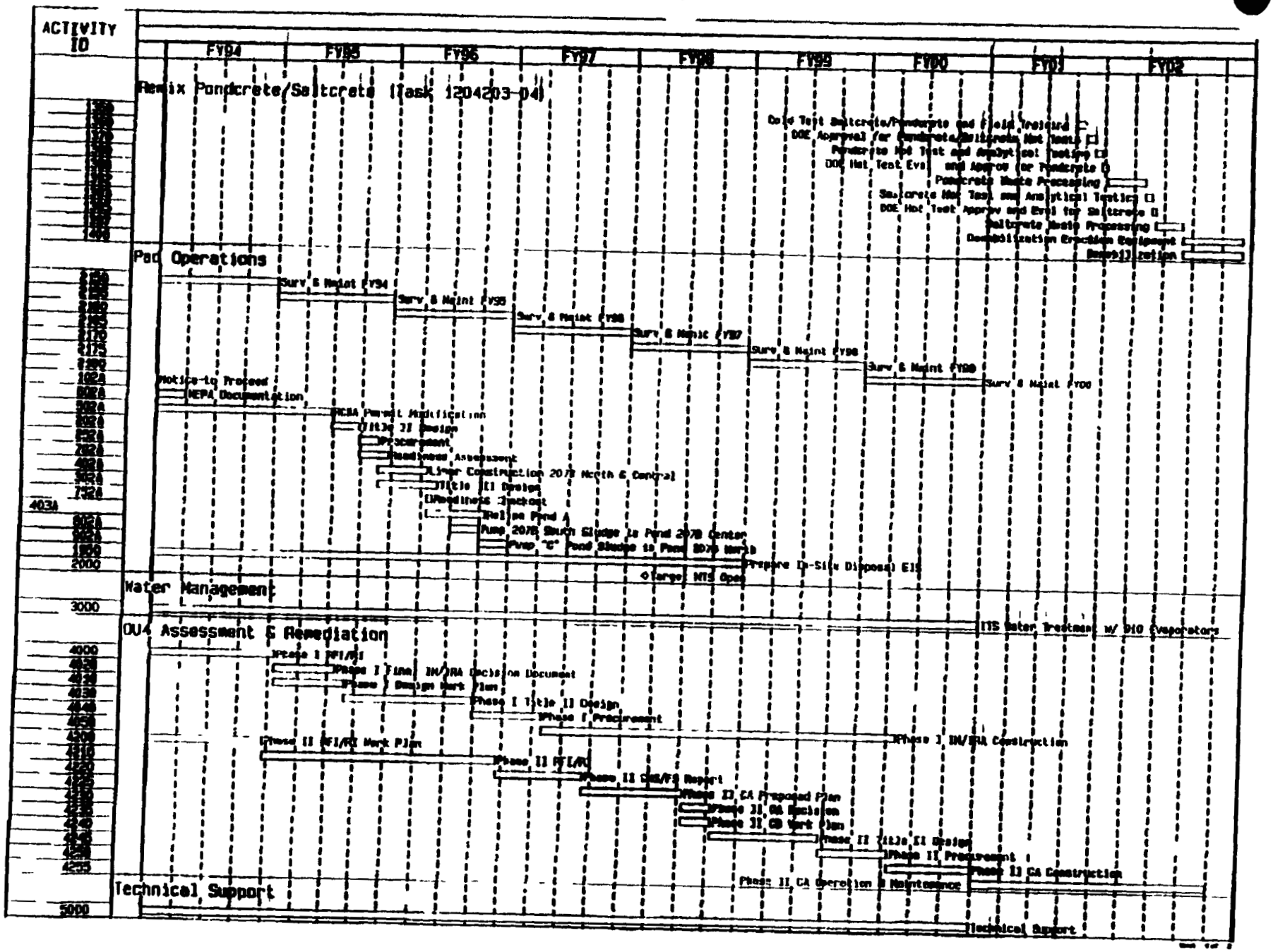
Erection Equipment
Erection
Operational Readiness Review
Erection Equipment
Classroom Training For Operations Personnel

OPTION 4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Surv & Maint FY96
Surv & Maint FY97
Surv & Maint FY98
Surv & Maint FY99
Surv & Maint FY00
Notice to Proceed
NEPA Documentation
RCRA Permit Modification
Title II Design
Procurement
Readiness Assessment
Liner Construction 207B North & Central
Title II Design
Readiness Assessment
Prepare In-Situ Disposal EIS
Target NTS Open
Water Management
ITS Water Treatment w/ DTO Evaporators
OU4 Assessment & Remediation
Phase I RFI/RI
Phase I Final IM/IRA Decision Document
Phase I Design Work Plan
Phase I Title II Design
Phase I Procurement
Phase I IM/IRA Construction
Phase II RFI/RI Work Plan
Phase II RFI/RI
Phase II CMS/FS Report
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Phase II Procurement
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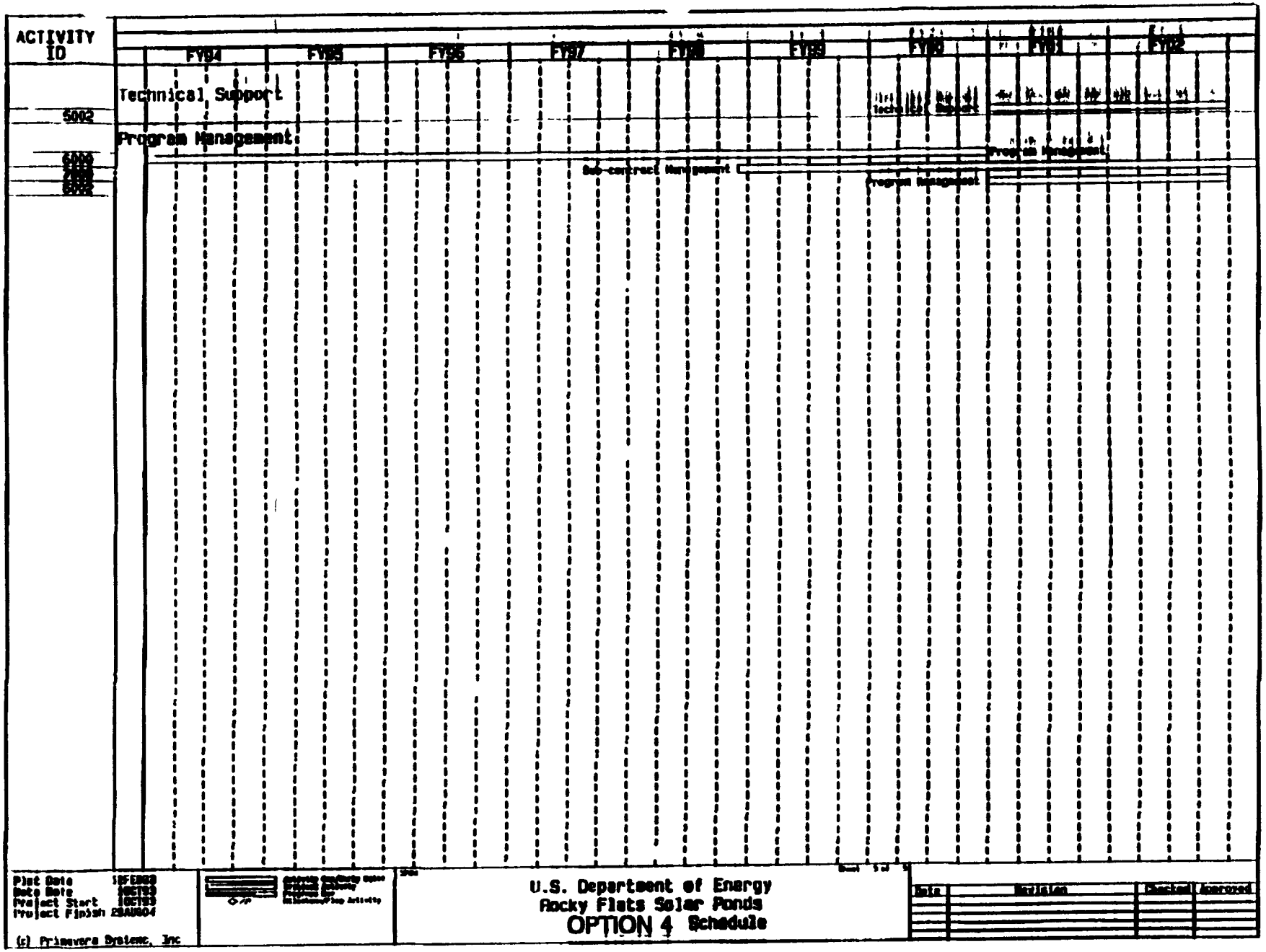
Phase II CA Operation & Maintenance
Technical Support
Technical Support

OPTION 4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U.S. Department of Energy
Rocky Flats Solar Ponds
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Date
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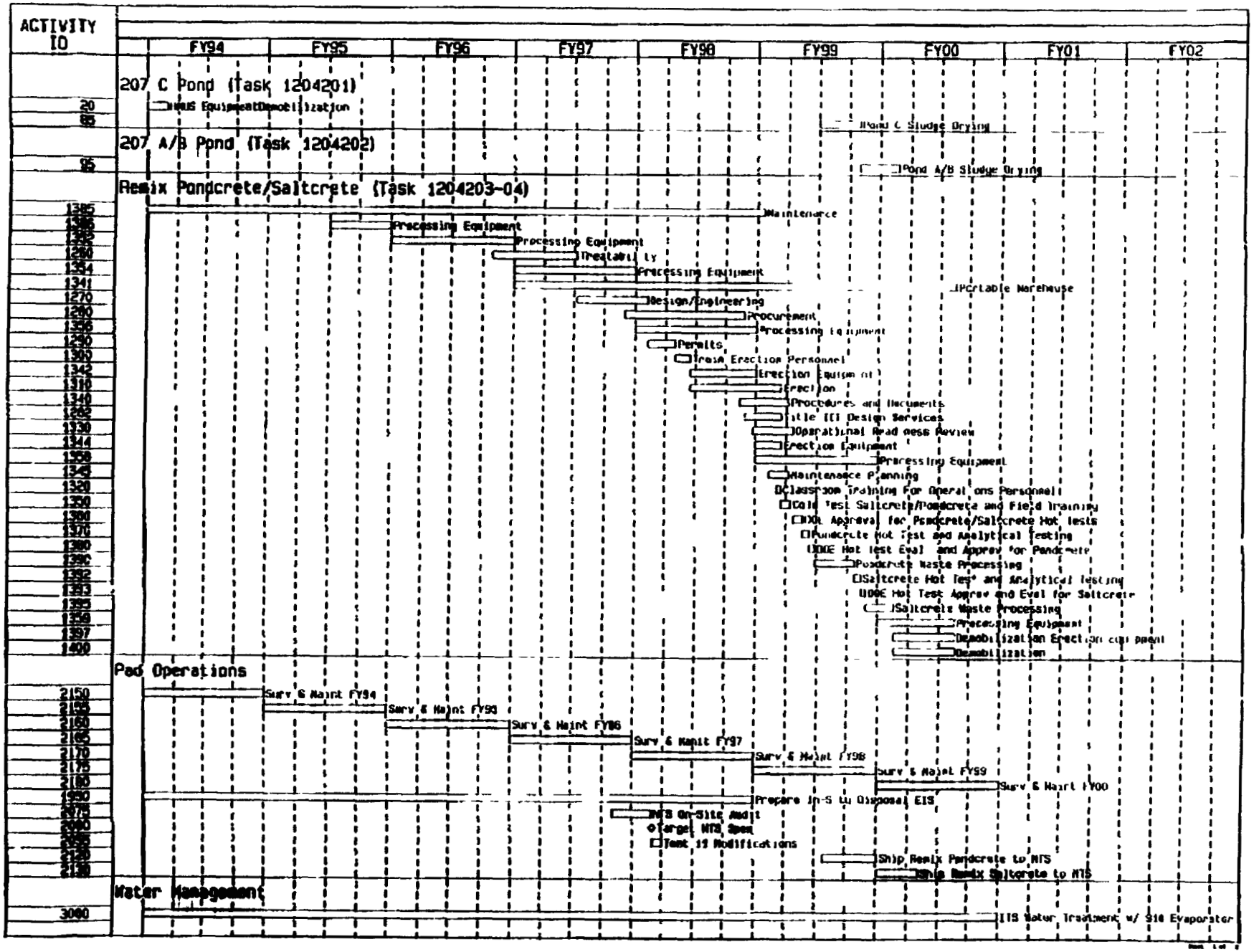
FIGURE A-7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Remix Pondcrete/Saltcrete (Task 1204203-04)
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Pad Operations
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2120
2130
Water Management
3000
Processing Equipment
Processing Equipment
Processing Equipment
Design/Engineering
Procurement
Processing Equipment
Permits
Maintenance
Erection Equipment
Procedures and Documents
Operational Readiness Review
Erection Equipment
Processing Equipment
Maintenance Planning
Classroom Training For Operations Personnel
Cold Test Saltcrete/Pondcrete and Field Training
DOE Approval for Pondcrete/Saltcrete Hot Tests
Pondcrete Hot Test and Analytical Testing
DOE Hot Test Eval and Approv for Pondcrete
Pondcrete Waste Processing
Saltcrete Hot Test and Analytical Testing
DOE Hot Test Approv and Eval for Saltcrete
Saltcrete Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
Surv & Maint FY94
Surv & Maint FY95
Surv & Maint FY96
Surv & Maint FY97
Surv & Maint FY98
Surv & Maint FY99
Surv & Maint FY00
Prepare In-S tu Disposal EIS
NTS On-Site Audit
Target NTS Open
Test 11 Modifications
Ship Remix Pondcrete to NTS
Ship Remix Saltcrete to NTS
ITS Water Treatment w/ STE Evaporator

OPTION 4A

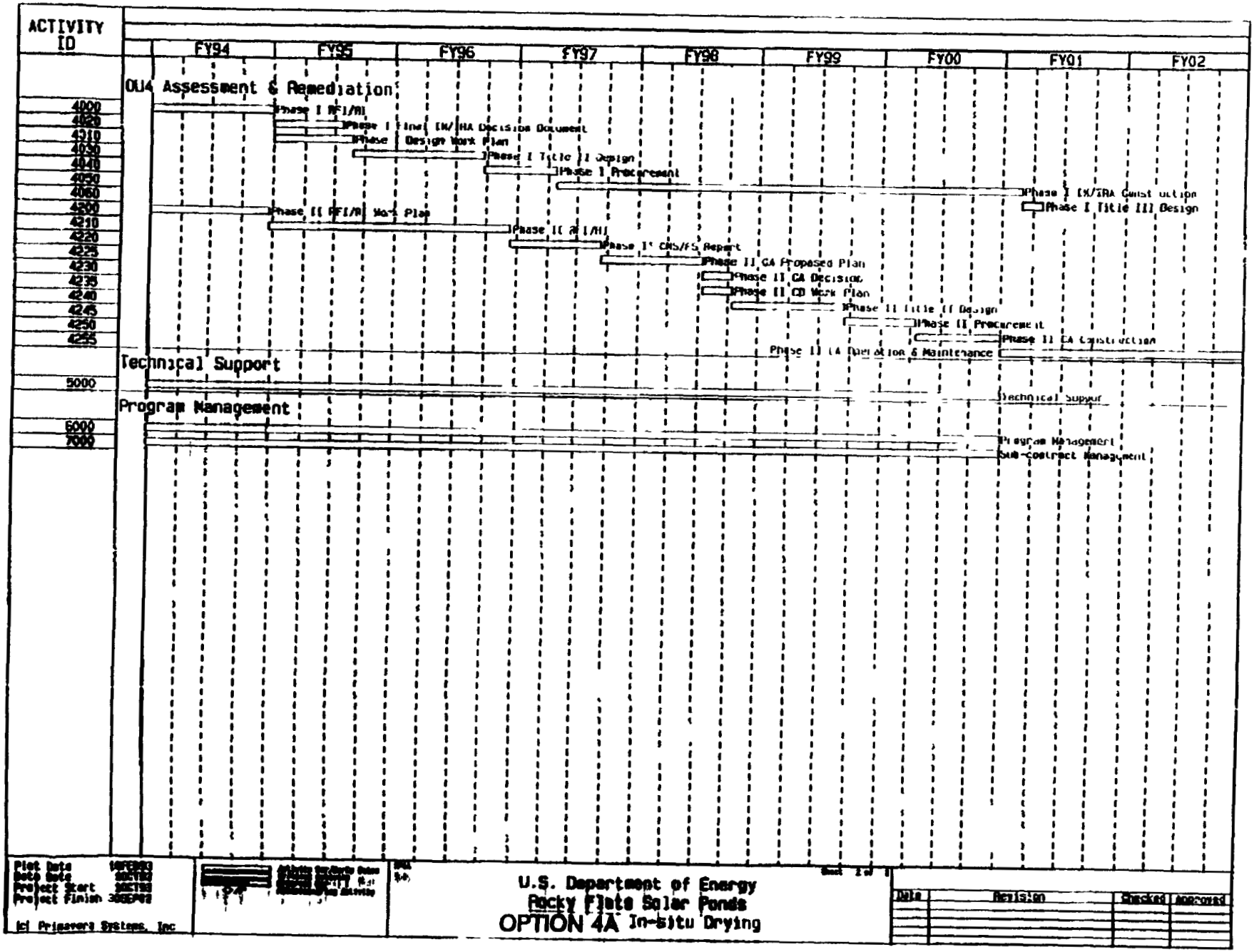
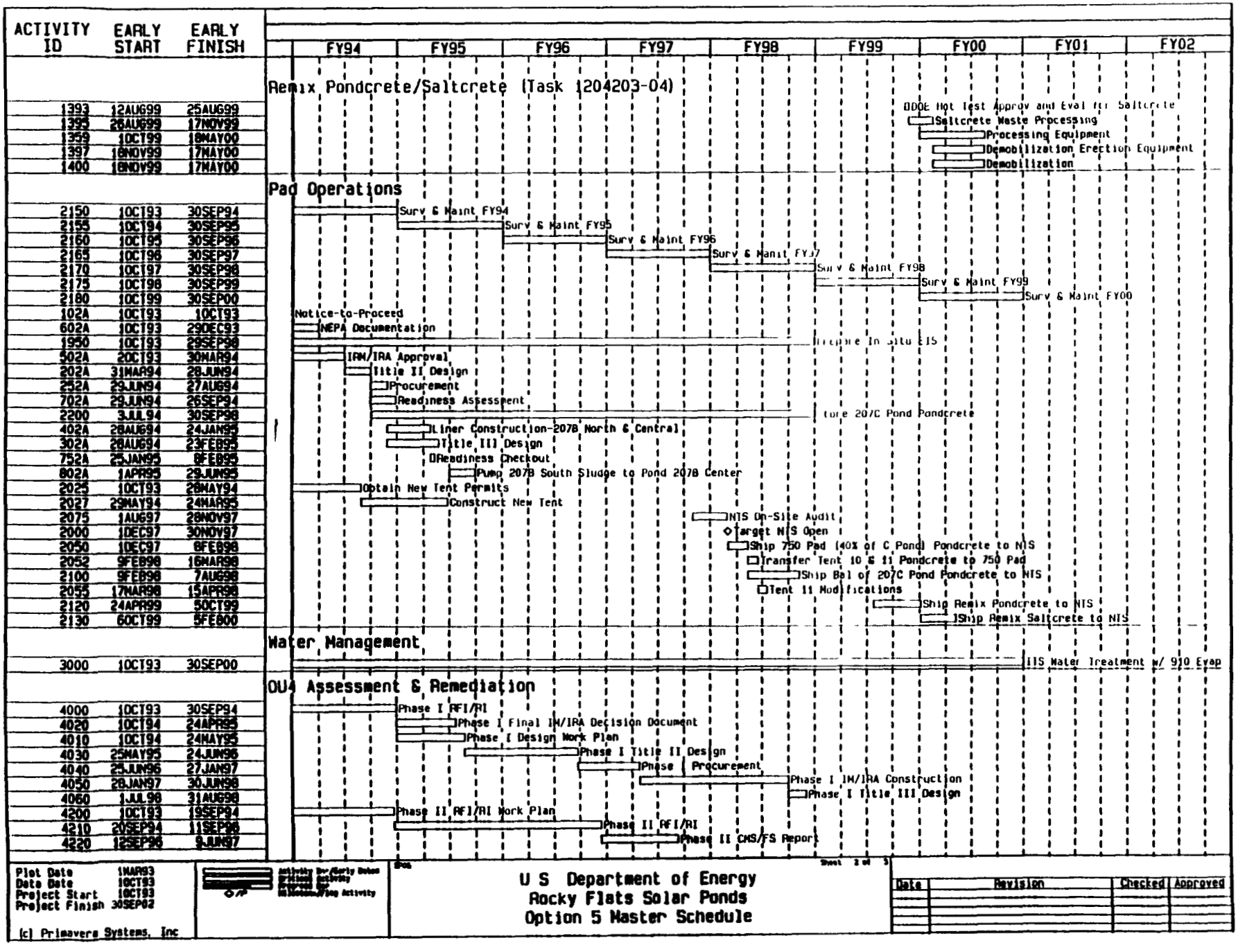
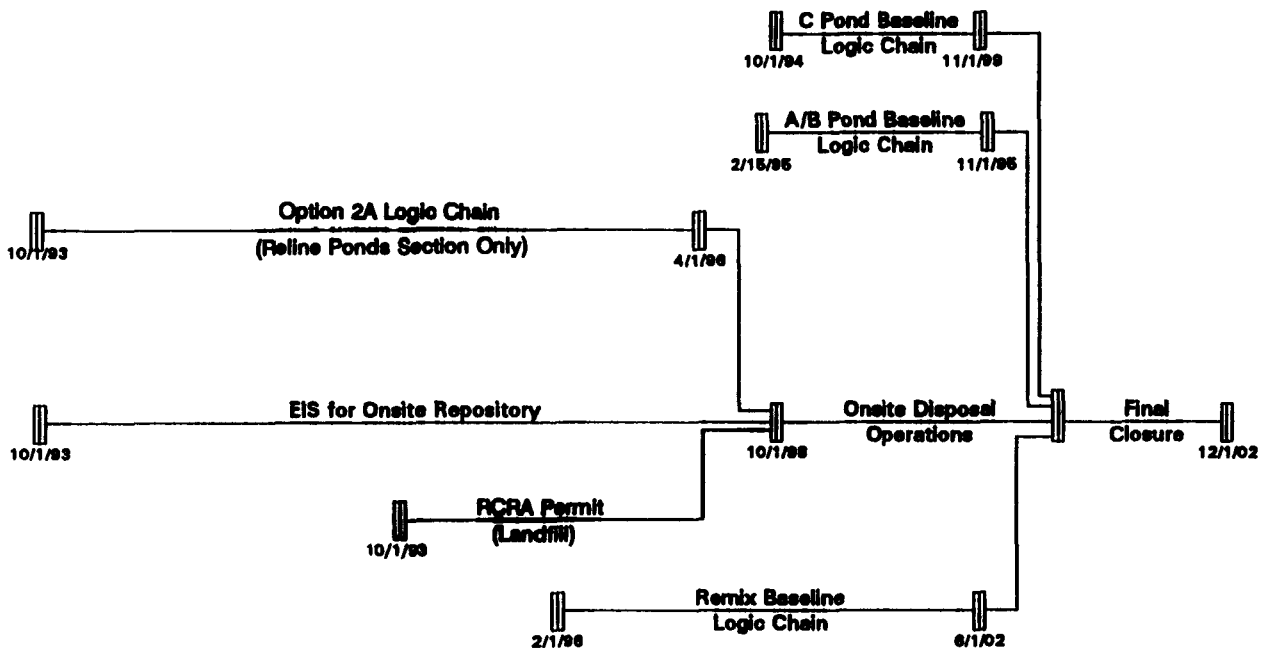

ACTIVITY ID
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
OU4 Assessment & Remediation
4000
4020
4210
4050
4040
4050
4060
4500
4210
4220
4225
4230
4235
4240
4245
4250
4255
Phase I RFI/RI
Phase I Final EM/ERA Decision Document
Phase I Design Work Plan
Phase I Title II Design
Phase I Procurement
Phase I EM/ERA Construction
Phase I Title III Design
Phase II RFI/RI Work Plan
Phase II RI/FS
Phase II CMS/FS Report
Phase II CA Proposed Plan
Phase II CA Decision
Phase II CD Work Plan
Phase II Title II Design
Phase II Procurement
Phase II CA Construction
Phase II CA Operation & Maintenance
Technical Support
5000
Technical Support
Program Management
6000
7000
Program Management
Sub-contract Management
Plot Date
Data Date
Project Start
Project Finish
(c) Primavera Systems, Inc
U.S. Department of Energy
Rocky Flats Solar Ponds
OPTION 4A In-Situ Drying
Date
Revision
Checked
Approved

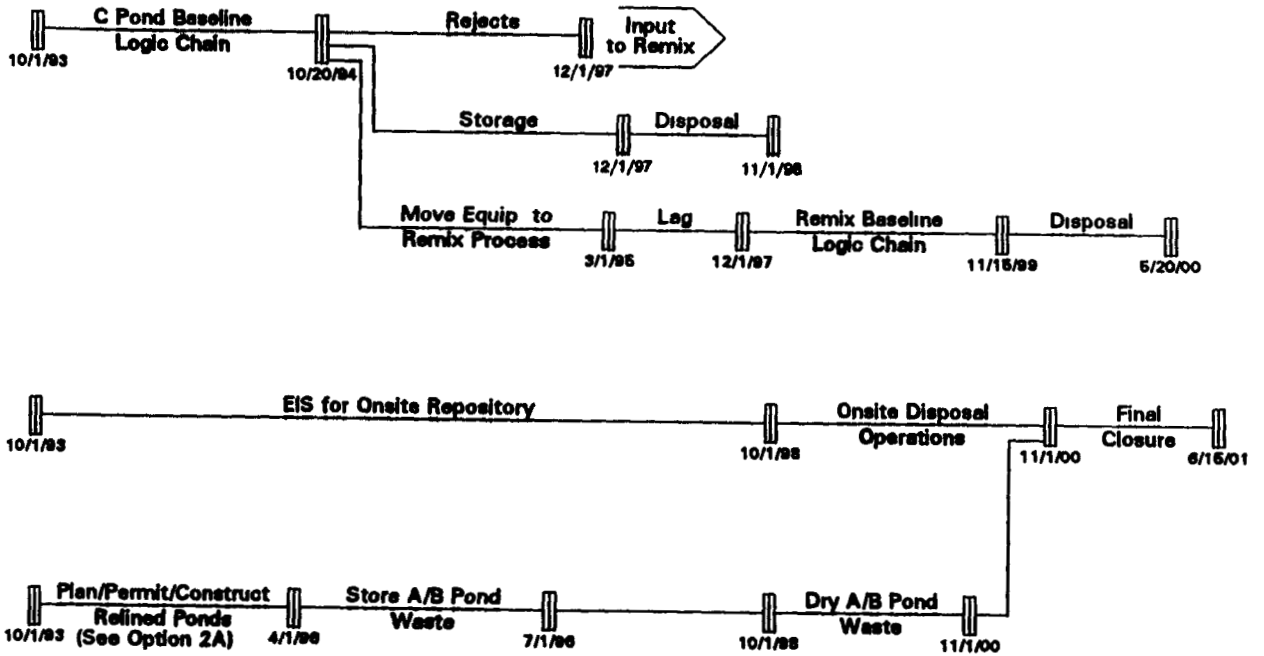
FIGURE A-8


ACTIVITY ID
EARLY START
EARLY FINISH
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
Remix Pondcrete/Saltcrete (Task 1204203-04)
1393 12AUG99 25AUG99 DOE Hot Test Approv and Eval for Saltcrete
1395 26AUG99 17NOV99 Saltcrete Waste Processing
1359 10CT99 18MAY00 Processing Equipment
1397 18NOV99 17MAY00 Demobilization Erection Equipment
1400 18NOV99 17MAY00 Demobilization
Pad Operations
2150 10CT93 30SEP94 Surv & Maint FY94
2155 10CT94 30SEP95 Surv & Maint FY95
2160 10CT95 30SEP96 Surv & Maint FY96
2165 10CT96 30SEP97 Surv & Maint FY97
2170 10CT97 30SEP98 Surv & Maint FY98
2175 10CT98 30SEP99 Surv & Maint FY99
2180 10CT99 30SEP00 Surv & Maint FY00
102A 10CT93 10CT93 Notice-to-Proceed
602A 10CT93 29DEC93 NEPA Documentation
1950 10CT93 29SEP98 Prepare In Situ EIS
502A 20CT93 30MAR94 IRM/IRA Approval
202A 31MAR94 28JUN94 Title II Design
252A 29JUN94 27AUG94 Procurement
702A 29JUN94 26SEP94 Readiness Assessment
2200 3JUL94 30SEP98 tore 207C Pond Pondcrete
402A 28AUG94 24JAN95 Liner Construction-207B North & Central
302A 28AUG94 23FEB95 Title III Design
752A 25JAN95 8FEB95 Readiness Checkout
802A 1APR95 29JUN95 Pump 207B South Sludge to Pond 207B Center
2025 10CT93 28MAY94 Obtain New Tent Permits
2027 29MAY94 24MAR95 Construct New Tent
2075 1AUG97 28NOV97 NTS On-Site Audit
2000 1DEC97 30NOV97 Target NTS Open
2050 10DEC97 6FEB98 Ship 750 Pad (40% of C Pond) Pondcrete to NTS
2052 9FEB98 16MAR98 Transfer Tent 10 & 11 Pondcrete to 750 Pad
2100 9FEB98 7AUG98 Ship Bal of 207C Pond Pondcrete to NTS
2055 17MAR98 15APR98 Tent 11 Modifications
2120 24APR99 5OCT99 Ship Remix Pondcrete to NTS
2130 6OCT99 5FEB00 Ship Remix Saltcrete to NTS
Water Management
3000 10CT93 30SEP00 IIS Water Treatment w/ 910 Evap
OU4 Assessment & Remediation
4000 10CT93 30SEP94 Phase I RFI/RI
4020 10CT94 24APR95 Phase I Final IM/IRA Decision Document
4010 10CT94 24MAY95 Phase I Design Work Plan
4030 25MAY95 24JUN96 Phase I Title II Design
4040 25JUN96 27JAN97 Phase I Procurement
4050 28JAN97 30JUN98 Phase I IM/IRA Construction
4060 1JUL98 31AUG98 Phase I Title III Design
4200 10CT93 19SEP94 Phase II RFI/RI Work Plan
4210 20SEP94 11SEP96 Phase II RFI/RI
4220 12SEP96 9JUN97 Phase II CMS/FS Report
Plot Date 1MAR93
Data Date 10CT93
Project Start 10CT93
Project Finish 30SEP02
(c) Primavera Systems, Inc
U S Department of Energy
Rocky Flats Solar Ponds
Option 5 Master Schedule
Date
Revision
Checked
Approved

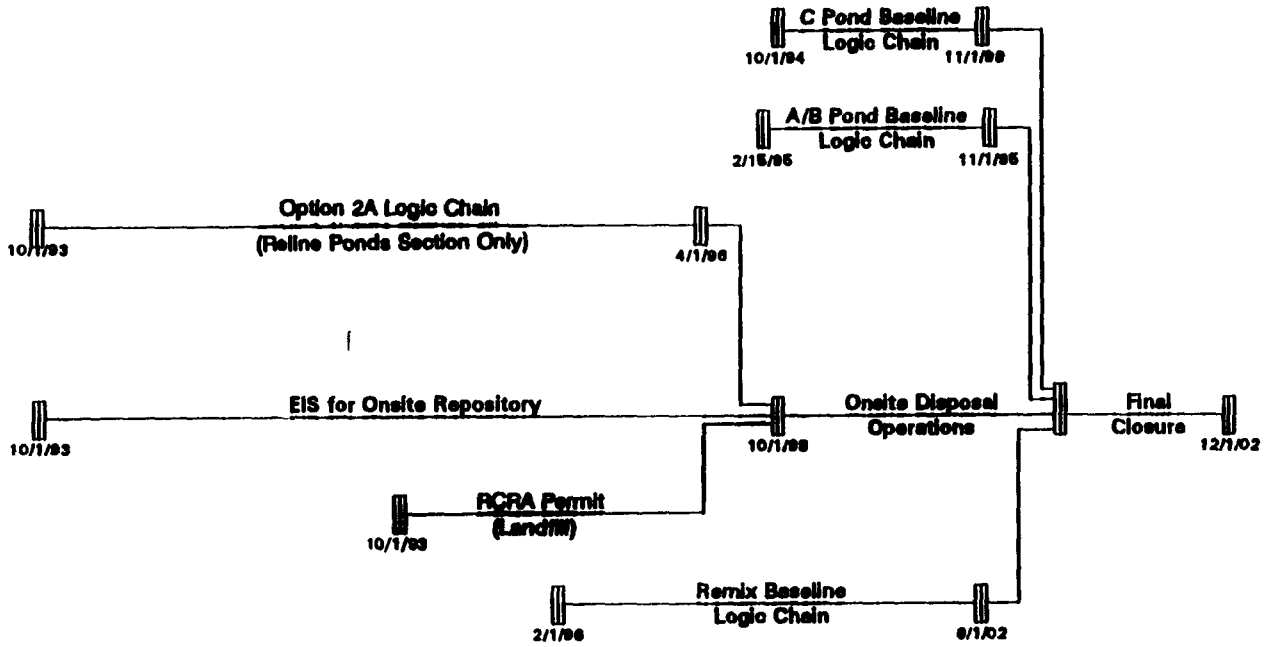
OPTION 4 - IN-SITU STABILIZATION



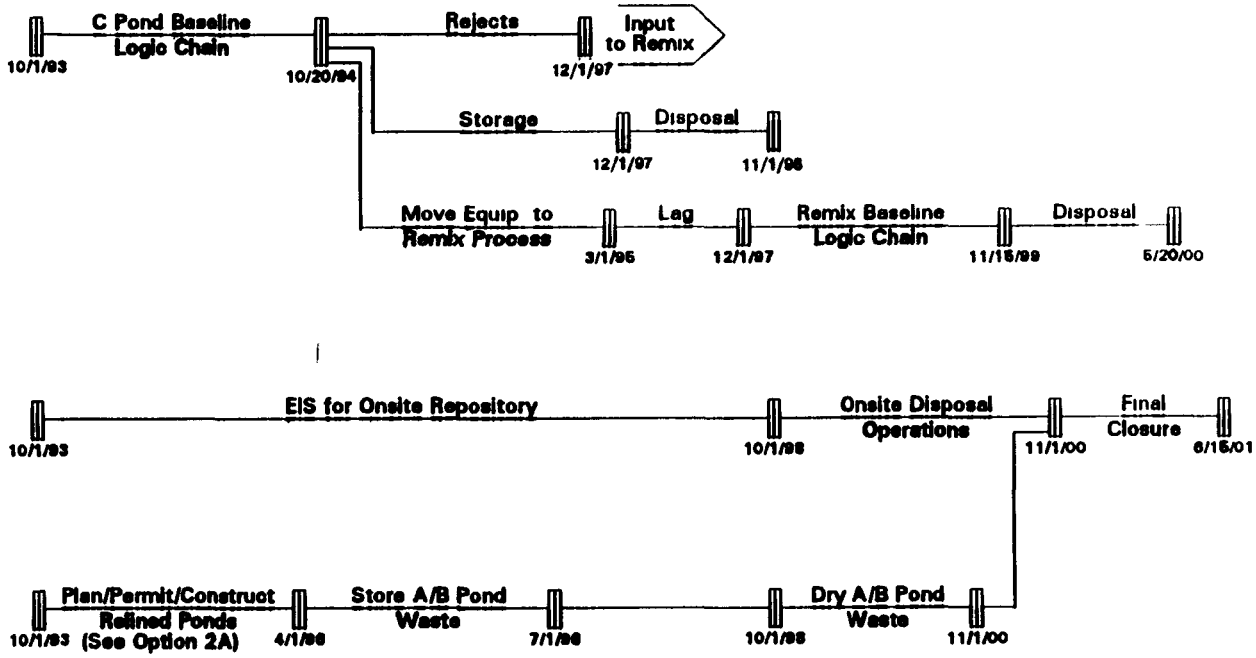
OPTION 5 - OFF-SITE/ONSITE DISPOSAL (NTS)



OPTION 4 - IN-SITU STABILIZATION



OPTION 5 - OFF-SITE/ONSITE DISPOSAL (NTS)



INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Delisting Pondcrete

Activity (NODE).

Planned Schedule. Start Date/End Date 4/1/03 - 2/6/95 Duration (Mo) 25

Is this a reasonable schedule? If not, what is a reasonable schedule Start Yes

End _____ Duration _____

Current Status. _____ Started on 1/1/93 Date. — % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $ 340K (Approved or Estimated)

Bounds + 20K %; - 20K %

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

75 % probability of completion within the planned time duration.

75 % Probability of completion by the scheduled end date

75 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
25 Months 75 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

_____ Months @ _____ % Probability of completing within that time.

Information provided by: _____ Date. 1/27/93
(Name)

_____
(Signature)

Bob James - E&G

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Closure -

Activity (NODE). Unit 1 2FT 1RT 2PT1+

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

95 % probability of completion within the planned time duration

80 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

TBD - 32 all

Max and Mins

What is the estimated least time (duration) required to complete this activity as scheduled Months 30% % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

as scheduled + 6 months Months @ 95% % Probability of completing within that tim

Information provided by Ron Hall (Name) Date 12/4/93

(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title Closure

Activity (NODE). Draft Final EMEA Decision Doc

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

35 % probability of completion within the planned time duration

65 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
is scheduled Months 35 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity
is scheduled +12 months Months @ 95% % Probability of completing within that time

Information provided by P. Day (Name) Date 2/4/93

MAP (Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Closure

Activity (NODE). Phase I Design Work Plan

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

85 % probability of completion within the planned time duration.

70 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity

as scheduled Months 85 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

as scheduled + 6 months Months @ 90 % Probability of completing within that time

Information provided by R. Ogg (Name) Date 2/4/93

(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Closure

Activity (NODE). Phase I Into II

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date. _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates:[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

95 % probability of completion within the planned time duration.

70 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity

AS scheduled Months 85 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

as scheduled + 6 months Months @ 90 % Probability of completing within that tim

Information provided by R. Ogg (Name) Date 2/4/93

(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Closure

Activity (NODE). Phase I IM/IRA Construction

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

65 % probability of completion within the planned time duration.

90 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity

as scheduled Months 65 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

as scheduled +12 months Months @ 95 % Probability of completing within that ti

Information provided by: R Cox (Name) Date. 2/4/93

(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Clouse

Activity (NODE). Phase I Procurement

Planned Schedule. Start Date/End Date _____ Duration (Mo) _____

Is this a reasonable schedule? If not what is a reasonable schedule Start _____

End _____ Duration _____

Current Status: _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

20 % probability of completion within the planned time duration.

5 % Probability of completion by the scheduled end date

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity

as scheduled + 2 months Months 25 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

as scheduled + 12 months Months @ 50% % Probability of completing within that ti

Information provided by: R. Clouse (Name) Date 2/14/92

(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. 1, 2A, 2B, 2C, 3

Activity (NODE). RCRA Storage - Mod to Part B

Planned Schedule. Start Date/End Date see schedule Duration (Mo) 1.5 YRS

Is this a reasonable schedule? If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $ 200K (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

Assume tech requirements are met

100 % probability of completion within the planned time duration.

100 % Probability of completion by the scheduled end date

100 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
1yR Months 50 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

1.5 YRS Months @ 100 % Probability of completing within that t

Information provided by: B. Bruninga (Name) Date 2/5/93

(Signature)

(1) - pad/tent storage
(2A) - relining of ponds for storage
(2B,C) - modular tank storage
(3) - drum storage for dry sludge

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Option 4

Activity (NODE). RCRA Monitoring - Level 11

Planned Schedule Start Date/End Date — Duration (Mo) 5 years

Is this a reasonable schedule? If not what is a reasonable schedule Start ____

End — Duration ____

Current Status. ____ Started on — Date, ____ % Completed

X Not started, Forecast to start on — Date

Budget/Estimates [1] $ — (Approved or Estimated)

Bounds + — %, - — %

[1] The budget/estimate to meet the planned schedule

Probability of Completion

50 % probability of completion within the planned time duration

50 % Probability of completion by the scheduled end date

50 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
3.5 yrs Months 25 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

8 years Months @ 90% % Probability of completing within that time.

Information provided by B. Buenger Date 2/5
(Name)

(Signature)

pa Tilcon

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. Option 3

Activity (NODE). RCRA Permitting of Evaporator - F039

Planned Schedule. Start Date/End Date Initiate within next 6 months Duration (Mo) 9 months

Is this a reasonable schedule? If not what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date. _____ % Completed

X Not started, Forecast to start on 1-6 months Date

Budget/Estimates.[1] $ 100 K (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

80 % probability of completion within the planned time duration.

100 % Probability of completion by the scheduled end date

100 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
7 Months 50 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

15 Months @ 100 % Probability of completing within that ti

Information provided by Bill Bruninga (Name) Date 2/5

(Signature)

per Deleon

INPUT TO DISPOSAL NODE

Option No 1, 2A, B, C, D, 3 Title Disposal - Hanford 1997

Disposal Site Hanford

Probability of Beginning of Disposal by 1997

Regardless of the disposal option, the probability of being able to begin disposal by 1997 is dependent on four variables

1 Probability of delisting of waste stream being approved 25% %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2 3 and 4 are established for two cases: wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 10 %

3 Probability of Rocky Flats application being approved 90 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 50 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be <u>two</u> data sheets per disposal option. One for the waste delisted case and one for the waste not delisted case

Prepared by: MRO / ref w/ P. Aguilar Date. 2/6/93

May not want to co-fund scale; cost constraints
Program highly likely to change to NTS. Change will probably
take place; significance is not known

INPUT TO DISPOSAL NODE

Option No 1 2 A B C, D, 3 Title Disposal Alt. 2 1994

Disposal Site NTS-21)

Probability of Beginning of Disposal by 1994

Regardless of the disposal option, the probability of being able to begin disposal by 1994 is dependent on four variables

1 Probability of delisting of waste stream being approved 0 %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2 3 and 4 are established for two cases: wastes delisted wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 75 %

3 Probability of Rocky Flats application being approved 50 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 80 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be <u>two</u> data sheets per disposal option. One for the waste delisted case and one for the waste not delisted case

Prepared by: LLNL/Mtg w/ CD Aquisitn Date: 2/6/93

* Application Process → Generator Status; currently have a small generator status apply to ship.

INPUT TO DISPOSAL NODE

Option No 1, 2A, B, C, D, 3 Title NTS - Disposal 1997

Disposal Site NTS

Probability of Beginning of Disposal by 1997

Regardless of the disposal option, the probability of being able to begin disposal by 1997 is dependent on four variables.

1 Probability of delisting of waste stream being approved 12% %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1.0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2, 3, and 4 are established for two cases: wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 80 %

3 Probability of Rocky Flats application being approved 90 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 50 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be two data sheets per disposal option: One for the waste delisted case and one for the waste not delisted case.

Prepared by: UAO/mt w/ P. Aguilera Date: 2/6/93

INPUT TO DISPOSAL NODE

Option No 1.2A,B,C,D,3 Title NTS Disposal 1991

Disposal Site NTS

Probability of Beginning of Disposal by 1991

Regardless of the disposal option, the probability of being able to begin disposal by 1991 is dependent on four variables

1 Probability of delisting of waste stream being approved 0 %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2 3, and 4 are established for two cases: wastes delisted wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 0 %

3 Probability of Rocky Flats application being approved 10 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 90 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be two data sheets per disposal option. One for the waste delisted case and one for the waste not delisted case.

Prepared by: WAC/mt w/ R. Aguilar Date: 4/6/93

Delisting not expected to be comp until 1995, therefore no chart for delisting. -

INPUT TO DISPOSAL NODE

Option No [illegible] Title [illegible]

Disposal Site ____________________

Probability of Beginning of Disposal by [illegible]

Regardless of the disposal option, the probability of being able to begin disposal by __________ is dependent on four variables

1 Probability of delisting of waste stream being approved __________ %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2 3, and 4 are established for two cases. wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) __________ %

3 Probability of Rocky Flats application being approved __________ %

4 Probability of Waste Acceptance Criteria (WAC) not changing __________ %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be two data sheets per disposal option One for the waste delisted case and one for the waste not delisted case

Prepared by: [illegible] / D Aguilar Date 2/6/93

Rocky - not a disposal site; highly unlikely this will take place

INPUT TO DISPOSAL NODE

Option No 1, 2A, B, C, 3 Title Envirocare - 1997

Disposal Site Envirocare

Probability of Beginning of Disposal by 1997

Regardless of the disposal option, the probability of being able to begin disposal by 1997 is dependent on four variables.

1 Probability of delisting of waste stream being approved 25 %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2, 3, and 4 are established for two cases: wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 90 %

3 Probability of Rocky Flats application being approved 90 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 50 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be two data sheets per disposal option One for the waste delisted case and one for the waste not delisted case.

Prepared by: WAO /ltr w/ P. Aguilera Date: 2/6/93

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. All but 6

Activity (NODE). Disposal Commercial Site

Planned Schedule. Start Date/End Date 10/94 Duration (Mo) N/A

Is this a reasonable schedule? If not, what is a reasonable schedule Start 8/95 - ?

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of ~~Completion~~ STARTING

22 % probability of ~~completion within~~ STARTING BY the planned time ~~duration~~ (10/94)

70 % Probability of completion by the REASONABLE scheduled ~~end~~ date (8/95)

_____ % Probability of completion within budget/estimate

Max and Mins

What is the estimated ~~least time (duration) required to complete~~ EARLIEST START OF this activity

10/94 ~~Months~~ 30 % Probability of success

What is the "Worst Case Estimate" of ~~time (duration) required to complete~~ START DATE FOR this activity

10/96 ~~Months~~ @ 90 % Probability of ~~completing~~ STARTING within that time.

Information provided by Dun Fetterly Date 2/16/93

(Name)

_____

(Signature)

INPUT TO DISPOSAL NODE

Option No ALL PUT 4 Title DISPOSAL — NOT DELISTED

Disposal Site COMMERCIAL - ENVIRO CARE

Probability of Beginning of Disposal by 8/95

Regardless of the disposal option, the probability of being able to begin disposal by 8/95 is dependent on four variables

1 Probability of delisting of waste stream being approved 10 %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2, 3, and 4 are established for two cases wastes delisted, (wastes not delisted)

2 Probability of site being available (operating permits approved, capacity availability) 90 %

3 Probability of Rocky Flats application being approved 90 %

4 Probability of Waste Acceptance Criteria (WAC) not changing 90 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be <u>two</u> data sheets per disposal option One for the waste delisted case and one for the waste not delisted case

Prepared by _____ Date 2/16/93

INPUT TO DISPOSAL NODE

Option No 1,2A,B,C,D,3 Title Envirocare 1994

Disposal Site Envirc Inc

Probability of Beginning of Disposal by 1994

Regardless of the disposal option, the probability of being able to begin disposal by 1994 is dependent on four variables

1 Probability of delisting of waste stream being approved 50% % (Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2 3, and 4 are established for two cases: wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 20 %.

3 Probability of Rocky Flats application being approved 50 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 90 %. (If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be <u>two</u> data sheets per disposal option One for the waste delisted case and one for the waste not delisted case.

Prepared by: NMO / Mtg w/ D. Aquilina Date: 2/6/93

May need to resolve with EnviroCare Application process - time + documents, SAA plan. Paperwork less than DOE System. Liability issues needs to be addressed. Plutonium contam. waste - handling as an issue. Pu^{239} approval needed by EnviroCare

POD/05397-002-00/02/02/93

Don't have necessary protect. clothes, no equipment to detect alpha, lack of procedures, etc Program currently not adequate.

INPUT TO DISPOSAL NODE

Option No All but Title Disposal - Delisted

Disposal Site Envirocare

Probability of Beginning of Disposal by 8/95

Regardless of the disposal option, the probability of being able to begin disposal by 8/95 is dependent on four variables

1 Probability of delisting of waste stream being approved 10 %
(Approval by the date wastes are ready to be shipped)

If the delisting petition is approved by the proposed date then the probability of the NTS disposal site being available goes to 1 0 The effect of delisting on the availability of other sites is case by case

Probability for variables 2, 3, and 4 are established for two cases wastes delisted, wastes not delisted

2 Probability of site being available (operating permits approved, capacity availability) 90 %

3 Probability of Rocky Flats application being approved 20 %.

4 Probability of Waste Acceptance Criteria (WAC) not changing 50 %.
(If the WAC changes then the probability of an available site is reduced)

Thus, for any chosen disposal date there will be two data sheets per disposal option One for the waste delisted case and one for the waste not delisted case

Prepared by: [signature] Date 2/17/93

BASIS FOR ASSIGNED PROBABILITY
FOR RCRA STORAGE OF PRODUCT

Q What is the probability of having sufficient space/facilities available to store end product

1 For C-Pond by 06/94 ___95___ %

2 For A/B Pond by 06/95 ___80___ % IF

3 For Remix by 06/96 ___80___ %

Factors affecting probability

1 Space - does waste pile approval free-up more space ? Not A lot - mainly so there is its boss for processing → forecast on NOV

2 Availability of disposal - if wastes can't be shipped beginning in late '94 will there be storage space for A/B pond and/or remix? NOT WITHOUT A NEW / MOD / PMT

3 Does change in disposal requirement impact storage needs (less/more volume of end product) ?

4 Will other ongoing plant operations use of space reserved for C-Pond ½ crates?

Q What is the cost of

1 Achieving RCRA compliance storage by 06/94?

- w/o waste pile approval $_____
- w/ wastepile approval $_____

2 Costs for providing full RCRA storage for C-Pond ~~to~~ + A/B Pond processed wastes

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. C-Pond Baseline

Activity (NODE). 50 TEST (Includes Approvals)

Planned Schedule. Start Date/End Date 4/1/94 - 7/10/94 Duration (Mo) _____

Is this a reasonable schedule? Yes If not, what is a reasonable schedule. Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, 0 % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

.50 % probability of completion within the planned time duration

.50 % Probability of completion by the scheduled end date

.85 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
2 Months @ 40 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity
6 Months @ 90 % Probability of completing within that time.

Information provided by: S. KEITH Date 1-27-93
(Name)
S. Keith
(Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. A-B BASELINE

Activity (NODE). SOTEST (INCLUDES APPROVALS)

Planned Schedule. Start Date/End Date 1/1/95 - 7/15/95 Duration (Mo)_____

Is this a reasonable schedule? If not, what is a reasonable schedule Start_____

End_____ Duration _____

Current Status. _____Started on _____ Date, 0 % Completed

_____Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1]The budget/estimate to meet the planned schedule

Probability of Completion.

50 % probability of completion within the planned time duration

50 % Probability of completion by the scheduled end date

85 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
2 Months 40 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

6 Months @ 90 % Probability of completing within that time.

Information provided by: S KEITH (Name) Date 1-27-93

S Keith (Signature)

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. REMIK BASELINE

Activity (NODE). SO TEST (INCLUDES APPROVALS)

Planned Schedule. Start Date/End Date ~~Hga Notes~~ Duration (Mo)_____

Is this a reasonable schedule? If not, what is a reasonable schedule Start_____

End_____ Duration _____

Current Status. _____Started on _____ Date, 0 % Completed

_____Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

50 % probability of completion within the planned time duration.

50 % Probability of completion by the scheduled end date

85 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
3 Months 40 % Probability of success

What is the "Worst Case Estimate" of-time (duration) required to complete this activity
7 Months @ 90 % Probability of completing within that time.

Information provided by: S KEITH Date 1-27-93
(Name)
A Keith
(Signature)

BASIS FOR ASSIGNED PROBABILITY

START SO TEST THROUGH COMPLETE SO

O What is the probability of completing SO testing in ____________ days

Factors

- Operating procedures approved .95
- Operating personnel trained/available .9
- Security issues addressed/resolved .9
- SO test plan approval .95
- Spare parts availability .55
- Maintenance availability .5
- RPT availability .8
- Permits (plant) .9
- Weather impacts (NONE) .8
- Plant emergency impacts .7
- H & S violations/shutdowns/accidents .75
- Labor related work stoppage .70
- Supplies .85
- Waste disposal (operative wastes) .9
- Utility interruptions. .85

- HOT ~~START~~ TEST APPROVAL .5 (DEFENSE BOARD MAY REVIEW)
- ~~TREATMENT~~ OPERATIONS APPROVAL .75

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. C-TRAIN BASELINE

Activity (NODE). TREATMENT

Planned Schedule. Start Date/End Date 1/1/94 – 10/20/94 Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start 1 MONTH EAR START FOR COLD WEATHER

End 1 MONTH EARLIER Duration JK

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated) PROPOSAL 10 YR – A/B/C POND

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

SEE KEIFF 2/10/93 ~~50~~ 60 % probability of completion within the planned time duration

SEE KEIFF 2/10/93 ~~95~~ _____ % Probability of completion by the scheduled end date

SEE KEIFF 2/10/93 (60) % Probability of completion within budget/estimate BASED ON PROPOSAL BUDGET NOT KNOWN BY HNUS

Max and Mins

What is the estimated least time (duration) required to complete this activity

2 Months 10 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

120 (55) DAYS ~~Months~~ (MO) @ 95 % Probability of completing within that time.

Information provided by Ted Bittner (Name) Date. 1-27-93

Ted Bittner (Signature)

BRAD ALLEN HNUS

C POND

BASIS FOR ASSIGNED PROBABILITY

START TREATMENT TO COMPLETE TREATMENT CHAIN

Q What is the probability of the Pond Sludge Processing being completed in four months?

Factors Affecting Probability of Success

70 • Weather delays (rain late or early freezes, etc)

30 • Mechanical failures (availability of spare parts and maintenance staff)

40 • Work stoppers (strikes H/S violations, job disputes)

— • Staff turnover

— • Sufficient labor force

— • Delays in delivery of additives or supplies

10 • Spills (process)

10 • Accidents

2 • Security

1 • Plant emergencies

0 • Loss of funds

30 • QA acceptance of product/PROCESS

70 6 • PRODUCTIVITY

340

67
+ 34
101 DAYS REQ'D

HAVE 90 DAYS

- NEED 67 WORKING DAYS = 14 WKS
- EXPECT 6 WIND DAYS (100%)
- " 1 COLD WEATHER DAY (50%)
- RAIN - NO DELAY

- MECHANICAL 8 DAYS FAIL / 7 DAYS CUST
- STOPPAGES 2 EVENTS / 2 DAYS EACH
- SPILLS 1 DAY ENTIRE SCHEDULE
- PRODUCTIVITY 1 DAY / WK WILL NOT GET 3RD RUN } DOUBLE SHIFT
  (9 DAYS AT 2/3 PRODUCTION) => 6 DAYS }
  1 DAY FOR ENTIRE PROCESS PERIOD WHERE 1 BATCH WON'T BE PROCESS

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. A-B BASELINE

Activity (NODE). TREATMENT

Planned Schedule Start Date/End Date 7/5/95 - 11/1/95 Duration (Mo) _____

Is this a reasonable schedule? If not, what is a reasonable schedule Start 1 MONTH EARLIER STM

End 1 MONTH EARLIER Duration _____

Current Status. _____ Started on _____ Date, 0 % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion:

10 % probability of completion within the planned time duration

40 % Probability of completion by the scheduled end date

60 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
2 Months 5 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity
(58) Months @ 90 % Probability of completing within that time.

Information provided by: TED BITTNER Date 2/1/93
(Name)

_____
(Signature)

PER TELECON T. BITTNER

A-B

BASIS FOR ASSIGNED PROBABILITY

START TREATMENT TO COMPLETE TREATMENT CHAIN

) What is the probability of the Pond Sludge Processing being completed in four months?

Factors Affecting Probability of Success

40 • Weather delays (rain late or early freezes, etc)

8 • Mechanical failures (availability of spare parts and maintenance staff)

4 • Work stoppers (strikes, H/S violations job disputes)

• Staff turnover

• Sufficient labor force

• Delays in delivery of additives or supplies

4 ~~10~~ • Spills (process)

1 • Accidents

2 • Security

1 • Plant emergencies

• Loss of funds

3 • QA acceptance of product

2 • PRODUCTIVITY

~~25~~ 290 LOST DAYS

+87

~~1106~~ 1116 —

$\frac{116}{20} = 5.8$ MO

A-B CALC. NEEDS 87 DAYS

SINCE SHIFT OP MOST OF TIME WIND IS NOT AN ISSUE AS MUCH

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title REMIX BASELINE

Activity (NODE). TREATMENT

Planned Schedule Start Date/End Date ~~7/1/98 10/30/99~~ Duration (Mo)_____

Is this a reasonable schedule? YES If not, what is a reasonable schedule Start_____

End_____ Duration _____

Current Status. _____Started on _____ Date, 0 % Completed

_____Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $_____ (Approved or Estimated)

Bounds +_____%, - _____%

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

85 % probability of completion within the planned time duration

85 % Probability of completion by the scheduled end date

— % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
5 Months ~~50~~ 40 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity
9 Months @ 95 % Probability of completing within that time

Information provided by BRAD ALLEN (Name) Date _____

Brad Allen (Signature)

KE-11K

BASIS FOR ASSIGNED PROBABILITY

START TREATMENT TO COMPLETE TREATMENT CHAIN

Q What is the probability of the Pond Sludge Processing being completed in four months?

Factors Affecting Probability of Success

.95 • Weather delays (rain, late or early freezes, etc)

.85 • Mechanical failures (availability of spare parts and maintenance staff)

.85 • Work stoppers (strikes, H/S violations, job disputes) (4 DAYS)

.95 • Staff turnover

.95 • Sufficient labor force

.75 • Delays in delivery of additives or supplies

.9 • Spills (process)

.9 • Accidents

.95 • Security

.95 • Plant emergencies

.95 • Loss of funds

.9 • QA acceptance of product

.9 • EG&G BACK END SUPPORT. ASSUME EG&G WILL MATCH OUTPUT

BASIS

15,000 HALF CRATES IN 6 MONTHS - CAPACITY

2 SHIFTS/DAY - 10 HR DAYS

10 HALF/HR 12 ACTUAL HRS/DAY 120 HALF CRATES/DAY

POND CRETE (780) - ESTAB W W

SALT CRETE (470 - ESTAB W W.

125

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title: BOND C- BASELINE

Activity (NODE): READINESS ASSESSMENT

Planned Schedule Start Date/End Date 2/1/94 - 6/16/94 Duration (Mo) 2 5

Is this a reasonable schedule? YES If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status: _____ Started on _____ Date, 0 % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates:[1] $ 100K (Approved or Estimated)

Bounds + 50 75 %, - 0 %

[1] The budget/estimate to meet the planned schedule

Probability of Completion:

90 % probability of completion within the planned time duration.

60 % Probability of completion by the scheduled end date

85 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
3 Months 50 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity
7 Months @ 90 % Probability of completing within that time.

Information provided by: DONALD A. RINGLE (Name) Date: 1/28/93

Donald A. Ringle (Signature)

PANEL C

BASIS FOR ASSIGNED PROBABILITY
START READINESS ASSESSMENT THROUGH COMPLETE READINESS ASSESSMENT

Q What is the Probability of completing the readiness assessment in _____ days?

Factors

- Development and approval (DOE) of assessment criteria .95
- Development of readiness assessment methodology and documents .95
- Definition of level of readiness review (i e , DOE ORR team) —
- Selection of readiness assessment team .75
- Equipment ready .95
- Support ready (maintenance, engineering, etc) .80
- Personnel ready (staffed, trained, qualified) .95
- Procedures ready (operating, emergency, ARP's) .95
- Safety analysis documentation approved .50
- OSR's/TSR's in place N/A
- Code compliance verified .5
- Operating permits in place .95
- Quality assurance program in place .80
- Configuration control procedures in place .80

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. A-3 BASELINE

Activity (NODE). READINESS ASSESSMENT

Planned Schedule. Start Date/End Date 1/20/95 - 6/20/95 Duration (Mo) _____

Is this a reasonable schedule? YES If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status: _____ Started on _____ Date, 0 % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $ 100 (Approved or Estimated)

Bounds + 50 %, - 0 %

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

95 % probability of completion within the planned time duration

80 % Probability of completion by the scheduled end date

85 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
3 Months 50 % Probability of success

What is the "Worst Case Estimate" of time (duration) required to complete this activity

7 Months @ 90 % Probability of completing within that time.

Information provided by: DONALD A. RINGLE Date 1/28/93
(Name)

Donald A. Ringle
(Signature)

FONS 4-6

BASIS FOR ASSIGNED PROBABILITY
START READINESS ASSESSMENT THROUGH COMPLETE READINESS ASSESSMENT

0 What is the Probability of completing the readiness assessment in _____ days?

Factors

- Development and approval (DOE) of assessment criteria 95
- Development of readiness assessment methodology and documents 95
- Definition of level of readiness review (i e , DOE ORR team) —
- Selection of readiness assessment team ~~.75~~ 85
- Equipment ready 95
- Support ready (maintenance, engineering, etc) .8
- Personnel ready (staffed trained, qualified) 75
- Procedures ready (operating, emergency, ARP's) .95
- Safety analysis documentation approved .65
- OSR's/TSR's in place —
- Code compliance verified .70
- Operating permits in place .95
- Quality assurance program in place .80
- Configuration control procedures in place .80

INPUT DATA FORM
for
VERT BASED OPTIONS ANALYSIS
SOLAR POND REMEDIATION PROJECT
ROCKY FLATS PLANT

Option Title. REMY BASELINE

Activity (NODE). READINESS ASSESS.

Planned Schedule. Start Date/End Date 1/1/99 – 4/1/99 Duration (Mo) _____

Is this a reasonable schedule? YES If not, what is a reasonable schedule Start _____

End _____ Duration _____

Current Status. _____ Started on _____ Date, _____ % Completed

_____ Not started, Forecast to start on _____ Date

Budget/Estimates.[1] $ 100 (Approved or Estimated)

Bounds + 25 %, - _____ %

[1] The budget/estimate to meet the planned schedule

Probability of Completion.

90 % probability of completion within the planned time duration.

90 % Probability of completion by the scheduled end date

90 % Probability of completion within budget/estimate

Max and Mins

What is the estimated least time (duration) required to complete this activity
3 Months 70 % Probability of success

– What is the "Worst Case Estimate" of time (duration) required to complete this activity
7 Months @ 90 % Probability of completing within that time

Information provided by: DONALD A. RINGLE Date 1/28/93
(Name)
Donald A. Ringle
(Signature)

1R BASELINE

BASIS FOR ASSIGNED PROBABILITY
START READINESS ASSESSMENT THROUGH COMPLETE READINESS ASSESSMENT

- What is the Probability of completing the readiness assessment in _____ days?

Factors

- Development and approval (DOE) of assessment criteria .75
- Development of readiness assessment methodology and documents 95
- Definition of level of readiness review (i e , DOE ORR team) —
- Selection of readiness assessment team 95
- Equipment ready 95
- Support ready (maintenance, engineering, etc) 8
- Personnel ready (staffed, trained, qualified) 95
- Procedures ready (operating, emergency, ARP's) 95
- Safety analysis documentation approved .95
- OSR's/TSR's in place —
- Code compliance verified .8
- Operating permits in place .95
- Quality assurance program in place 95
- Configuration control procedures in place .95

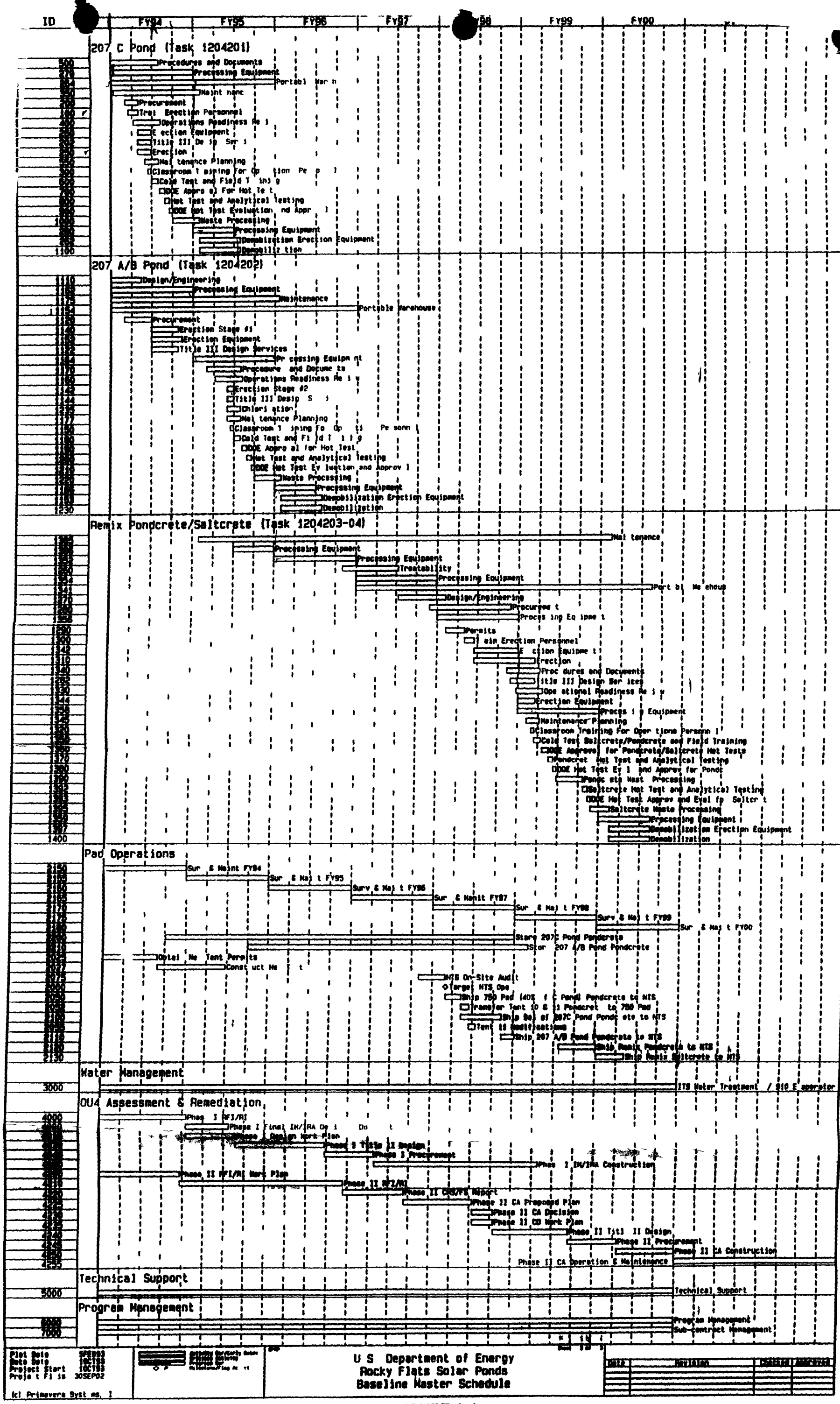
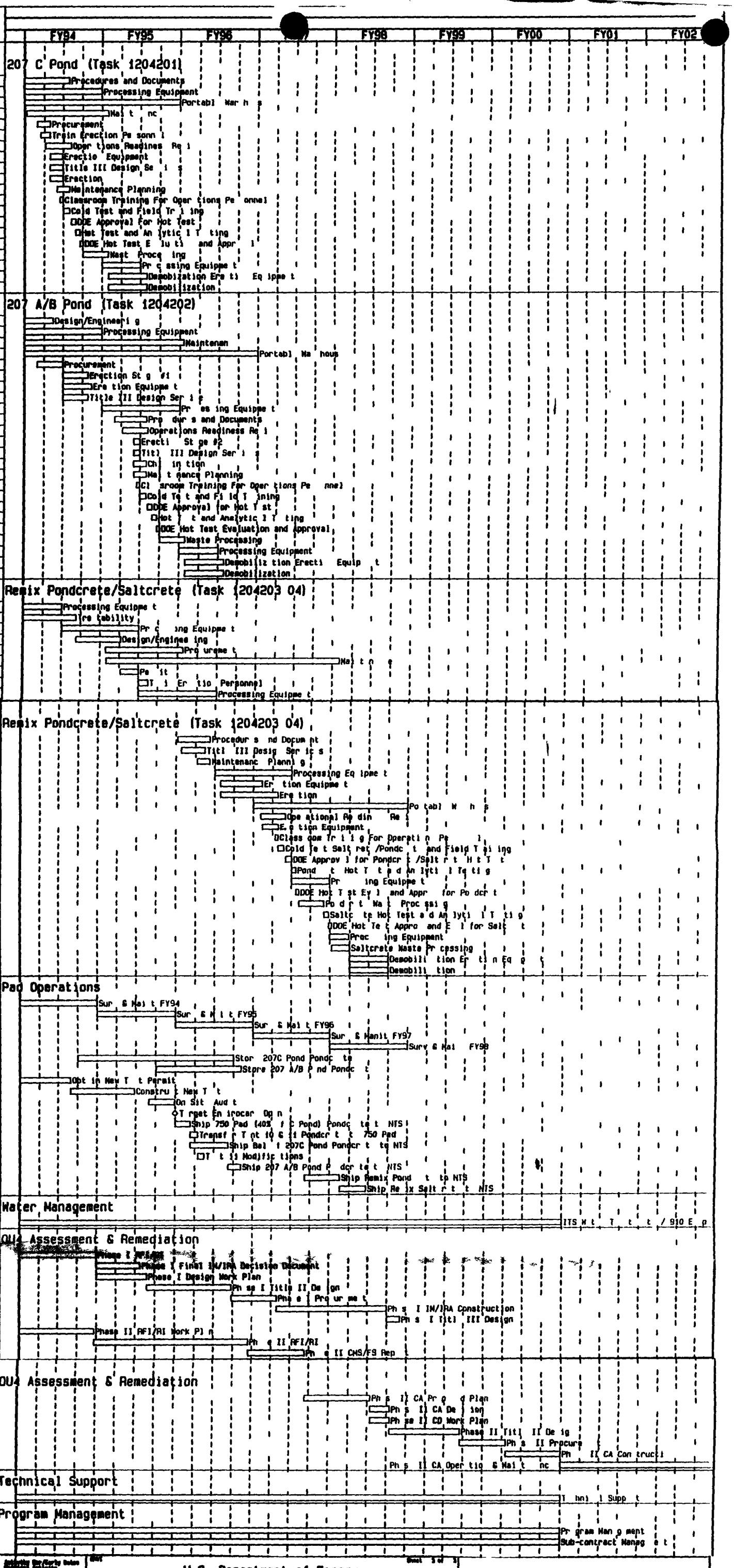

ID
FY94
FY95
FY96
FY97
FY98
FY99
FY00
207 C Pond (Task 1204201)
Procedures and Documents
Processing Equipment
Portabl War h
Maint nanc
Procurement
Trai Erection Personnel
Operations Readiness Re i
E ection Equipment
Title III De ig Ser i
Erection
Mai tenance Planning
Classroom T aining For Op tion Pe p l
Cold Test and Fie d T ini g
DOE Appro a) For Hot Te t
Hot Test and Analytical Testing
DOE Hot Test Evaluation nd Appr l
Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobiliz tion
207 A/B Pond (Task 1204202)
Design/Engineering
Processing Equipment
Maintenance
Portable Warehouse
Procurement
Erection Stage #1
Erection Equipment
Title III Design Services
Pr cessing Equipm nt
Procedure and Docume ts
Operations Readiness Re i w
Erection Stage #2
Title III Desig S s
Chlori ation
Mai tenance Planning
Classroom T ining Fo Op ti Pe sonn l
Cold Test and Fi ld T i i g
DOE Appro al for Hot Test
Hot Test and Analytical Testing
DOE Hot Test Ev luation and Approv l
Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
Mai tenance
Processing Equipment
Processing Equipment
Treatability
Processing Equipment
Port bl We ehous
Design/Engineering
Procurem t
Proces ing Eq ipme t
Permits
T ain Erection Personnel
E ction Equipme t
rection
Proc dures and Documents
itle III Design Ser ices
Ope ational Readiness Re i w
rection Equipment
Proces i g Equipment
Maintenance Planning
Classroom Training For Oper tions Personn l
Cold Test Saltcrete/Pondcrete and Field Training
DOE Approval for Pondcrete/Saltcrete Hot Tests
Pondcret Hot Test and Analytical Testing
DOE Hot Test Ev l and Approv for Pondc
Pondc ete Wast Processing
Saltcrete Hot Test and Analytical Testing
DOE Hot Test Approv and Eval fo Saltcr t
Saltcrete Waste Processing
Processing Equipment
Demobilization Erection Equipment
Demobilization
Pad Operations
Sur & Maint FY94
Sur & Ma t FY95
Surv & Ma t FY96
Sur & Maint FY97
Sur & Ma t FY98
Surv & Ma t FY99
Sur & Ma t FY00
Store 207C Pond Pondcrete
Stor 207 A/B Pond Pondcrete
Optal We Tent Permits
Const uct We t
NTS On-Site Audit
Target NTS Ope
Ship 750 Pad (40% f C Pond) Pondcrete to NTS
Transfer Tent to & i Pondcret to 750 Pad
Ship Bal of 207C Pond Pondc ete to NTS
Tent M odifications
Ship 207 A/B Pond Pondcrete to NTS
Ship Remix Pondcrete to NTS
Ship Remix Saltcrete to NTS
Water Management
ITS Water Treatment / 910 E operator
OU4 Assessment & Remediation
Phas I RFI/RI
Phase I Final IM/IRA Op t Do t
Phase I Design Work Plan
Phase I Title II Design
Phase I Procurement
Phase I IM/IRA Construction
Phase II RFI/RI Work Plan
Phase II RFI/RI
Phase II CMS/FS Report
Phase II CA Proposed Plan
Phase II CA Decision
Phase II CD Work Plan
Phase II Titl II Design
Phase II Procurement
Phase II CA Construction
Phase II CA Operation & Maintenance
Technical Support
Technical Support
Program Management
Program Management
Sub-contract Management
Plot Date 5FEB93
Data Date 1OCT93
Project Start 1OCT93
Proje t Fi ish 30SEP02
(c) Primavera Syst ms, I
U S Department of Energy
Rocky Flats Solar Ponds
Baseline Master Schedule
Date
Revision
Checked
Approved

FIGURE A 1

ACTIV ID	EARLY START	EARLY FINISH
500	10OCT93	23APR94
270	10OCT93	30SEP94
284	10OCT93	30SEP94
290	10OCT93	30OCT94
200	28NOV93	27JAN94
100	10DEC93	27JAN94
400	7JAN94	6MAY94
280	24JAN94	23MAR94
302	25JAN94	23MAR94
300	25JAN94	23MAR94
310	1FEB94	30MAR94
320	15FEB94	13APR94
330	1APR94	29APR94
340	7MAY94	25MAY94
350	26MAY94	15JUN94
360	16JUN94	5JUL94
1000	5JUL94	29OCT94
380	10OCT94	31MAR95
390	30OCT94	28APR95
1100	30OCT94	29APR95
1110	10OCT93	12FEB94
1180	10OCT93	30SEP94
1170	10OCT93	10OCT94
1184	10OCT93	30SEP94
1120	30NOV93	28MAR94
1140	28MAR94	5JUL94
1150	28MAR94	12AUG94
1130	30NOV93	27JUL94
1164	10OCT94	30SEP95
1170	10DEC94	30APR95
1160	7JAN95	6MAY95
1142	1MAR95	29MAR95
1144	1MAR95	29MAR95
1146	1MAR95	29APR95
1177	29MAR95	30APR95
1190	10MAR95	29MAR95
1180	1APR95	29APR95
1190	7MAY95	6MAY95
1200	29MAY95	16JUN95
1210	19JUN95	5JUL95
1220	5JUL95	29OCT95
1186	10OCT95	1APR96
1199	30OCT95	29APR96
1230	30OCT95	29APR96
1300	10OCT93	1APR94
1290	10OCT93	8JUN94
1305	2APR94	2APR95
1270	10JUN94	8JAN96
1280	29OCT94	29OCT96
1306	30OCT94	6NOV97
1310	7JAN95	2APR96
1320	1APR95	16MAY96
1354	2APR96	1APR98
1340	10OCT95	6MAR96
1362	27OCT95	13FEB96
1348	9JAN96	6MAR96
1358	2APR96	1APR97
1344	28NOV95	12NOV96
1318	6MAR96	6JAN97
1341	10OCT95	30SEP96
1350	2NOV95	5MAR97
1344	13NOV95	28JAN97
1320	15JAN97	28JAN97
1360	27JAN97	24FEB97
1360	4MAR97	1APR97
1370	2APR97	22APR97
1368	2APR97	29SEP97
1380	23APR97	6MAY97
1390	7MAY97	29SEP97
1382	6SEP97	29SEP97
1393	24SEP97	7OCT97
1398	29SEP97	27DEC97
1399	8OCT97	30DEC97
1387	31DEC97	30JUN98
1400	31DEC97	30JUN98
2150	10OCT93	30SEP94
2160	10OCT94	30SEP95
2180	10OCT95	30SEP96
2185	10OCT96	30SEP97
2175	10OCT97	30SEP98
2200	3JUL94	1JUL95
2210	3JUL95	1JUL96
2025	10OCT93	28MAY94
2027	28MAY94	24MAR95
2075	1JUN95	29SEP95
2000	10OCT93	30SEP95
2040	10OCT95	30DEC95
2062	10DEC95	14JAN96
2100	10DEC95	6JUN96
2055	15JAN96	13FEB96
2110	7JUN96	2AUG96
2120	6JUN97	17NOV97
2130	18NOV97	20MAR98
3000	10OCT93	30SEP00
4000	10OCT93	30SEP94
4000	10OCT94	31DEC95
4010	10OCT94	28MAY96
4030	28MAY96	24JUN96
4040	25JUN96	27JAN97
4050	28JAN97	30JUN98
4060	1JUL98	31AUG98
4200	10OCT93	19SEP94
4210	20SEP94	11SEP96
4220	12SEP96	9JUN97
4225	10JUN97	14APR98
4230	15APR98	14JUL98
4235	15APR98	14JUL98
4240	15JUL98	12JUN00
4245	15JUN00	17JAN00
4250	18JAN00	30SEP00
4255	10OCT00	30SEP02
5000	10OCT93	30SEP00
6000	10OCT93	30SEP00
7000	10OCT93	30SEP00



Plot Date 10OCT93
Data Date 10OCT93
Project Start 10OCT93
Project Finish 30SEP02

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Start

Sheet 1 of 1

U S Department of Energy
Rocky Flats Solar Ponds
OPTION 1 Schedule

Date	Revision	Checked	Approved

FIGURE A 2

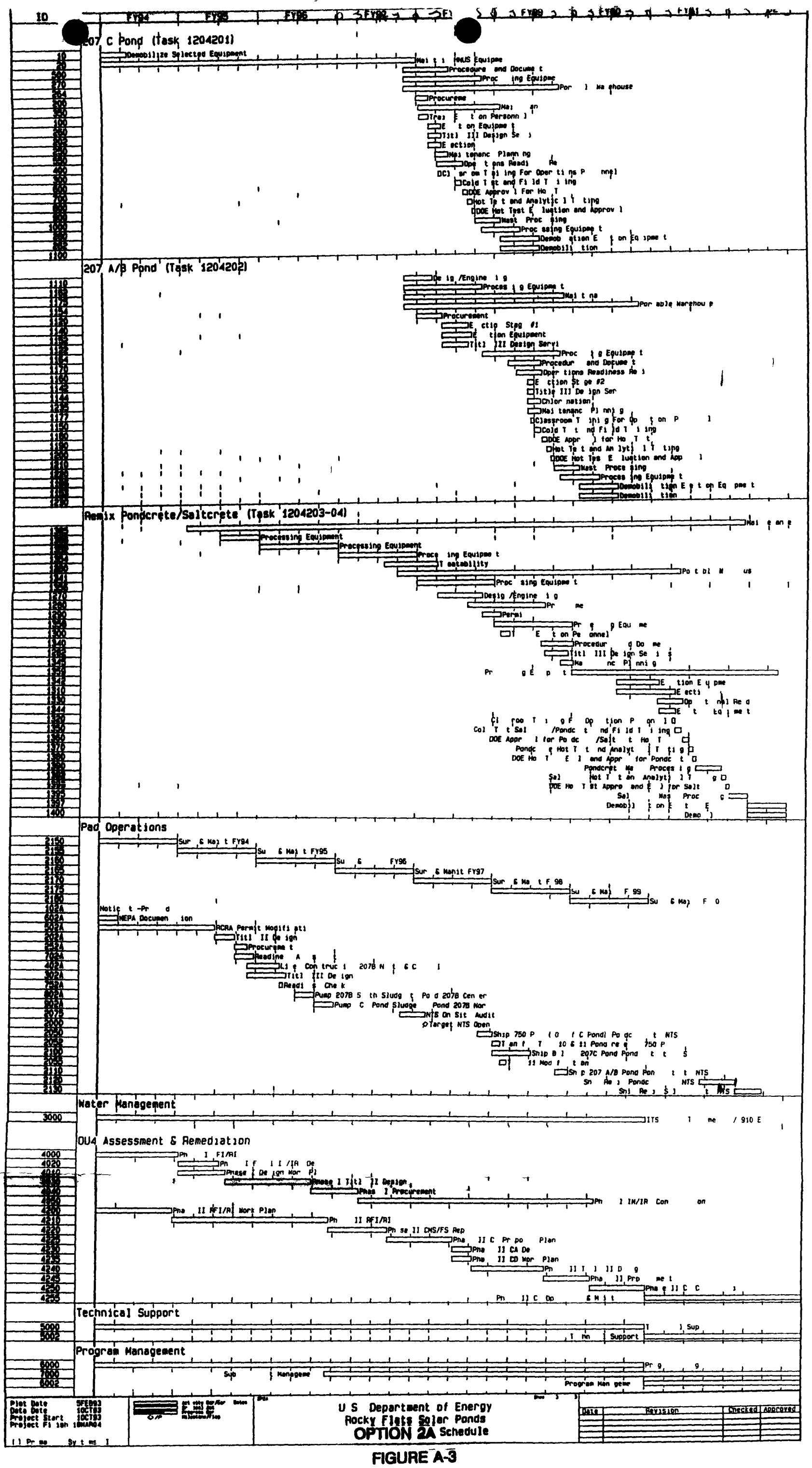

ID
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
207 C Pond (Task 1204201)
Demobilize Selected Equipment
Procurement
Mobilization
Decontamination Personnel
Excavation Equipment
Title III Design Services
Excavation
Maintenance Planning
Operations Readiness Review
DOE Approval For Hot Testing
Hot Test Evaluation and Approval
Mast Processing
Processing Equipment
Demobilization Equipment
Demobilization
207 A/B Pond (Task 1204202)
Design/Engineering
Processing Equipment
Maintenance
Portable Warehouse
Procurement
Excavation Staging #1
Excavation Equipment
Title III Design Services
Procedures and Documents
Operations Readiness Review
Excavation Staging #2
Title III Design Services
Chlorination
Maintenance Planning
Classroom Training For Operations
Cold Testing and Startup
DOE Approval for Hot Testing
Hot Test and Analytical Testing
DOE Hot Test Evaluation and Approval
Mast Processing
Processing Equipment
Demobilization Equipment
Demobilization
Remix Pondcrete/Saltcrete (Task 1204203-04)
Maintenance
Processing Equipment
Processing Equipment
Processing Equipment
Testability
Process Equipment
Design/Engineering
Permits
Procedures
Maintenance Planning
Operations Readiness Review
Excavation Equipment
Classroom Training For Operations
Cold Testing and Startup
DOE Approval for Pondcrete/Saltcrete
Pondcrete Hot Testing and Analytical Testing
DOE Hot Test Evaluation and Approval for Pondcrete
Pondcrete Maintenance
Processing
Saltcrete Hot Testing and Analytical Testing
DOE Hot Test Approval and Evaluation for Saltcrete
Saltcrete Maintenance
Demobilization
Pad Operations
Surveillance & Maintenance FY94
Surveillance & Maintenance FY95
Surveillance & Maintenance FY96
Surveillance & Maintenance FY97
Surveillance & Maintenance FY98
Surveillance & Maintenance FY99
Surveillance & Maintenance FY00
Notification-Preparation
NEPA Documentation
RCRA Permit Modification
Title II Design
Procurement
Readiness
Liquid Construction
2078 Mobilization
Title III Design
Readiness Check
Pump 2078 South Sludge to Pond 2078 Center
Pump C Pond Sludge to Pond 2078 Northeast
NTS On Site Audit
Target NTS Open
Shipping 750 Pondcrete to NTS
Transfer To 10 & 11 Pondcrete
Shipping Pondcrete
11 Modification
Shipping 207 A/B Pond Pondcrete to NTS
Shipping Pondcrete
Water Management
Maintenance / 910 Effluent
OU4 Assessment & Remediation
Phase I RFI/RI
Phase I RFI/RI Design
Phase I Procurement
Phase I IM/IR Construction
Phase II RFI/RI Work Plan
Phase II RFI/RI
Phase II CMS/FS Report
Phase II Corrective Action Plan
Phase II CA Design
Phase II CD Work Plan
Phase II Implementation
Phase II Project Management
Phase II Closure
Phase II Closure Monitoring
Technical Support
Technical Support
Program Management
Program Management
Subcontract Management
Program Management
Plot Date 5FEB03
Data Date 10CT03
Project Start 10CT03
Project Finish 10MAR04
Summary
Activity Bar/Bar Dates
Progress Bar
Milestone/Flag
U S Department of Energy
Rocky Flats Solar Ponds
OPTION 2A Schedule
Date
Revision
Checked
Approved

FIGURE A-3

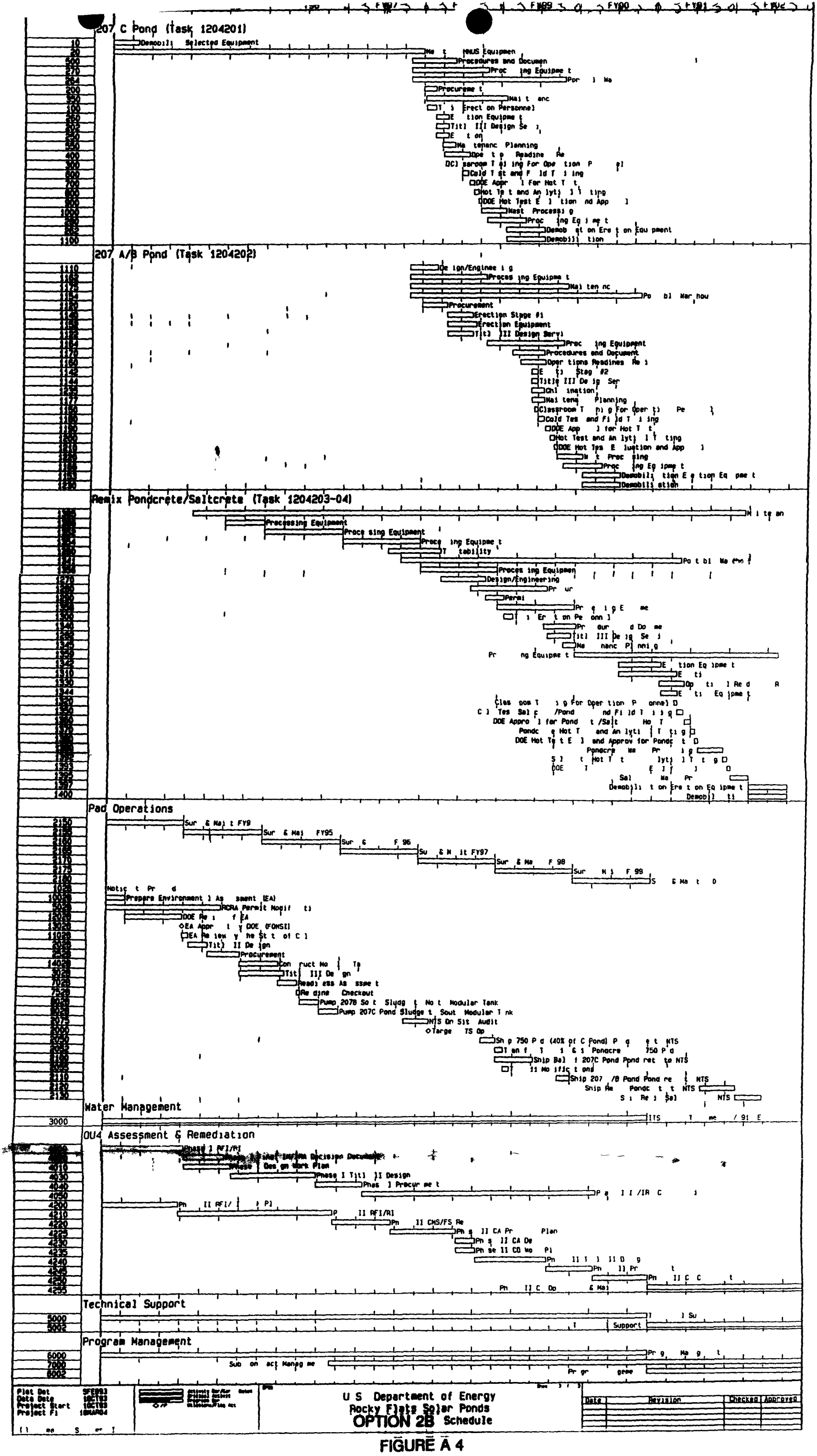

207 C Pond (Task 1204201)
207 A/B Pond (Task 1204202)
Remix Pondcrete/Saltcrete (Task 1204203-04)
Pad Operations
Water Management
OU4 Assessment & Remediation
Technical Support
Program Management
Plot Dat SFEB93
Data Date 10CT93
Project Start 10CT93
Project Fi 10MAR94
U S Department of Energy
Rocky Flats Solar Ponds
OPTION 2B Schedule
Date
Revision
Checked
Approved

FIGURE A 4

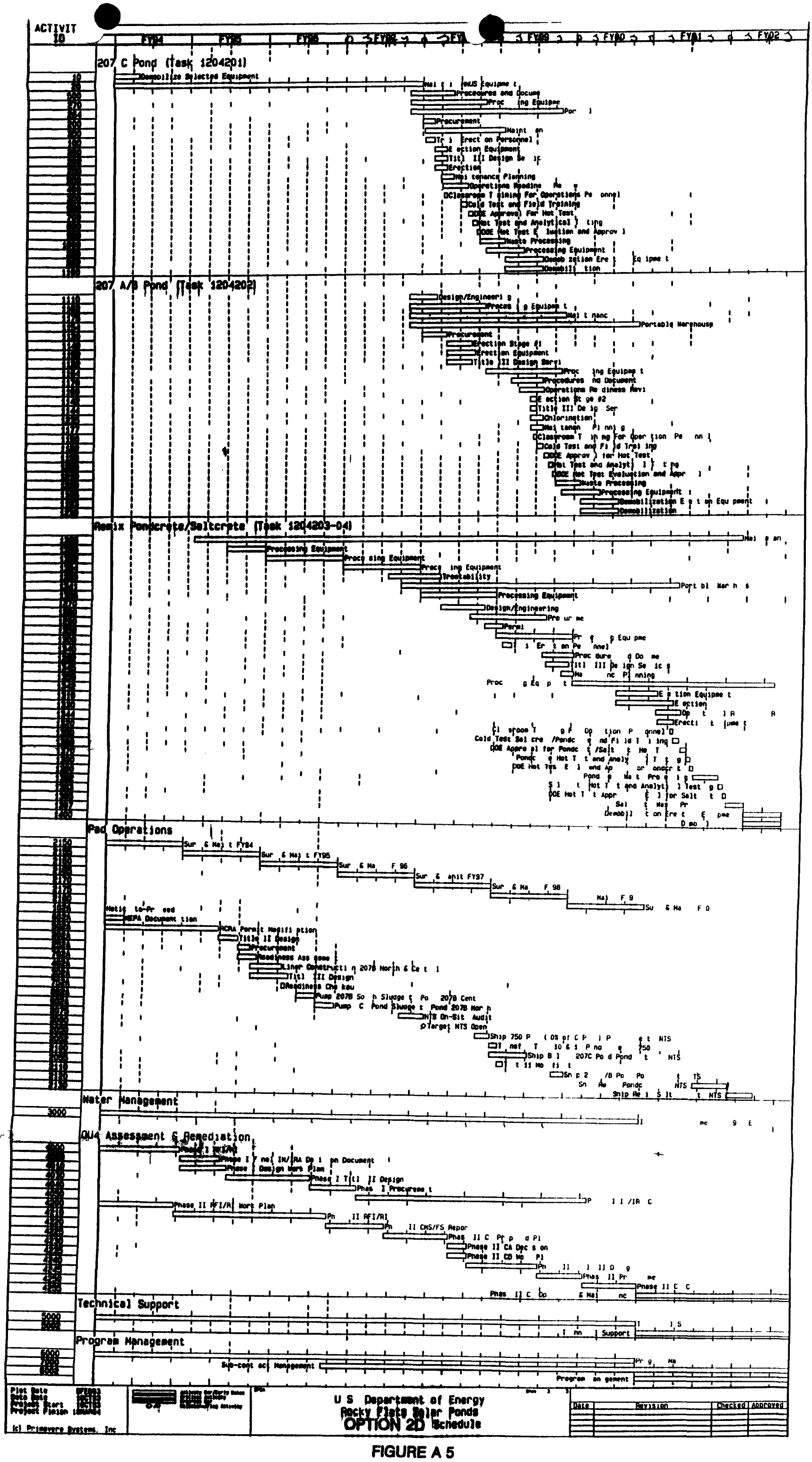
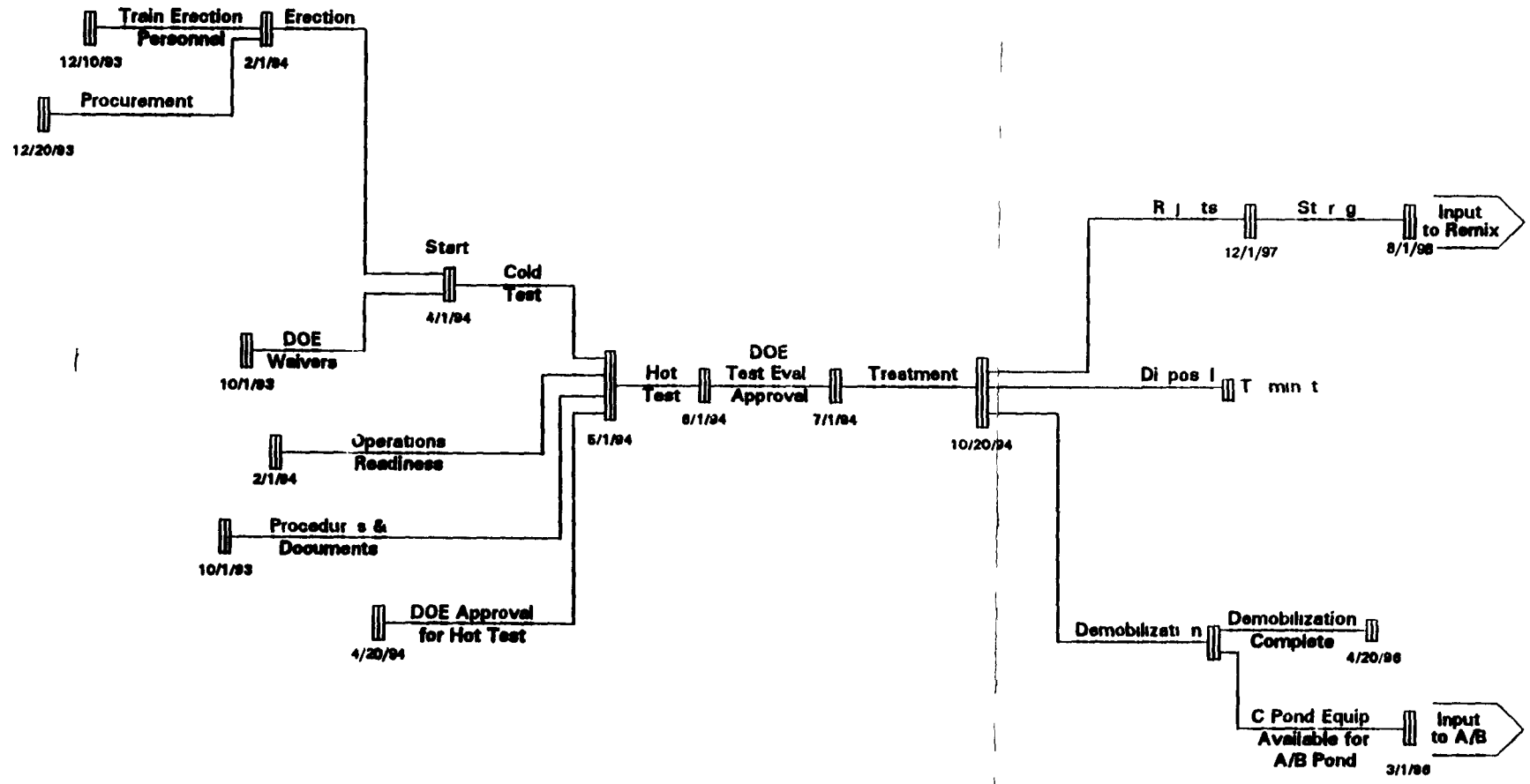
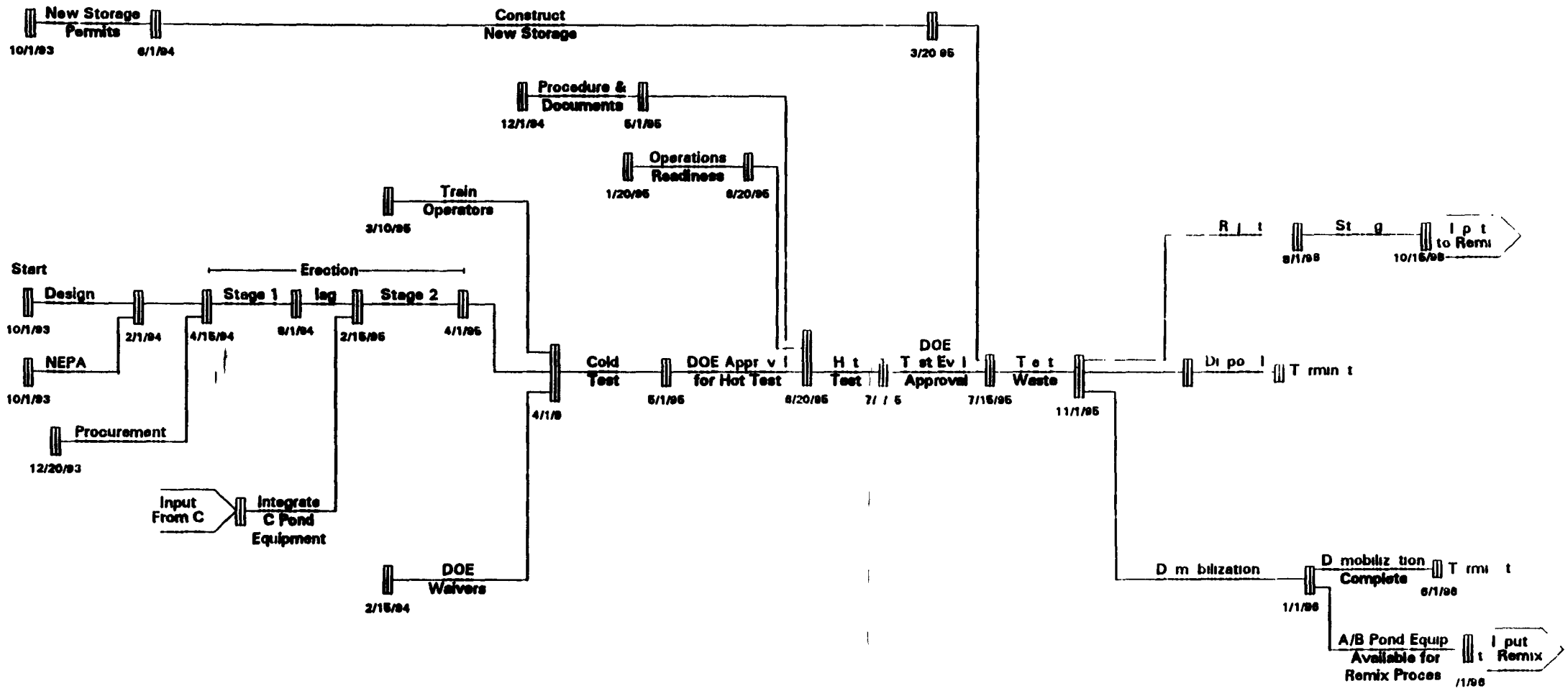

ACTIVITY ID
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
207 C Pond (Task 1204201)
Demobilize Selected Equipment
207 A/B Pond (Task 1204202)
Remix Pondcrete/Saltcrete (Task 1204203-04)
Pad Operations
Water Management
OU4 Assessment & Remediation
Technical Support
Program Management
U S Department of Energy
Rocky Flats Solar Ponds
OPTION 2D Schedule
(c) Primavera Systems, Inc

FIGURE A 5

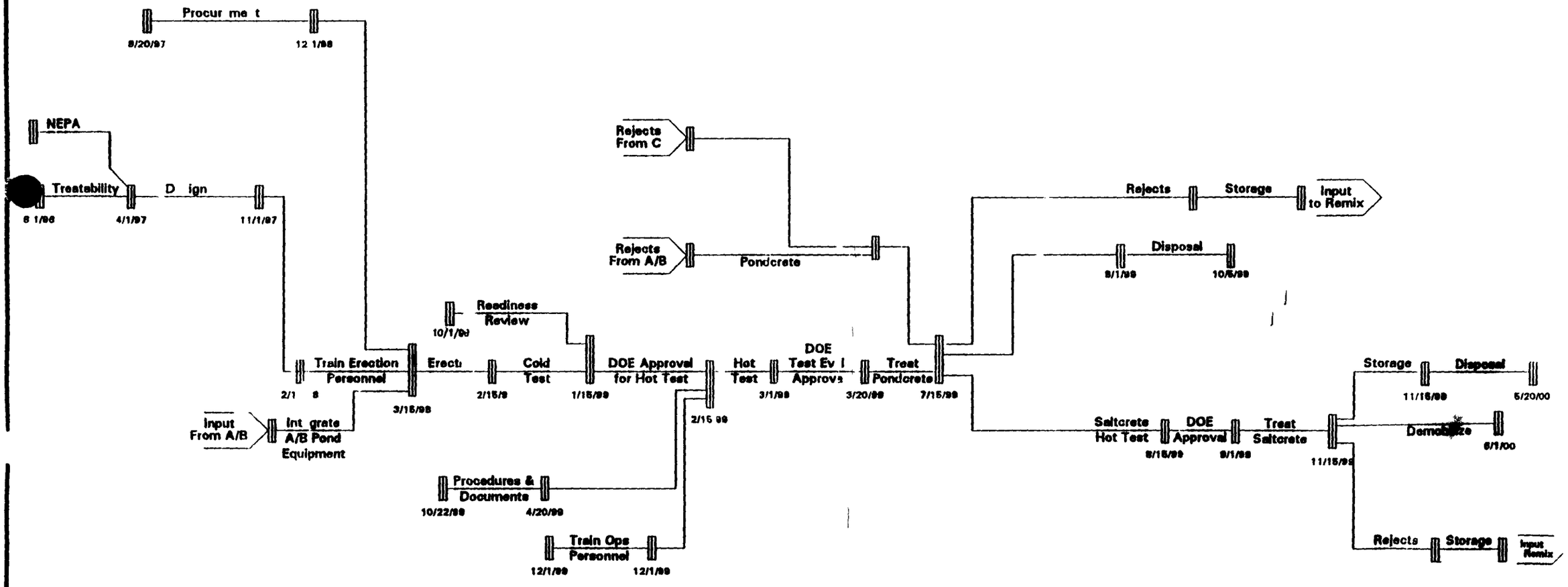
C POND PROCESS BASELINE



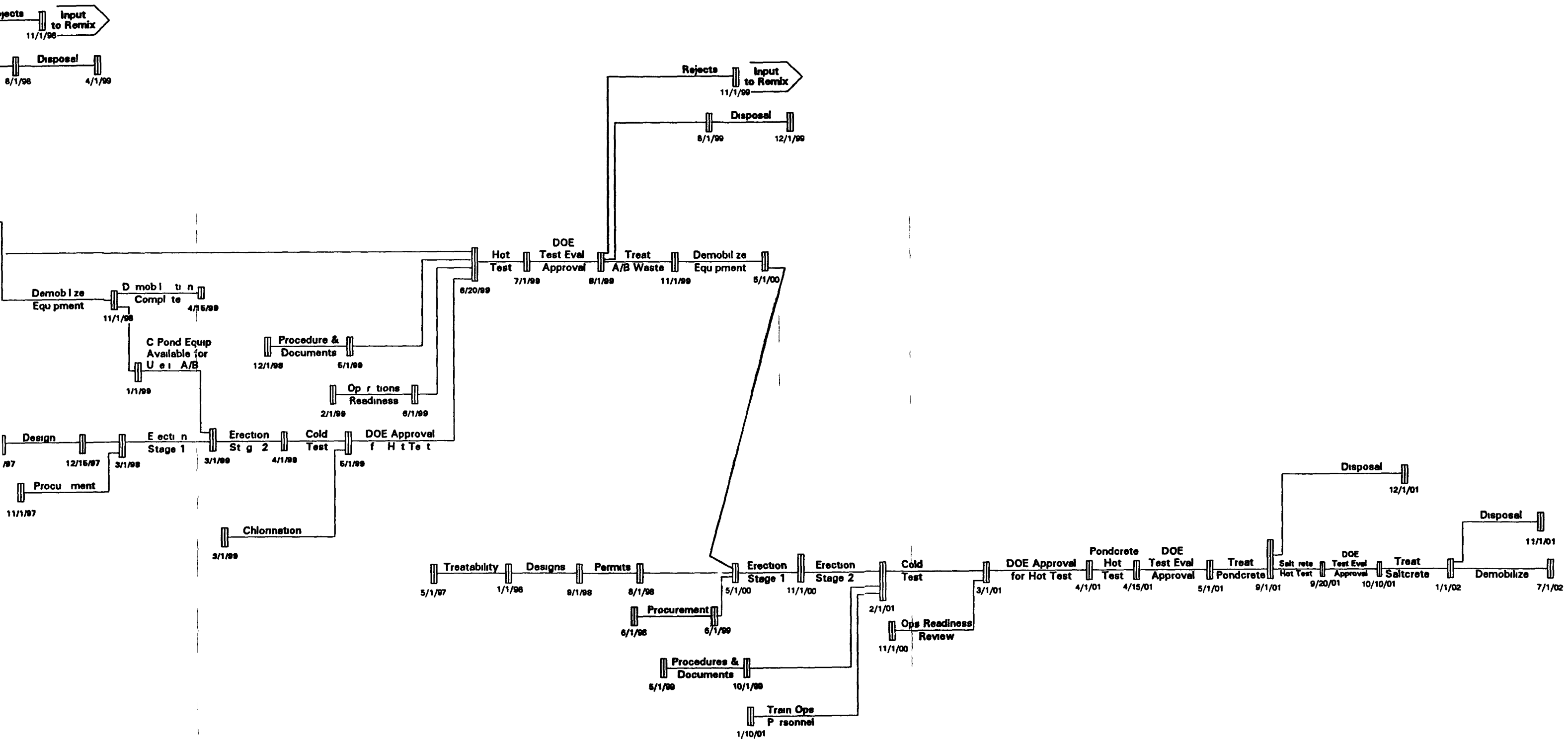
A/B POND PROCESS BASELINE



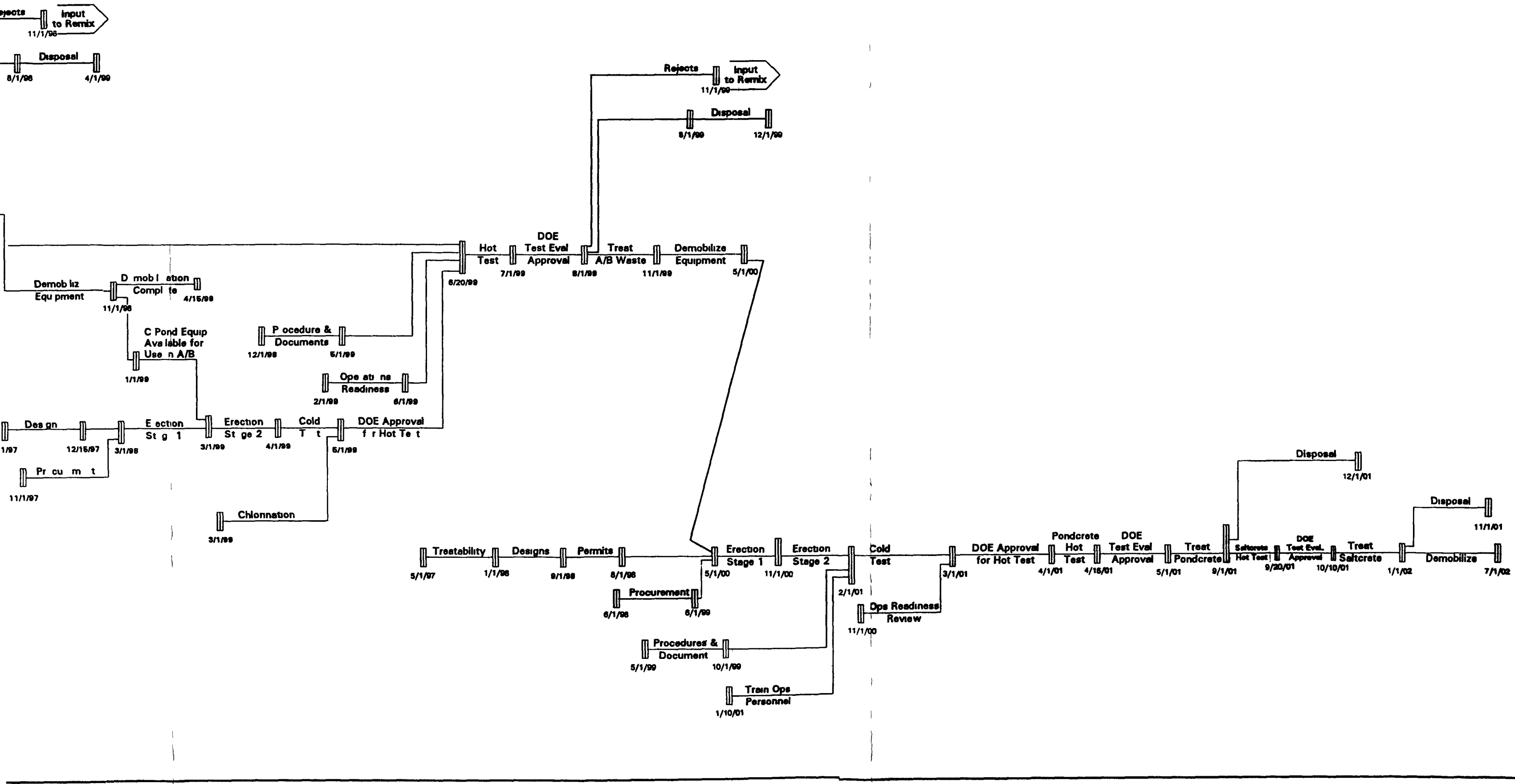
REMIX PROCESS BASELINE



OPTION 2A - RELINE PONDS TO RCRA STANDARDS



OPTION 2D - RELINE PONDS TO SUB-RCRA STANDARDS



OPTION 2B - NEW ABOVE GROUND MODULAR TANKS