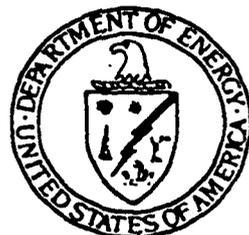


Multi-Purpose Canister Study

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Office of Civilian Radioactive Waste Management



Presented to

Nuclear Waste Technical Review Board

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Multi-Purpose Canister Study

- **Background**
- **Multi-Purpose Canister Study**
- **Issues and Future Activities**

Background -- Historical Background

- DOE Program Research and Development Announcement study 1985
- NRC's concern with "compatibility of various steps in the storage, transport and disposal" of Spent Nuclear Fuel (SNF) (November, 1988)
- MRS Review Commission asked what DOE was doing to enhance compatibility
- NWTRB has expressed interest in "minimizing waste handling"
- MRS potential host concerns
- Industry
 - Edison Electric Institute
 - Electric Power Research Institute
 - Utilities
- Recent DOE analyses

Background -- Background for DOE Study

- Initiated by Director of OCRWM October 1992
- Objective
 - Evaluate benefits
 - Identify pros and cons
 - How to implement MPC's if beneficial to program
 - Identify issues and future actions

MPC Study -- Definition of MPC

- Also called Universal Canister, Multiple Element Sealed Canister (MESCs), and Multi-Purpose Units (MPU)
- Sealed canisters holding multiple fuel assemblies
- Canister placed in separate over-packs for storage, transportation and geological disposal
- Intention of never opening canisters once sealed
- Canister and over-pack must meet NRC Regulations
 - Reactor loading 10 CFR Part 50
 - Storage 10 CFR Part 72
 - Transportation 10 CFR Part 71
 - Disposal 10 CFR Part 60

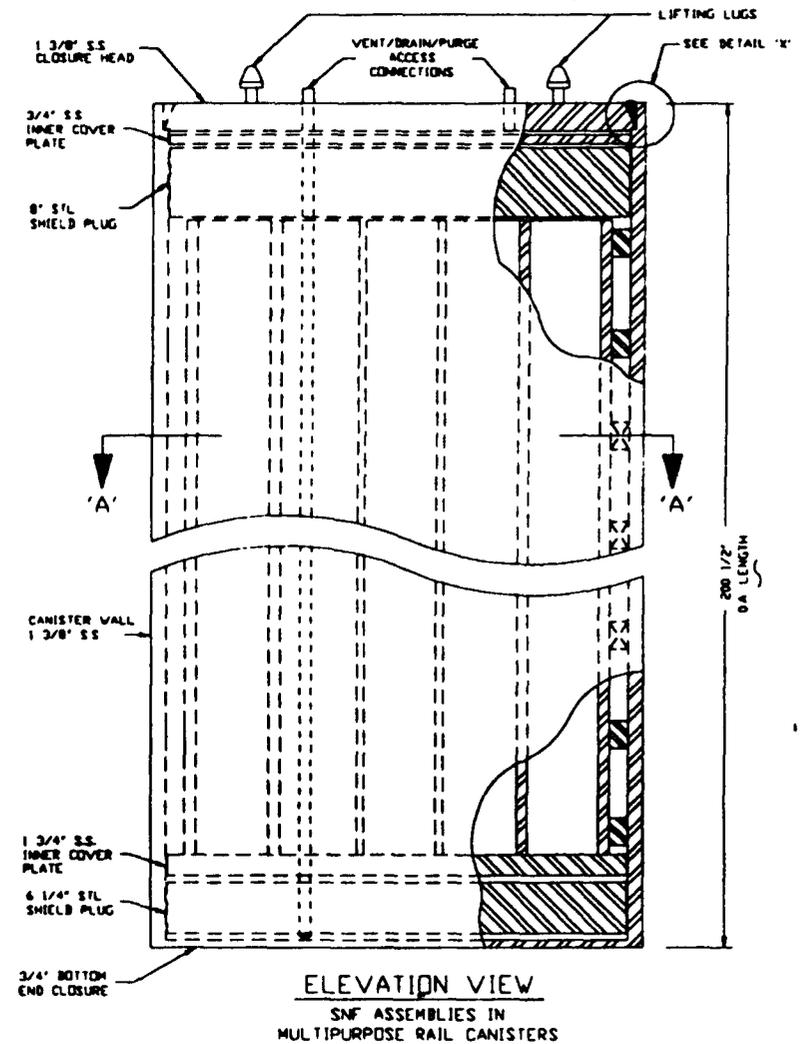
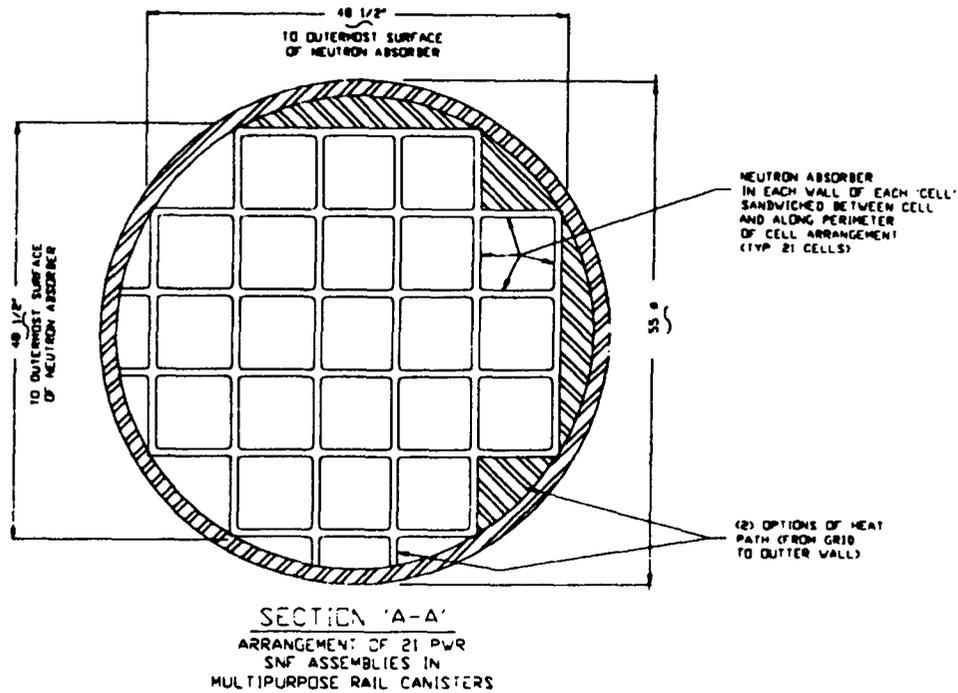
MPC Study -- Major MPC Characteristics

- Provides structural integrity and neutron absorption to ensure sub-criticality during handling and transportation accident events
- Provides design features to maintain fuel clad temperatures below allowed maximum
- Eliminates need to handle bare SNF after receipt from reactor
- Provides compatibility with storage, transport, and disposal over-packs
- Minimizes spent fuel handling
- Meets thermal requirements for storage, transportation, and disposal
- Containment for transport and storage
- No performance allocation assigned to disposal container

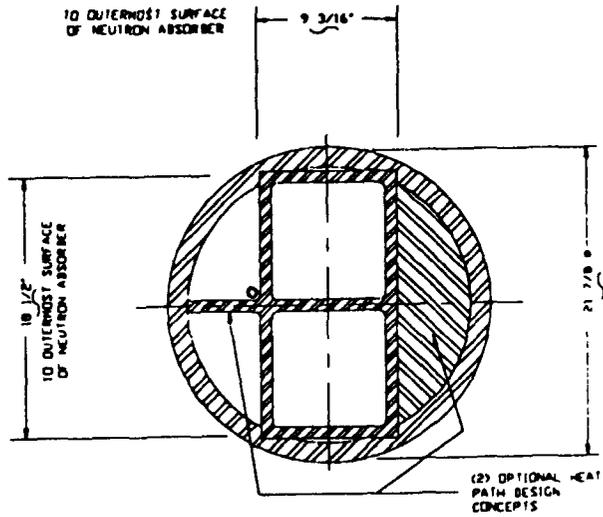
MPC Study -- MPC Preliminary Design Concepts

- **Large Canister**
 - 21 PWR/40 BWR
 - 125 Ton canister and rail transportation cask
 - Closure: double seal weld
 - Burn-up credit and poisoned canister
 - Stainless steel
- **Small Canister**
 - 2 PWR/4 BWR
 - 25 Ton Legal Weight Truck cask
- **Thick-walled Canister**
 - 16 PWR/37 BWR
 - Ductile cast iron over pack for shielding and disposal

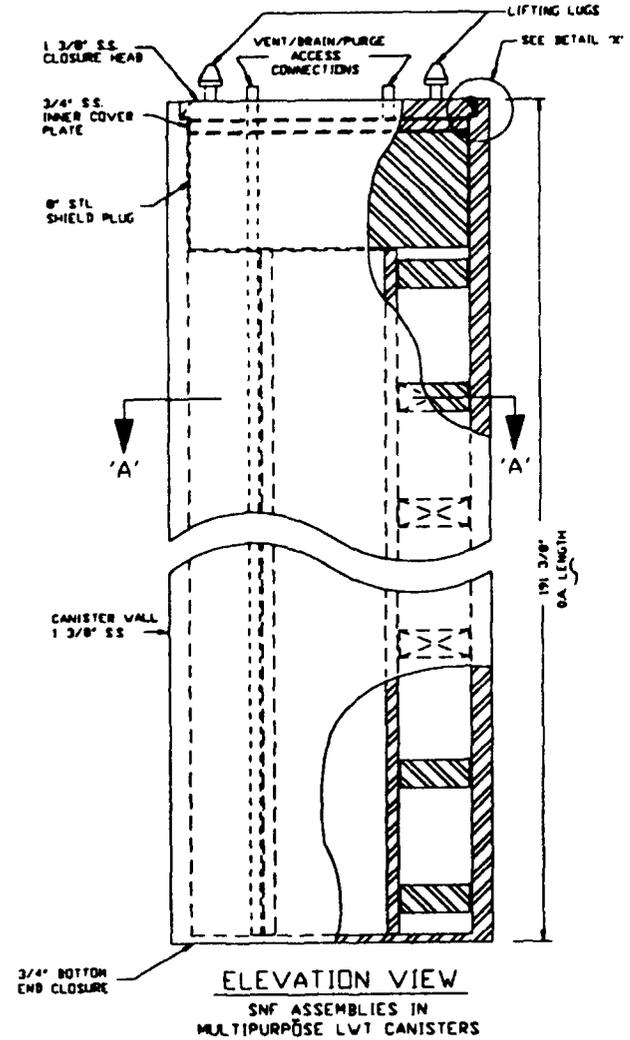
Large MPC - Preliminary Concept



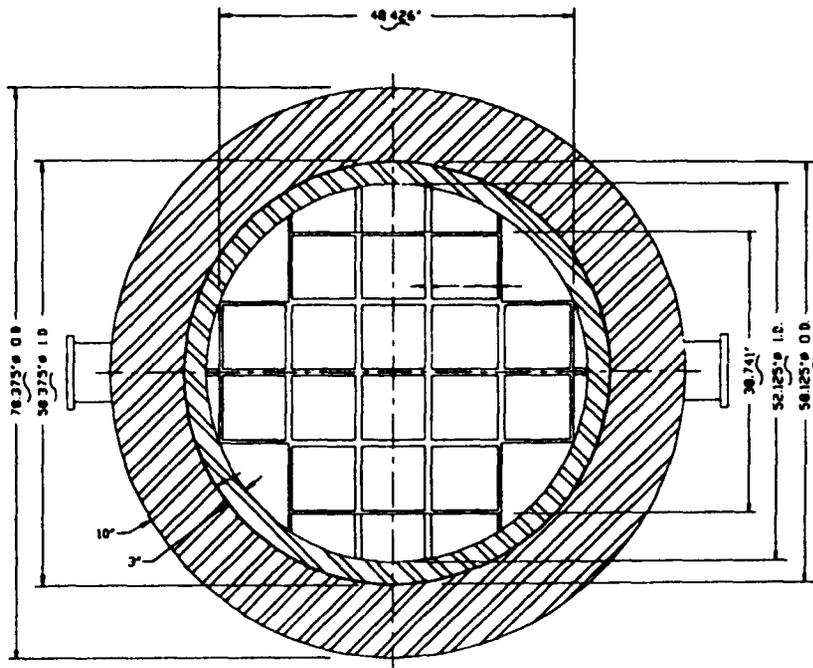
Small MPC - Preliminary Concept



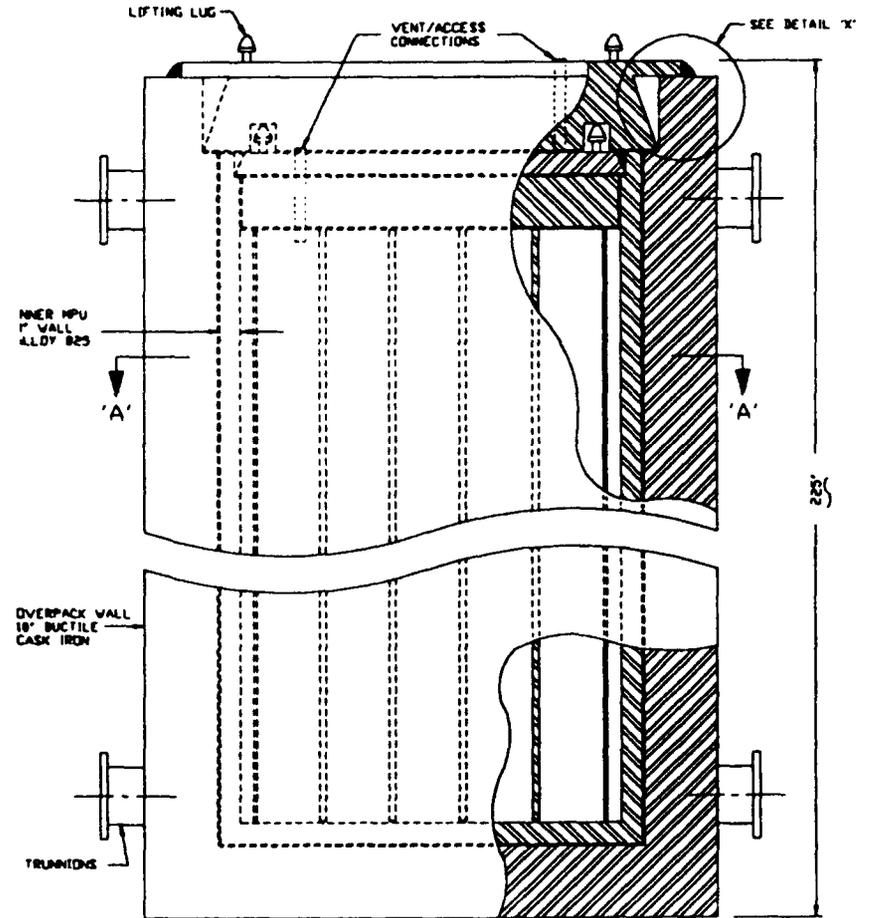
SECTION 'A-A'
 ARRANGEMENT OF 2 PWR
 SNF ASSEMBLIES IN
 MULTIPURPOSE LW1
 (LEGAL WEIGHT TRUCK)
 CANISTERS



Large MPU - Preliminary Concept



SECTION VIEW 'A-A'
ARRANGEMENT OF 16 PWR
SNF ASSEMBLIES IN
MULTI-PURPOSE UNIT

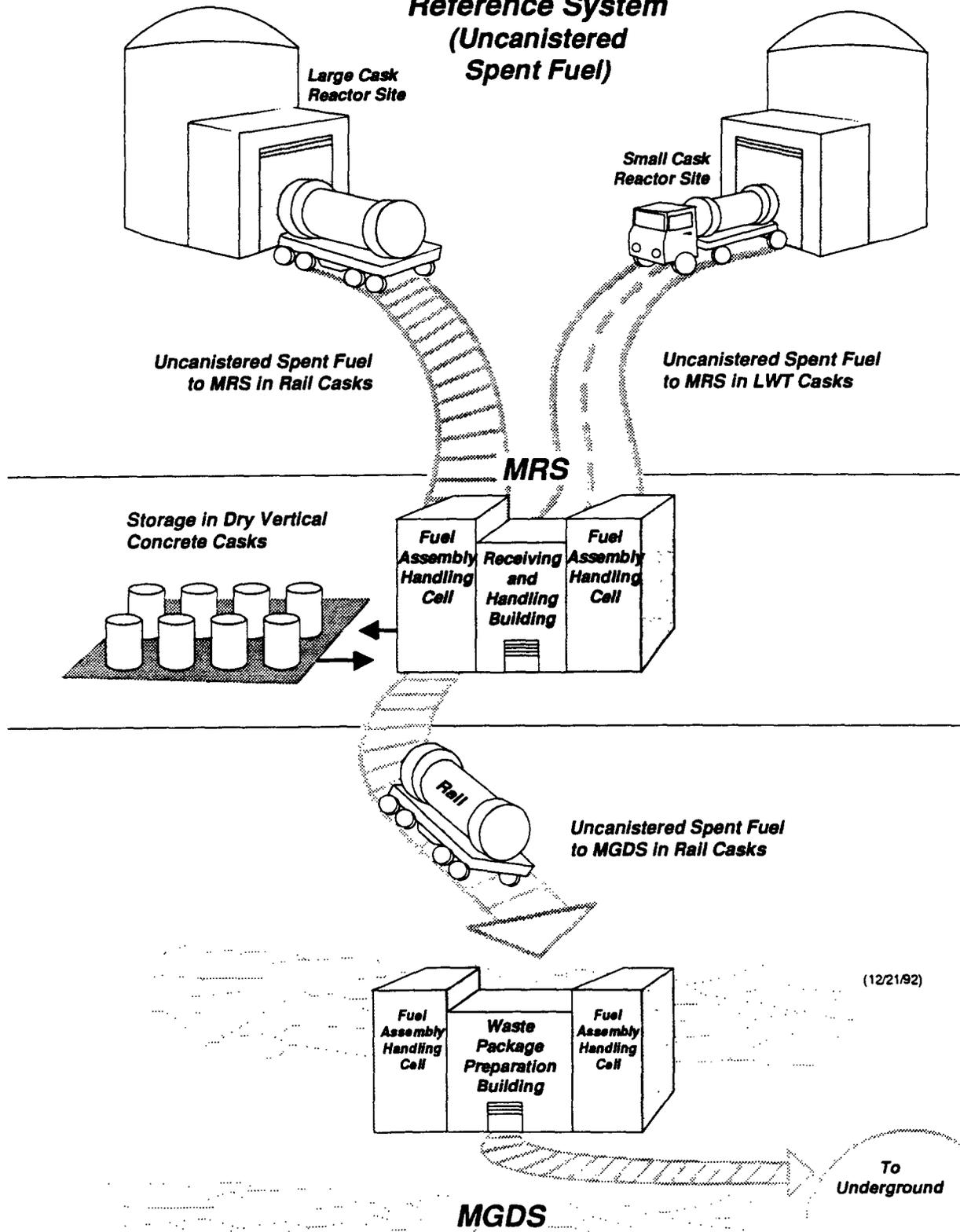


ELEVATION VIEW

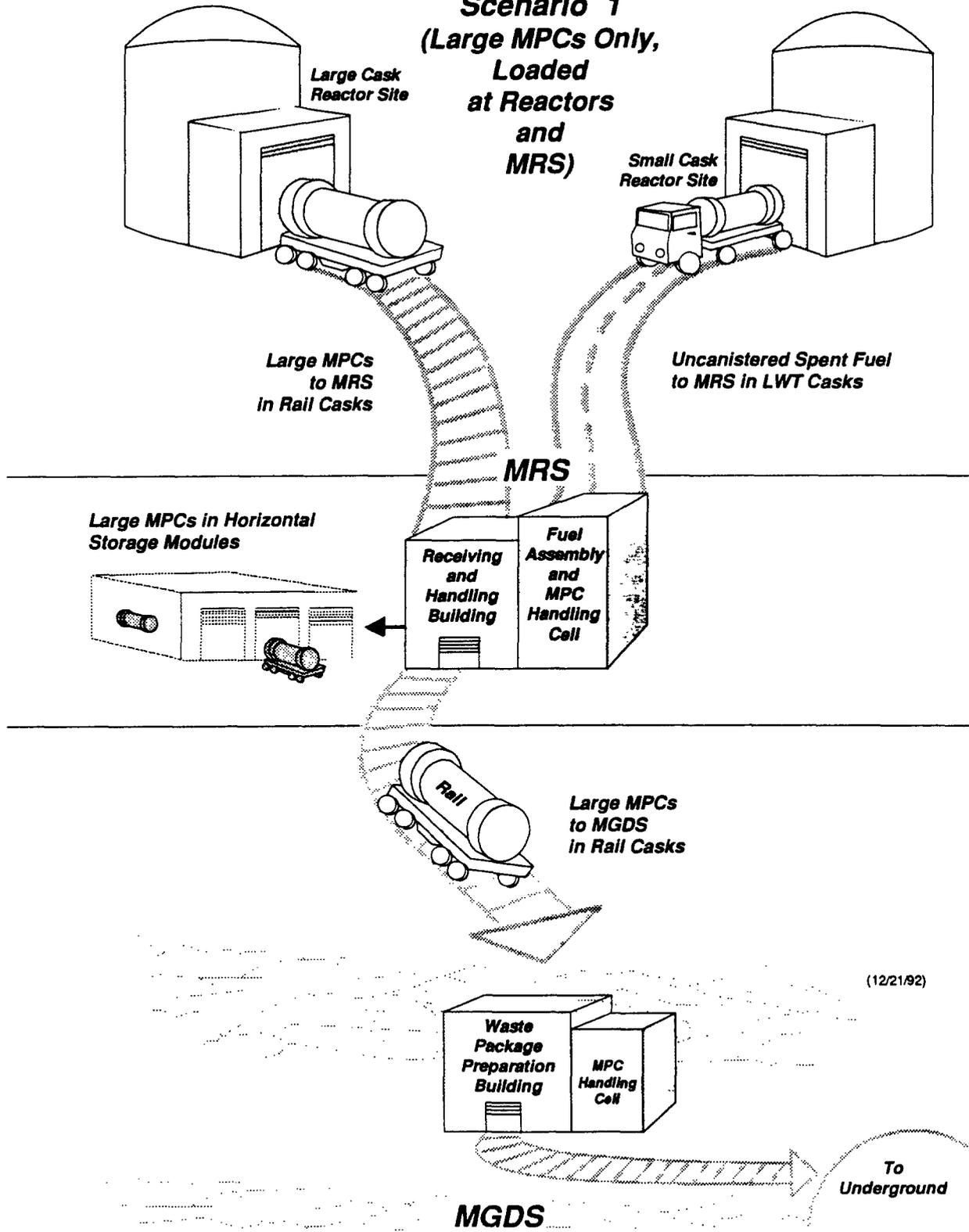
MPC Study -- Evaluation Scenarios

- MPC concepts compared to Reference waste system
 - Bare Spent Fuel loaded in transportation casks at reactors
 - Bare Spent Fuel unloaded at MRS and placed in concrete storage casks
 - Bare Spent Fuel transferred from concrete storage casks to transportation casks
 - Bare Spent Fuel unloaded from transportation casks at the repository and placed in disposal containers
- MPC scenarios included various combinations of large and small MPCs
 - Scenario 1 Large MPCs with some SNF handling at MRS
 - Scenario 2 Large MPCs all loaded at reactors
 - Scenario 3 Large and small MPCs loaded at reactors
 - Scenario 4 Small MPCs only (cold repository)
 - Scenario 5 Thick walled canister with ductile cast iron over-pack

Reference System (Unclustered Spent Fuel)

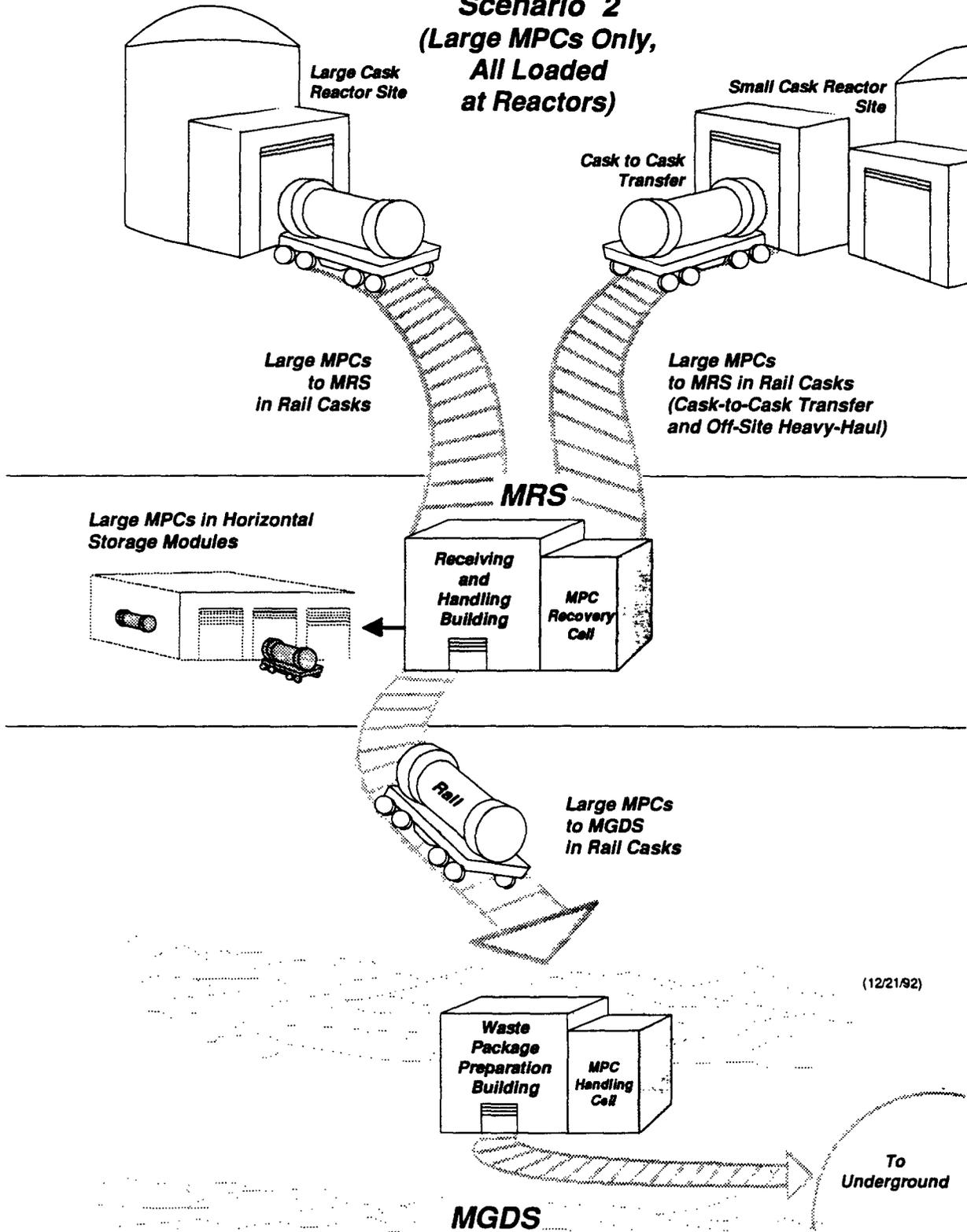


**Scenario 1
(Large MPCs Only,
Loaded
at Reactors
and
MRS)**

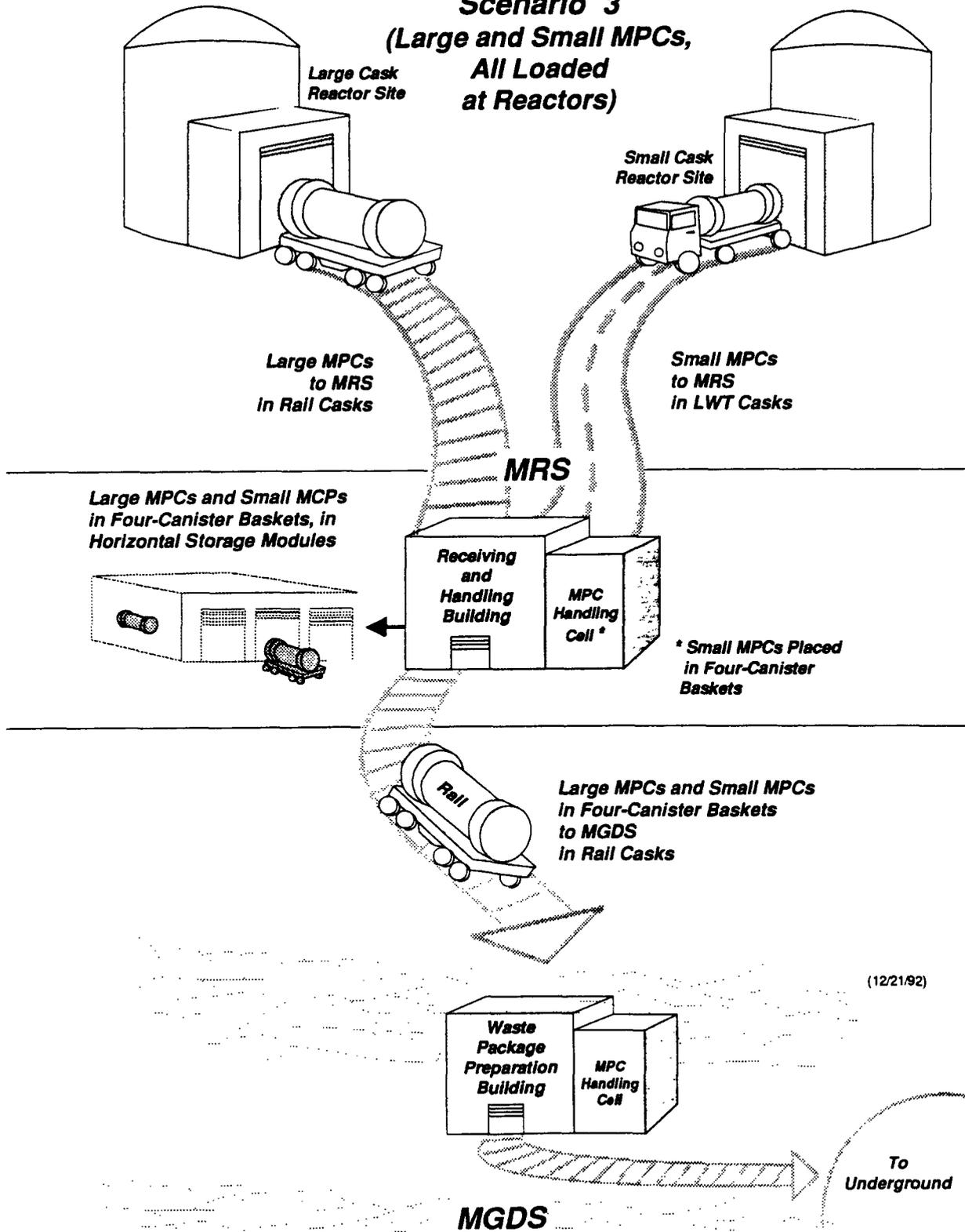


(12/21/92)

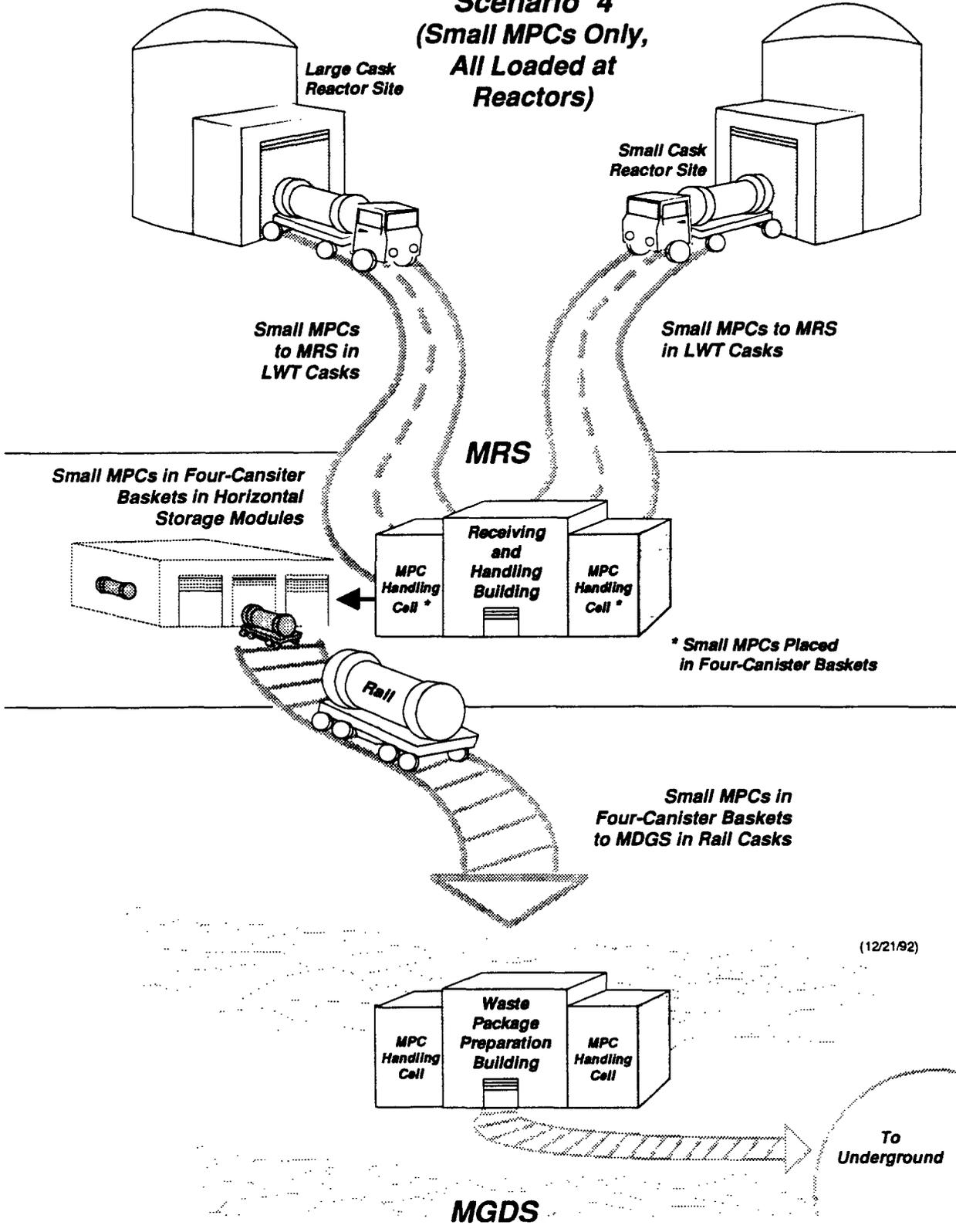
**Scenario 2
(Large MPCs Only,
All Loaded
at Reactors)**



**Scenario 3
(Large and Small MPCs,
All Loaded at Reactors)**

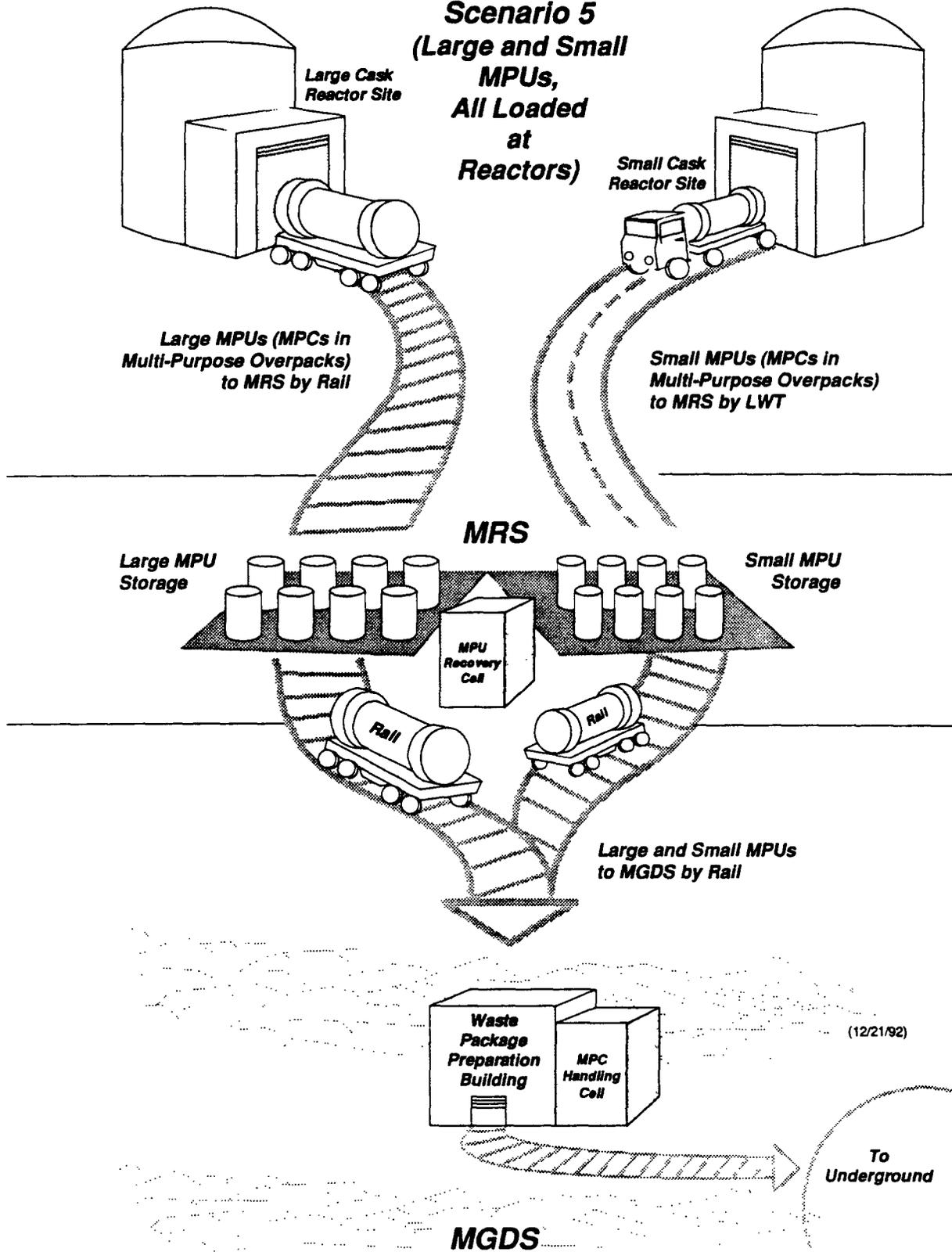


**Scenario 4
(Small MPCs Only,
All Loaded at
Reactors)**



(12/21/92)

**Scenario 5
(Large and Small
MPUs,
All Loaded
at
Reactors)**



MPC Study -- Evaluation Criteria

- **Quantitative**
 - SNF Handlings
 - Occupational and Public Radiation Exposure
 - Schedule impacts
 - Cost
- **Qualitative**
 - Public Perception
 - Licensing
 - Contract Resolution
 - Flexibility

MPC Study -- SNF Handlings

<u>SNF Handlings</u> <u>(thousands)</u>	<u>Ref.</u>	Scenarios				
		<u>Large</u> <u>MPC &</u> <u>BSNF</u>	<u>All</u> <u>Large</u> <u>MPC</u>	<u>Large/</u> <u>Small</u> <u>MPC</u>	<u>All</u> <u>Small</u> <u>MPC</u>	<u>Large/</u> <u>Small</u> <u>MPU</u>
Bare Assemblies	872	326	302	295	295	295
Heavy Containers	160	125	108	166	1059	179

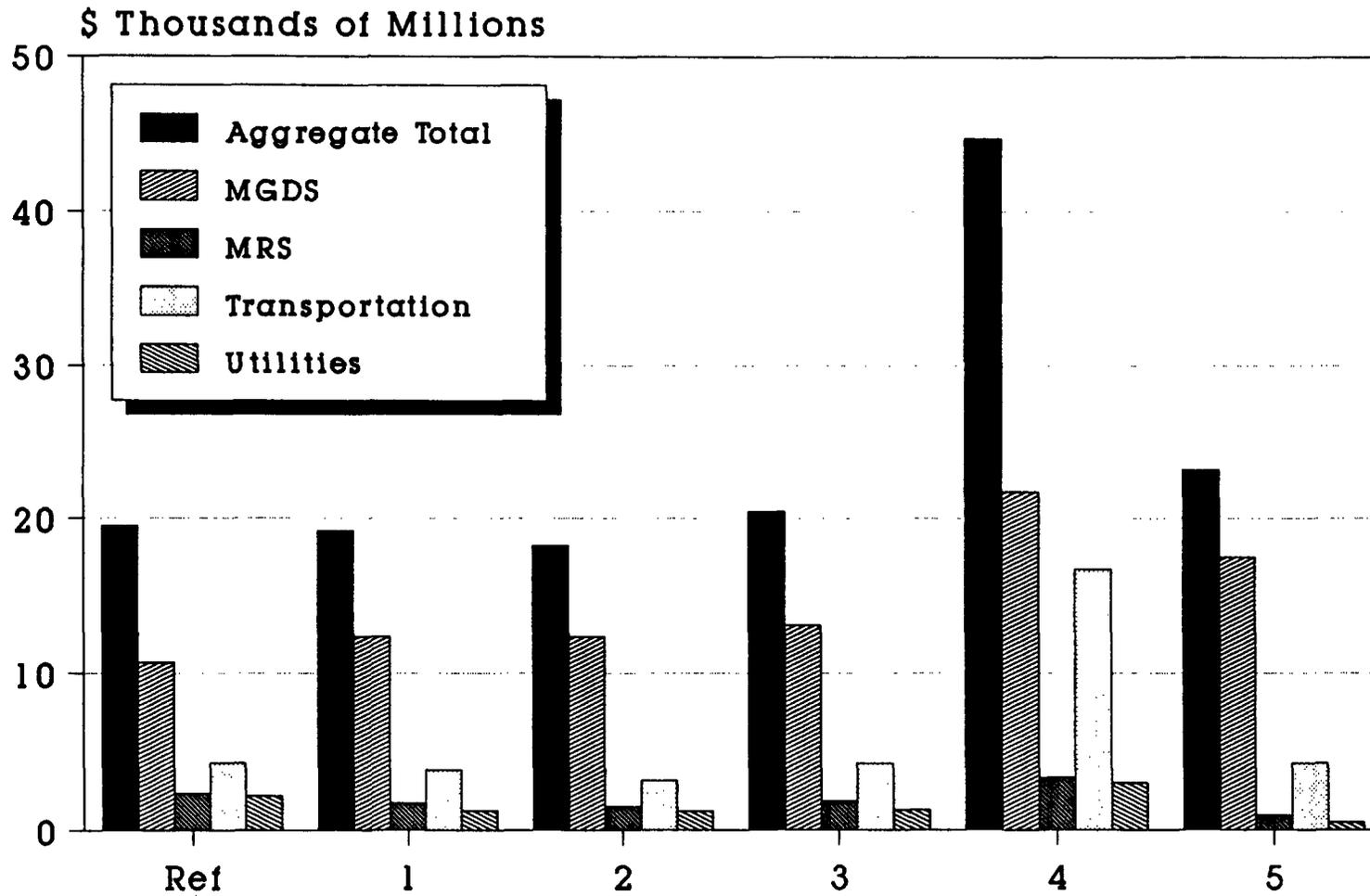
MPC Study -- Occupational and Public Radiation Exposure

<u>Person-Rem</u> <u>(thousands)</u>	<u>Ref.</u>	Scenarios				
		<u>Large</u> <u>MPC &</u> <u>BSNF</u>	<u>All</u> <u>Large</u> <u>MPC</u>	<u>Large/</u> <u>Small</u> <u>MPC</u>	<u>All</u> <u>Small</u> <u>MPC</u>	<u>Large/</u> <u>Small</u> <u>MPU</u>
At-Reactor	8	11	11	17	102	18
CRWMS	17	17	13	22	143	40
<u>Total</u>	<u>25</u>	<u>28</u>	<u>24</u>	<u>39</u>	<u>245</u>	<u>58</u>
Public portion of above total	3	3	1	5	50	9

MPC Study -- Comparative System Costs

<u>Element (\$M 1992)</u>	<u>Ref.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
<u>Utilities</u>	2190	1240	1210	1280	2990	479
Waste Fund						
<u>Addl. Equipment</u>	0	53	150	56	14	56
<u>Transportation</u>						
- Casks/Overpacks	1044	707	610	724	1670	0
- Operations	3250	3080	2380	3460	15000	4210
<u>MRS</u>						
- Facilities	1060	650	626	774	1430	124
- Operations	1270	1100	896	1070	1910	804
<u>MGDS</u>						
- Waste Package	3290	5190	5190	5920	14300	10300
- Trans MESC D&D	219	0	0	0	219	0
- Surf./Subsurf. (NE)	7200	7200	7200	7200	7200	7200
<u>Total Waste Fund</u>	<u>17333</u>	<u>17980</u>	<u>17052</u>	<u>19204</u>	<u>41743</u>	<u>22694</u>
<u>System Costs</u>	19523	19220	18262	20484	44733	23173

MPC Study -- Comparative System Cost Breakdown



MPC Study -- Summary of Economic Results

- Compared to Reference design, large MPC's show potential for \$1 Billion savings (Scenario-2).
- Compared to large MPC's, small MPC's cost twice as much, increase transportation costs by 6 times and more than double utility costs (Scenario-4).
- All scenarios except small MPC's (Scenario-4) significantly reduce utility total costs.
- All scenarios increase waste package costs compared to Reference design.

MPC Study -- MPC Implementation Schedule

Task Name	Years											
	92	93	94	95	96	97	98	99	0	1	2	
PHASE I - DETAILED EVALUATION		■										
PHASE II - DESIGN & LICENSING			■	■	■	■						
PHASE III - S&T DEPLOYMENT				■	■	■	■	■				
For At-Reactor Storage (Utility)				■	■	■						
For MRS Facility (DOE)				■	■	■	■					
PHASE IV - REPOSITORY DEPLOYMENT		■	■	■	■	■	■	■	■			
Repository Activities		■	■	■	■	■	■	■				
Cask-to-Cask Transfer Device		■	■	■	■	■	■	■				
2nd Generation MPCs					■	■	■	■				

MPC Study -- Preliminary Technical Conclusions

- **Maximum benefits achieved with all sites using large MPC's**
 - **100% clean MRS**
 - **Standardization on site storage**
- **Large MPC's not compatible with low-thermal loading repository**
- **MPC upper bound capacity about 21 PWR assemblies**
- **Presently licensed MESC's and those under design by vendors are not believed to be certifiable for disposal under 10 CFR Part 60 regulations**
- **Burn-up credit must be incorporated in the MPC design**

MPC Study -- Advantages

- **Facilitates compatibility of at-reactor dry storage with CRWMS**
- **Allows shutdown reactors to proceed with expeditious decommissioning of spent fuel pools**
- **Allows direct acceptance of SNF by CRWMS without repackaging**
- **Reduces contamination/low-level waste concerns at CRWMS facilities**
- **Reduces bare spent fuel handling operations**
- **Provides an additional containment barrier**
- **Simplifies CRWMS facilities (CMF, MRS, MGDS)**

MPC Study -- Disadvantages

- **Requires additional at-reactor operations**
- **Standardized system with large MPC not compatible with all reactor facilities**
- **Involves increase in cask fleet size**
- **Requires amendments to existing 10 CFR 961 standard contract**
- **Involves amendments to existing utility operating licenses**

Issues and Future Activities -- Issues

- Industry issues
 - Standard contract (10 CFR Part 961)
 - Reactor facility upgrades
- MPC licensing issues
 - Burnup credit
 - Opening/Inspection requirements
 - Certification for utility use under General License
 - Licensing/Certification schedule
 - NRC issues
- Repository uncertainties
 - Canister filler material (nuclide retention, heat transfer)
 - Amount of shielding
 - Hot vs Cold
 - Performance credit for canisters

Issues and Future Activities -- Future Activities

- Continue interactions with utility industry
- Develop MPC conceptual design
- Develop Transportation overpack designs
- Refine system designs based on MPC concept