U. S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

NUCLEAR WASTE TECHNICAL REVIEW BOARD FULL BOARD MEETING

SUBJECT: Update on the Multipurpose Canister Concept

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Agenda

- Systematic approach to MPC evaluation
- Assessment of why MPC is preferred
- Summary of current status
- Approach to mitigating remaining risks
- Overall MPC implementation approach

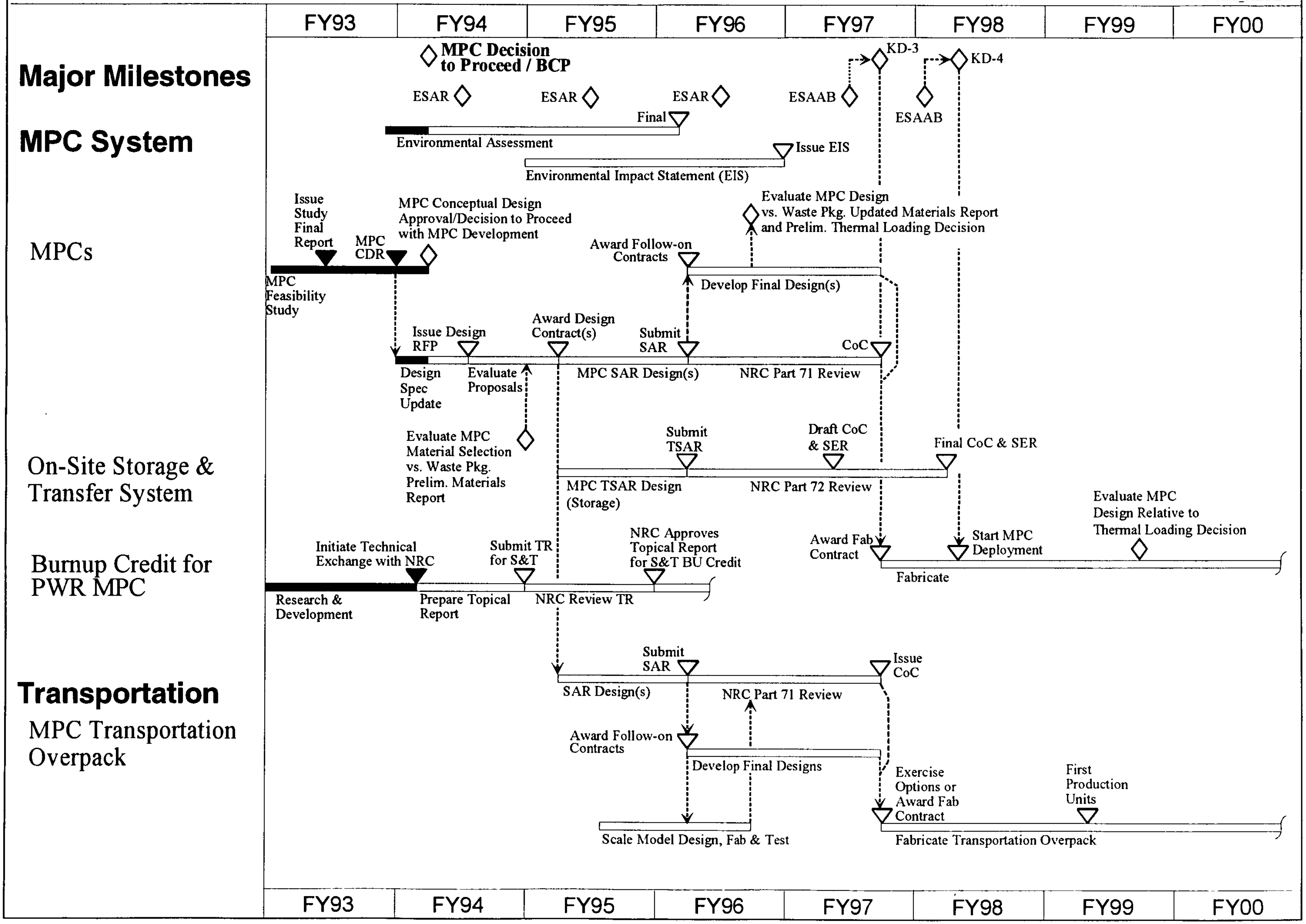
Systematic Approach to MPC Evaluation

Motivation for Evaluating Multipurpose Concepts

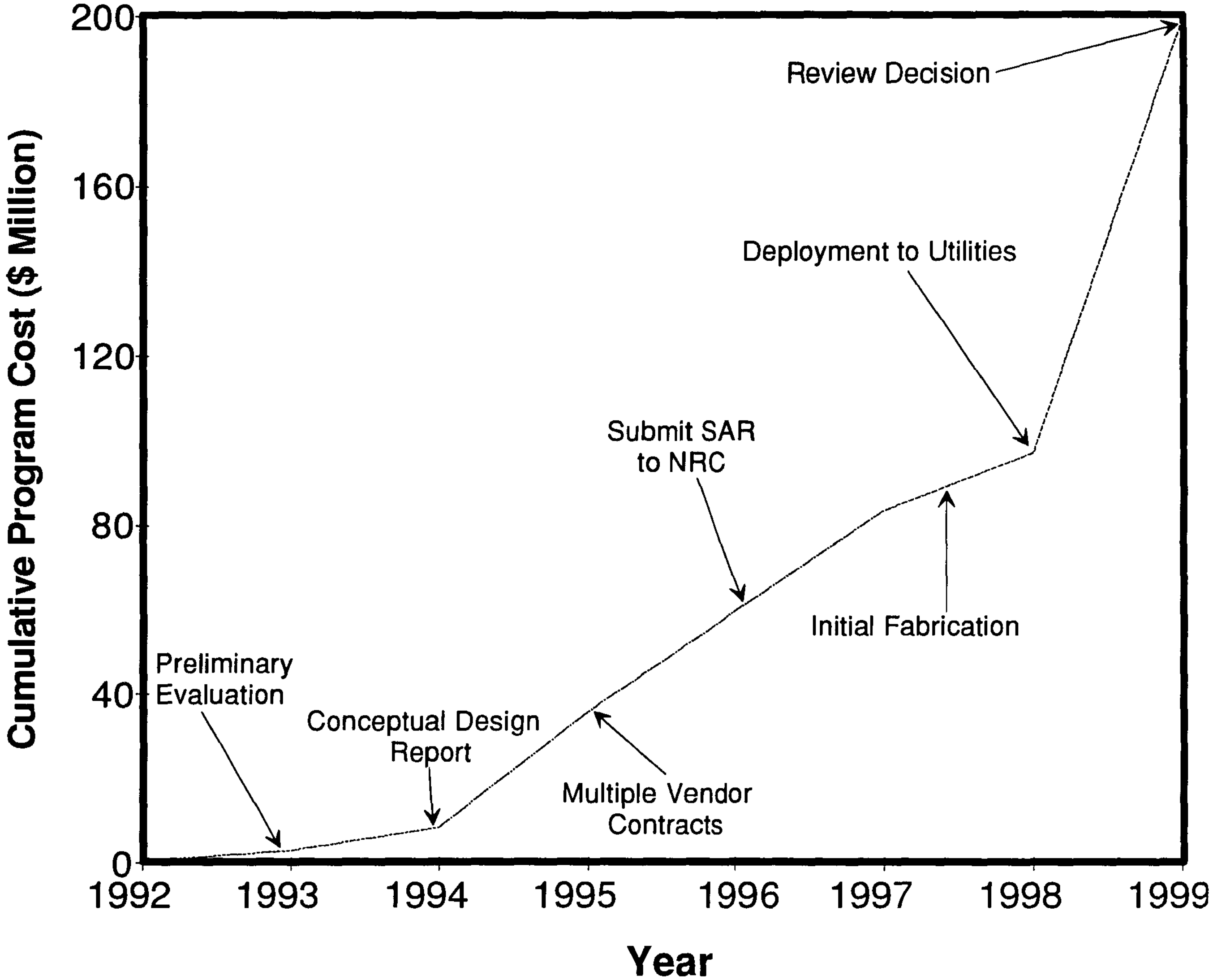
- Reference system appeal hindered by
  - MRS facility -- unlikely to be available in 1998
  - Additional at-reactor dry storage needed
  - Need for more than single purpose storage technology to decouple pool and dry storage
  - Large number of individual fuel assembly handlings
  - Several types of nonstandardized/incompatible dry storage technologies
- Multipurpose concepts address these issues
- Potential advantages of multipurpose concepts identified by NWTRB, utilities, and others
- Proactive approach to address promising concepts

MPC DEVELOPMENT SCHEDULE

TESS 01/05
MPC_TRB2 ds4



Schedule of MPC Investment



Supporting Studies for MPC Evaluation

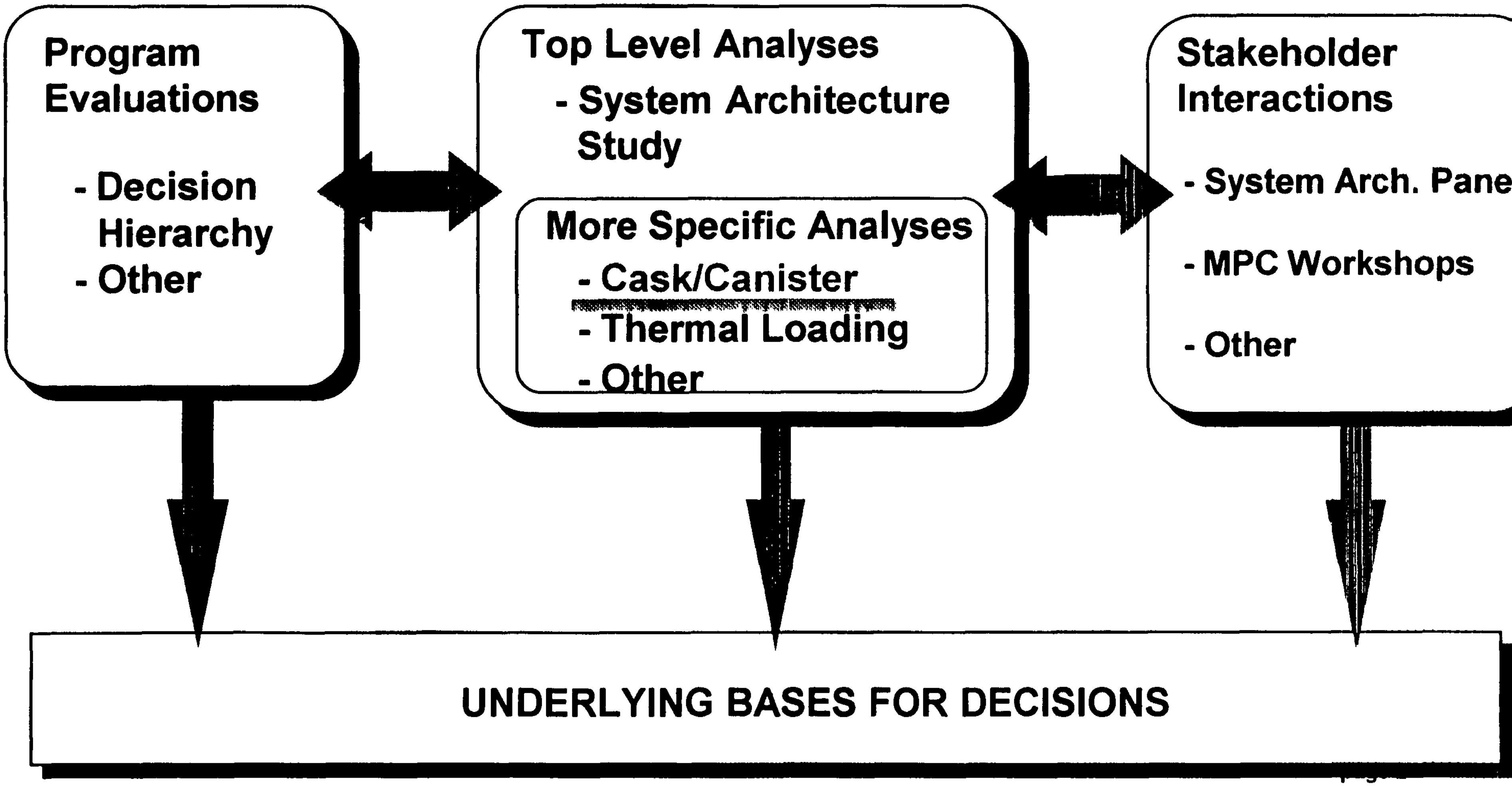
- Concept of Operations (Dec 10, 1993)
- Operational Throughput for the MPC System (Dec 10, 1993)
- Mined Geologic Disposal System Multipurpose Canister Design Considerations Report (Sep 27, 1993)
- Life Cycle Cost Comparison for the Multipurpose Canister System (Dec 10, 1993)
- Health & Safety Impacts Analysis for the Multipurpose Canister System (expected Jan 14, 1994)
- Programmatic Risk & Contingency Analysis for the Multipurpose Canister System (Dec 10, 1993)

Supporting Studies for MPC Evaluation (Concluded)

- At-Reactor Dry Storage Issues (Dec 10, 1993)
- Regulatory Considerations Report for the Multipurpose Canister System (Sep 30, 1993)
- Stakeholder Involvement Report for the Multipurpose Canister System (Sep 30, 1993)
- Program-Level Decision Milestone Network (PLDM) for the Reference System with the Multipurpose Canister (Oct 15, 1993)
- System Architecture Study (Dec 21, 1993)
- Evaluation of Alternative Cask/Canister Systems (expected Jan 14, 1994)

Assessment of Why MPC is Preferred

INTER-RELATIONSHIP OF ANALYSIS AND DECISION PROCESS



Multipurpose Cask/Canister Alternatives

Single Purpose Cask System (Reference System)	Dual Purpose Cask System (TSC)	Dual Purpose Canister System	Multipurpose Cask System (MPU)	Multipurpose Canister System (MPC)
Individual SNF assemblies transferred to different cask/canisters at utilities, MRS, & MGDS	Individual SNF assemblies loaded into TSCs at utilities & transferred to waste package at MGDS	Individual SNF assemblies loaded into DPCs at utilities & transferred to waste package at MGDS	Individual SNF assemblies loaded into MPUs at utilities & remain in MPU for disposal	Individual SNF assemblies loaded into MPCs at utilities & remain in MPC for disposal
Separate casks designed for storage, transport, and disposal	TSC designed for storage and transport. Requires separate cask for disposal	DPC plus two overpacks designed for storage & transport. Requires separate cask for disposal	MPU designed for storage, transport, & disposal.	MPC plus three overpacks designed for storage, transport, & disposal
3 casks	2 casks	1 canister with 2 overpacks plus 1 cask	1 cask	1 canister with 3 overpacks

TSC = Transportable Storage Cask
MPU = Multipurpose Unit
MPC = Multipurpose Canister

Comparison of System Alternatives

- Total system evaluation
- Cost includes both CRWMS (waste fund) and utility (non-waste fund) costs
- MPC system has lowest overall cost

Costs are increments from Ref. system

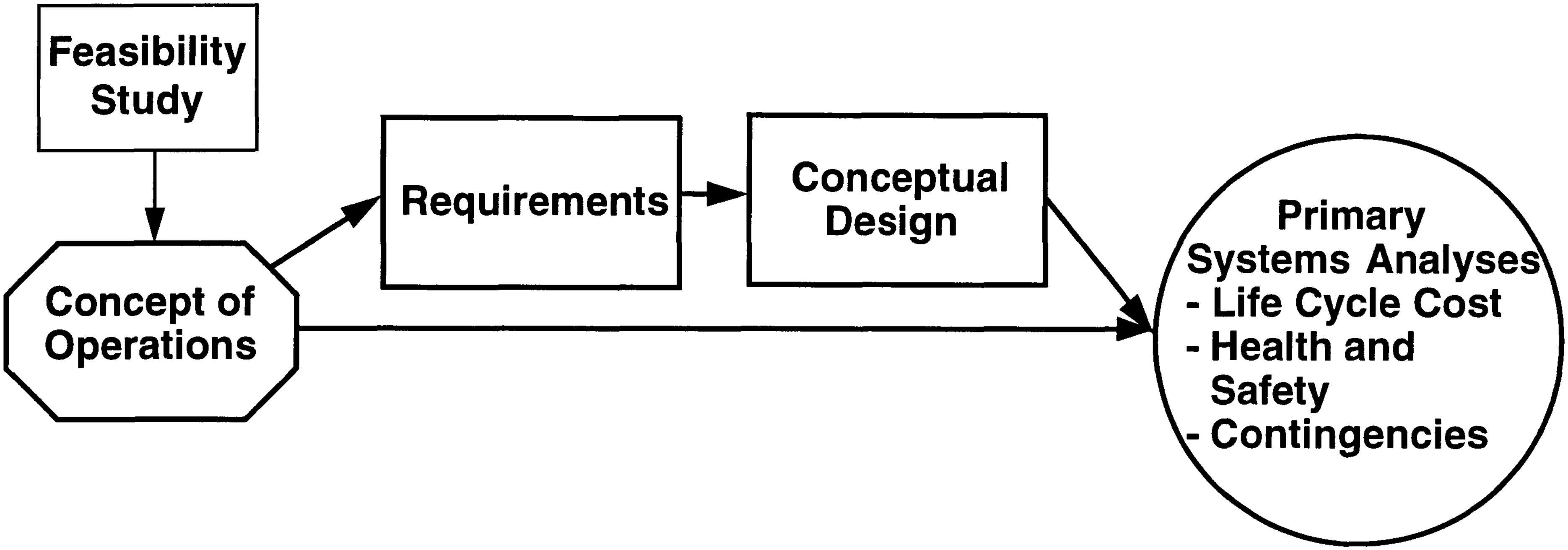
	Single Purpose Cask System (Reference)	Dual Purpose Cask System (TSC)	Dual Purpose Canister System	Multipurpose Cask System (MPU)	Multipurpose Canister System (MPC)
Life Cycle Cost[1]	$-0-	$4.3 B[2]	$1.2 B[2]	$3.2 B[2]	- ($550 M)[2]
Health and Safety[3]	57,800	57,900	67,300	61,400	72,000

1 All Life Cycle Cost impacts shown as differentials to the Reference System with MRS. All costs in 1993 dollars.
2 Assumes all SNF loaded into dry storage five years after reactor shutdown.
3 Health and Safety impacts shown as routine radiation exposure in Person-Rem over program lifetime.

Systems Analysis of Multipurpose Alternatives

- Done as part of MPC conceptual design phase
- Included entire waste management system from utility operations to underground repository
- Considered all cask/canister alternatives
- Compared alternatives on a consistent basis

Systematic Approach to Evaluation



- Concept of Operations defines all assumptions
- System requirements used to develop design requirements
- Design requirements used to develop conceptual designs
- Conceptual designs and assumptions serve as documented basis for evaluations
- Consistent approach used for all alternatives

Life Cycle Cost Evaluation

- Determine impact of alternatives on life cycle cost
- All costs reported as differentials to the reference system
- Includes both CRWMS (waste fund) costs plus utilities (non-waste fund) costs
- Unit costs developed as part of design effort:
  - Typical unit costs for alternatives (21 PWR package):
    - » MPC - $350K (plus overpacks)
    - » TSC - $1,100K (plus waste package)
    - » MPU - $1,100K (includes neutron shield overpack)
- Evaluation includes impact on both facilities and operations

MPC Life Cycle Cost is Lower than Other Alternatives

- Canister-based systems are less expensive than cask-based systems
- Multipurpose systems are less expensive than dual purpose systems

	Single Purpose Cask System (Reference)	Dual Purpose Cask System (TSC)	Dual Purpose Canister System	Multipurpose Cask System (MPU)	Multipurpose Canister System (MPC)
Casks/Canisters	$-0-	$8200 M		$13000 M	$5100 M
Waste Acceptance	$-0-	$-0-		$31 M	$30 M
Transportation	$-0-	- ($2 M)		- ($510 M)	- ($230 M)
MRS/CMF	$-0-	- ($890 M)		- ($940 M)	- ($370 M)
MGDS	$-0-	$-0-		- ($5000 M)	- ($3000 M)
Utilities	$-0-	- ($3000 M)**	**	(- $2900 M)**	- ($2100 M)**
Total	$-0-	$4300 M	$1200 M*	$3200 M	- ($550 M)

Note: All Life Cycle Cost impacts shown as differentials to the Reference System with MRS. All costs in 1993 dollars.
* Dual Purpose Canister system cost developed as variation to Multipurpose Canister system cost.
** Assumes all SNF loaded into dry storage five years after reactor shutdown.

Health and Safety Evaluation

- Determine impact of alternatives on system health and safety
- Includes total system from utility operations to underground repository
- Evaluated radiological and non-radiological impacts, both routine and incident
- Primary focus on routine radiological exposure
- Both occupational and public exposure considered
- Routine public exposure same for all alternatives and represents one percent of total system dose

MPC Radiological Exposure Comparable to Alternatives

All Health and Safety impacts shown as total routine radiation exposure over the lifetime of the program.

(Number of Person-Rem)

	Single Purpose Cask System (Reference)	Dual Purpose Cask System (TSC)	Dual Purpose Canister System*	Multipurpose Cask System (MPU)	Multipurpose Canister System (MPC)
Occupational Utilities	11,700	12,200	18,500	24,200	27,400
MRS	10,500	7,500	12,700	9,300	12,700
CMF	90	60	60	60	60
MGDS	33,600	36,200	34,100	25,900	30,000
Transportation	1,100	1,100	1,100	1,100	1,100
Public (Transportation)	800	800	800	800	800
Total	57,800	57,900	67,300	61,400	72,000

* Dual Purpose Canister system evaluation developed as variation to Multipurpose Canister system and Reference System.

Programmatic Risk and Contingency Analysis

- **Contingencies evaluated for the MPC system:**
  - Impact of MRS vs no MRS
  - Impact of MGDS delay
  - Impact of transportation after storage uncertainty
  - Impact of MGDS uncertainties
- **Programmatic risk measured as economic impact**
  - No MRS and MGDS delay - MPC as good or better
  - MPC not transportable after storage - impact ranges from -$500M (fixable MPC) to +$500M (abandon MPC)
  - MPC not emplaceable - impact ranges from -$300M (fixable MPC) to +$1.2B (dual purpose {non-emplaceable} MPC)

Evaluation Suggests Proceeding with MPC System

- MPC system offers multipurpose concept benefits cited as motivation for work:
  - Ability to transport after storage without returning to pool
  - Reduction in individual fuel assembly handlings
  - Standardized basis for dry storage technology
  - Integrate approach to spent fuel management throughout system
  - Potential to offset financial burden of on-site storage
- MPC life cycle cost same or better than alternatives
- MPC health and safety comparable to alternatives

Summary of Current Status

Potential Implementation Schedule

- Decision to proceed with MPC concept - early 1994
- Issue RFP for design of MPCs - Spring 1994
- Award multiple design contracts - late 1994
- Issue EA - late 1995
- Complete design and submit applications to NRC - late 1995
- Issue EIS - late 1996
- NRC issue Certificates of Compliance - mid 1997
- Begin MPC deployment - January 1998

MPC Decision Plan

- DOE management review of conceptual designs & supporting studies
- Finalize key system studies
- Develop technical, cost & schedule baselines
  - System Requirement Documents
- External interactions
  - NWTRB (Jan6, Nov1-2, 1993; Jan11-12, 1994)
  - NRC (Nov 9, Nov 30)
  - Stakeholders workshop (Jul 1-2, Nov 17-18)
  - EEI (Jul 14, Sep 9, Oct 26, Dec 7)
  - Affected units of Government (Nevada) (Dec 10)
  - NARUC (Dec 21)
  - NCSL, NCAI, TCG, SSEB

Development of RFP

- Information package released Nov 5, 1993
- Develop acquisition plans & strategies
- Develop statement of work
- Develop design specifications
  - Performance based requirements
  - Comply with Part 71&72 and high confidence to comply with Part 60
- Resolve outstanding issues
  - Repository thermal requirements
  - Criticality control and burnup credit
  - Materials

Approach to Mitigating Remaining Risks

Development of Thermal Criteria

- Goal was to define MPC/MGDS design interface for thermal performance
- MPC performance based criteria specifying:
  - Thermal output to be rejected per MPC
  - Temperature delta (ΔT) for heat rejection
- Criteria developed jointly by MGDS/waste package designers and MPC designers
- Assumptions
  - 350°C peak fuel rod cladding temperature
  - Large, in-drift waste package
  - 20°C ΔT across waste package overpack
  - 200°C maximum drift wall rock surface temperature

Development of Thermal Criteria (Concluded)

- Specifications
  - 14.2 kW maximum MPC thermal output
  - 350°C peak cladding temperature
  - 225°C peak MPC shell temperature (125°C ΔT for heat rejection)
  - MGDS design must provide environment for MPC shell

    $\leq$ 225°C with 14.2 kW per MPC
- **MPC Requirements are consistent with a range of thermal strategies of 30 to 100 kW per acre**

Burnup Credit Strategy

- **Two step strategy: storage and transportation, then disposal**
- **Use of burnup credit in design of MPC criticality control system**
  - Potential large cost savings over other criticality approaches
  - Maximizes MPC capacity and, therefore, reduces handlings and exposure
  - Likely needed for long-term criticality control in repository
- **Burnup Credit Issue Resolution Team established**
  - Members: DOE, M&O, Labs, EPRI, Utilities, et al
  - Technical exchange meetings scheduled with NRC; started in November 1993, others in February and March 1994
  - Topical report for storage and transportation to NRC in Oct 1994
  - Topical report for disposal to NRC late 1995

Criticality Control Strategy

- Strategy for MPC-based system to use burnup credit and neutron absorbers for transportation and disposal
- If approval of burnup credit for transportation is delayed by NRC then fallback would be to use flux-trap design for transportation
  - Need to complete analysis on when to change design to flux-trap
  - Need to determine cost impact of going to flux-trap
  - Need to determine impact on waste package performance
- Uncertainty regarding long-term criticality for disposal
  - MPC could be designed for moderator displacement using filler material
  - Need for probablistic based performance assessment

Materials

- **Critical MPC design areas**
  - MPC shell material
  - MPC basket material
  - Neutron absorber material
- **MPC specifications are performance based for materials**
- **Requirements re-evaluated as new information is available**
  - Waste Package Preliminary Materials Report (late 94)
  - Waste Package Updated Materials Report (mid 96)

Overall MPC Implementation Approach

MPC Implementation Phases

- **Current Phase - Existing Dry Storage Technology**
  - DOE has encouraged development of dry storage technologies (e.g., via cooperative agreements)
  - Prior to waste acceptance, utilities and vendors are free to implement out-of-pool storage as they wish
  - Other canister systems that are certified for transport may become an acceptable waste form
    - » Acceptance criteria are TBD
    - » Minimize proliferation of waste forms

MPC Implementation Phases

- **Initial Phase - Initial Multipurpose Canister**
  - Goal to be ready for 1998
  - Needs to meet requirements for storage and transportation
  - Have a high probability of disposal based on known waste package and repository requirements
- **Subsequent Phases - Future Generation MPC**
  - Results of additional scientific analysis and testing may result in changes to requirements for thermal performance, criticality control, and materials
  - Optimization and enhancements to MPC design may be desirable to lower cost or improve system performance

Transition from Initial Phase to Subsequent Phases

- **Primary technical uncertainties for MPC design**
  - Thermal performance, criticality control, materials
  - Efforts initiated to resolve technical uncertainties
- **As technical uncertainties are resolved, develop new requirements to evolve MPC design**
  - To correct deficiencies in initial phase design
  - To enhance/optimize initial phase design
- **Transition to subsequent phase through a controlled process**
  - Develop new requirements
  - Flow down new system requirements to design requirements
  - Develop subsequent phase MPC design consistent with requirements
- **Physical interfaces will be maintained in subsequent phases to provide equipment/facility compatibility**

MPC Development Logic

Decisions

Resolve Technical Uncertainties

- Conceptual design and system studies (end 93)
- Decision to proceed (early 94)
- Specification and RFP (spring 94)
- Environmental assessment (late 95)
- Design and certification (late 95)
- Environmental impact statement (late 96)
- Fabrication of initial phase (late 97)
- Begin deployment (early 98)
- Subsequent phases (as appropriate)