



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



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NRC/DOE Technical Exchange on Physical Protection, Material Control & Accounting, and Emergency Planning



June 28, 2007
Rockville, Maryland

ENCLOSURE 4

Upcoming NRC/DOE Interactions

- **Colloids and In-Package Chemistry, Multi-scale Thermohydrologic Models, Near-Field Environment, Appendix 7 Meeting, July 10-12**
- **Drift Degradation, Appendix 7 Meeting, September 13**
- **Postclosure Subjects, Technical Exchange, September 27**



Planned NRC/DOE Interactions (dates TBD)

- **Preclosure Criticality, Technical Exchange**
- **Other Postclosure Topics, Technical Exchange**
- **Infiltration, Technical Exchange**
- **Preclosure Safety Analysis**
 - **Hazard Identification, Event Sequences Development and Categorization**
 - **Identification of Important to Safety Structures, Systems, and Components**
 - **Source Term and Consequences**
- **Transportation, Aging, and Disposal (TAD) Canister System Planning**





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Concept of Operations

Presented to:

**NRC/DOE Technical Exchange on Physical Protection,
Material Control & Accounting, and Emergency Planning**

Presented by:

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June 28, 2007
Rockville, Maryland

Acronyms

- **SNF** **spent nuclear fuel**
- **HLW** **high-level radioactive waste**
- **TAD** **transportation, aging, and disposal (canister)**
- **PWR** **pressurized water reactor**
- **BWR** **boiling water reactor**
- **DPC** **dual-purpose canister**
- **MTHM** **metric tons of heavy metal**
- **GROA** **Geologic Repository Operations Area**
- **CRCF** **Canister Receipt and Transfer Facility**
- **ITS** **Important to Safety**
- **TEV** **transport and emplacement vehicle**



Presentation Overview

- **Waste Receipt at YMP**
- **Waste Form Quantities**
- **Waste Form Description**
- **Waste Packages**
- **Site Description and Boundaries**
- **Nuclear Surface Facilities**
- **Non-Nuclear Support Facilities**
- **Subsurface Operations**
- **Retrieval**



Waste Receipt at the Yucca Mountain Project

- **Waste forms to be received at the repository include:**
 - **Commercial spent nuclear fuel (SNF)**
 - **U.S. Department of Energy (DOE) SNF**
 - **High-level radioactive waste (HLW) (as vitrified glass)**
 - **Naval SNF**
- **All waste, with the exception of ~ 10% of the commercial SNF, will be received at the Yucca Mountain Project in canisters suitable for loading into a waste package for disposal**
- **The remaining 10% will be received in transportation casks (certified under 10 CFR Part 71) and loaded into transportation, aging, and disposal (TAD) canisters at the repository**



Waste Form Quantities

- **Commercial SNF**

- **~ 6,700 TAD canisters containing boiling water reactor (BWR) and pressurized water reactor (PWR) assemblies**
 - ◆ Represents ~ 90% of the commercial inventory
 - ◆ Will be loaded into TAD canisters at the utility sites and transported to the repository
 - ◆ This is approximately 200,000 BWR and PWR assemblies
- **~ 750 TAD canisters containing BWR and PWR assemblies**
 - ◆ Represents ~ 10% of the commercial inventory
 - ◆ Loaded in the Wet Handling Facility at the repository
 - ◆ ~ 30,000 BWR and PWR assemblies



Waste Form Quantities

- **DOE and commercial HLW**
 - ~ 9,300 canisters of vitrified glass
- **DOE SNF**
 - ~ 2,500 to 5,000 canisters
- **Naval SNF**
 - ≤ 400 canisters



Waste Receipt at YMP

Commercial SNF	Uncanistered	Truck Shipment	4,500 MTHM
Commercial SNF	Uncanistered	Rail Shipment	2,500 MTHM
Commercial SNF (Capability to Receive)	Dual-Purpose Canisters (DPCs)	Rail Shipment	1,300 Canisters 13–15,000 MTHM
Commercial SNF	TAD Canisters	(21-PWR/44-BWR) Rail Shipment	6,700 Canisters
HLW	Canisters	Rail or Truck Shipment	9,300 Canisters
DOE SNF	Canisters	Rail Shipment	3,500 Canisters
Naval SNF	Canisters	Rail Shipment	400 Canisters



Waste Form Description

- **Commercial SNF**
 - **Uncanistered BWR and PWR assemblies**
 - **BWR and PWR assemblies loaded into TAD canisters at the utility sites**
 - **Capability to receive DPCs transported from utility sites**
 - **Capability to receive failed-fuel cans as part of uncanistered SNF, or in DPCs, or in TAD canisters**

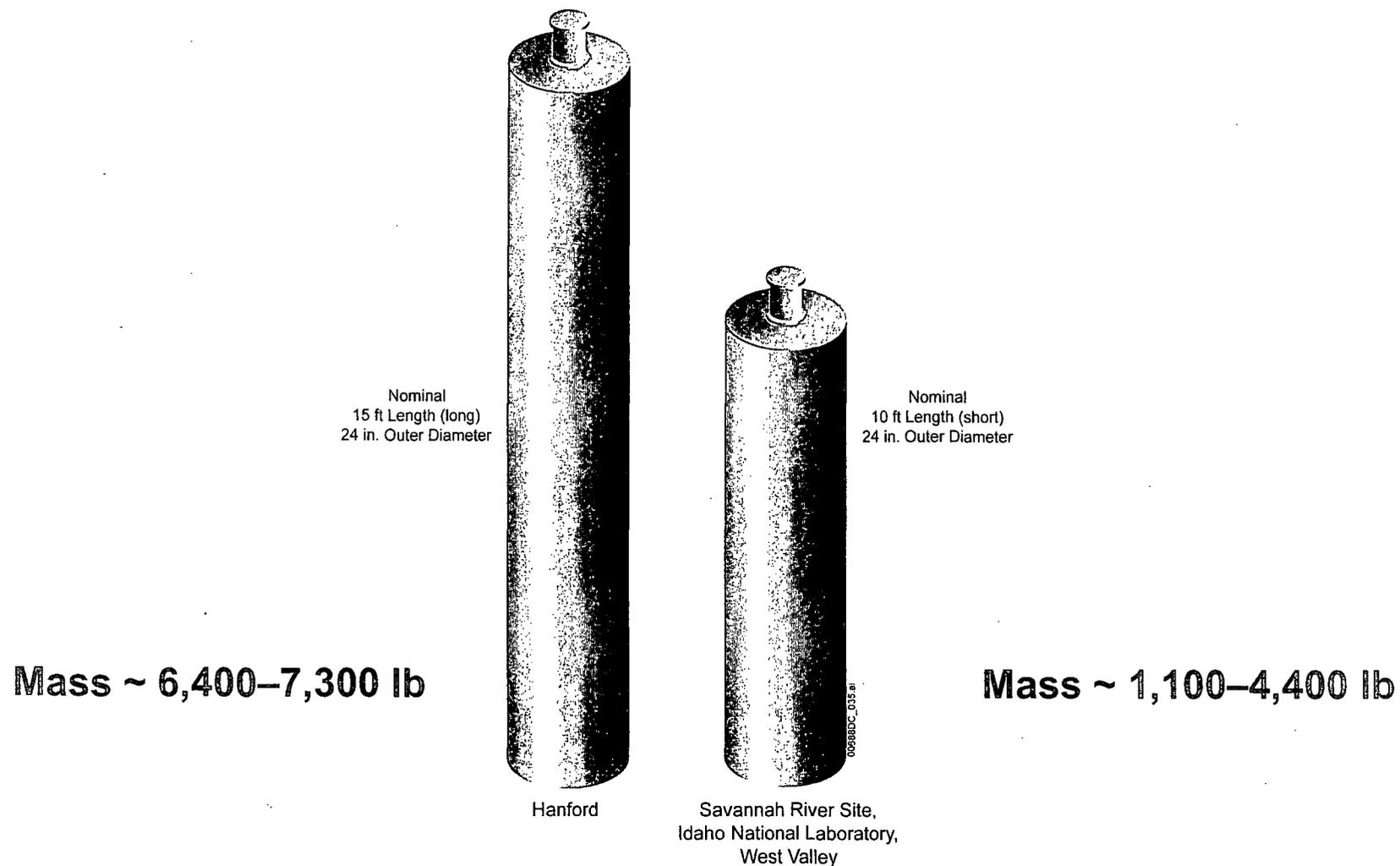


Waste Form Description

- **HLW**
 - **Vitrified glass from**
 - ♦ **Hanford Waste Treatment and Immobilization Plant**
 - ♦ **Defense Waste Processing Facility at the Savannah River Site (may include 870 canisters containing 13 metric tons total of immobilized plutonium)**
 - ♦ **Idaho National Laboratory**
 - ♦ **West Valley Demonstration Project**



HLW Radioactive Waste Standard Canisters



Waste Form Description

- **DOE SNF**

- **Bulk of waste composed of:**

- ◆ **DOE production reactors (N Reactor)**
 - ◆ **Commercial demonstration—Four reactors**
 - ◆ **Domestic and foreign research and training reactors**
 - ◆ **High-Flux Beam Reactor (Savannah River Site)**
 - ◆ **Fast Flux Test Facility (Hanford and Idaho National Laboratory)**
 - ◆ **TRIGA (Hanford and Idaho National Laboratory)**
 - ◆ **Advanced Test Reactor (Idaho National Laboratory)**



Waste Form Description

(Continued)

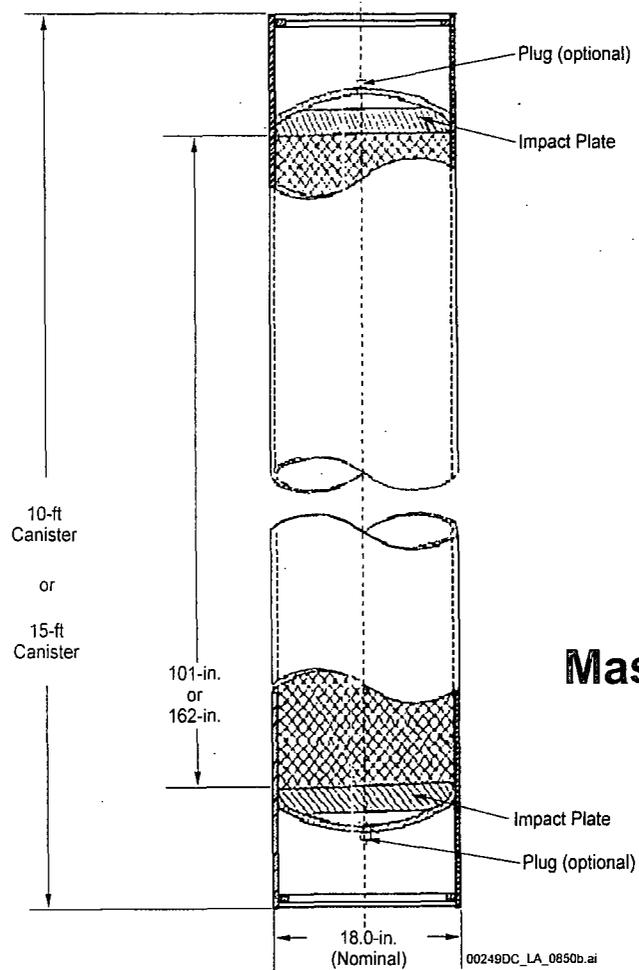
- **DOE SNF** (Continued)

- **Large variability in types of waste forms**

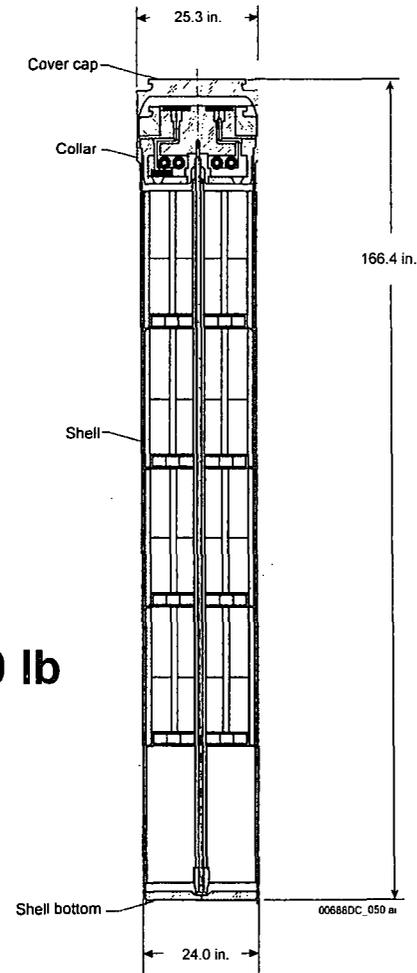
- ♦ **Moderator**
- ♦ **Configuration and size**
- ♦ **Cladding**
- ♦ **Enrichment**



DOE SNF Canisters



Mass ~ 5,000–10,000 lb



Standardized Canister

Multicanister Overpack



Waste Form Description

- **TAD Canister**

- **Sized to accommodate 21-PWR or 44-BWR spent fuel assemblies**
- **Certified as part of a 10 CFR Part 71 transportation system**
- **Designed to satisfy aging requirement at the repository**
- **Designed to meet 10 CFR Part 63 disposal requirement when loaded into a waste package**
- **Similar physical parameters as the Naval Long canister**



Typical TAD Canister



Mass ~ 108,000 lb

Nominal
66.5 in. Outer Diameter
212.0 in. Length

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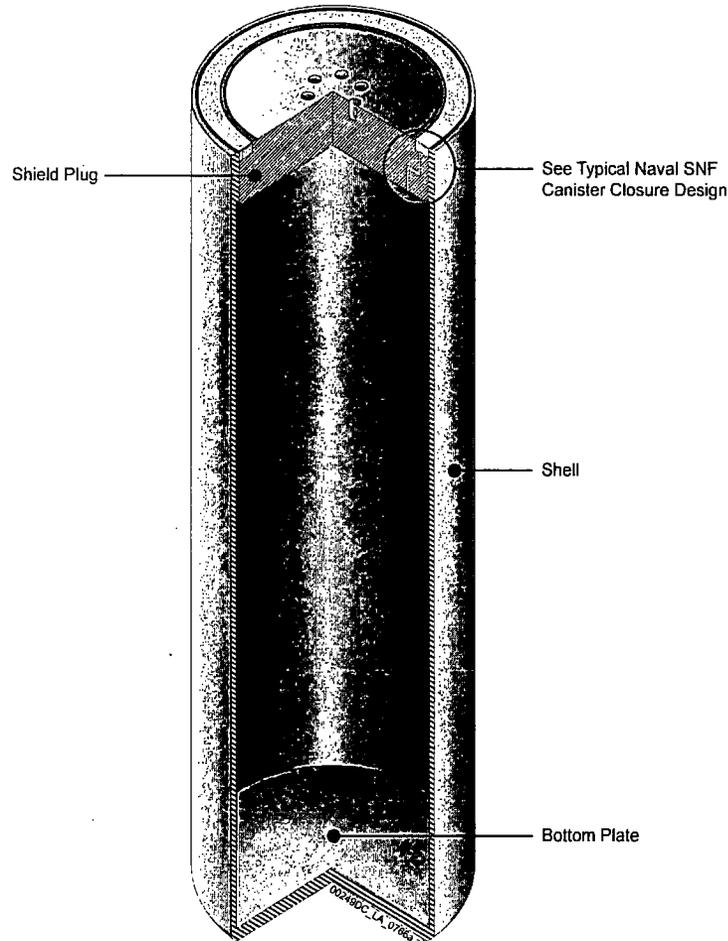


Waste Form Description

- **Naval SNF**
 - **Shipped in two standard containers suitable for disposal**
 - ◆ **Naval Short: 187-in.-long canister**
 - ◆ **Naval Long: 212-in.-long canister**
 - ◆ **Mass ~ 100,000 lb when loaded**



Naval SNF Canisters



Typical Naval Spent Nuclear Fuel Canister

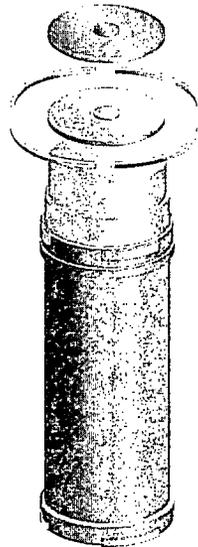


Waste Packages

- **Waste packages are loaded with disposable canisters, then welded closed in the Initial Handling Facility and Canister Receipt and Closure Facilities just prior to emplacement in the subsurface**
- **There are six waste package configurations:**
 - 21-PWR/44-BWR TAD Waste Package
 - Naval Short
 - Naval Long
 - 5-DHLW/DOE Short
 - 5-DHLW/DOE Long
 - 2-MCO/2-DHLW



Waste Package Configurations



21-PWR/44-BWR
TAD Waste Package



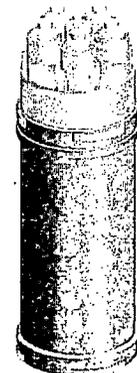
Naval Short



Naval Long



5-DHLW/DOE Short



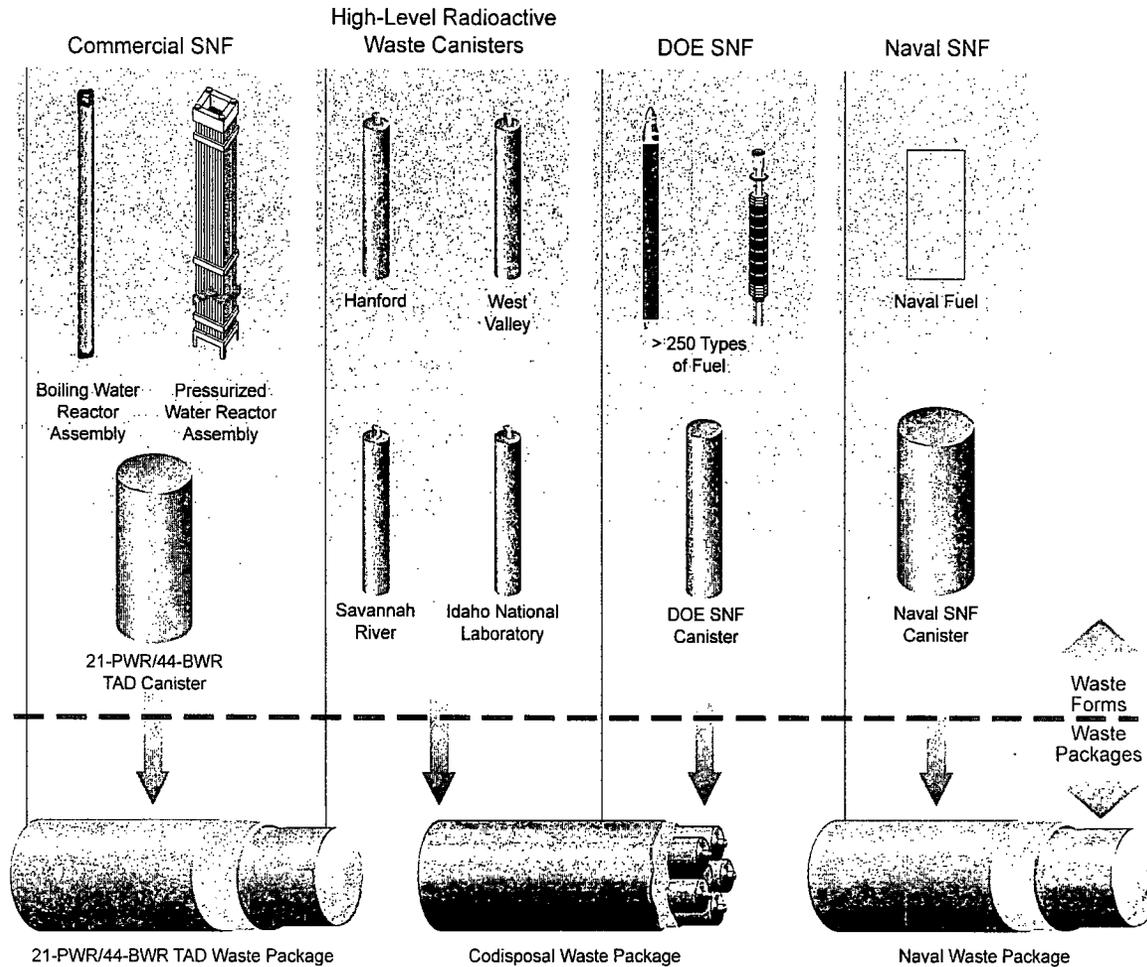
5-DHLW/DOE Long



2-MCO/2-DHLW



Waste Form and Waste Package Configurations



Drawing Not To Scale
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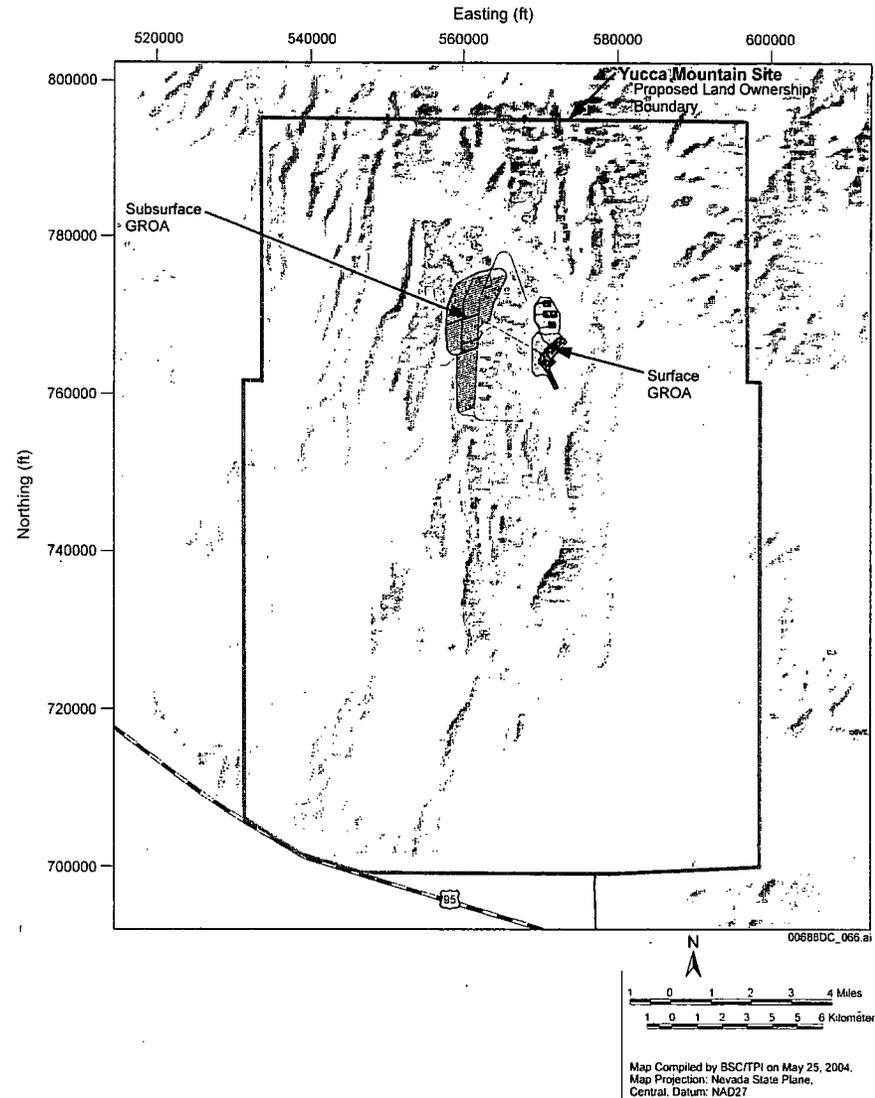


Site Description and Boundaries

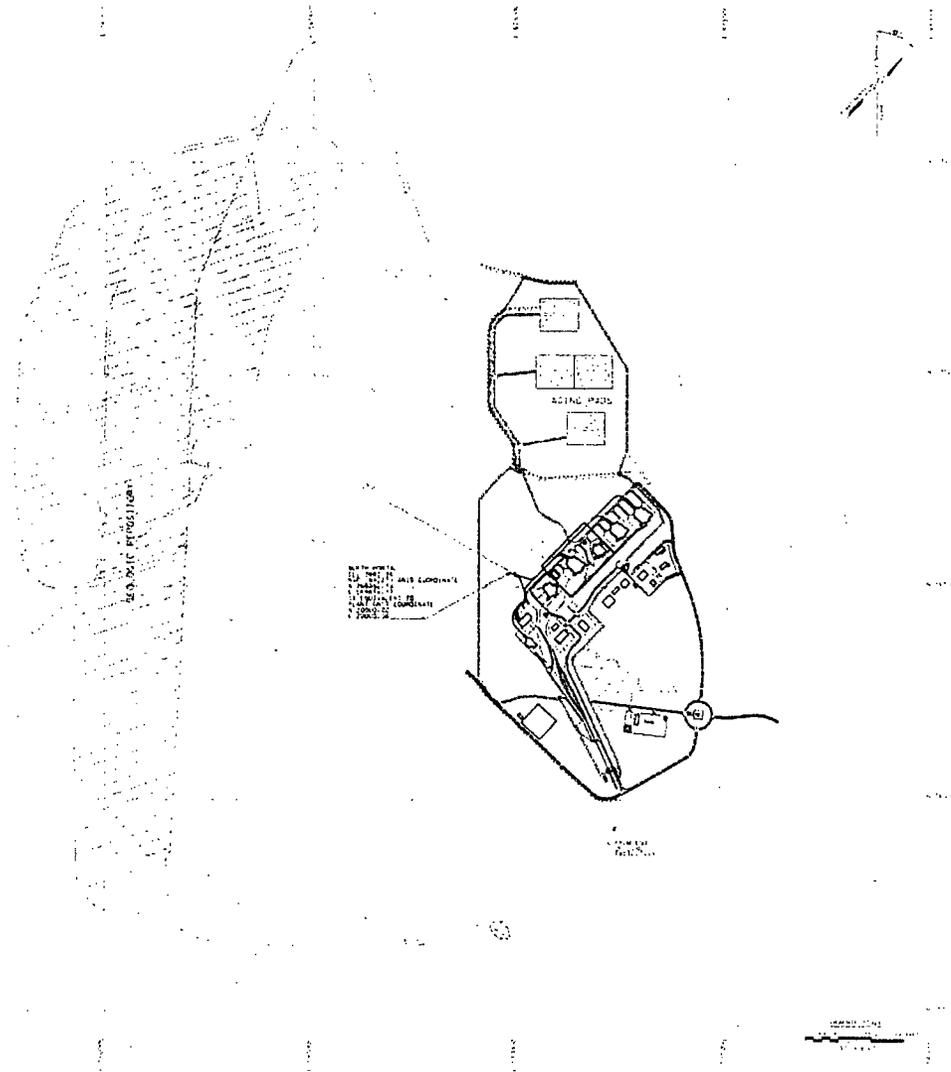
- **YMP is located within the Basin and Range Province of the western United States on federal lands in Nye County, Nevada**
- **The owner-controlled area (or site) is the area that DOE exercises its authority over and sets the boundary for safety analyses**
- **The site consists of lands that are or will be permanently withdrawn and reserved for DOE use**
- **Waste handling operations will be conducted within the geologic repository operations area (GROA) located within the site**



Geologic Repository Operations Area and Site Boundaries



Overall Site Plan



Nuclear Surface Facilities

- **The nuclear surface facilities receive, handle, package, age, and prepare waste for emplacement**
- **These facilities consist of:**
 - **Initial Handling Facility**
 - **Canister Receipt and Closure Facility (3 CRCFs)**
 - **Receipt Facility**
 - **Wet Handling Facility**
 - **Aging Pads and Aging Facility**

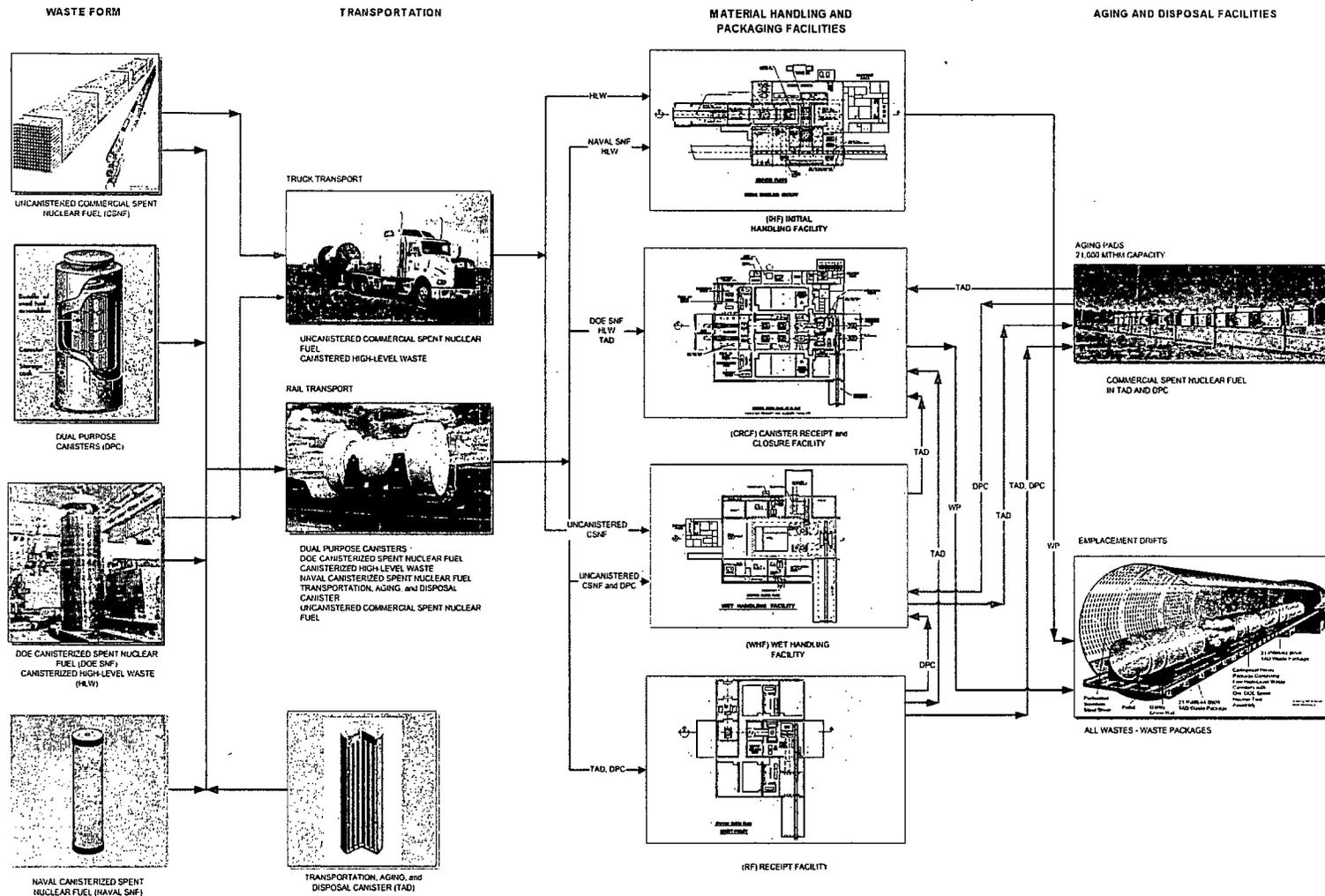


Operations in the GROA

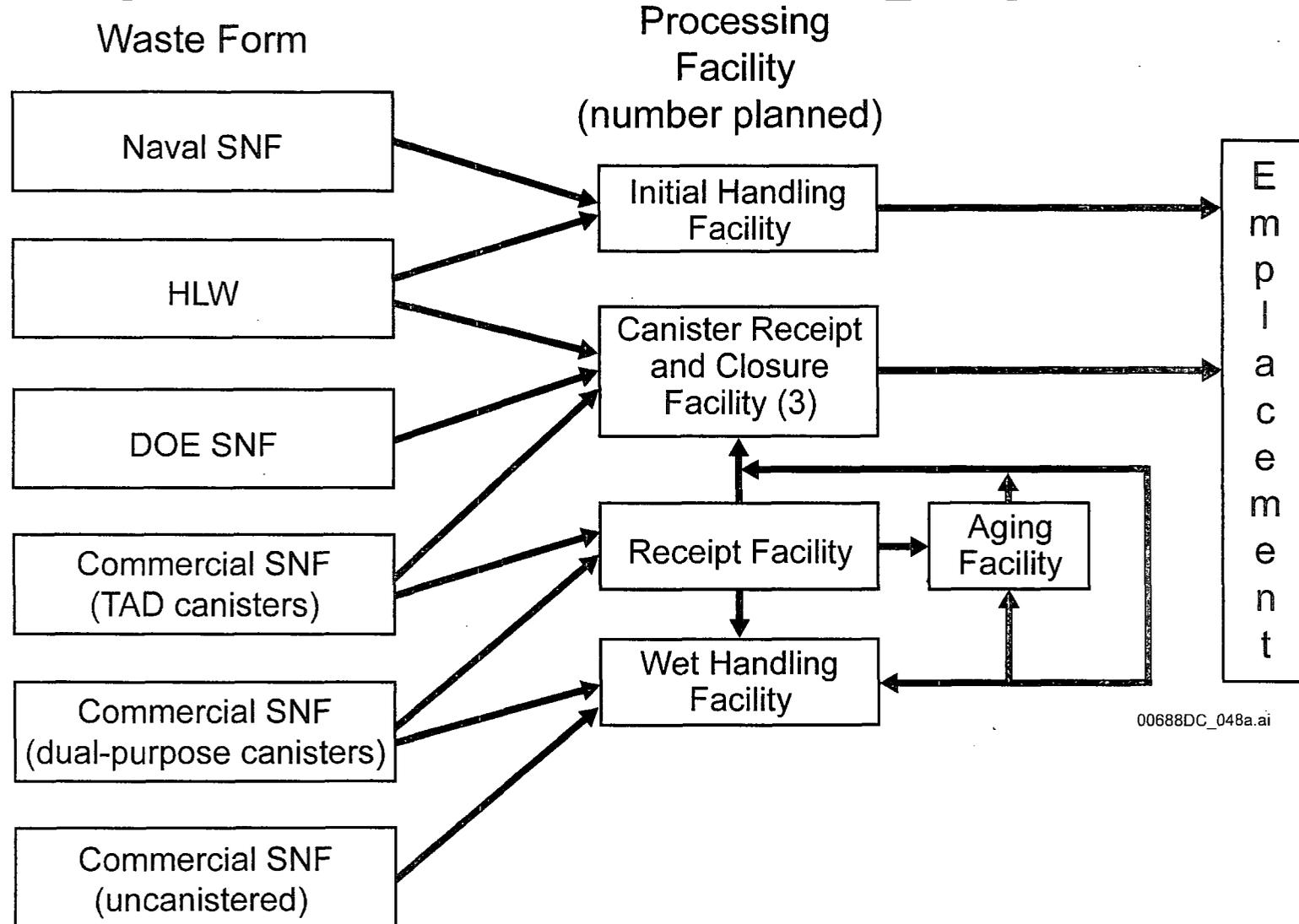
- **Facility operations controlled locally in each facility**
 - **Control areas include**
 - ◇ **Cask Transfer**
 - ◇ **Canister Transfer**
 - ◇ **Waste Package Closure**
 - ◇ **Waste Package Loadout**
 - ◇ **Refueling Machine Transfers**
 - **Facility Managers direct operations personnel in each facility**
 - **Site Operations, including monitoring and interrupt capability for other facilities, exists in the Central Control Center (CCC)**
 - **Shift Manager, in the CCC, directs Facility Managers**
 - **CCC directs transport and emplacement vehicle (TEV) and Subsurface Operations**



Detailed Waste Handling Operations



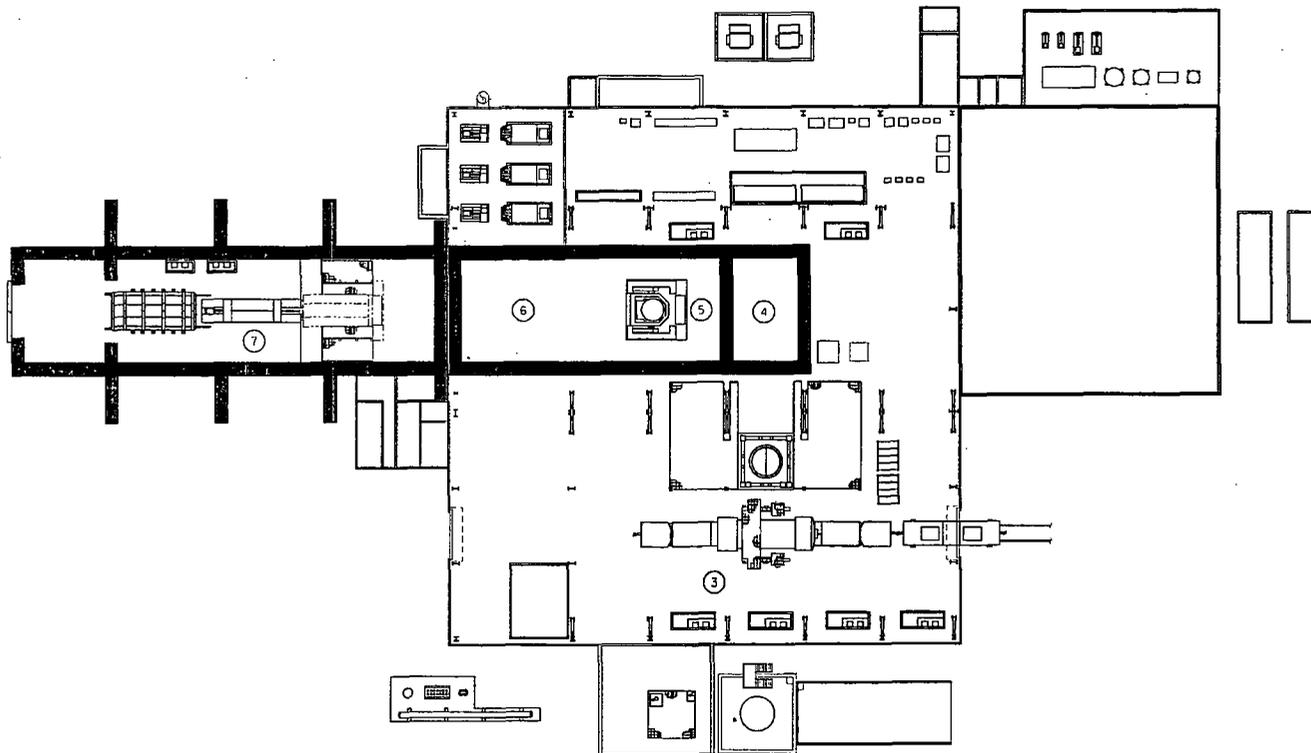
Simplified Waste Handling Operations



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Initial Handling Facility



- ③ CASK PREPARATION
- ④ UNLOADING
- ⑤ LOADING
- ⑥ WP POSITIONING
- ⑦ WP LOADOUT

GROUND FLOOR PLAN

INITIAL HANDLING FACILITY

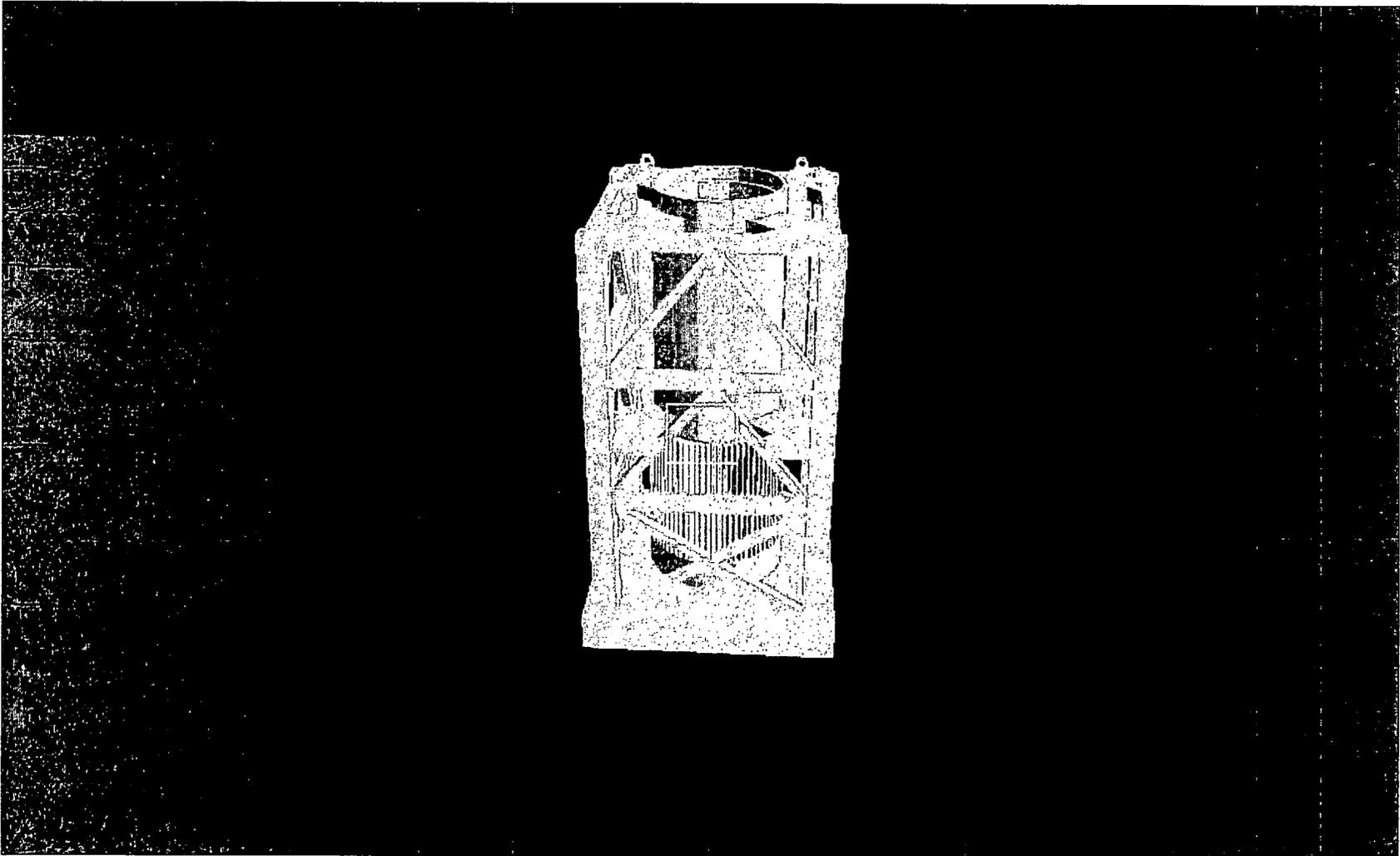


Animations for the Basic Operations for Surface Facilities

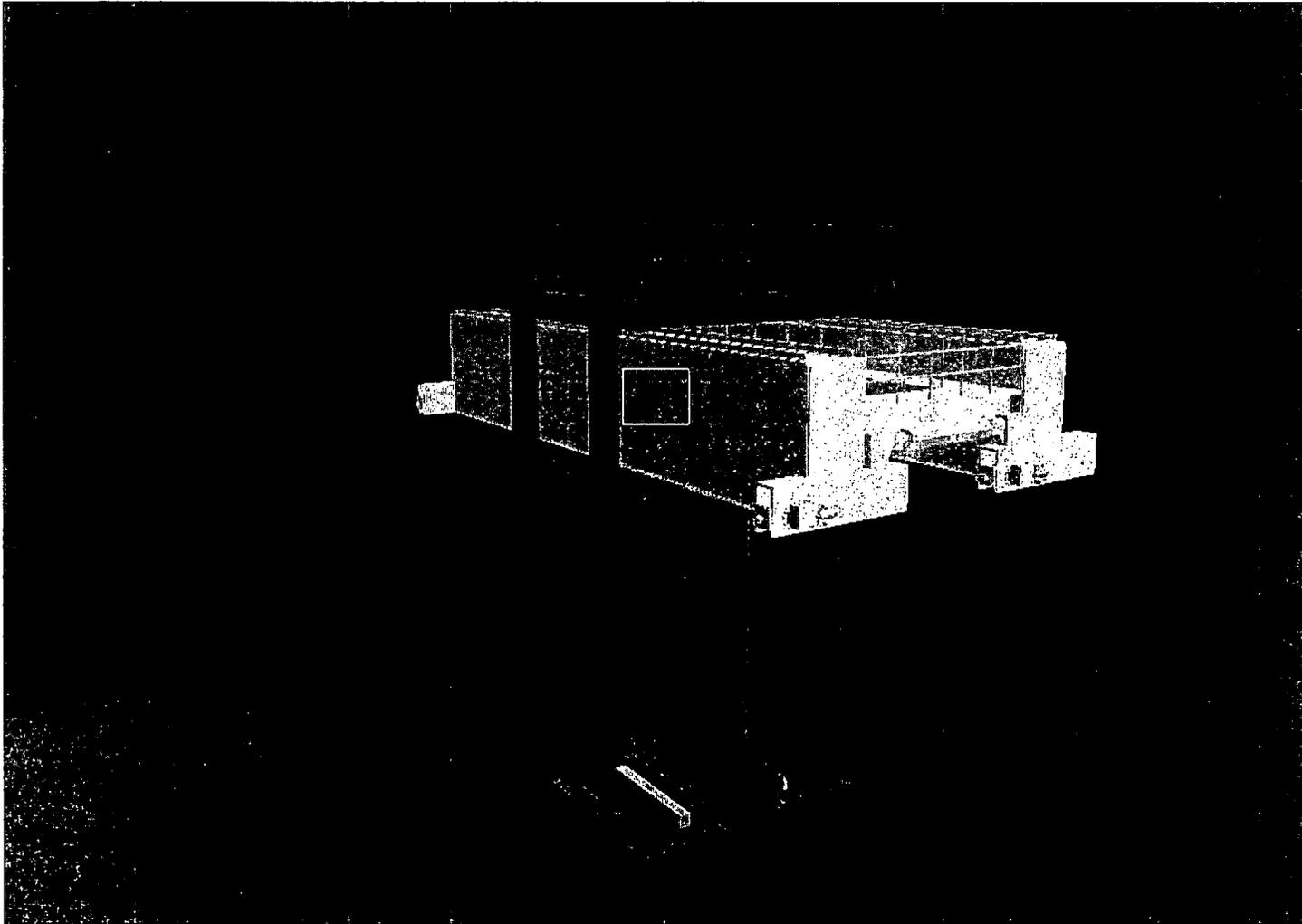
- **Cask Transfer Trolley**
- **Canister Transfer Machine**
- **Waste Package Trolley—Vertical**
- **Waste Package Trolley—Horizontal**



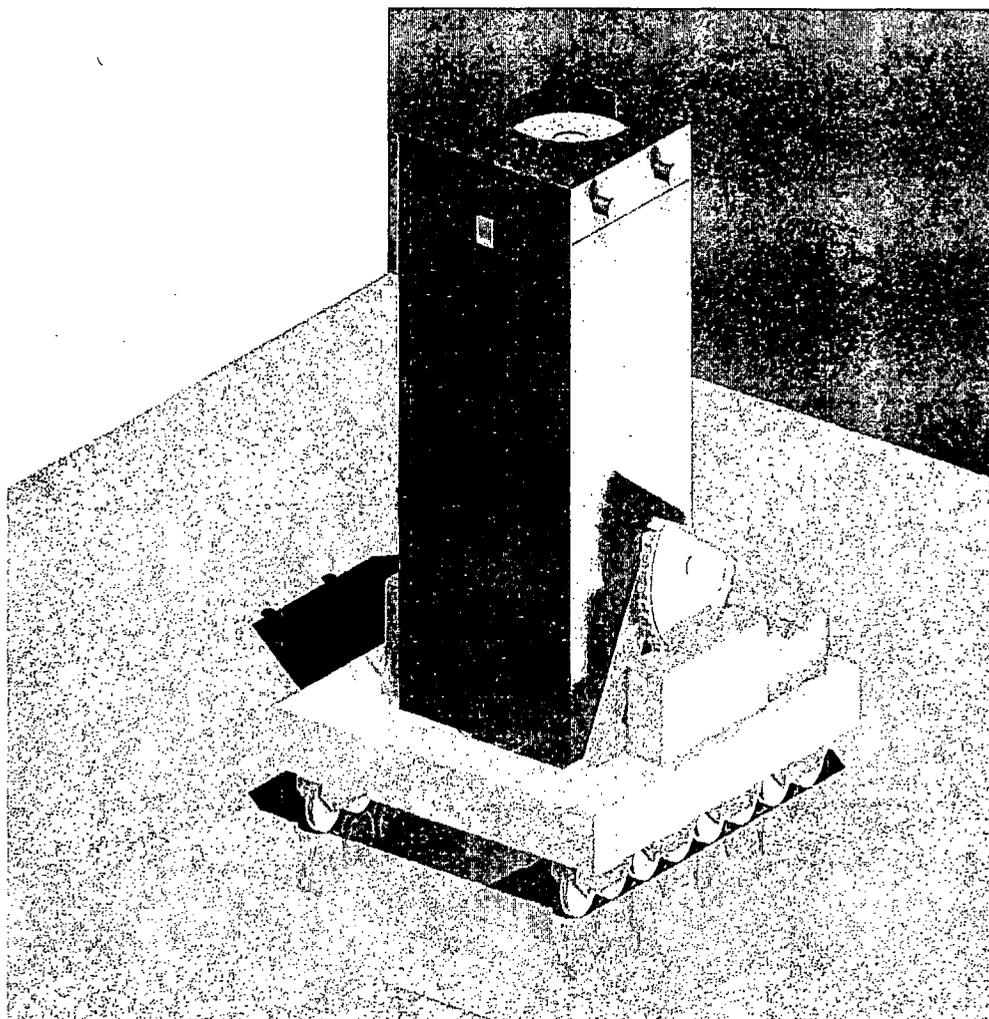
Cask Transfer Trolley



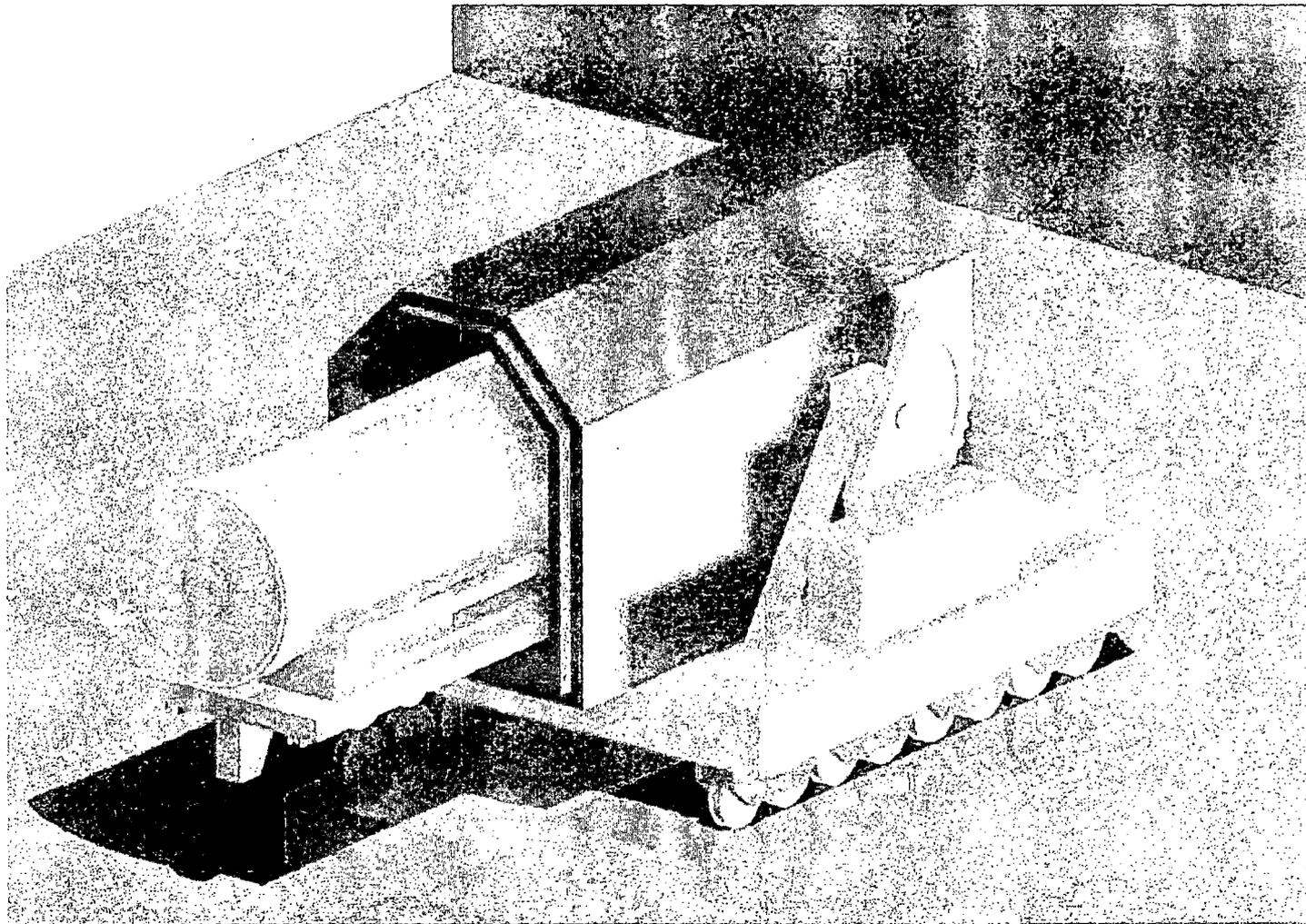
Canister Transfer Machine



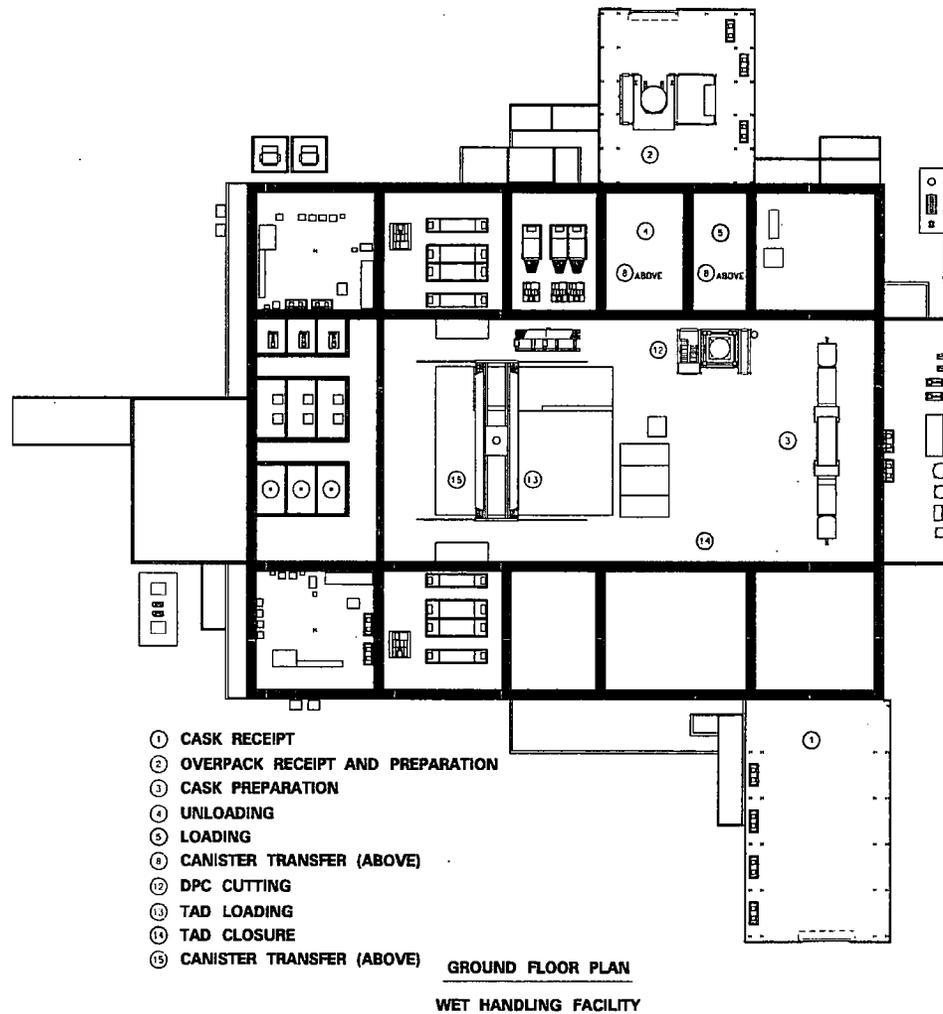
Waste Package Trolley—Vertical



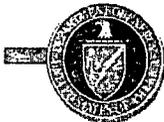
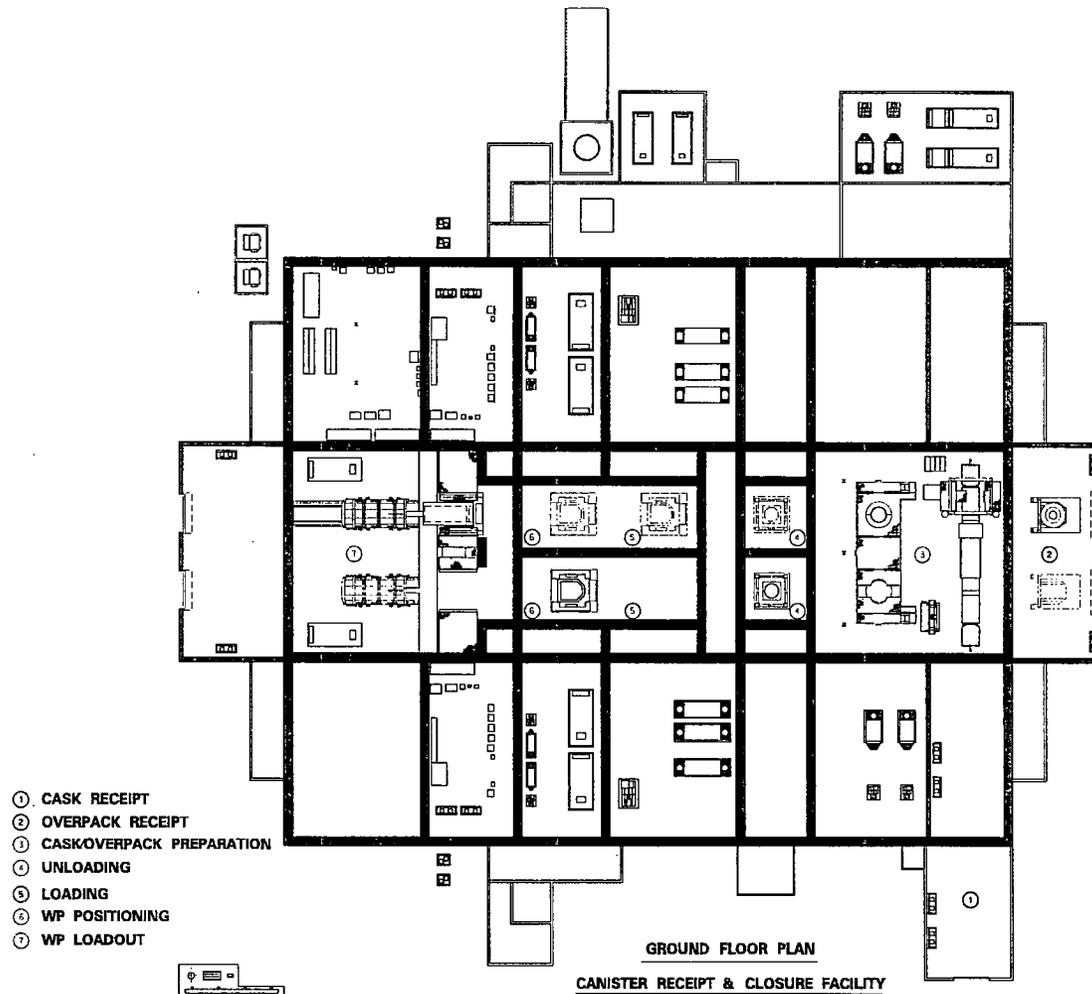
Waste Package Trolley—Horizontal



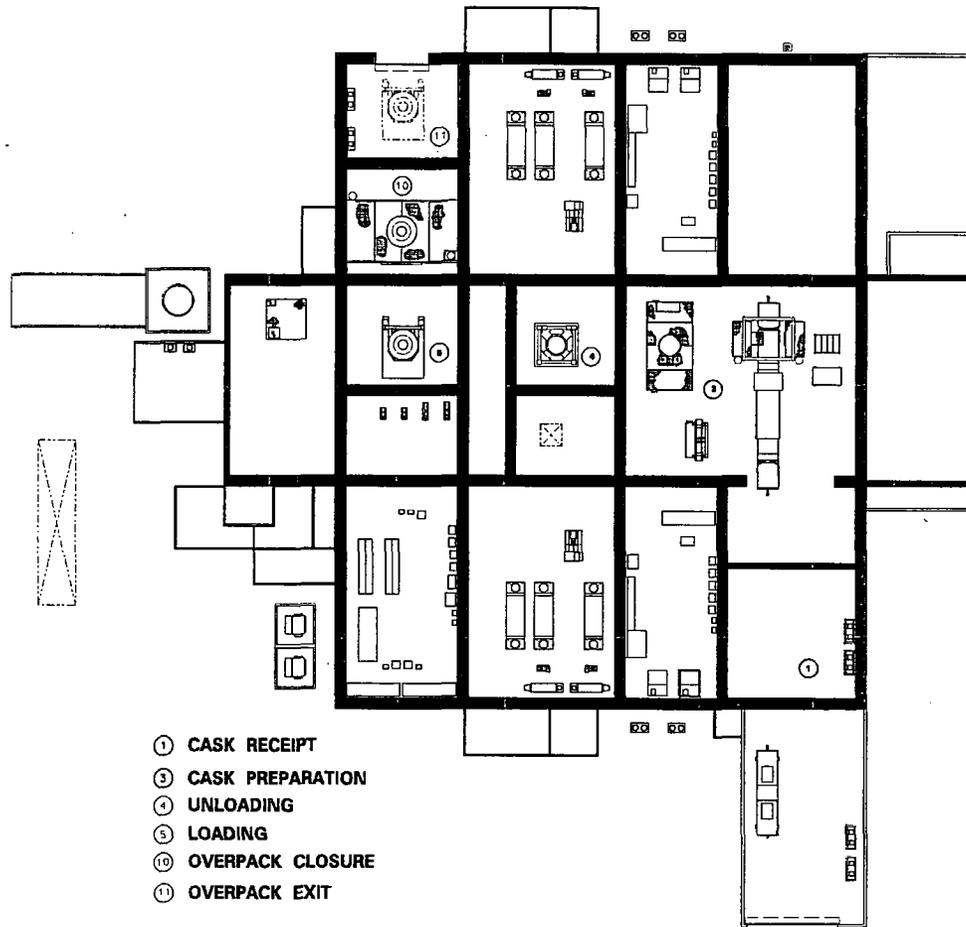
Wet Handling Facility



Canister Receipt and Closure Facility



Receipt Facility

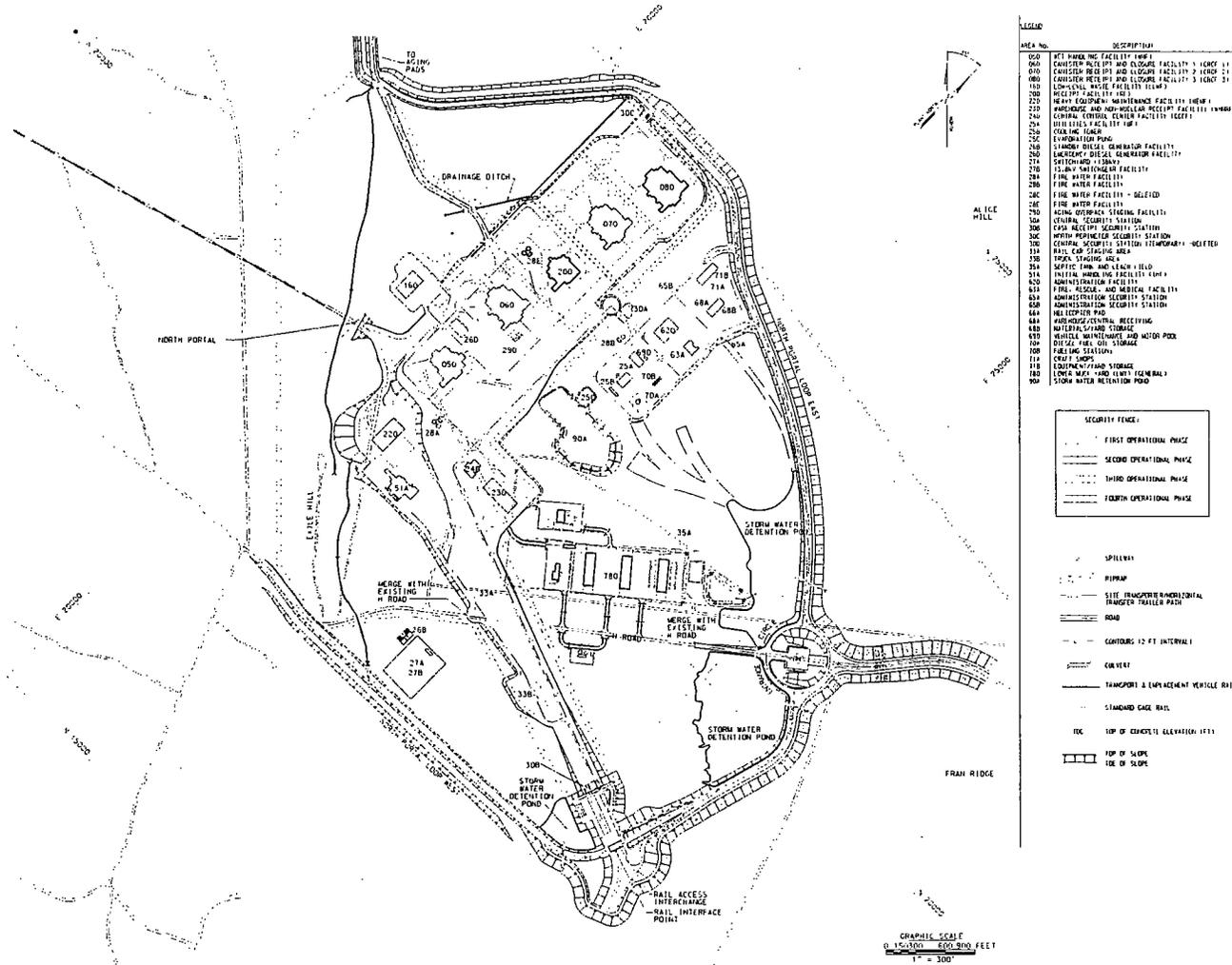


GROUND FLOOR PLAN

RECEIPT FACILITY



Phased Construction



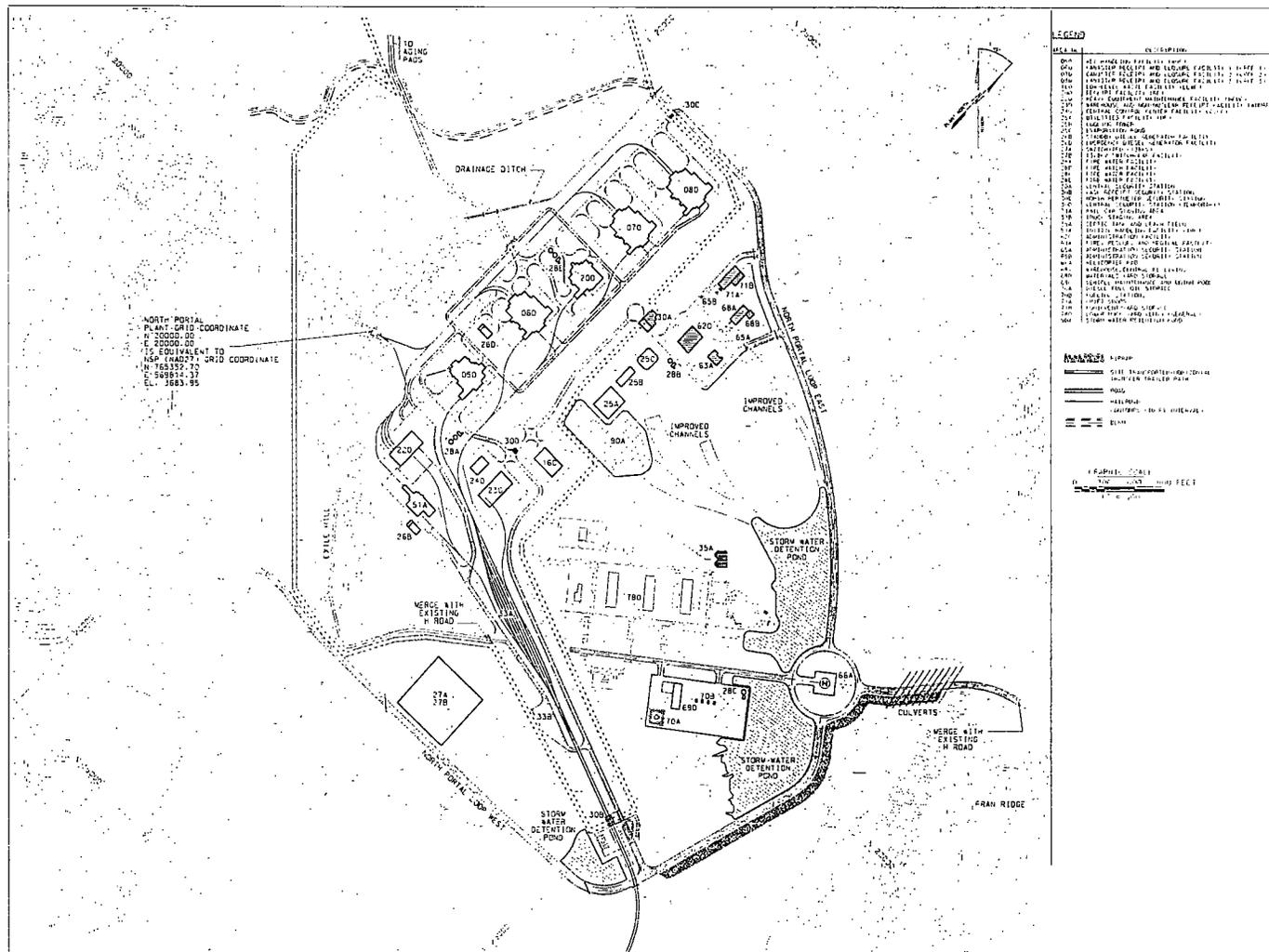
Phased Construction (Continued)

This table will be updated to reflect the new surface GROA outline and plan. Note that not all areas listed on this table are included on the previous slide.

Initial Operating Capability			
Phase 1			
050	Wet Handling Facility	26D	Emergency Diesel Generator Facility
060	Canister Receipt and Closure Facility 1	27A	Switchyard (138 kV)
51A	Initial Handling Facility	27B	13.8 kV Switchgear Facility
17K	Aging Pad K	28A	Fire Water Facility (Central)
160	Low-Level Waste Facility	28B	Fire Water Facility (East)
220	Heavy Equipment Maintenance Facility	30A	Central Security Station
230	Warehouse and Non-Nuclear Receipt Facility	30B	Cask Receipt Security Station
240	Central Control Center Facility	33A	Railcar Staging Area
25A	Utilities Facility	33B	Truck Staging Area
25B	Cooling Tower	35A	Septic Tank and Leach Field
25C	Evaporation Pond	66A	Helicopter Pad
26B	Standby Diesel Generator Facility		
Full Operating Capability			
Phase 2			
200	Receipt Facility	68A	Warehouse/Central Receiving
28C	Fire Water Facility (South)	68B	Materials/Yard Storage
28E	Fire Water Facility (North)	690	Vehicle Maintenance and Motor Pool
620	Administration Facility	70A	Diesel Fuel Oil Storage
63A	Administration Security Station	71A	Craft Shops
65B	Administration Security Station	71B	Equipment/Yard Storage
Phase 3			
070	Canister Receipt and Closure Facility 2	17M	Aging Pad M
17L	Aging Pad L		
Phase 4			
080	Canister Receipt and Closure Facility 3	17N	Aging Pad N
30C	North Perimeter Security Station		



Non-Nuclear Support Facilities Included in the Surface Facilities



Non-Nuclear Support Facilities

Facility	Description
Emergency Diesel Generator Facility	Important to safety (ITS) seismically designed reinforced concrete structure that houses the diesel generators (and their local fuel storage [day tank]) that provide power to the ITS systems credited in the safety analyses (generally HVAC components in the major processing facilities).
Low-Level Waste Facility	Seismically designed reinforced concrete and steel structure for collection and packaging of low-level waste generated during handling operations, prior to shipment.
Heavy Equipment Maintenance Facility	Structure that houses equipment and areas to perform maintenance on the heavy mechanical equipment (such as the aging cask transporter and the transport and emplacement vehicle).
Warehouse and Non-Nuclear Receipt Facility	Structure for acceptance and staging of components used for the waste handling operations of the repository (such as waste packages).
Central Control Center Facility	Seismically designed reinforced concrete structure that houses the control center for (1) monitoring operations throughout the repository and providing permissive signals for surface operations, and (2) for control of the operations of the transport and emplacement vehicle.



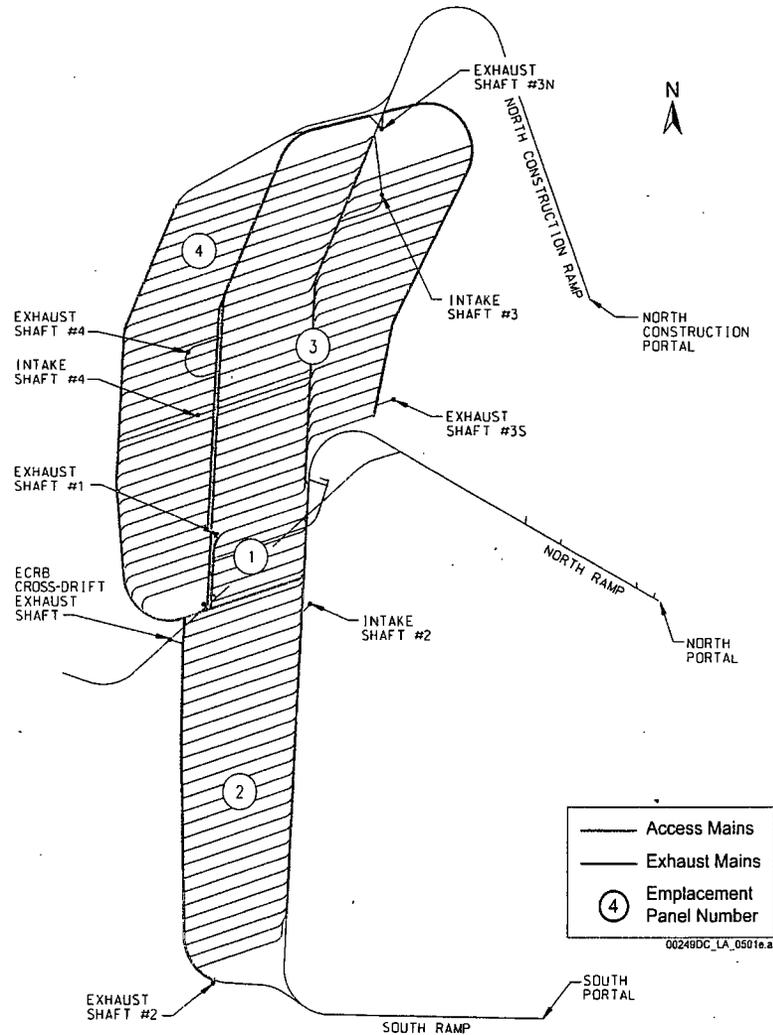
Non-Nuclear Support Facilities

(Continued)

Facility	Description
Cooling Tower	Structure that provides cooling for service water for system and process components that have no important to safety function.
Evaporation Pond	Structure for waste water disposal that provides no ITS function.
Standby Diesel Generator Facility	Structure that houses the diesel generators (and their local fuel storage [day tank]) that provide power to important process components that have no important to safety functions.
Railcar Buffer Area	Area located inside the geologic repository operations area for queuing loaded and unloaded rail cars with transportation casks while waiting for availability of the process facilities.
Truck Buffer Area	Area located inside the geologic repository operations area for queuing loaded and unloaded trucks with transportation casks while waiting for availability of the process facilities.
Diesel Fuel Oil Storage	Structure that houses diesel fuel used for refilling local fuel storage at diesel-powered components and heavy equipment.



Subsurface Facility Layout



Subsurface Facility

- **Located between 215 and 450 m below the surface and between 215 and 365 m above the water table**
- **Facility consists of access mains, exhaust mains, and 108 emplacement drifts in four panels constructed in phases**
- **Emplacement is conducted only through the North Portal, adjacent to the Surface Facilities**



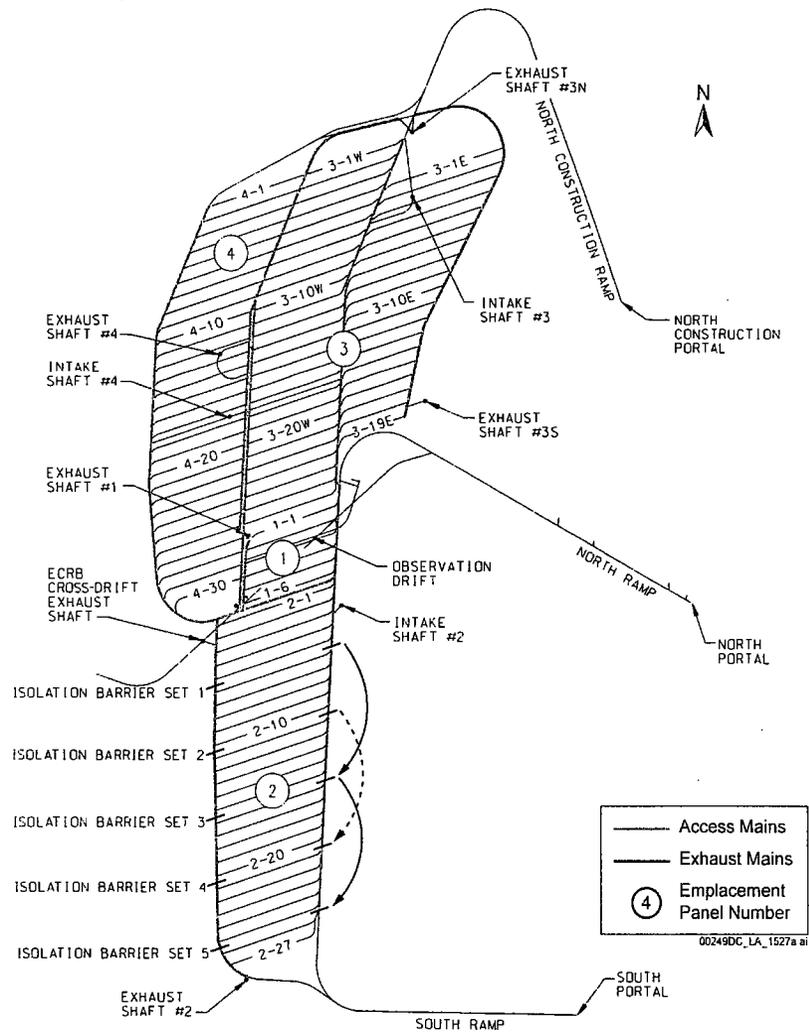
Subsurface Facility

(Continued)

- **Construction and emplacement areas are separated by pairs of isolation barriers; Each pair is located in the ventilation and access mains between construction and operations areas**
- **Each isolation barrier consists of a bulkhead with an airlock and will be constructed of structural steel and is an alarmed security boundary**
- **The isolation barriers contain modular components and are moved as additional emplacement drifts are completed**



Sample of Isolation Barrier Movement

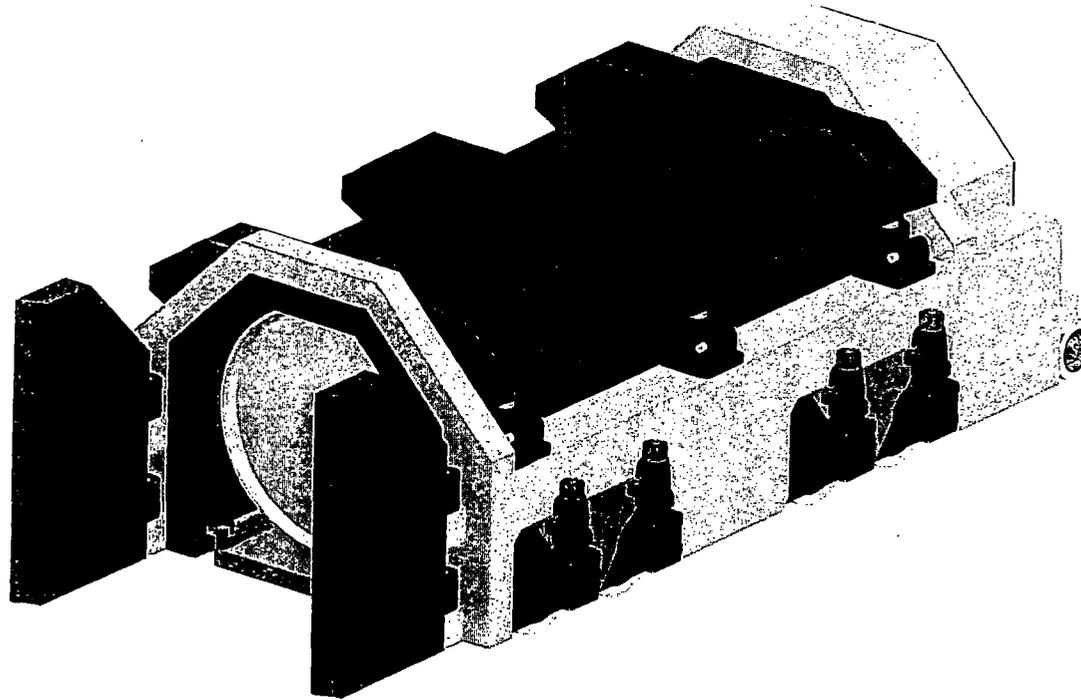


Subsurface Emplacement

- **Transport and emplacement vehicle (TEV) accepts the waste package at the Canister Receipt and Closure Facilities and the Initial Handling Facility following waste package closure**
- **The TEV moves the waste package to the North Portal, into the subsurface, and places the waste package into the emplacement drift**
- **Each emplacement drift contains a set of access doors, which are opened to allow access to the transport and emplacement vehicle; Following emplacement of the waste package, the emplacement drift access doors open to allow the TEV to exit**



Transport and Emplacement Vehicle



Retrieval

- **The repository design preserves the option to retrieve any or all of the emplaced waste**
- **This is accomplished by maintaining systems such that the reverse of emplacement can be accomplished**
- **If the decision is made to retrieve any or all of the waste, handling facilities and any additional storage facilities would be developed and a request to amend the license to receive and possess would be prepared to provide to the NRC the specific preclosure safety analyses for retrieval**





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Emergency Planning

Presented to:

**NRC/DOE Technical Exchange on Physical Protection,
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Presented by:

Daniel Hulbert

**Senior Emergency Management Program Coordinator
Bechtel SAIC Company, LLC**

June 28, 2007

Rockville, Maryland

Acronyms

- **LA** License Application
- **GROA** Geologic Repository Operations Area
- **NTS** Nevada Test Site
- **EPA** Environmental Protection Agency
- **CCCF** Central Control Center Facility
- **TSC** Technical Support Center
- **EOF** Emergency Operations Facility
- **GET** General Employee Training
- **EPCRA** Emergency Planning and Community Right-To-Know Act
- **EPA 400** Manual of Protection Action Guides and Protective Actions for Nuclear Incidents



EMERGENCY PLANNING

Overall Approach

- **Emergency Planning – two distinct aspects:**
 - **10 CFR 63.21(c)(21): Description of Emergency Plan – The License Application (LA), Section 5.7, will contain a description of the Emergency Plan**
 - **10 CFR 63.161 – Emergency Plan criteria will be based on 10 CFR 72.32(b)**



EMERGENCY PLANNING

Overall Approach

(Continued)

- **Additional guidance for the Emergency Plan**
 - **NUREG-1804, Section 2.5.7**
 - ◆ **One Acceptance Criterion**
 - » **Divided into 20 Parts**
 - **NUREG-1567 as modified by SFPO-ISG-16 (Spent Fuel Project Office-Interim Staff Guidance-16: Emergency Planning)**



EMERGENCY PLANNING

Implementation

- **LA Section 5.7 will contain a discussion of the 20 sub-criteria based on the information available at the time of LA submittal**
- **DOE anticipates submitting the Emergency Plan to the NRC approximately six months prior to the submittal of the updated LA**
- **DOE will meet with the NRC staff and other interested parties as we develop the Emergency Plan to update our progress**



EMERGENCY PLAN

Status

- **Work on the Emergency Plan has begun**
- **Inputs to the Emergency Plan include**
 - **Design Details**
 - **Results of Preclosure Safety Analysis**
 - **Discussions with potential offsite responders**
- **DOE is using lessons learned from Emergency Plans developed for other licensed nuclear facilities as guidance**



EMERGENCY PLAN

Section Breakdown

- Repository Description
- Types and Classification of Accidents
- Detection of Accidents
- Mitigation of Consequences
- Assessment of Releases
- Responsibilities
- Notification and Coordination
- Information to be Communicated
- Training
- Safe Condition



EMERGENCY PLAN

Section Breakdown

(Continued)

- Exercises
- Hazardous Materials
- Comments on Plan
- Offsite Assistance
- Public Information



EMERGENCY PLAN

- **Repository Description**
 - **Describes the facility and surrounding areas**
 - ◆ **The buildings associated with the Geologic Repository Operations Area (GROA) will be shown consistent with the engineering drawings**
 - ◆ **The configuration of the site boundary will be shown along with the corridors for the rail line and expected locations of other facilities within the site boundary**
 - ◆ **Actual configurations at the time of operations are still subject to change**



EMERGENCY PLAN

(Continued)

- **Repository Description** (Continued)
 - **Near site areas will be described**
 - ♦ **There are no facilities of concern (schools, hospitals, parks, recreation areas, etc)**
 - ♦ **There are no population centers in close proximity to the site**
 - » **Nearest resident is approximately 14 miles from the North Portal**
 - » **Total Population within a 50 mile radius is approximately 23,000**
 - **Site access is primarily from US-95 with additional access available from the Nevada Test Site (NTS)**



EMERGENCY PLAN

(Continued)

- **Types and Classification of Accidents**
 - The type of events will be the same as those to be contained in LA Section 1.7.
 - The repository will be using the Alert and Site Area Emergency definitions as contained in SFPO-ISG-16

- **Detection of Accidents**
 - Once the events sequences are finalized, the detection methods will be identified



EMERGENCY PLAN

(Continued)

- **Mitigation of Consequences**
 - For the identified event sequences, the mitigation provisions will be generally described
 - Procedures will be developed for the implementation of these actions prior to facility operations



EMERGENCY PLAN

(Continued)

- **Mitigation of Consequences** (Continued)

- **Onsite Protective Actions**

- ◆ **The repository will be using EPA 400 guidance for exposure guidelines for specific actions**
- ◆ **The repository will be using both Sheltering and Evacuation as its primary protective action strategies for workers**
 - » **Sheltering will use unaffected facilities**
 - » **Evacuation will be predominantly by bus (some private vehicles expected)**
 - » **If needed, monitoring of evacuees is expected to be performed prior to leaving the site**



EMERGENCY PLAN

(Continued)

- **Mitigation of Consequences** (Continued)
 - **Offsite Protective Actions**
 - ◆ The preliminary indications from the consequence analysis indicate that there will be no offsite consequences requiring mitigative actions



EMERGENCY PLAN

(Continued)

- **Assessment of Releases**
 - **Release assessment will focus primarily on the site to provide assurance that site workers are adequately protected**
 - **Protecting GROA & site construction workers also provides assurance that the general public is protected**
 - **The Operational Radiation Protection Program provides release assessment capabilities, monitoring equipment, and personnel protective equipment**



EMERGENCY PLAN

(Continued)

- **Responsibilities**

- The normal facility organization, consistent with LA Section 5.3, will be described in the Emergency Plan
- The Emergency Plan will establish the Emergency Response Organization
 - ◆ Where the organizational detail is not currently available, functions will be assigned to organizations with specific staffing to be defined later
 - ◆ There will be sufficient staff on shift at all times to implement the Emergency Plan until augmented staff can arrive



EMERGENCY PLAN

(Continued)

- **Responsibilities** (Continued)
 - **Emergency Response Records**
 - ◆ Record of actual events will be collected and retained
 - ◆ Causes and investigations of actual events will use the repository's Corrective Action Program and any records will be retained through that program
 - ◆ Records of drills and exercise will be retained as Training Records
 - ◆ Emergency equipment testing and maintenance records will be retained in accordance with their respective program requirements
 - ◆ Supporting agreements will be reviewed annually and updated as necessary



EMERGENCY PLAN

(Continued)

- **Responsibilities** (Continued)

- **Responsibilities of Government Agencies at the Site**

- ◆ **There will be notifications of the appropriate government agencies when incidents occur**
 - ◆ **It is not currently anticipated that State or Local governments will have primary response roles for incidents occurring within the GROA**



EMERGENCY PLAN

(Continued)

- **Notification and Coordination**

- **Incident classification and initial notification will be performed in the Central Control Center Facility (CCCF) by the Shift Manager**
 - ◆ **Site personnel (by Public Address Systems) and first responders (by radio or telephone) will be notified first**
 - ◆ **The Emergency Response Organization will be activated by a high speed notification system**
 - ◆ **Local and State governments will be notified**
 - ◆ **NRC will be notified within one hour of classification or earlier as conditions allow**



EMERGENCY PLAN

(Continued)

- **Notification and Coordination** (Continued)
 - **Emergency Response Facilities and Equipment**
 - ◆ **The repository is using the guidance contained in NUREG-0696 for Emergency Response Facilities with modifications**
 - » **The CCCF becomes the Technical Support Center (TSC) to provide a control point for the management of the repository response to an incident**
 - » **The Administration Building contains the necessary physical space, along with voice, video, and data communications capabilities to allow it to serve as an alternate TSC or Emergency Operations Facility (EOF)**



EMERGENCY PLAN

(Continued)

- **Notification and Coordination** (Continued)
 - **Emergency Response Facilities and Equipment** (Continued)
 - ◇ **The Operations Support Center will be in the Warehouse and Non-Nuclear Receipt Facility**
 - » **A non-affected nuclear facility will be used as an alternate location**
 - ◇ **An EOF will be co-located with the OCRWM offsite offices**



EMERGENCY PLAN

(Continued)

- **Notification and Coordination** (Continued)
 - **Emergency Response Facilities and Equipment** (Continued)
 - ◆ A Joint Information Center will be co-located with the EOF to address media and public information activities
 - ◆ The repository will provide suitable equipment and supplies for personnel protection and incident mitigation in accessible locations and in sufficient quantities to support an effective incident response



EMERGENCY PLAN

(Continued)

- **Information to be Communicated**
 - **The information to be included in the notifications will be consistent with the NRC Event Notification Worksheets. (suggest NRC Form 361 be modified for repository use)**



EMERGENCY PLAN

(Continued)

- **Training**

- The repository will use the *Systematic Approach to Training*; this approach will also be applied to Emergency Plan training

- ♦ The specific courses and estimated training times for the Emergency Response Organization will be developed
- ♦ General Employee Training (GET) will include training on emergency response actions to be taken by all site personnel
- ♦ Training for offsite response agencies will be offered annually



EMERGENCY PLAN

(Continued)

- **Safe Condition**

- Reentry and Recovery plans will be generally described
 - ◆ Specific procedures will be developed prior to operations

- **Exercises**

- The repository will conduct biennial full participation exercises
 - ◆ Offsite response agencies will be offered the opportunity to participate
- Exercise material development and control will be consistent with accepted practices
- Controllers and evaluators will be trained, and used to evaluate the effectiveness of the response



EMERGENCY PLAN

(Continued)

- **Exercises** (Continued)

- Critiques will be conducted
- Deficiencies and weaknesses will be entered into the repository corrective actions program for tracking through resolution
- Drills will be conducted of the functions specified in the rule and at the frequencies required

- **Hazardous Chemicals**

- The repository will certify compliance with EPCRA (Emergency Planning and Community Right-To-Know Act)
 - ◆ Quantities of hazardous materials are expected to be limited within the GROA



EMERGENCY PLAN

(Continued)

- **Comments on the Plan**
 - **The DOE will provide the Emergency Plan to offsite response organizations for review and comment prior to submittal in accordance with the requirements of 10 CFR 72.32(b)(14)**
 - ◆ **Any comments received will be provided with the Emergency Plan at the time of submittal**



EMERGENCY PLAN

(Continued)

● Offsite Assistance

- DOE is currently in discussions with Nye County on a Memorandum of Understanding pertaining to planning for public safety and related services during repository development and operations
- The other potential major source of offsite assistance is NTS
 - ◆ While there have been no formal discussion with NTS regarding future assistance arrangements, there is an existing agreement for NTS support of current operations



EMERGENCY PLAN

(Continued)

- **Offsite Assistance** (Continued)
 - **Offsite assistance is expected to be a partnership between DOE and the offsite assistance providers**
 - **Once the respective roles of the offsite assistance providers are established, reasonable measures will be taken to assure that the providers can and will meet their response obligations**
 - **Periodic training will be offered, exercise participation will be encouraged, and periodic meetings will be held to review items of mutual interest**



EMERGENCY PLAN

(Continued)

- **Public Information**

- **As discussed previously, DOE intends to co-locate a Joint Information Center with its EOF to provide information to the media and the public on repository events**





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

www.ocrwm.doe.gov

Physical Protection

Presented to:

**NRC/DOE Technical Exchange on Physical Protection,
Material Control & Accounting, and Emergency Planning**

Presented by:

Steve Ruffin

Safeguards & Security Lead

Licensing & Nuclear Safety

Bechtel SAIC Company, LLC

June 28, 2007

Rockville, Maryland

Acronyms

- **GROA** **Geologic Repository Operations Area**
- **CCCF** **Central Control Center Facility**
- **CRSS** **Cask Receipt Security Station**
- **PAS** **Primary Alarm Station**
- **SAS** **Secondary Alarm Station**
- **PA** **Protected Area**



Presentation Overview

- **Physical Protection Operations**
- **Surface Security Facilities**
- **Primary Alarm Station**
- **Secondary Alarm Station**
- **Communications**
- **Equipment Operability and Compensatory Measures**



Physical Protection Operations

- **NRC general performance objectives and system requirements per 10 CFR 73.51**
- **NRC additional compensatory measures for licensees with similar materials and risks**
- **Addresses guidance in NUREG-1804, *Yucca Mountain Review Plan***
- **Maintains flexibility to address evolving threats and associated NRC requirements**
- **DOE anticipates submitting the Physical Protection plan to the NRC no later than 180 days after issuance of the Construction Authorization**



Physical Protection Operations

- **Physical Protection Objectives**
 - **Prevent loss of control of Geologic Repository Operations Area (GROA) consistent with 10 CFR 72.106**
 - **Satisfy general performance objectives in 10 CFR 73.51**
 - **Protect against theft or diversion**
 - **Protect against radiological sabotage**
 - **Protect classified matter**



Physical Protection Operations

Security Organization (Continued)

- **Training & Qualification**
 - **Protective force officers will at a minimum meet the requirements in 10 CFR Part 73, Appendix B, *General Criteria for Security Personnel***
 - **Training program will incorporate several factors such as classroom training and performance testing to evaluate the officer's ability to perform functional and operational duties; and weapons training and qualification**
 - **Tactical response team training for specific contingency situations**



Physical Protection Operations

Security Organization (Continued)

- **Contingency Planning**
 - **Identify procedures to accomplish specific, defined objectives in the event of threats or sabotage**
 - **Specify the actions to be taken by management and security personnel**
 - **Provide predetermined responses to safeguards contingency events consistent with the requirements of 10 CFR 73.51 and 10 CFR Part 73, Appendix C**



Surface Security Facilities

- **Area No. 240 - Central Control Center Facility**
 - Includes Primary Alarm Station
- **Area No. 30A - Central Security Station**
- **Area No. 30B - Cask Receipt Security Station**
 - Includes Secondary Alarm Station
- **Area No. 30C - North Perimeter Security Station**



Area No. 240 - Central Control Center Facility (CCCF)

- **CCCF includes Primary Alarm Station (PAS), Central Control Center, communications centers, and supporting utilities and HVAC**
- **Access to the CCCF operating areas will be controlled via an access control system**
- **Additional physical protection and access controls protect designated vital areas, such as the PAS**



Area No. 30A - Central Security Station

- **Primary entrance and exit for pedestrians and vehicles into the Protected Area (PA)**
- **Personnel and vehicles will be searched prior to entry into the PA**



Area No. 30B - Cask Receipt Security Station (CRSS)

- **Security inspections and initial Material Control & Accounting receipt of rail and truck casks**
- **Radiological inspections and surveys**
- **Rail shipments of waste packages, site casks, heavy equipment, supplies**
- **Not a routine personnel access point**



Area No. 30C - North Perimeter Security Station

- Serves primarily as an emergency exit in the event of a site emergency requiring personnel evacuation
- In an emergency, protective force personnel monitor emergency evacuations
- When not in use, gates are locked and alarmed



Primary Alarm Station (PAS)

- **Continuously staffed and provides for monitoring**
- **Monitors alarms for other Safeguards and Security events**
- **Vital Area – additional physical protection and access controls will be implemented**
- **Hardened and constructed of bullet resisting materials**



Primary Alarm Station

(Continued)

- **Personnel access is limited and will be controlled via an access control system**
- **Communication links with the Administrative Security Stations, the Secondary Alarm Station and the Gate 510 Security Complex; and protective force members**
- **Communication links with offsite response forces, such as the FBI, Nevada Test Site security, local law enforcement agencies, and other organizations determined by DOE**
 - **Specified in memorandum of understanding with specific organizations**



Secondary Alarm Station (SAS)

- **Continuously staffed backup to the PAS**
- **Personnel access will be controlled via an access control system**
- **Communication system for ensuring offsite response**



Communications

- **Communications system functions: alarm annunciation and display, protective force communications**
- **Redundant and diverse voice communication**
- **Continuous recording system provided for all security radio traffic and telecommunication**



Communications

(Continued)

- **Communications system will be operable during loss and recovery of power**
 - **Uninterruptible Power Supply**
 - **Emergency Diesel Generator**
- **Duress systems will be supplied for mobile and fixed posts; including the PAS and SAS**
- **Fixed post radios, mobile radios, and portable radios will be provided**



Equipment Operability and Compensatory Measures

- **Procedures will be implemented to ensure**
 - **Continuous and reliable equipment operability**
 - **Compensatory measures during periods of equipment inoperability**





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Material Control & Accounting

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Acronyms

- **MC&A** **Material Control & Accounting**
- **SNF** **spent nuclear fuel**
- **HLW** **high-level radioactive waste**
- **SNM** **special nuclear material**
- **NMMSS** **Nuclear Materials Management Safeguards System**
- **LANMAS** **Local Area Network Material Accounting System**
- **TID** **tamper identification device**
- **MBA** **material balance area**
- **ICA** **item control area**
- **WHF** **Wet Handling Facility**



Presentation Overview

- **MC&A Approach**
- **General Performance Objectives**
- **System Capabilities**
- **Organization**
- **Shipper-Receiver Validation**
- **Item Control**
- **Physical Inventory**
- **Investigation and Anomaly Resolution**
- **Record Keeping**
- **Reporting**
- **Draft ANSI N15-8**



MC&A Approach

- **DOE will implement a Material Control & Accounting (MC&A) program that satisfies the requirements specified in 10 CFR 63.78, which refers to 10 CFR 72.72, 72.74, 72.76, and 72.78**
- **The program will incorporate guidance contained in NUREG-1804, *Yucca Mountain Review Plan***
- **The MC&A Plan format will follow**
 - ***NUREG-1065, Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities***
- **DOE anticipates submitting the MC&A plan to the NRC no later than 180 days after issuance of the Construction Authorization**



General Performance Objectives

- **Control and protect all spent nuclear fuel (SNF) and high-level radioactive waste (HLW) within the Geologic Repository Operations Area (GROA) from receipt to emplacement**
- **Detect and respond to loss of SNF and HLW**
- **Report loss of special nuclear material (SNM) or accidental criticality to the NRC Operations Center**
- **Prepare nuclear material transfer reports, material status reports, and inventory reports**
- **Transmit reports to the Nuclear Materials Management Safeguards System (NMMSS) and/or NRC**



System Capabilities

- **Management structure will include separation of overall MC&A responsibilities and key functions**
- **Facility-wide annual physical inventories will be performed and material balances will be closed on an item basis**
- **Inventory items will be tracked and controlled by the DOE corporate MC&A system (LANMAS) from receipt to emplacement**
- **Shippers' values will be accepted after undergoing data validation checks**



System Capabilities

(Continued)

- **Duplicate record retention at separate locations**
 - Records will be appropriately archived after closure for future reference
- **Reports to NRC on accidental criticality or loss of SNM**
- **Collusion protection program to thwart insider attempts to divert nuclear material**
- **Anomaly reporting system**



Organization

- **The MC&A organization will be independent from operations**
- **Key MC&A functions will be separate from each other**
- **Independent assessment of MC&A**



Shipper-Receiver Validation

- **Validation of the shippers' values will be based on**
 - Knowledge that each shipment can be uniquely identified
 - Confidence that each shipment originated from an NRC-approved MC&A program (DOE shipments under DOE program)
- **Shippers' values will be accepted and entered into the accounting system after validation**
- **Unique identification will require agreement of item and tamper identification device (TID) identity**



Item Control

- **Tracking of items at the GROA will be facilitated by use of material balance areas (MBAs) and item control areas (ICAs)**
 - **Two MBAs: surface and subsurface**
 - **ICAs for each nuclear facility, aging pad, and staging area**
 - **ICAs for each drift**
- **Whether above or below the surface, the item's location and information will be maintained**



Item Control

(Continued)

- **Routine periodic administrative checks will be conducted in surface ICAs**
- **At least two individuals will be required within the ICA during handling and transfer activities**
- **The two-person signature rule will apply within the ICA at data entry**
- **Item transfers between ICAs will be reported to the LANMAS by both ICAs**
- **Empty casks will be verified empty and tracked until shipped off site**



Physical Inventory

- **Physical inventories are required by 10 CFR 72.72 (b) at intervals not to exceed 12 months**
- **Surface ICAs: the physical location of each item will be verified**
- **An item will be a container such as a transportation, aging, and disposal (TAD) canister, except at the Wet Handling Facility (WHF)**
 - **If an item is opened in the WHF, the internal items (e.g., fuel assemblies), will be accounted for as individual items**
- **Subsurface ICA: A closed drift with door and TID installed will be considered an item for inventory purposes**



Physical Inventory

(Continued)

- **Two-person inventory teams**
- **No item measurement will be performed**
- **Item movements will be frozen during inventory**
- **Accounting adjustments and reconciliation with NMMSS**



Investigation and Anomaly Resolution

- **Report to the NRC per 10 CFR 72.74**
- **Quarantine and investigation per procedure**
- **Resolution procedure will include**
 - **Checking records and source information**
 - **Identifying source of problem**
 - **Identifying reason for the problem**
 - **Determining amounts of material involved**
 - **Determining whether problem is resolved**
- **Thorough documentation for possible DOE or NRC follow up review**



Recordkeeping

- **Records will be maintained in accordance with 10 CFR 72.72 (a)**
- **Information will be received from the shipper**
 - **Typical Form 741 data**
 - **TID and item identification data**



Reporting

- **Inventory and material status reporting to NMMSS and/or NRC**
- **Reconciliation with NMMSS data will be performed jointly by MC&A office and NMMSS staff**
- **Any data reconciliation will be reflected both in NMMSS and the facility records**



Draft ANSI N15-8

- **NRC staff and nuclear power industry representatives are jointly drafting an updated ANSI N15-8, *Special Nuclear Material Control and Accounting Systems for Nuclear Power Plants***
- **The draft standard accepts accounting for SNM at power reactors on an item basis**
 - **Measured values for enriched uranium quantities in fuel elements will be performed by fuel suppliers and accepted by reactors without measurement**
 - **After irradiation, the remaining uranium values, burnup values, and the values for plutonium produced in the reactor are calculated by computer program; no measurement is done**



Draft ANSI N15-8

(Continued)

- **Key provisions of draft ANSI N15-8**
 - ***Review of Fuel Supplier's Values*** – the utility or its representative would review the adequacy of the fuel supplier's Material Control & Accounting system used in establishing quantities and assays of SNM
 - ***Inventory Method*** – conduct a count of all items which contain SNM
 - ***Fuel Components*** – inventory each component for fuel components that are not
 - ◇ Part of an intact assembly
 - ◇ Physically captured in an assembly
 - ◇ Stored in a fuel component container (such as separated rods stored in baskets, or pellets/fragments stored in a bucket)



Draft ANSI N15-8

(Continued)

- **Key provisions of draft ANSI N15-8 (Continued)**
 - ***Item Count (piece count)*** – location of an item as documented in the material control records would be visually verified
 - ***Element and Isotopic Computations*** – methods of computation would be established and utilized for determining the total element and isotopic composition of SNM in irradiated nuclear fuel assemblies and fuel components.
 - ***Records and Reports*** – creation of items containing SNM, such as a fuel rod fragment, would be recorded in the accounting system



Draft ANSI N15-8

(Continued)

- **Implications of draft ANSI N15.8 to GROA MC&A**
 - The proposed spent fuel accounting provisions would apply to the GROA due to similar spent fuel handling operations planned for the WHF
 - The inventory of SNM in the WHF pool, including pellets, would be taken by item count
 - MC&A measurements would not be required since it similarly would not be required for power reactors

