



U.S. Department of Energy
Office of Civilian Radioactive Waste Management



Surface Facilities Design

Presented to:

**Nuclear Waste Technical Review Board Panel on the
Waste Management System**

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U.S. Department of Energy

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Monitored Geologic Repository Surface Design Functions

- **Receiving spent nuclear fuel and high-level radioactive waste**
- **Receiving, processing and handling of empty waste packages (WPs) and associated lids**
- **Unloading, handling, and packaging radioactive waste**
- **Management of Spent Nuclear Fuel (SNF) and High-Level Waste (HLW) to allow waste package thermal loading goals**
- **Transporting casks and waste packages between surface facilities**
- **Processing of shipping casks for return to transportation project**
- **Transporting waste packages from the surface to the underground facility**
- **Collection and handling of site generated Low-Level Waste (LLW)**

Monitored Geologic Repository Surface Design Functions

(Continued)

- **Monitoring surface operations and repository system performance**
- **Retaining the capability to retrieve waste for at least 50 years from start of emplacement**
- **Decommissioning and closure of the repository**
- **Containing the radioactive waste form during normal operating event sequences and protecting the waste during repository preclosure activities**
- **Provide for and maintain a radiological control area**
- **Provide for and maintain a security system and emergency operations center**
- **Provide surface infrastructure and support systems**
 - **Common to all Radiological Handling Facilities**

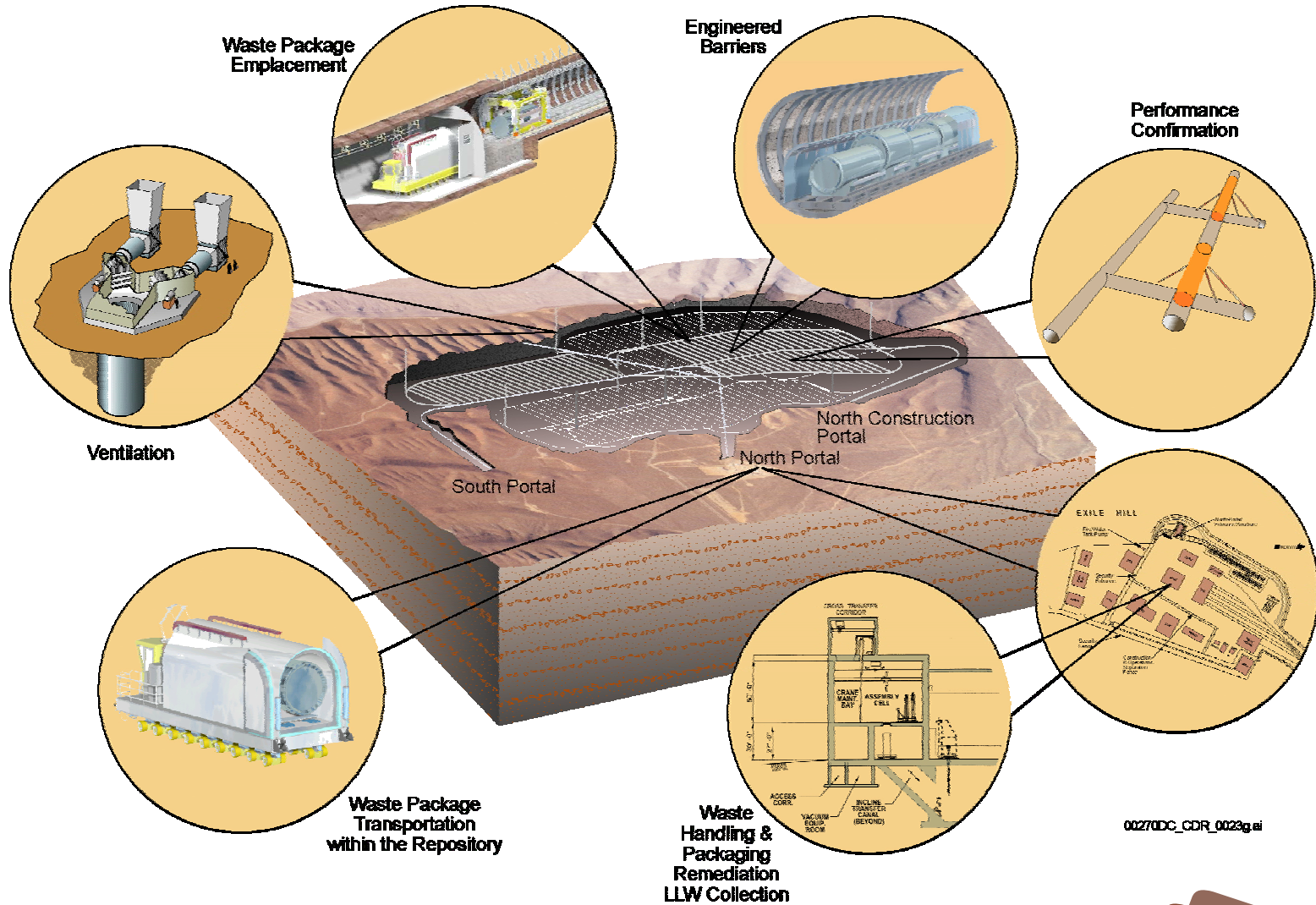


Monitored Geologic Repository Surface Design Functions

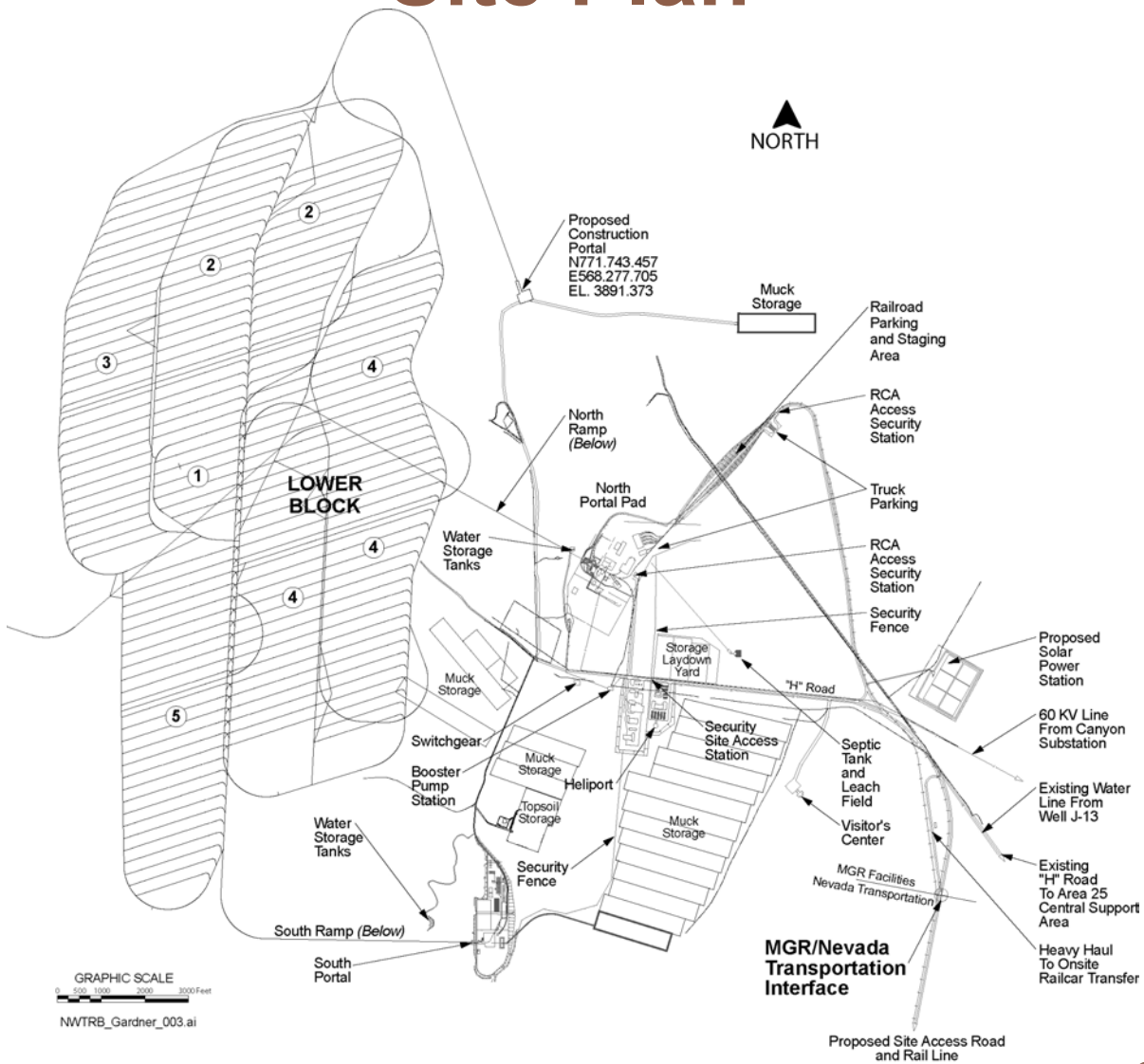
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- **Perform equipment maintenance, radiological surveys, decontamination, dry cell cleaning, and low-level radioactive waste processing, as required**
- **Confine and control radioactive waste sources during normal, off-normal, and hazardous event sequences**
- **Control radiation exposure, criticality, nuclear material accountability, temperature, human access, and mitigate naturally occurring external hazards (earthquake, wind, flood, national emergencies, etc.)**
- **Monitor facility operations and performance to ensure the safety of the workers and the public in accordance with NRC license conditions**

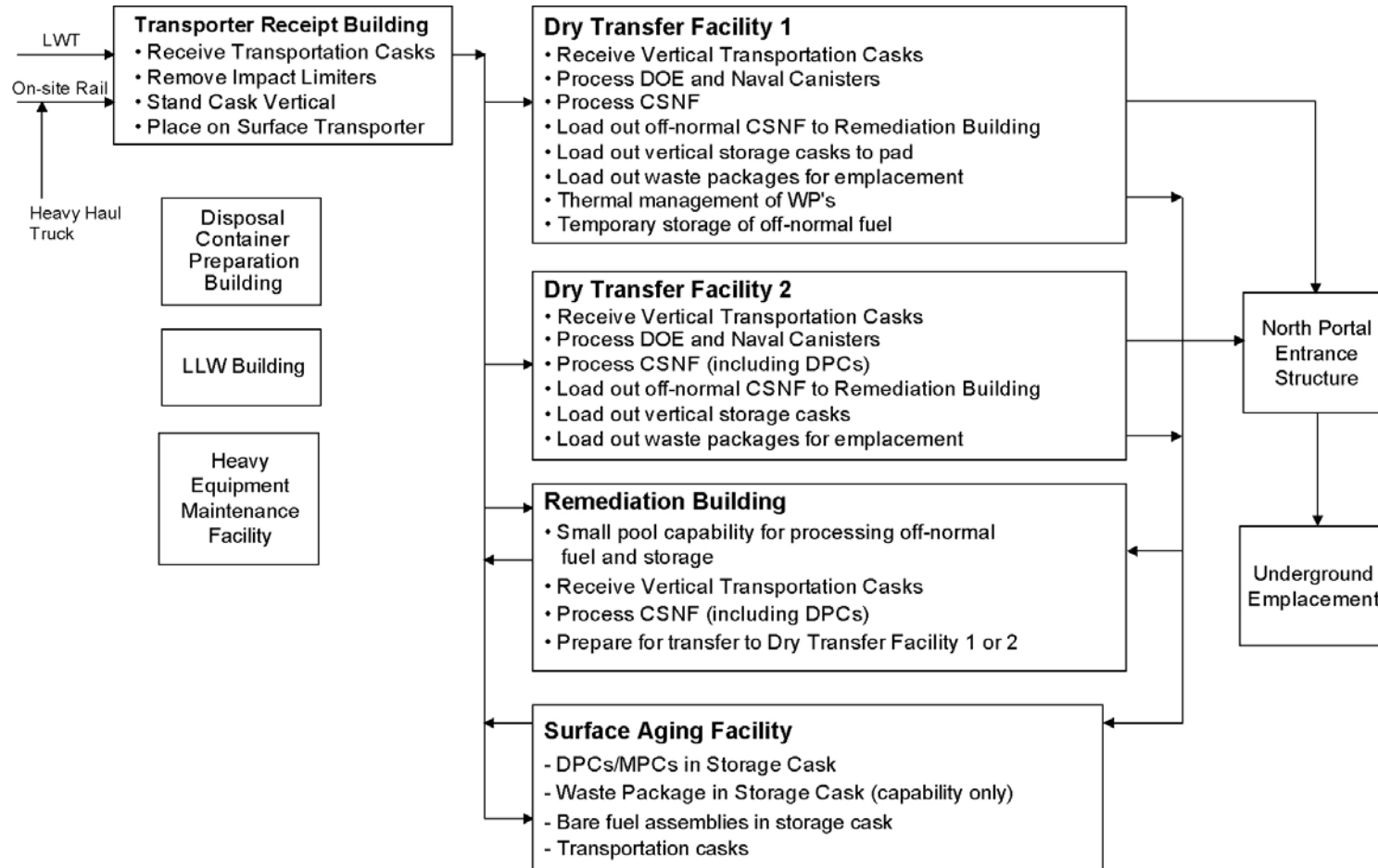
Site Overview



Site Plan



Process Flow

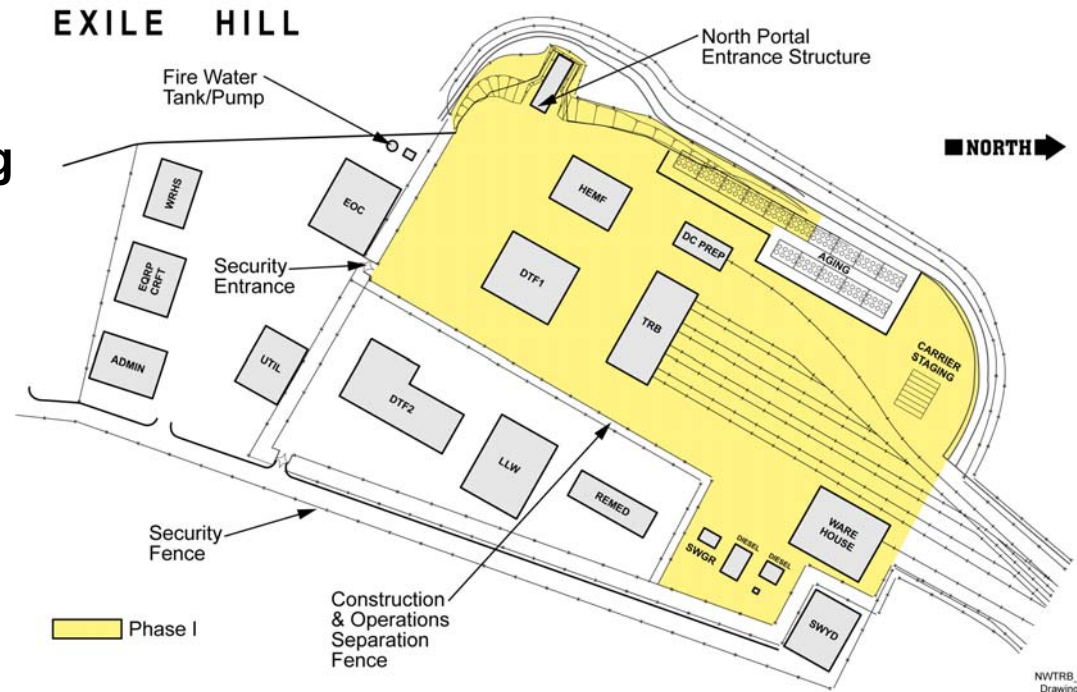


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Phased Surface Facilities Approach

Phase 1

- Dry Test Facility #1 (~ 500-1,000 MTHM/yr) (DTF1)
- DC Preparation Building (DC PREP)
- Transporter Receipt Building (TRB)
- Aging Pad (~ 1,000 MTHM)
- Heavy Equipment Maintenance Facility (HEMF)
- Warehouse
- Operations Support Facilities

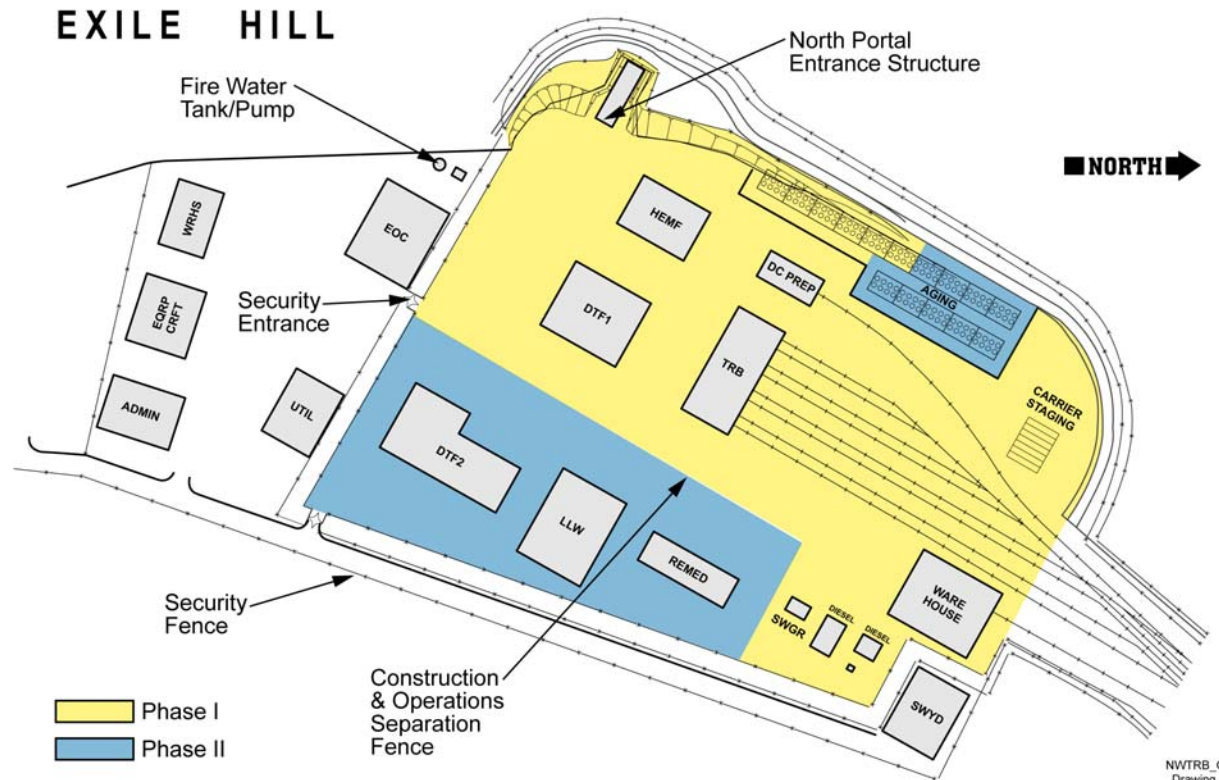


Phased Surface Facilities Approach

(Continued)

Phase 2

- Dry Test Facility #2 (DTF2)
- Remediation Building (REMED)



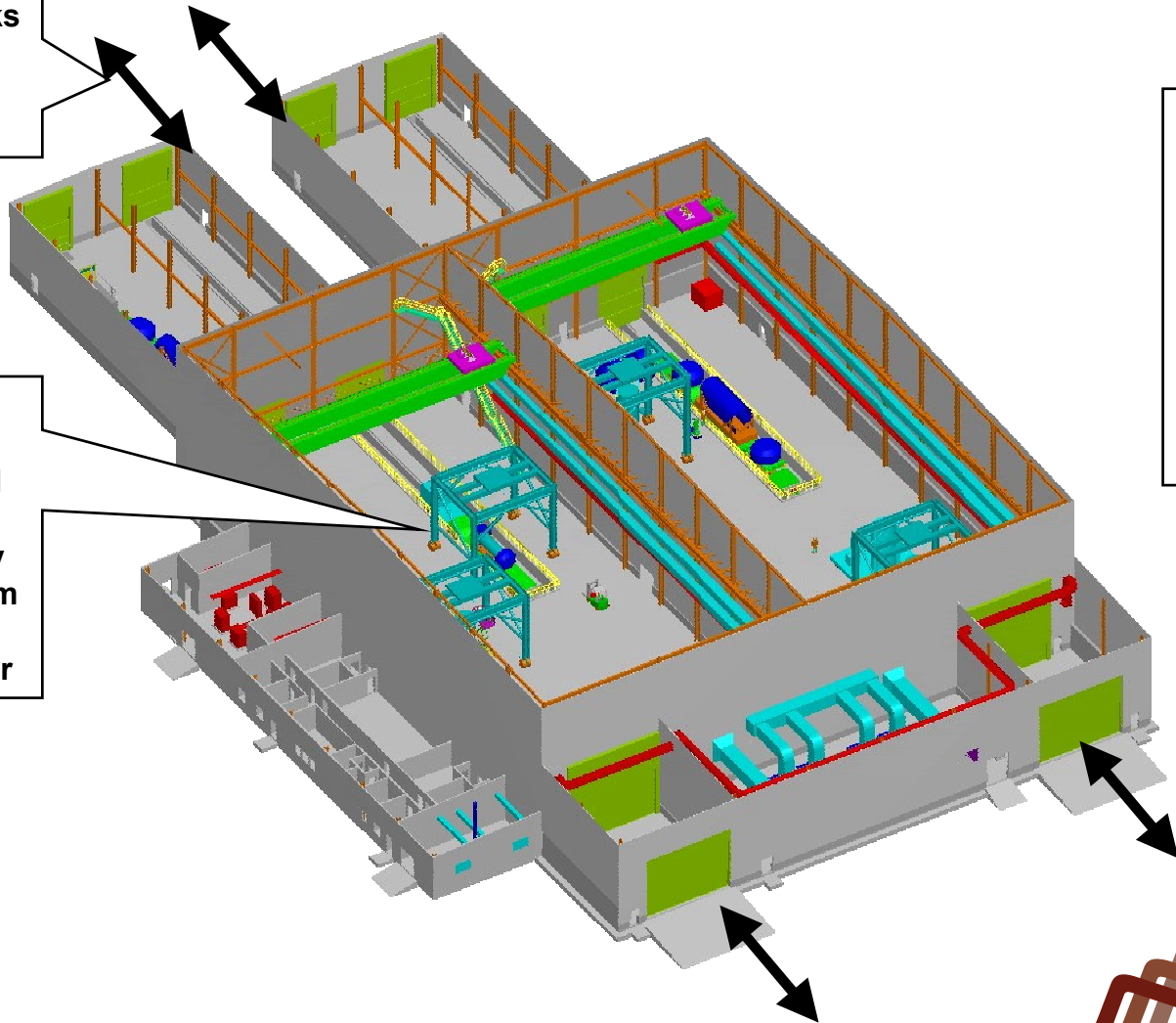
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Transporter Receipt Building 3-D Rendering

Transportation casks (with waste) enter TRB, empty transportation casks returned to transportation project

Loaded casks removed from carrier and loaded on surface transporter, empty casks removed from transporter and loaded on to carrier

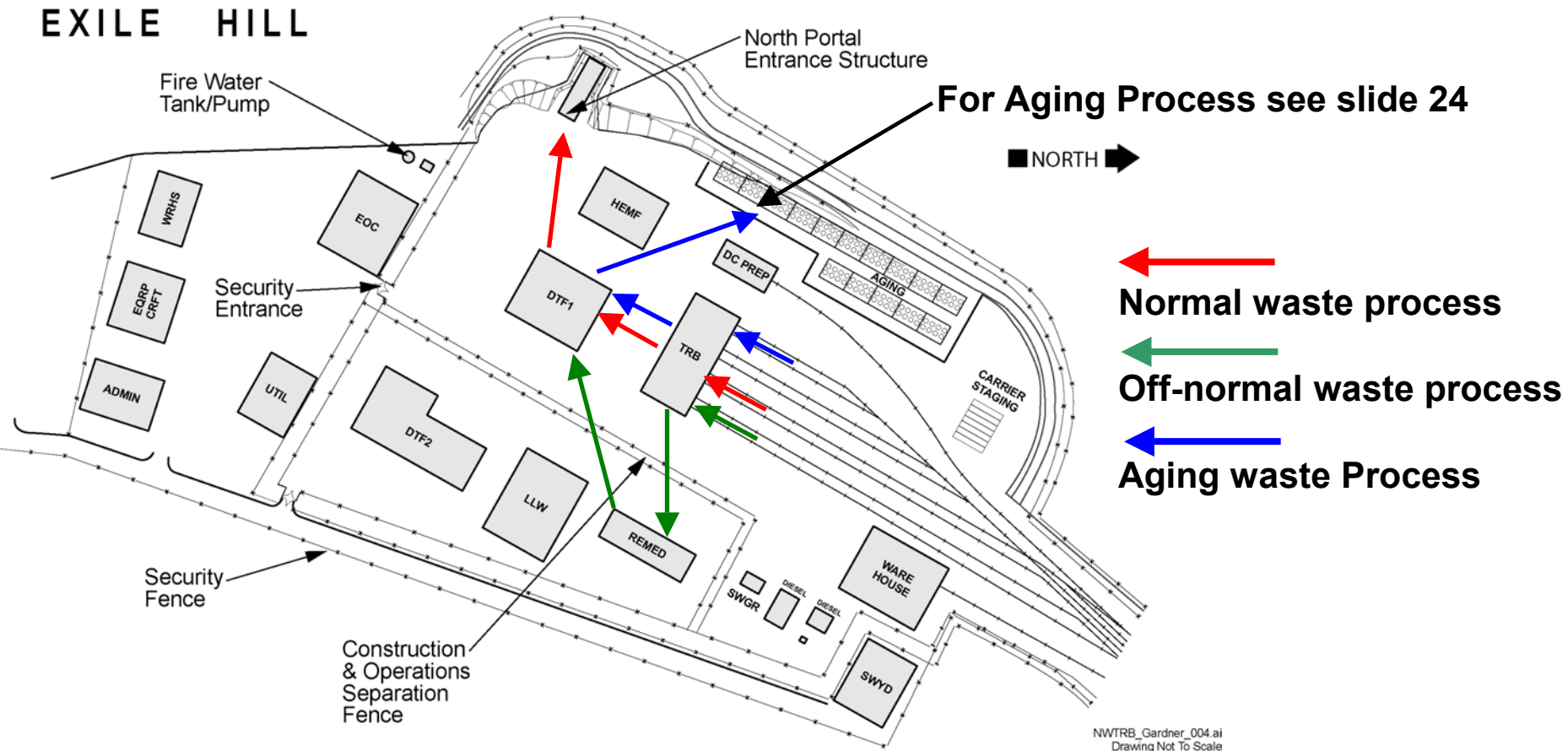
Transportation casks (with SNF) exit building on surface transporter, empty transportation casks enter building for return to transportation project



Transporter Receipt Building Functions

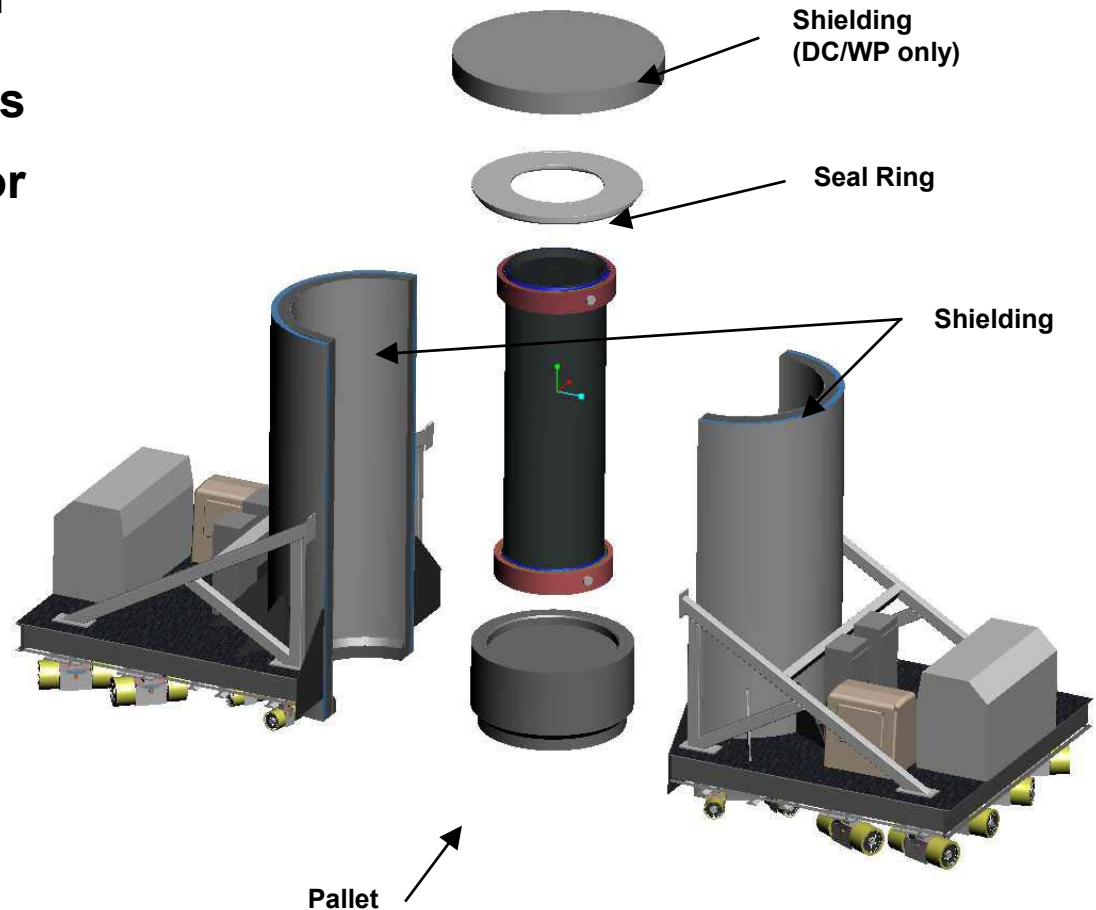
- **Receive loaded transportation casks from the Transportation System**
- **Unload transportation casks from the carrier**
- **Load transportation casks on the surface transporter for movement to Dry Transfer Facility 1 or 2, the Remediation Building, or the Aging Facility**
- **Receive unloaded transportation casks from Dry Transfer Facility 1 or 2 or the Remediation Building**
- **Load unloaded transportation casks on the carrier and return it to the Transportation System**
- **Capable of handling approximately 6 Legal Weight Trucks (LWTs) and 3 Rail Casks/day - Throughput studies still ongoing**

Surface Facilities Transportation Approach



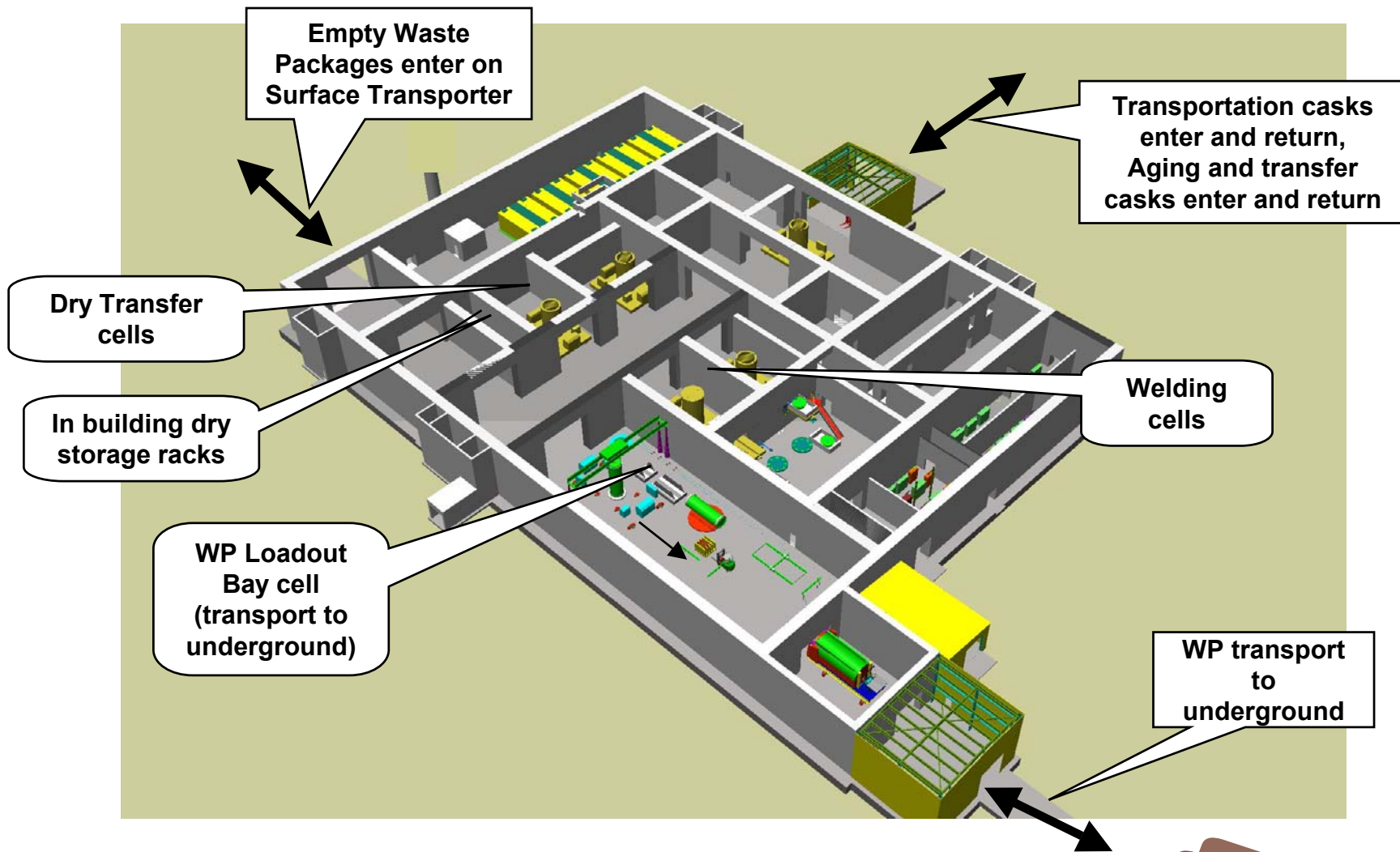
Proposed Surface Transporter Concept

- Used to transport casks and waste packages at and between the surface facilities
- Different shielding design for casks, transfer casks, aging canisters and WPs
- Accommodates different cask/WP sizes by adjusting pallet height
- Integral shielding to allow WP transport
- Evaluation of transportation options are still ongoing



Dry Transfer Facility #1

First Floor 3-D Rendering



Dry Transfer Facility #1

Functions

- **Receive transportation casks from the Transporter Receipt Building**
- **Receive empty waste packages from the Disposal Container Preparation Building**
- **Prepare the transportation casks for unloading**
- **Unload waste form from the transportation cask**
- **Manage commercial spent nuclear fuel (CSNF) and blend fuel assemblies from in-building storage or from aging pad storage canister to meet waste package thermal limits**
- **Load the waste form into the waste package in a dry cell operation**

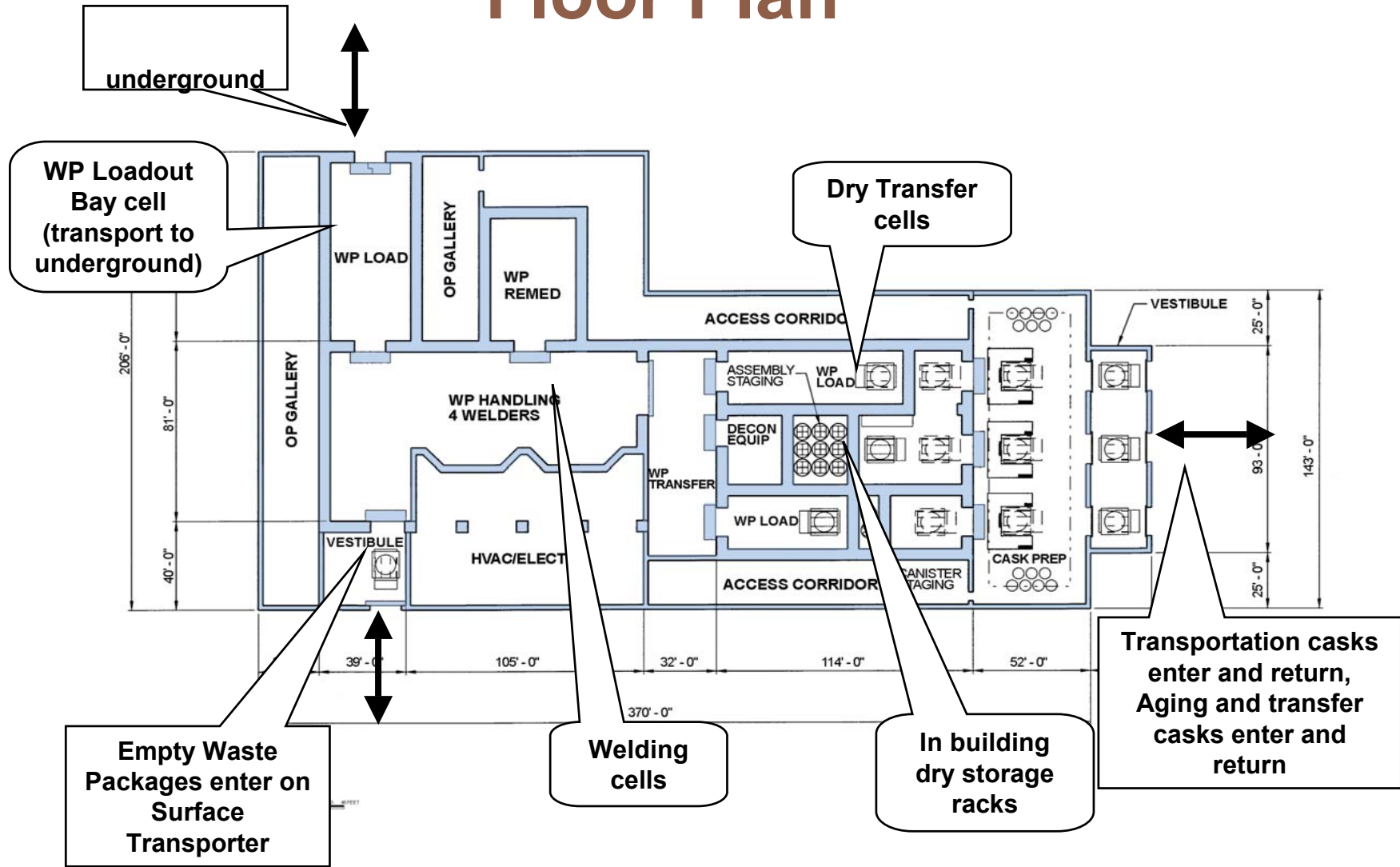
Dry Transfer Facility #1 Functions

(Continued)

- **Install closure lids and weld**
- **Perform post weld heat treatment on finished waste packages**
- **Perform final inspection and decontaminate waste package**
- **Load the waste package and pallet onto the waste package transporter**
- **Close the transportation cask and return it to the Transporter Receipt Building**
- **Capable of processing 2 LWT and 1 Rail Cask/day**
- **In-building process staging capacity of 48 pressurized water reactor (PWR) assemblies, 72 boiling water reactor (BWR) assemblies, and 10 DOE SNF canisters - for thermal management (about 2 WPs)**



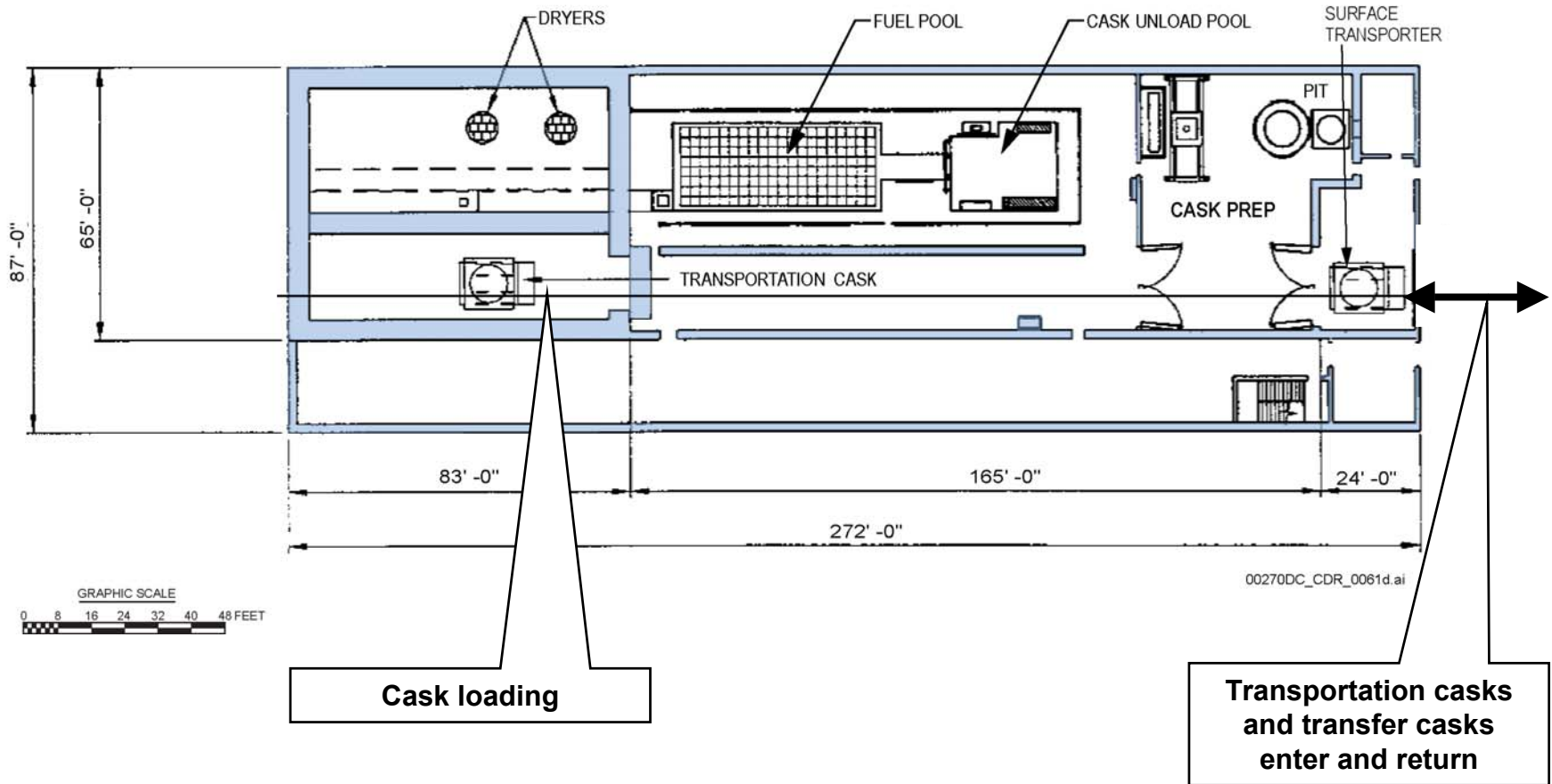
Dry Transfer Facility #2 Floor Plan



Dry Transfer Facility #2 Functions

- **Same functions as DTF #1 with the following exceptions:**
 - Includes capability of receiving Dual Purpose Canisters (DPCs) and opening the DPC to remove assemblies
 - Throughput capacity is approximately 2-2.5 times greater (2000 - 2500 metric tons of heavy metal (MTHM))
- **Close the transportation cask and return it to the Transporter Receipt Building**
- **Capable of processing 4 LWT and 2 Rail Casks/day**
- **In-building process staging capacity of 144 PWRs, 288 BWRs, and 10 DOE SNF canisters for thermal management (about 7 WPs of CSNF)**

Remediation Building Floor Plan



Source: CDR Rev 01

Remediation Building Functions

- **Receive transportation casks containing off-normal fuel transported from the Transporter Receipt Building and Deep Test Facility (DTF) #1 and DTF #2**
- **Prepare the transportation casks for unloading**
- **Transfer the transportation casks into a cask unloading pool**
- **Unload the transportation cask**
- **Prepare the cask for closure, close the cask and return the empty cask to the Transporter Receipt Building**

Remediation Building Functions

(Continued)

- **Separate commercial normal spent nuclear fuel and off-normal fuel assemblies**
- **Transfer CSNF into a transfer cask for transportation to Dry Transfer Facility 1 or 2 or the Aging Facility**
- **Remediate Waste Packages as required**
- **Remediate off-normal fuel**

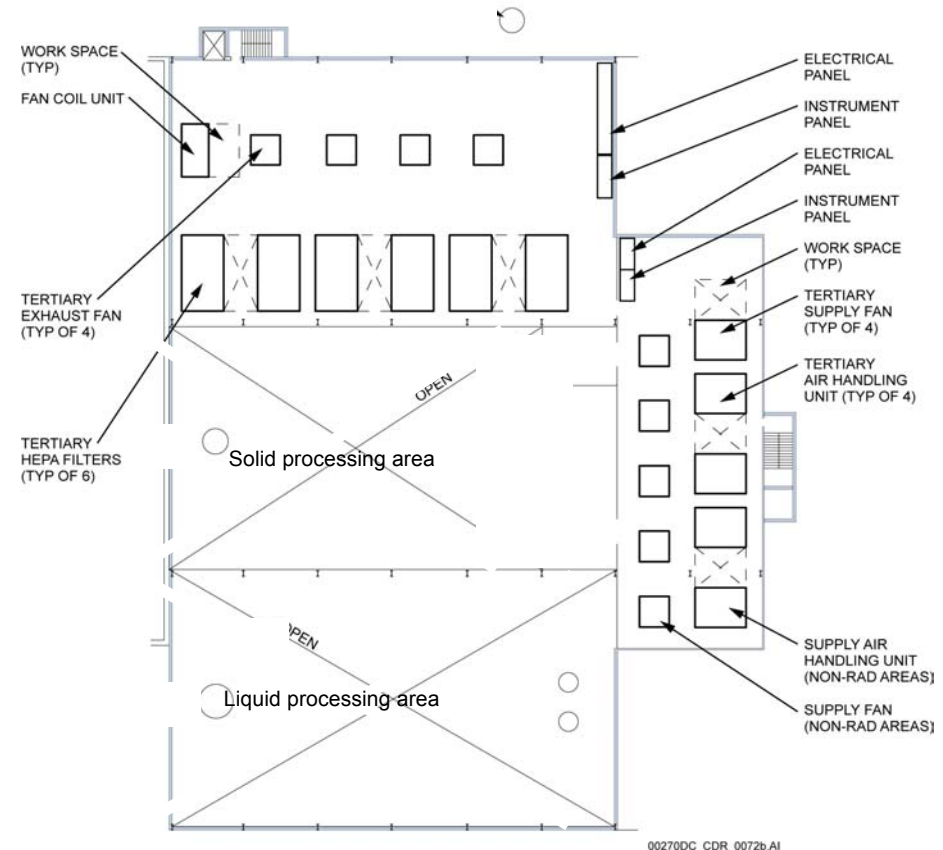
Proposed Low Level Waste Building Floor Plan

CDR Design

- Area for non-recyclable liquid LLW
- Area for recyclable liquid LLW
- Area for solid LLW

Design Under Consideration

- Area for solid LLW (volume reduction)
- Liquid LLW is expected to be a low volume waste stream and will be solidified



Low Level Waste Building Functions

- **Receive low-level radioactive waste generated from the operations of the surface facilities (liquid and dry)**
- **Collect and treat LLW liquid as needed to meet disposal means**
- **Process and package the dry waste suitable for offsite disposal**

Proposed Aging Facility Layout

- **Transporter Receipt Building**

- Transportation casks to Aging
- From Aging to DTF1/DTF2/RB

- **DTF1**

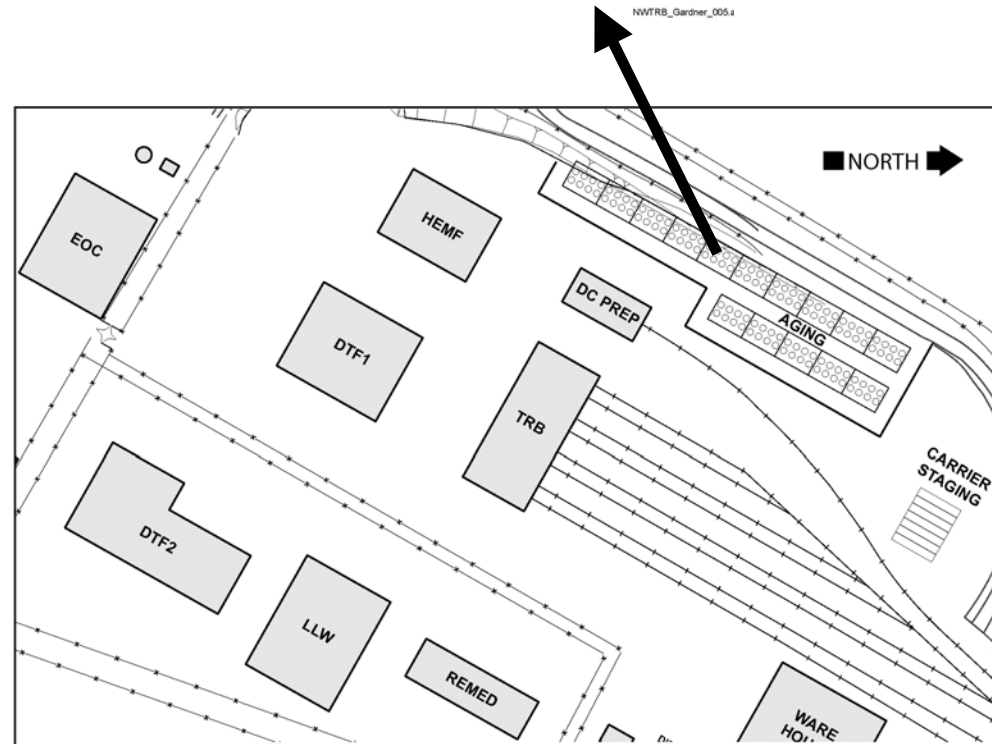
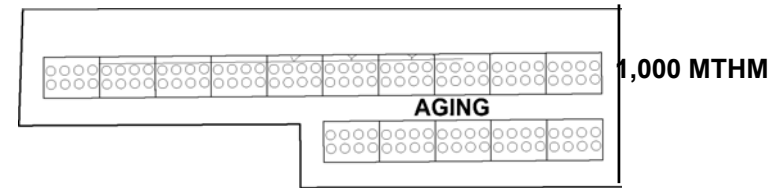
- Transportation casks from TRB
- Transfer to aging cask
- To Aging
- From Aging to DTF1

- **DTF2**

- Same as DTF1

- **Remediation Building**

- Transportation casks from TRB, DTF1, or DTF2
- Transfer to fuel pool for aging
- Transfer to transfer cask
- To DTF1 or DTF2



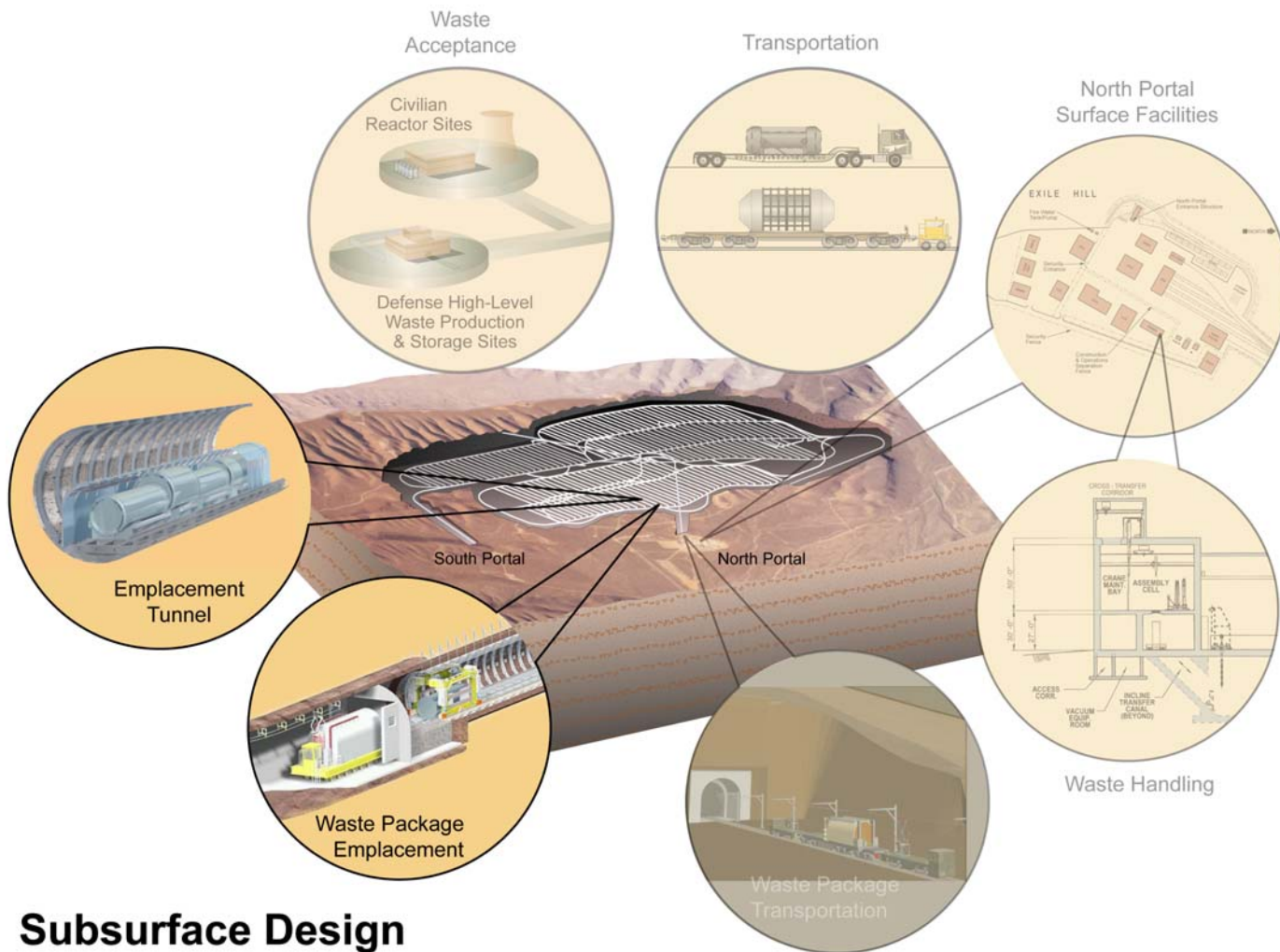
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Aging Facility Functions

- **Provide facilities and space for staging waste on aging pad**
- **Age CSNF to meet repository thermal loading requirements**
- **Uncouple waste receipts and waste emplacement for additional flexibility in waste processing operations**
- **Design for a phased implementation so that a portion of the facility will be available in 2010**
- **Design is similar to facilities currently in use at nuclear power plants**
- **Provide monitoring and radiological control system**
- **Provide security and access control**

Continuing Evaluations in Surface Facility Design

- **Independent review of design by Cogema**
- **Transportation system rail and truck shipment combinations and impacts on the design**
- **Concurrent operations and construction impact on design**
- **Prototype test program for fuel handling and surface transporters**
- **Requirement changes for safeguards and security and the impacts on the design**
- **Thermal management and impacts on the design**
- **Fuel characterization, fuel burnup measurement requirements**
- **Offsite training facility**



Subsurface Design

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