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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: REPOSITORY OPERATIONAL CONCEPTS

PRESENTER: DR. KAL BHATTACHARYYA

PRESENTER'S TITLE AND ORGANIZATION: DEPARTMENT MANAGER, REPOSITORY DESIGN
MANAGEMENT AND OPERATING CONTRACTOR
LAS VEGAS, NEVADA

TELEPHONE NUMBER: (702) 794-1872

SALT LAKE CITY, UTAH
JULY 11-12, 1995

Overview

- Repository operational concepts for the following phases:
  - Construction
  - Waste package emplacement
  - Waste package retrieval
  - Closure
- Within the above context address
  - Alternatives considered
  - Specific design issues

Repository Design Schedule

According to OCWRM Program Plan

- Complete conceptual design by March 1997
- Complete License Application design by September 2000
- Presently less than halfway through conceptual design

Phases of Mined Geological Disposal System (MGDS) Operations

The MGDS is developed and operated in the following phases

1. Site characterization
2. Construction *
3. Development*
4. Emplacement*
5. Caretaker
6. Retrieval*
7. Closure*
8. Off-normal
9. Performance confirmation
10. Postclosure

Repository Construction Phase

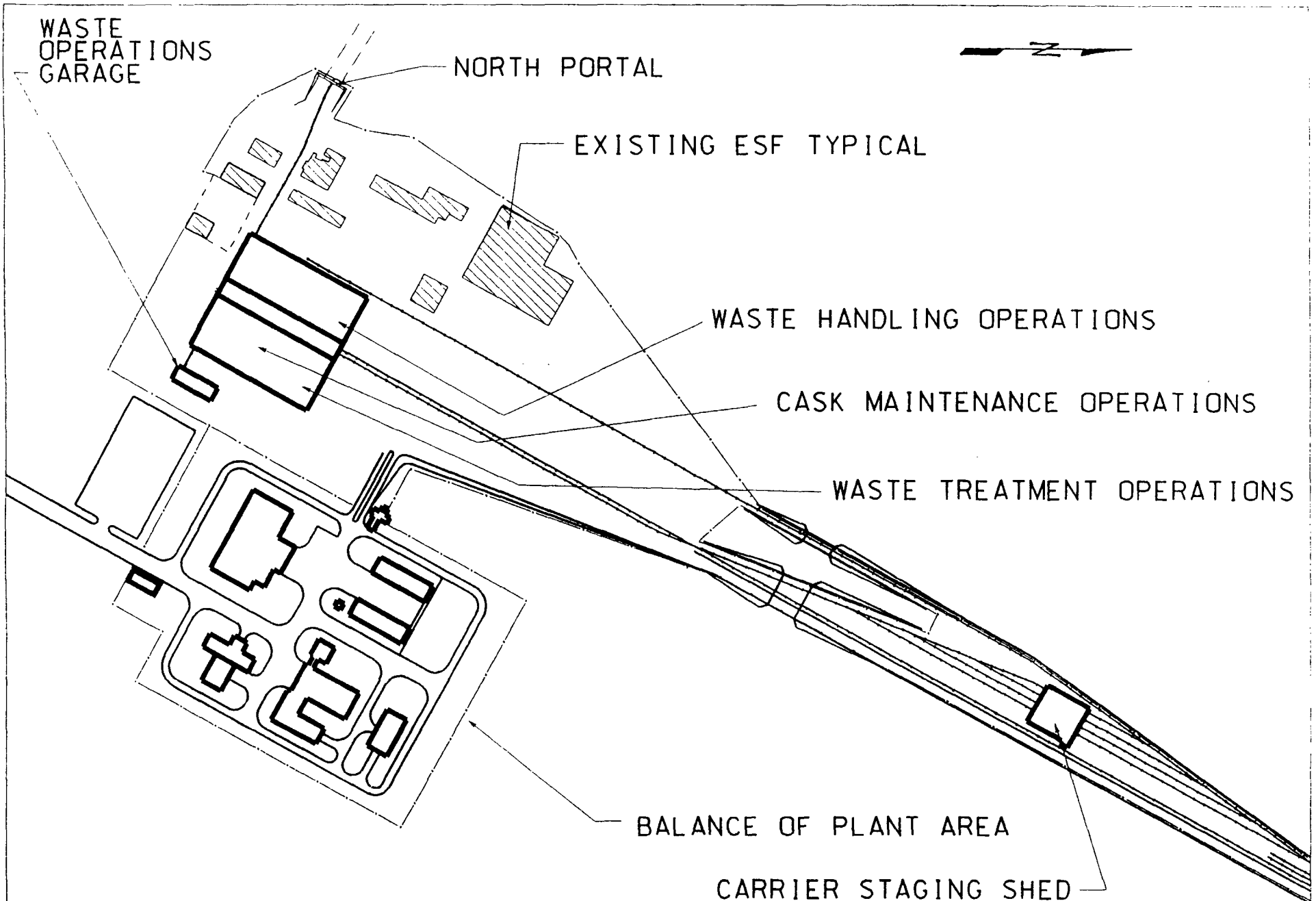
- Begins after construction authorization (FY 2004)
- Ends when surface facilities and sufficient underground construction have been completed to permit steady emplacement that may be concurrent with the development phase (FY 2010)

Repository Construction Phase

(Continued)

At the end of the construction period the following surface facilities will have been constructed:

- Site preparation system
- Site transportation systems
- Site utilities systems
- Waste handling facilities
- Operational support facilities
- General support facilities
- Offsite utilities
- Offsite transportation

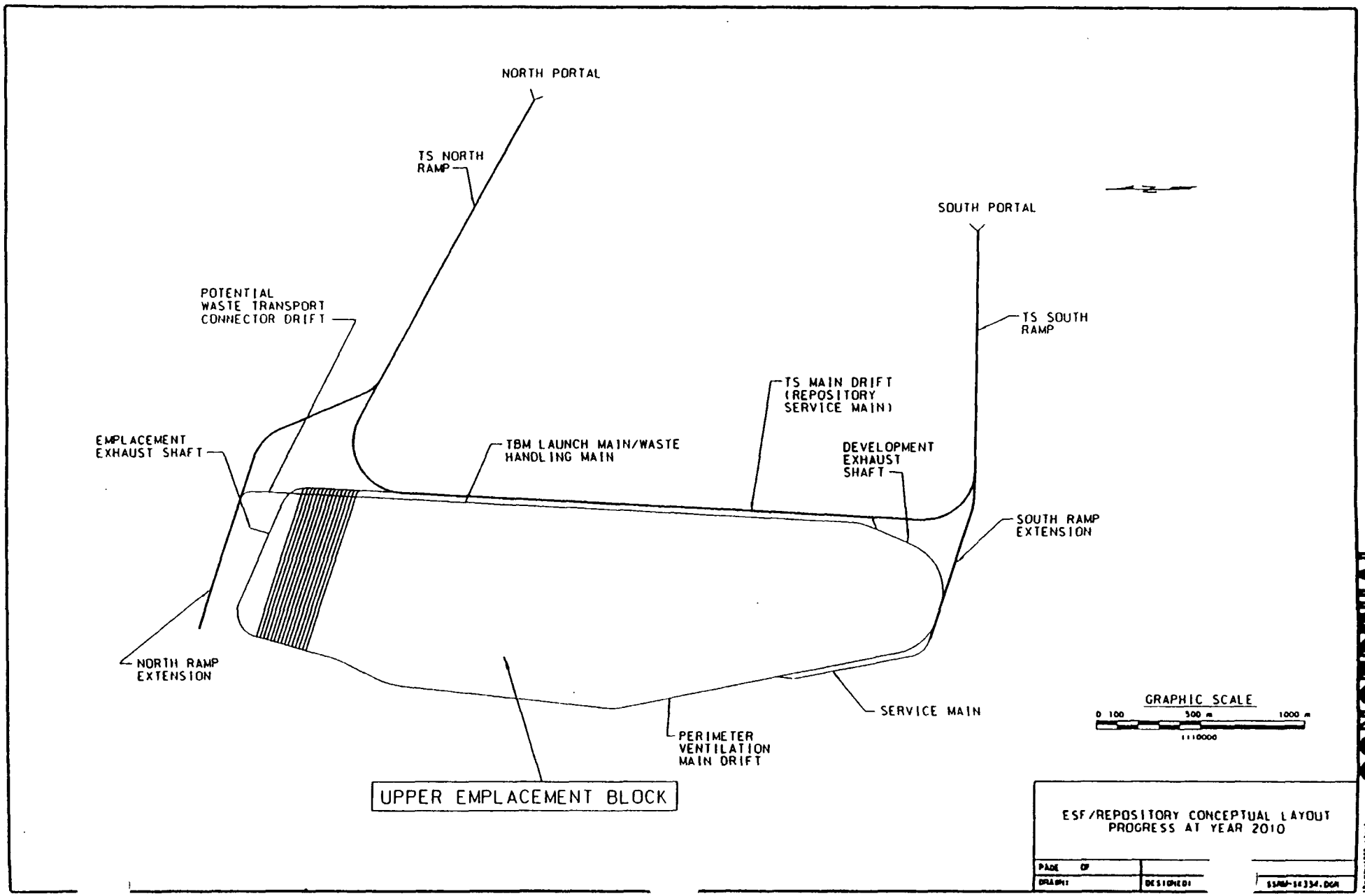


PROPOSED REPOSITORY SURFACE FACILITIES

Repository Construction Phase

(Continued)

- Subsurface construction will begin in the upper emplacement block and will include
  - System of main drifts
  - Shafts
  - Interconnections from mains to shafts
  - Supporting openings
  - Emplacement drifts (10 to 25) starting at the north and proceeding south
  - Separate ventilation system
  - Physical separation of development and emplacement operations


NORTH PORTAL
TS NORTH RAMP
SOUTH PORTAL
POTENTIAL WASTE TRANSPORT CONNECTOR DRIFT
TS SOUTH RAMP
TS MAIN DRIFT (REPOSITORY SERVICE MAIN)
EMPLACEMENT EXHAUST SHAFT
TBM LAUNCH MAIN/WASTE HANDLING MAIN
DEVELOPMENT EXHAUST SHAFT
SOUTH RAMP EXTENSION
NORTH RAMP EXTENSION
SERVICE MAIN
PERIMETER VENTILATION MAIN DRIFT
UPPER EMPLACEMENT BLOCK
GRAPHIC SCALE
0 100 500 m 1000 m
1:10000
ESF/REPOSITORY CONCEPTUAL LAYOUT PROGRESS AT YEAR 2010
PAGE OF
DRAWN:
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CONCEPTUAL

Repository Construction Phase

(Continued)

At the end of the construction period the following subsurface facilities will have been completely or partially constructed:

- **Excavated openings**
- **Support facilities**
- **Utilities system**
- **Ventilation system**
- **Shielding equipment/systems**
- **Waste package handling system**
- **Operational support system**
- **Performance confirmation system**
- **Construction equipment and temporary facilities**

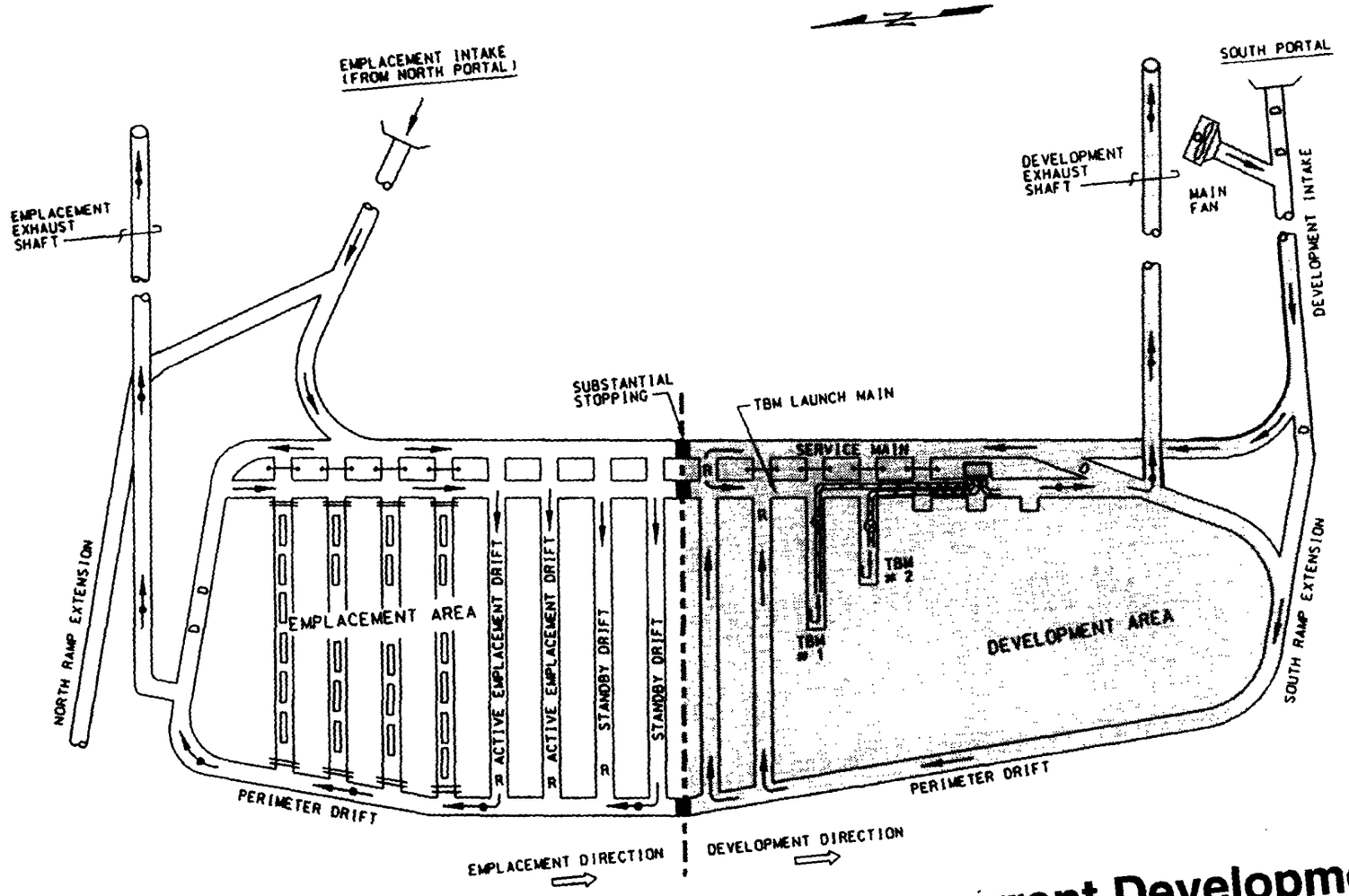
Repository Development Phase

- Repository development is a continuation of the construction phase
- Continues from the time when steady emplacement begins (FY 2010) through end of emplacement (FY 2034)
- Proceeds concurrently with waste package emplacement

Repository Development Phase

(Continued)

- Development continues with excavation of a number of drifts (e.g. 10 to 25) at a time
- These drifts are provided with ventilation, transportation, ground support, etc.
- Substantial stoppings are built to physically separate them from future development activity
- A set of these drifts are turned over to the emplacement operation



Conceptual Layout Showing Concurrent Development and Emplacement Phases

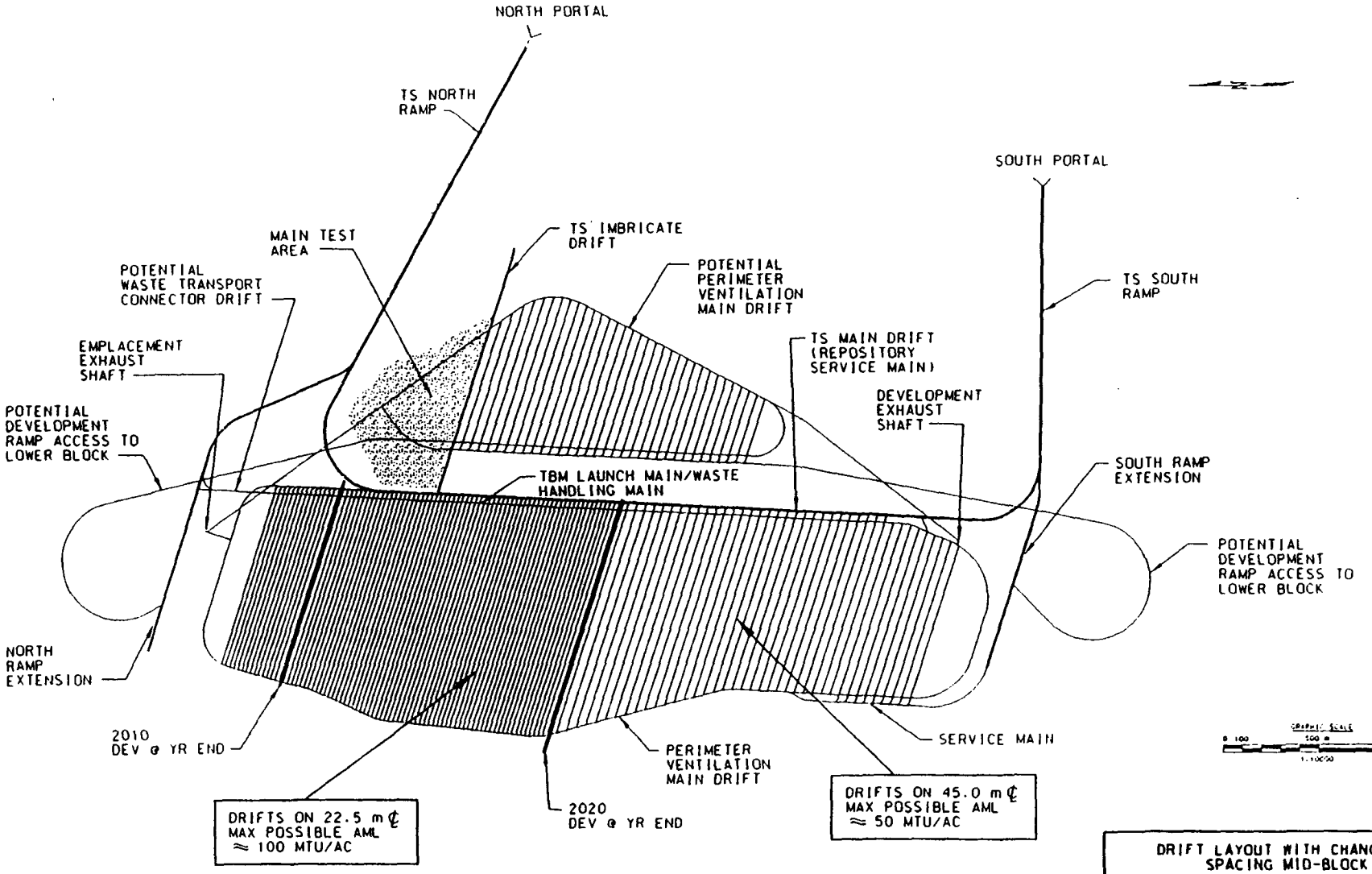
CONCEPT2.CDR.125.TRB/6-28-95

Repository Development Phase

(Continued)

Some of the issues related to repository development are

- Flexibility
- Thermal loading
- Extent of areas needed
- Emplacement strategy
- Rate of emplacement
- Spacing of waste packages and drifts
- Interface between development and emplacement
- Limitations of excavation equipment used



DRIFT LAYOUT WITH CHANGE IN SPACING MID-BLOCK
INTERIM ESF/REPOSITORY CONCEPTUAL LAYOUT, OPTION 1
(WITHOUT CALICO HILLS DRIFTING)

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CONCEPTUAL

Repository Emplacement Phase

- Begins when first shipment of waste is received
- Ends when the last shipment is emplaced
- Development and emplacement are concurrent

Repository Emplacement Phase

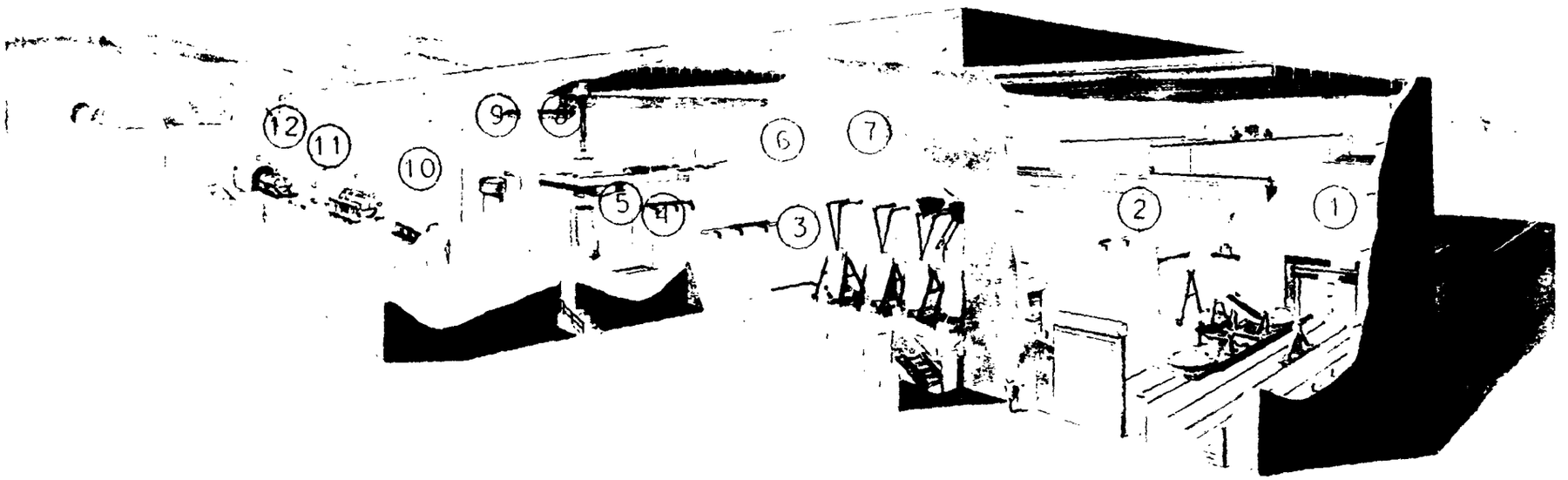
(Continued)

Transfer of waste package from surface facilities to underground

- At the waste handling building
  - Load waste package into transport cask
  - Attach waste package prime mover to the transport cask
  - Move transport cask out of the building
  - Transport to a ramp portal
  - Transport through waste handling main drift to the designated emplacement drift

WASTE HANDLING BUILDING

MULTI-PURPOSE CANISTER OPERATIONS



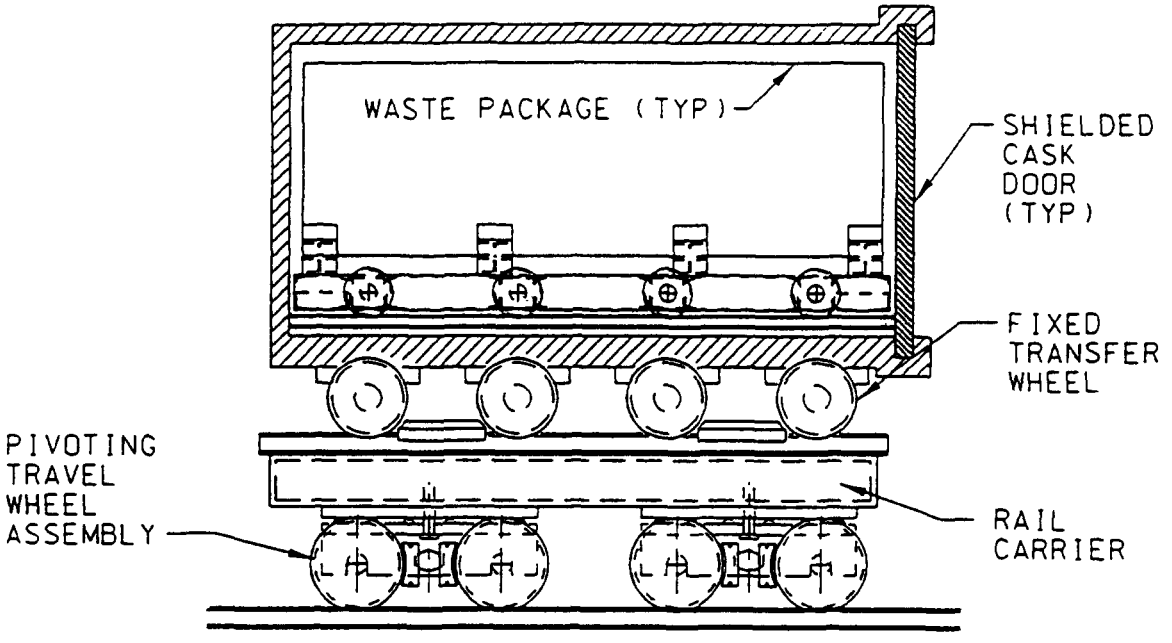
1. CARRIER BAY
2. AIRLOCK
3. LOADED CASK PREPARATION
4. RAIL CASK DECON
5. RAIL CASK PORT ROOM
6. AIRLOCK
7. SPENT FUEL ASSEMBLY CASK DECON
8. RAIL CASK TRANSFER ROOM
9. DISPOSAL CONTAINER WELDING
10. DISPOSAL CONTAINER HORIZONTALIZING
11. DISPOSAL CONTAINER DECON
12. UNDERGROUND TRANSFER

Repository Emplacement Phase
(Continued)

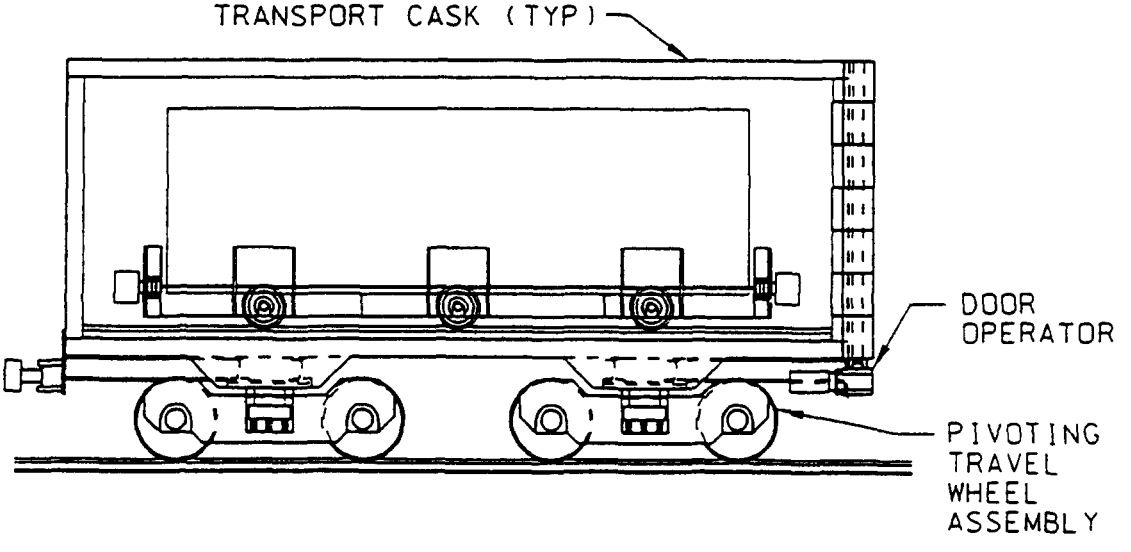
Transfer of waste package from surface facilities to underground (continued)

Alternatives under consideration include

- Waste package transport cask/carrier
- Transport mechanism to underground
  - Wheeled and tracked vehicles
  - Monorail system
  - Integrated rail system



TRANSPORT CASK WITH TRANSFER WHEELS ON RAIL CARRIER



TRANSPORT CASK WITH TRAVEL WHEELS

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Repository Emplacement Phase

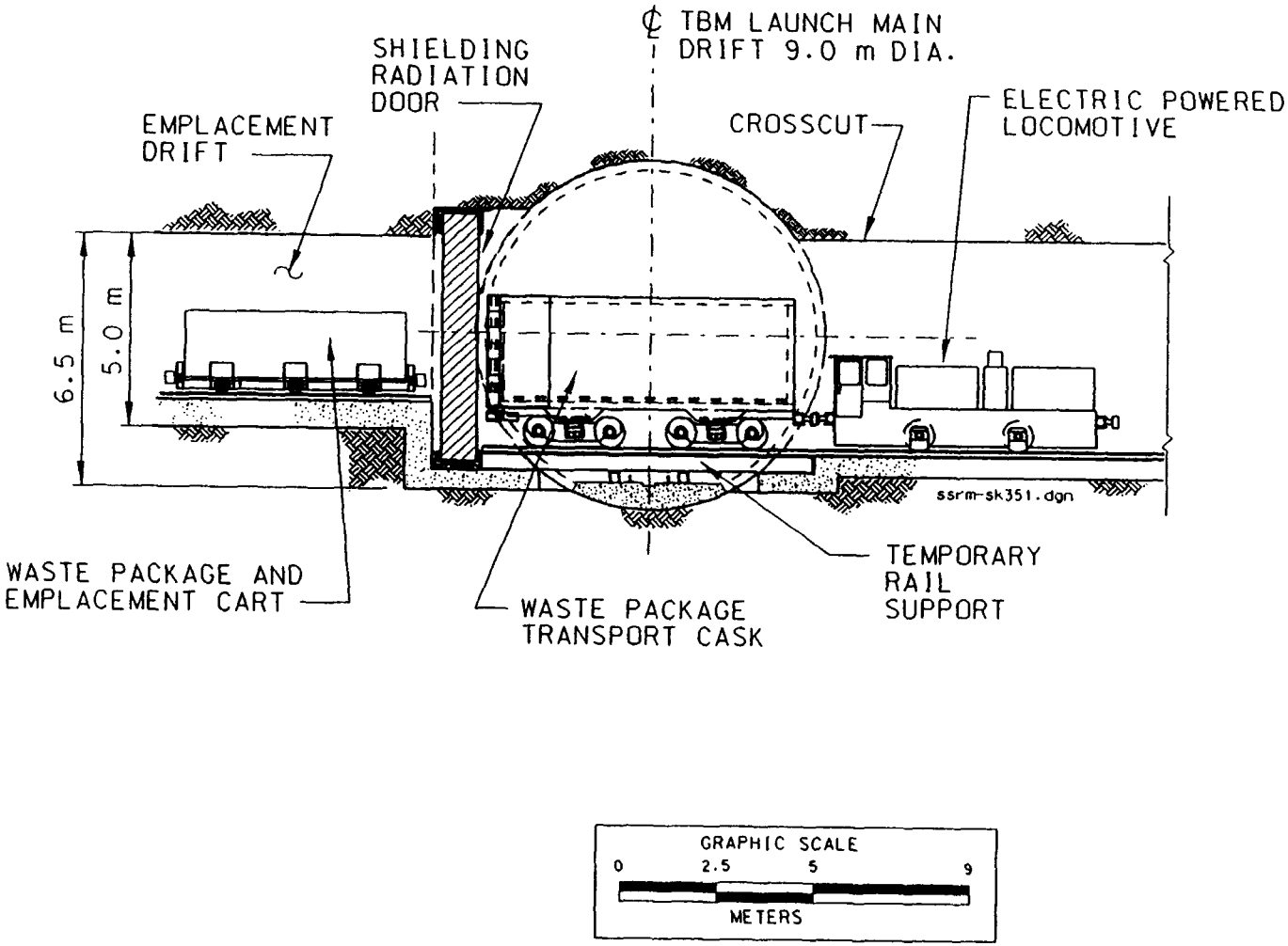
(Continued)

Handle waste package at designated emplacement drift entrance

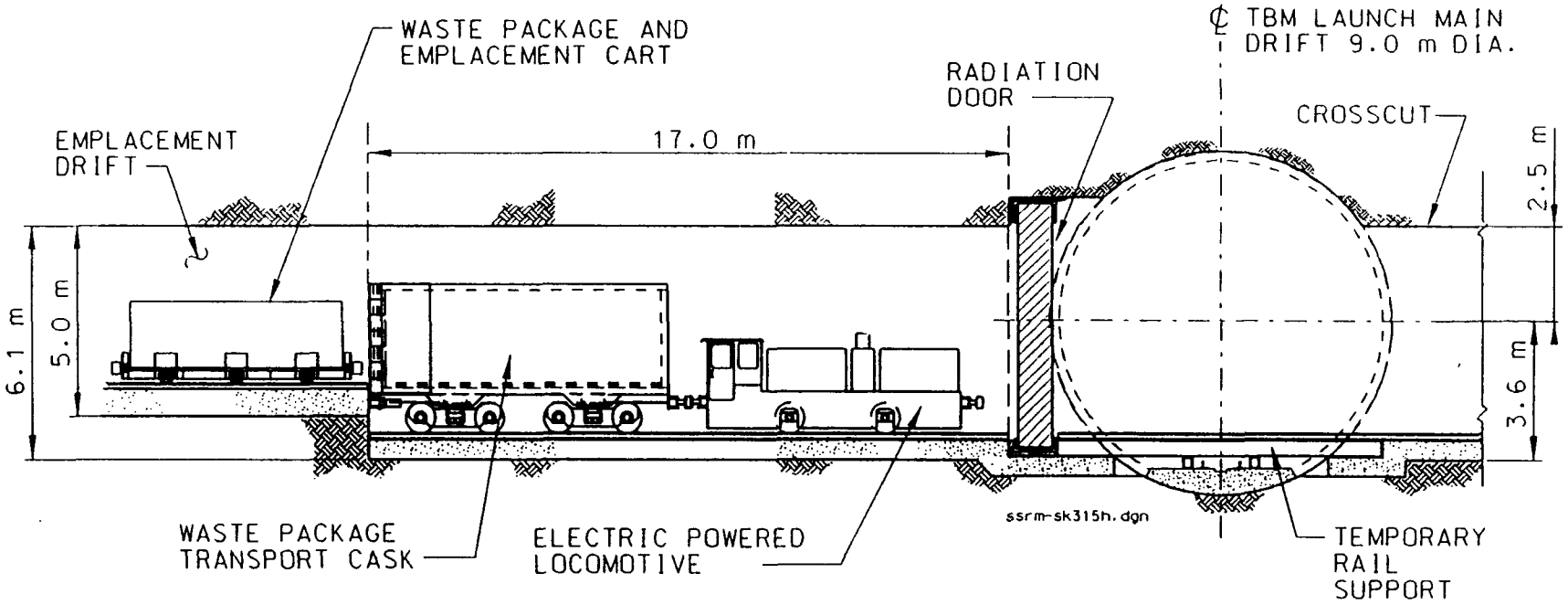
Operations will include

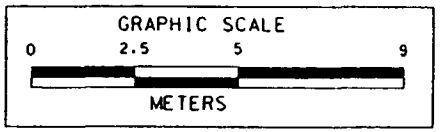
- **Position transport cask**
- **Open shielding components**
- **Off-load waste package from transport cask**
- **Remove transport cask**
- **Position emplacement equipment**
- **Off-load emplacement equipment**
- **Close shielding components**

Waste Package Handling at Designated Emplacement Drift Entrance



Waste Package Handling at Designated Emplacement Drift Entrance





Repository Emplacement Phase
(Continued)

Handle waste package at designated emplacement drift entrance (continued)

Alternatives under consideration include

- Turntable versus direct transfer
- Air bearing/pallet
- Rail cart
- Roller conveyor

Repository Emplacement Phase

(Continued)

Emplace waste package in drift

- Operation will include
  - Transport waste package through emplacement drift
  - Emplace waste package
  - Return emplacement equipment to drift entrance
- Alternatives under consideration:
  - Emplacement equipment-emplacement drift locomotive/gantry
  - Waste package base-rail cart/pedestal

Waste Package Retrieval Phase

- Includes all actions required to retrieve waste, if required
- Retrieval may be necessary or required at any time during or after emplacement
- Retrieval option to be maintained for up to 100 years after initiation of emplacement (2110)

Waste Package Retrieval Phase
(Continued)

Retrieval operation will include the following:

- Provide access to the emplacement drift
- Remove waste package from emplacement drift
- Transfer waste package to surface handling facilities
- Further handle and process retrieved waste

Note: Issues and alternatives are discussed in a separate presentation on retrievability

Repository Closure Phase

- Begins when NRC amends the license to authorize permanent closure
- Includes backfilling and sealing
- Decontamination and dismantling of facilities
- Protective system established

Repository Closure Phase

(Continued)

Closure will include the following operations:

- Decontaminate and remove underground equipment and fixtures
- Prepare emplacement drifts to receive backfill (if required)
- Backfill the drifts (if required)
- Emplace repository seals
- Establish protective systems

Repository Closure Phase

(Continued)

Issues related to closure include the following:

- Performance requirement of backfill
- Type of backfill
- Construction of backfill to meet a given specification

Summary

- Discussed the construction, development, emplacement, retrieval, and closure phases
- Provided examples of alternate concepts for each phase
- Discussed some of the issues related to the various phases of repository operations