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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
SG&G PANEL MEETING:
SCENARIO A AND ESF DESIGN/CONSTRUCTION

SUBJECT: FOCUSED ACD STRATEGY

PRESENTER: DEAN STUCKER

PRESENTER'S TITLE AND ORGANIZATION: LEAD PROJECT ENGINEER,
REPOSITORY/WASTE PACKAGE/MPC
U.S. DEPARTMENT OF ENERGY
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

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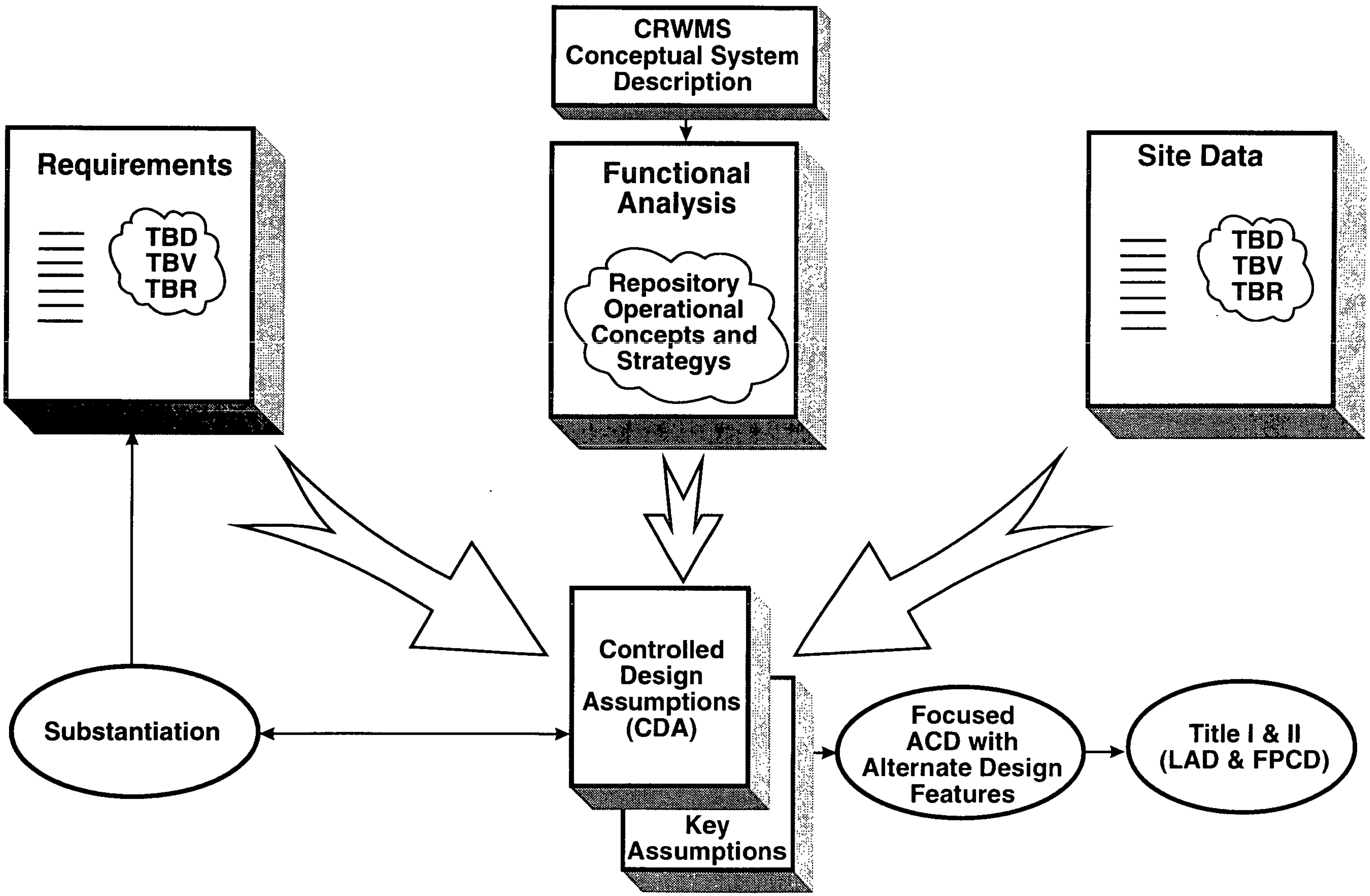
61394CVR1 125 NWTRB PM4/6-13-94

Briefing Topics

- Focused ACD strategy
- Requirements document hierarchy
- Key assumptions
- Thermal loading decision strategy
- Focused ACD schedule
- ACD Initial Summary Report

Focused ACD Strategy



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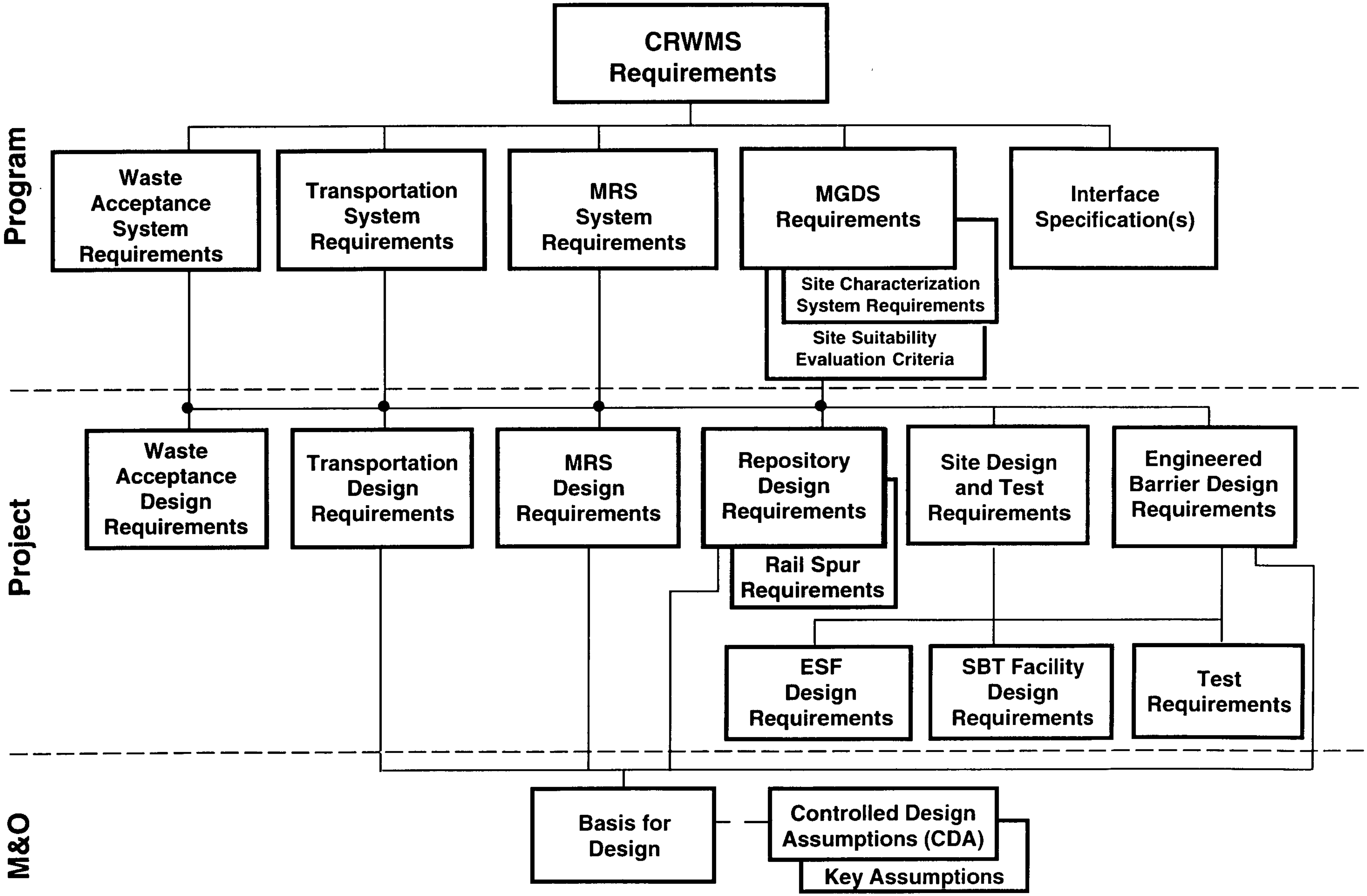
Requirements Document Hierarchy



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Key Assumptions
(Group 1)

- Tunnel excavation method - mechanical
- Rod consolidation - unutilized
- Emplacement mode - horizontal
- Underground transportation - rail
- Criticality control method - burnup credit
- Waste package shielding - containment barrier shielding
- Repository horizon - TSw2
- Retrieval strategy - developed
- Sub-surface fault stand-off - sixty meters
- Substantially complete containment strategy - developed
- Criticality control period - repository life (10,000 years)

Tunnel Excavation Method

Assumption:

- The primary method of tunnel excavation will be mechanical
- Where it is impractical to use mechanical methods, drill-and-blast may be used to a limited degree primarily in non-emplacement areas of the repository

Rod Consolidation

Assumption:

- Rod consolidation will not be performed at the MGDS
- The option for rod consolidation will be removed from the current Technical Baseline

Emplacement Mode

Assumption:

- Waste packages will be emplaced in-drift in a horizontal mode

Underground Transportation

Assumption:

- Integrated rail transport will be used for subsurface transport of waste packages
- Rail will be used for transporting supplies and personnel to the extent practical

Criticality Control Method

Assumption:

- Will receive credit for burnup

Waste Package Shielding

Assumption:

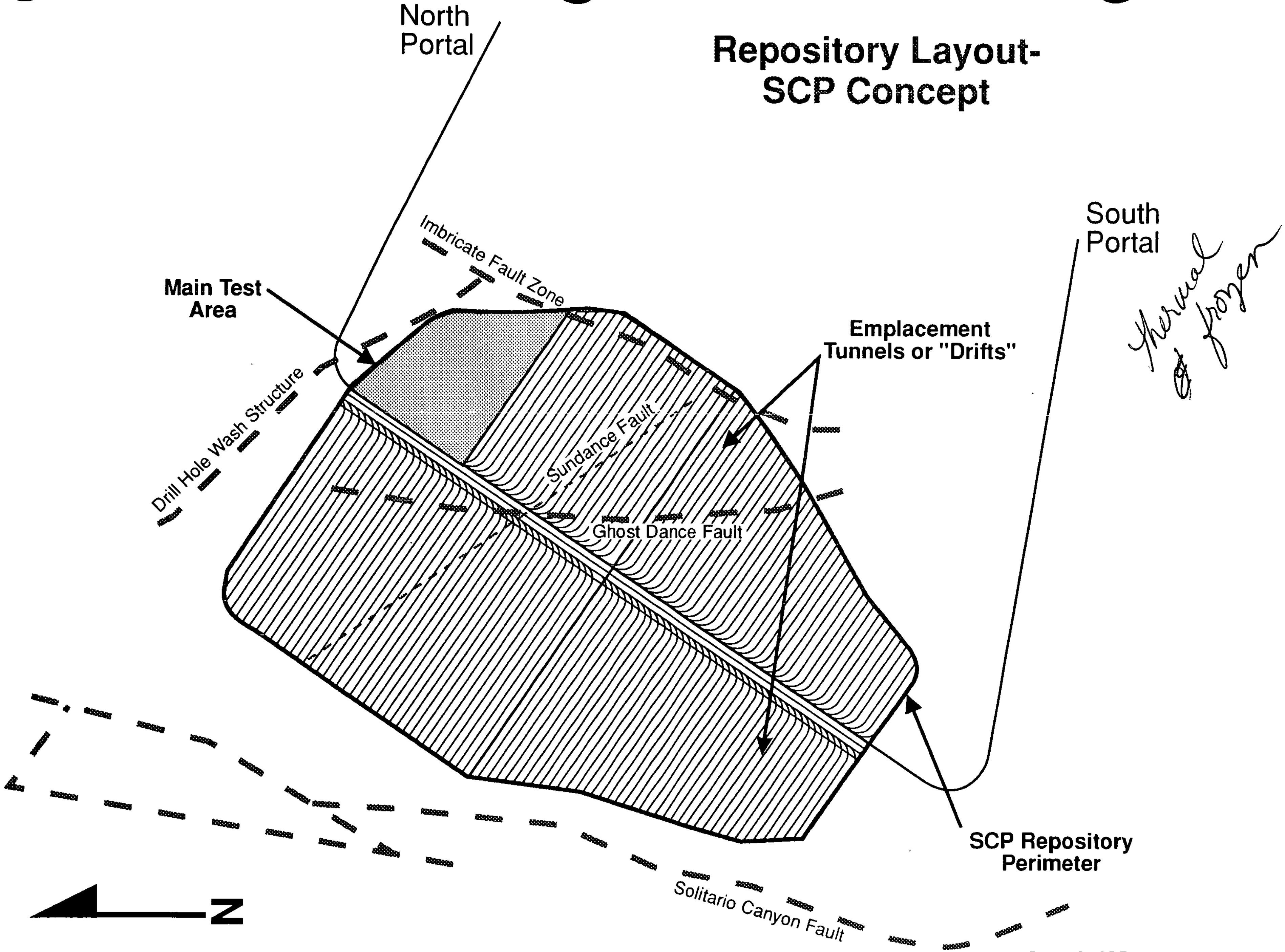
- Waste package containment barriers will provide sufficient shielding for protection of materials from radiation enhanced corrosion
- Additional shielding for personnel protection provided on transporter and in surface facilities
- Individual waste packages will not be shielded to personnel limits

Repository Horizon

Assumption:

- Repository horizon will be limited to the TSw2 geologic unit in the primary area

Repository Layout- SCP Concept



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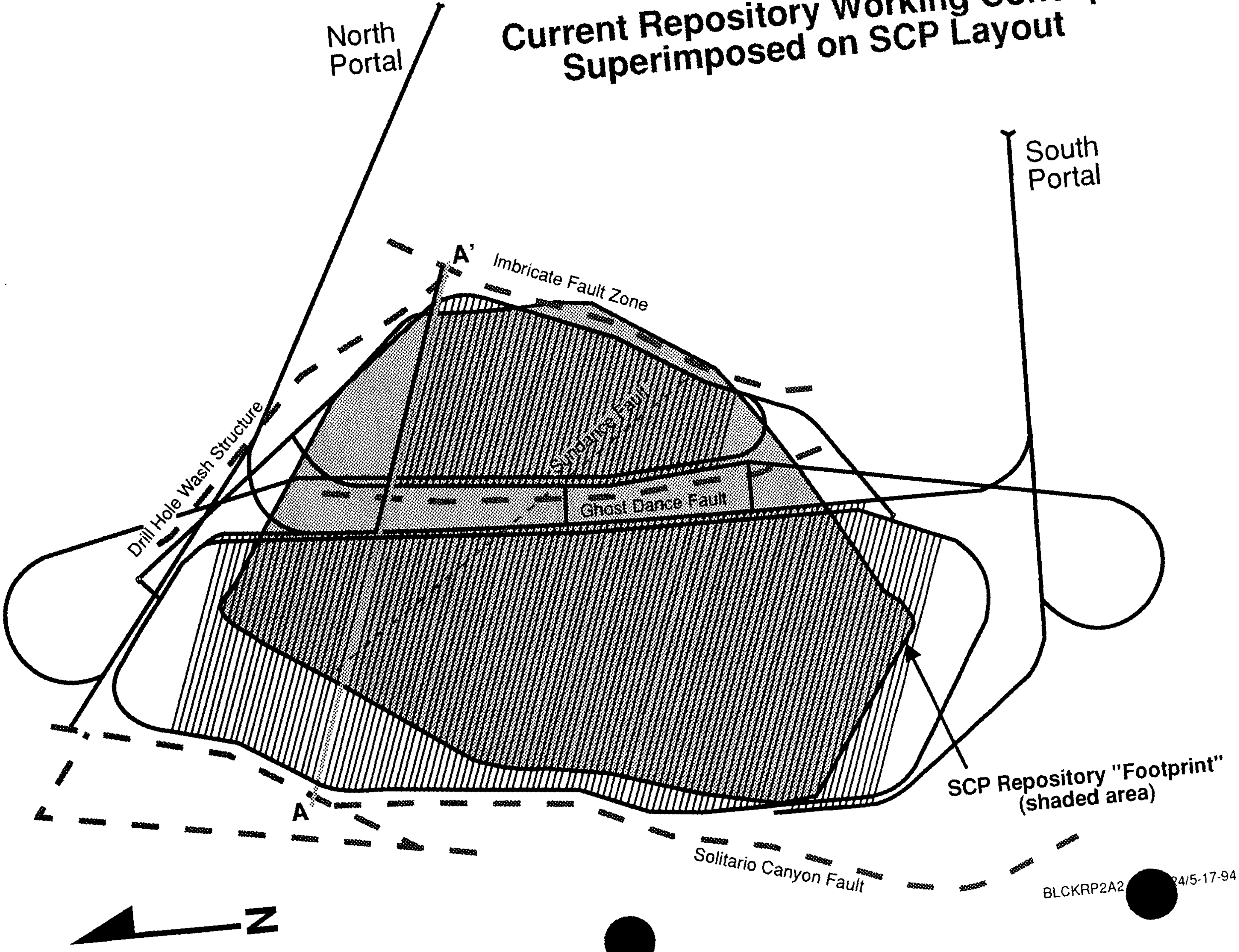
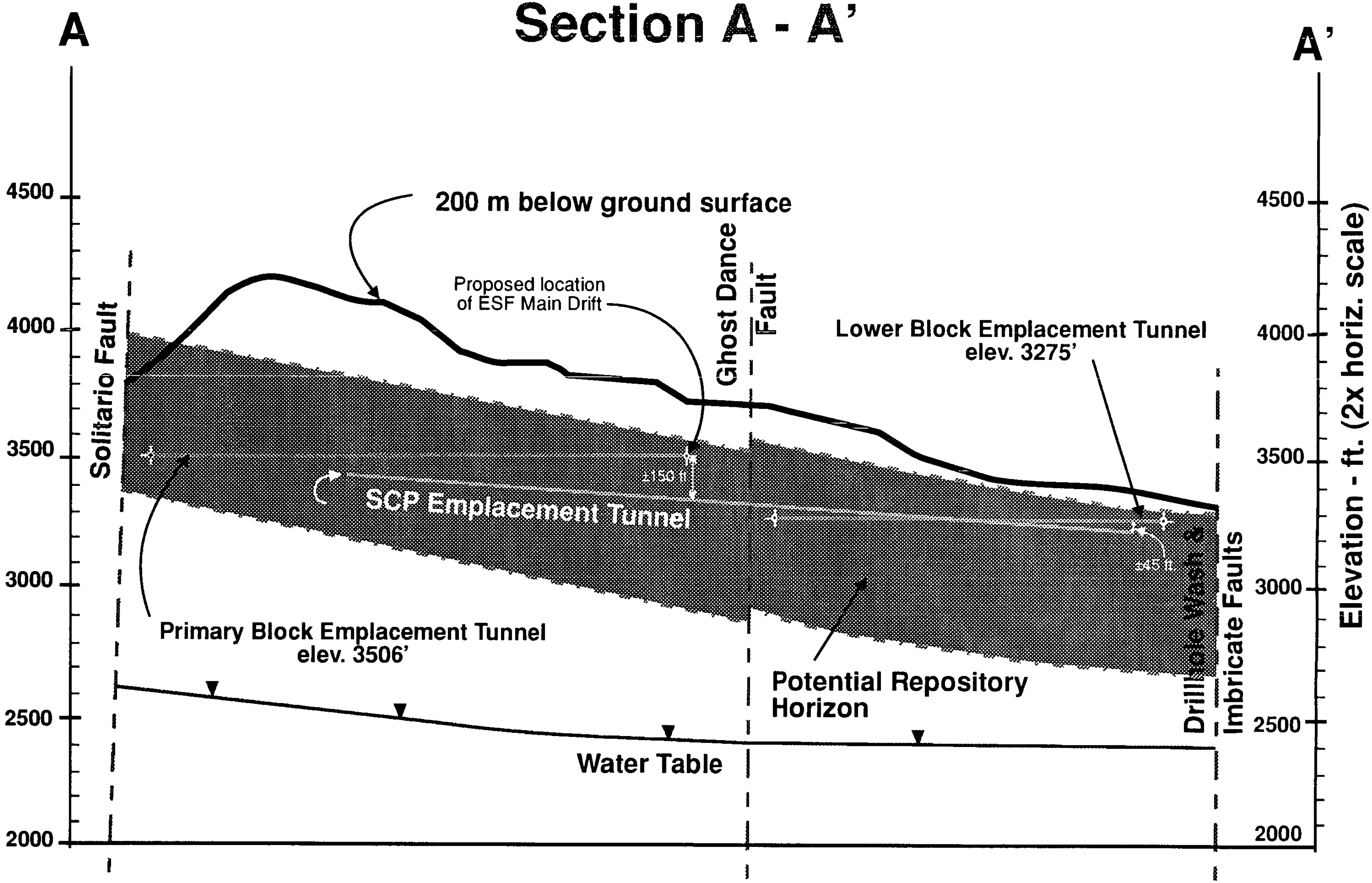
Current Repository Working Concept Superimposed on SCP Layout



Section A - A'



Note: Plane of section cuts through lowest emplacement drift in working concept layout.

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Retrieval Strategy

Assumption:

- The repository will be designed (proof of principle) for a retrievability period of up to 100 years after initiation of emplacement

- Retrieval of emplaced waste will be performed for the following reasons
  - Failure of site or waste package or some other system causing a possible risk to public health
  - DOE would have determined that recovery of valuable resources from the spent nuclear fuel is necessary

- Repository design will not preclude the possibility of constructing facilities for temporary or lag storage of retrieved waste packages if required

Subsurface Fault Stand-Off

Assumption:

- To the extent practical, locate repository openings to avoid faults that traverse a major portion of the potential emplacement area
- Avoidance is assumed to be adequate using a 60 m offset from the main trace of a fault at the repository level
  - Exception: 120 m offset should be used on the west side of the Ghost Dance Fault because the ESF Topopah Spring Main drift will be excavated before the Ghost Dance Fault characteristics are fully investigated
- Where avoidance cannot be reasonably achieved, for Type I faults that intersect emplacement drifts, allow 15 m stand-off distance of emplaced waste packages from the edges of the fault zone

Substantially Complete Containment Strategy

Assumption:

- Statement in 10 CFR 60.113 will be retained as is, with substantially complete containment not defined quantitatively
- Design goal - achieve mean waste package lifetime well in excess of 1000 years
- Fraction of waste packages breached at 1000 years less than 1%

Criticality Control Period

Assumption:

- Control required for period of isolation
- Period of isolation currently 10,000 years

Key Assumptions
(Group 2)

- Waste type and quantity
- Backfill strategy
- Surface facilities location
- Operations generated waste disposal
- Sub-surface robotics
- Repository thermal load
- Waste package materials

Waste Type and Quantity

Assumption:

- Rail shipments total approximately 3800 (MPC = 3300, HLW = 500) with 3 SNF train cars per rail shipment
- Truck shipments total approximately 1900, all uncanistered SNF
- Receipt at repository starting 2010 and ending 2033
- Receipt and emplacement rate in accordance with repository requirements Document Table 3-3. Steady state rate 3000 MTU/yr SNF, 400 MTU/yr (equivalent) HLW glass
- Total commercial spent nuclear fuel - 63000 MTU in about 9000 MPCs and some uncanistered fuel waste packages
- Average spent nuclear fuel 22 years old with 42.2 Gwd/MTU burnup (PWR)
- No repackaging of MPC's for purposes of Heat Load Tailoring
- Total high level waste - 7000 MTU equivalent in 14000 HLW glass canisters of Savannah River/West Valley design

Backfill Strategy

Assumption:

- **No backfill will be used in the emplacement drifts**

Surface Facilities Location

Assumption:

- The proposed repository surface facilities will be located adjacent to the north portal

Operations Generated Waste Disposal

Assumption:

- Site generated low level radioactive waste will be collected, treated, packaged, and disposed at the Geologic Repository Operations Area

Subsurface Robotics

Assumption:

- Robotics will be used where applicable to achieve the concept of ALARA
- No human entry will be allowed in an emplacement drift while waste packages are present. The waste emplacement/retrieval equipment may use robotics features to perform operations within the emplacement drifts
- Robotics may be used to perform routine monitoring activities during the pre-closure period
- Remote handling systems will be used for operations not applicable to robotics and will provide a safe recovery and back-up method for robotics systems

Repository Thermal Load

Assumption:

- Develop a surface/subsurface configuration that will accommodate thermal loading operations for both a primary, high thermal load (80-100 MTU/acre, 91-114 KW/acre) and an alternative, low thermal load (25-35 MTU/acre, 28-40 KW/acre)

hotter

not so hot

- Develop waste package/EBS designs to accommodate both primary and alternative thermal load ranges as specified above
- A preliminary repository operational thermal load decision will be made by 2008 license application update
- Final thermal load confirmation will be made during operations
- Performance confirmation areas will be designed for both low and high thermal loads

Waste Package Containment Barrier Materials

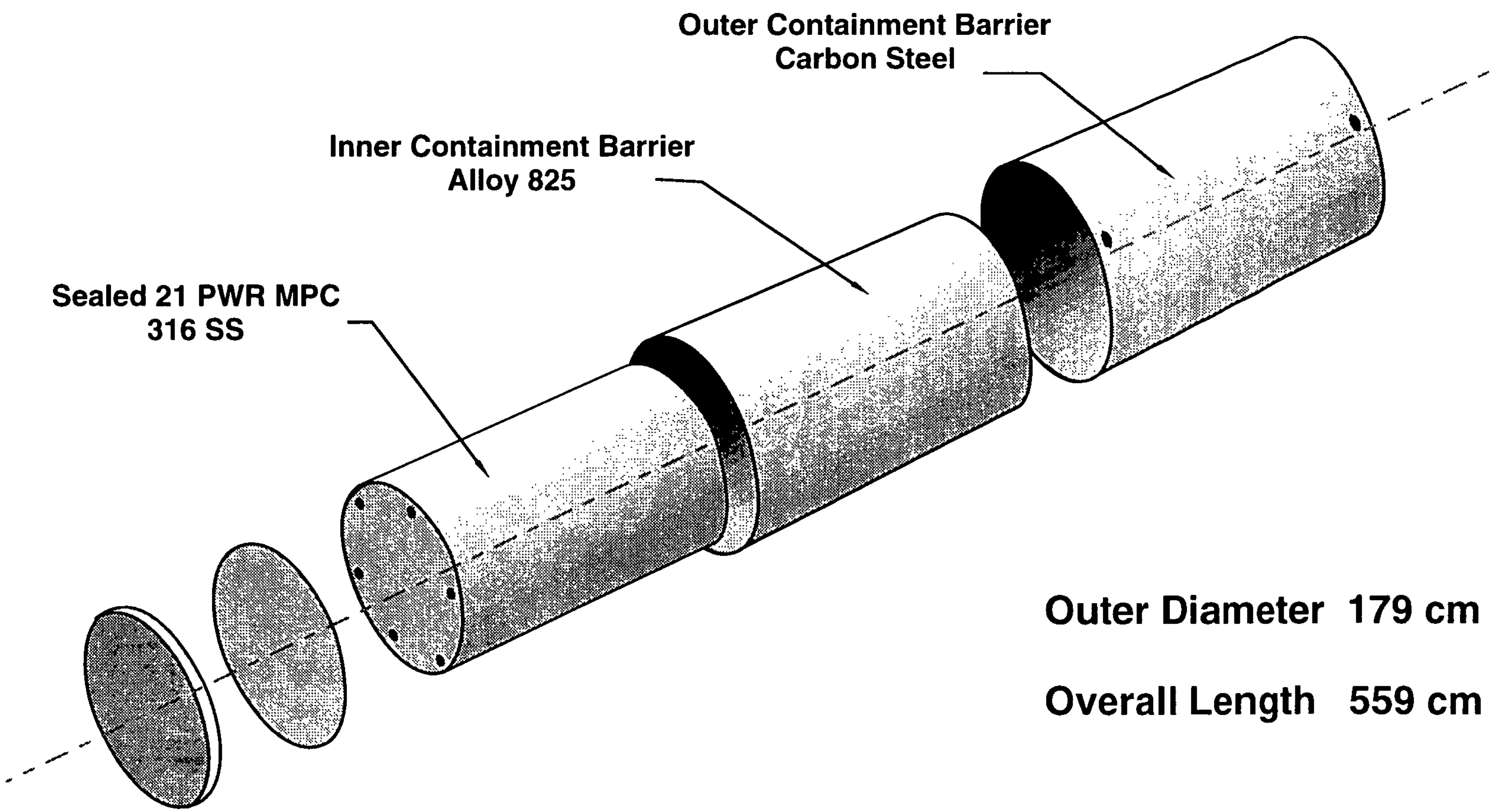
Assumption:

- **Assume materials in accordance with the thermal loading assumption for primary and alternative cases**
- **Materials assumption for the primary, high thermal load (80-100 MTU/acre, 91-114 KW/acre)**
  - Inner Containment Barrier: Alloy 825
  - Outer Containment Barrier: A516
- **Materials assumption for the alternative, low thermal load (25-35 MTU/acre, 28-40 KW/acre)**
  - Inner Containment Barrier: Alloy 825
  - Middle Containment Barrier: A516
  - Outer Containment Barrier: Monel 400
- **An alternative to each of the component materials indicated will be identified in the CDA document since containment barriers are important to waste isolation**

Waste Package Design

21 PWR Multi-Purpose Canister

Primary Thermal Load Case



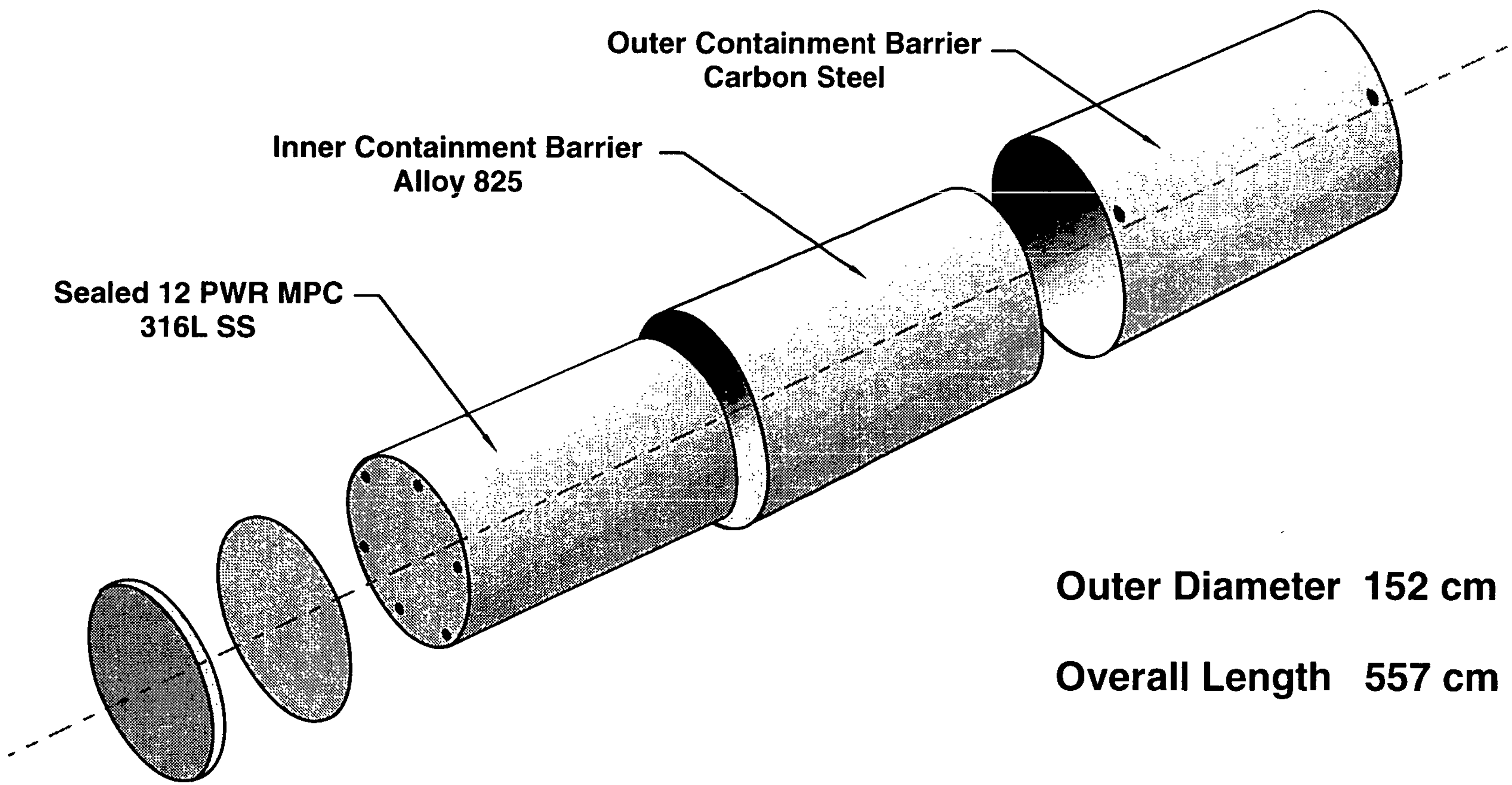
Outer Diameter 179 cm

Overall Length 559 cm

Waste Package Design

12 PWR Multi-Purpose Canister

Primary Thermal Load Case



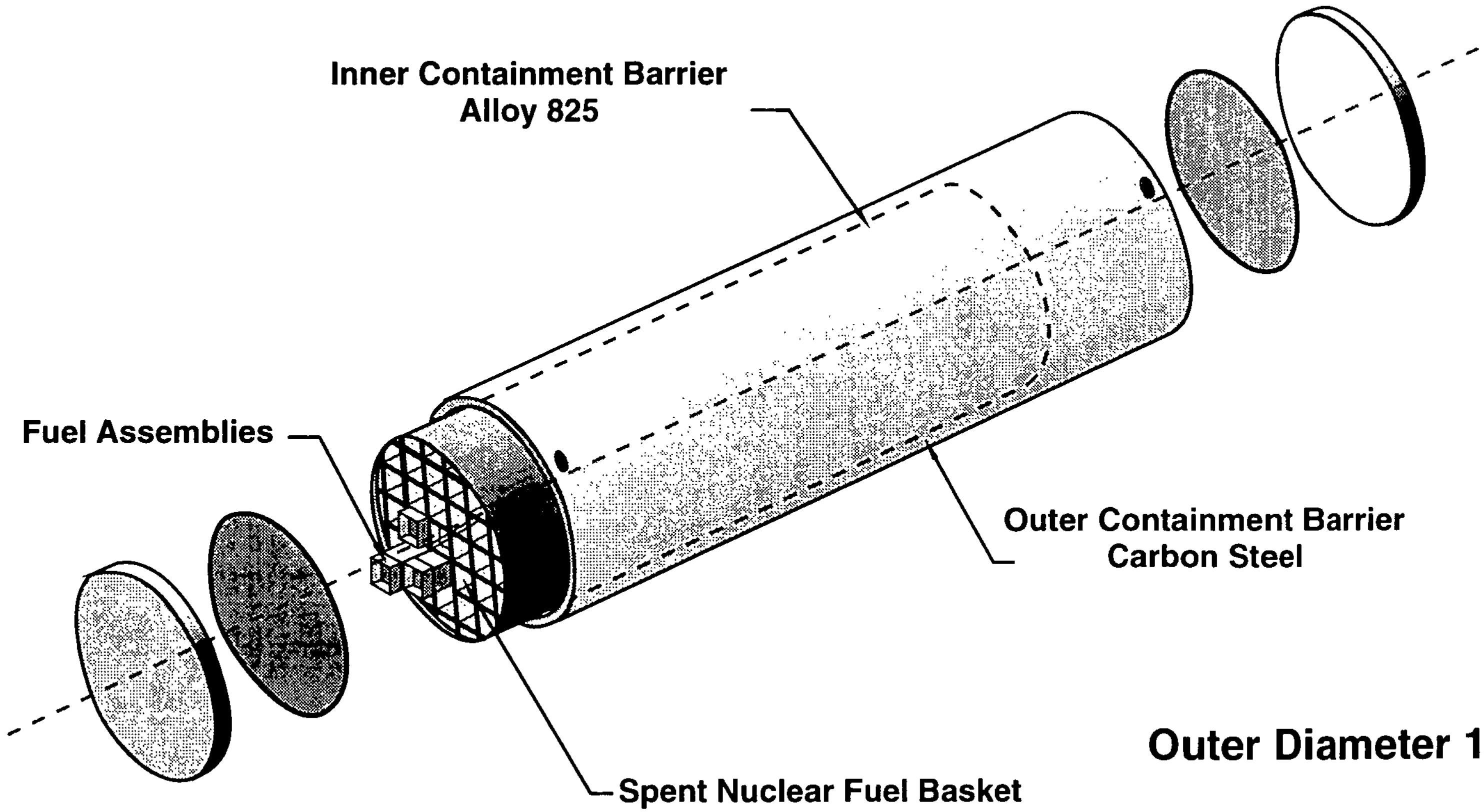
Outer Diameter 152 cm

Overall Length 557 cm

Waste Package Design

Uncanistered Spent Fuel

Primary Thermal Load Case



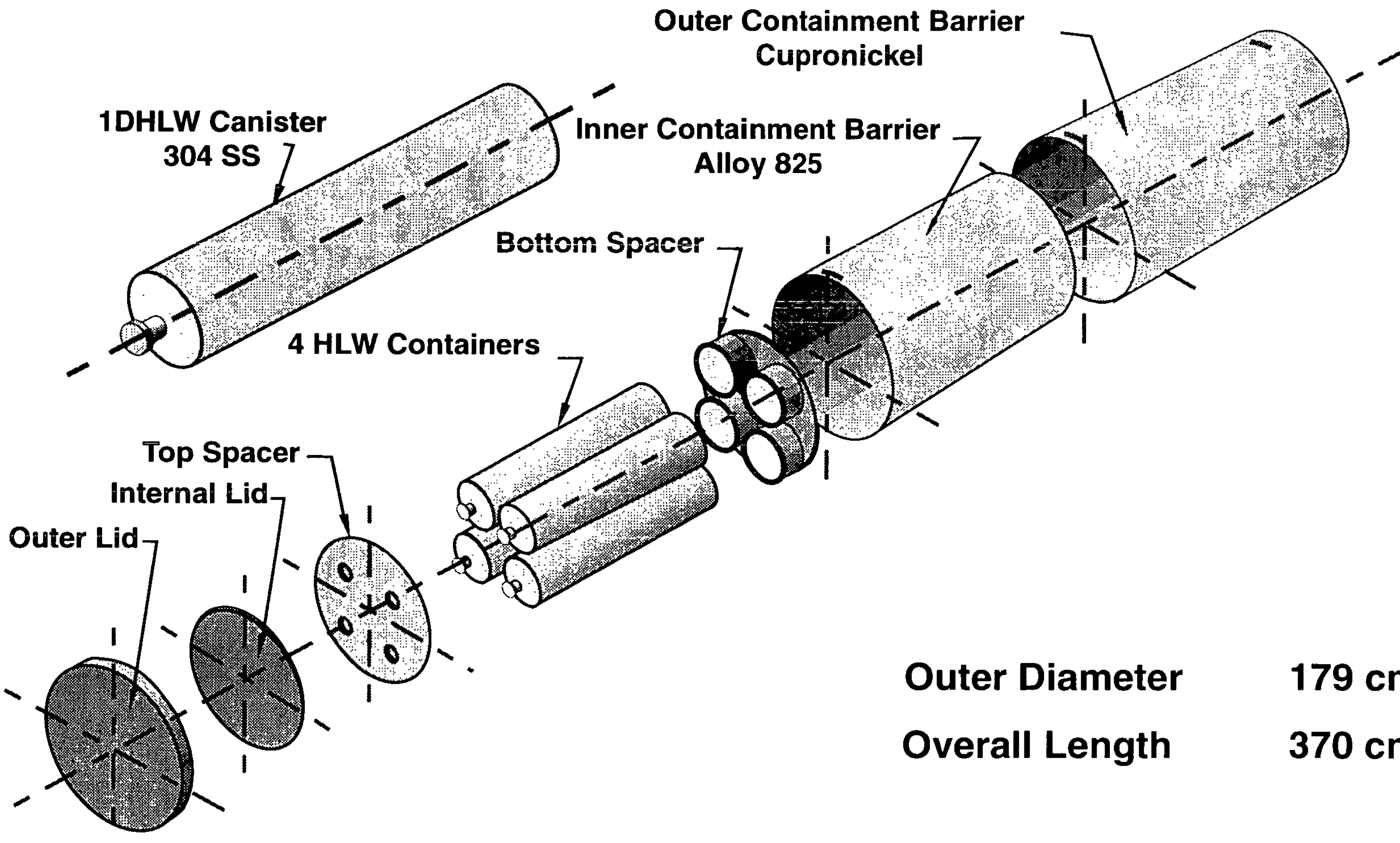
Outer Diameter 175 cm

Overall Length 529 cm

Waste Package Design

High Level Waste Glass Canister

Primary Thermal Load Case

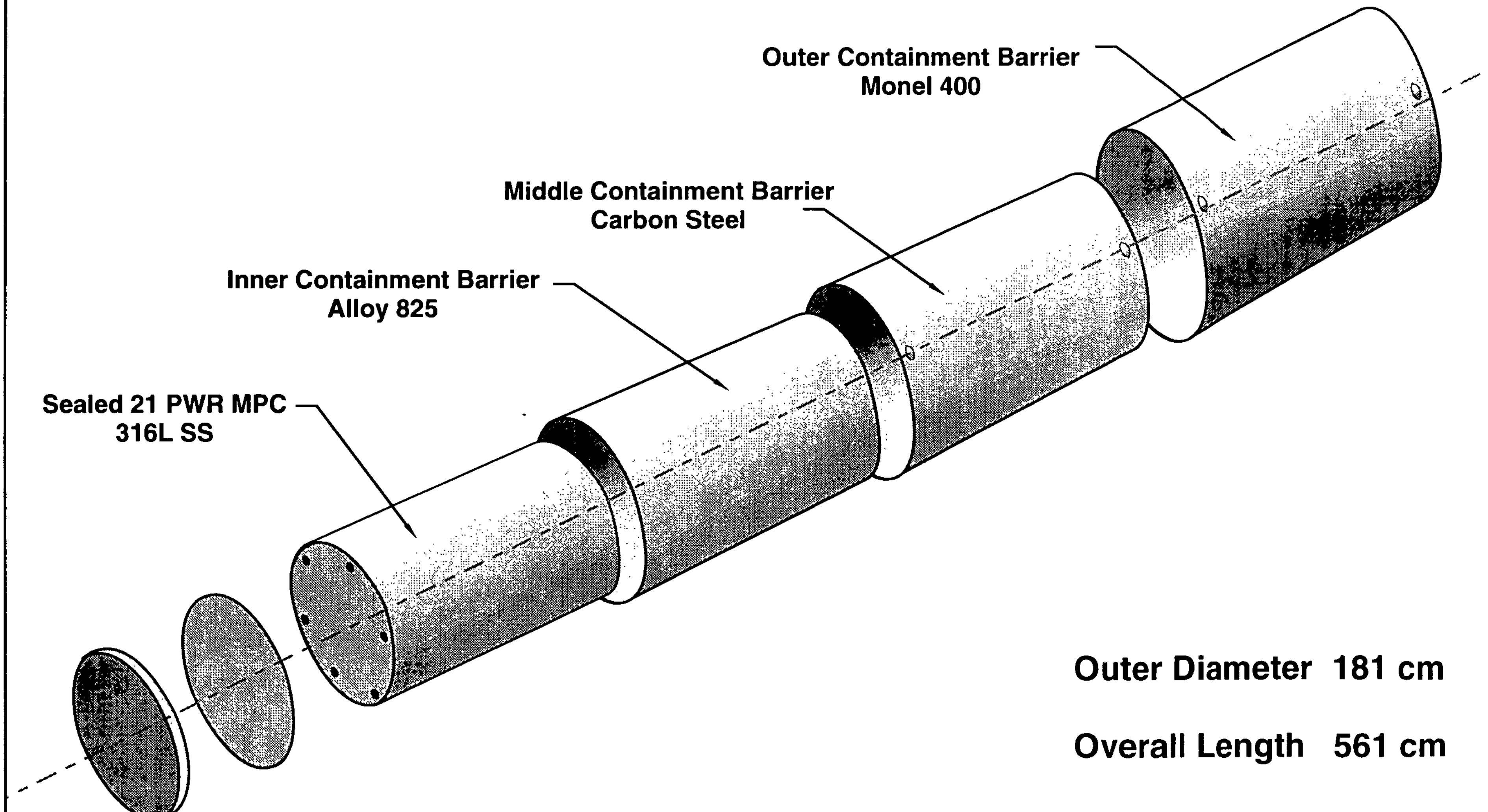


Outer Diameter	179 cm
Overall Length	370 cm

Waste Package Design

21 PWR Multi-Purpose Canister

Alternative Thermal Load Case



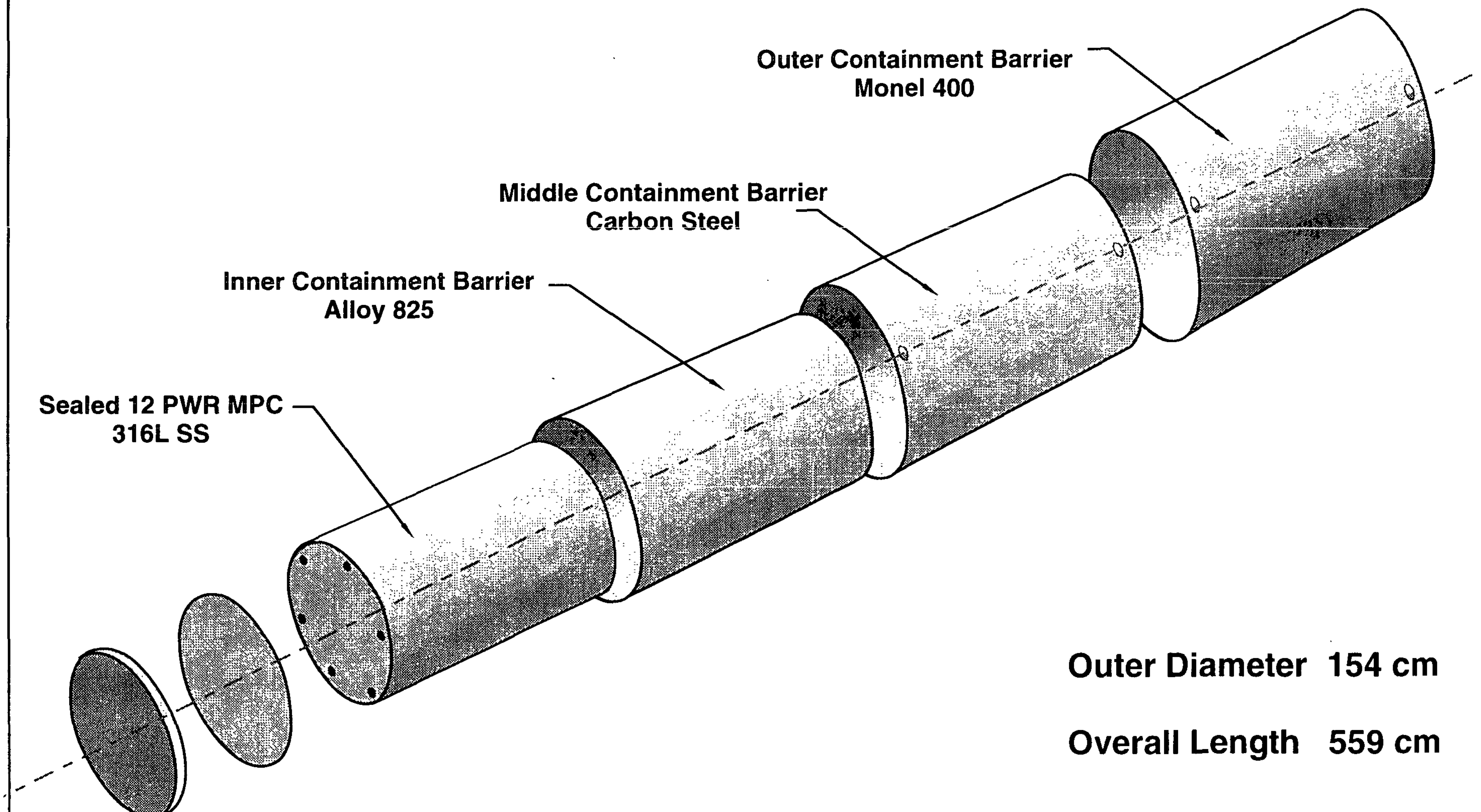
Outer Diameter 181 cm

Overall Length 561 cm

Waste Package Design

12 PWR Multi-Purpose Canister

Alternative Thermal Load Case



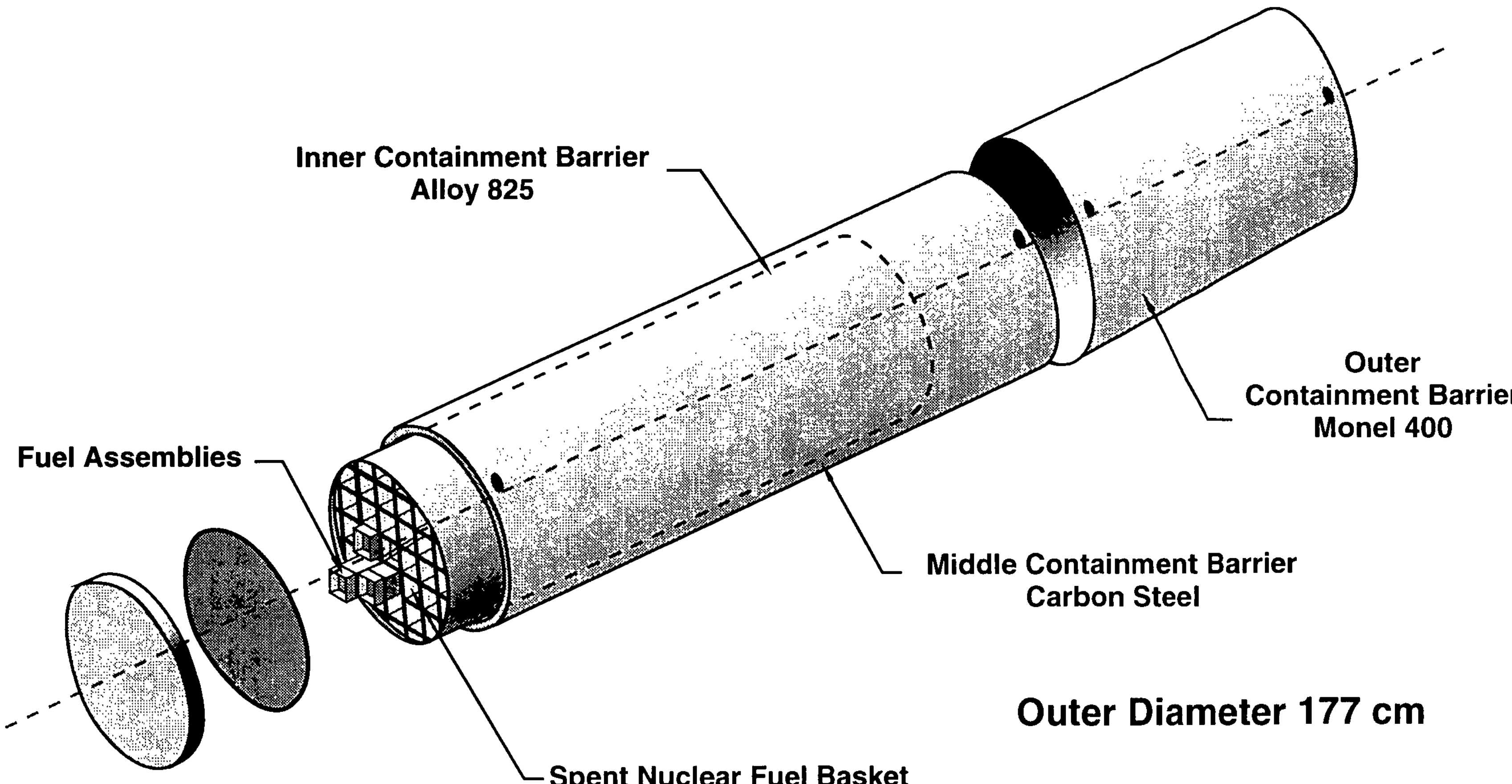
Outer Diameter 154 cm

Overall Length 559 cm

Waste Package Design

Uncanistered Spent Fuel

Alternative Thermal Load Case



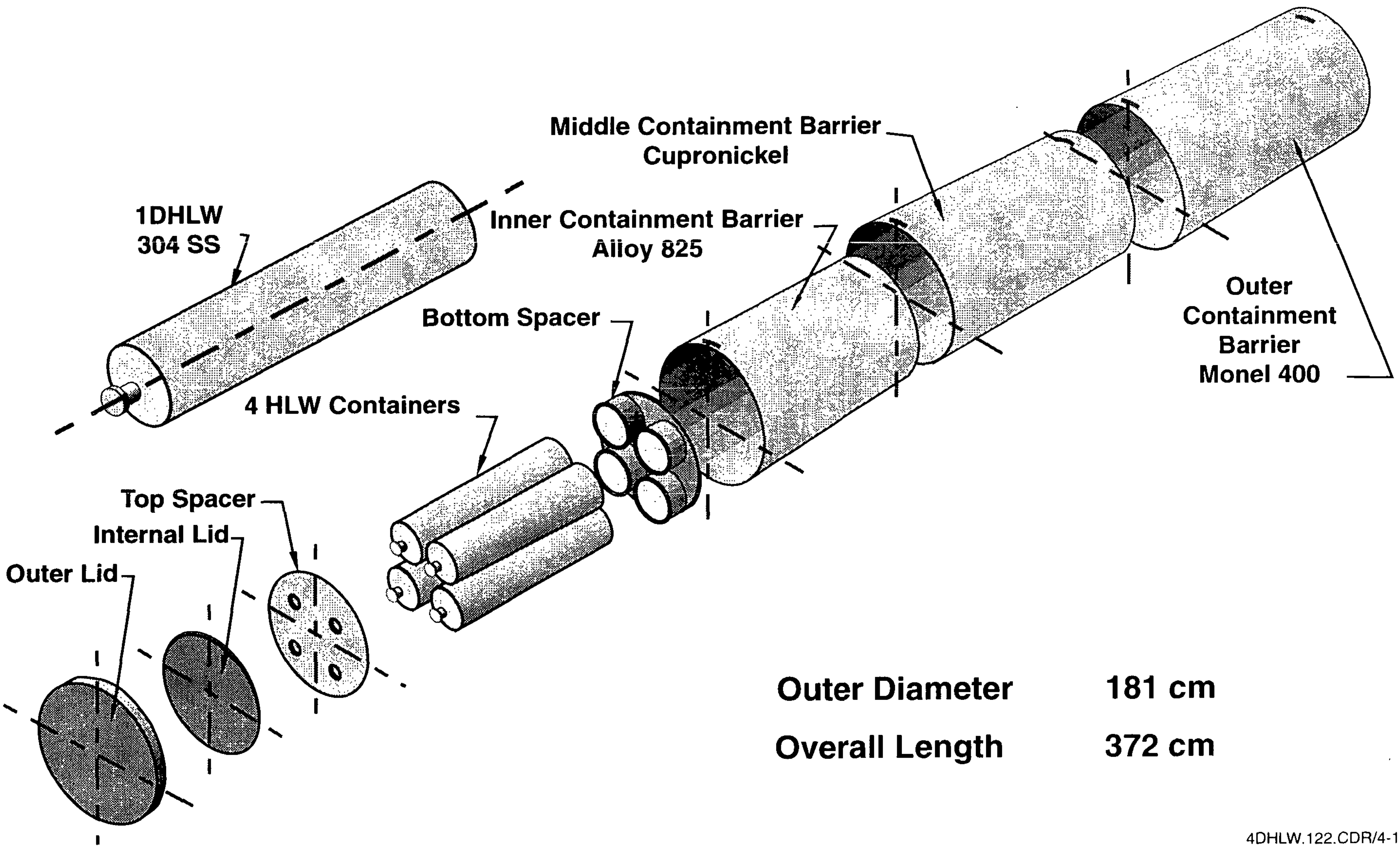
Outer Diameter 177 cm

Overall Length 531 cm

Waste Package Design

High Level Waste Glass Canister

Alternative Thermal Load Case



Outer Diameter	181 cm
Overall Length	372 cm

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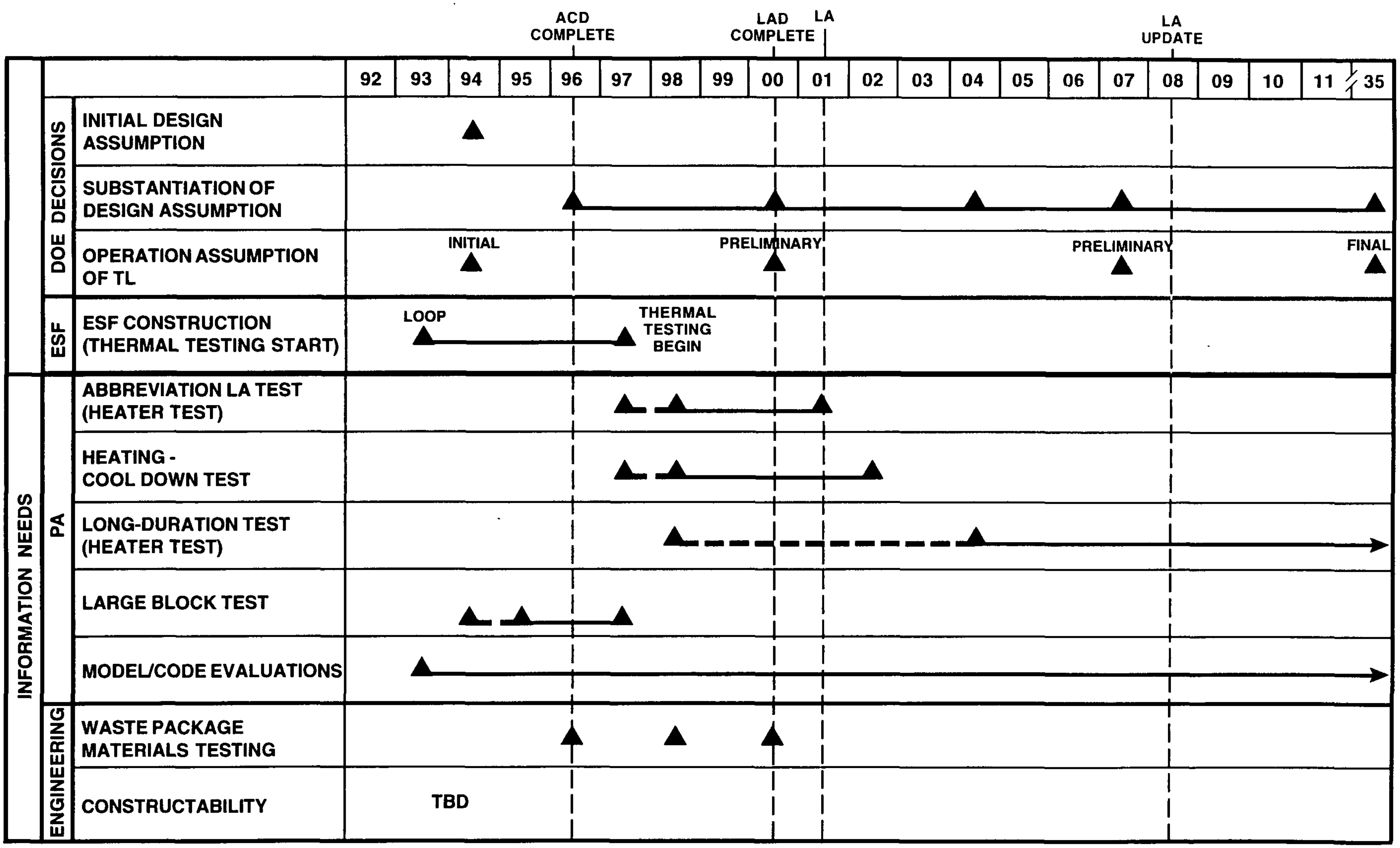
Thermal Loading Decision Strategy



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Focused ACD Schedule

KEY ACTIVITY	FY 1994	FY 1995	FY 1996
Design:			
MPC	Baseline; RFP	Award contracts	Submit applications to NRC; EIS
CDA	Draft; Rev.0	Rev.1	Rev.2
ACD Summary Report	Initial	Interim	Final
ACD Summary Report Review	Review	Review	Review
Substantiation of Assumptions	Initial	Status Review	
Rail Spur	Workshop	Stakeholders Mtg.; Stakeholders Mtg.	Corridor Selection; Routing Concepts
Elements Requiring Design Support:			
Interim Site Suitability Report			▼
License Application Annotated Outline	Rev.3	Rev.4	Rev.5
Site Characterization Progress Reports	#9; #10	#11; #12	#13; #14
Input to Total System Life Cycle Cost			▼

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ACD SUMMARY REPORT OUTLINE

1. Introduction
2. Project Scope and Methodology
3. Design Input
4. Quality Assurance
5. Site Description
6. Waste Package Design Description
7. Surface Repository Design Description
8. Subsurface Repository Design Description
9. Closure and Decommissioning
10. Cost Estimates
11. Schedules and Milestones
12. Uncertainties, Issues and Recommendations