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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
ENGINEERED BARRIER SYSTEM, TRANSPORTATION AND SYSTEMS JOINT PANEL MEETING

SUBJECT: MULTI-PURPOSE CANISTER SYSTEM DEVELOPMENT AND PLANNING

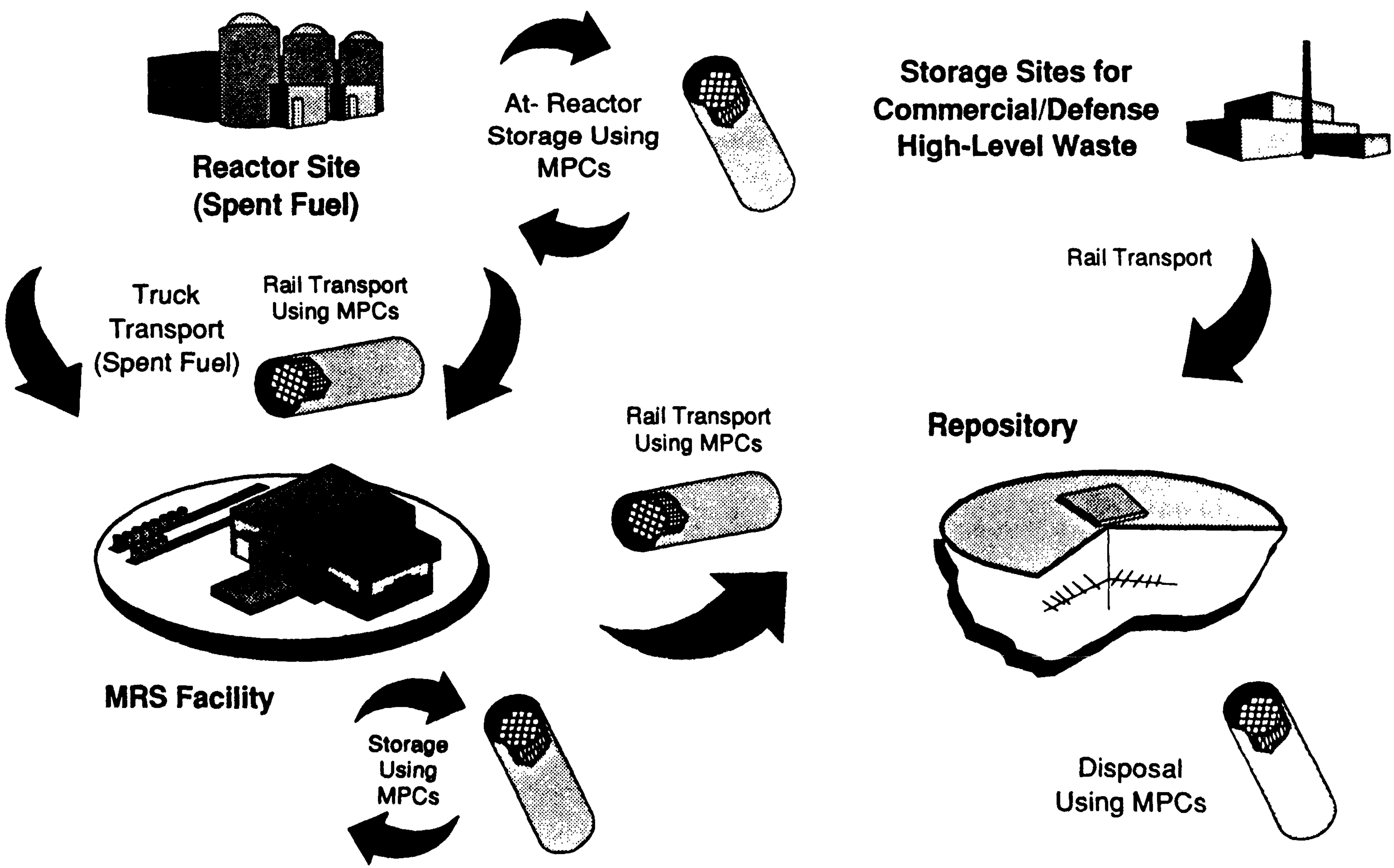
PRESENTER: RONALD A. MILNER

PRESENTER'S TITLE AND ORGANIZATION: Associate Director, Office of Storage and Transportation.

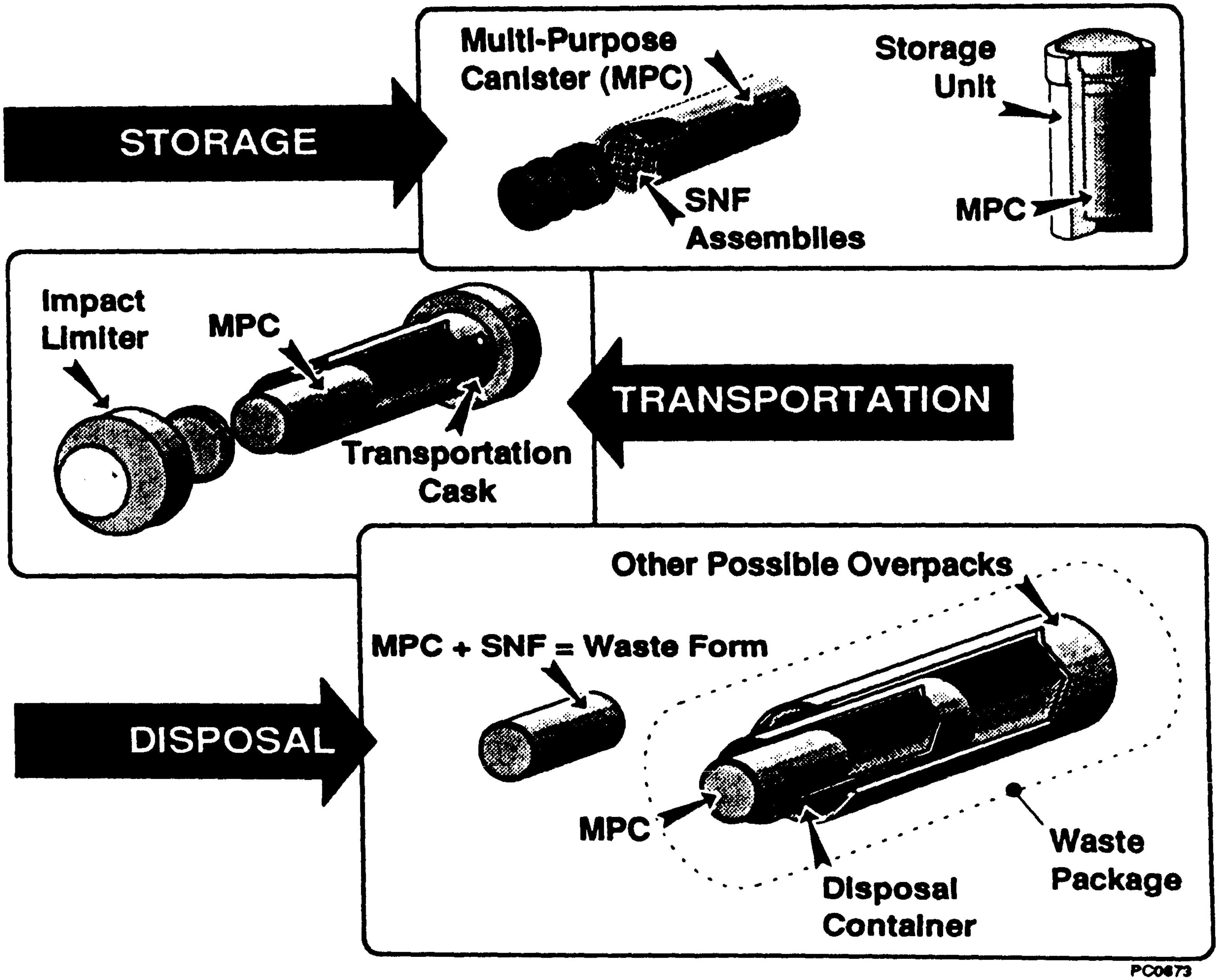
PRESENTER'S TELEPHONE NUMBER: (202) 586-9694

Dallas, Texas
November 1-2, 1993

System Operational Concept with Multi-Purpose Canisters



Multi-Purpose Canister (MPC) System



MPC Conceptual Design Basis

- Meet the requirements of:

10 CFR 71	Packaging and Transportation of Radioactive Material
10 CFR 72	Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste

- Be compatible with the requirements of:

10 CFR 60	Disposal of High-Level Radioactive Waste in Geologic Repositories

- Incorporate utility requirements
- Openly review MPC concept with all stakeholders

Waste Acceptance Requirements for MPC Conceptual Design

- Initial requirements
  - Maximize amount of SNF per canister
- Constraint
  - SNF has different physical, nuclear, and thermal characteristics
- Design basis SNF characteristics:

Design basis SNF characteristics	PWR	BWR
— Maximum length (in)	180	180
— Maximum width (in)	9	6
— Maximum weight (lbs)	1720	730
— Burnup (MWd/MTU)	40,000	40,000
— Enrichment (wt% U-235)	3.75	3.75
— Decay (yrs)	10	10
— Decay Heat (kW/assembly)	0.675	0.317

Utility Requirements for MPC Conceptual Design

- Initial requirements
  - Maximize number of utilities
  - Suitable for on-site dry storage
- Constraints
  - Transportation mode
    - « Rail compatible — 102 facilities
    - « Truck compatible — 19 facilities
  - Handling capability if rail compatible (cask weight)
    - « >125 tons — 56 facilities
    - « 100-125 tons — 32 facilities
    - « 75-100 tons — 14 facilities
  - ALARA
- Design basis
  - 125 ton cask — 88 facilities (32 with MPC transfer cask)
  - 75 ton cask — 14 facilities
  - Truck cask — 19 facilities
  - Welded closure
  - 9 foot diameter
  - Utility Transfer System

Transportation Requirements for MPC Conceptual Design

- Initial requirements
  - Maximize use of rail facilities
  - Minimize number of shipments
  - 10 CFR 71
    - « Dose rate: surface <200 mrem/hr, at 2 meters <10 mrem/hr
- Constraints
  - Operate rail cars in unrestricted interchange (maximum width 128 in., maximum car weight 394,500 lbs.)
  - Cask exterior surface temperature: <82°C
  - Criticality control: $k_{eff} < 0.95$
  - Peak cladding temperature: 10-year-old SNF <340°C, 5-year-old SNF <380°C
  - Transportation overpack compatible with MPC
- Design basis
  - 125 ton maximum
  - Transportation accident requirements
    - « Burnup credit for criticality control
    - « Flooded conditions for criticality control
    - « No containment credit for MPC shell

Interim Storage Requirements for MPC Conceptual Design

- Initial requirements
  - Service life of 100 years
  - Transportable after long-term storage
  - 10 CFR 72
- Constraints
  - Criticality control: k_{eff} <0.95
  - Peak cladding temperatures: 10-year-old SNF <340°C,
5-year-old SNF <380°C
  - Storage overpack/interim storage facility at utilities compatible with MPC
- Design basis
  - Containment credit for MPC
  - No internal inspection prior to transportation after storage

Disposal Requirements for MPC Conceptual Design

- Initial requirements
  - MPC compatible with baseline thermal loading approach
    - « Waste package exterior temperature: >100°C
    - « Near field temperature: >100°C
    - « Areal loading: 30 - 114 kW per acre
  - MPC compatible with requirements of 10 CFR 60
    - « Criticality control: subcritical by five percent margin in k_{eff}, after uncertainties
- Constraints
  - Peak cladding temperature: <350°C
- Design basis
  - Overpack is primary engineered barrier
  - Credit will be taken for all elements, as appropriate, including fuel cladding, MPC shell
  - Burnup credit for criticality control

Key Trades

Issue	Alternatives	Rationale
Storage		
• MPC closure mechanism	[Welded,] Bolted	Minimize storage monitoring; crevice corrosion concern
Economics		
• MPC shell material	[Stainless Steel,] Carbon Steel, Alloy 825	Cost; transportability after long-term storage
• Large MPC capacity	24 PWR vs. [21PWR]	Thermal constraint on cladding in repository (under review)
Criticality and Thermal		
• Filler material	Yes, No, [Maybe] Loading, [Emplacement]	Firm requirement not established
• Burnup credit for large PWR MPC	[21 PWR capacity with,] 17 PWR capacity without	Cost, shipment reduction
• Basket neutron absorber lifetime, physical integrity	[Borated aluminum,] Borated stainless steel	Heat transfer; lifetime at least equal to canister (under review)

RD&D Strategy for Unresolved Issues

- Criticality Control
  - Topical report working group being formed
  - Will brief NRC on long-term criticality evaluation needs 11/30/93
  - Topical report presentation planned early '95

- Thermal Loading
  - MGDS thermal loading study FY 93-94
  - Follow-on system studies FY 94-01
  - Large heater block tests FY 94-95
  - Abbreviated heater tests FY 96-99
  - ESF heater tests FY 96-01
  - Anticipated decision time frame FY 97-99

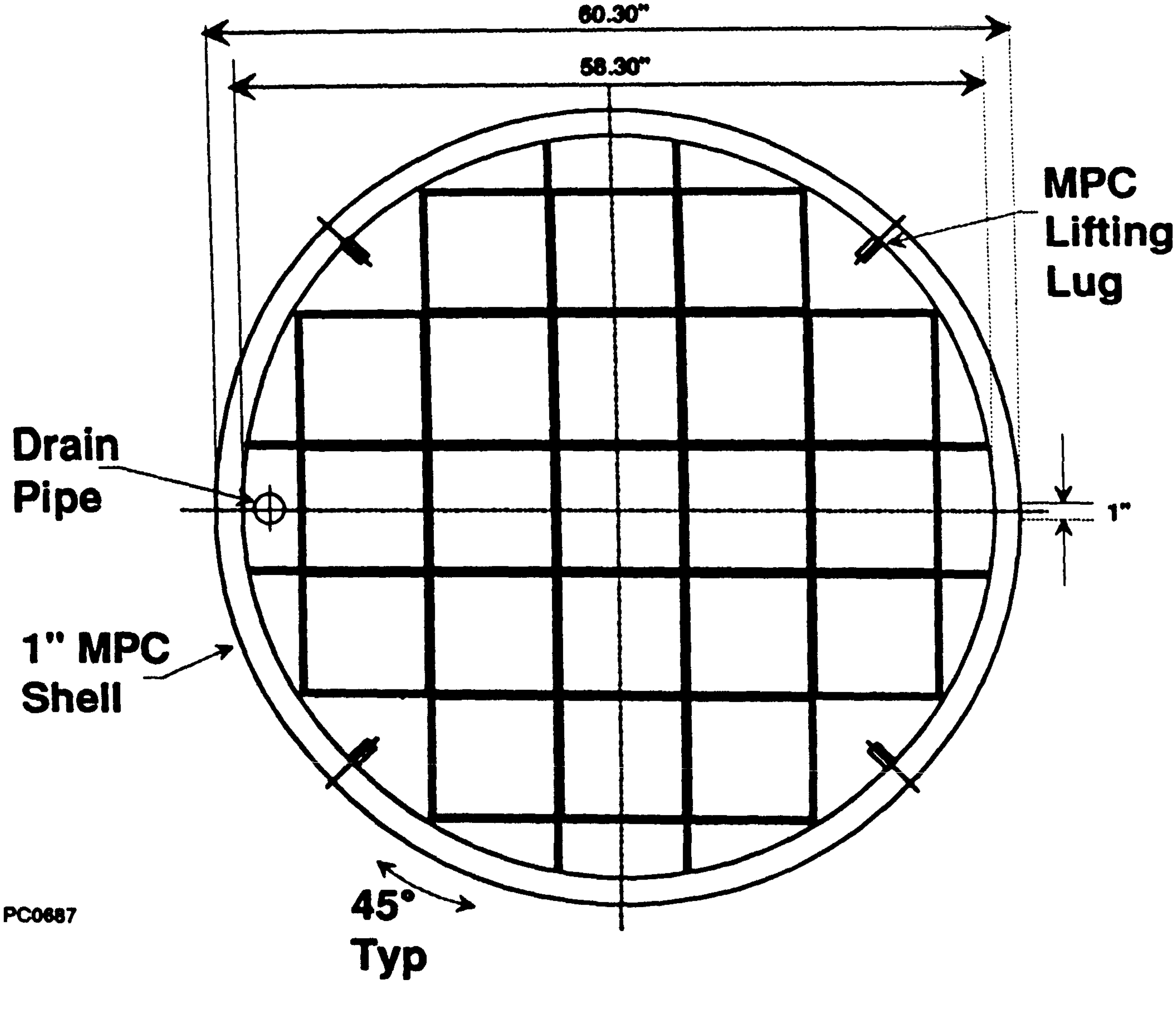
- Burnup Credit
  - Management meeting 8/27/93
  - First technical exchange 11/30-12/1/93
  - Three topical reports planned
    - For storage and transport PWR SNF - submitted 9/94
    - For disposal PWR/BWR SNF - submitted 9/95
    - For storage and transport BWR SNF - if needed
  - One year NRC turnaround requested

Conceptual Designs for MPC

Size	Capacity	Reactors Served	Number of Assemblies
• 125 Ton MPC	21 PWR	64	109,000
	40 BWR	24	112,000
• 75 Ton MPC	12 PWR	5	8,000
	24 BWR	9	33,000

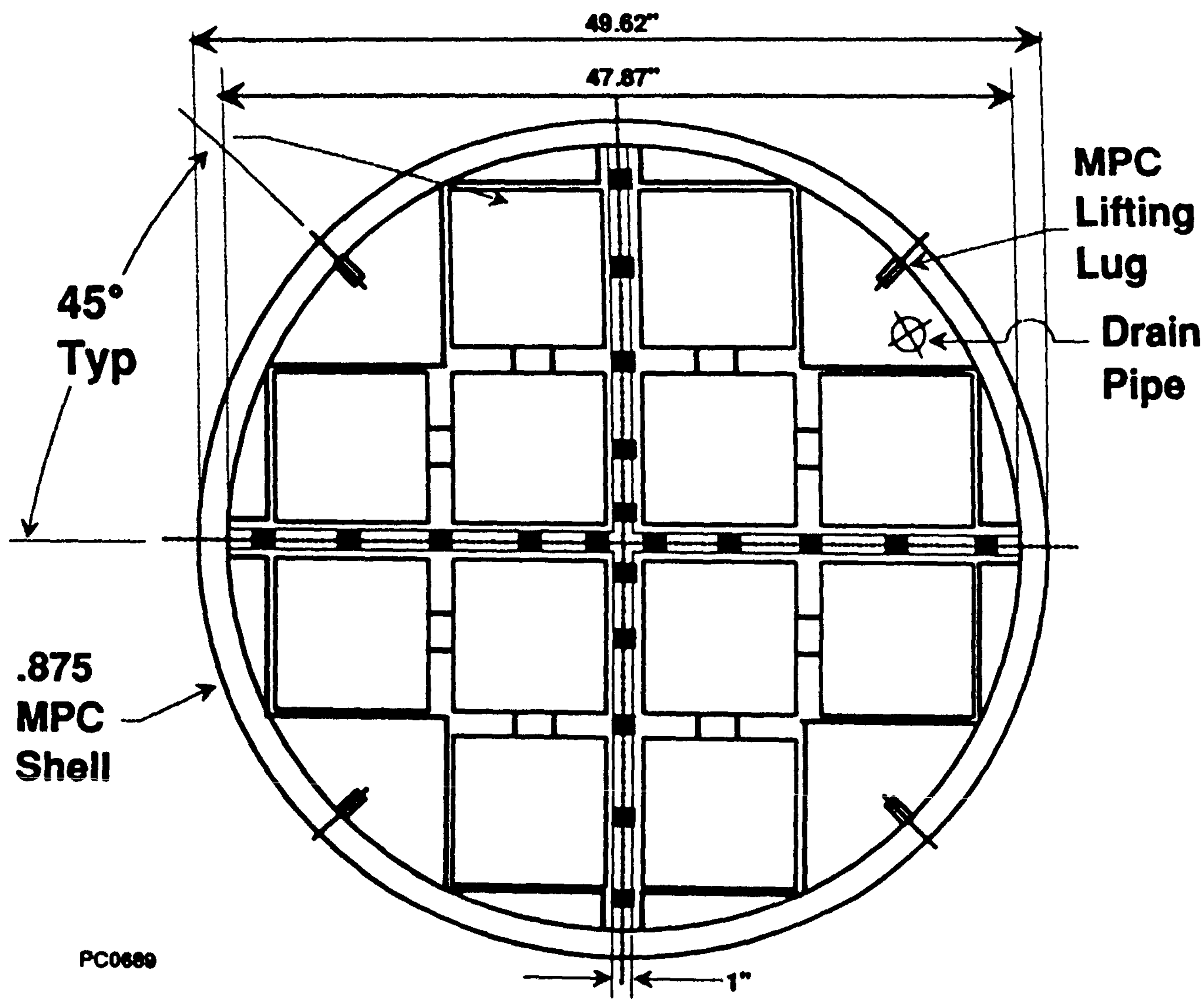
- Remainder of projected 298,000 SNF assemblies would be picked up from reactors in truck casks.

125 - Ton 21 PWR Configuration



PC0687

75 - Ton 12 PWR Configuration



Contingencies

- MPC Not Emplaceable
  - Cause:
    - « Incompatible with repository requirements, including criticality control and thermal loading
  - Impact:
    - « Additional cost to open, then rework, redesign and dispose, or convert to dual purpose MPC system
    - « Dual purpose MPC is upper bound of impact, could add up to $500 million to program cost

- MPC Not Transportable After Long-Term Storage
  - Cause:
    - « Uncertainty over condition of basket and contents
  - Impact:
    - « Additional cost to open, then rework or design and dispose
    - « Could add up to $500 million to program cost

- No MRS
  - Cause:
    - « Failure to obtain MRS site consistent with system requirements
  - Impact:
    - « Increased at-reactor dry storage, increased system costs
    - « MPC mitigates impact

MPC Conceptual Design Report Products

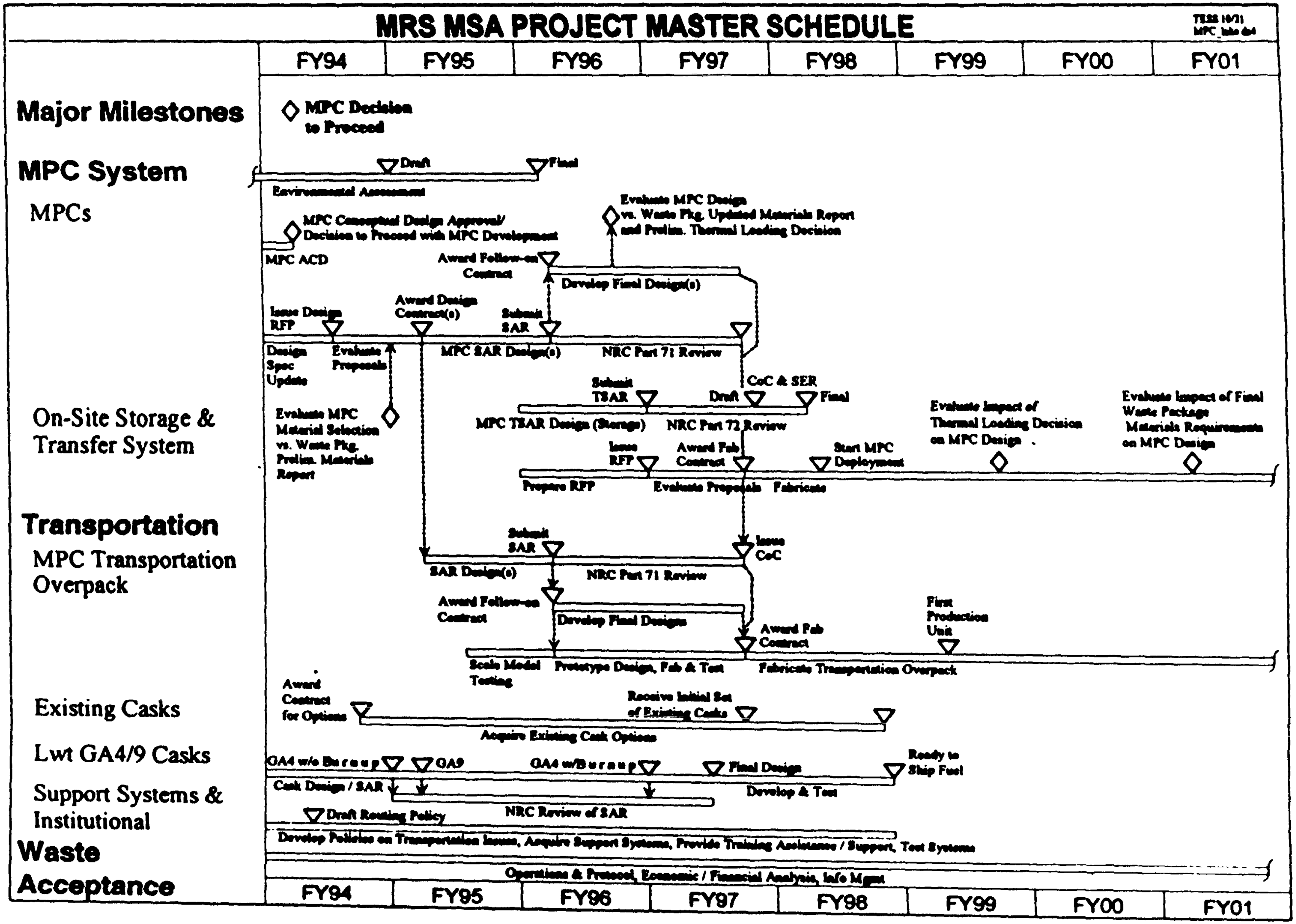
- **Volume I** Summary Report
- **Volume II** Conceptual Designs
  - MPC
  - Transportation Cask
  - MRS
  - Utility Transfer System
- **Volume III** Draft RFP and Design Specifications (Procurement Sensitive)
- **Volume IV** Cost and Schedule
- **Volume V** Supporting Studies (Concept of Operations, Repository and Regulatory Considerations, others)
- **Other related products** (Life Cycle Cost, Risks and Contingencies, Health and Safety, Alternative Cask/Canister Concepts)

Factors for Decision to Proceed with MPC

- Should DOE incorporate an MPC system into the baseline and commence design?
- Primary criteria - evaluated for nominal case and contingencies
  - Health and safety
  - Life cycle cost
  - Licensing and regulatory compliance
  - Stakeholder acceptance
  - Waste acceptance schedule
  - Standard contract impacts
  - Flexibility in overall waste system
- Inputs to decision process
  - Conceptual Design Report
  - IMRG review
  - EEI review
  - Stakeholder workshop
  - Environmental input
  - NRC
  - NWTRB

MPC System Schedule

- MPC Schedule
  - Decision on proceeding with MPC change to technical cost/schedule baseline - January '94
  - Issue RFPs for MPC design contracts - April '94
  - Award MPC design contracts - December '94
  - MPC Safety Analysis Report Design completed for License Application submission to NRC - December '95
  - Complete final Environmental Assessment for MPCs - December '95
  - MPC system prototype testing complete - March '97
  - NRC issue Certificate of Compliance for MPCs under 10CFR71 and 10CFR72 - June '97
  - Issue RFPs for MPC fabrication - September '96
  - Award MPC fabrication contracts - June '97
  - Start MPC deployment - January '98
  - Waste Package License Application Design activities - start June '96; completed 2001



MRS MSA PROJECT MASTER SCHEDULE
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
Major Milestones
MPC Decision to Proceed
MPC System
Draft
Final
Environmental Assessment
MPCs
Evaluate MPC Design vs. Waste Pkg. Updated Materials Report and Prelim. Thermal Loading Decision
MPC Conceptual Design Approval/ Decision to Proceed with MPC Development
MPC ACD
Award Follow-on Contract
Develop Final Design(s)
Issue Design RFP
Award Design Contract(s)
Submit SAR
Design Spec Update
Evaluate Proposals
MPC SAR Design(s)
NRC Part 71 Review
Evaluate MPC Material Selection vs. Waste Pkg. Prelim. Materials Report
Submit TSAR
CoC & SER
Draft
Final
On-Site Storage & Transfer System
MPC TSAR Design (Storage)
NRC Part 72 Review
Evaluate Impact of Thermal Loading Decision on MPC Design
Evaluate Impact of Final Waste Package Materials Requirements on MPC Design
Issue RFP
Award Fab Contract
Start MPC Deployment
Prepare RFP
Evaluate Proposals
Fabricate
Transportation
Submit SAR
Issue CoC
MPC Transportation Overpack
SAR Design(s)
NRC Part 71 Review
Award Follow-on Contract
Develop Final Designs
Award Fab Contract
First Production Unit
Scale Model Testing
Prototype Design, Fab & Test
Fabricate Transportation Overpack
Existing Casks
Award Contract for Options
Receive Initial Set of Existing Casks
Acquire Existing Cask Options
Lwt GA4/9 Casks
GA4 w/o Burnup
GA9
GA4 w/Burnup
Final Design
Ready to Ship Fuel
Cask Design / SAR
Develop & Test
NRC Review of SAR
Support Systems & Institutional
Draft Routing Policy
Develop Policies on Transportation Issues, Acquire Support Systems, Provide Training Assistance / Support, Test Systems
Waste Acceptance
Operations & Protocol, Economic / Financial Analysis, Info Mgmt
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01

MPC Conceptual Design Conclusions

- Report asserts MPC approach offers advantages
  - Initial investment that should reduce national cost
  - Provides flexibility in interim storage system
  - Facilitates system standardization
  - Reduces bare SNF handlings
- MPC contingencies need to be addressed through
  - Analysis
  - Research
  - Design
- Decision making approach must encompass
  - Regulatory
  - Programmatic
  - Technical
  - Stakeholder