START

0039149

OCT 26 1994

ENGINEERING DATA TRANSMITTAL

1. EDT 160155

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Process Systems	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: SNF/K Basins	6. Cog. Engr.: Dennis L. Sherrell	7. Purchase Order No.: N/A
8. Originator Remarks: Approval/Release		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 105-KE
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date:

NOV 1994 RECEIVED EDMC

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-SNF-PD-007	ALL	0	Schedule For Final Disposition Of Contaminated K-East Basin Water	E,D	1	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. Dennis L. Sherrell	DL Sherrell	10/26		J. Greenborg		10/26/94		1	1
1	1	Cog. Mgr. James R. Frederickson	J.R. Frederickson	10/26/94		DOE O.M.Holgado		10-26-94	R3-81	1	
		QA N/A									
		Safety N/A									
1	1	Env. ~~N/A~~ G.C.Mooers	G.C.Mooers	10/26/94							
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1	1	E.W. Gerber		10/26/94							

18.	19.	20.	21. DOE APPROVAL (if required)
Richard J. Williams Signature of EDT Originator. Date 10/26/94	James R. Frederickson Authorized Representative for Receiving Organization Date 10/26/94	James R. Frederickson Cognizant Manager Date 10/26/94	Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

BD-7400-172-2 (04/94) GEF097

BD-7400-172-1 (07/91)

SUPPORTING DOCUMENT

1. Total Pages 13

2. Title	3. Number	4. Rev No.
SCHEDULE FOR FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER	WHC-SD-SNF-PD-007	0

5. Key Words

K-BASINS, CONTAMINATED WATER, SLUDGE, K-EAST

APPROVED FOR PUBLIC RELEASE

KMB 10/26/94

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Organization/Charge Code 2C110/L2601

7. Abstract

THIS DOCUMENT IS TO PROVIDE WHC'S RECOMMENDED SCHEDULE DESCRIBING THE ACTIVITIES FOR THE FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER. THE SCHEDULE WILL SUPPORT THE 100-KR-4 RECORD OF DECISION ACTIVITIES, AND WILL MEET THE TRI-PARTY AGREEMENT (TPA) MILESTONE M-34-00-T04.

8. RELEASE STAMP

OFFICIAL RELEASE BY WHC (13)
DATE OCT 26 1994
STA 4

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SCHEDULE FOR FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER

WHC-SD-SNF-PD-007
REV. 0

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October 25, 1994

SCHEDULE FOR FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER

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SCHEDULE FOR FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER

1.0 INTRODUCTION

The purpose of this document is to provide WHC's recommended schedule describing the activities for the final disposition of contaminated K-East Basin water. This schedule is for planning purposes in the overall goal to move the fuel, sludge and water from the K Basins and relocate it away from the Columbia River until it can be ultimately disposed. The schedule will support the 100-KR-4 Record of Decision activities, and will meet the Tri-Party Agreement (TPA) Milestone M-34-00-T04, which states

> "Submit a Schedule Describing Activities for the Final Disposition of Contaminated K-East Basin Water for Planning Purposes to Support the 100-KR-4 Record of Decision."

The Milestones are found in *Hanford Federal Facility Agreement and Consent Order* (89-10).

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1.1 SCOPE

The activities covered by the K-East Basin Water Treatment and Disposition project include:

- Reduction of basin water tritium concentration per TPA Milestone M-34-01
- Basin equipment and operations upgrades to meet requirements for tritium and non-tritium contamination removal
- Continued basin treatment to remove radionuclides from the water after the fuel and sludge have been removed, and ultimate disposition of the water.

The K-East Basin water treatment and removal program activities discussed in this document will be defined to a level corresponding with activities currently being considered for the Hanford Spent Nuclear Fuel Project recommended path forward. The schedule in the recommended path forward, which has all fuel out of the Basin by November 2000, does not allow for the M-34-01 option to defer tritium removal. This option depends on removal of all fuel and sludge from the KE Basin by early 1999. Therefore, several options for the tritium reduction and disposition will be presented. Option selection will require a final decision based on cost, schedule and effectiveness in meeting the requirements of the Spent Nuclear Fuel Project (SNFP). These options are described in more detail in WHC-SD-SNF-ES-005, *Options For Disposition of KE-Basin Water.*

1.2 BACKGROUND

The 105-KE Basin (sometimes referred to as "K East Basin" or "KE Basin") was constructed during the early 1950's, as an integral component of the

105-KE reactor building. Although the 105-KE reactor was shut down in 1971, the KE Basin was reactivated several years later to store spent fuel from N-Reactor.

The KE Basin contains over 1100 metric tons of spent nuclear fuel (SNF). The bulk of this inventory consists of over 50,000 zirconium alloy clad, uranium metal N-Reactor fuel element assemblies (along with less than half a metric ton of single-pass reactor fuel elements) stored in over 3600 open top canister assemblies ("canisters").

A recent Department of Energy (DOE) assessment of the environmental, safety, and health (ES&H) vulnerabilities associated with storage of SNF throughout the DOE complex (DOE, 1994) identified a number of concerns at the KE Basin. These included:

- Sludge accumulation containing fissile and fission product material from damaged and degraded fuel.
- Two previous incidents during which water containing tritium and other contaminants is thought to have leaked from the basin and released radioactive materials to the environment.
- A potential seismic vulnerability of a construction joint between the basin floor and the N Reactor building foundation.
- The assumption that a majority of the canisters contain at least one fuel assembly with breached cladding, resulting in the release of significant amounts of fission products to the pool.

The 100-KR-4 Interim Record of Decision (IROD) Decisional *Draft, Proposed Plan for Interim Remedial Measure at the 100-KR-4 Operable Unit*, DOE/RL-94-113) describes a joint DOE, U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology plan for interim action to address groundwater contamination at the 100-KR-4 Operable Unit.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) applies to the 100-KR-4 Operable Unit. An operable unit refers to a subset of a CERCLA site which is typically the subject of a site specific investigation and remedial action. This unit was placed on CERCLA's Superfund National Priorities List (NPL) on November 3, 1989 due to soil and groundwater contamination from past operation of nuclear facilities. The 100-KR-4 Operable Unit addresses contamination in the underlying ground water for the entire 100-K Area. At some point in the future (following completion of requisite studies) the 100-KR-4 Operable Unit will be combined with other 100 Area operable units under the 100 Area Aggregate Record of Decision (ROD).

The site history section of the Draft Decision states that both tritium and carbon-14 were disposed into French drains adjacent to the KW and KE Reactors, and that "...these wastes are a concern because their radioactive emissions could be hazardous to humans and wildlife." The Decisional Draft proposes: (1) continued operation and evaluation of a pilot-scale groundwater treatability system (located at the 100-D/DR Area); (2) further study of groundwater/Columbia River interactions and chromium migration in groundwater;

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(3) further evaluation of ecological risks through the Columbia River Comprehensive Impact Assessment; (4) continued application of institutional controls; and (5) continued groundwater monitoring.

TPA Milestone M-34-00-T03 established an engineering study to be submitted to determine the feasibility of moving the fuel and sludge currently in the KE Basin to the KW Basin. WHC-SD-SNF-ES-003, *105KE and 105KW Basins Fuel and Sludge Consolidation Study*, has been submitted and recommends that the fuel not be consolidated. This study also examined water treatment and disposal options for the consolidation process. Although the study concluded that treatment at the site and disposal through the NPDES Outfall 004 had the lowest cost, this operation would have a high permitting risk. Therefore, disposal in the river after treatment is being assessed against other options.

An integral part of removal of the fuel and sludge is the treatment and disposition of the contaminated basin water. The activities for the water treatment and disposition must be scheduled to coordinate with and support the other K East Basin fuel and sludge removal activities. The path forward document provides a schedule and description of recommended steps leading to the safe interim storage of the fuel and sludge until final disposition is achieved in the future. The path forward recommendation is for on-site stabilization and dry interim storage of the fuel. An aggressive schedule date for having the fuel removed from the K-Basins by November, 2000 is presented in the path forward document. TPA Milestone M-34-00-T05 requires DOE to provide a schedule for fuel and sludge encapsulation and contaminated water removal or replacement to the Washington State Department of Ecology and EPA that supports the TPA Milestone M-34-01.

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2.0 WATER TREATMENT DESCRIPTION AND SCHEDULES

The objectives of KE Basin Water Treatment/Disposition project are to treat and/or dispose of the contaminated K-East Basin water to achieve the following:

- Support the ultimate goal to remove the fuel, sludge and contaminated water from the KE Basin.
- Limit releases of tritium, other radionuclides, and contaminants to the environment and to the KR-4 Operable Unit during all phases of the project through final decomissioning of the basin. (This supports the 100-KR-4 Record of Decision activities).
- Optimize the existing water treatment equipment to achieve the following:
  - Improve basin water quality.
  - Reduce worker exposure.
  - Extend ion exchange resin life.
  - Accomodate additional loading from fuel and sludge movements.

Figure 2.1 is a flow chart relating water teatment to fuel and sludge removal activities.

2.1 REDUCTION OF BASIN WATER TRITIUM

Five tritium management options have been proposed for the basin water:

1. Treat and dispose at 100K
2. Treat at 100K, transport to Effluent Treatment Facility (ETF) for further treatment, and dispose in State Approved Land Disposal Site (SALDS)
3. Transport to the 200 Area, treat at 242-A Evaporator and ETF, and dispose to SALDS
4. Option 2 or 3 then de-tritiate at ETF and dispose in SALDS
5. Treat water behind construction joint isolation barrier and dispose via options 1, 2, 3, or 4

All but one of the options (Option 4, which includes de-tritiation of the water) are considered technically practical, and all but one of the options (in this case, Option 1) would support a September 1996 tritium mitigation process startup schedule, as required by M-34-01. M-34-01 also provides an option to defer tritium management/disposal actions. However, the acceptability of that option is dependent on removal of all fuel and sludge from the KE Basin by early 1999. Because that schedule is not supported by WHC's M-34-00-T03 submittal (WHC-SD-SNF-ES-003), nor by current planning for expedited fuel and sludge removal, a no-interim-action option for tritium would be unresponsive to M-34-01.

Final selection of the option to be implemented will be based on a functions and requirements document, a draft permitting strategy, an engineering study, and process testing results. These will be input to a decision matrix, which will then be employed to select the process. The planned completion date for this down selection activity is December 30, 1994. The process selection will be based on the following objectives:

- Addresssing TPA Stakeholder concerns by removal of radioactive materials to the maximum practical extent before release of the water to the environment
- Ability to obtain all necessary regulatory permits
- Cost effectiveness
- Availability of site facilities
- Characterization data
- Ability to support fuel and sludge removal
- Ability to meet TPA milestone schedules
- Minimum occupational exposure
- Facility Safety Analysis considerations

Figure 2.2 shows a proposed schedule for the activities required to treat and dispose of the KE Basin water.

2.2 BASIN WATER SYSTEM UPGRADES TO SUPPORT PATH FORWARD

The recommended path forward involves a series of projects to construct

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and operate facilities to safely retrieve, package, transport and store K Basin fuel and sludge. The fuel will be transported to a dual purpose staging and vault storage facility where it can be stored temporarily. When an adjoining facility is completed, the fuel will be processed (drying and passivation) and returned to the same storage facility for interim (40 yr) storage. Figure 2.3 shows the schedule for path forward activities in conjunction with water treatment activities for the major fuel transfer and storage program.

Water treatment facilities for on-site treatment of the waste will be upgraded as needed to facilitate fuel and sludge removal and pool remediation. Tasks will include:

1. Additional filtration to maintain water clarity during fuel and sludge removal
2. Enhanced ion-exchange to improve water quality, prolong resin life, and minimize worker doses.
3. Additional ion-exchange (if fuel motion enhances dissolution rate)

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2.3 WATER TREATMENT FOR SUPPORT OF FINAL DISPOSITION AFTER FUEL REMOVAL

The water treatment systems will be operated for a maximum period of 18 months, starting from the time that the fuel and sludge are completely removed from the basins. At the end of this period the basins will be turned over for deactivation. During this phase of water processing the entire inventory will be removed and disposed of if desirable for deactivation. The goal for water purity at turnover is to meet the levels required to transport the water to the Effluent Treatment Facility.

The water treatment equipment at the KE Basin consists of pumps, sand filters, ion-exchange modules, and ion-exchange columns. This existing treatment equipment should be adequate for treatment at Evaporator 242-A. Basin Operations and Transportation personnel exposure limits can be met with the water exiting the existing treatment system. The water purity should meet the requirements for Low Specific Activity, reducing the requirements for transportation.

If the water is to be treated at the ETF only (Option 2), or disposed of on-site (Option 1), additional on-site treatment equipment is needed. This equipment will include micro-filters, polishing ion exchange columns, pumping equipment, and discharge tanks to stage the treated liquid.

Figure 2.1
K Basin Fuel Removal, Processing and Storage Major Activities

Water Treatment and Disposition Activities

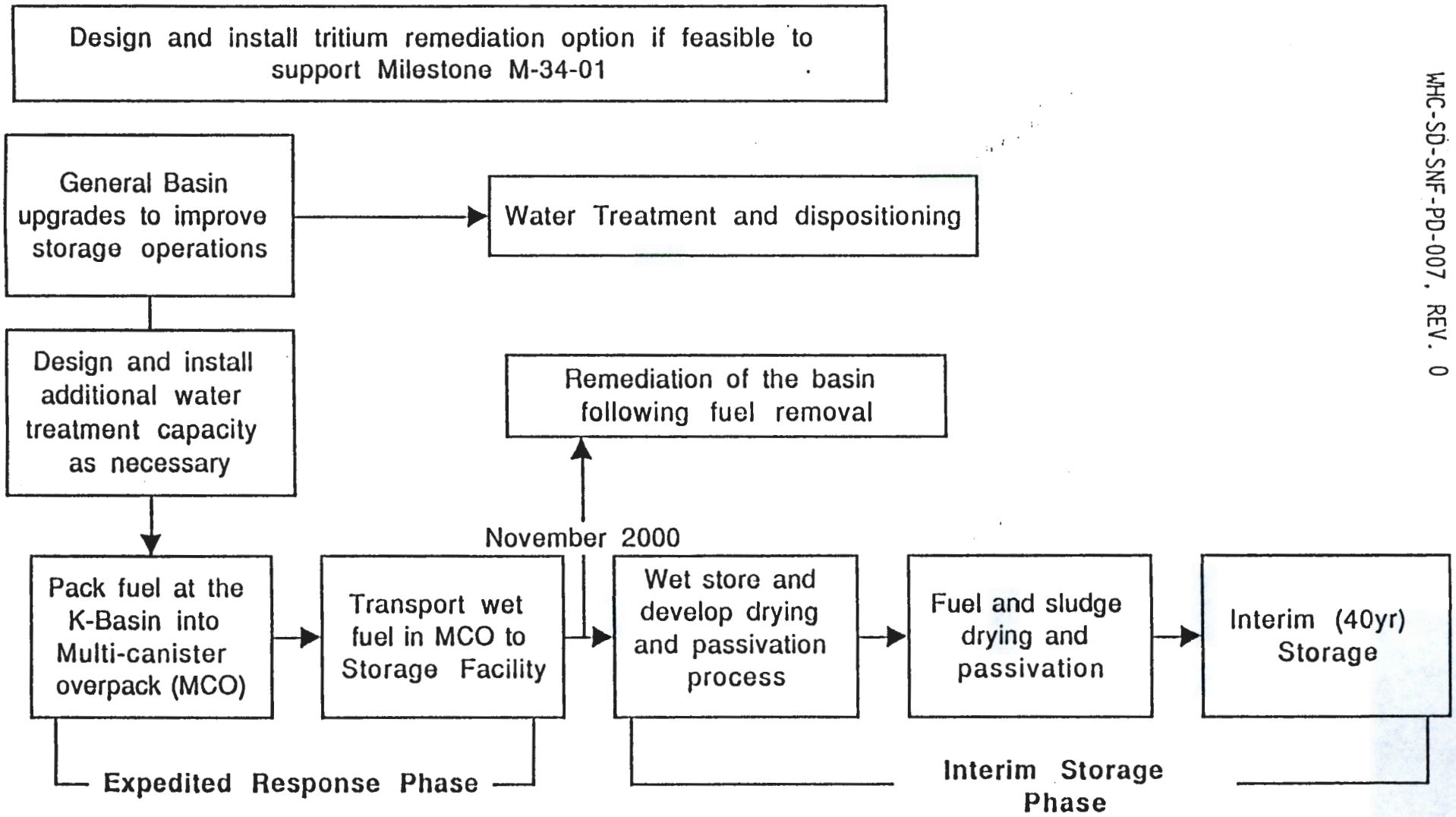

Figure 2.2, K-Basin Water Treatment and Disposition-Design and Installation

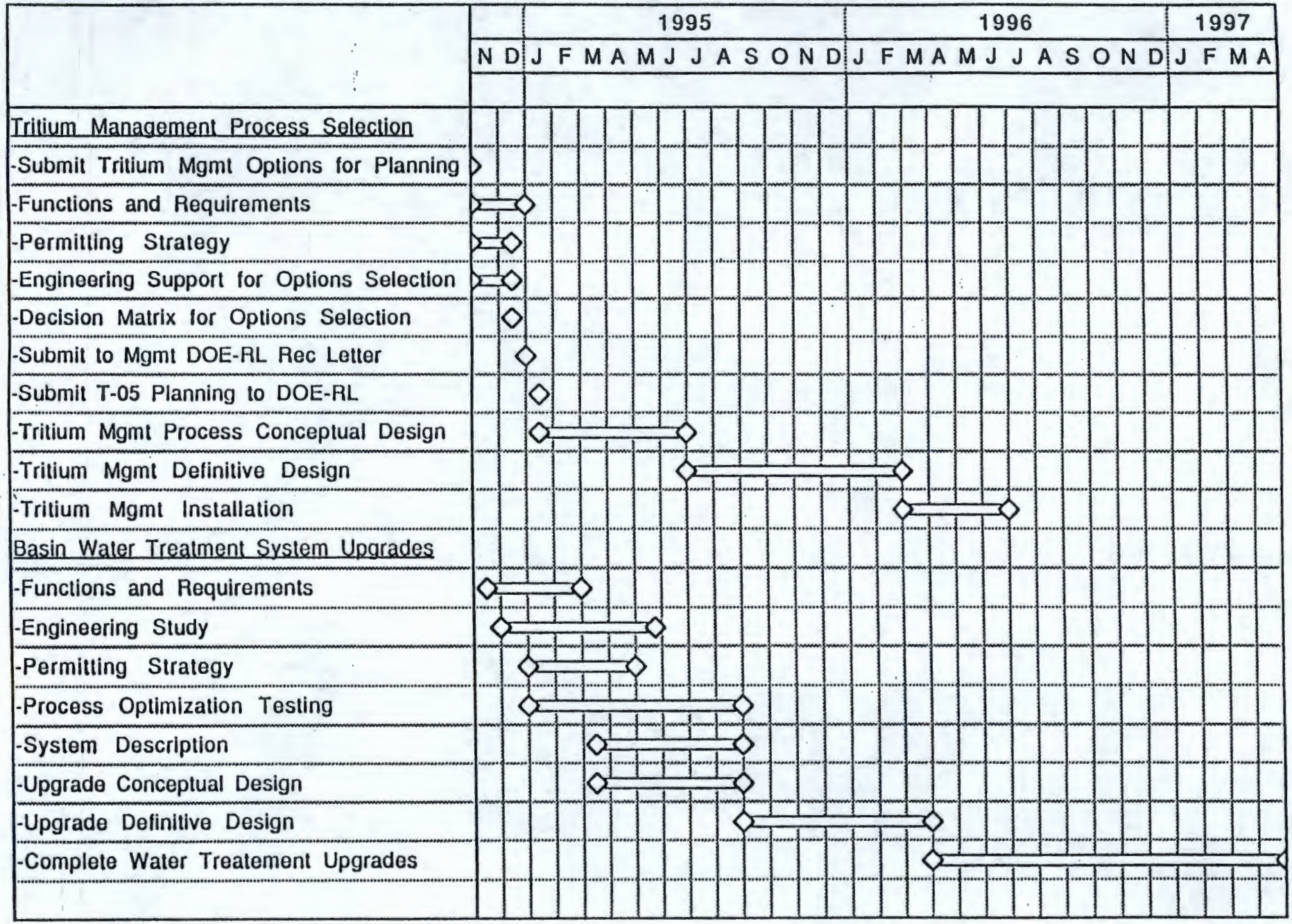

Figure 2.3, K Basin Fuel Removal, Processing and Storage Activity Schedule

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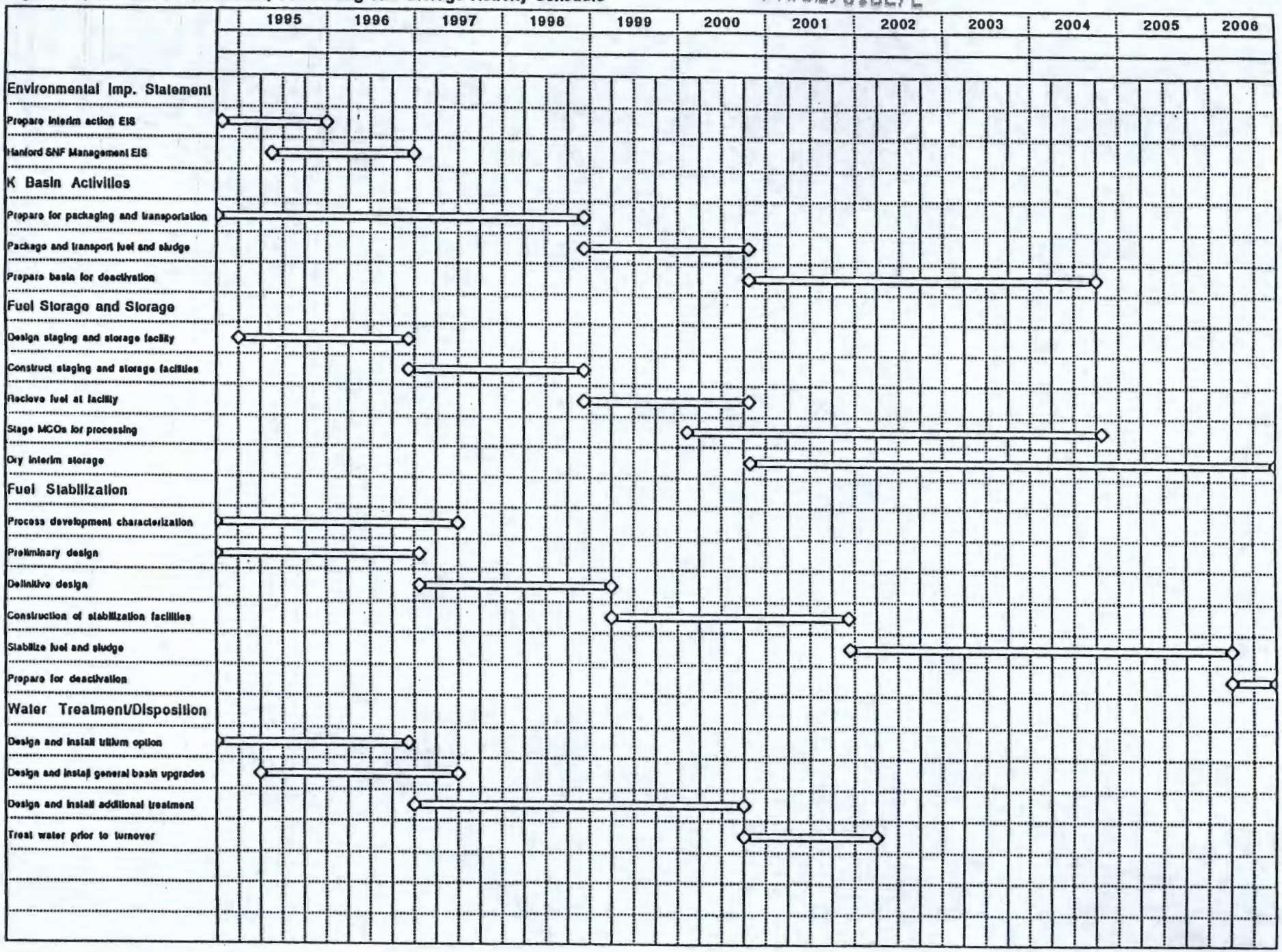

3.0 COSTS

A rough estimate of the costs associated with each of the options for tritium management are shown in Table 3.1. These costs do not include those items associated with current continuous operation of the site, because those activities must be performed independent of the tritium removal. These costs assume that water will be processed at two million gallons per year for six years. The actual amount will probably be smaller. Therefore the additional tritium remediation costs would be lower. When the option for tritium management is selected and as the designs associated with other activities progress, these cost estimates will be improved.

The costs associated with upgrades to the basin water treatment systems will depend highly on requirements based on fuel and sludge removal processes. Therefore these costs are not included in the table and will be estimated for Milestone M-34-00-T05.

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TABLE 3.1, COST TO TREAT 2 MILLION GALLONS PER YEAR

OPTION	FUNCTIONS		COST FOR 6 YEARS ($M)	
OPTION 1	Treat	Local	Capital	4.01
	Trans	None	Operation	6.70
	Dispose	River	TOTAL	10.71
	Treat	Local	Capital	5.65
	Trans	None	Operation	9.70
	Dispose	Solar	TOTAL	15.35
OPTION 2	Treat	Local	Capital	6.59
	Trans	Truck	Operation	11.34
	Dispose	SALDS	TOTAL	17.93
OPTION 3	Treat	Evaporator	Capital	5.37
	Trans	Truck	Operation	50.89
	Dispose	SALDS	TOTAL	56.26
OPTION 4	Remove tritium		Same as 2 or 3 above, plus tritium removal	
OPTION 5	1a		TOTAL	4.81
	1b		TOTAL	8.69
	2		TOTAL	7.91
	3		TOTAL	10.58

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DISTRIBUTION SHEET

To	From	Page 1 of 1
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RELEASE AUTHORIZATION

Document Number: WHC-SD-SNF-PD-007, Rev 0

Document Title: SCHEDULE FOR FINAL DISPOSITION OF CONTAMINATED K-EAST BASIN WATER

Release Date: 10/26/94

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara Broz 10/26/94

Kara Broz

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