OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL COVER SHEET

Complete Only Applicable Items

1. QA: QA

2. ☒ Analysis — Check all that apply

Type of Analysis: ☒ Engineering ☐ Performance Assessment ☐ Scientific

Intended Use of Analysis: ☐ Input to Calculation ☐ Input to another Analysis or Model ☒ Input to Technical Document ☐ Input to other Technical Products

Describe use:

Support Site Recommendation

3. ☐ Model — Check all that apply

Type of Model: ☐ Conceptual Model ☐ Abstraction Model ☐ Mathematical Model ☐ System Model ☐ Process Model

Intended Use of Model: ☐ Input to Calculation ☐ Input to another Model or Analysis ☐ Input to Technical Document ☐ Input to other Technical Products

Describe use:

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	Printed Name	Signature	Date
8. Originator	Willis D. Lindholm	Willis Lindholm	5/22/00
9. Checker	Frank White	Frank White	5/22/00
10. Lead/Supervisor	Willis D. Lindholm	CG Mattsson for	5/25/00
11. Responsible Manager	C. Gus Mattsson	CG Mattsson	5/25/00

12. Remarks:

Technical Checkers:

Architectural - F. White
Mechanical, Electrical - R. Hallum
HVAC - E. Segura
Civil/Structural - M. Custer

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL REVISION RECORD

Complete Only Applicable Items

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Rev 00	Initial Issue

CONTENTS

Page

ATTACHMENTS

TABLES

ACRONYMS

AC	air change
AC	alternating current
acfm	actual cubic feet per minute
AHC	assembly handling cell
ALARA	as low as is reasonably achievable
ATS	Assembly Transfer System
BOP	balance of plant
BWR	boiling water reactor
CCHS	Carrier/Cask Handling System
CCTS	Carrier/Cask Transport System
cfm	cubic feet per minute
CPB	Carrier Preparation Building
CRWMS	Civilian Radioactive Waste Management System
CSNF	commercial spent nuclear fuel
CTS	Canister Transfer System
DC	disposal container
DCHS	Disposal Container Handling System
DHLW	defense high-level waste
DOE	U.S. Department of Energy
DPC	dual-purpose canister
DSNF	U.S. Department of Energy spent nuclear fuel
EDA-II	Enhanced Design Alternative II
ESF	Exploratory Studies Facility
ESF-NPSF	Exploratory Studies Facility North Portal Surface Facility
F	Fahrenheit
fpm	feet per minute
ft	feet
ft^2	square feet
ft^3	cubic feet
gal	gallon
g/cm	grams per cubic centimeter
HEPA	high-efficiency particulate air
HIC	high-integrity container
HLW	high-level waste
HPT	health physics technician

ACRONYMS (Continued)

hr	hour
HVAC	heating, ventilation, and air-conditioning
in.	inch
Inc	inclined
IOC	interoffice correspondence
kW	kilowatt
LLW	low-level waste
max	maximum
MGR	Monitored Geologic Repository
MPa	megapascal
MTU	metric tons uranium
NDE	nondestructive examination
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory Commission
PMF	probable maximum flood
PSB	Pool Storage Building
PSF	pounds per square foot
PWR	pressurized water reactor
QA	quality assurance
QC	quality control
QL	quality level
RCA	radiologically controlled area
SNF	spent nuclear fuel
SPA	space program analysis
sq ft	square feet
SSC	structure, system, and component
TBD	to be determined
TBV	to be verified
VA	Viability Assessment
WHB	Waste Handling Building
WP	waste package
WPRS	Waste Package Remediation System
WTB	Waste Treatment Building

1. PURPOSE

The purpose of this analysis is to identify and evaluate the functional space and spatial relationship requirements for the two main nuclear buildings, the Waste Handling Building (WHB) and the Waste Treatment Building (WTB), which are part of the Repository Surface Facilities. This analysis is consistent with the Development Plan for *WHB/WTB Space Program Analysis for Site Recommendation* (CRWMS M&O 2000r), which concentrates on the primary, primary support, facility support, and miscellaneous building support areas located in the WHB and WTB. The development plan was completed in accordance with AP-2.13Q, *Technical Product Development Planning*.

The objective and scope of this analysis is to develop a set of spatial parameters (e.g., square footage, room heights, etc.) and layout requirements (e.g., adjacency and access/circulation requirements, etc.) from which preliminary building floor plans are developed and presented as figures. The resulting figures will provide information to support the Site Recommendation and the total system life cycle cost.

This analysis uses the Viability Assessment (VA) *Surface Nuclear Facilities Space Program Analysis* (SPA) (CRWMS M&O 1997c) as the baseline reference document and further develops the functional requirements based on Project-directed changes, including incorporation of a new design basis waste stream and the applicable elements of Enhanced Design Alternative (EDA)-II, as identified in the *License Application Design Selection Report* (CRWMS M&O 1999e), which followed the initial SPA (baseline).

The impacts of the EDA-II were almost entirely to the WHB. To meet the EDA-II thermal requirements, hotter fuel would be handled, therefore requiring a fuel-blending pool to be added to the WHB in order to age the hotter fuel at the repository and provide for commercial spent nuclear fuel (CSNF) blending.

In addition to EDA-II recommendations, the waste stream was modified, including the elimination of approximately 300 multi-purpose canisters from the CSNF schedule. The bases for the Monitored Geologic Repository (MGR) surface design changes, as a result of the waste stream changes, are defined in *Calculations from Surface Facilities Operations in Support of the Revision to the Waste Quantity, Mix, and Throughput Study* (CRWMS M&O 2000c, Section 2.4). This effort resulted in a reduction in the number of canister transfer lines from 2 to 1. In addition, as indicated in *WITNESS Model Input for Thermal Blending of Commercial Spent Nuclear Fuel Assemblies* (CRWMS M&O 1999l), the quantity of dual-purpose canisters (DPCs) assumed to be shipped to the repository has been reduced by about 37 percent. This change resulted in a reduction of the number of Assembly Transfer System (ATS) lines in the WHB from 3 to 2.

In summary, this analysis is intended to provide a preliminary level of design showing room square footages and heights associated with the WHB and WTB. These spatial dimensions are anticipated to increase or decrease as the design progresses.

2. QUALITY ASSURANCE

The work presented in this document has been prepared in accordance with Office of Civilian Radioactive Waste Management approved program document AP-3.10Q, *Analyses and Models.* An Activity Evaluation, *Development of Space Program Analysis* (Work Package 24012123M3) (CRWMS M&O 1999c) has been performed in accordance with QAP-2-0, *Conduct of Activities.* The Activity Evaluation determined that this document is subject to the requirements of the *Quality Assurance Requirements and Description* (DOE 2000).

Structures, systems, and components (SSCs) are assigned quality levels (QLs) within classification analyses performed in accordance with QAP-2-3, *Classification of Permanent Items.* The WHB Structure is a QL-1 SSC based on the *Classification of the MGR Waste Handling Building System* (CRWMS M&O 1999a, Table 1). The WTB Structure is a QL-2 SSC based on the *Classification of the MGR Waste Treatment Building System* (CRWMS M&O 1999b, Table 1).

As required by AP-SV.1Q, *Control of the Electronic Management of Data,* the methods used to control the electronic management of data was accomplished in accordance with the controls specified in the development plan for this document.

Use of any data from this report for input into documents supporting procurement, fabrication, or construction is required to be controlled as to be verified (TBV) or to be determined (TBD) in accordance with AP-3.15Q, *Managing Technical Product Inputs:* "This document may be affected by technical product input information that requires confirmation. Any changes to the document that may occur as a result of completing the confirmation activities will be reflected in subsequent revisions. The status of the input information quality may be confirmed by review of the Document Input Reference System database."

3. COMPUTER SOFTWARE AND MODEL USAGE

Software used in the development of this analysis was limited to standard commercial software (Excel and Microsoft Word) provided by the Yucca Mountain Project and loaded on standard workstation computers. As standard office automation software, this software is exempt from qualification under the requirements of AP-SI.1Q, *Software Management.* No macros or software routines were used or developed to perform this work..

4. INPUTS

4.1 DATA AND PARAMETERS

The use of unqualified and unverified inputs throughout this document is considered appropriate for the intended purpose of this analysis (Site Recommendation and the total-system life cycle cost). The results of this analysis will not impact safety or waste isolation. This data is also not intended to be used for procurement, fabrication, or construction.

4.1.1 Civil/Structural Parameters

4.1.1.1 Site Layout

4.1.1.1.1 The design basis for the 100-year flood, the 500-year flood, and the probable maximum flood (PMF) will be based on the *Repository Surface Design Site Layout Analysis* (Site Layout Analysis) (CRWMS M&O 1998d, Section 4.1.4). The North Portal site is adjacent to Midway Valley Wash. The maximum depth of water in this wash was estimated to be 9 to 12 ft during a PMF with a 2-times bulking factor. The preconstruction PMF for the North Portal repository surface facilities is shown in Attachment I, Figure I-12, North Portal Repository Grading Plan.

4.1.1.1.2 The topographical survey data and surface morphology is described in the Site Layout Analysis (CRWMS M&O 1998d, Section 4.1.6). The existing North Portal pad site is relatively flat (i.e., about 2 percent slope) and is located between Drillhole Wash and Exile Hill. The North Portal entrance is the portal currently used for the Exploratory Studies Facility (ESF).

4.1.1.1.3 The proposed repository waste handling and administrative surface facilities will be located adjacent to the North Portal (CRWMS M&O 1999f, CPA 004).

4.1.1.1.4 Roads are required at the perimeter of the areas to provide for maintenance and security.

4.1.1.1.5 Rail and legal truck access to the North Portal area will be from the southeast through the valley south of Alice Hill (CRWMS M&O 1998d, Attachment I, Figure 4).

4.1.1.2 Building Structure

The following parameters are used for the building structure for the WHB and WTB, as discussed in Sections 6.2 and 6.3.

Shielding wall thicknesses shall be up to 5 ft based on the radiological safety recommendations in Attachment II.

4.1.2 Mechanical Parameters

4.1.2.1 Carrier/Cask Handling System Parameters

4.1.2.1.1 The rail and truck carrier and transportation cask characteristics and parameters are defined in the *Interface Control Document for the Transportation System and the Mined Geological Disposal System Surface Repository Facilities and Systems for Mechanical and Envelope Interfaces between the Surface Facility Operations and the Waste Acceptance and Transportation Office* (CRWMS M&O 1998c, Tables 7-7 through 7-10).

4.1.2.1.2 Two carrier transport lines are required to accommodate either truck or rail carriers in the WHB (CRWMS M&O 2000c and CRWMS M&O 2000a, Section 7.2.3.1).

4.1.2.2 Assembly Transfer System Parameters

4.1.2.2.1 Two ATS lines with cask unloading and fuel staging pools are required to handle the waste throughput and support maintenance operations (CRWMS M&O 2000c).

4.1.2.2.2 Two cask preparation and decontamination rooms are required in each ATS line to meet throughput needs (CRWMS M&O 2000c).

4.1.2.2.3 Two fuel drying vessels are needed in each ATS line to provide the staging capacity for fuel drying (CRWMS M&O 1998e, Section 7.3.3).

4.1.2.2.4 The pressurized water reactor (PWR) assembly baskets will each accommodate 4 PWR fuel assemblies (CRWMS M&O 2000b, Section 5.9).

4.1.2.2.5 The boiling water reactor (BWR) assembly baskets will each accommodate 8 BWR fuel assemblies (CRWMS M&O 2000b, Section 5.9).

4.1.2.2.6 Loaded disposal container (DC) maximum thermal output shall not exceed 11.8 kilowatt (kW) (CRWMS M&O 1999k, Section 1.2.4.4).

4.1.2.3 Waste Package Remediation System Parameters

4.1.2.3.1 The Disposal Container Handling System (DCHS) facilitates transport and transfer of retrieved waste packages (WPs) from the Waste Emplacement/Retrieval System to the Waste Package Remediation System (WPRS) (CRWMS M&O 2000n, Section 6.3).

4.1.2.3.2 The WPRS shall be capable of handling 9 DCs or WPs per year during the 40-year operational life of the system and 1 WP per year during the system's remaining years of operational life (CRWMS M&O 2000m, Section 1.2.1.9).

4.1.2.4 Canister Transfer System Parameters

4.1.2.4.1 One Canister Transfer System (CTS) line is required to handle all expected defense high-level waste (DHLW) and U.S. Department of Energy (DOE) spent nuclear fuel (DSNF) canister waste throughput and maintenance support operations (CRWMS M&O 2000c, Section 2.4.2).

4.1.2.4.2 One CTS cask preparation station and decontamination station is required to meet expected DHLW and DSNF cask throughput and maintenance support operations (CRWMS M&O 1998e, Section 7.2.3.3).

4.1.2.5 Disposal Container Handling System Parameters

4.1.2.5.1 Eight welding stations are required to support the planned facility throughput (CRWMS M&O 1998e, Section 7.2.3.4).

4.1.2.5.2 The DCHS must support the operation of two ATS lines and one CTS line (CRWMS M&O 2000c, Sections 2.4.2 and 3.5).

4.1.2.5.3 The DCHS supports transport and transfer of retrieved WPs from the Waste Emplacement System to the WPRS (CRWMS M&O 2000f, Section 1.2.1.15).

4.1.2.5.4 The empty DC preparation area provides space for staging 20 DCs and associated hardware including lids, base collars, lifting collars, and temporary seal devices (CRWMS M&O 1997c, Section 7.2.1.4).

4.1.2.5.5 The loaded DC staging area provides staging capacity for 20 DCs (CRWMS M&O 1998e, Section 7.2.3.4).

4.1.3 Architectural Parameters

4.1.3.1 Staffing Levels

4.1.3.1.1 The staffing levels for the facility support area used within the WHB and the WTB are mentioned in Sections 6.2.4 and 6.3.2 and are based on the best available data and source documents (CRWMS M&O 1997c, Section 4, Item 4.1.1).

4.2 CRITERIA

4.2.1 Waste Handling Building System Safety Criteria

4.2.1.1 Waste Handling Building Nuclear Safety Criteria

The building's structures, systems, and components (SSCs) important to safety shall be designed to withstand a design basis earthquake of Frequency Category 1 or Frequency Category 2, as appropriate to the seismic frequency classification assigned to a specific SSC (CRWMS M&O 2000k, Section 1.2.2.1.1).

The building SSCs important to safety shall be designed to withstand dynamic effects from internal and external missile impacts (CRWMS M&O 2000k, Section 1.2.2.1.2).

The system shall be designed to protect the SSCs that are important to confinement against the adverse effects of operation of the fire protection system (CRWMS M&O 2000k, Section 1.2.2.1.3).

The system shall be designed such that during and after design basis events and off-normal environmental conditions, operation of SSCs important to safety is not affected by failure of other SSCs (CRWMS M&O 2000k, Section 1.2.2.1.5).

As stated in the *Waste Handling Building System Description Document* (CRWMS M&O 2000k, Section 1.2.2.1.9), the system shall be designed for the design basis flood in accordance with the guidelines in Regulatory Guide 1.102, *Flood Protection for Nuclear Power Plants*.

Reinforced concrete structures and other SSCs with a structural role that are important to safety shall have sufficient capability for every section to withstand the worst-case loads under normal and off-normal conditions without permanent deformation and with no degradation of capability to withstand any future loading (CRWMS M&O 2000k, Section 1.2.2.1.11).

The QL-1 portions of the system shall withstand the maximum tornado wind speed of 189 mph with corresponding pressure drop of 0.81 pounds per sq in. (psi) and rate of pressure drop of 0.3 psi/second (CRWMS M&O 2000k, Section 1.2.2.1.14).

The tornado-generated missiles that must be considered for the system are either the Spectrum I or Spectrum II missiles as identified in "MGR Design Basis Extreme Wind/Tornado Analysis," Section 6.3 (CRWMS M&O 2000k, Section 1.2.2.1.15).

4.2.1.2 Waste Handling Building Non-nuclear Safety Criteria

The system shall be designed such that floor surfaces upon which highway vehicles are loaded and unloaded are flat and level. Any surface between the railroad track should be at the same level as the rails and surrounding floor (CRWMS M&O 2000k, Section 1.2.2.2.1).

The system shall be designed to permit prompt termination of operations and evacuation of personnel during an emergency (CRWMS M&O 2000k, Section 1.2.2.2.2).

4.2.1.3 Waste Handling Building System Environment Criteria

The system shall be designed for maximum wind speed of 121 miles per hour (CRWMS M&O 2000k, Section 1.2.3.4).

The system shall be designed for an outside temperature environment of 5 degrees F to 117 degree F (CRWMS M&O 2000k, Section 1.2.3.5).

The system shall be designed for an environment with a maximum daily snowfall of 10 in. and maximum snowfall accumulation of 17 in. (CRWMS M&O 2000k, Section 1.2.3.6).

The system shall be designed for an environment with a maximum annual precipitation of 10 in. and maximum daily precipitation of 5 in. (CRWMS M&O 2000k, Section 1.2.3.8).

The system shall be designed to withstand a frost line depth of 15 in. below the top of ground surface (CRWMS M&O 2000k, Section 1.2.3.9).

4.2.2 Waste Treatment Building System Safety Criteria

4.2.2.1 Waste Treatment Building Nuclear Safety Criteria

As stated in the *Waste Treatment Building System Description Document* (CRWMS M&O 2000q, Section 1.2.2.1.3), the system shall be designed in accordance with the project ALARA (as low as is reasonably achievable) program goals and the applicable guidelines in "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be As Low As Is Reasonably Achievable" (Regulatory Guide 8.8)

The foundations and walls of structures that house the liquid radioactive waste system shall be designed to a height sufficient to contain the maximum liquid inventory in the building during and following a Frequency Category 1 design basis earthquake (CRWMS M&O 2000q, Section 1.2.2.1.1).

4.2.2.2 Waste Treatment Building Non-nuclear System Criteria

The system shall limit the release of radioactive material and the spread of radioactive contamination by dividing the WTB into confinement zones based on radiation and contamination levels (CRWMS M&O 2000q, Section 1.2.2.1.2).

4.2.2.3 Waste Treatment Building System Environment Criteria

The system components affected by wind shall be designed for a basic wind speed of 121 miles per hour (CRWMS M&O 2000q, Section 1.2.3.2).

The system shall be designed for a maximum daily snowfall of 10 in. and maximum snowfall accumulation of 17 in. (CRWMS M&O 2000q, Section 1.2.3.4).

The system shall be designed for an environment with a maximum annual precipitation of 10 in. and a maximum daily precipitation of 5 in. (CRWMS M&O 2000q, Section 1.2.3.6).

The system shall be designed to withstand a frost line depth of 15 in. below the top of the ground surface (CRWMS M&O 2000q, Section 1.2.3.7).

4.3 CODES AND STANDARDS

4.3.1 DOE Order 420.1, Change 2. 1996. *Facility Safety.*

4.3.2 NFPA 101. 1997. *Life Safety Code.*

5. ASSUMPTIONS

Assumptions used in this analysis do not require confirmation for the Site Recommendation phase of design.

5.1 ARCHITECTURAL ASSUMPTIONS

5.1.1 It is assumed that a 6-person crew of 2 operators and 4 workers/riggers is adequate staff for the crane maintenance area change rooms.

Basis: The workers in this crew represent similar crane maintenance crews at other DOE facilities.

Used in: Section 6.2.4.1.1

5.1.2 It is assumed that the minimum provided floor area (8,554 ft^2) is adequate to accommodate the loading dock and staging area functional requirements for shipping/receiving activities.

Basis: The loading dock and staging area are sized using the best available data from similar DOE facilities.

Used in: Section 6.2.4.5.7

5.1.3 A length of corridor for the calculation of building circulation between areas is assumed based on anticipated circulation path orientation and lengths within the facility to provide access for personnel and equipment between facility areas.

Basis: The functional dimensions for the corridor is believed to be reasonably adequate for the intended use because a calculation based on assigned percentage of assigned area is not applicable for this type of personnel and equipment circulation.

Used in: Sections 6.2.4.5.10 & 6.3.2.4

5.1.4 It is assumed that a 12-foot minimum width corridor will accommodate movement and circulation of major equipment throughout the facility. The specific equipment, type, and size to be utilized are not known at this time.

Basis: The 12-foot dimension width is based on the best available data and sources related to equipment movement, circulation, and fire egress requirements.

Used in: Section 6.2.4.6

5.1.5 It is assumed that a 5-foot wide minimum width corridor is adequate to accommodate personnel circulation and emergency egress.

Basis: The minimum corridor width is sized to comply with emergency egress of the model building code.

Used in: Sections 6.2.4.1.8, 6.2.4.2.4, 6.2.4.3, 6.2.4.3.9, 6.2.4.4.11, & 6.2.4.6

5.1.6 It is assumed that airlocks and vestibules are required in order to comply with the minimum DOE Orders regarding control of radiological contamination.

Basis: Confinement control measures are required to ensure that facilities containing potential radiation exposure to the outside environment comply with principles of ALARA, as indicated in the *Surface Nuclear Facilities Space Program Analysis* (CRWMS M&O 1997c, Sections 4.3.1.9 and 4.3.1.13).

Used in: Section 6.2.4.6

5.1.7 It is assumed that 10 percent of the installed capacity for both clean and contaminated high-efficiency particulate air (HEPA) filters is provided.

Basis: This space is provided to allow for lag storage capability during filter change out activities and is not intended to provide storage for a complete system filter changeout.

Used in: Section 6.2.4.5.5

5.2 MECHANICAL ASSUMPTIONS

5.2.1 Carrier/Cask Handling System Assumptions

5.2.1.1 It is assumed that rail carrier dimensions and overall dimensional criteria are based on data provided in Parameter 4.1.2.1.1 for the largest transportation cask. Other dimensions are based on the cask characteristics in CRWMS M&O 1998f, Section 5, Table 1.

Basis: Rail carriers will be used to haul waste transportation casks. The carrier dimensional envelopes are based on existing and planned designs for U.S. Nuclear Regulatory Commission (NRC) -docketed cask transportation systems (CRWMS M&O 1998b, Section 4.1.3, and CRWMS M&O 1998f, Section 5, Table 1).

Used in: Sections 6.2.1.1 and 6.2.1.2.1

5.2.1.2 It is assumed that the legal-weight truck carrier dimensions are based on data provided in Parameter 4.1.2.1.1 for the largest legal-weight transportation cask. Other dimensions are based on the cask characteristics in CRWMS M&O 1998f, Section 5, Table 1.

Basis: Truck carriers will be used to haul waste transportation casks. The carrier dimensional envelopes are based on existing and planned designs for NRC-docketed cask transportation systems (CRWMS M&O 1998b, Section 4.1.3 and CRWMS M&O 1998f, Section 5, Table 1).

Used in: Section 6.2.1.1

5.2.1.3 It is assumed that a contact operation area using manual and remote handling equipment will be adequate.

Basis: Contact operation area using manual and remote handling equipment will ensure that radiation exposure rates will meet ALARA principles for cask unloading/loading in the Carrier/Cask Handling System (CCHS). This is based on the readily available remote/robotic technology in the nuclear industry (CRWMS M&O 1997b, Section 4.1.2).

Used in: Section 6.2.1.1

5.2.2 Assembly Transfer System Assumptions

5.2.2.1 It is assumed that 5,000 metric tons uranium (MTU) of CSNF will be stored in four storage pools, each with 1,250 MTU (equivalent to 750 fuel baskets).

Basis: The results of a WITNESS computer program simulation run using data for Design Basis Waste Input show that a total storage of 5,000 MTU is required for heat output blending purposes (CRWMS M&O 2000c, Attachment 1, Section 3.5).

Used in: Sections 6.2.1.2 & 6.2.1.2.3

5.2.2.2 It is assumed that during the life of the repository, some of the fuel assemblies will be classified as nonstandard and will require remedial processing before they are acceptable for loading into a DC.

Basis: The MGR will be required to have the capability to handle canistered waste forms that require remedial processing. The nonstandard fuel assembly remedial processing will be performed in a separate (off-line) room/pool area to prevent the fuel assembly remedial operations from interfering with normal waste handling operations and impacting the waste handling throughput. This will be accomplished by diverting nonstandard fuel assemblies in the ATS line to a nonstandard fuel assembly handling pool inside an enclosed room located in the storage pool area. The pool is interconnected to the ATS cask unloading pool. After repackaging, the waste is processed in the same manner as standard CSNF (CRWMS M&O 1999f, Section 2.5 - CPA-007).

Used in: Sections 6.2.1.2.4 and 6.2.1.2.1

5.2.2.3 It is assumed that the fuel assembly basket racks in each ATS assembly staging pool will have the capacity to stage 16 fuel assembly baskets. These baskets will contain 4 PWR or 8 BWR fuel assemblies.

Basis: The storage capacity of the fuel assembly basket racks in the ATS assembly staging pool is based on 1) the combined storage required to provide assemblies to one of the assembly drying vessels in the assembly handling cell; and 2) staging capacity required for unloading a cask in the cask unloading pool.

Used in: Section 6.2.1.2.3

5.2.2.4 It is assumed two types of baskets will be provided to handle nonstandard single or multiple element canisters. The first basket type will be used to receive nonstandard wastes which will be similar in size to the baskets handling standard fuel assemblies. The second basket type will be provided for handling oversized canisters that are larger in cross-section than the standard fuel assemblies.

Basis: A majority of the nonstandard wastes will be received in single element canisters that conform to standard size, which is comparable in cross-section size to bare fuel assemblies. The remaining canisters are smaller in cross-section or oversized in cross-section than a standard fuel assembly. Therefore, different basket types will be required to handle the oversize packages (CRWMS M&O 2000b, Section 5.9).

Used in: Section 6.2.1.2.4

5.2.2.5 It is assumed that approximately 11 ft of water will provide safe and adequate gamma and neutron shielding for personnel from spent fuel elements.

Basis: The minimum water depth shielding for 1-year-old fuel is typically 8 ft. The fuel unloaded at the Repository will be more typically 25 to 27 years old, and the dose rate will be significantly less than that of the 1-year old fuel. Design of the Repository surface facilities is based on an 11-foot minimum water depth. This assumption has to be confirmed for handling of loaded canisters and multiple-assembly handling baskets. The water will also shield and contain alpha and beta radiation contamination sources and prevent nearly all radioactive particulate matter from becoming airborne. This is based on the proven nuclear power plant practice of using a pool as both a shield and a confinement for radionuclides (CRWMS M&O 1997b, Section 5.5.1.4).

Used in: Sections 6.2.1.2.1, 6.2.1.2.3, & 6.2.1.2.4

5.2.2.6 It is assumed that two fuel basket transfer canals are needed to convey fuel baskets from the storage pools and to return fuel baskets to the ATS lines.

Basis: One canal is used to transfer filled assembly baskets from the staging pool to the storage pools. The other canal transfers assembly baskets from the storage pools to the assembly staging pools (CRWMS M&O 2000c, Attachment 1, Section 3.5).

Used in: Sections 6.2.1.2.1 & 6.2.1.2.3

5.2.2.7 It is assumed that a minimum floor space of 30 ft by 22 ft, with an overhead space of 12 ft, is required to provide space for two vacuum pump sets, associated pipes and valves, and equipment.

Basis: The identified minimum floor space for two vacuum pump sets installed side by side is 174 in. by 128 in. (14.5 ft by 10.7 ft) (CRWMS M&O 1998a, Section 7.9). The space also requires piping, valves, and instrumentation. Doubling this area results in an area of approximately 30 ft by 22 ft, which is believed sufficient for two vacuum pump sets, pipe bends, valves, and instrumentation.

Used in: Section 6.2.1.2.2

5.2.3 Canister Transfer System Assumptions

5.2.3.1 It is assumed that during the life of the repository, some of the canisters will be classified as off-normal and will require remedial processing before they are acceptable for loading into a DC.

Basis: The MGR will need to have the capability to handle canistered waste forms that require remedial processing. Off-normal canisters are canisters damaged, contaminated, or received and that do not meet acceptance specifications. The off-normal canister remedial processing will be performed in a separate (off-line) cell to prevent the canister remedial operations from interfering with normal waste handling operations and impacting the waste handling throughput. (CRWMS M&O 1999f, CPA-007).

Used in: Section 6.2.1.3

5.2.3.2 It is assumed that the canister transfer cell is divided into upper and lower levels.

Basis: The canister transfer cell is divided to reduce the canister lift height above the cell floor when moving a canister from a cask into a DC or to a canister staging position. The purpose is to reduce the potential damage to a canister if it is dropped (CRWMS M&O 1999d, Section 8.4).

Used in: Section 6.2.1.3

5.2.3.3 It is assumed that due to the classification of some DSNF and the complexity and variety of DOE wastes, the transfer and repackaging of DOE disposable canister waste is infeasible at the MGR.

Basis: This approach is based on the assumption that solidified DHLW cannot be effectively removed from its canister and repackaged in a replacement canister. In addition, it is assumed that DSNF cannot be repackaged due to criticality concerns, security requirements, and the potential for extensive cell contamination during repackaging.

Used in: Section 6.2.1.3

5.2.3.4 It is assumed that staging capacity for 40 small canisters will be available in the CTS.

Basis: The CTS will provide staging capacity for 40 small canisters prior to loading the DC. Twenty spaces will be available in the canister transfer cell and 20 in the off-normal canister handling cell. The 20 spaces in the canister transfer cell will provide staging capacity for loading of a DC. If personnel need to enter the canister transfer cell, the 20 spaces in the off-normal canister handling cell will be used to off-load canisters from the canister transfer cell (CRWMS M&O 1997a, Section 7.1.5.5).

Used in: Section 6.2.1.3

5.2.3.5 It is assumed that one off-normal canister handling cell with a canister transfer tunnel is required to perform remedial processing for damaged, contaminated, or abnormal canisters and maintenance support operations. The tunnel will be located below the operating floor of the upper canister transfer cell and the off-normal canister handling cell. The minimum dimensions for the off-normal transfer tunnel are 35 ft wide, 10 ft long, and 25 ft high. Remotely operated overhead bridge cranes, used in both cells, will be used to lift or lower the canister through ports in the floor into the tunnel. A canister transfer cart in the transfer tunnel will be used to transport the canisters between the two cells.

Basis: The off-normal canister handling cell must provide the capability to receive and handle abnormal canisters without impacting waste throughput or normal operations. Reference Assumption 5.2.3.1 (CRWMS M&O 1999f, Section - CPA-007)

Used in: Section 6.2.1.3

5.2.3.6 It is assumed that the off-normal canister handling cell bridge crane capacity is based on the weight of the smaller canisters plus canister overpack.

Basis: The maximum loaded mass of the canister and overpack is the minimum design load for MGR equipment (DOE 1999, Section 10).

Used in: Section 6.2.1.3

5.2.3.7 It is assumed that the off-normal canister handling cell is equipped to handle, repair, weld, stage, and decontaminate small DOE canisters.

Basis: Tooling required for the off-normal canister handling cell consists of the following: canister repair equipment, decontamination equipment, robotic welding machine, canister staging rack, electromechanical manipulator with hoist, and miscellaneous tooling to support off-normal and recovery operations. (CRWMS M&O 1999f, Section - CPA-007).

Used in: Section 6.2.1.3

5.2.3.8 It is assumed that a maintenance bay for the bridge crane and manipulator will not be required for the off-normal canister handling cell.

Basis: The utilization of this cell is expected to be infrequent and any maintenance operations can be performed in the cell manually, by personnel entry. However, remote recoverability is required for off-normal events. (CRWMS M&O 1999f, Section - CPA-007).

Used in: Section 6.2.1.3

5.2.3.9 It is assumed that the length of the off-normal canister handling cell is the same as the length of the canister transfer cell, and the width is assumed to be 30 ft.

Basis: The size of the off-normal canister handling cell is based on best available information. The above dimensions provide adequate space for a shielded canister transfer tunnel, an in-cell crane, an electromechanical manipulator with a hoist, and a robotic welding machine (CRWMS M&O 1999f, Section - CPA-007).

Used in: 6.2.1.3

5.2.3.10 It is assumed that off-normal canisters that cannot be repaired (weld repair, crack repair, etc.) in the CTS off-normal canister handling cell will be placed in a disposable overpack container. Since repackage of a DOE canister is not feasible, defective canisters will be loaded into an overpack container in the cell, welded closed, and returned to the canister transfer cell for loading into a DC. A DC will be configured with a special basket that will accept the canister overpack container and a small canister.

Basis: CRWMS M&O 1999f, Section - CPA-007

Used in: 6.2.1.3

5.2.3.11 It is assumed that the minimum width of the cask transfer corridor is 20 ft.

Basis: The above width will provide sufficient clearance for cask transfer carts and the movement of equipment and material to support maintenance and waste handling operations between the CTS and CCHS (CRWMS M&O 1997a, Section 7.1.5.8).

Used in: 6.2.1.3

5.2.4 Disposal Container Handling System Assumptions

5.2.4.1 It is assumed that the best available information on the design of the DCHS is contained in CRWMS M&O 2000g.

Basis: This document provides preliminary waste handling descriptions, equipment size, capacities, layout, and sketches for this system. The information is based on the concepts and operations presented in the *Preliminary Design Concept for the Repository and Waste Package.* Volume 2 of *Viability Assessment of a Repository at Yucca Mountain* (VA report) (DOE 1998, Section 4.1.4.2) and changes to the design developed since its release.

Used in: Section 6.2.1.4

5.2.4.2 It is assumed that the WP transporter design is changed and its length increased from 31 ft to 70 ft.

Basis: This increase will lengthen the space required for unloading the transporter to 72 ft. In the VA SPA (CRWMS M&O 1997c), the WP transporter design is based on a docking concept where rails for the re-useable railcar must be aligned and butted together. A new concept is planned where the transporter is equipped with a long loading platform that enters a trench so that two sets of rails with different gages may overlap to avoid direct alignment. The loading platform will also increase the space for transporter loading and enclosure to 72 ft (CRWMS M&O 2000o, Section 6.4).

Used in: Section 6.2.1.4

5.2.4.3 The DC handling cell is equipped with redundant cranes to support continuous DCHS operating schedules during waste emplacement. Redundant cranes are considered prudent design contingencies against unplanned crane outages and extensive crane maintenance activities.

Basis: *Disposal Container Handling System Input to Support the Site Recommendation Phase* (DIRS 138733, Figure 7.1-14)

Used in: Section 6.2.1.4

5.2.5 Waste Package Remediation System Assumptions

5.2.5.1 It is assumed that the best available information on the design of the WPRS is contained in CRWMS M&O 2000n.

Basis: This document provides a description of the WPRS, preliminary WPRS design concept, system configuration, equipment sizes, capacities, cell arrangement, and dimensions (CRWMS M&O 2000n, Section 6.3).

Used in: Section 6.2.1.5

5.2.5.2 It is assumed that the DC/WP preparation, staging, examination, repair, opening, and decontamination operations will be performed in a shielded hot cell using remote handling equipment.

Basis: Remote/robotic technology readily available in the nuclear industry will be used to perform or support these operations to ensure that personnel radiation exposure rates are consistent with ALARA principles (CRWMS M&O 1997b, Section 5.5).

Used in: Section 6.2.1.5

5.2.5.3 The WPRS is one of the surface waste handling systems housed in the WHB. The WHB systems are designed for operation only during the MGR emplacement period, with a design life of 40 years. Therefore, the maximum operational life of the WPRS is 40 years. If it is required that the operational life of the WPRS extends beyond the MGR emplacement period, (i.e., through the MGR caretaker period, for a total of 300 years), the WHB would have to be modified and re-qualified. An alternative to an extended WHB design life could include construction of a new facility (prior to the end of the WHB 40-year life) with WPRS capabilities.

Basis: *Waste Package Remediation System Input to Support the Site Recommendation Phase* (DIRS 147450, Section 5.3).

Used in: Section 6.2.1.5

5.3 HEATING, VENTILATION, AND AIR-CONDITIONING ASSUMPTIONS

5.3.1 The heating, ventilation, and air conditioning (HVAC) airchange rate is based on the assumption that 8-10 airchanges per hour is provided for areas envisioned to have high heat load and 3-6 airchanges for areas that may have lower heat loads or as required by their occupancy. It is also assumed that the facility is reasonably airtight and that the airchanges will result in enough air movement and filtration to minimize build-up of radioactive particulate in the air inside the spaces.

Basis: For this level of detail, the above assumptions are consistent with those used at other DOE nuclear fuel handling facilities to satisfy the cooling requirements for the expected internal heat loads. Higher airchanges are not required to overcome other impacts such as in-leakage since the facility is designed to be reasonably airtight due to few doors and no exterior windows.

Used in: Tables 6-1 and 6-3

5.3.2 The height of the HVAC equipment areas is established by assuming that 4 ft of allowance for piping and other utilities plus 11 ft allowance for duct crossovers and seismic supports above the equipment are adequate.

Basis: For space allocation efforts, estimated space in equipment rooms should account for installation, access, and maintenance space for all anticipated components and utilities that are commonly found in equipment rooms. The space allocation includes space for floor-mounted equipment and overhead-mounted items (ductwork, piping, controls, electrical, supports, etc.), and some estimated space to offer some flexibility to accommodate future changes.

Used in: Section 6.2.5.1

5.3.3 It is assumed that air clean-up units with two stages of HEPA filtration in series at the exhaust air stream meets the requirement of the off-site release dose limits.

Basis: For space allocation efforts, the space required for air clean-up units is directly dependent on the number of HEPA filtration stages. In the absence of a safety analysis and for conservative measures, a standard space for air clean-up units with two stages of HEPA filters in series is provided. The *Waste Handling Building Ventilation System Description Document* (CRWMS M&O 2000l, Sections 1.2.1.10 and 1.2.1.11) describes that "at least" one stage of HEPA filtration is required.

Used in: Sections 6.2.5.1 and 6.2.5.3.1

5.3.4 In the absence of a confinement zoning analysis, it is assumed that the rooms and corresponding confinement ventilation zoning classification used in this analysis is adequate.

Basis: The accepted method for controlling the spread of airborne contamination within nuclear facilities is by providing ventilation confinement zones with pressure controls. This allows the flow of air from the least contaminated areas to the areas with the most potential for contamination. The contamination confinement ventilation zones within the facility are as described in the *Waste Handling Building Ventilation System Description Document* (CRWMS M&O 2000l, Section 1.2.1.4, Table 4).

Used in: Tables 6-1 and 6-3

5.3.5 In the absence of a safety analysis, it is assumed that the selected primary confinement areas require emergency ventilation.

Basis: Emergency ventilation may be required in this facility. For that reason, judicial space will be provided to account for installation, access, and maintenance space for anticipated components to support an emergency ventilation system. The space allocation should include space for floor mounted equipment and overhead mounted items (ductwork, piping, controls, electrical, supports, etc.), and some estimated space to offer some flexibility to accommodate future changes.

Used in: Section 6.2.5.1

5.3.6 It is assumed that the emergency ventilation rate shall be designed to ensure a safe temperature for confinement areas expected to contain numerous canisters. The emergency ventilation shall be designed to ensure inward ventilation flow to maintain the required negative pressurization.

Basis: The emergency ventilation system capacity, in addition to providing confinement of airborne contamination, should also ensure safe temperatures to allow for anticipated recovery operations. There may be areas in the facility with high heat loads. For this level of detail, the anticipated worst conditions to be considered for sizing the emergency system capacity appear to be either the control of confinement pressures or the internal heat loads caused by decay heat from nuclear material in lag storage. For that reason, the emergency ventilation system needs to be provided with enough capacity to satisfy either of those worst anticipated conditions (CRWMS M&O 2000l, Section 1.2.1.4, Table 4).

Used in: Table 6-1

5.3.7 It is assumed that a face velocity of 450-550 ft per minute (fpm) for the cooling coils sizing is adequate for configuring the HVAC equipment.

Basis: The above assumption is bounding for the space allocation effort. It is common practice for manufacturers to use this face velocity range to design their equipment. Based on this experience, the lower 450 fpm was used so that it resulted in a larger HVAC equipment configuration for estimating space usage and one that will fit the equipment of various manufacturers.

Used in: Section 6.2.5.4

5.3.8 It is assumed that the nominal capacity of 18,000 and 30,000 cubic ft per minute (cfm) are practical capacities to standardize multiple equipment that are part of large system.

Basis: The above assumption is based on the practicality of using sizes that can be obtained as off-the-shelf equipment for the purpose of standardizing the system's components to minimize capital and maintenance costs.

Used in: Sections 6.2.5.4 and 6.2.5.5

5.4 CIVIL/STRUCTURAL ASSUMPTIONS

Reserved

5.5 PROCESS ASSUMPTIONS

5.5.1 It is assumed that the space available in WHB rooms H-020, H-084A, H-084B, and H-083 is sufficient to house pool water treatment and cooling equipment, and that adequate space is available external to the WHB for placement of the chilled-water package refrigeration units.

Basis: Although this equipment has not been sized, it is reasonable to assume that it will fit the allocated space.

Used in: Section 6.2.3

5.5.2 It is assumed that the WTB process floor area identified in the *Surface Nuclear Facilities Space Program Analysis* (CRWMS M&O 1997c, Section 7.3.1.1) is sufficient for location and operation of low-level waste (LLW) processing equipment.

Basis: For the EDA-II design, the peak annual waste receipt rate, as indicated in *WITNESS Model Input for Blending of Commercial Spent Nuclear Fuel Assemblies* (CRWMS M&O 1999l), is anticipated to be equal to or less than the design waste receipt rate used in the VA; therefore, it is reasonable to assume that the WTB process floor area allocated for the VA design will be adequate for the EDA-II plant design.

Used in: Section 6.3.1.1

6. ANALYSIS

6.1 GENERAL DISCUSSION AND METHOD

This design analysis defines the required minimum floor area, room height, and essential functional relationships between internal process areas, equipment, facility circulation including life safety issues, and operational personnel spaces requirements. The specific facilities being discussed in this document are the WHB and the WTB. This analysis also reviews anticipated building structural systems that may be economically incorporated into the surface nuclear facilities. Also, the building's structural systems analysis examines anticipated wall thickness, where shielding is required, column grid locations, roof systems, and building foundation systems that impact each individual structure.

The design analysis further defines the functional areas within the surface nuclear facilities consistent with the assumptions identified in Section 5 and review any new requirements that may not have been known or considered during the VA SPA (CRWMS M&O 1997c). The analysis and discussion of individual required spaces are described within the general functional area sections for each facility. Floor plans of the surface nuclear facilities, including program spaces, functional relationships, and circulation, are included in Attachment I as figures. Building sections indicating anticipated structural systems and interior heights of major process areas are also included in Attachment I.

Summaries of the provided floor areas and individual room heights are indicated in Sections 6.2.8 and 6.3.6. These floor areas indicate the net square footages of each space. The gross building area, which includes the building structure (i.e. wall and roof structure), is not defined in this analysis.

The method used in this analysis to develop and organize the facility layout is based on segregating the required facility components into major areas (e.g. primary area, primary support area, facility support area, HVAC). These major areas were then subdivided into smaller sub-areas based on their functional requirements and spatial relationships. An example resulting from the use of this method is the primary area, which was segregated by the system. Another example is the facility support area whose segregation is driven by various functions such as radiation protection, internal security, administration, etc.

The sub-areas may be further segregated if necessary to define anticipated use(s), such as the personnel decontamination room or the health physics office and related radiation protection area.

Finally, the resulting layouts and square footages in this analysis are consistent with the descriptions provided for each area or sub-area. The descriptions helped develop the spatial requirements needed to support each function.

Consideration was given for anticipated spatial needs (horizontal and vertical), including maximum anticipated equipment envelopes, equipment lay-down area, in-process storage, maintenance, access/circulation, worker safety, etc. Also identified in the description are adjacency requirements. An overview of the building structure is described and includes recommendations for construction materials and foundation system.

A preliminary set of floor plans and sections is included, which integrates the spatial and adjacency requirements of all functional areas. Included in the plans and sections are the anticipated room numbers and room titles that relate to major areas and sub-areas.

6.2 WASTE HANDLING BUILDING

6.2.1 Primary Areas

The purpose and objective of this section is to document the size of the primary area for the mechanical SSCs in the five primary waste handling systems housed in the WHB. The primary systems are required to receive, lift, unload, handle, load, package, and deliver high-level waste (HLW) forms to the subsurface repository. Analysis of the WHB configuration and the primary system functions and operations are included in the following documents:

- *Carrier/Cask Handling System Design Analysis* (CRWMS M&O 1998b)
- *Assembly Transfer System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000b)
- *Canister Transfer System Design Analysis* (CRWMS M&O 1997a)
- *Disposal Container Handling System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000g)
- *Waste Package Remediation System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000n)

This analysis integrates the combined space requirements for waste handling, radiation protection, safety, shielding, ventilation, maintenance, decontamination, recovery, retrieval, waste storage, and performance criteria. Due to WHB reconfiguration and system changes since the VA SPA (CRWMS M&O 1997c), modifications to the original VA design are described and discussed in this section.

The method used to perform the space allocation analysis follows a standard approach for facility design and layout. This includes use of material handling dimensional outlines and maximum equipment envelopes. For each system area, the space (length, width, and height) required to house the system and support equipment is defined.

Plan and/or section sketches for each primary area are prepared that illustrate the arrangement of the waste handling systems, pools, hot cells, and transfer lines. These plans and/or sketches include space for airlocks, waste ingress and egress paths, doors, workstations, maintenance bays, circulation, and space-intensive support equipment. Additional space allowances for in-process storage, equipment lay-down, staging, waste handling aisles, and operating galleries is provided. The equipment sizing and space allocation plans and/or sketches for the primary systems above are included as figures in Attachment I to this analysis and are used to prepare general arrangement figures for the WHB. The resulting layouts will support the development of the site recommendation.

A number of separate analyses and references are required to configure and size system equipment, work areas, rooms, hot cells, pools, airlocks, staging areas, maintenance bays, and waste handling system spaces. Attachment I provides a detailed set of space requirements, including the dimensional outlines that are utilized to size the primary areas. The referenced documents in this section are based on the best available information on system configuration, equipment design, and waste handling operations. Attachment I provides the spatial layout developed using the reference sources for each system area. For each of the waste handling systems identified above, a reference document, analysis, or assumption is used to establish the requirements that generated the system configuration layouts shown in Attachment I. The layout will be described further in separate subsections for each of the five primary systems in the WHB.

In the subsections to follow, each of the five primary systems is analyzed and described based on the recommended configuration in the system references above. Updates to the configuration, and any layout assumptions and changes since the information was developed, are discussed.

6.2.1.1 Carrier/Cask Handling System

The CCHS receives rail and truck transportation cask carriers from the Carrier/Cask Transport System (CCTS), unloads casks from carriers, and loads empty casks onto carriers for off-site shipment. Loaded casks are transferred to the ATS or the CTS. Empty casks are received from the ATS and the CTS for off-site shipment. The CCHS also receives empty DPC overpacks from CCTS, unloads overpacks from carriers, transfers overpacks to the ATS, and loads them onto carriers for off-site shipment.

The CCHS operations begin when loaded truck or rail transportation cask carriers are delivered to the WHB carrier bay by the CCTS. The cask carriers are configured for many different cask sizes, types, characteristics, and designs (Assumptions 5.2.1.1 and 5.2.1.2). The carrier bay is sized to accommodate the largest truck or rail cask carriers (Assumptions 5.2.1.1 and 5.2.1.2). The casks are unloaded from the carriers and placed on cask transfer carts that transport the casks to either an ATS or CTS line. After the cask waste contents are unloaded, the ATS or CTS returns the empty casks to the CCHS. The CCHS receives the empty casks from the ATS and CTS and loads the casks onto cask carriers for off-site shipment. The CCHS also unloads empty DPC overpacks from rail cars and truck carriers and transfers the overpacks to the ATS using a transfer cart. After the empty DPCs are loaded into the overpacks, the ATS returns the overpacks to the CCHS. The CCHS then loads the overpacks onto rail cars or truck carriers for off-site shipment.

Two carrier transport lanes enter and leave the WHB (Parameter 4.1.2.1.2) providing unloading/loading stations in the carrier bay, each of which can accommodate either truck or rail carriers (CRWMS M&O 1998b). Truck carriers can enter and leave the carrier bay in one direction (one-way drive through) to minimize handling time in the carrier bay. Rail carriers enter and leave from the same end of the carrier bay. The truck or rail carrier is towed into the carrier bay unloading/loading area of the CCHS using a site prime mover.

The WHB carrier bay is configured and sized to accommodate two lanes, a carrier unloading area, a carrier loading area, three cask transfer carts, an overhead bridge crane, gantry-mounted manipulators, and other support equipment. In the carrier bay unloading area, the overhead bridge crane is used to upright and transfer the cask to a cask transfer cart (CRWMS M&O 1998b). The reverse operation is used to load an empty cask on the carrier. The carrier unloading/loading area is also equipped with support equipment such as cask lifting yokes, tooling, and maintenance equipment required to support normal and recovery activities. The system is configured to accommodate the waste transportation and receiving schedules without reducing the handling efficiencies of the ATS and the CTS (CRWMS M&O 2000c and CRWMS M&O 1998e).

The bridge crane is mounted on overhead rails in the carrier bay and consists of a double bridge-girder, trolley, main hoist, and auxiliary hoist. The crane main hoist/hook, rated for lifting a 160-ton load, is equipped with an electrically powered rotating hook to rotate the cask, if required. The crane main hoist is used in conjunction with the cask lifting yoke. The auxiliary hoist hook is used for lighter lifting operations. The cask lifting yoke is suspended from the crane hook and is equipped with two lifting arms designed to engage the cask trunnions. The cask lifting yoke facilitates tilting the cask to a vertical orientation and transfer of the cask to the transfer cart. The distance between the lifting arms is adjustable to accommodate the various diameters of the transportation casks. The lifting arm adjustment is accomplished by means of an electromechanical device incorporated into the lifting yoke. Multiple lifting yokes may be required to support the different cask designs.

The crane bridge and trolley move in a rectangular (X-Y coordinate) pattern inside the carrier bay loading/unloading area, the main hook rotates 360 degrees, and both the main and auxiliary hooks move in a vertical (Z coordinate) lifting motion. The crane is also equipped with platforms for contact maintenance in the carrier bay.

The crane bridge span of 78 ft is based on the carrier bay width of 80 ft minus a 2-ft clearance between the crane rails and the carrier bay walls.

A gantry-mounted manipulator is provided for each carrier transport lane to assist cask unloading/loading operations and allow partial remote handling to reduce radiation exposure. Each gantry-mounted manipulator consists of an electromechanical manipulator and a telescoping mast installed on a rail-mounted gantry and trolley system. The manipulator can be equipped with a variety of tools and accessories such as a robotic arm and hand assembly to assist in cask unloading and inspection operations.

The cask unloading/loading procedure for the CCHS is a contact or remote operation using manual and remote equipment (Assumption 5.2.1.3). To reduce radiation exposure rates for manual operation, operators will remotely operate the overhead bridge crane or the gantry-mounted manipulators (with the assistance of remote tools) from a safe distance by a radio control, a portable control console, or a crane overhead cab.

The truck or rail carrier is towed into the carrier bay unloading/loading area of the CCHS using a site prime mover. The cask is lifted off of the carrier using the large carrier bay bridge crane and a lifting yoke. The overhead bridge crane is used to engage the cask trunnions with the cask lifting yolk and rotate the cask to an upright position (CRWMS M&O 1998b). After the cask is in the upright position, the crane lifts the cask high enough to clear the carrier trunnion cradle and move the cask to a position for placement onto either an ATS or CTS cask transfer cart. The potential to drop a loaded cask during lifting exists. To minimize the lift height and the potential damage to the cask if a cask is accidentally dropped, the transport lanes are recessed below the carrier bay floor. If necessary, the cask will be rotated about its vertical axis and then placed onto the rail-mounted transfer carts. The transfer cart will be used to transfer the cask into the ATS or CTS lines. The system is configured and sized to accommodate the waste transportation and receiving schedules established for the repository (CRWMS M&O 2000c and CRWMS M&O 1998e).

The CCHS interfaces with the CCTS that provides the rail and road system for the site prime movers (transport vehicles) to tow and haul rail and truck carrier system to the CCHS. The CCHS also interfaces with the ATS and the CTS for delivering loaded casks, shipping empty casks, receiving empty DPC overpacks, and shipping DPC overpacks off-site. The WHB System houses the CCHS, and provides the utility and safety systems required for support maintenance and operations.

The design configuration for the CCHS is based on the *Carrier/Cask Handling System Design Analysis* (CRWMS M&O 1998b) and the VA SPA (CRWMS M&O 1997c). A modified layout, since the VA design report, showing the equipment arrangements for the CCHS is provided in Figures I-13 and I-14 of Attachment I. The modifications are addressed in the following sections:

<u>Carrier Bay</u>

The 200-ft width of the carrier bay (H-100A) has decreased to 196 ft (Attachment I, Figure I-13). Modifications to the size and number of ATS and CTS lines, as well as other changes in these areas, have affected the width of the CCHS. In addition to the above, the overall carrier bay has changed for the following reasons:

- The cask carrier length has increased from 66 ft to 72 ft (CRWMS M&O 1998b and CRWMS M&O 1998c).
- The distance between the carriers in the same lane within the carrier bay is reduced from 34 ft to 26 ft. This still provides adequate clearance for handling and the minimum required distance of 20 ft between loaded casks (CRWMS M&O 1997c and CRWMS M&O 2000e).

The length of the carrier bay has been increased from 70 ft to 80 ft. The overall cell length is increased for the following reasons: The distance between loaded casks has been increased from 12 ft to 20 ft for the reasons described previously (Attachment I, Figure I-13). These two changes increase the length of the carrier bay by 10 ft.

The interior height of the carrier bay remains the same at 60 ft.

As a result of the changes described above, the carrier bay length was increased 10 ft and the width was decreased 4 ft. The height of the carrier bay remains unchanged at 60 ft, as shown in Attachment I, Figure I-14.

The above dimensions and layout are based on the CCHS sketches in Attachment I, Figures I-13 and I-14.

In summary, the CCHS carrier bay (H-100A) minimum dimensions of 60-ft high, 70-ft long, and 200-ft wide, with an associated minimum required floor space of 14,000 ft^2, have been modified for the reasons discussed above. The revised minimum dimensions are 60-ft high, 80-ft long, and 196-ft wide, with an associated minimum required floor space of 15,680 ft^2.

6.2.1.2 Assembly Transfer System

The ATS receives rail and truck transportation casks from the CCHS, unloads spent nuclear fuel (SNF) assemblies, single element canisters, and DPCs from the casks, opens DPCs, unloads fuel assemblies from DPCs, repackages non-standard fuel assemblies, delivers and returns SNF assemblies to and from the fuel storage pools, delivers fuel assemblies to the DCHS, dries fuel assemblies, loads fuel assemblies into DCs, transfers filled DCs to the DCHS for emplacement preparation, and prepares empty casks and DPCs for off-site shipment.

The ATS can be divided into four functional subsystems: the cask unloading area, the non-standard fuel handling area, the fuel storage pool area, and the DC loading area. The operations of the first three preceding subsystems take place mostly under water; the operations of the last preceding subsystem takes place in hot cells only. The ATS receives, cools, and opens rail and truck transportation casks from the CCHS. The system unloads CSNF consisting of bare SNF assemblies, single element canisters, as well as DPC from the transportation casks. For casks containing a DPC, the system opens the DPC and then unloads the SNF assemblies and single element canister. The system stages or stores the assemblies, loads them into a DC, temporarily fills the DC with inert gas and seals the DC, decontaminates the DC, and transfers the DC to the DCHS. The system repackages non-standard fuel assemblies into acceptable packages. The system also prepares empty casks and DPC overpacks for off-site shipment.

Two ATS lines are provided in the WHB. As part of the ATS, four fuel basket storage pools and one non-standard pool are housed in an annex (H-183) to the WHB. The ATS line is configured to handle both BWR and PWR fuel assemblies. The areas will operate concurrently to meet ATS throughputs and to support maintenance operations.

Each ATS line consists of a cask unloading area, fuel storage pool area, and a hot cell area. The cask unloading area includes a cask preparation and decontamination area and a pool area. The pool area contains a cask unloading pool and an assembly staging pool. A single transfer canal connects the two pools. The fuel storage pool area consists of four fuel basket storage pools with two single fuel basket transfer canals connecting the pool areas. The hot cell area consists of an assembly handling cell (AHC), a DC loading cell, and a DC decontamination cell. An incline transfer canal is used to move the SNF assemblies and single element canisters from the staging pool to the AHC. The AHC is equipped with two drying stations, a DC loading port, a dry assembly transfer machine, a DC loading manipulator, an in-cell service crane, and a maintenance bay.

One of the ATS lines is specifically designed and equipped to handle shipments of non-standard SNF assemblies and single element canisters. The ATS line is connected to the non-standard fuel handling room/pool by an underwater transfer canal equipped with isolation gates and an SNF transfer cart. All the ATS pools and fuel basket storage pools have isolation gates to allow each pool to be segregated from the other pools, if necessary.

The ATS operating sequence begins with moving transportation casks to the cask preparation and decontamination area. The cask preparation operations consist of remote cask cavity gas sampling, cask venting, cask cool-down, cask lid unbolting and removal, shield plug unbolting, and shield plug lifting fixture attachment. Casks containing bare SNF assemblies (no DPC) are filled with water in the cask preparation area and placed in the cask unloading pool. The shield plugs are removed from the cask underwater. For casks containing a DPC, the cask lid(s) is remotely removed, the DPC vent valves are opened, and the DPC cavity is sampled, vented, and cooled. A DPC lifting fixture is remotely attached and the cask is placed into the cask unloading pool. In the cask unloading pool, the DPC is removed from the cask and placed in a canister overpack where the DPC lid is severed and removed.

SNF assemblies and single element canisters are individually removed from either an open cask or DPC and loaded into assembly baskets positioned in the assembly staging pool or in the assembly basket transfer cart. The assembly baskets are then transferred to the fuel storage pool area. Two fuel basket transfer canals, each equipped with an assembly basket transfer cart, interconnect the ATS staging pools of both ATS lines with the fuel storage pool area. The fuel storage pool area consists of four fuel basket storage pools.

The assembly baskets are transferred to the storage pools only when CSNF loaded in the DC is generating heat at a rate greater than 11.8 kW (Parameter 4.1.2.2.6). The assembly baskets are transferred from the fuel basket storage pools to the AHC only when CSNF loaded in the DC is generating heat at a rate less than 11.8 kW. It has been determined (CRWMS M&O 2000c) that approximately 12,000 SNF assemblies and 2,800 assembly baskets will accumulate in the storage pools during the emplacement period to satisfy the blending requirement. This amount of SNF can be held in four storage pools, each sized to stage 1,250 MTU or 750 fuel baskets (Assumption 5.2.2.1).

From the fuel basket storage pools, assembly baskets are moved to a dry AHC and loaded into one of two SNF drying vessels. After drying, the SNF assemblies and single element canisters are individually removed from the drying vessels and loaded into a DC positioned below the DC load port. After installation of a DC inner lid sealing device, the DC is transferred to the DC decontamination cell, where the top area of the DC and the DC inner lid sealing device are decontaminated and the DC is evacuated and filled with nitrogen gas. The DC is then transferred to the DCHS for lid welding and inspection.

In the second cask preparation and decontamination area, lids are replaced on the empty transportation cask and DPC overpack, the cask and DPC overpack are decontaminated, inspected, and transferred to the CCHS for shipment off-site. Cask preparation equipment is designed to facilitate remote or manual operation, decontamination, and contact maintenance.

The ATS interfaces with the CCHS for incoming and outgoing transportation casks, incoming DPCs, and outgoing DPC overpacks. The ATS also interfaces with the DCHS by receiving an empty DC prepared for loading and returning loaded DC for sealing and subsequent emplacement. The ATS also interfaces with the WHB, the WHB electrical system, and other WHB utility systems for operation and maintenance support.

The. ATS equipment is designed to facilitate manual decontamination, maintenance, and component replacement. All handling operations are supported by a variety of remote handling fixtures including cask lifting fixtures, cask lid lifting fixtures, staging racks, storage racks, DC lifting and base collars, and lifting grapples. Crane maintenance bays are provided at the far end of the AHCs and the cask preparation and unloading area to allow for contact maintenance, decontamination, and inspection of the bridge cranes and AHC manipulators.

The design configuration for the ATS is based on the VA SPA (CRWMS M&O 1997c) and the VA report (DOE 1998). The design has been modified to accommodate design changes to the ATS process and the WHB. The major changes have been the deletion of one ATS line and the additions of a second cask preparation and decontamination area, non-standard fuel handling area, and four fuel basket storage pools. An updated and modified layout with sketches showing the equipment arrangements for the ATS are provided in Figures I-15 through I-24 and I-39 in Attachment I. These modifications are based on assumptions 5.2.2.1 and 5.2.2.2 and are addressed in the following sections.

6.2.1.2.1 Cask Unloading Area

Each ATS line consists of an airlock, a crane maintenance bay for contact maintenance of the cask unloading area bridge crane, two-partitioned cask preparation and decontamination areas, and a pool area. One of the ATS lines has a fuel basket transfer canal, with normally closed isolation gates at each end, that connects the cask unloading pool with the non-standard fuel pool (Assumption 5.2.2.2).

An airlock separates the first cask preparation and decontamination area from the carrier bay. Each of the partitioned cask preparation and decontamination areas contains a station for loading and unloading transportation casks from the cask transfer cart and a cask preparation pit for preparation of loaded casks or for decontamination of empty casks and DPC overpacks. Each pool area contains a cask unloading pool and an assembly staging pool interconnected by a transfer canal. The assembly staging pool is connected to the dry AHC by an incline transfer canal. Two fuel basket transfer canals, each equipped with a fuel basket transfer cart, interconnect the ATS pool areas of both ATS lines with the fuel storage pool area. In the assembly staging pool, a basket staging rack is located between the two fuel basket transfer carts pathway. The cask unloading pool closest to the fuel storage pool area is dedicated to the unloading of non-standard fuel shipments. A water lock transfer canal with isolation gates at both ends connects the dedicated cask unloading pool to the non-standard fuel pool.

Each of the cask unloading areas are equipped with a cask transfer cart, a cask unloading area bridge crane, cask and DPC lifting yokes and fixtures, a wet assembly transfer machine, wet assembly lifting grapples, two DPC lid severing tools, DPC overpacks, assembly baskets, a basket staging rack, two fuel basket transfer canal carts (part of the fuel storage pool area), and an incline transfer canal cart. Each cask preparation pit is equipped with access platforms that are adjustable for the various cask diameters and a remotely operated gantry-mounted cask preparation manipulator that straddles the pit and access platforms. A variety of tools and accessories are available for the performance of remote preparation and decontamination activities using the preparation manipulator.

The layout of the cask airlock and cask preparation and decontamination area is shown in Attachment I, Figure I-15. The width of cask preparation area is dictated by the width of the cask unloading area and the AHC. The 44-ft width of the ATS lines is established by the size of the cask unloading pool, which is discussed below. The length of the airlock is 23 ft, sufficient to accommodate the 15-ft long cask transfer cart with 4-ft clearance between the cart and each isolation door at the ends of the cask airlock. The width of the airlock is 17 ft, sufficient to accommodate the 11-ft wide cask transfer cart with a 3-ft clearance between the cart and the inside walls of the airlock. The height of the airlock is determined by the height of the cask transfer cart, the tallest shipping cask, and the door opening height passage clearance and an allowance for the rolling door mechanisms. Therefore the airlock inside height is 28 ft [(2 ft (cart) + 19½ ft (tallest cask) + ½ ft (clearance) + 6 ft (mechanism) = 28 ft)]. The common center line of the cask, cask transfer cart and airlock is 8½ ft from the longitudinal wall of the cask preparation, within the range of the 7-ft minimum approach of the cask unloading area bridge crane. The preparation pit centerline is 13 ft from the opposite wall within the range of the 10-ft minimum approach of the cask unloading area bridge crane. The length of the first cask preparation and decontamination area must be sufficient to accommodate successively a 5-ft wide by 10-ft long by 10-ft deep floor cavity required for storing the dry cask lifting yoke, a 1-ft handrail space, a 13-ft diameter cask preparation pit with retractable access platforms, and a 12-ft length of lay-down area each side of the pit. Therefore the length is 43 ft [5 ft (cavity) + 1 ft (handrail) + (2 by 12 ft lay-down) + 13 ft (pit) = 43 ft]. The second cask preparation and decontamination area has the same attributes and space requirements as the first one without the need for the floor cavity to store the dry cask lifting yoke and space for a handrail. Therefore the length is 37 ft [43 ft – (5 ft cavity + 1 ft handrail) = 37 ft].

The width of the cask preparation and decontamination area must be sufficient to accommodate successively a 1-ft clearance between the wall and the cask preparation manipulator, a 25-ft long cask preparation manipulator, a 4-ft clearance between cask preparation manipulator and cask transfer cart, an 11-ft wide cask transfer cart, and a 3-ft clearance to the wall. Therefore the width is 44 ft [1 ft (clear) + 25 ft (manipulator) + 4 ft (clearance) + 11 ft (cart) + 3 ft (clearance) = 44 ft)].

A gantry-mounted manipulator straddles and operates over the cask preparation pit. The pit is sized to accommodate the largest diameter cask, and its 13-ft depth ensures that the shortest cask lid is accessible to operators. Lay-down areas on each side of the pit are used for manipulator gantry parking, cask lids, and tooling staging. The height of the partition walls between the cask preparation and decontamination areas and the pool area is 24 ft.

The maximum height of the cask unloading area bridge crane lifting hook is the critical dimension for cask handling in the cask preparation and decontamination area; this height has been established at 56½ ft in the pool area, as shown in *Assembly Transfer System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000b, Figure II-1). The minimum height of the crane hook in the cask preparation area is determined by the height of the cask transfer cart guides, a cask lifting clearance of 2 ft, the tallest shipping cask and the height of the dry cask yoke, and the vertical clearances required for the cask handling crane. Therefore, the crane hook height is 36¼ ft [4 ft (cart) + 2 ft (clearance) + 17½ ft (cask) + 12¾ ft (yoke) = 36¼ ft] and within the 56½-ft available space.

Once the cask preparation is completed, a loaded cask is transferred to the pool area using the bridge crane. The layout of the pool area is shown in Attachment I, Figure I-16 and Figure I-17. The length of the pool area is 85 ft, which is sufficient to accommodate the 25-ft long cask unloading pool, the 6-ft long transfer canal between the two pools, the 24-ft long staging pool, and 31 ft of aisle clearance at the pool ends (19 ft at the unloading pool and 11 ft at the staging pool). The 44-ft width of cask unloading area is based on the 21-ft widths of the cask unloading pool and the staging pool (identical widths), with 11½ ft of aisle space on each side of the pools. The 25-ft long by 21-ft wide (Attachment I, Figures I-16 and I-17) by 50-ft deep (CRWMS M&O 2000b, Figure II-1) cask unloading pool is based on space required for the maximum diameter shipping cask (Assumption 5.2.1.1), the DPC overpack retainer, and staging space for the shipping cask shield plug. The length is sized to accommodate the 8-ft 3-in. maximum diameter cask, the 7-ft 9-in. diameter DPC overpack retainer and for a 3-ft clearance between both items and the end walls of the pool. A 6-ft wide by 6-ft long by 39-ft deep transfer canal connects the unloading pool to the staging pool. The unloading pool also includes space for staging of the lifting yokes, fixtures, and staging the pool transfer canal gate. The unloading pools of both ATS lines are identical except that the one closest to the storage pool area is dedicated to receive the non-standard fuel shipments.

In addition to the transfer canal that connects the unloading pools to the staging pools, two fuel basket transfer canals connect both of the ATS staging pools to the fuel basket lag storage area (Assumption 5.2.2.6). To allow segregation between the ATS lines and the fuel basket lag storage area, a set of two isolation gates per staging pool is provided. These gates are normally stored against the side of the pool, leaving the fuel basket transfer canals open. The 24-ft long staging pool accommodates the two 6-ft wide canals separated by a 9-ft wall and a 2-ft allowance for the isolation gate at each end [(2-ft by 6-ft canal) + (1-ft by 5-ft wall) + (2-ft by 2-ft gate) = 21 ft].

The 21-ft width of the staging pool establishes the width of the ATS lines. The minimum aisle space on either side of the pool is 11½ ft. The pool is sized in accordance with Assumption 5.2.2.3 for a staging rack with a capacity of 16 fuel assembly baskets. The staging rack capacity allows it to receive the full content of any cask. Each basket is 25 in. by 25 in. in plan cross-section and is designed to hold four PWR or eight BWR fuel assemblies. The size of the basket is determined by the maximum dimensions of the PWR and BWR fuel. The baskets are positioned in a staging rack using a 2 by 8 array with a 30-in. pitch. The 5-ft wide by 20-ft long staging rack is located between the two transfer canals in a 5-ft wide by 21-ft long and 50-ft deep cavity inside the staging pool.

A 6-ft wide and 80-ft high inclined transfer canal also connects the staging pools to the AHCs. The canal slopes upward from the bottom of the assembly staging pool to the dry area of the AHC. The nominal depths of the staging pools are 39 ft, except at the bottom of the staging racks and at the bottom of the inclined transfer canals, where the depths are 50 ft. The 39-ft depth of the staging pools matches the depths of the two inclined transfer canals and the transfer canal to the cask unloading pool (Attachment I, Figure I-18).

The 71-ft height of the cask unloading area, including the area above the crane maintenance bay and the airlock, is based to the following: 1) 1-ft lifting clearance between the bottom of the cask and the cask unloading area floor on the tallest transportation cask; 2) the height of the wet cask lifting yoke; 3) the vertical operating space required for the cask unloading bridge crane; and 4) an allowance for potential dimensional changes in the cask, lifting yoke, and crane (CRWMS M&O 2000b, Assumptions 5.4 and 5.5). Therefore the height is 71 ft [1 ft (clearance) + 17½ ft (cask) + 36½ ft (yoke) + 14½ ft (crane) + 1½ ft (allowance) = 71 ft].

The 50-ft depth of the cask unloading pools and the assembly staging pools are based on the tallest transportation cask (19⅜ ft), the longest fuel assembly (16⅝ ft), (Assumption 5.2.1.1), the minimum water shielding depth (Assumption 5.2.2.5), a 1-ft high underwater platform, 1 ft of handling clearance between the fuel assembly and the top of the cask, and the pool water freeboard clearance. Therefore the total depth is 50 ft [1 ft (platform) + 19⅜ ft (cask) + 1 ft (clearance) + 16⅝ ft (fuel assembly) + 11 ft (water for shielding) + 1 ft (freeboard) = 50 ft].

In summary, the cask airlocks (H-101A, 101B) minimum dimensions are 28-ft high, 17-ft wide, and 23-ft long, with an associated minimum required floor space of 483 ft^2 each. The cask preparation and decontamination area (rooms H-102A, H-102A2, H-102B, & H-102B2) require dimensions of 71-ft high and 44-ft wide. The combined length of each set of rooms (H-102A with H-102A2, H-102B with H-102B2) is 80 ft, with an associated minimum required floor space of 3,124 ft^2 each. The cask unloading pool area (H-103A & H-103B) minimum dimensions are 71-ft high, 44-ft wide and 85-ft long, with an associated minimum required floor space of 3,740 ft^2 each. The pools, staging, and cask unloading (H-103A1 & H-103B1) minimum dimensions are 50-ft high (or deep), 21-ft wide, and 49-ft long. The non-standard fuel handling area (H-183J) is 40-ft high, 36-ft wide and 45-ft long, with an associated minimum required floor space of 1,620 ft^2. The non-standard fuel basket transfer canal (H-183H) is 39-ft high (or deep), 6-ft wide and 36-ft long, with an associated minimum required floor space of 216 ft^2. The inclined transfer canal (H-104A, H-104B) is 80-ft high (or deep), 6-ft wide, and 72-ft long, with a minimum required floor space of 432 ft^2. The minimum floor space at grade level required in the WHB for the ATS cask preparation, decontamination, and unloading areas for the two lines is 14,996 ft^2, based on Attachment I, Figures I-15 and I-16. The minimum required pool area crane maintenance bays (H-301A & B) for the two lines is 2,200 ft^2.

6.2.1.2.2 DC Loading Area

Each DC loading area includes an AHC and an AHC crane maintenance bay separated by an isolation door from the AHC. Each AHC interfaces with a DC load cell through a DC loading port located on the floor of the cell. Each DC load cell interfaces with a DC decontamination cell, which interfaces with the DCHS.

The dry assembly handling area contains a wet-to-dry transfer canal interface, two assembly drying vessels, an equipment maintenance bay, a DC loading cell, and a decontamination cell. The area also contains handling equipment consisting of a dry fuel assembly and basket transfer machine, a DC loading port mating system, an overhead bridge crane, DC transfer cart, and decontamination and inerting equipment. Various manipulators, lifting fixtures, and support tooling are provided for fuel assembly and basket and DC handling. All equipment is designed to facilitate remote operation and removal for decontamination and maintenance. Interchangeable components are provided where appropriate. Lay-down areas are included, as required, for fixtures, grapples, tooling, shield plugs, lids, and off-normal recovery operations.

Assembly Vacuum Drying

To support the assembly vacuum drying operation, vacuum drying vessels (two each) are provided (Figures I-21 and I-22). Equipment is required to provide the vacuum to these vacuum drying vessels. Each vacuum drying vessel set (e.g., rooms H-205A and H-205B) has two dedicated vacuum pump sets and is sized to provide sufficient vacuum for the operation of one vacuum vessel. The vacuum piping arrangement allows either vacuum pump set to support either vacuum vessel (CRWMS M&O 1998a, Page 2 of 2, Attachment VII).

The minimum floor space required to support the installation of two vacuum pump sets (installed side-by-side) is 14 ft 6 in. by 10 ft 8 in. (CRWMS M&O 1998a, Section 7). Additional floor space is required for the off-gas superheater and the HEPA filter-box. The off-gas superheater and the HEPA filter-box support all four vacuum pump sets. Piping to the suction side of the vacuum pump sets is by a 6-in. or larger stainless steel pipe (CRWMS M&O 1998a, Page 1 of 46, Attachment V). Floor space is also required for piping, piping bends, valves, and valve actuators. Additional space is also required to allow initial equipment installation and to provide access for the performance of routine and off-normal maintenance. It is assumed (Assumption 5.2.2.7) that doubling the floor space required for the vacuum pump sets (i.e., a minimum floor space of 30 ft by 22 ft with an overhead space of 12 ft) is adequate to install one pair of vacuum pump sets and associated piping and equipment for each ATS line.

The vacuum pump sets, piping, and valves, off-gas superheater, and HEPA filter-box are located in room H-040 (at the 80-ft elevation). This room is approximately 45-ft wide by 105-ft long with an overhead clearance of 45 ft. for a total of 4,725 ft^2. This room area is immediately below the vacuum vessels; this allows for minimized vacuum piping runs. Equipment access is provided through two floor plugs located in room H-110, DC handling cell (at the 100-ft elevation). Doorways allow equipment access into room H-040 through access corridor H-053.

The layout of the AHC (H-205 and H-205B) is shown in Attachment I, Figures I-21 and I-22. The width of the AHC is controlled by the width of the ATS lines in the cask unloading pool area (Section 6.2.1.2.1). The width of the two ATS lines is estimated to be 116 ft (2 lines by 44-ft pool area width + 4 walls by 2-ft wall thickness + 1 by 20-ft gallery width). The width of the assembly cells are, therefore, determined by the width of the lines less the space required by operating galleries and shield walls between the two dry hot cell lines. This width is estimated to be 38 ft (since 2 lines by 38-ft cell width + 4 walls by 5-ft wall thickness + 20-ft operating gallery width = 116 ft) based on a shield wall thickness of 5 ft (Attachment II, Figure II-1) and a 20-ft operating gallery. The length of the AHC is 66 ft. This includes space for staging the drying vessel lids, opening length for the incline transfer canal, staging drying vessel shield plugs and DC load port lid covers and isolation door, (3-ft clearance + 25-ft vessel lid staging + 12-ft opening + 25-ft vessel plug staging + 1-ft thick door = 66 ft). The height of the AHC is based on the height of the dry spent fuel handling machine, the height and clearance for the in-cell manipulator, and the height and clearance for the in-cell crane. The interior height of the AHC is 50 ft, based on the assumed values in Attachment I, Figure I-22, and *Assembly Transfer System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000b, Figure I-5).

The AHC (H-205A & B) is the same height (50 ft), width (38 ft), and length (66 ft). The total floor area of H-205A & B is 5016 ft^2.

The AHC crane maintenance area (H-206A & B) is the same height (50 ft) and width (38 ft) as the AHC. Its length is 24 ft to allow the crane to be isolated for maintenance. The total floor area of H-206A & B is 1,824 ft^2.

The layout of the DC load and decontamination cell is shown in Attachment I, Figures I-23 and I-24. The width of the cells is determined by the width of the ATS lines (i.e., the same width as the 38-ft AHC discussed above). The length of the two cells is 45 ft. The DC load cell (H-105A and H-105B) is 20-ft long and has a 1-ft thick door that isolates it from the 24-ft long DC decontamination cell (H-106A and H-106B). The decontamination cell has a 5-ft thick shielding door. Each cell has a 4-ft clearance between the 11-ft long DC cart and the walls and doors. The height of the DC load and decontamination cells is based on the height of the DC transfer cart, the tallest DC, and clearance for the DC load cell port mating system. The interior height of the two cells is 28 ft, based on the assumed values in Attachment I, Figure I-24, and *Assembly Transfer System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000b, Figure I-5).

In summary, the minimum floor space required in the WHB for the ATS DC loading area for the two lines is 10,184 ft^2, based on Attachment I, Figures I-21 through I-24.

6.2.1.2.3 Fuel Storage Pool Area

The fuel storage pool area (H-183) includes four fuel basket storage pools connected by two fuel basket transfer canals that also connect the two ATS lines (Assumption 5.2.2.6). The fuel basket storage pools receive fuel baskets containing PWR or BWR fuel assemblies from the ATS cask unloading area. After receiving the fuel baskets, the fuel storage pool area places the fuel baskets into the fuel basket storage racks. The fuel basket storage racks, which are located underwater in the storage pools, store the fuel baskets until they are routed back to the ATS DC loading lines for further processing.

The storage pools that hold the fuel baskets are contained in the fuel storage pool area and are designed with capacities of 1,250 MTU each (Assumption 5.2.2.1), such that they will meet the minimum storage requirements for blending. Each storage pool is configured to accept and store fuel baskets containing four PWR or eight BWR commercial fuel assemblies (CRWMS M&O 2000b, Section 6.4.1.18). The two fuel basket transfer canals, each equipped with a fuel basket transfer cart, interconnect the staging pools of both ATS lines with each of the four fuel basket storage pools in the fuel storage pool area. The northern fuel basket transfer canal is mainly dedicated to the transfer of the fuel baskets from the ATS basket staging racks to the storage pools. The southern fuel basket transfer canal is mainly dedicated to the transfer of the fuel baskets from the storage pools to the ATS incline transfer canal cart. The fuel basket transfer carts can be operated independently of each other. Once loaded with fuel assemblies, the fuel baskets are removed, one at a time, from the basket staging rack by the wet assembly transfer machine and placed in one of the fuel basket transfer carts. The remotely operated fuel basket transfer cart is then used to transfer loaded fuel baskets to one of the storage pools. The storage pool assembly basket transfer machine removes, one at a time, the fuel baskets from the transfer cart and lowers them into a selected location in the fuel assembly storage rack, located in the storage pools. When a loaded fuel basket, stored in one of the storage pools is selected for DC loading, the assembly basket transfer machine loads the fuel basket in the transfer cart and transfers it back to one of the staging pools. The loaded fuel basket is removed from the transfer cart by the wet assembly transfer machine and placed in the incline transfer canal cart for further processing. The returning of empty fuel baskets are stored in the staging rack or returned to the storage pools.

The fuel storage pool area consists of four nearly identical fuel basket storage pools. The equipment to service each of the four storage pools includes one assembly basket transfer machine and two fuel basket transfer canal isolation gates. The equipment common to the four storage pools includes two fuel basket transfer carts and maintenance access hatches on each of the two fuel basket transfer canals.

The fuel basket transfer cart has a holding capacity of 8 fuel baskets, distributed in an array of 2 wide by 4 long. Each of the fuel baskets holding slot has a 30-in. by 30-in. nominal cross section (CRWMS M&O 2000b, Section 6.4.1.19), making the fuel basket transfer cart 5-ft wide (2 by 30 in./12 in. per ft = 5 ft) by 10-ft long (4 by 30 in./12 in. per ft = 10 ft) by 8-ft high. The fuel basket transfer cart travels on rail located at the bottom of the fuel basket transfer canal.

The fuel basket transfer canals (H-183F and H-183G) connect the two staging pools with the four fuel basket storage pools. The fuel basket transfer canals are 6-ft wide with the bottom located 39 ft below the pool deck. The canal length of 82 ft each, connects all six pools. Each of the transfer canals is open on the top, except where the canals penetrate the staging pools and storage pools through walls. Removable access hatches cover the fuel basket transfer canals where open at pool deck level. The reason for the penetrations is to reduce significantly the size of the isolation gates. The penetrations through the walls are 6-ft wide and 20-ft high. The justification for the 20-ft opening is dependent on the following: The nominal height of the tallest fuel basket is 18 ft (actual height 17 ft 9 in.); when placed in the transfer carts the bottom of the fuel assembly is 1 ft above the bottom of the canal and a 1-ft clearance is allocated between the top of the fuel basket and the top of the opening. Therefore the required height of the opening is 20 ft [(1 ft (bottom clearance) + 18 ft (tallest fuel basket) + 1 ft (top clearance) = 20 ft].

To allow the placement of a two-fuel basket-wide staging rack in the staging pools, the wall between both fuel basket transfer canals has to be 6 ft. The distance between the south end of the pool and the nearer fuel basket transfer canal wall and the distance between the northern edge of the platform and its nearer fuel basket transfer canal wall is 2½ ft. Therefore the platform is 23-ft wide [(2½ ft x 2) + (6 ft x 2) + 6 ft = 23 ft].

The 39-ft depth of the fuel basket transfer canal provides adequate space for the transfer of fuel baskets over the fuel basket transfer cart and minimum water shielding coverage for personnel. The justification for the 39 ft is as follows: 1) the nominal height of the tallest fuel basket is the 18-ft PWR fuel basket (actual height 17 ft 9 in.); 2) when placed in the 8-ft high fuel basket transfer cart, the tallest fuel assembly has a nominal height of 17 ft (actual height 16 ft 9 in.); 3) during transfer a 2-ft clearance is allocated between the bottom of the fuel basket and the top of the fuel basket transfer cart; 4) the tops of the fuel assemblies require a minimum of 11 ft of water cover to provide adequate shielding (Assumption 5.2.2.5); and 5) 1-ft freeboard clearance to the top of the pool deck. Therefore, the required depth of the fuel basket transfer canal is 39 ft [(8 ft (fuel basket transfer cart height) + 2 ft (clearance) + 17 ft (tallest fuel assembly) + 11 ft (water shielding) + 1 ft (freeboard) = 39 ft].

Each fuel basket storage pool has a 20-ton capacity, 50-ft span overhead service crane. The overhead crane rails are located 30 ft above the pool deck and are attached to the columns supporting the ceiling for the fuel storage pool area. The crane height from top of the rails to its highest point is 6 ft. Its coverage includes the storage pools and the equipment lay-down areas at the end of the storage pools. Other than general maintenance, the crane functions include handling of the storage pool fuel assembly storage racks, the fuel basket transfer carts, and the fuel basket transfer canal isolation gates. The fuel basket transfer canal isolation gates are assumed to be the heaviest load to be handled by the overhead crane, and the weight of each has been estimated at 15 tons. The gate is a trapezoidal shape with 10-ft and 8-ft long bases, 22 ft in height, 1-ft thick, and made of concrete.

The assembly basket transfer machine has a bridge crane-type configuration, straddling the fuel basket storage pools and travelling on 41-ft span rails, located on the top of the pool walls. The assembly basket transfer machine, a fully automated machine with manual override, rides lengthwise above the pools in an operator-accessible controlled area. Operating platforms are provided along the full length of each side of the bridge. A trolley, supporting the mast retractable tubes, is mounted on the bridge. A fuel basket grapple attached at the end of the smaller retractable tube can reach and grapple the shorter fuel baskets stored in fuel racks at the bottom of the storage pools. The mast retractable tubes have a minimum lift of 26 ft and a minimum lifting capacity of 6 tons. The 6-ton lifting capacity is based on the weight of the heaviest loaded fuel basket, which has been established at 5.3 ton (CRWMS M&O 2000b, Section 6.4.1.11). The critical dimensions of the assembly basket transfer machine are a 20-ft maximum height from the floor, a 37-ft maximum span, and a 26-ft lift minimum. Part of the above basket transfer machine dimensions are based on Figure 6.4.7 in *Assembly Transfer System Input to Support Site Recommendation* (CRWMS M&O 2000b, Section 6.4.1.11). The required lift is based in the difference between the depth required to reach a stored 12-ft nominal fuel basket (actual dimension is 12 ft 3 in. (CRWMS M&O 2000b, Section 6.4.1.18) and the height required to lift up an 18-ft nominal fuel basket (actual dimension is 17 ft 9 in.) clearing by 2 ft a stored 18-ft nominal fuel basket. Therefore 26 ft of lift is required [(19 ft (fuel basket higher point of the tallest fuel basket when stored) + 2 fuel basket (clearance) + 18 ft (fuel basket height)] – [13 ft (fuel basket higher point of the smallest fuel basket when stored) = 26 ft].

Attachment I, Figures I-19 and I-20 depict the equipment layout of the fuel basket storage area. A single storage pool would hold 750 spent fuel baskets, or 1,250 MTU CSNF and provides a transfer/parking area for the fuel basket transfer carts (Assumption 5.2.2.1). The fuel basket storage pool area mechanical support equipment includes any required hook/grapple to basket lifting devices, tooling, and maintenance equipment required for support normal and recovery operations.

The 5,000 MTU requirement for surface storage of fuel assemblies dictates the dimensions for the four fuel basket storage pools. Based on the total inventory of CSNF in the waste stream, 230 PWR or 560 BWR fuel assemblies contain 100 MTU each (CRWMS M&O 2000c). Thus, a storage system with a capacity of 1,250 MTU will accept 2,875 PWR [(1,250 MTU/100 MTU)(230 PWR) = 2,875 PWR)] or 7,000 BWR [(1,250 MTU/100 MTU)(560 BWR) = 7000 BWR)] assemblies. Since CSNF will be received at the WHB, unloaded and transferred to fuel baskets containing four PWR or eight BWR assemblies (Assumption 5.2.2.3), a 1,250 MTU storage pool will contain 719 PWR fuel baskets [(2,875 PWR)/4 PWR) = 719 fuel baskets)] or 875 BWR fuel baskets [(7,000 BWR)/8 BWR = 875 fuel baskets]. When the most likely mixtures of PWR and BWR fuel are considered, approximately 750 fuel baskets are required to store 1,250 MTU. Therefore, a 750-basket storage pool is selected as the minimum required storage pool size.

Each fuel basket is 25 in. by 25 in. in plan cross-section and is designed to hold four PWR or eight BWR fuel assemblies. The basket storage racks in each fuel basket storage pools are arranged in a rectangular array of 14 by 54 fuel basket emplacements. The fuel basket transfer canals enter and cross the storage pools by the southern end of each storage pool. A 23-ft length of the south end of each pool is required to accommodate the two fuel basket transfer canals, two fuel basket transfer carts, and the canal isolation gates. This 23-ft long pool is 39-ft deep matching the bottom of the fuel basket transfer canals. The outside dimension of the racks are a nominal 30 in. by 30 in. (actual inside dimension are 29 in. by 29 in.) (CRWMS M&O 2000b, Figure 6.4-15). On either side of the racks, there is a 12-in. gap between the pool walls and the outside of the racks in the width direction and 12 in. in the length direction. These gaps will provide adequate water circulation around the fuel assemblies for cooling. The overall storage pool inside dimensions are 37 ft [(14)(30 in./12 in. per ft) + 2(12 in./12 in. per ft) = 37 ft)] x 160 ft [((54)(30 in./12 in. per ft) + 2(12 in./12 in. per ft) + 23 ft = 160 ft)] to accommodate 1,250 MTUs of CSNF, or one fourth of the required total storage inventory of 5,000 MTUs.

The overall outside width of the fuel storage pool area at the 100-ft elevation must be sufficient to accommodate the 160-ft long storage pool, the 14-ft or 16-ft long equipment lay-down area on each end of the pool and the 2-ft thick fuel storage pool area walls. Therefore, the total width required is 190 ft (160-ft pool + [14-ft lay-down] + [16-ft lay-down] = 190 ft). The length of the fuel storage pool area must be sufficient to accommodate one 35-ft width equipment lay-down area, four 37-ft wide storage pools, three 16-ft wide decks between the pools, one 10-ft space between storage pool (H-183A) and outside wall of the non-standard fuel handling room, and 37-ft outside width of the non-standard fuel handling room. Therefore the total required length is 278 ft ([1x35-ft lay-down] + [4x37-ft pool] + [3x16-ft deck] + [1x10-ft space] + [1x37-ft long wall] = 278 ft]).

The 160-ft long section of the storage pool dedicated to the fuel baskets storage is 50-ft deep to provide adequate space for transferring fuel baskets over other fuel baskets placed in storage racks, and minimum water coverage to provide shielding for personnel. The nominal 18-ft PWR fuel baskets (actual height is 17 ft 9 in.), which are the tallest, are stored in 9-ft 6-in. tall storage racks (CRWMS M&O 2000b, Sections 6.4.1.18 and 6.4.1.19*)*. The tallest fuel assembly has a nominal height of 17 ft (actual height 16 ft 9 in.). Because of the 1-ft rack leg supports, the top of the fuel basket actually is 19 ft above the pool floor. When transferring a fuel basket above a stored fuel basket a 2-ft clearance is provided between both baskets, the tops of the fuel assemblies require a minimum of 11 ft of water cover to provide adequate shielding. A freeboard clearance of 1 ft is provided. Therefore the required depth of the storage pool adjacent to the 39-ft deep fuel basket transfer canal platform is 50 ft [(19 ft (for highest stored fuel basket) + 2 ft (clearance) + 17 ft (tallest fuel assembly) + 11 ft (water shielding) + 1 ft (freeboard) = 50 ft].

The height of the fuel storage pool area structure itself (structure above the pool deck) is based on the fuel pool storage area maintenance overhead crane highest point of 31 ft (25 ft (from pool deck to top of rail) + 6 ft (from top of the rails to crane highest point) (CRWMS M&O 2000b, Assumption 5.4). A headspace for roof supporting structure, lighting, HVAC ducting, and other obstructions and equipment is 9 ft.

In summary, the fuel storage pool area (H-183) has the minimum inside dimensions of 190-ft wide by 278-ft long and 40-ft high above the pool deck. Each of the four fuel basket storage pools is 37-ft wide by 160-ft long with various depths. The fuel basket storage pools are 39-ft deep for a 23-ft (H-183A, H-183B, H-183-C, H-183D) length with the remaining 137 ft of length at a depth of 50 ft. The minimum floor space required for the fuel storage pool area (H-183), non-standard fuel handling area (H-183J), and vestibule (H-100E) is 52,820 ft^2 (190 ft x 278 ft = 52,820 ft^2).

6.2.1.2.4 Non-standard Fuel Handling Area

The non-standard fuel handling area (H-183J) is a completely enclosed area with personnel controlled access. The non-standard fuel handling area processes only nuclear wastes, mostly CSNF that does not meet the criteria for DC loading. For non-standard fuel assemblies to meet the DC loading criteria, the waste is subjected to cutting, reshaping, consolidating and repackaging operations (Assumption 5.2.2.2). All of these operations take place under water in the non-standard fuel pool. As shown in Attachment I, Figure I-39, the non-standard fuel handling room is located in the fuel pool storage area of the WHB. One side of the room shares a common wall with one of the ATS lines. A water lock transfer canal, with normally closed isolation gates at each of its end, connects one ATS cask unloading pool with the non-standard fuel pool inside the non-standard fuel handling area. It is expected that most of the non-standard waste will be delivered to the ATS cask unloading pool in specially identified transportation casks. Only the ATS line connected to the non-standard fuel handling area receives these shipments. Occasionally it might happen that during routine cask unloading preparation operations of standard fuel shipments, some defective or suspect fuel assemblies would be sent to the non-standard fuel handling area for further inquiries or processing.

Casks containing non-standard wastes will be directed to the non-standard waste dedicated ATS line. After completion of the cask preparation operations, the cask is placed in the ATS cask unloading pool. The isolation gate to the ATS staging pool is placed (closed position); the cask is opened. The isolation gate between the ATS cask unloading pool and the non-standard fuel basket transfer canal is removed (open position). The ATS wet assembly transfer machine unloads the waste from the cask and places it in baskets located in the non-standard fuel transfer cart. Once the unloading is done, the isolation gate between the ATS cask unloading pool and the non-standard fuel basket canal is placed back (closed position). The isolation gate between the non-standard fuel pool and the non-standard fuel basket canal is removed (open position). The non-standard fuel basket transfer cart is moved to the non-standard fuel pool. Using a lifting rod, the over head bridge crane moves the waste loaded baskets from the non-standard fuel transfer cart and places them into the pool basket staging stand. After the waste has been repackaged it is loaded in baskets and the baskets are sent back to the ATS cask unloading pool by reversing the above operational sequences. Once in the ATS cask unloading pool, the loaded baskets are directed either to the fuel basket storage pools or to the DC loading lines.

The non-standard fuel handling area contains all of the equipment, tools, and packages required for processing non-standard waste forms into acceptable WPs. The pool contains a cutting stand, an assortment of handling and cutting tools, a basket staging stand, an empty package staging stand, a loaded package staging stand, and pool cleaning, monitoring, inspection, and remote equipment. Above the pool a mobile work platform on rails is able to move over the full pool area. At the top of the non-standard fuel handling area, an overhead crane covers the full area of the room.

Due to the condition of the waste received and the type of operations conducted in the non-standard fuel pool, the pool has the potential for being more contaminated than the ATS pools. For these reasons, and to minimize cross contamination, the non-standard fuel pool has an independent filtration system with a higher change rate than the other pools forcing the water to flow toward the non-standard fuel pool. The non-standard fuel pool is 30-ft long, 15-ft wide, and 50-ft deep. To allow a better view and an easier handling of the fuel baskets during the loading/unloading operations, the non-standard fuel basket cart enters the pool within the range of the mobile work platform. The non-standard fuel pool 50-ft depth provides adequate clearance during fuel basket transfer over other fuel baskets placed in staging stands, and provides minimum water shielding coverage for the personnel. The nominal 18-ft PWR fuel baskets (actual height 17 ft 9 in.), which are the tallest, are stored in a 9-ft 6-in. tall staging stand (CRWMS M&O 2000b, Sections 6.4.1.18 and 6.4.1.19). The tallest fuel assembly has a nominal height of 17 ft (actual height 16 ft 9 in.). Because of the 1-ft tall rack leg supports, the top of the fuel basket actually sits 19 ft above the non-standard pool floor. When transferring a fuel basket above stored fuel baskets, a 2-ft clearance is provided between both baskets and the tops of the fuel assemblies require a minimum of 11 ft of water cover to provide adequate shielding (Assumption 5.2.2.5). A freeboard clearance of 1 ft is given. Therefore the required depth of the non-standard fuel pool is 50 ft [(19 ft (for tallest stored fuel basket) + 2 ft (clearance) + 17 ft (tallest fuel assembly) + 11 ft (water shielding) + 1 ft (freeboard) = 50 ft].

The non-standard fuel basket transfer cart has a holding capacity of 2 non-standard fuel baskets (Assumption 5.2.2.4), distributed in an array of 2 wide by 1 long. Each of the non-standard fuel basket staging stands has a 30-in. by 30-in. nominal plan cross section (CRWMS M&O 2000b, Section 6.4.1.19), making the fuel basket transfer cart 5-ft wide (2 x 30 in./12 in. per ft = 5 ft) x 2½-ft long (1 x 30 in./12 in. per ft = 2½ ft) and 7-ft high. The non-standard fuel basket transfer cart is an upended cart traveling on rails located at the top of the non-standard fuel basket transfer canal and clearing the bottom of the canal by one foot.

The non-standard fuel basket transfer canal connects one of the ATS cask unloading pools to the non-standard fuel pool. The non-standard fuel basket transfer canal is open at the top, covered with removable hatches. The non-standard fuel basket transfer canal's 6-ft width allows 6-in. clearance on each side of the non-standard fuel basket transfer canal. The non-standard fuel basket transfer canal's 39-ft depth provides adequate space for the transfer of fuel baskets over the non-standard fuel basket transfer cart and provides minimum water shielding coverage for personnel. The justification for the 39 ft is as follows: The nominal height of the tallest non-standard fuel basket is the 18-ft PWR fuel basket (actual height 17 ft 9 in.); when it is placed in the 7-ft tall non-standard fuel basket transfer cart, the cart clears the bottom of the canal by 1 ft, the tallest non-standard fuel has a nominal height of 17 ft (actual height 16 ft 9 in.), during transfer a 2-ft clearance is provided between the bottom of the non-standard fuel basket and the top of the non-standard fuel basket transfer cart, the top of the fuel assemblies requires a minimum of 11 ft (Assumption 5.2.2.5) of water cover to provide adequate shielding (Assumption 5.2.2.5), 1-ft freeboard clearance to the top of the pool deck. Therefore the required depth of the non-standard fuel basket transfer canal is 39 ft [(1 ft (non-standard fuel basket transfer cart/canal clearance) + (7 ft (fuel basket transfer cart height) + 2 ft (clearance) + 17 ft (tallest fuel basket) + 11 ft (water shielding) + 1 ft (freeboard) = 39 ft].

The mobile work platform is a motorized bridge crane type configuration, straddling the non-standard pool and travelling on 17-ft span rails on top of the pool deck. The mobile work platform is used by the operators for observing, handling, guiding, transforming, packaging, monitoring, and cleaning operations. It has an assumed width of 6 ft (Assumption 5.2.2.2).

The 30-ton overhead crane is used for all lifting operations. The crane rails are located 30 ft above the pool deck. When fully retracted, the crane lifting hook is 28½ ft above the pool deck, 1½ ft more than the 27-ft minimum lift required. The required lift is based on the difference between the depth required to reach (using a rigid lifting rod) a stored 12-ft nominal fuel basket (actual dimension is 12 ft 3 in.) and the height required to lift up a 18-ft nominal fuel basket (actual dimension is 17 ft 9 in.) clearing by 2 ft a stored 18-ft nominal fuel basket. Therefore [(19 ft (fuel basket highest point of the tallest fuel basket when stored) + 2 ft (clearance) + 18 ft (fuel basket height)] – [13 ft (fuel basket higher point of the smallest fuel basket when stored) - (1 ft for rod disengagement] = 27 ft of lift is required.

The non-standard fuel basket transfer canal isolation gate is assumed to be the heaviest load to be handled by the overhead crane and its weight has been conservatively estimated at 27 ton. A 30-ton crane capacity has been selected. The gate has a trapezoidal shape with 10-ft and 8-ft long bases, a 40–ft height, 1-ft thick, and made of concrete. Therefore the gate weighs 27 tons [((10 ft+8 ft)/2) x 40 ft x 1 ft)) x 150 lbs/ft^3 = 54,000 lbs. (27-tons)].

The height of the non-standard fuel handling area structure itself (above the pool deck) is 40 ft, the same as the fuel storage pool area. The overhead crane highest point is 36 ft above the pool deck (30 ft (from pool deck to top of rail) + 6 ft (from top of the rails to crane highest point) (CRWMS M&O 2000b, Assumption 5.4). The headspace for the roof supporting structure, lighting, ventilation ducting, and other obstructions and equipment, is 4 ft.

In summary, the non-standard fuel handling area (H-183J) has the minimum inside dimensions of 45-ft long by 36-ft wide and 40-ft high above the pool deck. This area contains a personnel entrance air lock of 8 ft by 8 ft. The non-standard fuel pool (H-183E) is 30-ft long by 15-ft wide and 50-ft deep. The non-standard fuel basket transfer canal (H-183H) is 6-ft wide by 39-ft deep and 36-ft long. The minimum floor space required for the non-standard fuel handling area is 1,620 ft^2 (45 ft x 36 ft = 1620 ft^2).

ATS Summary

The minimum floor space required in the WHB for the ATS is 84,286 ft^2, based on Attachment I, Figures I-15 through I-24. This floor space includes 6,248 ft^2 for the cask unloading areas, 7,480 ft^2 for the pool areas, 50,395 ft^2 for the fuel storage pool area, and 10,184 ft^2 for the DC loading areas.

6.2.1.3 Canister Transfer System

The CTS receives rail transportation casks containing large and small disposable canisters from the CCHS, unloads the canisters from the casks, stages canisters (as required), loads canisters into DCs, and prepares the empty casks for off-site shipment. The loaded DCs are then transferred to the DCHS. Cask unloading begins with cask inspection, gas sampling, and lid bolt removal operations. One or more cask lids are removed and the canisters are unloaded inside shielded hot cells. Small DHLW or DSNF canisters are either loaded directly into a DC or are staged in the hot cell until enough canisters are available to fill a DC. Large DSNF canisters are loaded directly into a DC. Canisters that are damaged, contaminated, or received and do not meet acceptance specifications are considered off-normal. Off-normal canisters are transferred to the off-normal canister handling cell for remedial processing (Assumption 5.2.3.1). The system delivers loaded DCs to the DCHS. Empty transportation casks and associated components are decontaminated as required, closed and delivered to the CCHS (CRWMS M&O 2000d, Section 1.2.2).

One CTS line is provided in the WHB (CRWMS M&O 2000c). The line is configured to handle disposable DHLW and DSNF canisters (DOE 1999, Section 10.1) and load them into a DC. The areas and cells operate concurrently to meet CTS throughputs and to support maintenance operations.

The canister transfer line includes a cask transfer corridor, airlock, cask preparation and decontamination area, canister transfer cell (CRWMS M&O 1997c, Section 7.2.1.3), off-normal canister transfer tunnel, and an off-normal canister handling cell (Assumptions 5.2.3.1 and 5.2.3.5). The cask preparation and decontamination area includes a cask preparation station and a cask decontamination station. Remote handling equipment in the cask preparation areas consists of a cask transfer cart, bridge-mounted manipulator, and tools required to perform cask unbolting, venting, lid removal, and decontamination.

The canister transfer cell consists of two canister upper and lower cell rooms (Assumption 5.2.3.2) with canister transfer ports employed to allow vertical canister lifts from the cask to the DC, staging area, or off-normal transfer tunnel and cart (Assumptions 5.2.3.2 and 5.2.3.5). The upper canister transfer cell room consists of a cask unloading port, a DC loading port, an off-normal canister transfer port, a small canister staging area, and a crane maintenance area. Canister staging is provided for the accumulation of small canisters in a shielded recess in the lower room (Assumption 5.2.3.4). The lower room consists of the cask unload area, the DC load area, the canister staging area, and the off-normal canister transfer tunnel (Assumption 5.2.3.5). This arrangement reduces the potential canister drop height during a canister transfer operation.

All radioactive canister transfer operations are performed remotely in the shielded canister transfer handling cell. The canisters are removed from a cask one at a time using in-cell remote equipment and placed in the DC, the canister staging area, or the off-normal canister port to be transported to the off-normal canister handling cell. Once a DC is loaded, it is transported to the DCHS. The empty cask is returned to the cask preparation and decontamination area and the CCHS for off-site shipment. Remote handling equipment in the canister transfer cell consists of a 65-ton overhead bridge crane (equipped to handle the large and small canisters), a DC loading manipulator with a 6-ton hoist, an off-normal canister transfer cart, and a suite of large/small canister lifting fixtures (CRWMS M&O 1997a, Section 7.1.5 and Assumption 5.2.3.5). A canister staging rack is provided for the accumulation of 20 small canisters (CRWMS M&O 1997a, Figure 7.3-3 and Assumption 5.2.3.4).

The equipment in the off-normal canister handling cell is provided to receive, handle and, if necessary, repackage an off-normal canister prior to final disposal in the repository (Assumptions 5.2.3.7 and 5.2.3.10).

Remote handling equipment in the off-normal canister tunnel and cell consists of a small overhead bridge crane (sized to lift the small canisters) (Assumption 5.2.3.6), a bridge mounted electromechanical manipulator, two overpack loading and welding stations (for canisters with different diameters and heights), a robotic welding machine, and miscellaneous tooling to support off-normal and recovery operations (Assumption 5.2.3.7). The loading and welding stations are located in a pit to reduce the canister lift height above the cell floor when placing a canister into the overpack. Handling fixtures are used at the loading and welding stations to properly position, load, and weld the various height overpacks. A robotic welding machine, positioned between the pits, performs remote welding of a loaded overpack in either station. The cell is also equipped with a canister transfer tunnel cart, storage rack for 20 small canisters, a canister repair station, canister overpacks, remote handling fixtures, a decontamination station, and strategically located closed-circuit video systems and shield windows (Assumptions 5.2.3.4, 5.2.3.5, and 5.2.3.7). Remote equipment is designed to facilitate decontamination and maintenance, and interchangeable components are provided, where appropriate. Lay-down areas are included as required for fixtures and tooling, and to support off-normal and recovery operations.

During normal handling operations in the canister transfer cell, canisters are transferred into a DC. When required, an off-normal canister (a damaged canister, failed canister, or surface contamination above permitted limits) is moved using the cell overhead crane to the off-normal canister transfer tunnel port and canister transfer cart. The off-normal canister is then transferred to the off-normal canister handling cell for repair or loading into an overpack (Assumptions 5.2.3.5 and 5.2.3.10). If the canister requires only weld repair or surface repair, the canister is placed in the cell floor weld station and the weld repair performed using the electromechanical manipulator and a welding tool. If it is determined that the canister must be repackaged, the canister is removed from the tunnel cart and placed in an overpack positioned in one of the welding pits. A lid is placed on the overpack and it is seal/welded using the robotic welding machine. After weld repair of the canister or seal welding of the overpack, the weld is inspected by nondestructive examination (NDE) methods. The canister or overpack is then placed in the decontamination station and decontaminated and inspected using the manipulator and appropriate tooling.

Off-normal canisters, with a contamination level higher than is acceptable for DC loading, are moved to the off-normal canister cell decontamination station. A repaired canister or canister overpack is returned to the CTS canister transfer cell and handled in the same manner as standard canisters. The naval DSNF canister cannot be repaired or placed in an overpack (Assumptions 5.2.3.1 and 5.2.3.3).

The CTS interfaces with the CCHS for incoming and outgoing transportation cask (CRWMS M&O 1998c). The CTS also interfaces with the DCHS by receiving an empty DC prepared for loading and returning loaded DC for sealing and subsequent emplacement (CRWMS M&O 2000d, Section 1.2.4). The CTS also interfaces with the WHB, the WHB Electrical System, and other WHB utility systems for operational support (CRWMS M&O 2000d, Section 1.2.4).

The CTS equipment is designed to facilitate manual decontamination, maintenance, and component replacement. All handling operations are supported by a variety of remote handling fixtures including DC lifting and base collars, canister lifting fixtures, cask lid lifting fixtures, canister grapples, and staging racks. A crane maintenance bay is provided at the far end of the canister transfer cell to allow for contact maintenance, decontamination, and inspection of the canister cell bridge crane and DC loading manipulator (CRWMS M&O 1997a, Section 7.3.2.2).

The design configuration for the CTS is based on the VA SPA (CRWMS M&O 1997c) and the VA report (DOE 1998). The design has been modified to accommodate design changes to the

CTS process and the WHB. The major changes have been the deletion of one CTS line and the addition of the off-normal canister handling cell. However, the CTS line operations, system configuration, and key dimensions for the CTS spaces have been modified slightly since the VA design. An updated and modified layout with sketches showing the equipment arrangements for the CTS are provided in Figures I-25 through I-30 in Attachment I. These modifications are based on Assumptions 5.2.3.1 and 5.2.3.2 and are addressed in the following sections.

Cask Transfer Corridor

The cask transfer corridor (H-100B) connects the CCHS with the CTS cask airlock (H-107A). Casks transferred between the CTS and the CCHS travel through the cask transfer corridor. The VA design grouped the cask transfer corridor with other corridors located within the WHB. The basic floor plan is unchanged from the VA design. The layout of the corridor is shown in Attachment I, Figure I-4. The minimum width of the corridor is 20 ft (Assumption 5.2.3.11). The minimum length of the corridor is 100 ft. The 100-ft length of the corridor compensates for the difference in the length of the ATS and the CTS lines which both interface with the CCHS and the DCHS. The height of the corridor is a minimum of 28 ft, which corresponds to the height of the CTS line airlock. The height of the airlock is determined by the tallest transportation cask, the height of the transfer cart, and ceiling clearance (CRWMS M&O 1997c, Section 7.2.1.3). This dimension is one foot higher than the CTS airlock in the VA design.

In summary, the cask transfer corridor (H-100B) minimum dimensions are 28-ft high, 20-ft wide, and 100-ft long, with an associated minimum required floor space of 2000 ft^2.

Airlock and Cask Preparation and Decontamination Area

The airlock provides a neutral pressure zone between the CTS line and the CCHS for receiving loaded casks and transferring empty casks for off-site shipment. The cask preparation and decontamination area operations include preparation of loaded casks for canister removal and preparation of empty casks for off-site shipment. The layout of the cask airlock and cask preparation area is shown in Attachment I, Figure I-25. The cask airlock area floor plan is unchanged since the VA SPA report (CRWMS M&O 1997c). The cask preparation area floor plan is unchanged. The height of the cask preparation and decontamination area is unchanged since the VA. The height of the airlock has increased by 1 ft to 28 ft since the VA. The increase is due to the reconfiguration of the WHB facility near the airlock.

The above dimensions and layout are based on the cask airlock and cask preparation area sketches in Attachment I, Figures I-25 and I-26. In summary, the cask airlock (H-107A) minimum dimensions are 28-ft high, 40-ft wide, and 23-ft long, with an associated minimum required floor space of 920 ft^2. The cask preparation and decontamination area (H-108A) minimum dimensions are 40-ft high, 38-ft wide, and 45-ft long, with an associated minimum required floor space of 1,710 ft^2.

Canister Transfer Cell

In the canister transfer cell, small canisters are either loaded directly into a DC or are staged until enough canisters are available to fill a DC. Large canisters are loaded directly into a DC. The canister transfer cell has been modified from the VA design (CRWMS M&O 1997c). The cell is divided into a lower and upper area (Assumption 5.2.3.2). The lower level is discussed below. The 60-ft length of the upper level of the canister transfer cell, excluding the maintenance bay, is increased by 18 ft to 78 ft (Attachment I, Figure I-27). The cell length increased due to the addition of the off-normal canister tunnel and shield wall (Assumption 5.2.3.5), that added 10 ft to the length of the cell. The crane maintenance bay was decreased in length from 32 ft to 24 ft. The crane maintenance bay length was decreased to align the bay with the ATS and CTS equipment cross transfer corridors. The increase from the transfer tunnel and the decrease from the maintenance bay provided the overall increase of 10 ft to the canister transfer cell.

The width of the canister transfer cell has increased by 1 ft to 35 ft. The increase is from the modifications to the VA design by removing one ATS and CTS line, by adding access corridors to the ATS and CTS lines, and adding the off-normal canister handling cell.

The overall height of the canister transfer cell has not changed from the VA design. The major change has been the addition of a floor dividing the cell into lower and upper level. The upper level (H-205C) minimum height, from the top of the intermediate floor, is 34 ft. The lower level (H-103C) minimum height, from the cell floor is 28 ft. The overall height of the canister handling cell (H-205C), including lower and upper levels and floor thickness, remains 64 ft.

The canister staging area (H-103D) is below the floor surface of the upper level. A space of 29 ft long by 12 ft wide by 28 ft deep with an area of 348 ft^2 is sufficient to provide for the storage of up to 20 small canisters.

Canister Transfer Cell, Lower Room Level

The canister transfer cell lower level (H-103C) size is increased since the VA SPA report (CRWMS M&O 1997c). The length is increased by 10 ft to 102 ft. The cell length was increased to compensate for the addition of the off-normal canister transfer tunnel and shield wall located approximately midway along the lower room's length. The width of the off-normal canister transfer tunnel is 10 ft. The height of the lower room is 28 ft. The width of the lower room is 35 ft, the same as the upper room.

Canister Transfer Cell Crane Maintenance Bay

The crane maintenance bay (H-209A) has decreased in size since the VA SPA report (CRWMS M&O 1997c). The width has increased by 1 ft to 35 ft to match the width of the canister transfer cell. The length has decreased from 32 ft to 24 ft. With the decrease in length, there is adequate space available to perform maintenance on the bridge crane and the DC loading manipulator (CRWMS M&O 1997a). The height of the maintenance bay is changed from 36 ft to 34 ft. Therefore the canister transfer cell crane maintenance bay is 24 ft long by 35 ft wide and 34 ft high for a total area of 840 ft^2.

In summary, the canister transfer cell dimensions and layout are based on the CTS sketches in Attachment I, Figures I-27 through I-29. The upper canister transfer cell room (H-205C) minimum dimensions are 34-ft high, 35-ft wide, and 78-ft long, with an associated minimum required floor space of 2,730 ft^2. The lower canister transfer cell room (H-103C) minimum dimensions are 28-ft high, 35-ft wide, and 102-ft long, with an associated minimum required floor space of 2,856 ft^2. The maintenance bay minimum dimensions are 34-ft high, 35-ft wide, and 24-ft long, with an associated minimum required floor space of 840 ft^2. Total floor space for the canister transfer cell is 6,426 ft^2.

Off-Normal Canister Transfer Tunnel

The CTS off-normal canister transfer tunnel (Attachment I, Figures I-27 through I-30) is a new addition to the WHB design (Assumptions 5.2.3.1 and 5.2.3.5). The off-normal canister transfer tunnel will be used to transfer and return abnormal canisters from the canister transfer cell to the off-normal canister handling cell. Large DSNF canisters will not be transferred to the off-normal canister handling cell (Assumption 5.2.3.3).

The tunnel dimensions and layout are adequate to provide space for the canister transfer cart, access area for maintenance, and any size small DHLW and DSNF canister. In summary, the off-normal canister transfer tunnel (H-104C) minimum dimensions are 25-ft high, 35-ft long, and 10-ft wide, with an associated minimum required floor space of 350 ft^2.

Off-Normal Canister Handling Cell

The CTS off-normal canister handling cell (Attachment I, Figure I-30) is a new addition to the WHB (Assumption 5.2.3.1). The off-normal canister handling cell will be used to perform remote remedial processing of small, contaminated, or damaged DHLW and DSNF canisters. Canisters are brought into the cell by the canister cart from the canister transfer cell via the off-normal canister tunnel. The size of the off-normal canister handling cell floor is based on Assumption 5.2.3.7. Major equipment maintenance in the cell shall be performed in the cell manually, by personnel entry, during the times when it is not in use (Assumption 5.2.3.8). The cell configuration plan is shown in Figure I-30 of Attachment I. The floor plan is based on best available information. The minimum length and width of the cell is 102 ft and 30 ft respectively (Assumption 5.2.3.9). The minimum height is 34 ft.

The above dimensions and layout are based on the CTS sketch in Attachment I, Figure I-30. In summary, the off-normal canister handling cell (H-205C1) minimum dimensions are 34-ft high, 30-ft wide, and 102-ft long, with an associated minimum required floor space of 3,060 ft^2.

Canister Transfer System Summary

The minimum floor space required in the WHB for the CTS is 14,814 ft^2 based on Attachment I, Figures I-25 through I-30. This floor space includes 2,000 ft^2 for the cask transfer corridor, 2,630 ft^2 for the cask airlock and cask preparation and decontamination area, 6,426 ft^2 for the canister transfer cell (including upper and lower rooms of the canister transfer cell plus the maintenance bay), 350 ft^2 for the off-normal canister transfer tunnel, and 3,060 ft^2 for the off-normal canister handling cell.

6.2.1.4 Disposal Container Handling System

The DCHS prepares empty DCs for loading, welds and stages DCs received from the ATS and CTS, and transfers the DCs to the repository subsurface transporter for emplacement. The system also transports retrieved WPs and defective DCs to the WPRS. Empty DC preparation includes unloading DCs from a carrier, staging empty DCs, tilting DCs for vertical handling, outfitting the empty DC with lids and fixtures, transferring the empty DC to a DC cart, and transferring it through an airlock to the DC handling cell. The DC handling cell provides DC staging capabilities, DC transfer carts connecting to the ATS and CTS, and a DC tilting station. DC handling cell operations include staging DC lids at the weld stations and transferring the empty DCs to the ATS or CTS for loading (CRWMS M&O 2000f).

The DCHS is located in the WHB and includes an unshielded empty DC preparation area and shielded hot cells for DC handling, welding, and transfer to the subsurface. Separate areas are provided for crane, welder, and manipulator maintenance bays. The areas operate concurrently to meet DCHS throughputs and to support DCHS maintenance.

The DCHS receives loaded and partially sealed DCs, then transfers them to a staging area or the DC welding stations. DC handling operations are supported by two remotely operated bridge cranes and hoists, as well as other peripheral equipment. The operations include positioning the DCs, removing temporary sealing devices, purging the DC lid area with inert gases for welding, back-filling the DC with helium prior to closure, turning and welding the inner lid, installing the outer lid, and welding the outer lid. Each weld operation includes NDE. Following examination and weld certification, the DC is either staged or prepared for transfer to the subsurface. A loaded, closed, welded, and inspected DC is called a WP.

The last DC handling sequence involves repositioning the WP to a horizontal orientation, transferring the welded WP to the WP transporter loading cell, remotely conducting final decontamination, final inspection, tagging, and recording WP data, and loading the WP on the subsurface transporter. These operations are performed using one of two DC handling cell overhead bridge cranes, a WP tilting station for changing the WP orientation, a transfer cart, a WP horizontal lifting machine, a remotely operated WP decontamination system, and the subsurface WP transporter. Once the WP is loaded onto the WP transporter pallet and railcar, the transporter operator will retract the railcar into the shielded transporter, undock the WP transporter from the transporter loading cell, and close the WP transporter shield doors prior to hauling the WP into the subsurface repository.

DCHS equipment is designed to facilitate manual decontamination, maintenance, and component replacement, when feasible. All handling operations are supported by a variety of remote handling fixtures including DC lifting and base collars, lifting trunnions, lifting yokes, lifting beams, tilting fixtures, staging fixtures, and DC lid sealing devices. A crane maintenance bay is provided at the far end of the DC handling cell to allow for contact maintenance and inspection of the DC handling cell cranes.

A remotely controlled robotic gantry is used to setup, prepare, weld, inert, and inspect the DC closure operations. The robotic gantry and its associated equipment are remotely removed from the DC handling cell into a welder maintenance bay for service, maintenance, and retooling. Lay-down areas are included as required for lids, fixtures, welder, NDE, tooling, and robotic end-effectors to support normal, off-normal, and recovery operations.

The system interfaces with the ATS and CTS to deliver empty DCs and receive loaded DCs. The system interfaces with the Waste Emplacement System during DC loading of the subsurface WP transporter. The system also interfaces with the WPRS for DC repair, inspection, and performance confirmation of retrieved WPs. The WHB interface provides the facility, utility, maintenance, safety, and auxiliary systems required for support operations and radiation protection activities.

The design configuration for the DCHS is based on the VA SPA (CRWMS M&O 1997c) and the VA report (DOE 1998). The design has been modified to accommodate design changes to the WP and the WHB. However, the DC handling operations, system configuration, and key dimensions for the DCHS have not been modified since the VA design. An updated and modified layout with sketches showing the equipment arrangements for the DCHS are provided in Figures I-31 through I-36 in Attachment I. These modifications are based on Assumption 5.2.4.1 and are addressed in the following sections.

<u>Disposal Container Handling Cell</u>

The 275-ft width of the DC handling cell (H-110) is increased to 300 ft (Attachment I, Figure I-31). Previously there were 3 ATS lines and 2 CTS lines in the VA SPA (CRWMS M&O 1997c, Sections 7.2.1.2 and 7.2.1.3). As described in the ATS and CTS sections of this document (6.2.1.2 and 6.2.1.3), the number of lines is reduced to 2 for the ATS and 1 for the CTS. Removing 1 ATS and 1 CTS line from the design would reduce the width of the DC handling cell. However, the overall cell width is increased for the following reasons:

- The width for each ATS and CTS line is increased.
- Two additional access corridors are added to the current design, one between the two ATS lines and one between the ATS lines and the CTS line.
- An off-normal canister handling cell is added to the CTS line in the revised WHB configuration.
- The empty DC preparation area, as well as the airlock between the empty DC preparation area and the DC handling cell, has been relocated and is now adjacent to the loaded DC staging area of the cell.

These changes are required to accommodate the addition of the fuel storage pool area that implement ATS fuel blending requirements (Attachment I, Figure I-4). To allow for empty DC transfers to the DC handling cell, the empty DC preparation area airlock space must be included in the width of the DC handling cell. As a result of the four changes described above, a net increase of 22 ft to the width of the DC handling cell is required. The length of the DC handling cell is unchanged at 72 ft (Attachment I, Figure I-32).

The height of the DC handling cell is increased from 60 ft to 71 ft. The increase in cell height is due to the addition of a second overhead bridge crane. The second crane is added to provide redundancy for the DC handling cell operations. Should a lengthy crane outage occur or a crane failure result in extended periods of crane maintenance, a backup crane is needed to avoid costly delays in waste handling operations. A second crane will prevent the interruption of all surface waste handling operations, ensuring that waste throughput rates are maintained. Both cranes are also provided with independent rails and power supplies to protect the cranes from a common-mode failure. Figure I-32 in Attachment I shows the dual crane configuration. Crane repairs will occur in the crane maintenance bay inside the DC handling cell.

The identical bridge cranes are mounted on separate rails in the DC handling cell, one above the other (Assumption 5.2.4.3). Each crane consists of a double-girder bridge and a rail-mounted trolley equipped with main and auxiliary hoists. Each bridge crane is equipped with a 150-ton main hoist and a 10-ton auxiliary hoist. This allows unrestricted access to the DC cell operating areas with either crane. The bridge and trolley travel in a rectangular X-Y pattern, and the hooks travel in the vertical Z direction. The main hook is capable of power rotation over 360 degrees (CRWMS M&O 2000g, Section 7.1.4.1).

Due to the additional space needed for the second bridge crane in the DC handling cell and a reassessment of the in-cell DC lift requirements, the cell height was increased 11 ft (from 60 ft to 71 ft). The basis for the new height of the DC handling cell can be found in *Disposal Container Handling System Input to Support the Site Recommendation Phase* (CRWMS M&O 2000g, Section 7.1.4.14 and Figure 7.1-14).

The above dimensions and layout are based on Assumption 5.2.4.1 and the DC handling cell sketches in Attachment I, Figures I-31 and I-32 (the cell layout is based on best available information documented in *Disposal Container Handling System Input to Support the Site Recommendation Phase* [CRWMS M&O 2000g]).

In summary, the DC handling cell (H-110) minimum dimensions of 60-ft high, 72-ft long, and 275-ft wide, with an associated minimum required floor space of 15,012 ft^2 has been modified to accommodate a second crane and revisions to the WHB. The revised dimensions are 71-ft high, 72-ft long, and 300-ft wide, with an associated minimum required floor space of 15,900 ft^2.

Disposal Container Handling Cell – Loaded Disposal Container Staging Area

The DC handling cell loaded DC staging area (H-113) floor plan is unchanged since the VA SPA (CRWMS M&O 1997c) (Attachment I, Figure I-33). The height of the cell and this area is increased from 60 ft to 71 ft to accommodate the addition of a redundant crane to service the DC handling cell, as previously described. Thus, the only change to this area is due the height increase of 11 ft. The loaded DC staging area is used as lag storage space for 20 loaded DCs in the event the subsurface repository or WP transporter loading operations are interrupted.

The above dimensions and layout are based on the DC handling cell sketches in Attachment I, Figures I-31, I-32, and I-33.

In summary, the DC handling cell loaded DC staging area minimum dimensions of 60-ft high, 72-ft long, and 98-ft wide, with an associated minimum required floor space of 7056 ft^2 are changed only in height. The revised dimensions are 71-ft high, 72-ft long, and 98-ft wide, with an associated minimum required floor space of 7056 ft^2.

Disposal Container Handling Cell Welder (H-208A through H-208H)

Once loaded, the DC is returned to the DC handling cell for welding. A number of DC welding stations are provided to receive loaded DCs from the ATS or CTS lines. The welding operations include mounting the DC on a turntable, removing lid seals, installing and welding the lids. The weld process for each lid includes NDE. Following NDE and weld acceptance, the WP is either staged or transferred to a tilting station for transfer to the repository subsurface.

The DC handling cell welder area floor plan is unchanged since the VA SPA (CRWMS M&O 1997c) and remains with 12 ft high, 23 ft long, and 12 ft wide dimensions, with an associated minimum required floor space of 2,208 ft^2.

Disposal Container Handling Cell Crane Maintenance Bay

The 40-ft width of the DC handling cell crane maintenance bay (H-301) has increased to 59 ft (Attachment I, Figure I-31). The crane maintenance bay has been modified to accommodate the addition of a redundant crane to service the DC handling cell, as previously described. The additional cell width is required to compensate for a 90 degrees rotation of the WP remediation cell. Since the remediation cell is located below the maintenance bay on the first floor of the WHB (Elevation 100 ft), changes to this cell layout affect the layout of the crane maintenance bay. The increase in width will also compensate for the additional 15-ft width required for the second crane (Attachment I, Figure I-32). Based on the new maintenance bay width, both cranes can be serviced simultaneously for planned outages, inspections, or testing. The cell width also provides an additional 4 ft for maintenance clearance when both cranes are being serviced.

The 22-ft height of the DC handling cell crane maintenance bay has increased to 33 ft to compensate for the additional crane as described in previous sections. As a result of these changes, the DC handling cell crane maintenance bay width increased 19 ft and the height increased 11 ft.

The above dimensions and layout are based on Assumption 5.2.4.1 and the DC handling cell sketches in Attachment I, Figures I-31 and I-32 (the cell layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the DC handling cell crane maintenance bay minimum dimensions of 22-ft high, 72-ft long, and 40-ft wide, with an associated minimum required floor space of 2,880 ft^2 has been modified to accommodate a second crane and a re-orientation of the WP remediation cell. The revised dimensions are 33-ft high, 72-ft long, and 59-ft wide, with an associated minimum required floor space of 4,248 ft^2.

Empty Disposal Container Preparation Airlock

The 35-foot width of the Empty DC Preparation cell airlock (H-115) is increased to 38 ft (Attachment I, Figure I-36). The 37-ft length of the empty DC preparation airlock is decreased to 28 ft. The overall width and length are modified due to relocation of the airlock and the empty DC preparation area. The airlock is now located inside the empty DC preparation area to provide overhead crane access to the empty DC cart that conveys empty DCs into the DC handling cell. In addition, dimensional modifications are required to provide for empty DC transfer carts to enter and exit at a different orientation than previously planned (Attachment I, Figure I-4). As a result of these changes, the airlock width decreased 17 ft and the length decreased 7 ft. The height of the airlock remains unchanged at 27 ft.

The above dimensions and layout are based on the empty DC preparation area sketch in Attachment I, Figure I-36 (the empty DC preparation area layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the empty DC preparation airlock (H-115) minimum dimensions of 27-ft high, 37-ft long, and 35-ft wide, with an associated minimum required floor space of 2035 ft^2 has been modified to accommodate relocation of the empty DC preparation area. The revised minimum dimensions are 27-ft high, 28-ft long, and 38-ft wide, with an associated minimum required floor space of 1,064 ft^2.

Empty Disposal Container Preparation Area

The empty DC preparation area (H-117) is increased in length from 176 ft to 180 ft (Attachment I, Figure I-36). The overall length has increased to accommodate the DC handling cell airlock now located inside the empty DC preparation area. As a result of this change, the length was increased 4 ft to provide the same net floor space for empty DC preparation operations. The width of the empty DC preparation area is unchanged.

The above dimensions and layout are based on the empty DC preparation area sketch in Attachment I, Figure I-36 (the empty DC preparation area layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the empty DC preparation area minimum dimensions of 50-ft high, 176-ft long, and 86-ft wide, with an associated minimum required floor space of 15,136 ft^2 have been modified to accommodate relocation of the empty DC preparation area. The revised minimum dimensions are 50-ft high, 180-ft long, and 86-ft wide, with an associated minimum required floor space of 15,480 ft^2.

Work Package Transporter Loading Cell

The WP transporter loading cell (H-111) is increased in the length from 63 ft to 72 ft (Attachment II, Figure I-13). The overall length has increased to accommodate a modified WP design and a longer WP transporter design (Assumption 5.2.4.2). In the VA design, the 31-ft long WP transporter is docked adjacent to the WP transporter loading cell (CRWMS M&O 1997c, Attachment I, Figure I-25). A re-usable railcar, enclosed inside the WP transporter, was pushed out of the enclosure into the WP load cell where a horizontal lifting machine lowered the WP onto the railcar. In the VA design, the WP was lifted using the skirts at both ends of the WP. In the revised design, the 70-ft long WP transporter enters the load cell to position the railcar for loading. To accommodate the WP transporter length, the WP transporter load cell length is increased to 72-ft (Assumption 5.2.4.2). In the revised design, the WP is lifted using a DC lifting collar and base collar attached at both ends of the WP. The DC collar designs will be developed once the WP design is fully defined. The width and height of the WP transporter loading cell remains unchanged at 36 ft and 30 ft, respectively, as shown in Attachment I, Figures I-34 and I-35.

The above dimensions and layout are based on Assumption 5.2.4.2 and the WP transporter loading cell and airlock sketches in Attachment I, Figures I-34 and I-35 (the WP transporter loading cell layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the WP transporter loading cell (H-111) minimum dimensions of 30-ft high, 63-ft long, and 36-ft wide, with an associated minimum required floor space of 2,268 ft^2 have been modified to accommodate a longer WP transporter. The revised minimum dimensions are 30-ft high, 72-ft long, and 36-ft wide, with an associated minimum required floor space of 2,592 ft^2.

Waste Package Transporter Airlock

The only change to the WP transporter airlock (H-112) is an increase in length from 60 ft to 72 ft (Attachment I, Figure I-34). The overall length is increased to accommodate an increased WP transporter length (Assumption 5.2.4.2). As a result of the change described above, the cell length was increased 12 ft. The width and height of the WP transporter load cell remains unchanged at 36 ft and 22 ft, respectively, as shown in Attachment I, Figures I-34 and I-35.

The above dimensions and layout are based on Assumption 5.2.4.2 and the WP transporter load cell and airlock sketches in Attachment I, Figures I-34 and I-35 (the WP transporter airlock layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the WP transporter airlock minimum dimensions of 22-ft high, 60-ft long, and 36-ft wide, with an associated minimum required floor space of 2,160 ft^2 are modified to accommodate a longer WP transporter. The revised minimum dimensions are 22-ft high, 72-ft long, and 36-ft wide with an associated minimum required floor space of 2,592 ft^2.

Disposal Container Handling System Summary

The minimum floor space required in the WHB for the DCHS is 51,216 ft^2, based on Attachment I, Figures I-31 through I-36. This floor space includes 15,900 ft^2 for the DC handling cell, 7,056 ft^2 for the loaded DC staging area, 2,208 ft^2 for the welders, 15,480 ft^2 for the empty DC preparation area and airlock, 5,184 ft^2 for the WP transporter loading cell and airlock, and 4,248 ft^2 for the DC handling cell crane maintenance bay.

6.2.1.5 Waste Package Remediation System

The WPRS performs remedial action on defective DCs and retrieved WPs inside the waste package remediation cell (H-114). The system receives DCs and WPs from, and delivers them to, the DCHS. The system receives DCs and WPs that have failed the weld examination processes in the DCHS, that have been selected for retrieval from the subsurface repository for performance confirmation examinations, and that are defective or abnormal. The system also delivers DCs and WPs to the DCHS that have been examined, repaired, and/or unsealed.

If examination of the closure weld in the DCHS indicates an unacceptable, but repairable, welding defect, the DC is transferred to the WPRS for examination, preparation for re-welding, and unsealing, if required. Correction of rejected closure welds will require removal of the weld material in such a way that the DCHS may resume and complete the closure welding process. If examinations indicate that the DC closure weld defect cannot be repaired, the DC is opened in the WPRS cell. If a WP is retrieved from the subsurface repository due to suspected damage, WP failure, or planned performance confirmation examinations, the WP is also opened in the WPRS cell.

The DCHS transports and transfers retrieved WPs from the Waste Emplacement System for delivery to the WPRS (Parameter 4.1.2.3). The WPRS is located inside the WHB and is directly connected to the DCHS. The WPRS performs remedial action on defective DCs and retrieved WPs. The system receives DCs and WPs from, and delivers them to, the DCHS. The system receives DCs and WPs that have failed the weld examination processes in the DCHS, that have been selected for retrieval from the subsurface repository for performance confirmation examinations, and that are defective or determined to be out-of-specification. The system also delivers DCs and WPs to the DCHS that have been examined, repaired, and unsealed.

WP and DC opening will require remote cutting of the closure weld for each of the lids, removal and staging of the lids, collection and processing of cutting fines, cutting-waste removal and disposal, and installation of a temporary seal to confine contamination inside the DC/WP (Assumption 5.2.5.2). Transferring the opened DC/WP to either the ATS or CTS facilitates SNF and HLW removal from an opened WP and DC.

The DCs/WPs are delivered to the WPRS from the DCHS for remedial action only if failure or damage has been detected. The DC/WP arrives on a DC transfer cart, is positioned at one of two workstations within the cell for remedial operations, and exits the cell without being removed from the transfer cart. The cell is accessed directly from the DCHS hot cell. Due to infrequent use, only one DC or WP at a time can be handled in the WPRS cell (Parameter 4.1.2.3).

All radioactive DC/WP remedial operations are performed remotely in the shielded WPRS hot cell. An operating gallery surrounds the WPRS cell on three sides. The design, configuration, and equipment arrangement for the cell are based on the best available design information on the system (Assumption 5.2.5.1). The system includes a wide variety of remotely operated equipment including an overhead bridge crane, an in-cell multi-purpose electromechanical manipulator, a lid cutting machine, and closed-circuit video viewing systems. Specialized tools and remote controlled equipment are used to perform lid removal, temporary DC lid sealing, drilling, ultrasonic NDEs, visual inspections, waste collection, decontamination, pressure measurement, gas sampling, testing, and data collection. All remotely operated equipment is designed to facilitate decontamination, hot cell equipment maintenance, and replacement of interchangeable components as required (Assumption 5.2.5.2).

The remediation of rejected closure welds on DCs/WPs may require minor repair or removal of the weld in such a way that the re-welding of the DC closure can be performed in the DC handling cell weld station in the DCHS. If the examination of the DC closure weld indicates an irreparable welding defect, or suspected failure or damage to a retrieved WP, DC/WP opening operations will be required. The DC/WP opening is expected to be infrequent, but the capability is required to unseal, vent, measure the temperature and pressure, and sample the gas composition of the DC/WP internals. WP and DC opening will require remote cutting of the closure weld on each of the lids, removal and staging of the lids, collection and processing of cutting fines, cutting-waste removal and disposal, and installation of a temporary seal to confine contamination inside the DC/WP. Once open, the DC/WP is inspected for contamination, decontaminated as required, and transferred to the ATS or CTS for fuel assembly or canister unloading operations.

The WPRS interfaces with the DCHS for the receipt and delivery of WPs and DCs. The WHB system houses the WPRS, and provides the facility, safety, and auxiliary systems required for support operations. The WPRS receives power from the WHB Electrical system. The WPRS also interfaces with the Performance Confirmation Data Acquisition/Monitoring System for the types of data needed to support the performance confirmation program. The WHB life is 40-years, but the WPRS life may extend beyond 40-years. Thus, a new or modified WHB may be needed to provide WPRS capabilities after 40-years of operation (Assumption 5.2.5.3).

The layout of the WPRS cell is shown in Attachment I, Figures I-37 and I-38. The minimum floor dimensions of the cell are 37-ft wide by 54-ft long giving a total square footage of 1,998 ft^2. The 37-ft cell width gives a 6-ft clearance to the cell wall on one side and 20-ft clearance to the other cell wall from the 11-ft wide DC transfer cart. The 54-ft cell length gives a 25-ft center-to-center spacing from the two workstations in the cell and a clearance at the machining station of 8½ ft (14 ft – [11 ft/2]) and at the decontamination station 9½ ft (15 ft – [11 ft/2]) from the 11 ft long DC transfer cart to the cell walls. These clearances provide adequate space for process/support equipment, tools, and fixtures while also providing lay-down areas for DC/WP lids that may be removed.

As shown in Attachment I, Figure I-38, the required minimum height of the WPRS cell is 36 ft (CRWMS M&O 1997c, Figure 15). This minimum height is based on a 2-ft DC cart height; a 21-ft WP; a 1-ft clearance from the top of WP to the bottom of the WP lid cutting machine (retracted position); a 3-ft high cutting machine; a 2-ft clearance to the bridge-mount trolley rail; and a 7-ft clearance to the ceiling [2 ft (cart) + 21 ft (WP) + 1 ft (clearance) + 3 ft (cutting machine) + 2 ft (to top of rail) + 7 ft (top of rail to ceiling) = 36 ft]. The door opening height of 24 ft is based on the height of the transfer cart and the WP plus a 1-ft clearance [2 ft (cart) + 21 ft (WP) + 1 ft (clearance) = 24 ft].

The minimum floor space required in the WHB for the WP remediation cell (H-114) is 1,998 ft^2 (Attachment I, Figure I-37). The dimensions of the cell are 37 ft long by 54 ft wide and 36 ft high.

6.2.2 Primary Support Areas

6.2.2.1 Operating Galleries

The primary waste handling areas discussed in Section 6.2.1 support different hot cells where remote operations are used exclusively. Operator viewing and station controlling must be strategically located outside the various hot cells to meet functional and safety requirements. The operator stations are placed in operating galleries adjacent to each hot cell window or viewing port. The operating galleries are nominally 15-ft wide and 16-ft high to accommodate remote equipment controls, observation locations, closed-circuit television displays, operator consoles, and through-the-wall manipulator workstations. A high ceiling is required to allow space for cell wall penetrations, instrumentation, cable, utilities, and overhead ductwork. Also a wide aisle or operating gallery is provided adjacent to the cells for replacement and maintenance of through-the-wall manipulators.

The following list outlines each operating gallery room dimension:

ATS Cask Prep: (H-118 G&H)	Length: 2@14ft	Width: 20 ft	Height: 28 ft
ATS Line: (H-207B)	Length: 69ft	Width: 20 ft	Height: 16 ft
ATS Line: (H-118B)	Length: 85ft	Width: 20 ft	Height: 16 ft
Off-normal canister handling cell: (H-207D)	Length: 102ft	Width: 15 ft	Height: 16 ft
ATS and CTS: (H-118C & 207C)	Length: 2@127ft	Width: 20 ft	Height: 16 ft
DCHS Welding #1: (H-207F)	Length: 27 ft	Width: 16 ft	Height: 12 ft
DCHS Welding #2: (H-207G)	Length: 27ft	Width: 16 ft	Height: 12 ft
DCHS Welding #3: (H-207H)	Length: 27ft	Width: 16 ft	Height: 12 ft
DCHS Welding #4: (H-207I)	Length: 27ft	Width: 16 ft	Height: 12 ft
DCHS Welding #5: (H-207J)	Length: 32ft	Width: 35 ft	Height: 12 ft
DCHS loading cell: (H-118 E & F)	Length: 2@148ft	Width: 15 ft	Height: 16 ft
WP remediation cell:	Length: 2@230 ft	Width: 15 ft	Height: 22 ft

(H-118A & 207A)

The minimum space required for the above operating galleries is 24,438 sq ft. The location of each operating gallery or operating gallery section must be integrated in the overall WHB arrangement. These operating galleries provide access to the waste handling remote workstations, hot cells, and usable wall space adjacent to the primary waste handling transfer areas.

6.2.2.2 Equipment Transfer Corridors

The purpose of the equipment transfer corridors is to facilitate equipment movement in and out of the maintenance bays and adjacent hot cells. The functional space requirements mandated the design layout to integrate two equipment transfer corridors into the overall WHB in order to provide access to the primary area hot cells where maintenance bays are used for equipment repair, replacement, and recovery operations.

The functional space requirements for the corridors are identified in the *Waste Handling Facilities Recovery Analysis* (CRWMS M&O 1997d). The design layout arranges the first corridor to traverse the ATS and CTS lines discussed in Sections 6.2.1.2 and 6.2.1.3 and passes directly over their respective maintenance bays. The second corridor location traverses the DCHS and WPRS hot cells discussed in Sections 6.2.1.4 and 6.2.1.5 and passes directly over the DC handling cell maintenance bay and the multi-purpose remediation work cell. The crane equipment anticipated to be installed above each transfer corridor is a 50-ton overhead bridge crane. Each 50-ton crane requires large unobstructed vertical space that permits large equipment to be removed through hot cell ceiling hatches to contaminated equipment rooms and also allows equipment movement without partial disassembly in the hot cell maintenance bay.

The following list outlines each equipment transfer corridor dimension:

<u>Assembly and Canister Transfer Corridor: (H-402)</u>

Length: 218 ft Width: 48 ft Height: 36 ft

<u>DC Handling and WP Remediation Equipment Transfer Corridor: (H-403)</u>

Length: 57 ft Width: 142 ft Height: 28 ft

The total combined minimum space required for the equipment transfer corridors (H-402 & 403) are 18,558 sq ft (CRWMS M&O 1997c, Section 7.2.2.2).

6.2.2.3 Contaminated Equipment Rooms

Two contaminated equipment rooms are required to interface with the equipment transfer corridors discussed in Section 6.2.2.2. The assembly and canister transfer corridor (H-402) directly connects to the first contaminated equipment room (H-116).

The DC handling and WPRS equipment transfer corridor (H-403) connects to the second contaminated equipment and decontamination room (H-120). The room dimensions were dictated by the size of the equipment transfer corridors requirements discussed in Section 6.2.2.2. The contaminated equipment rooms are located directly below two hatchways leading to the equipment transfer corridors. The equipment used within these areas includes portable cranes, forklift trucks, and manual tools. The overall purpose of the two rooms is to stage contaminated equipment for repair, replacement, and decontamination. Also, new equipment can be moved into these rooms prior to transfer into the hot cell maintenance bays using the equipment transfer corridors. The minimum space required for the two contaminated equipment rooms is 4,455 ft^2.

The contaminated equipment room is also required to have a staging area (H-120A), which is located adjacent to contaminated equipment room airlock (H-101H). The minimum required floor area for the staging area is 4,692 ft^2. The staging area is used for personnel and forklift access, a step-off area for radiation and contamination control, work areas for maintenance personnel, equipment removal and installation, and handling of low-level radioactive waste from the contaminated equipment rooms.

The total combined minimum space required for contaminated equipment including staging is 9,027 ft^2 (CRWMS M&O 1997c, Section 7.2.2.3).

6.2.2.4 Low-Level Waste Collection and Packaging

LLW is generated as a result of spent fuel and HLW handling operations within the WHB. These waste streams are comprised of dry solid LLW, wet-solid waste, and liquid LLW. Liquid LLW is comprised of two fractions, recyclable liquid LLW and non-recyclable liquid LLW. The following discussion details how these waste streams are handled within the WHB.

6.2.2.4.1 Dry Solid Low-Level Waste Collection

Dry solid LLW is primarily comprised of materials such as rags, paper, plastic, masking tape, etc. that result from normal operational and maintenance activities within the WHB (*Secondary Low-Level Waste Generation Rate Analysis* [CRWMS M&O 1999i, Section 7.3.1]). Dry solid LLW is collected, primarily at its point of origin within the WHB, and placed into bags. These bags are then collected into Room H-125, the LLW Collection and Packaging Room, before being transferred to the WTB for processing. Additional dry solid LLW may be comprised of contaminated equipment or tools that cannot be decontaminated. This material is also bagged and moved to Room H-125. These larger size LLW items may be placed into 55-gallon drums or wooden crates before they are sent to the WTB for processing. Room H-125 is approximately 20-ft wide by 35-ft long, with a ceiling height of approximately 16 ft. These room dimensions were defined in Attachment I of the VA SPA (CRWMS M&O 1997c, Figure I-4).

6.2.2.4.2 Liquid Low-Level Waste Collection

Liquid LLW streams are generated from the decontamination of room areas, handling equipment, incoming casks, and outgoing casks and WPs. Liquids generated by these activities is collected into local area sumps for temporary retention. Samples are collected and analyzed to determine both radiological and chemical characteristics of these liquids. Liquids containing appropriate levels of radioactive and non-hazardous chemical constituents are pumped to main collection sumps (either recyclable liquid LLW or non-recyclable liquid LLW) located in rooms H-020, H-083, H-084A, and H-84B of the WHB. If, after sampling and analyzing a local area sump, the liquid waste is determined to either contain hazardous chemicals or non-acceptable radioactive constituents, these materials are collected into appropriate containers and the sump decontaminated prior to future use.

The liquid LLW collected in the main collection sumps for either recyclable or non-recyclable liquid LLW (rooms H-020, H-083, H-084A, and H-084B) is sampled and analyzed to verify radioactive and chemical constituents. After verification, recyclable liquid LLW is pumped to a recyclable liquid LLW staging tank located in Room H-020 and non-recyclable liquid LLW is pumped to a non-recyclable liquid LLW staging tank located in Room H-020. These liquids are later pumped to holding tanks in the recyclable liquid LLW or the non-recyclable liquid LLW processing areas in the WTB.

A leak detection system is employed to identify, locate, and quantify any leakage between pool liners and outer pool concrete walls. Water collected from leak detection system(s) is collected into sumps located below pool bottom elevation. Collected water is sampled, analyzed, and then appropriately dispositioned as low-level liquid waste (either recyclable or non-recyclable) or TRU (transuranic) liquid waste (CRWMS M&O 2000p).

6.2.2.4.3 Wet-Solid Low-Level Waste

Wet/solid LLW generated in the WHB is comprised of spent filter media and spent ion exchange resins. These LLW materials are generated by pool water treatment operations.

Spent Ion Exchange Resin

The processing of spent ion exchange resins is performed in the WHB at the points of origin. Spent ion exchange resins become wastes when the ion exchange beds in the pool water treatment areas of the WHB require change out. The waste resins are transferred directly to a high-integrity container (HIC), which will later serve as the DC. The resin in the HIC is then dried by passing dry air through the HIC to ensure the HIC contains no free water (*Secondary Low-Level Waste Treatment Strategy Analysis* [CRWMS M&O 1999j, Section 6.4.1]). The cask is then transferred to the WTB holding area for disposal processing.

Spent Filter Cartridges

Filter cartridges used in the pool water treatment system are changed out by removing a cartridge unit (multiple filters in certain units) from a system and placing the spent cartridge unit into a 55-gal drum. The drum is then placed into a shielded transporter and moved to the filter grouting station in the WTB.

Space for handling both spent filter media and spent ion exchange resins is available in rooms H-020, H-083, H-084A, and H-084B as necessary (Section 6.2.2.4.2).

6.2.2.5 Maintenance Equipment Storage

The Maintenance Equipment Storage (H-122) is located adjacent to the contaminated equipment rooms (H-116; H-120). This functional area is required to support contaminated equipment removal, repair, and routine maintenance activities. The area contains space for storage, staging, handling of replacement parts and components, and equipment to be installed in the WHB. The area is not intended to provide permanent warehousing or storage for WHB equipment and spare parts. However, receiving of spare parts and equipment are anticipated in this area from central stores and other warehouse facilities.

The minimum space that is required for maintenance equipment area and room is 3,000 ft^2 (CRWMS M&O 1997c, Section 7.2.2.5).

6.2.2.6 Welder Materials Storage

The Welder Materials Storage (H-211) is the local source for the consumable materials for DC inner and outer lid welds. Consumable materials are electrodes, weld wire, and miscellaneous weld material supplies. Weld gas (argon/helium shield and argon trail gases) and inert gas are supplied from a compressed gas storage area located outside the WHB.

The storage area contains 600 ft^2 of storage area for 100 spools of weld wire, 200 ft^2 for weld electrodes, and 300 ft^2 of access and material circulation aisles.

The minimum space that is required for the weld material storage area is 1,100 ft^2 (CRWMS M&O 1997c, Section 7.2.2.6).

6.2.2.7 Maintenance Shop

The Maintenance Shop (H-124) services equipment used in the radiological controlled area of the WHB facility. The shop is anticipated to be equipped with the minimum amount of required hand and machine tools to allow repair of most in-house equipment items. The anticipated equipment includes but may not be limit to a small lathe, milling machine, band saw, etc. There may also be a basic array of electrical tools and instruments to permit the measurement of voltage, current, power, and waveform.

The minimum space required for the maintenance shop is 1,000 ft^2 (CRWMS M&O 1997c, Section 7.2.2.7).

6.2.2.8 Tool Storage

The discussions regarding the CCHS, Section 6.2.1.1, the ATS, Section 6.2.1.2, and the CTS, Section 6.2.1.3, describe the use of underwater and portable tools that support these operations areas. These hand tools can also be utilized to support individual activities including the carrier unloading, cask unloading, cask preparation, cask lid removal, cask handling, canister handling, and canister opening operations. Adjacent to the carrier bay in the WHB is the tool room (H-123) that provides storage support for these activities. The tool room contains space for storage of remote tools, hand tools, and special tools unique to the different carriers, casks, and canisters.

The minimum space required for the tool room (H-123) is 2,000 ft^2 (CRWMS M&O 1997c, Section 7.2.2.8).

6.2.2.9 Forklift Staging and Servicing

The WHB internal operations require the use of different forklift vehicles to handle the various loading dock shipments. The functional requirements that determined the various forklift types are indicated in the VA SPA (CRWMS M&O 1997c, Section 7.2.2.9). The specific shipment requiring support by forklifts involve areas that receive supplies and parts, pallets of 55 gal. drums, and waste handling hardware.

The following list identifies the general forklift capabilities required to support selected operational shipments:

Truck receiving dock:	1 @ 2 tons capacity
Hot support area:	1 @ 2 tons, 1 @ 5 tons
Cold support area:	1 @ 2 tons, 1 @ 5 tons
Carrier bay:	1 @ 20 tons

In each of these areas, the specific model, size or dimension, operation type (electric or gasoline), design, and special features, are based on practical design models that have been used to establish the minimum floor area needed to accommodate any one of the forklift units above. An example for one of the forklift staging areas indicates that the floor dimensions needed to park a 2-ton or 5-ton forklift is an area 6-ft wide by 6-ft long (including the forks) by 13-ft high. Another example using the 20-ton forklift would require a minimum area 7-ft wide by 20-ft long by 15-ft high. Also, where electric powered forklifts are anticipated, the floor area incorporates an additional 3 ft (added to the long dimension) to allow for electrical connections during battery charging.

In summary, the minimum floor area provided (based on 7 forklifts) is 737 sq ft. However, this number does not include circulation and maneuvering area. The overall total area provided from the design analysis anticipates that the minimum floor space needed is 2,000 sq ft (CRWMS M&O 1997c, Section 7.2.2.9), with a minimum dimension of 30 ft for the forklift Staging and Servicing Room (H-126).

6.2.2.10 Disposal Container Handling Cell Welder Maintenance Bay

DC handling cell welder maintenance bay (H-203) receives remotely removed equipment from the DC handling cell for manual repair or replacement (CRWMS M&O 2000g, Section 7.1.1). The DC handling cell and the maintenance bay are located directly adjacent to the other for efficient maintenance operations. To reduce welder maintenance bay radiation levels, the DC handling cell is shielded to provide radiation protection for the maintenance bay. Thick walls and shielded access doors facilitate weld and NDE equipment transfers to and from the DC handling cell.

The 206-ft width of the DC handling cell welder maintenance bay has decreased to 205 ft (Attachment I, Figure I-31). The overall width change is based on the reconfiguration of the WHB. The 40-ft length of the DC handling cell welder maintenance bay is decreased to 34 ft. The overall length is decreased due to addition of a 5-ft access corridor with a 1-ft partition directly between the DC handling cell and the welder maintenance bay. The purpose of this access corridor is to provide a means of egress for personnel from the welder operating galleries. At each end of the access corridor there are stairwells for exiting personnel. As a result of these changes, the maintenance bay width decreased by 1 ft and the maintenance bay length decreased by 6 ft.

The above dimensions and layout are based on the DC handling cell sketches in Attachment I, Figures I-31 and I-32 (the DC handling cell welder maintenance bay layout is based on best available information documented in the VA SPA [CRWMS M&O 1997c]).

In summary, the DC handling cell welder maintenance bay minimum dimensions of 39-ft high, 40-ft long, and 206-ft wide, with an associated minimum required floor space of 8,240 ft^2 are modified to accommodate additional corridors and aisles. The revised minimum dimensions are 39-ft high, 34-ft long, and 205-ft wide with an associated minimum required floor space of 6,970 ft^2 (CRWMS M&O 1997c, Section 7.2.2.10).

6.2.2.11 Disposal Container Handling Cell Welder Maintenance Hot Shop

The DC handling cell welder maintenance hot shop (Attachment I, Figure I-5) is a new addition to the WHB design depicted in the VA SPA (CRWMS M&O 1997c). The hot shop will be used to perform contact maintenance on the welders and any associated contaminated equipment or components. The hot shop dimensions are 39-ft high, 34-ft long, and 65-ft wide.

In summary, the DC handling cell welder maintenance hot shop (H-213) minimum dimensions are 39-ft high, 34-ft long, and 65-ft wide, with an associated minimum required floor space of 2,210 ft^2.

6.2.2.12 Waste Handling Operations Center

The Waste Handling Operations Center (H-119) monitors and controls the primary activities and systems throughout the WHB. The equipment in this room is able to observe key process areas throughout the facility. The monitoring equipment will also monitor or control automatic process systems including feed material and product data collection. The support systems for this area include electrical power, HVAC, communications, fire protection, process monitoring, radiological monitoring, environmental monitoring, security, process water, and process gases.

The floor space in this area is arranged to accommodate one supervisor and two operator/ controllers personnel during process operations. The minimum space required for this area, as referenced indicated in the VA SPA (CRWMS M&O 1997c), is 1,000 ft^2.

6.2.3 Pool Support Areas

The ATS includes pools and canals used for the opening of casks, for the removal of fuel assemblies, for the movement of fuel assemblies to and from the fuel storage pools, and for the transfer of assemblies to the assembly drying area. Fuel assembly storage utilizes four large pools for interim storage of assemblies thereby allowing for the mixing of assemblies within a WP to achieve optimum thermal loading for WPs.

The water in these pools and canals must be constantly treated to remove particulate materials, dissolved constituents, and the water must also be cooled to remove decay heat transferred to the water from the fuel assemblies. Several areas within the WHB are available to locate the pool water treatment and cooling equipment. (Assumption 5.5.1)

A portion of Room H-020 (50-ft elevation) is available for pool water treatment and cooling equipment. The minimum space required for Room H-020 to accommodate all located equipment and the associated operational activities is 105 ft by 112 ft (11,760 ft^2) with a ceiling height of 45 ft.

The space allocated within the WHB for liquid LLW collection sumps, recyclable and non-recyclable liquid LLW staging tanks, pool leak detection sumps, and pool water treatment and cooling equipment (including spent filter cartridge and spent ion exchange resin load-out) is:

Room H-020	105 ft by 112 ft with ceiling height of 45 ft
Room H-083	30 ft by 70 ft with ceiling height of 45 ft
Room H-084A	40 ft by 20 ft with ceiling height of 45 ft
Room H-084B	40 ft by 50 ft with ceiling height of 45 ft

Space must be allocated external to, but near, the WHB for a pad to place the chilled-water package refrigeration units, including pumps, refrigeration units, and air cooled heat exchangers used to provide chilled water for pool water cooling operations.

Corridor H-085 provides access to the pool equipment rooms (H-020, H-083, H-084A and H-084B.) The total minimum required are is 2,040 ft^2.

6.2.4 Facility Support Areas

The WHB contains functional areas within the facility required to support the primary systems operations. These areas include Radiation Protection, Security, Operations, Administration, and Maintenance. Also included throughout the functional areas are the minimum building circulation paths provided to connect operational personnel and equipment to essential facility areas. The floor areas and staffing levels that support this section are based on the VA SPA (CRWMS M&O 1997c, Section 7.2.4).

Additional functional requirements, design inputs, and assumptions to the facility analysis, have modified several functional areas. The changes or modifications to affected functional areas indicated in the VA SPA (CRWMS M&O 1997c) are identified in the specific program area analysis. The assumption descriptions are located in Section 5. These assumptions are believed reasonably bounding for the purpose of this analysis.

6.2.4.1 Radiation Protection

Radiation Protection includes space which house Health Physics Technicians (HPTs) and provides for the protection of personnel that are entering potentially contaminated areas of the WHB. These areas are situated throughout the facility to provide direct access to the areas for which personal protective equipment is required. These areas include all Primary Areas and specific spaces within the Primary Support Area, including transfer corridors, decontamination rooms, and the equipment maintenance shop.

6.2.4.1.1 Regulated Change Room

The Change Rooms are required for the donning of personnel protective clothing by both male and female workers who require access to areas of the building that may be radioactively contaminated. The rooms (H-010, H-302, H-305, and H-405) are arranged to provide access to potentially contaminated areas without entrance to non-contaminated space. The functional space requirements for the change rooms are described in the VA. The minimum space that is required for Room H-010 is 500 ft^2.

In addition to the primary Change Room (H-010), minor ancillary change rooms are needed at each crane maintenance area (3 total) to provide for the donning of personnel protective clothing. There is an assumed 6-person crew (2 operators and 4 workers/riggers) (Assumptions 5.1.1) at 20 ft^2 per person for locker rooms (CRWMS M&O 1997c, Section 7.2.4.1.1). The minimum space required for each ancillary change room is 120 ft^2. The combined minimum space required for the three ancillary change rooms is 360 ft^2.

6.2.4.1.2 Radiation Protection Portal

The Radiation Protection Portal (H-011) step-off area is required for removal of personnel protective clothing on a progressive step-off pad. The portal has direct access to the Regulated Change Room (H-010). The ceiling may be open to the underside of the building structure above. The minimum space required for this area is 400 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.2)

6.2.4.1.3 Personnel Decontamination Room

The Personnel Decontamination Room (H-012) is a required functional space for radiological decontamination of operational personnel. This room is located primarily in an area with direct access into the Radiological Protection Portal and from adjacent spaces that have other potential sources of radiological contamination. The minimum space that is required for this area is 225 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.3)

6.2.4.1.4 Personal Radiation Protection Equipment Storage

Personal Radiation Protection Equipment Storage (H-013) is required for storage of radiation protection equipment such as dosimeters, masks, and air equipment. Protective equipment items are issued by the HPT. This room is adjacent to the Health Physics Office and is located for convenient equipment issue to operational personnel. The anticipated amount of equipment stored in this room is based on one shift of operational personnel. The minimum space required for this area is 225 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.4)

6.2.4.1.5 Health Physics Office

The Health Physics Office (H-014) is required for the HPT staff. The office is located for easy access to all Radiation Protection Area spaces. The minimum space that is required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.5)

6.2.4.1.6 Protective Clothing Storage

Protective Clothing Storage (H-015A and H-015B) is required for storage of clean and dirty protective clothing. The storage areas are located adjacent to the Regulated Change Room with easy access to the Low Specific Activity Packaging and Shipping area. The minimum space required for this area is 100 ft^2 per room. (CRWMS M&O 1997c, Section 7.2.4.1.6)

6.2.4.1.7 Calibration Shop

The Calibration Shop (H-129) is required for calibration and operational testing of radiation detection and other alarm system equipment. The shop provides testing for instruments located within the WHB and other surface nuclear facilities. The shop is located in close proximity to the Radiation Protection Portal (H-011), Personal Radiation Equipment Storage Room (H-013), and the shipping/receiving area (H-163). The minimum space required for this area is 600 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.7)

6.2.4.1.8 Circulation

Circulation is required for movement of operational personnel and equipment throughout the Radiation Protection Area. The functional requirements used to determine the corridor areas are identified in Assumption 5.1.5 and in the VA SPA (CRWMS M&O 1997c). The minimum space required for this area is 584 ft^2. (CRWMS M&O 1997c, Section 7.2.4.1.8)

This circulation is a part of the unassigned corridor space in Table 6-2.

6.2.4.2 Security

The functional space for Security Operations is intended to be the central security alarm station for the entire WHB. The primary security access area is located at the main entry to the WHB. There is also a secondary entry access point that allows operational personnel to pass through the equipment/material shipping and receiving area. Additional support functions in this are include two security portals, a security alarm station, and two offices for security personnel.

6.2.4.2.1 Security Portals

The Security Portals (H-130A and H-130B) are arranged to provide access control points to high radiation areas, secondary access control point for vital areas, and material access within the WHB. Each security portal is located at the radiation area entrance and provides space for one security officer and two personnel radiation counters. The functional requirements anticipate that two portals will be utilized. The locations are the main entry (H-130A) and the other unit at the contaminated material shipping/receiving area (H-130B). The ceiling may be open to the underside of the building structure. The minimum required space for each area is 200 ft^2 and the total required combined area is 400 ft^2. (CRWMS M&O 1997c, Section 7.2.4.2.1)

6.2.4.2.2 Security Alarm Station for Monitoring of Security Alarms

The Security Alarm Station (H-131) is required to house the alarm console panels and secondary security alarm station. The minimum space provided for this area is 410 ft^2. (CRWMS M&O 1997c, Section 7.2.4.2.2)

6.2.4.2.3 Offices

The Security Office is a required space for security personnel. One shift office is provided for each portal (H-132A and H-132B) and will be located adjacent to the associated portal. The two offices will have a combined minimum space requirement of 300 ft^2. (CRWMS M&O 1997c, Section 7.2.4.2.3)

6.2.4.2.4 Circulation

Circulation is required for movement of operational personnel within the Security area. The functional requirements used to determine the corridor areas are identified in Assumption 5.1.5 and in the VA SPA (CRWMS M&O 1997c). The minimum space required for this area is 278 ft^2. (CRWMS M&O 1997c, Section 7.2.4.2.4)

This circulation is a part of the unassigned corridor space in Table 6-2.

6.2.4.3 Operations

Operations includes spaces that provide support of Primary, Primary Support, Pool Support Area activities, and associated support personnel. The Operations area is located adjacent to the main entry and is accessible by other related internal functions within the facility. This area includes a health physics and analytical laboratory, storage, first aid facilities, men and women's change rooms for non-radiological coverall worker clothing with shower facilities, lunchroom, and a janitor closet. (Assumption 5.1.5 and CRWMS M&O 1997c, Section 7.2.4.3)

6.2.4.3.1 Health Physics Laboratories

The Health Physics Laboratories (H-133A and H-133B) are required to analyze internal radiological and chemical samples taken from the surface nuclear facilities. The two labs are required to perform this task, with staffing of two technicians for each laboratory per shift. If needed, additional laboratories for the overall site will be identified from another facility. The laboratories are located within the facility to provide access to the WHB primary areas and health physics office, in order to retrieve samples from other surface nuclear facilities. The combined minimum space required for this area is 1,200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.1)

6.2.4.3.2 Laboratory Technician Offices

The Laboratory Technician Offices, located directly adjacent to the laboratories, are required for providing workstations for health physics laboratory technicians. Four offices (H-134A, H-134B, H-134C, and H-134D) are provided (two for each laboratory), and sized to accommodate three workstations each (one for each shift). The minimum combined space required for this area is 900 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.2)

6.2.4.3.3 Laboratory Material Storage

The Laboratory Material Storage (H-135) is required for storage of health physics laboratory materials, both flammable and non-flammable, required for sample analysis. Additionally, gas bottles are planned to be stored exterior to the WHB, adjacent to the laboratories. The minimum space required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.3)

6.2.4.3.4 First Aid Room and Office

The First Aid Room and Office (H-136) is required and intended to provide minor first aid care. The first aid room includes a satellite first aid station for a nurse to perform minor first aid to operational personnel working in the WHB and adjacent facilities. Also, an office is provided for one nurse and is located directly adjacent to the first aid room. The first aid room is located for easy access from all areas of the WHB and other adjacent facilities. The minimum combined space required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.4)

6.2.4.3.5 Change Rooms

The Change Rooms including the associated showers and restroom facilities are provided to support both male (H-016A) and female (H-016B) operational and maintenance personnel working within the WHB. The change rooms are located for direct personnel access to the primary and primary support areas of the facility and are accessible from the maintenance areas. The combined minimum space required for this area is 1,757 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.5)

6.2.4.3.6 Coverall Storage

The Coverall Storage (H-017A and H-0107B) consists of two rooms, which provided storage space for clean and dirty coverall clothing. The storage areas are located adjacent to the change rooms, with easy access from the shipping/receiving area. The space is sized to accommodate coverall storage for the anticipated number of workers using the change rooms. The combined minimum space required for this area is 244 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.6)

6.2.4.3.7 Operations Lunchroom

The Operations Lunchroom (H-137) is provided for operations and maintenance personnel assigned to the WHB. The lunchroom is intended to provide the minimum amount of seating area to support dining/eating, small food preparation, storage, and vending equipment. The food preparation area can accommodate the heating of pre-cooked foods, while the food storage area will include minor refrigeration equipment. The minimum space required for this area is 1,355 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.7)

6.2.4.3.8 Janitor Closet

A Janitor Closet (H-138) is provided for storage of janitorial supplies. This janitor closet is used for all operational areas, and provides the main janitorial supply storage for the entire WHB. The minimum space required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.8)

6.2.4.3.9 Circulation

Circulation is required for movement of personnel within the Operations area. The functional requirements used to determine the corridor areas are identified in Assumption 5.1.5 and in the VA SPA (CRWMS M&O 1997c). The minimum space required for this area is 1,514 ft^2. (CRWMS M&O 1997c, Section 7.2.4.3.9)

This circulation is a part of the unassigned corridor space in Table 6-2.

6.2.4.4 Administration

The Administration area includes office space to house various management and support functions for the WHB. The specific types of office and support functions include supervisor offices, plant operations, DOE staff offices, a conference room, copy room, lunchroom, document control, storage, and restrooms. The administration area is located adjacent to the main entry, which allows reasonable separation from facility operations so as not to disrupt circulation flow of operational personnel. (CRWMS M&O 1997c, Section 7.2.4.4)

6.2.4.4.1 Entry Lobby

The Entry Lobby (H-139) is the main distribution point for facility personnel and visitors wanting access to operational and support areas within the WHB. The lobby space includes a seating area for at least 10 persons and is also directly adjacent to the main entry security portal. The minimum space required for this area is 180 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.1)

6.2.4.4.2 Supervisor Offices

Supervisor Offices are provided for operation and maintenance personnel. The four offices (H-018A, H-018B, H-140A, and H-140B) provide the minimum square footage to accommodate three shift supervisors per office. In each room, the supervisor is intended to have an individual office. The minimum combined space required for this area is 1,000 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.2).

6.2.4.4.3 Operations Offices

The Operations Offices (11 in total) are provided for the plant operations manager, quality assurance (QA)/quality control (QC) personnel, operations staff, and staff support. The plant operations manager has an individual office (H-141); QA/QC personnel are provided with two offices (H-142A and H-142B), each with space for three persons; operations staff is accommodated in four offices (H-143A, H-143B, H-143C, and H-143D), with three offices providing three workstations and the fourth office provides two other workstations; staff support is accommodated in four offices, two offices (H-145A, and H-145B) have one secretary each, another office (H-151) contains two clerk workstations, and the last office (H-144) will have four office systems staff personnel. The minimum space required (circulation not included) for this area is 2,408 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.3)

6.2.4.4.4 DOE Offices

There are nine offices for DOE management and staff support located in the administration area. Two managers (H-146A and H-146B), four staff persons (H-147A, H-147B, H-147C, and H-147D), and two staff support personnel (H-148A and H-148B) are assigned individual offices. The remaining two staff support persons share one office (H-149). The minimum space required (not including circulation) for this area is 1,359 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.4)

6.2.4.4.5 Conference Room

The Conference Room (H-150) is provided and sized to accommodate 50 percent of the maximum shift support personnel working in the WHB. The minimum space required for this area is 600 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.5)

6.2.4.4.6 Document Control

The Document Control (H-151A) room is provided for central storage of controlled documents and located in a secured environment. The minimum space required for this area is 140 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.6)

6.2.4.4.7 Copy and Storage Room

The Copy and Storage Rooms (H-152 and H-153) are provided for general office copy and supply storage. This area includes floor space for a copy machine, fax machine, and general office supply storage. The minimum combined space required for this area is 150 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.7)

6.2.4.4.8 Restrooms

Restrooms are provided for women (H-154A) and men (H-154B) administrative personnel. The floor area for both restrooms is based on the maximum number of administrative personnel on a single shift. The combined minimum space required for this area is 340 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.8)

6.2.4.4.9 Lunchroom

The lunchroom (H-155) is provided for administrative personnel assigned to the WHB. The floor area includes space for minor food preparation, chairs and tables, and vending equipment. The food preparation area will support the heating of precooked foods and the storage area will have refrigeration equipment. The floor area is based on the maximum number of administrative personnel on a single shift. The minimum space required for this area is 750 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.9)

6.2.4.4.10 Janitor Closet

A Janitor Closet (H-156) is provided for storage of janitor supplies for administrative areas only. The minimum space required for this area is 100 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.10)

6.2.4.4.11 Circulation

Circulation is required for movement of personnel within the administrative area. The functional requirements used to determine the circulation space is identified in Assumption 5.1.5 and in the VA SPA (CRWMS M&O 1997c). The minimum required space required for this area is 1,582 ft^2. (CRWMS M&O 1997c, Section 7.2.4.4.11)

This circulation is a part of the unassigned corridor space in Table 6-2.

6.2.4.5 Maintenance

The Maintenance area includes spaces that provide equipment maintenance, storage and shipping/receiving functions for non-contaminated areas of the WHB. (The Central maintenance shops are provided at the balance of plant [BOP] area.) The personnel and equipment flow in this area is arranged to allow easy access to locations requiring routine maintenance activities and deliveries of supply materials to support the operations and administrative areas. Several other functions are located here including instrument maintenance shops, equipment, tool and material storage, HEPA filter storage, waste staging, gas bottle storage, and satellite shipping/receiving. (CRWMS M&O 1997c, Section 7.2.4.5)

6.2.4.5.1 Equipment Maintenance Shop

The Equipment Maintenance Shop (H-019) provides space to maintain and perform minor repair to WHB support systems and other nearby nuclear surface facilities. (Other equipment repair and maintenance activities are performed at the BOP). The Equipment Maintenance Shop is located with access directly to the shipping/receiving area so that shop equipment can be easily moved. Examples of basic machine shop equipment are grinders, drill presses, and saws. Other equipment in this area includes electrical repair equipment, a cutting station, and storage for flammable liquids and materials. The minimum space required for this area, including circulation, is 1,954 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.1)

6.2.4.5.2 Instrument Maintenance Shop

The Instrument Maintenance Shop (H-019B) is required for repair of facility instrumentation support systems, communication equipment, and emergency and security alarm systems. The instrument shop is also required to test/maintain emergency alarm and communication equipment. The shop may be located with direct access to the shipping/receiving area or be provided with an individual access to the exterior for acceptance and return of instrumentation equipment. Another requirement for locating the instrument shop within the WHB is to provide access to areas containing alarming and other instrumentation. The ceiling in this area is open to the underside building structure. The minimum space required for this area is 1,342 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.2)

6.2.4.5.3 Tool Storage

The Tool Storage (H-159) room provides space for tools required for in-house use by maintenance personnel in non-contaminated areas of the WHB. The tools stored in this room are assigned to personnel for day use only and then are returned for storage prior to the end of the shift. Personnel needing tools from this area or the adjacent maintenance materials room have direct access to the storage room from non-contaminated areas of the facility. The ceiling in this area is open to the underside building structure. The minimum space required for this area including circulation is 240 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.3)

6.2.4.5.4 Maintenance Material Storage

The Maintenance Material Storage (H-160) area provides functional space for non-contaminated materials used in the WHB. Material staging within the maintenance material storage area is intended for several items such as air handler filters, chemicals, and miscellaneous hardware. The room is located for convenient access to the non-contaminated areas of the facility, shipping/receiving, and the adjacent tool storage room. The ceiling in this area is open to the underside of the building structure. The minimum space required for this area, including circulation, is 400 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.4)

6.2.4.5.5 High-Efficiency Particulate Air Filter Storage

The HEPA Filter Storage rooms (H-161A and H-161B) are provided for clean and contaminated HEPA filter storage and staging. The functional space is divided into two rooms so that one room can store clean filters in an area adjacent to the maintenance materials storage room. The other room is located adjacent to the Low Specific Activity packaging/shipping area and will store changed out filters that are contaminated. The rooms are sized to accommodate only 10 percent storage (Assumption 5.1.7) capacity in either clean or contaminated HEPA filters rooms. The minimum floor space required for both rooms is 760 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.5)

6.2.4.5.6 Janitor Closet

A Janitor Closet (H-162) is provided for storage of janitor supplies to support the maintenance area. The minimum space required for this area is 100 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.6)

6.2.4.5.7 Shipping/Receiving

The Shipping/Receiving area (H-121 and H-163) provides a loading dock (Assumption 5.1.2) and staging area for materials to be used in the non-contaminated areas on the WHB. Incoming materials include but are not limited to laboratory, first aid, administrative and janitorial supplies, coverall storage, maintenance/repair shop equipment and supplies, clean HEPA filters, and other routine maintenance supplies. The Shipping/Receiving area is positioned in an area to accept deliveries from on-site shipping and other material movement within the facility. The ceiling is open to the underside of the building structure. The minimum space required for this is 8,554 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.7)

6.2.4.5.8 Waste Staging

The Waste Staging area (H-164) provides space to accommodate paper waste from security, operations, administrative, and maintenance activities. The staging area is located adjacent to shipping/receiving. The ceiling is open to the underside of the building structure above. The minimum space required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.8)

6.2.4.5.9 Gas Bottle Storage

The Gas Bottle Storage (H-165) room provides storage for laboratory and shop activities. This storage area is located to provide exterior access for bottles entering the facility from shipping/staging area. The requirements for storage of gas bottles will be in accordance with National Fire Protection Association (NFPA) 54 and 55. The ceiling in this area is also open to the underside of the building structure. The minimum space required for this storage area is 50 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.9)

6.2.4.5.10 Circulation

The circulation space describe in this section is required for movement of operational personnel and equipment within the WHB maintenance area. The sizing of the corridors are identified in Assumption 5.1.3 and in the VA SPA (CRWMS M&O 1997c). The minimum space required for this area is 1,442 ft^2. (CRWMS M&O 1997c, Section 7.2.4.5.10)

This circulation is a part of the unassigned corridor space in Table 6-2.

6.2.4.6 Building Circulation

The functional space requirements for building circulation is included in the floor area analysis for individual support areas. The building circulation was based on assumed spatial needs that were in response to the initial design inputs and functional space requirements for the WHB.

However, additional building circulation (e.g. stairways, elevators, corridors, a pipe chase, airlocks and vestibules) was still needed in the WHB for access by personnel and equipment to the primary, primary support and other building support areas throughout the facility.

The current figures, reference Figures I-14 through I-20, Attachment I, are intended to capture the impact of additional design inputs and the anticipated impacts of NFPA 101, *Life Safety Code,* requirements for fire egress and requirements for personnel movement. The impacts illustrated affect both the horizontal (corridors) and vertical (stairways) circulation throughout the facility with regards to the Life Safety Code. Other circulation modifications show the addition of interior transition stairways, equipment elevators (vertical), and related corridors, which are required to transport equipment and operational and maintenance personnel from one location to the other throughout the entire facility.

As a result of this analysis, the minimum building circulation total of 18,000 sq ft, as required in the VA SPA (CRWMS M&O 1997c, Section 7.2.4.6), has been revised. The revised building circulation total required by the current figures is 96,600 sq ft. The revised building circulation incorporates Assumptions 5.1.4, 5.1.5, 5.1.6, and the unassigned floor space from the VA SPA, WHB Facility Program Area Summary (CRWMS M&O 1997c, Table 7.2-3) not accounted for in the minimum functional floor area total. The significance of this revised building circulation figure is critical because this figure represents an increase of four-and-a-half times the floor area originally indicated.

It is assumed that the revised figures now take into account the majority of the design inputs and functional requirements for the WHB. This assumption is believed to be reasonably bounding for the purpose of this analysis.

6.2.5 Heating, Ventilation, and Air Conditioning Equipment Areas

6.2.5.1 Methodology

This section establishes the HVAC equipment room requirements that allow for judicial space usage and yet offer some flexibility to accommodate future changes without major building reconfiguration. The HVAC equipment room(s) will house the majority of the HVAC equipment such as refrigeration machines, HEPA filter plenums, air handling units, fans, pumps, ductwork systems, etc., and including auxiliary equipment such as heat exchangers, electrical panels, instrument control panels, and distribution lines. (Assumptions 5.3.2, 5.3.3, and 5.3.5)

Equipment room spaces account for servicing and component replacement operations, in-place testing, and maintenance for each of the different type of equipment and/or component consistent with the manufacturer's recommended instructions and practices. The room height is determined by the equipment plus the spaces required to accommodate the air distribution, ductwork systems, and other miscellaneous utility support systems such as electrical tray and conduits, fire protection piping, and cooling and hot water piping. Miscellaneous process piping are not expected in the HVAC equipment rooms. (Refer to Figure I-53 of Attachment I.)

The major HVAC components that directly impact the equipment room size and configuration are defined based on the ventilation air estimates and equipment configurations in Sections 6.2.5.2 and 6.2.5.3.

The HEPA filtration housings/plenums are determined by using standard, commercially available off-the-shelf filter elements with nominal dimensions of 24-in. wide by 24-in. high by 12-in. deep. The HEPA filter housing is sized to accommodate 18 filter elements; 6-filters wide stacked 3-filters high. The resultant HEPA filter plenum assembly is arranged to fit between 24-ft by 24-ft structural column grid. (Refer to Section 6.2.5.3 for HEPA filter plenum sizing, and Figure I-45 of Attachment I for space allocation.)

Air handling units, fans, refrigeration machines, pumps, and other system components are based on standard, commercially available off-the shelf industrial grade equipment.

Safety-related exhaust HEPA filter and fan systems, if required, will be separated from the rest of the HVAC equipment in a hardened enclosure. (Refer to Figures I-47 and I-51 of Attachment I.)

6.2.5.2 Heating, Ventilation, and Air Conditioning System Development

Calculations of the airflow quantities for the WHB are as shown in Table 6-1. The ventilation zoning based on the potential for radioactive contamination is shown in Figures I-41 and I-42, and the major HVAC system is presented in Figures I-43 through I-54 (all of Attachment I).

The major HVAC components that directly impact the room size and configuration are defined based on the ventilation air estimates and equipment configurations in Sections 6.2.5.2 and 6.2.5.3.

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Primary Confinement	H-114	WP Remed / Decon Cell	1,998	20	8	2.7	5,328	100%	0	5,328	Non-comfort Design
				16	2	-	1,066	100%	0	1,066	"
	H-205A	Assembly Handling Cell	2,508	20	10	3.3	8,360	100%	0	8,360	"
				30	2	-	2,508	100%	0	2,508	"
	H-205B	Assembly Handling Cell	2,508	20	10	3.3	8,360	100%	0	8,360	"
				30	2	-	2,508	100%	0	2,508	"
	TOTAL (PRIMARY-Normal Operation)		7,014	-	-	-	28,130	100%	0	28,130	
Emergency System	H-205C	Canister Transfer Cell	2,730	-	-	-	55,000	100%	0	55,000	Supply to Can.Transfer
	H-110	DC Handling Cell	15,900	-	-	-	Included	-	-	Included	& DC Hdlng/Stg. Areas
	H-113	Loaded DC Staging Area	7,056	-	-	-	Included	-	-	Included	and cascade to the
	Misc.	Primary Confinement Areas	7,014	-	-	-	(55,000)	-	-	(55,000)	Prim. Conf'mt Areas.
	TOTAL (EMERGENCY-Operation)		32,700				55,000	100%	0	55,000	
Secondary Confinement	H-075	Pipe Chase	4,800	20	8	2.7	12,800	100%	0	12,800	Non-comfort Design
	H-083	Pool Treatment Equip Room	2,100	20	8	2.7	5,600	100%	0	5,600	"
				25	2	-	1,750	100%	0	1,750	"
	H-084A	Pool Treatment Equip Room	800	20	8	2.7	2,133	100%	0	2,133	"
				25	2	-	667	100%	0	667	"
	H-084B	Pool Treatment Equip Room	2,000	20	8	2.7	5,333	100%	0	5,333	"
				25	2	-	1,667	100%	0	1,667	"
	H-105A	DC Load Cell	760	20	10	3.3	2,533	100%	0	2,533	"
				8	2	-	203	100%	0	203	"
	H-105B	DC Load Cell	760	20	10	3.3	2,533	100%	0	2,533	"
				8	2	-	203	100%	0	203	"
	H-106A	DC Decontamination Cell	912	20	8	2.7	2,432	100%	0	2,432	"
				8	2	-	243	100%	0	243	"
	H-106B	DC Decontamination Cell	912	20	8	2.7	2,432	100%	0	2,432	"
				8	2	-	243	100%	0	243	"
	H-110	DC Handling Cell	15,900	20	8	2.7	42,400	100%	0	42,400	"
				51	2	-	27,030	100%	0	27,030	"
	H-113	Loaded DC Staging Area	7,056	20	8	2.7	18,816	100%	0	18,816	"
				51	2	-	11,995	100%	0	11,995	"
	H-206A	AHC Crane Maintenance Bay	912	20	8	2.7	2,432	100%	0	2,432	"
				30	2	-	912	100%	0	912	"
	H-206B	AHC Crane Maintenance Bay	912	20	8	2.7	2,432	100%	0	2,432	"
				30	2	-	912	100%	0	912	"
	H-205C	Canister Transfer Cell Upper Level	2,730	20	10	3.3	9,100	100%	0	9,100	"
				14	2	-	1,274	100%	0	1,274	"

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Secondary Confinement (Cont)	H205C1	Off-Normal Canister Handling Cell	3,060	20	10	3.3	10,200	100%	0	10,200	"
				14	2	-	1,428	100%	0	1,428	"
	H-301	DCH Cell Crane Maintenance Bay	4,248	20	8	2.7	11,328	100%	0	11,328	"
				13	2	-	1,841	100%	0	1,841	"
	H-103C	CT Cell, Lower Level	3,264	20	8	2.7	8,704	100%	0	8,704	"
		(Incl. H-103D & H-104C)avg		14	2	-	1,523	100%	0	1,523	"
	H-020	Pool Treatment Equip. Room	11,760	20	8	2.7	31,360	100%	0	31,360	"
				25	2	-	9,800	100%	0	9,800	"
	TOTAL (SECONDARY)		62,886	-	-	-	234,260	100%	0	234,260	
Tertiary Confinement (Unoccupied)	H-040	Vac Pump Room	4,725	20	4	1.3	6,300	100%	0	6,300	Non-comfort Design
				25	2	-	3,938	100%	0	3,938	"
	H-102A	Cask Preparation & Decon	1,496	20	4	1.3	1,995	100%	0	1,995	"
				51	2	-	2,543	100%	0	2,543	"
	H-102B	Cask Preparation & Decon	1,496	20	4	1.3	1,995	100%	0	1,995	"
				51	2	-	2,543	100%	0	2,543	"
	H-103A	Cask Unloading Pool Areas	3,740	20	4	1.3	4,987	100%	0	4,987	"
				51	2	-	6,358	100%	0	6,358	"
	H-103B	Cask Unloading Pool Areas	3,740	20	4	1.3	4,987	100%	0	4,987	"
				51	2	-	6,358	100%	0	6,358	"
	H-108A	Cask Preparation & Decon	1,710	20	4	1.3	2,280	100%	0	2,280	"
				20	2	-	1,140	100%	0	1,140	"
	H-111	WP Transport Loading Cell	2,592	20	4	1.3	3,456	100%	0	3,456	"
				10	2	-	864	100%	0	864	"
	H-116	Contaminated Equip. Room	1,890	20	4	1.3	2,520	100%	0	2,520	"
				65	2	-	4,095	100%	0	4,095	"
	H-120	Cont. Equip. & Decon	2,565	20	4	1.3	3,420	100%	0	3,420	"
				51	2	-	4,361	100%	0	4,361	"
	H-208A	Welder #1	276	12	4	0.8	221	100%	0	221	"
	H-208B	Welder #2	276	12	4	0.8	221	100%	0	221	"
	H-208C	Welder #3	276	12	4	0.8	221	100%	0	221	"
	H-208D	Welder #4	276	12	4	0.8	221	100%	0	221	"
	H-208E	Welder #5	276	12	4	0.8	221	100%	0	221	"
	H-208F	Welder #6	276	12	4	0.8	221	100%	0	221	"
	H-208G	Welder #7	276	12	4	0.8	221	100%	0	221	"
	H-208H	Welder #8	276	12	4	0.8	221	100%	0	221	"
	H-209A	C. T. Cell Maintenance Bay	840	20	4	1.3	1,120	100%	0	1,120	"
				14	2	-	392	100%	0	392	"

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Tertiary Confinement (Unoccupied) (Cont)	H-213	Welder Maintenance Hot Shop	2,210	20	4	1.3	2,947	100%	0	2,947	"
				19	2	-	1,400	100%	0	1,400	"
	H-301A	Pool Area Crane Maint Bay	1,100	17	4	1.1	1,247	100%	0	1,247	"
	H-301B	Pool Area Crane Maint Bay	1,100	17	4	1.1	1,247	100%	0	1,247	"
	H-402	Assembly & Can'str Transf Corr	10,464	20	4	1.3	13,952	100%	0	13,952	"
				16	2	-	5,581	100%	0	5,581	"
	H-403	DC Handling & WP Remed.	8,094	20	4	1.3	10,792	100%	0	10,792	"
		Transfer Corr.		8	2	-	2,158	100%	0	2,158	"
	H102A2	Cask Preparation & Decon.	1,628	20	4	1.3	2,171	100%	0	2,171	"
				51	2	-	2,768	100%	0	2,768	"
	H102B2	Cask Preparation & Decon.	1,628	20	4	1.3	2,171	100%	0	2,171	"
				51	2	-	2,768	100%	0	2,768	"
	SUB-TOTAL (TERTIARY-Unoccupied)		53,226	-	-	-	116,616	100%	0	116,616	
Tertiary Confinement (Unoccupied) Equip.Rooms	H-171	Tertiary Confinement Exhaust	25,434	20	3	1.0	25,434	0%	25,434	0	Independent Recirc. Clg.
	H-201	Tertiary Confinement Exhaust/Recirculating	29,058	20	3	1.0	29,058	0%	29,058	0	"
	H-400	Secondary Confinement Exhaust	34,400	20	3	1.0	34,400	0%	34,400	0	"
	H-400A	Primary Confinement Exhaust	7,678	20	3	1.0	7,678	0%	7,678	0	"
	H-383A	Fuel Storage Pool Tertiary Confinement Supply	16,672	20	3	1.0	16,672	0%	16,672	0	"
	H-383B	Fuel Storage Pool Tertiary Confinement Exhaust	17,484	20	3	1.0	17,484	0%	17,484	0	"
	H-400B	Emergency Confinement Exhaust	7,068	20	3	1.0	7,068	0%	7,068	0	"
	H-400C	Emergency Confinement Exhaust	7,638	20	3	1.0	7,638	0%	7,638	0	"
		TOTAL (Equip.Rms-Recirc. System)	-	-	-	-	-	0%	145,432	-	
	H-171	Tertiary Confinement Exhaust	25,434	20	1	0.3	8,478	100%	0	8,478	Outside Air Supply
	H-200	Tertiary Confinement Supply	39,040	20	1	0.3	13,013	100%	0	13,013	"
	H-201	Tertiary Confinement Exhaust/Recirculating	29,058	20	1	0.3	9,686	100%	0	9,686	"
	H-300	Primary/Secondary Confinement Supply	27,559	20	1	0.3	9,186	100%	0	9,186	"
	H-308A	PrimaryConfinement Emergency Supply	8,428	20	1	0.3	2,809	100%	0	2,809	"
	H-308B	Primary Confinement Emergency Supply	8,084	20	1	0.3	2,695	100%	0	2,695	"
	H-400	Secondary Confinement Exhaust	34,400	20	1	0.3	11,467	100%	0	11,467	"
	H-400A	Primary Confinement Exhaust	7,678	20	1	0.3	2,559	100%	0	2,559	"
	H-400B	Emergency Confinement Exhaust	7,068	20	1	0.3	2,356	100%	0	2,356	"
	H-400C	Emergency Confinement Exhaust	7,638	20	1	0.3	2,546	100%	0	2,546	"
		SUB-TOTAL (Equip. Rooms)	194,387	-	-	-	64,796	100%	0	64,796	
	TOTAL (TERTIARY-Unoccupied)		247,613	-	-	-	181,412	100%	0	181,412	

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Tertiary Confinement (Occupied)	H-050	Corridor	2,475	15	6	1.5	3,713	20%	2,970	743	Comfort Design
	H-051	Corridor	6,750	15	6	1.5	10,125	20%	8,100	2,025	"
	H-052	Corridor	6,900	15	6	1.5	10,350	20%	8,280	2,070	"
	H-053	Corridor	5,250	15	6	1.5	7,875	20%	6,300	1,575	"
	H-054	Corridor	2,625	15	6	1.5	3,938	20%	3,150	788	"
	H-085	Corridor	2,040	20	6	2.0	4,080	20%	3,264	816	"
				25	2	-	1,700	20%	1,360	340	"
	H-118A	Operating Gallery	3,450	20	6	2.0	6,900	20%	5,520	1,380	"
	H-118B	Operating Gallery	1,700	16	6	1.6	2,720	20%	2,176	544	"
	H-118C	Operating Gallery	2,540	16	6	1.6	4,064	20%	3,251	813	"
	H-118E	Operating Gallery	2,220	16	6	1.6	3,552	20%	2,842	710	"
	H-118F	Operating Gallery	2,220	16	6	1.6	3,552	20%	2,842	710	"
	H-118G	Operating Gallery	280	20	6	2.0	560	20%	448	112	"
				8	2	-	75	20%	60	15	"
	H-118H	Operating Gallery	280	20	6	2.0	560	20%	448	112	"
	H-127	Access Corridor	2,960	16	6	1.6	4,736	20%	3,789	947	"
	H-128	Access Corridor	1,800	16	6	1.6	2,880	20%	2,304	576	"
	H-207A	Operating Gallery	3,450	22	6	2.2	7,590	20%	6,072	1,518	"
	H-207B	Operating Gallery	1,380	16	6	1.6	2,208	20%	1,766	442	"
	H-207C	Operating Gallery	2,540	16	6	1.6	4,064	20%	3,251	813	"
	H-207D	Operating Gallery	1,530	16	6	1.6	2,448	20%	1,958	490	"
	H-207F	Operating Gallery	432	12	6	1.2	518	20%	415	104	"
	H-207G	Operating Gallery	432	12	6	1.2	518	20%	415	104	"
	H-207H	Operating Gallery	432	12	6	1.2	518	20%	415	104	"
	H-207I	Operating Gallery	432	12	6	1.2	518	20%	415	104	"
	H-207J	Operating Gallery	1,120	12	6	1.2	1,344	20%	1,075	269	"
	H-401A	Access Corridor	736	14	6	1.4	1,030	20%	824	206	"
	H-401B	Access Corridor	486	14	6	1.4	680	20%	544	136	"
	H-401C	Access Corridor	1,148	22	6	2.2	2,526	20%	2,020	505	"
	H-401D	Access Corridor	500	14	6	1.4	700	20%	560	140	"
	H-XXX	Utility Corr (Bet Op Gal Lvl)	5,100	10	4	0.7	3,400	20%	2,720	680	"
	H-XXX	Utility Corr (Bet Op Gal Lvl)	5,100	10	4	0.7	3,400	20%	2,720	680	"
	H-122	Maintenance Equip Storage	3,010	16	4	1.1	3,211	20%	2,569	642	"
	H120A	Staging Area (Hot Support)	4,692	16	4	1.1	5,005	20%	4,004	1,001	"
	H-124	Maintenance Shop	1,015	16	6	1.6	1,624	20%	1,299	325	"
	H-125	LLW Collection & Packing	700	16	4	1.1	747	20%	597	149	
	H-126	Forklift Staging and Servicing	2,030	16	6	1.6	3,248	20%	2,598	650	"
	H-203	Welder Maintenance Bay	6,970	20	6	2.0	13,940	20%	11,152	2,788	"
				19	2	-	4,414	20%	3,531	883	"

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Tertiary Confinement (Occupied) (Cont)	H-XXX	Stairways	160	46	1	0.8	123	20%	98	25	"
	H-XXX	Stairways	160	46	1	0.8	123	20%	98	25	"
	H-XXX	Stairways	160	46	1	0.8	123	20%	98	25	"
	H-XXX	Stairways	160	71	1	1.2	189	20%	151	38	"
	H-XXX	Stairways	160	71	1	1.2	189	20%	151	38	"
	H-XXX	Stairways	160	71	1	1.2	189	20%	151	38	"
	H-XXX	Stairways	200	80	1	1.3	267	20%	213	53	"
	H-XXX	Stairways	200	80	1	1.3	267	20%	213	53	"
	H-XXX	Stairways	200	80	1	1.3	267	20%	213	53	"
	H-XXX	Stairways	200	80	1	1.3	267	20%	213	53	"
	H-XXX	Stairways	200	71	1	1.2	237	20%	189	47	"
	H-XXX	Stairways	200	100	1	1.7	333	20%	267	67	"
	H-XXX	Stairways	200	41	1	0.7	137	20%	109	27	"
	H-XXX	Stairways	200	41	1	0.7	137	20%	109	27	"
	H-XXX	Elevator	140	41	1	0.7	96	20%	77	19	"
	H-XXX	Elevator	140	41	1	0.7	96	20%	77	19	"
	H-XXX	Elevator	140	41	1	0.7	96	20%	77	19	"
	H-XXX	Elevator	140	41	1	0.7	96	20%	77	19	"
		SUB-TOTAL(TERTIARY-Occupied)	89,845	-	-	-	138,260	20%	110,608	27,652	
	H-XXX	Corridors & Hallways	2,060	9	4	0.6	1,236	20%	989	247	"
	H-XXX	Corridor (1st Flr Cold Support)	2,100	16	4	1.1	2,240	20%	1,792	448	"
	H-XXX	Corridor (1st Flr Cold Support)	2,100	16	4	1.1	2,240	20%	1,792	448	"
	H-XXX	Corridor (1st Flr Cold Support)	750	16	4	1.1	800	20%	640	160	"
	H-XXX	Corridor (1st Flr Cold Support)	1,000	16	4	1.1	1,067	20%	853	213	"
		SUB-TOTAL(TERTIARY-Occupied)	8,010	-	-	-	7,583	20%	6,066	1,517	
	TOTAL (TERTIARY-Occupied)		97,855	-	-	-	145,842	20%	116,674	29,168	
Pool Storage (Tertiary Confinement)	H-183	Fuel Basket Storage Pool Area	50,395	20	4	1.3	67,193	100%	0	67,193	Non-comfort Design
				20	2	-	33,597	100%	0	33,597	"
	H-183J	Non-Std Fuel Handling Area	1,620	20	4	1.3	2,160	100%	0	2,160	"
				20	2	-	1,080	100%	0	1,080	"
	TOTAL (TERTIARY - Pool Storage)		52,015	-	-	-	104,030	100%	0	104,030	Independent System
HVAC Equip. Rm.											
	H-383A	Fuel Storage Pool Tertiary Confine Supply	16,672	24	1	0.4	6,669	100%	0	6,669	Outside Air Supply
										-	
	H-383B	Fuel Storage Pool Tertiary Confine Exhaust	17,484	24	1	0.4	6,994	100%	0	6,994	Outside Air Supply
		SUB-TOTAL (Outside Air)	34,156	-	-	-	13,662	100%	0	13,662	

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Non-Conf'mt Areas	H-117	Empty DC Preparation	15,480	20	4	1.3	20,640	20%	16,512	4,128	
				30	2	-	15,480	20%	12,384	3,096	
		TOTAL - Empty DC Prep	15,480	-	-	-	36,120	20%	28,896	7,224	Independent System
	H-119	Waste Handling Operation Ctr	1,000	16	10	2.7	2,667	20%	2,133	533	Independent System
	H-MISC	Cold Support Areas	36,400	10	6	1.0	36,400	20%	29,120	7,280	Independent System
	H-170	Communications Room	Included								
	H-180	Unused Areas	4,510	25	0	-	-	-	-	-	
	H-181	Access Corridor	610	22	4	1.5	895	20%	716	179	"
	H-182	Access Corridor	900	22	4	1.5	1,320	20%	1,056	264	"
	H-204	Hydronic Equipment Room	6,310	20	2	0.7	4,207	20%	3,365	841	"
	H-306	Access Corridor	170	20	4	1.3	227	20%	181	45	"
			170	12	2	-	68	20%	54	14	"
	H-218	Access Corridor	3,000	16	4	1.1	3,200	20%	2,560	640	"
	H-219	Access Corridor	2,680	23	4	1.5	4,109	20%	3,287	822	"
	H-221	Access Corridor	4,680	16	4	1.1	4,992	20%	3,994	998	"
	H-224	Access Corridor	610	22	4	1.5	895	20%	716	179	"
	H-225	Access Corridor	1,320	20	4	1.3	1,760	20%	1,408	352	"
				19	2	-	836	20%	669	167	"
	H-226	Access Corridor	870	22	4	1.5	1,276	20%	1,021	255	"
	H-227	Access Corridor	1,025	12	4	0.8	820	20%	656	164	"
	H-100B	Cask Transfer Corridor	2,000	20	6	2.0	4,000	20%	3,200	800	(Supplied from the
				8	2	-	533	20%	427	107	Tertiary System)
	H-100C	Access Corridor	3,249	20	4	1.3	4,332	20%	3,466	866	Comfort Design
				8	2	-	866	20%	693	173	"
	H-123	Tool Storage	2,000	20	4	1.3	2,667	20%	2,133	533	"
				8	2	-	533	20%	427	107	"
	H-170	Communications Room	578	12	6	1.2	694	20%	555	139	"
	H-211	Welder Material Storage	2,024	16	4	1.1	2,159	20%	1,727	432	"
	TOTAL:	NON-CONFINEMENT AREAS	74,106				79,455		63,564	15,891	
	H-100A	Carrier Bay	15,680	20	4	1.3	20,907	20%	16,725	4,181	
				40	2	-	20,907	20%	16,725	4,181	
	TOTAL (Carrier Bay Only)		15,680	-	-	-	41,814	20%	33,450	8,362	

Table 6-1. WHB Ventilation Air Estimate

Confinement Zone	Rm. No	Area Description	Area Sq. Ft.	Height Ft.	Vent. Rate AC/ hr	Vent. Rate cfm/sq.Ft.	Supply Air acfm	Outside Air (%)	Return Air acfm	Outside Air acfm	Remarks
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Non-Conf'mt Areas (Cont)	H-168	Electrical Power Distribution	9,850	20	4	1.3	13,600	20%	10,880	2,720	
		(Rm. H-171A included)		10	2	-	3,400	20%	2,720	680	
		TOTAL-Electrical / Equip Room	9,850	-	-	-	17,000	20%	13,600	3,400	Independent System
	H-169A	Emergency Generator	1,080	22	12	4.4	4,752	20%	3,802	950	
	H-172A	Safety Electrical Equipment	540	22	12	4.4	2,376	20%	1,901	475	
		TOTAL (Train "A")	1,620	-	-	-	7,128	20%	5,702	1,426	Independent System
	H-169B	Emergency Generator	1,080	22	12	4.4	4,752	20%	3,802	950	
	H-172B	Safety Electrical Equipment	540	22	12	4.4	2,376	20%	1,901	475	
		TOTAL (Train "B")	1,620	-	-	-	7,128	20%	5,702	1,426	Independent System

NOTES:

1. Input — Assumption 5.3.4
2. Input — From Table 6.2-1, WHB Facility Program Area Summary
3. Input — The airchange rate is applied to an effective height of 20 feet above the floor and 2 airchanges is assumed above the effective height. Calculated flowrate shall be checked to meet either cooling or heating requirements.
4. Formula — Supply Air / Area
5. Formula — (Area x Height x AC/hr) / 60
6. Input — Based on 100% for once-through systems and 20% for recirculation systems.
7. Formula — Supply Air flow - Outside Air flow
8. Formula — Supply Air flow x % of Outside Air

GENERAL NOTE:

Refer to Assumptions 5.3.1 and 5.3.6.

6.2.5.3 High-Efficiency Particulate Air Housings Configuration

The HEPA filter housing is sized based on standard, commercially available HEPA filter element with a nominal dimension of 24-in. wide by 24-in. high by 12-in. deep. The housing is designed to provide for sufficient space between filter stages to allow for required maintenance, replacement, inspection, and monitoring.

6.2.5.3.1 Exhaust/Recirculation High-Efficiency Particulate Air Housings Housing

In an effort to standardize the HEPA filter housing or plenum size for this analysis, the filter plenum is configured for 2-stages of 18 filter elements arranged 6-filters wide and stacked 3-filters high (Assumption 5.3.3). This filter arrangement allows the ventilation system configuration to be modular and to fit adequately in the preliminary column grid for the facility. Following is the plenum sizing convention:

WIDTH	
6-filters wide @ 2 ft each	12'-0"
Holding frames, 7 spaces @ 4 in. each	2'-4"
Total width	14'-4"
HEIGHT	
3-filters high @ 2 ft each	6'-0"
Holding frames, 4 spaces @ 4 in. each	1'-4"
Structural skid allowance	0'-8"
Total height	8'-0"
LENGTH	
Inlet section with pre-filter	6'-0"
1st stage HEPA with maintenance space	8'-0"
2nd stage HEPA with maintenance space	8'-0"
Outlet section	4'-0"
Total length	26'-0"

6.2.5.3.2 Recirculation Housing

The recirculation filter housing is basically a Fan-Coil system with commercial grade filters. The unit configuration is given as follow:

WIDTH:	14'-4"
HEIGHT:	8'-0"
LENGTH:	
Inlet section	5'-0"
Single stage high-efficiency filters with maintenance space	6'-0"
Coil Section	1'-0"
Outlet section with fan	7'-0"
Total length	19'-0"

6.2.5.4 Outside Air Intake Air Handling Unit Configuration

The performance criteria used for the sizing of the Air Intake Handling Unit is based on a 450 fpm face velocity through the cooling coil to preclude moisture carryover. Coil manufacturers recommended or acceptable range of 450 to 550 fpm (Assumptions 5.3.7 and 5.3.8). The coil face area is cfm/450 fpm. The unit is designed with adequate space to allow for required maintenance, replacement, inspection, and monitoring. Although the units may vary in size throughout the facility, two basic air intake handling unit capacities were selected for this analysis to represent the equipment envelope for the various systems.

		30,000 cfm	18,000 cfm
CAPACITY		(without fan)	(with fan)
Coil Face Area @ 450 fpm		67 ft^2	40 ft^2
WIDTH:			
Coil tube-length		10'-0" (max)	7'-0" (max)
Coil header and frame		2'-0"	1'-6"
Pipe interface connection		1'-0"	0'-6"
	Total width	13'-0"	9 '-0"
HEIGHT:			
Coil height		6' 9"	5' 9"
Coil support and frame		1'-0"	9"
Structural skid		9"	6"
Housekeeping pad		6"	4"
	Total height	9 '-0"	7' 4"
LENGTH:			
Air inlet with preheat coil		6'-0"	6'-0"
Pre-filter and high efficiency filter section		6'-0"	6'-0"
Cooling coil and outlet sect		5'-0"	5'-0"
Fan section		0	3'-0"
	Total length	17'-0"	20'-0"

6.2.5.5 Fans Configuration

Considered for this evaluation are belt driven centrifugal fans with a nominal capacity of 30,000 cfm. Fan physical size is governed by airflow delivery against a given pressure. In the absence of the system pressure drop calculation, the fan/motor envelope is estimated as a space keeper only. (Assumption 5.3.8)

Fan/motor footprint	= 10'-0" x 10'-0" = 100 ft^2
Height including base and housekeeping pad for up-blast discharge.	= 8'-0" + 1'-0" = 9'-0"

6.2.5.6 Waste Handling Building Heating, Ventilation, and Air Conditioning Equipment Rooms Configuration

The WHB HVAC equipment rooms are shown in Figures I-47 through I-53 of Attachment I. The following are some of the factors considered in developing the HVAC equipment space requirements.

6.2.5.6.1 As a general rule air handling equipment that process outdoor air are considered contaminant-free and are grouped into rooms separate from equipment handling potentially contaminated particulate. An example of potentially contaminated air handling equipment is the HEPA filtration system exhausting air from the contaminated areas of the facility.

6.2.5.6.2 Refrigeration equipment has the potential refrigerant gas contamination and is located in a separate room.

6.2.5.6.3 Safety Class equipment, if required, are enclosed in safety-related barriers so that its operation is not jeopardized by any failure of the non-safety class system or component.

6.2.5.6.4 Space for removal and replacement of components such as cooling and heating coils, electric motors, pumps, heat exchangers, etc.

6.2.5.6.5 Maintenance aisles to permit transport of replacement components to and from the equipment room, and including maintenance equipment.

6.2.5.6.6 Space allowance for motor controllers that support the HVAC operation. It is estimated that about 70 sizeable motors requiring controllers of approximately 20" x 20" with a minimum of 48" frontal clearance recommended by the controller manufacturer. An additional 10% space allowance for unaccounted smaller motors is included.

6.2.5.6.7 Space for accessibility to above-the-floor components to perform inspection, maintenance or removal/replacement of such components.

6.2.5.7 Waste Handling Building Heating, Ventilation, and Air Conditioning Equipment Rooms Space Summary

Following is a summary of the evaluation results of the HVAC equipment space requirements incorporating the factors mentioned in Section 6.2.5.6.

6.2.5.7.1 Outside Air Intake Space Requirements: Equipment selection is based on a capacity of 30,000 cfm per Sections 6.2.5.4 and 6.2.5.5. The following figures provide the outline of the equipment arrangement that determine the minimum space required.

Figure I-50. Tertiary Confinement Supply, Room H-200
11 air handling units and 11 supply fans are required to supply 327,254 cfm
4 air handling units and 4 supply fans is the allowance for future growth
Minimum space required = 39,040 ft^2

Figure I-51. Primary Confinement Emergency Supply, Rooms H-308A & H-308B
2 air handling units and 2 supply fans are required to supply 55,000 cfm
1air handling unit and 1 supply fan is the allowance for future growth
Minimum space required = 16,512 ft^2 total for two rooms

Figure I-51. Primary/Secondary Confinement Supply, Room H-300
Primary:
1 air handling unit and 1 supply fan is required to supply 28,130 cfm
1 air handling unit and 1 supply fan as standby
1 air handling unit and 1 supply fan is the allowance for future growth

Secondary:
8 air handling units and 8 supply fans are required to supply 234,260 cfm
1 air handling unit and 1 supply fan is the allowance for future growth
Minimum space required = 27,559 ft^2

Figure I-52. Fuel Storage Pool Tertiary Confinement Supply, Room H-383A
4 air handling units and 4 supply fans are required to supply 104,030 cfm
2 air handling unit and 2 supply fan is the allowance for future growth
Minimum space required = 16,672 ft^2

6.2.5.7.2 Exhaust equipment Space Requirements: HEPA filter equipment selection is based on maximum capacity of 18,000 cfm per Section 6.2.5.3.1. Exhaust fans is based on a maximum capacity of 30,000 cfm per Section 6.2.5.5. The following figures provide the outline of the equipment arrangement that determine the minimum space required.

Figure I-47. Secondary Confinement Exhaust, Room H-400
14 HEPA filter plenum and 8 exhaust fans are required to exhaust 234,260 cfm
2 HEPA filter plenums and 1 exhaust fan is the allowance for future growth
Minimum space required = 34,400 ft^2

6.2.5.7.3 Primary Confinement Exhaust Space Requirements: Primary Exhaust Filtration Systems are enclosed in a hardened structure.

Figure I-47. Primary Confinement Exhaust, Room H-400A
2 HEPA filter plenum and 1 exhaust fan to exhaust 28,130 cfm
1 HEPA filter plenum and 1 exhaust fan as standby
1 HEPA filter plenum and 1 exhaust fan is the allowance for future growth
Minimum space required = 7,678 ft^2

Figure I-47. Emergency Confinement Exhaust, Room H-400B
3 HEPA filter plenum and 2 exhaust fans to exhaust 55,000 cfm
1 HEPA filter plenum and 1 exhaust fan is the allowance for future growth
Minimum space required = 7,068 ft^2

Figure I-47. Emergency Confinement Exhaust Room H-400C
3 HEPA filter plenum and 2 exhaust fans to exhaust 55,000 cfm
1 HEPA filter plenum and 1 exhaust fan is the allowance for future growth
Minimum space required = 7,638 ft^2

6.2.5.7.4 Tertiary Confinement Exhaust Space Requirements: The Tertiary Confinement Exhaust Equipment are located in two different levels.

Figure I-48. Tertiary Confinement Exhaust/Recirculation for Occupied Areas, Room H-201
8 HEPA filter plenums and 5 exhaust fans to exhaust 145,842 cfm
2 HEPA filter plenum and 1 exhaust fan is the allowance for future growth
Minimum space required = 29,058 ft^2

Figure I-49. Tertiary Confinement Exhaust Room H-171
10 HEPA filter plenums and 6 exhaust fans to exhaust 181,412 cfm
3 HEPA filter plenums and 2 exhaust fan is the allowance for future growth
Minimum space required = 25,434 ft^2

6.2.5.7.5 Fuel Storage Pool Area Exhaust

Figure I-52. Fuel Storage Pool Tertiary Confinement Exhaust, Room H-383B
6 HEPA filter plenums and 4 exhaust fans to exhaust 104,030 cfm
2 HEPA filter plenum and 1 exhaust fan is the allowance for future growth
Minimum space required = 17,484 ft^2

6.2.5.7.6 Hydronic Equipment Room, Room H-204: This area is provided to house miscellaneous equipment such as heat exchangers, pumps, and tanks.

Minimum space required = 6,313 ft^2

Electrical Distribution HVAC Room H-171A: Equipment selection is based on a capacity of 17,000 cfm per Section 6.2.5.4. This equipment room houses the air-handling unit for cooling the Electrical Distribution Room (H-168).
1 Operating air handling unit, and 1 standby unit
Minimum space required = 2,200 ft^2

Cold Support HVAC (H-157): Equipment selection is based on a capacity of 36,400 cfm per Section 6.2.5.4. Located in this room is the air cooling equipment for the miscellaneous Cold Support Areas.
2 air handling units @ 100 % capacity each with no standby provision
Minimum space required = 4000 ft^2

6.2.5.7.7 Stack Monitoring Rooms (H-171B and C): Two stack monitoring rooms (H-171B and C) are provided to house the stack monitoring instrumentation and accessories with one room provided as a back-up. The required minimum floor area for each room is 100 ft^2 with a minimum room height of 12 ft. The total minimum required floor area for the two rooms is 200 ft^2.

The total minimum required space to house the major pieces of HVAC equipment in the WHB is equal to 241,056 ft^2. This requirement does not include miscellaneous support equipment areas, basically areas with independent fan coil systems that would suggest locating the cooling equipment within the room it serve based on preliminary economic evaluation.

6.2.6 Miscellaneous Building Support Areas

The WHB contains miscellaneous systems and support areas required for safely managing, maintaining, and operating various functional areas throughout the entire structure. These systems include but are not limited to fire protection, electrical power, egress circulation, and communication systems. The floor area requirements for these functions are based on the requirements identified in the VA SPA (CRWMS M&O 1997c).

Currently, additional functional requirements and design inputs to the facility analysis have modified selected functional areas. The changes or modifications to affected functional areas indicated in the VA SPA (CRWMS M&O 1997c) are identified in the specific program area analysis. Modified functional areas in the specific program area analysis that do not have a reference indicator are considered additional assumptions. The descriptions for these assumptions are located in Section 5.3.3. These assumptions are believed reasonably bounding for the purposes of this analysis.

6.2.6.1 Fire Protection

The following descriptions and requirements are from the *Waste Handling Building Fire Protection System Description Document* (CRWMS M&O 2000i, Sections 1.2.6.3 and 1.2.6.5):

The WHB is provided with fire suppression and alarm systems meeting the requirements of DOE Order 420.1, *Facility Safety* 1996, Implementation Guide for use with DOE Orders 420.1 and 440.1, *Fire Safety Program* 1995. For requirements governed by both the NRC and DOE Order 420.1, NRC requirements take precedence. Adequate area is provided for sprinkler system risers. Twelve risers are provided to service the building. Maximum square footage of protection for each riser is 52,000 sq ft, per NFPA 13, 1999, Sec. 5.2. A fire alarm annunciation panel is located within the vestibule at the main entry to the facility.

The required fire riser area is located either in a separate room or within a general area that does not detract from the function of the space. Each riser requires area for the riser piping, valves, backflow preventer, and associated alarm annunciation. The riser space may be open to the building structure above. Minimum required floor area for each riser is 100 sq ft, based on a 10-ft by 10-ft floor area. Total area for 12 riser rooms (H-167A, H-167B, H-167C, H-167D, H-167E, H-167F, H-167G, H-267C, H-267D, H-267E, H-267F, H-367G) is 1,200 sq ft.

6.2.6.2 Electrical

The electrical power distribution system for the WHB consists of normal and backup power. Backup power is provided for critical safety systems and consists of emergency diesel generators and uninterruptible power supplies. All backup power sources are located within the WHB facility. Safety class of systems, with associated requirements for emergency and uninterruptible power, has not been determined.

The emergency diesel generator is located in the Emergency Generator Room (H-169A), the associated emergency power distribution equipment switchgear etc. is located in the Safety Electrical Equipment Room (H-172A and H-172B) and the normal power, non emergency power equipment, is located in the Electrical Power Distribution Room (H-168). The minimum floor areas required for these spaces are 7,600 ft^2 for normal electrical power distribution equipment (H-168), 1,080 ft^2 for emergency power distribution equipment (H-172A and H-172B), and 2,160 ft^2 for the emergency diesel generator (H-169A and H-169B).

6.2.6.3 Communication

A Communication room (H-170) is provided for telephone, radio, computer networking, and building/site alarm system equipment. The ceiling is open to the underside of the building structure above. Communication systems are yet to be defined. A minimum of 480 ft^2 is required.

6.2.7 Building Structure

The WHB site is located on the North Portal Pad, which was constructed for the ESF. The North Portal Pad is located along the western margin of Midway Valley, at the eastern base of Exile Hill. It is an area of approximately 800 to 1,200 ft by 600 to 700 ft of man-made fill sloping roughly 2 degrees to the east, and is situated at approximately 3,670 to 3,683-ft elevation. ESF tunnel muck piles along the eastern side of the North Portal Pad rise to approximately 3,700-ft elevation. The eastern part of the WHB footprint is in the area of the present muck storage (Figure I-11, Attachment I) (CRWMS M&O 1999h, Section 1.2.2).

The WHB is located on the surface within the protected area of the MGR site. The WHB system provides space and layout to support waste handling operations, staging of WPs, and storage of empty DCs. The WHB System also helps maintain a suitable environment for personnel and equipment that supports the waste handling operations; protects the systems within the WHB from natural and induced environments; confines contaminants; provides radiological protection to personnel; and provides space and layout for industrial and radiological safety systems, operations control and monitoring, safeguards and security systems, fire protection systems, ventilation systems, and utilities systems. The WHB also provides the required space and layout for maintenance, tool storage, and personnel administrative and support facilities (CRWMS M&O 2000k, Section 1.1).

The WHB System integrates waste handling systems within its protective structure to support the throughput rates established for waste emplacement. The system also provides shielding, layout, and other design features to help limit personnel radiation exposure to levels that are ALARA (CRWMS M&O 2000k, Summary).

The preliminary building design is shown on Figures I-1 through I-9 in Attachment I. The WHB is about 600-ft wide and 700-ft long with finished floor elevation at 3,682 ft. The grades around the WHB will be approximately 3,681-ft elevation from the northwest corner to the southeast corner of the building; will vary from approximately 3,681 to 3,680-ft elevation along the west side of the building; and will vary from approximately 3,680 to 3,679-ft elevation along the south side of the building. While most of the WHB has no floor area below the finished floor elevation, the base of the mat for the pools and pool treatment equipment room is over 50 ft below finished floor elevation (CRWMS M&O 1999h, Section 1.2.3).

Pool Storage Building (PSB) modules will be constructed west of and adjacent to the WHB, near the ATS line unloading pools, and will be connected via underwater transfer canals (Figure I-4, Attachment I).

The outside plan dimensions of a PSB module is 280-ft long by 194-ft wide, with common water-cooling and purification equipment located between the pools (Figure I-4). The internal dimensions of the storage pool are 36.5-ft wide by 160-ft long, and 50-ft deep (Figures I-19 and I-20).

The PSB superstructure modules will be steel-framed buildings with metal clad siding. The clear space of 38 ft above the pool deck is required for operations. A floor above the pool area will house the HVAC equipment. The total height of the steel frame structure will be approximately 70 ft above the finish ground. The structure is considered safety-related and will require design to preclude collapse during a design basis event in accordance with NRC criteria for nuclear facilities.

The water pools will require thick concrete floors and walls lined with stainless steel plate to ensure no loss of water. Wall thickness will be determined by lateral loads from earthquakes, hydrodynamic forces from sloshing water during earthquake ground motion, potential cask drops, and other possible accidents. The stainless steel liners will be the primary containment with leak detection systems. The concrete walls of the water pools will serve as secondary containment.

The primary factor for sizing of the structural system is expected to be the need for radiation shielding. Based on the preliminary shield wall assessment of Attachment II, Section 1.2, the DC Load Cells, the DC Decontamination Cells, the AHC, the AHC Crane Maintenance Bays, the lower level of the Canister Transfer Cell, the Canister Transfer Cell, the upper level of the Off-normal Canister Handling Cell, the Canister Transfer Cell Crane Maintenance Bay, the DC Handling Cell, the Loaded DC Staging Area, the DC Handling Cell Crane Maintenance Bay, and the WP Remediation Cell (Table 6-2 and Figure I-1) will require 5-ft thick concrete walls up to a height of 30 ft above the operating floor. Above 30 ft, the wall thickness can be stepped down to 3 ft up to the rooftop.

The roof structures will act as both shielding and tornado-generated missile barriers. Because the radiation shielding requirements will decrease due to distance from the source on the floor, it is assumed that the roof structure will be a concrete slab 8- to 10-in. thick supported by steel beams and the concrete walls. The 8- to 10-in. thick slab is based on shielding design for tornado missiles protection in similar facilities containing nuclear material. The walls and roof structures will result in loads of more than 50,000 lbs. per foot of wall over one half of the building (CRWMS M&O 1997c, Section 7.2.7).

In the areas where filled WPs/DCs will be handled, 3-ft thick concrete walls provide the required shielding protection. Wall thickness of 1.5 ft above the 10-ft elevation will be safe in the horizontal WP loadout area (CRWMS M&O 1997c, Section 7.2.7).

Secondary factors that impact the size of the structural system and the resulting foundation is the concentrated loads on the operating floor due to heavy duty overhead cranes with capacities of up to 125 tons and 90 to 140 ton concentrated loads on the operating floor from casks and DCs on transfer carts. These concentrated loads can be over most of the operating floor of the building (CRWMS M&O 1997c, Section 7.2.7).

Two transfer corridors with overhead cranes are required for moving equipment to the hot support area for repair work. One transfer crane operates above the wet and dry process DC load areas, and the other crane will operate over the WP Remediation area (H-114). Since radiation shielding is not required for the corridors, the structural systems can consist of structural steel beams, columns, and bracing with heavy metal clad siding. The columns of the transfer corridor areas may be supported by concrete column pilasters built into the thick concrete walls below.

The pool area of the wet process lines consists of seven water pools, two pools for staging and cask unload, one non-standard fuel pool, and four storage pools (Table 6-2 and Attachment I, Figure I-4). The water pools will require thick concrete walls lined with stainless steel plate to ensure no loss of water. Wall thickness will be determined by lateral loads from earthquakes, hydrodynamic forces from sloshing water during earthquake ground motion, potential cask drops, and other possible accidents. The stainless steel liners will be the primary containment with leak detection systems. The concrete walls of the water pools will serve as secondary containment.

The superstructure of the dry process cask prep areas, wet process pool areas, cask prep areas, equipment and tool rooms, and the carrier bay can be heavy metal clad structural steel framing since there are no shielding requirements. However, heavy floor loads will be present in the carrier bay area from railcars and trucks. The roof areas of the Tertiary Confinement Exhaust, Tertiary Confinement Supply, Tertiary Confinement Re-circulating, Primary and Secondary Confinement Supply Room, and Primary and Secondary Confinement Exhaust will be the supporting floors for the WHB facility HVAC equipment (Table 6-2). Since these areas have no radiation shielding requirements, the superstructure can be structural steel framing with metal siding and roofing.

The column spacing would be in the range from 16 to 30 ft, resulting in steel columns supporting elevated equipment floors, overhead cranes, and roof structures (CRWMS M&O 1999h, Section 1.2.3).

The potential WHB structure will be supported on a 5-ft thick reinforced-concrete slab. Although the locations where the estimated loads would be applied have not been finalized, based on wall/roof loading of 50 kips per foot of 5-ft thick wall and the load distribution attributed to the 5-ft thick slab-on-grade, it is estimated that the load transmitted from the slab to the soil will be on the order of 3 kips per square foot, including 0.75 kips per sq ft for the mass of the 5-ft thick slab-on-grade (CRWMS M&O 1999h Section 1.2.3).

The cold support facility consists of administrative offices and laboratories for the WHB operations. This is a commercial type facility without radiation shielding requirements. The first floor of this two-story steel framed structure with sheet metal siding will be a slab on grade. The second floor concrete slab and metal deck roof will be supported by steel beams and columns. Combined spread footings for columns will be used to avoid possible settlements due to the use of uncontrolled fill to construct the existing pad. The cold support structure will be separated from the WHB to avoid interaction during an earthquake (CRWMS M&O 1997c, Section 7.2.7).

The carrier washdown and empty DC preparation buildings are industrial type facilities without radiation shielding requirements. They will be constructed with light steel framing with sheet metal siding. Rail and truck transporters will be bringing empty DCs into these buildings. The floor slab will be designed for the rail and truck wheel loads and the storage of empty DCs (CRWMS M&O 1997c, Section 7.2.7).

The WHB will be seismically isolated from the WTB, located to the north, the cold support facility, and the DC preparation building to avoid structural interaction during an earthquake.

The design for natural phenomena hazards, such as earthquakes, tornadoes, and wind, will be completed in a future analysis (CRWMS M&O 1997c, Section 7.2.7).

6.2.7.1 Waste Handling Building Foundation

6.2.7.1.1 Existing Site Conditions

The WHB is sited on the existing North Portal pad constructed for the ESF. The existing geotechnical data is discussed in *Preliminary Geotechnical Investigation for Waste Handling Building, Yucca Mountain Site Characterization Project* (CRWMS M&O 1999h) and is summarized in this section.

Common Fill for the North Portal pad was required to have a 30-in. maximum size and contain no debris; there were no other material requirements. The specifications required that the Common Fill be placed in layers that were as thick as the maximum particle size plus 6 in. (consequently, up to 36-in. lift thickness). Common Fill that had less than 30 percent of its particles retained on the ¾-in. sieve was required to be compacted to at least 95 percent of the maximum dry density and to at least 90 percent in the deeper fill. If the Common Fill had more than 30 percent of its particles retained on the ¾-in. sieve, it was to be compacted by 5 complete passes of a 10-ton (minimum) vibratory sheepsfoot roller or a 35-ton (minimum) non-vibratory sheepsfoot roller. The water content of the fill was required to be not more than two percentage points above the optimum water content of the material. (CRWMS M&O 1999h, Section 3.7)

The WHB would be located in the fill pad that was constructed for the ESF North Portal Surface Facility (ESF-NPSF). The ESF-NPSF grading operations are described in field data forms and are largely undocumented from a geotechnical-engineering point of view. The fill pad at the ESF-NPSF consists of material from at least three sources. The initial fill was obtained from a bench cut into the colluvium and shallow bedrock at the location of the North Portal of the ESF tunnel. Additional fill was obtained from borrow pits at Forty Mile Wash and Fran Ridge. Laboratory tests of material from SFS-TP-3 and soil engineering properties of the additional fill material from Borrow Pit #3 are presented in the *Preliminary Geotechnical Investigation for Waste Handling Building, Yucca Mountain Site Characterization Project*, (CRWMS M&O 1999h, Section 3.7, Table 3-3 and Table 3-4).

Finally, as the ESF tunnel was being excavated, tunnel muck was placed on and/or adjacent to the fill, extending the pad to its present size using muck from initial ESF tunneling. Some of the Common Fill failed to meet the 95 percent minimum relative compaction requirement and had to be reworked and re-tested, sometimes several times, before a passing retest was obtained. The summary of soil engineering properties at the ESF Test Pit, ESF-3 is found in *Preliminary Geotechnical Investigation for Waste Handling Building, Yucca Mountain Site Characterization Project* (CRWMS M&O 1999h, Section 3.7, Table 3-6).

Review of the construction records lead to the conclusion that the North Portal Pad should not be considered engineered fill. Obviously, the same is true of the adjacent muck piles onto which the WHB would extend, for which even less documentation exists. (CRWMS M&O 1999h, Section 3.7)

6.2.7.1.2 Foundation Systems

The analysis and evaluation of the subsurface conditions and the potential WHB characteristics resulted in two types of foundation systems to be considered. The two foundations potentially feasible are the mat foundation and a drilled shaft foundation. (CRWMS M&O 1999h, Section 7.3)

The mat foundation alternative is predicated on removing the non-engineered fill (North Portal Pad and muck piles) that has been placed at the potential WHB site. The non-engineered fill should be removed because their geotechnical properties cannot be ascertained with the existing data and cannot be adequately ascertained even with additional exploration and testing. The removal should include all fill underlying the mat foundation and lying within a horizontal distance beyond the edges of the mat foundation that is equal to the difference in the elevations of the base of the mat and the base of the non-engineered fill. From this limit, either temporary shoring or an inclined cut slope may be constructed. (CRWMS M&O 1999h, Section 7.3)

On the other hand, the drilled shaft foundation alternative would not necessarily have to remove the non-engineered fill. However, the cost of removing the non-engineered fill might be partially or entirely offset by potential savings due to increased resistance to lateral loading from engineered fill relative to non-engineered fill, which could result in smaller drilled shafts. Because the mat foundation is expected to be significantly more economical than a drilled shaft foundation, only the mat foundation alternative is being considered. (CRWMS M&O 1999h, Section 7.3)

6.2.7.1.3 Engineered Fill

Engineered fill will be required to achieve the final grades and to replace the non-engineered fill. Relative to the grades of the north portal pad (excluding muck piles), about 2 ft of fill is required along the west side of the potential WHB and about 20 to 30 ft along the east side. Relative to the pre-north portal pad grade (original grade), about 10 to 15 ft of fill are required along the west side of the potential WHB and about 20 to 30 ft along the east side. It is recommended that the engineered fill consist of alluvial/colluvial sand and gravel from the potential WHB excavations or other local alluvial/colluvial sources. A preferred borrow source should be identified, and a geotechnical investigation of the borrow source should be performed prior to construction. The characteristics of borrow material, and particularly the coarseness of its particle-size distribution, will determine the modalities of fill control during construction and affect the construction specifications. (CRWMS M&O 1999h, Section 7.4)

If the engineered fill material is mainly sand and fine gravel, fill control can be by relative compaction or relative density. Then, the fill should be compacted to a predetermined degree, such as at least 95 percent of its maximum dry unit weight or at least 75 percent relative density.

6.2.7.1.4 Bearing Capacity and Settlement

The design of the WHB mat foundation is expected to be limited by settlement rather than bearing capacity (CRWMS M&O 1999h, Section 7.5.1).

Because loading data was unavailable for settlement calculations, it is estimated that the building loads could be approximated by a uniform load of 3,000 lbs/ft^2 acting at the base of the main mat (elevation 3,676.5 ft). For this calculation, the 3,000 lbs/ft^2 was treated as a uniform net load. This means that in the deeper parts of the WHB, the 3,000 lbs/ft^2 is the increase in load over the existing vertical stress; however, the settlement associated with reloading, which is expected to be small, was neglected. The engineered fill placed at the site also represents a load that will result in settlement at the potential WHB site. Whether that settlement affects the potential WHB depends on whether the engineered fill is placed before the WHB is constructed or after. On the basis that the engineered fill will be placed before the WHB is constructed, the WHB will experience smaller total settlements. The presence of other loads, such as might be imposed by any adjacent structures such as the WTB, was not considered. (CRWMS M&O 1999h, Section 7.5.1)

The typical soil profile at the WHB will consist of engineered fill overlying alluvium/colluvium deposits, which in turn overlie tuffaceous bedrock. The alluvium/colluvium deposits at the WHB site consist of silty sand to well-graded gravel with sand. The engineered fill to be placed at the WHB site will be similar to the alluvium/colluvium material and will be compacted to at least 95 percent of the maximum dry unit weight. (CRWMS M&O 1999h, Section 7.5.1)

Because of the granular nature of the soil and its location above the water table, it is expected that the majority of settlements will occur "instantaneously," that is, as the load is applied or within one month of the end of loading. Creep is expected to be small and was not considered. (CRWMS M&O 1999h, Section 7.5.1)

For the uniform 3,000 lbs/ft^2 load, it is estimated that immediate settlements will be about 0.25 in. or less along the perimeters of the potential WHB and about 0.5 in. or less in interior areas, along the building perimeters, lower settlements are expected to occur at the salient corners and higher settlements at re-entrant corners. (CRWMS M&O 1999h, Section 7.5.1)

As mentioned above, building settlement estimates are on the bases of the engineered fill be placed before the WHB is constructed. However, it may be worthwhile in future investigations to examine other construction sequence scenarios, which may have the effect of increasing total settlement in some areas, but decreasing differential settlement across the structure. Also, it may be preferred to construct the deep basement areas (pool areas) after excavating the non-engineered fill and before placing the engineered fill above about 3,660-ft elevation in order to reduce the height of the temporary excavation. (CRWMS M&O 1999h, Section 7.5.1)

6.2.7.1.5 Modulus of Subgrade Reaction

The modulus of subgrade reaction for a one-foot square plate, k_{v1}, is expected to range from 300 to 2,000 $tons/ft^3$ for the main mat bearing at elevation 3,676.5, and from 800 to 6,000 $tons/ft^3$ for the lower mat bearing at elevation 3,626.5 ft to 3,628.5 ft (CRWMS M&O 1999h, Section 7.5.2).

6.2.7.1.6 Lateral Earth Pressures

The recommended value for the permanent static total lateral earth pressures on subsurface walls of the WHB, were estimated to be 4,367 lb/ft^2 (CRWMS M&O 1999h, Section 7.5.4, Table 7-4). These are residual (permanent) static lateral earth pressures at depth of 100 ft, they are the stresses that will be felt after construction is completed. The permanent static lateral earth pressures at any depth can be linearly interpolated.

The backfill friction angle was taken as 42 degrees and the backfill unit weight was taken as 132 lbs. per cubic foot. Groundwater is not included, as the groundwater table is so deep. For the calculation of residual (permanent) static lateral earth pressure, the basement walls are constructed before the fill is placed. Also, the basement walls are restrained against deflection under static conditions, such that active earth pressures cannot develop. (CRWMS M&O 1999h, Section 7.5.4)

Backfill compaction will be performed in a manner to minimize the lateral earth pressures on the walls (CRWMS M&O 1999h, Section 7.5.4).

Dynamic lateral pressures imposed on the walls due to design-level seismic shaking have been evaluated by the Seed-Whitman approach (CRWMS M&O 1999h, Section 7.5.4).

6.2.7.1.7 Vapor Barrier

It is desirable to install impervious sheeting under the WHB mats to act as a vapor barrier. The purpose of a vapor barrier would be to prevent migration of water into and through the mats. Such water vapor may contain soluble salts, such as sulfates, leached from the soil. Some of these salts may affect the reinforced concrete mat. In addition, when the migrating water evaporates inside the building, the salts remain as an encrustation (efflorescence) that can affect floor coverings. This condition can occur even when standing water is not observed on the floor. Vapor barriers can also be helpful in reducing the entry of gases, such as radon, into buildings. If impervious sheeting is used, it should be placed on and covered by 2-in. thick layers of clean sand. (CRWMS M&O 1999h, Section 7.5.3)

6.2.7.1.8 Depth of Frost Penetration

The depth of frost penetration for the WHB foundation design is estimated to be 15 in. (CRWMS M&O 1999h, Section 7.5.6).

6.2.8 Facility Program Area Summary

Table 6-2 summarizes the provided floor areas and ceiling heights indicated in the figures for the WHB. Sections 6.2.1 through 6.2.6 indicate the minimum square footages required by each individual functional space contained in the WHB systems analysis. The adjacency requirements that define efficient functional relationships between individual spaces and system areas are described in the individual sections. The provided floor areas indicated are net square footages and do not include allowances for building structure (i.e. walls, columns) needed to determine the gross square footage for the entire facility.

The net total, taken from Table 6-2, is 645,600 ft^2, and the square foot number has been rounded to two significant digits.

Table 6-2. WHB Facility Program Area Summary

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
		Primary Areas			
		CCHS			
H-100A	Carrier Bay	80'-0"	196'-0"	15,680	60'-0"
	Subtotal			**15,680**	
		ATS			
H-040	Vacuum Pump Room	45'-0"	105'-0"	4,725	45'-0"
H-101A	Cask Airlock	23'-0"	*21'-0"	483	28'-0"
H-101B	Cask Airlock	23'-0"	*21'-0"	483	28'-0"
H-102A	Cask Prep and Decontamination	43'-0"	*40'-0"	1,730	71'-0"
H-102A2	Cask Prep and Decontamination	37'-0"	44'-0"	1,628	71'-0"
H-102B	Cask Prep and Decontamination	43'-0"	*40'-0"	1,730	71'-0"
H-102B2	Cask Prep and Decontamination	37'-0"	44'-0"	1,628	71'-0"
H-103A	Cask Unloading Pool Area	85'-0"	44'-0"	3,740	71'-0"
H-103A1	Pool, Staging & Cask Unload	49'-0"	21'-0"	WATER	50'-0"
H-103B	Cask Unload Pool Area	85'-0"	44'-0"	3,740	71'-0"
H-103B1	Pool, Staging & Cask Unload	49'-0"	21'-0"	WATER	50'-0"
H-104A	Incline Transfer Canal	72'-0"	6'-0"	WATER	18'-0"
H-104B	Incline Transfer Canal	72'-0"	6'-0"	WATER	18'-0"
H-105A	DC Load Cell	20'-0"	38'-0"	760	28'-0"
H-105B	DC Load Cell	20'-0"	38'-0"	760	28'-0"
H-106A	DC Decontamination Cell	24'-0"	38'-0"	912	28'-0"
H-106B	DC Decontamination Cell	24'-0"	38'-0"	912	28'-0"
H-183	Fuel Storage Pool Area	*278'-0"	*190'-0"	50,395	40'-0"
H-183A	Fuel Basket Storage Pool	160'-0"	37'-0"	WATER	50'-0"
H-183B	Fuel Basket Storage Pool	160'-0"	37'-0"	WATER	50'-0"
H-183C	Fuel Basket Storage Pool	160'-0"	37'-0"	WATER	50'-0"
H-183D	Fuel Basket Storage Pool	160'-0"	37'-0"	WATER	50'-0"
H-183E	Non-Standard Fuel Pool	*30'-0"	15'-0"	WATER	50'-0"
H-183F	Fuel Basket Transfer Canal	82'-0"	6'-0"	WATER	39'-0"
H-183G	Fuel Basket Transfer Canal	82'-0"	6'-0"	WATER	39'-0"
H-183H	Non-Standard Fuel Basket Transfer Canal	36'-0"	6'-0"	WATER	39'-0"
H-183J	Non-Standard Fuel Handling Area	45'-0"	36'-0"	1,620	40'-0"
H-205A	AHC	66'-0"	38'-0"	2,508	50'-0"
H-205B	AHC	66'-0"	38'-0"	2,508	50'-0"
H-206A	AHC Crane Maintenance Bay	24'-0"	38'-0"	912	50'-0"
H-206B	AHC Crane Maintenance Bay	24'-0"	38'-0"	912	50'-0"
H-301A	Pool Area Crane Maintenance Bay	25'-0"	44'-0"	1,100	17'-0"
H-301B	Pool Area Crane Maintenance Bay	25'-0"	44'-0"	1,100	17'-0"
	Subtotal			**82,300**	

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
		CTS			
H-100B	Cask Transfer Corridor	100'-0"	20'-0"	2,000	28'-0"
H-103C	Canister Transfer Cell, Lower Level	102'-0"	*28'-0"	2,850	28'-0"
H-103D	Canister Staging	29'-0"	12'-0"	348	28'-0"
H-104C	Off-Normal Canister Transfer Tunnel	35'-0"	10'-0"	350	25'-0"
H-107A	Cask Airlock	40'-0"	23'-0"	920	28'-0"
H-108A	Cask Prep & Decontamination	45'-0"	38'-0"	1,710	40'-0"
H-205C	Canister Transfer Cell Upper Level	78'-0"	35-0"	2,730	34'-0"
H-205C1	Off-Normal Canister Handling Cell	102'-0"	30'-0"	3,060	34'-0"
H-209A	Canister Transfer Cell Crane Maintenance Bay	24'-0"	35'-0"	840	34'-0"
	Subtotal			**14,800**	
		DCHS			
H-110	DC Handling Cell	*53'-0"	*300'-0"	15,900	71'-0"
H-111	WP Transporter Loading Cell	72'-0"	36'-0"	2,592	30'-0"
H-112	WP Transporter Airlock	72'-0"	36'-0"	2,592	22'-0"
H-113	Loaded DC Staging Area	98'-0"	72'-0"	7,056	71'-0"
H-115	Empty DC Preparation Airlock	28'-0"	38'-0"	1,064	27'-0"
H-117	Empty DC Preparation	*180'-0"	86'-0"	15,480	50'-0"
H-208A	Welder #1	23'-0"	12'-0"	276	12'-0"
H-208B	Welder #2	23'-0"	12'-0"	276	12'-0"
H-208C	Welder #3	23'-0"	12'-0"	276	12'-0"
H-208D	Welder #4	23'-0"	12'-0"	276	12'-0"
H-208E	Welder #5	23'-0"	12'-0"	276	12'-0"
H-208F	Welder #6	23'-0"	12'-0"	276	12'-0"
H-208G	Welder #7	23'-0"	12'-0"	276	12'-0"
H-208H	Welder #8	23'-0"	12'-0"	276	12'-0"
H-301	DC Handling Cell Crane Maintenance Bay	72'-0"	59'-0"	4,248	33'-0"
	Subtotal			**51,140**	
		WPRS			
H-114	WP Remediation Cell	54'-0"	37'-0"	1,998	36'-0"
	Subtotal			**2,000**	
		Primary Support Areas			
H-116	Contaminated Equipment Room	45'-0"	42'-0"	1,890	85'-0"
H-118A	Operating Gallery	230'-0"	15'-0"	3,450	22'-0"
H-118B	Operating Gallery	85'-0"	20'-0"	1,700	16'-0"
H-118C	Operating Gallery	127'-0"	20'-0"	2,540	16'-0"

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
H-118E	Operating Gallery	148'-0"	15'-0"	2,220	16'-0"
H-118F	Operating Gallery	148'-0"	15'-0"	2,220	16'-0"
H-118G	Operating Gallery	14'-0"	20'-0"	280	28'-0"
H-118H	Operating Gallery	14'-0"	20'-0"	280	28'-0"
H-119	Waste Handling Operation Center	59'-0"	17'-0"	1,000	16'-0"
H-120	Contaminated Equipment & Decontamination	45'-0"	57'-0"	2,565	71'-0"
H-120A	Staging Area (Hot Support)	*204'-0"	*23'-0"	4,692	16'-0"
H-122	Maintenance Equip Storage	86'-0"	35'-0"	3,010	16'-0"
H-123	Tool Storage	100'-0"	20'-0"	2,000	28'-0"
H-124	Maintenance Shop	29'-0"	35'-0"	1,015	16'-0"
H-125	LLW Collection & Packaging	20'-0"	35'-0"	700	16'-0"
H-126	Forklift Staging & Servicing	35'-0"	58'-0"	2,030	16'-0"
H-203	Welder Maintenance Bay	34'-0"	205'-0"	6,970	39'-0"
H-207A	Operating Gallery	230'-0"	15'-0"	3,450	22'-0"
H-207B	Operating Gallery	69'-0"	20'-0"	1,380	16'-0"
H-207C	Operating Gallery	127'-0"	20'-0"	2,540	16'-0"
H-207D	Operating Gallery	102'-0"	15'-0"	1,530	16'-0"
H-207F	Operating Gallery	27'-0"	16'-0"	432	12'-0"
H-207G	Operating Gallery	27'-0"	16'-0"	432	12'-0"
H-207H	Operating Gallery	27'-0"	16'-0"	432	12'-0"
H-207I	Operating Gallery	27'-0"	16'-0"	432	12'-0"
H-207J	Operating Gallery	32'-0"	35'-0"	1,120	12'-0"
H-211	Welder Materials Storage	44'-0"	46'-0"	2,024	16'-0"
H-213	Welder Maintenance Hot Shop	34'-0"	65'-0"	2,210	39'-0"
H-402	Assembly & Canister Transfer Corridor	218'-0"	48'-0"	10,464	36'-0"
H-403	DC Handling & WP Remediation Equipment Transfer Corridor	57'-0"	142'-0"	8,094	28'-0"
	Subtotal			**73,100**	
Pool Support Areas					
H-020	Pool Treatment Equip Room	105'-0"	112'-0"	11,760	45'-0"
H-083	Pool Treatment Equip Room	30'-0"	70'-0"	2,100	45'-0"
H-084A	Pool Treatment Equip Room	40'-0"	20'-0"	800	45'-0"
H-084B	Pool Treatment Equip Room	40'-0"	50'-0"	2,000	45'-0"
H-085	Corridor	10'-0"	204'-0"	2,040	45'-0"
	Subtotal			**18,700**	
Facility Support Areas					
Maintenance					
H-019	Equipment Maintenance Shop	70'-0"	28'-0"	1,960	10'-0"
H-019B	Instrument Maintenance Shop	50'-0"	28'-0"	1,400	10'-0"

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
H-121	Shipping & Receiving	61'-0"	44'-0"	2,684	22'-0"
H-159	Tool Storage	16'-0"	17'-0"	272	10'-0"
H-160	Maintenance Material Storage	24'-0"	17'-0"	408	10'-0"
H-161A	HEPA Filter Storage	23'-0"	17'-0"	391	10'-0"
H-161B	HEPA Filter Storage	10'-0"	38'-0"	380	10'-0"
H-162	Janitor Closet	17'-0"	7'-0"	119	9'-0"
H-163	Shipping & Receiving	155'-0"	38'-0"	5,890	12'-0"
H-164	Waste Staging	20'-0"	10'-0"	200	12'-0"
H-165	Gas Bottle Storage	5'-0"	10'-0"	50	9'-0"
	Subtotal			**13,800**	
		Operations			
H-016A	Change Room, Men	45'-0"	20'-0"	900	9'-0"
H-016B	Change Room, Women	46'-0"	20'-0"	920	9'-0"
H-017A	Coverall Storage	10'-0"	17'-0"	170	9'-0"
H-017B	Coverall Storage	10'-0"	17'-0"	170	9'-0"
H-133A	Health Physics Laboratory	40'-0"	20'-0"	800	10'-0"
H-133B	Health Physics Laboratory	40'-0"	20'-0"	800	10'-0"
H-134A	Laboratory Technicians Office	12'-0"	20'-0"	240	9'-0"
H-134B	Laboratory Technicians Office	12'-0"	20'-0"	240	9'-0"
H-134C	Laboratory Technicians Office	12'-0"	20'-0"	240	9'-0"
H-134D	Laboratory Technicians Office	12'-0"	20'-0"	240	9'-0"
H-135	Laboratory Material Storage	20'-0"	10'-0"	200	10'-0"
H-136	First Aid Room & Office	17'-0"	17'-0"	204	9'-0"
H-137	Operations Lunchroom	17'-0"	37'-0"	1,369	9'-0"
H-138	Janitor Closet	10'-0"	20'-0"	200	9'-0"
	Subtotal			**6,700**	
		Administration			
H-018A	Supervisor Office	15'-0"	18'-0"	270	9'-0"
H-018B	Supervisor Office	15'-0"	18'-0"	270	9'-0"
H-139	Entry Lobby	20'-0"	10'-0"	200	9'-0"
H-140A	Supervisor Office	15'-0"	18'-0"	270	9'-0"
H-140B	Supervisor Office	15'-0"	18'-0"	270	9'-0"
H-141	Plant Operations Manager Office	20'-0"	12'-0"	240	9'-0"
H-142A	QA/QC Operations Office	15'-0"	20'-0"	300	9'-0"
H-142B	QA/QC Operations Office	15'-0"	20'-0"	300	9'-0"
H-143A	Operations Staff Office	15'-0"	8'-0"	120	9'-0"
H-143B	Operations Staff Office	15'-0"	8'-0"	120	9'-0"
H-143C	Operations Staff Office	20'-0"	12'-0"	240	9'-0"
H-143D	Operations Staff Office	20'-0"	12'-0"	240	9'-0"
H-144	Staff Support-Open Office	15'-0"	20'-0"	300	9'-0"

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
H-145A	Secretarial Office	14'-0"	10'-0"	140	9'-0"
H-145B	Secretarial Office	21'-0"	8'-0"	168	9'-0"
H-146A	DOE Manager Office	15'-0"	20'-0"	300	9'-0"
H-146B	DOE Manager Office	10'-0"	20'-0"	200	9'-0"
H-147A	DOE Staff Office	10'-0"	10'-0"	100	9'-0"
H-147B	DOE Staff Office	10'-0"	10'-0"	100	9'-0"
H-147C	DOE Staff Office	10'-0"	10'-0"	100	9'-0"
H-147D	DOE Staff Office	10'-0"	10'-0"	100	9'-0"
H-148 A&B	DOE Staff Support-Secretarial	40'-0"	10'-0"	400	9'-0"
H-149	DOE Staff Support-Clerical	34'-0"	22'-0"	748	9'-0"
H-150	Conference Room	24'-0"	27'-0"	648	9'-0"
H-151	Operations Clerk Office	15'-0"	17'-0"	255	9'-0"
H-151A	Document Control	10'-0"	17'-0"	170	9'-0"
H-152	Copy Room	10'-0"	15'-0"	150	9'-0"
H-153	Storage Room	5'-0"	11'-0"	55	9'-0"
H-154A	Restroom, Women	16'-0"	11'-0"	176	9'-0"
H-154B	Restroom, Men	16'-0"	11'-0"	176	9'-0"
H-155	Lunchroom	34'-0"	22'-0"	748	9'-0"
H-156	Janitor Closet	10'-0"	10'-0"	100	9'-0"
	Subtotal			**7,970**	
Radiation Protection					
H-010	Regulated Change Room	35'-0"	20'-0"	700	9'-0"
H-011	Radiation Protection Portal	50'-0"	10'-0"	500	9'-0"
H-012	Personnel Decontamination Room	15'-0"	15'-0"	225	9'-0"
H-013	Personnel Radiation Protection Equipment Storage	15'-0"	15'-0"	225	9'-0"
H-014	Health Physics Office	15'-0"	15'-0"	225	9'-0"
H-015A	Protective Clothing Storage	10'-0"	10'-0"	100	9'-0"
H-015B	Protective Clothing Storage	10'-0"	10'-0"	100	9'-0"
H-129	Calibration Shop	22'-0"	35'-0"	770	16'-0"
H-302	Regulated Change Room	26'-0"	20'-0"	520	14'-0"
H-305	Regulated Change Room	44'-0"	24'-0"	1,056	14'-0"
H-405	Regulated Change Room	29'-0"	13'-0"	377	14'-0"
	Subtotal			**4,800**	
Security					
H-130A	Security Portal	77'-0"	10'-0"	770	9'-0"
H-130B	Security Portal	25'-0"	20'-0"	500	9'-0"
H-131	Security Alarm Station	34'-0"	17'-0"	578	9'-0"
H-132A	Office	15'-0"	10'-0"	150	9'-0"
H-132B	Office	15'-0"	10'-0"	150	9'-0"
	Subtotal			**2,150**	

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
		HVAC Equipment Areas			
H-157	Cold Support HVAC	80'-0"	50'-0"	4,000	24'-0"
H-171	Tertiary Confinement Exhaust	*157'-0"	*162'-0"	25,434	30'-0"
H-171A	Electrical Distribution HVAC	88'-0"	25'-0"	2,200	30'-0"
H-171B	Stack Monitor Room	10'-0"	10'-0"	100	12'-0"
H-171C	Stack Monitor Room	10'-0"	10'-0"	100	12'-0"
H-200	Tertiary Confinement Supply	*206'-0"	*190'-0"	39,040	32'-0"
H-201	Tertiary Confinement Exhaust/Recirculating	*87'-0"	*334'-0"	29,058	31'-0"
H-204	Hydronic Equipment Room	107'-0"	59'-0"	6,313	20'-0"
H-300	Primary/Secondary Confinement Supply	167'-0"	167'-0"	27,559	28'-0"
H-308A	Primary Confinement Emergency Supply	*98'-0"	*86'-0"	8,428	24'-0"
H-308B	Primary Confinement Emergency Supply	*94'-0"	*86'-0"	8,084	24'-0"
H-383A	Fuel Storage Pool Tertiary Confinement Supply	178'-0"	94'-0"	16,672	24'-0"
H-383B	Fuel Storage Pool Tertiary Confinement Exhaust	186'-0"	94'-0"	17,484	24'-0"
H-400	Secondary Confinement Exhaust	200'-0"	172'-0"	34,400	26'-0"
H-400A	Primary Confinement Exhaust	122'-0"	65'-0"	7,678	26'-0"
H-400B	Emergency Confinement Exhaust	114'-0"	62'-0"	7,068	26'-0"
H-400C	Emergency Confinement Exhaust	114'-0"	67'-0"	7,638	26'-0"
	Subtotal			**241,260**	
		Miscellaneous Building Support Areas			
		Corridors and Hallways			
H-050	Corridor	165'-0"	15'-0"	2,475	15'-0"
H-051	Corridor	450'-0"	15'-0"	6,750	15'-0"
H-052	Corridor	460'-0"	15'-0"	6,900	15'-0"
H-053	Corridor	350'-0"	15'-0"	5,250	15'-0"
H-054	Corridor	175'-0"	15'-0"	2,625	15'-0"
H-120B	Corridor	6'-0"	130'-0"	780	16'-0"
H-127	Access Corridor	148'-0"	20'-0"	2,960	16'-0"
H-128	Access Corridor	90'-0"	20'-0"	1,800	16'-0"
H-181	Access Corridor	10'-0"	61'-0"	610	22'-0"
H-182	Access Corridor	15'-0"	60'-0"	900	22'-0
H-218	Access Corridor	150'-0"	20'-0"	3,000	16'-0"
H-219	Access Corridor	20'-0"	134'-0"	2,680	23'-0"
H-221	Access Corridor	234'-0"	20'-0"	4,680	16'-0"
H-224	Access Corridor	10'-0"	61'-0"	610	22'-0"
H-225	Access Corridor	264'-0"	5'-0"	1,320	39'-0"
H-226	Access Corridor	15'-0"	58'-0"	870	22'-0"

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
H-227	Access Corridor	205'-0"	5'-0"	1,025	12'-0"
H-306	Access Corridor	10'-0"	17'-0"	170	32'-0"
H-314	Access Corridor	160'-0"	8'-0"	1,280	12'-0"
H-315	Access Corridor	8'-0"	69'-0"	552	12'-0"
H-316	Access Corridor	6'-0"	60'-0"	360	12'-0"
H-401A	Access Corridor	92'-0"	8'-0"	736	14'-0"
H-401B	Access Corridor	81'-0"	6'-0"	486	14'-0"
H-401C	Access Corridor	14'-0"	82'-0"	1,148	22'-0"
H-401D	Access Corridor	10'-0"	50'-0"	500	14'-0"
H-401E	Access Corridor	6'-0"	42'-0"	252	12'-0"
H-401F	Access Corridor	6'-0"	142'-0"	852	12'-0"
	Additional Corridors (unassigned)	(Total Square Footage)		8,010	16'-0"
	Subtotal			**59,600**	
Airlock and Vestibule					
H-086	Vestibule	34'-0"	42'-0"	1,428	45'-0"
H-100C	Access Corridor	171'-0"	19'-0"	3,249	28'-0"
H-100D	Vestibule	18'-0"	23'-0"	414	40'-0"
H-100E	Vestibule	23'-0"	35'-0"	805	28'-0"
H-100F	Vestibule	12'-0"	15'-0"	180	16'-0"
H-101D	Airlock	20'-0"	20'-0"	400	16'-0"
H-101E	Airlock	20'-0"	20'-0"	400	16'-0"
H-101F	Airlock	10'-0"	12'-0"	120	12'-0"
H-101G	Airlock	15'-0"	20'-0"	300	16'-0"
H-101H	Airlock	45'-0"	38'-0"	1,710	16'-0"
H-116A	Access Corridor	42'-0"	8'-0"	336	16'-0"
H-183K	Vestibule	19'-0"	26'-0"	494	16'-0"
H-217	Airlock	15'-0"	20'-0"	300	16'-0"
H-220	Airlock	15'-0"	20'-0"	300	16'-0"
H-223	Vestibule	38'-0"	33'-0"	1,254	39'-0"
H-228	Vestibule	23'-0"	35'-0"	805	10'-0"
H-303	Airlock	20'-0"	20'-0"	400	14'-0"
H-304	Vestibule	36'-0"	67'-0"	2,412	23'-0"
H-307	Airlock	15'-0"	24'-0"	360	32'-0"
H-309	Access Corridor	6'-0"	200'-0"	1,200	12'-0"
H-310	Vestibule	19'-0"	24'-0"	456	12'-0"
H-312	Vestibule	8'-0"	12'-0"	96	12'-0"
H-313	Vestibule	34'-0"	24'-0"	816	24'-0"
H-317	Vestibule	22'-0"	15'-0"	330	24'-0"
H-404	Airlock	10'-0"	8'-0"	80	14'-0"
H-406	Airlock	10'-0"	13'-0"	130	14'-0"
H-407	Airlock	10'-0"	14'-0"	140	22'-0"
	Subtotal			**18,900**	

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
			Stairways		
	14 Stairways (unassigned)	(Total Square Footage)		2,560	Varies
	Subtotal			**2,560**	
			Electrical		
H-168	Electrical Power Distribution	75'-0"	102'-0"	7,650	30'-0"
H-169A	Emergency Generator	40'-0"	27'-0"	1,080	22'-0"
H-169B	Emergency Generator	40'-0"	27'-0"	1,080	22'-0"
H-172A	Safety Electrical Equipment	20'-0"	27'-0"	540	22'-0"
H-172B	Safety Electrical Equipment	20'-0"	27'-0"	540	22'-0"
	Subtotal			**10,900**	
			Fire Protection		
H-167A	Fire Riser	10'-0"	10'-0"	100	14'-0"
H-167B	Fire Riser	10'-0"	10'-0"	100	14'-0"
H-167C	Fire Riser	10'-0"	10'-0"	100	16'-0"
H-167D	Fire Riser	10'-0"	10'-0"	100	22'-0"
H-167E	Fire Riser	10'-0"	10'-0"	100	30'-0"
H-167F	Fire Riser	10'-0"	10'-0"	100	22'-0"
H-167G	Fire Riser	10'-0"	10'-0"	100	40'-0"
H-267C	Fire Riser	10'-0"	10'-0"	100	28'-0"
H-267D	Fire Riser	10'-0"	10'-0"	100	39'-0"
H-267E	Fire Riser	10'-0"	10'-0"	100	31'-0"
H-267F	Fire Riser	10'-0"	10'-0"	100	22'-0"
H-367G	Fire Riser	10'-0"	10'-0"	100	24'-0"
	Subtotal			**1,200**	
			Communications		
H-170	Communications Room	34'-0"	17'-0"	578	12'-0"
	Subtotal			**580**	
			Elevators		
	Four Elevators (unassigned)	(Total Square Footage)		560	
	Subtotal			**560**	
			Pipe Chase		
H-075	Pipe Chase	20'-0"	240'-0"	4,800	20'-0"
	Subtotal			**4,800**	

Table 6-2. WHB Facility Program Area Summary, continued

Facility Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
Utilities Corridor (Between Operating Gallery Levels)					
Unassigned	Utility Corridor (Between Operating Gallery Levels)	255'-0"	20'-0"	5,100	10'-0"
Unassigned	Utility Corridor (Between Operating Gallery Levels)	255'-0"	20'-0"	5,100	10'-0"
	Subtotal			**10,200**	
WHB Square Footage Summary					
TOTAL WHB *This dimension is an average due to the irregular shape of space. (Total provided floor area, not including building structure.)				**645,600**	

6.3 WASTE TREATMENT BUILDING

6.3.1 Process Areas

6.3.1.1 Low-Level Wastes

The process areas within the WTB provide space for the handling, processing, and packaging for disposal of site generated secondary LLW. The waste streams treated in the WTB are dry-solid LLW, recyclable liquid LLW, non-recyclable liquid LLW, and wet-solid LLW. The wet-solid LLW (spent ion exchange resins and filter cartridges) generated within the WTB are packaged for disposal within the WTB.

A total floor area of 36,800 ft^2 was defined in the VA SPA (CRWMS M&O 1997c, Section 7.3.1.1) for LLW processing in the WTB. It is assumed that the 36,800-ft^2 space determined previously is sufficient for location and operation of LLW processing equipment (Assumption 5.5.2). Therefore, no changes to the WTB concept presented in the VA SPA (CRWMS M&O 1997c) are necessary.

6.3.1.2 Mixed and Hazardous Wastes

Mixed waste is not anticipated to be generated as a result of normal MGR operations; however, should the need arise, provision has been made to stage a small quantity of packaged mixed waste within the WTB. As identified in the VA SPA (CRWMS M&O 1997c, Section 7.3.1.2), the area required is approximately 800 ft^2. This space is in addition to the 36,800 ft^2 identified for LLW processing.

As with mixed waste, it is not anticipated that significant quantities of hazardous wastes will be generated as a result of MGR operations. Hazardous waste, if generated, is to be packaged at its point of origin, and then staged in an area external to the WTB for proper shipment. Hazardous waste is excluded from entering the WTB to minimize the potential of generating mixed waste.

6.3.2 Facility Support Areas

The WTB contains functional areas within the facility required to support of the treatment process. These areas include Operations and Administration. Also included throughout the functional areas are the minimum required building circulation paths needed to connect operational personnel and equipment to essential facility functions. The floor areas and staffing levels that support this section are based primarily on the VA SPA (CRWMS M&O 1997c, Section 7.3.2).

Additional functional requirements, design inputs, and assumptions to the facility analysis have modified several functional areas. The changes or modifications to the affected functional areas indicated in the VA SPA (CRWMS M&O 1997c) are identified in the specific program area analysis. The assumptions descriptions are located in Section 5. These assumptions are believed to be reasonably bounding for the purposes of this analysis.

6.3.2.1 Security

The functional requirements for security operations are intended to identify the required security functions to be housed inside the WTB. The requirements anticipate that only two security portals are needed, with one security portal and a small office located at the main entry of the facility while the second security portal is at the shipping/receiving area. (CRWMS M&O 1997c, Section 7.3.2.1)

6.3.2.1.1 Security Portals

The Security Portals (T-105 and T-106) are arranged to provide entry and exit control points into the WTB. Each portal, one located at the main entry and the other at the shipping/receiving area entrance into the facility, includes a security officer and a personnel radiation counter. The minimum space required for each portal is 150 sq ft and the combined total not including the security office is 300 ft^2. (CRWMS M&O 1997c, Section 7.3.2.1.1)

6.3.2.1.2 Office

The shift office (T-107) provides space for one security person. This office is adjacent to the main security portal. The minimum space required for this area is 150 ft^2. (CRWMS M&O 1997c, Section 7.3.2.1.2)

6.3.2.2 Operations

The Operations area provides functional support spaces for operational activities and associated personnel. This area includes a parts storage room, men and women's change rooms with shower facilities, restrooms for non-radiological coverall worker clothing, coverall storage, a lunchroom, janitor closet, forklift staging and charging area, and a shipping/receiving area. (CRWMS M&O 1997c, Section 7.3.2.2)

6.3.2.2.1 Parts Storage

The parts storage room (T-108) is a required functional space within the WTB as indicated in the VA SPA (CRWMS M&O 1997c). The minimum space required for this area is 120 ft^2. (CRWMS M&O 1997c, Section 7.3.2.2.1)

6.3.2.2.2 Change Rooms

The change rooms (T-109 and T-110) including the associated showers are provided for both male and female operational and maintenance employees working within the WTB to change into worker coveralls. Restrooms are also provided in this area and are based on the anticipated male and female employees ratios planned for the WTB. The change rooms are located to provide direct access into the process areas of the facility. The combined minimum space required for both change rooms areas is 1,389 ft^2. (CRWMS M&O 1997c, Section 7.3.2.2.2)

6.3.2.2.3 Coverall Storage

The coverall storage (T-111) is provided for clean and dirty coverall clothing. The storage area is located adjacent to the change rooms. The minimum space required for this area is 85 ft^2. (CRWMS M&O 1997c, Section 7.3.2.2.3)

6.3.2.2.4 Lunchroom

The lunchroom (T-112) is provided for all operational personnel assigned to the WTB. The floor area includes space for minor food preparation, chairs and tables, and vending equipment. The food preparation area will support the heating of precooked foods and the storage area will accommodate minor refrigeration equipment. The minimum space required for this area is 980 ft^2. (CRWMS M&O 1997c, Section 7.3.2.2.4)

6.3.2.2.5 Janitor Closet

There are two janitor closets (T-113A and T-113B) incorporated into the WTB which provide janitorial supply storage. The combined minimum space required for both areas is 150 ft^2. (CRWMS M&O 1997c, Section 7.3.2.2.5)

6.3.2.2.6 Forklift Staging

The functional space requirements taken from the VA SPA (CRWMS M&O 1997c) identified the requirement of forklift staging (T-114) and circulation/forklift access corridor (T-129) in the operations area. The minimum number of forklifts to be staged has not been determined at this time. The space provided in the operations area is the same as the VA SPA (CRWMS M&O 1997c). This staging area is anticipated to house several parked forklifts, including a battery charging station. The circulation or corridor access provides general equipment movement and is needed to connect the forklift staging area to the process area in the WTB. The ceiling height in the forklift staging area is open to the underside of the building structure. The minimum space required for the forklift staging area is 1,340 ft^2 (CRWMS M&O 1997c, Section 7.3.2.2.6) and the minimum space provided for circulation is 1,755 ft^2, the total combined space provided is 3,195 ft^2.

6.3.2.2.7 Shipping/Receiving

The Shipping/Receiving area (T-115) provides a loading dock with a staging area to receive routine supplies for the process, operations, and administration areas. The loading dock is also used for shipping waste materials produced by the WTB process area. The dock area is positioned for direct access from the mixed waste accumulation areas and to the exterior of the facility where site-shipping activities are handled. The ceiling in this area is open to the underside of the building structure. The minimum space required for this area is 1,450 ft^2.

6.3.2.3 Administration

The Administration area includes spaces that house various management and support functions for the WTB. These spaces include supervisor and plant operations offices, staff offices, health physics and QA offices, inventory control office, a calibration lab, and copy/supply storage. The administrative area is located adjacent to the main entry to the facility. The minimum total square footage for the administration area is 1,900 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3)

6.3.2.3.1 Plant/Process Maintenance Supervisor Offices

Two offices (T-117 and T-118) are provided to accommodate a plant maintenance supervisor and a process maintenance supervisor. The minimum space provided for each office is 100 ft^2. The combined minimum total space required for this area is 200 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.1)

6.3.2.3.2 Plant Manager Office

One office (T-119) is provided for the WTB Plant Manager. The minimum space required for this area is 225 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.2)

6.3.2.3.3 Plant Management Supervisor Office

One office (T-120) is provided for the Plant Management Supervisor. The minimum space required for this area is 150 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.3)

6.3.2.3.4 Staff Support

The Staff Support Office (T-121) is an open floor plan work area intended to provide space for six workstations. The minimum space required for this area is 600 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.4)

6.3.2.3.5 Health Physics Office

The Health Physics Office (T-122) provides space for two HPTs and storage for radiation detection equipment and personnel dosimeter devices. The office is located adjacent to the instrument calibration shop and the entry point to the process area. The minimum space required for this area is 250 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.5)

6.3.2.3.6 Quality Assurance Office

One office (T-123) is provided for a QA Officer. The minimum space required for this area is 128 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.6)

6.3.2.3.7 Inventory Control Office

The inventory control office (T-124) is provided to accommodate inventory control of incoming and outgoing waste materials processed in the WTB. The minimum space required for this area is 128 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.7)

6.3.2.3.8 Copy/Storage Room

The copy/storage room (T-125) provides space for a copy machine, fax machine, and a storage area for general office supplies. The minimum space required for this area is 60 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.8)

6.3.2.3.9 Instrument Calibration

The instrument calibration shop (T-126) provides space for minor instrument calibration and storage space for radiological instruments used in the WTB. (Repairs to instruments are performed in the WHB.) The shop is located adjacent to the HPTs' office. The minimum space required for this area is 250 ft^2. (CRWMS M&O 1997c, Section 7.3.2.3.9)

6.3.2.4 Circulation

The functional space requirements for circulation of personnel (see Assumption 5.1.3) was included in the floor area analysis for the operation and administration areas excluding the forklift staging (T-114), forklift access corridor (T-129) and the shipping and receiving (T-115). The circulation requirements for the forklift staging (T-114), forklift access corridor (T-129) and the shipping/receiving area (T-115) were figured separately along with the remainder of the unassigned/assigned circulation (e.g. stairways, elevator and facility support air equipment) and the vestibule (T-130). The adjacency requirements for functional areas are direct and do not require additional space. The combined minimum space required is 2,400 ft^2. (CRWMS M&O 1997c, Section 7.3.2.4).

6.3.3 Waste Treatment Building Heating, Ventilation, and Air Conditioning Equipment Areas

6.3.3.1 Methodology

The methodology for determining the equipment room size for the WTB is similar to the methodology used for the WHB, Section 6.2.5, with the following exceptions:

6.3.3.1.1 There is no safety-related HVAC equipment for the WTB eliminating the need for a hardened equipment enclosure.

6.3.3.1.2 The HVAC system airflow capacities are smaller than the WHB and a clear ceiling height of 15 ft is adequate to accommodate the equipment, ductwork, and other utility support systems.

6.3.3.2 Air Flow Estimate

The development of the airflow quantities is shown in Table 6-3. (Refer to Figures I-53a and I-54 for the Ventilation Zoning.)

6.3.3.3 Waste Treatment Building Heating, Ventilation, and Air Conditioning Equipment Rooms Configuration

The size and configuration of the WTB HVAC equipment room for the WTB is designed to accommodate two separate equipment rooms for the normally clean outside air intake, and a separate room for the potentially contaminated recirculation or exhaust systems. The guideline in Section 6.2.5.6 is consistently applied.

6.3.3.4 Waste Treatment Building Heating, Ventilation, and Air Conditioning Equipment Space Summary

Following is a summary of the evaluation results of the HVAC equipment space requirements incorporating the factors mentioned in Section 6.2.5.6. The WTB HVAC equipment space requirement is shown in Figure I-54 of Attachment I.

6.3.3.4.1 Process Area Air Supply and Facility Support Area HVAC, Rooms T-200 and T-201

Air handling unit and fan selection is based on a nominal capacity of 30,000 cfm per Sections 6.2.5.4 and 6.2.5.5.

Figure I-54: Tertiary Supply - 4 air handling units and 4 supply fans to supply 98,800 cfm
Non- Rad Areas – 1 air handling unit and 1 supply fan to supply 28,500 cfm
Minimum space required = 5,375 ft^2

6.3.3.4.2 Process Area Exhaust HVAC, Room T-202

HEPA filter plenum selection is based on a nominal capacity of 18,000 cfm per Section 6.2.5.3.1. Exhaust fan is based on a nominal capacity of 30,000 cfm per Section 6.2.5.5.

Figure I-54: 6 HEPA filter plenums and 4 exhaust fans to exhaust 98,800 cfm
Minimum space required = 13,500 ft^2

The total minimum required space to house the HVAC equipment in the WTB is equal to 18,875 ft^2.

Table 6-3. WTB Ventilation Air Estimate

Confinement	Rm. No	Area Description	Area	Height	Vent. Rate		Supply Air	Outside	Return Air	Outside Air	Remarks
Zone			Sq. Ft.	Ft.	AC/ hr	cfm/ sq.Ft.	acfm	Air (%)	acfm	acfm	
Note 1	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 3*	*Note 4*	*Note 5*	*Note 6*	*Note 7*	*Note 8*	
Secondary Confinement	T-101	Process Areas	38,700	20	6	2.0	77,400	100%	0	77,400	Non-comfort Design
	thru			10	2	-	12,900	100%	0	12,900	"
	T-104										
	T-200, T-201	HVAC Equipment Room	20,076	15							
	and T-202	Outside Air System			1	0.3	5,019	100%	0	5,019	
		Recirc Air System			3	0.8	15,057	0%	15057	0	Independent Recirc. Clg.
		TOTAL (SECONDARY)	58,776	-	[illegible]	-	95,319	[illegible]	-	95,319	
Non-Conf'mnt Areas	Misc.	Facility/Support Areas	16,224	9	8	1.2	19,469	20%	15,575	3,894	Comfort Design
				(Avg.)							

NOTES:

1. Input	Assumption, Section 5.3.4
2. Input	From Table 6-4, WTB Facility Program Area Summary
3. Input	The airchange rate is applied to an effective height of 20 feet above the floor and 2 airchanges is assumed above the effective height. Calculated flowrate shall be checked to meet either cooling or heating requirements. (Assumption 5.3.1)
4. Formula	Supply Air / Area
5. Formula	(Area x Height x AC/hr) / 60
6. Input	Based on 100% for once-through systems and 20% for recirculation systems.
7. Formula	Supply Air flow - Outside Air flow
8. Formula	Supply Air flow x % of Outside Air

6.3.4 Waste Treatment Building Miscellaneous Support Areas

The WTB contain miscellaneous support utilities. These include fire protection, electrical, communication, and process systems supporting the WTB system operation. The building support spaces are sized to accommodate maintenance of equipment.

6.3.4.1 Fire Protection

The following descriptions and requirements are based on DOE Order 420.1, *Facility Safety*, Section 4.2.2:

The WTB is provided with fire suppression and alarm systems meeting the requirements of DOE Order 420.1, *Facility Safety* 1996, and Implementation Guide for use with DOE Orders 420.1 and 440.1, *Fire Safety Program* 1995. However, when the NRC and DOE Order 420.1 drive facility design requirements, the NRC requirements take precedence. The WTB is also required to have sprinkler riser systems and associated alarms. The fire riser piping assembly is usually in a convenient location to service the building and one fire alarm annunciation panel is typically located inside the vestibule at the main entry to the facility.

The fire riser rooms (T-127 A & B) may be located either in a separate room or within a general area that does not detract from the functions of other spaces. Each fire riser assembly requires area for piping, valves, a backflow preventer unit, and associated alarms annunciation. The fire alarm annunciation panel is required to be located on the wall of the main entry vestibule. No additional floor area is required. The ceiling in the fire riser area may be open to the underside of the building structure. The minimum space required for each area is 100 ft^2 each per riser room, based on a 10-ft by 10-ft room. Total area for 2 riser room (T-127 A & B) is 200 ft^2. The maximum allowable protected floor area that can be covered by each riser is 52,000 ft^2 in accordance with NFPA 13, 1999, Section 5.2.

6.3.4.2 Electrical

The electrical power distribution room (T-203) and the electrical switch-gear room (T-204) provide the facility with the required electrical power and switching hardware needed to operate the entire WTB. The electrical service for the facility includes both normal and backup power. The backup power system is provided to assist critical safety systems and provide uninterruptable power supplies. Facility requirements for backup and uninterruptible power have not been determined. The allotted floor area used for the electrical rooms is based on assumed electrical power systems and associated equipment. The minimum combined space required for both electrical rooms is 1,950 ft^2.

6.3.4.3 Communication

The communication room (T-128) provides space for telephone, radio, computer networking equipment, and building/site alarm system equipment. The specific communication system for the WTB has not been defined. The ceiling for this area may be open to the underside of the building structure. The minimum space required for this area is 50 ft^2.

6.3.5 Waste Treatment Building Structure

The WTB is also sited on the existing ESF pad, adjacent to the WHB carrier bay (Figure I-4, Attachment I). The WTB system provides SSCs that support the collection, segregation, and disposal of low-level radioactive waste generated within the MGR. The activities conducted within the WTB include sorting, volume reduction and packaging of liquid and dry waste, and collecting, processing, and solidification. The system is located within the surface facility's restricted area. The system provides space and controls for the internal building environment within which the Site-Generated Radiological Waste Handling System operates. The system protects Site-Generated Radiological Waste Handling System equipment and operations from natural and induced environmental conditions for the duration of the waste emplacement operation. The system's primary function is to control radiological contaminants and provide radiological protection to personnel (CRWMS M&O 2000q, Summary).

The WTB System integrates LLW processing systems within its protective structure to support the throughput rates established for waste emplacement. The WTB System also provides shielding, layout, and other design features to help limit personnel radiation exposures to levels which are ALARA (CRWMS M&O 2000q, Summary).

The building is an open, high bay industrial structure without radiation shielding requirements. The main operating floor is a slab on grade. The superstructure is a structural steel, braced frame with metal siding and metal deck roof with concrete containment walls to prevent any possible spills from entering the surrounding soil. Those slab portions and walls acting as containment will be designed for appropriate design basis events. Support personnel offices are located on the ground floor. An elevated floor or mezzanine is located above the personnel offices for the building mechanical equipment. The WTB and the WHB are separated by a seismic joint to prevent structure interaction between the two different framing systems during an earthquake (CRWMS M&O 1997c, Section 7.3.5).

6.3.5.1 Waste Treatment Building Foundation

Waste Treatment Building Foundation Recommendation

The WTB is a relatively lightly loaded building. There are no overhead cranes inside the facility and all major process equipment is sitting on the ground floor slab. Because the building columns have modest loads, individual spread footings can be assumed for the column foundations (CRWMS M&O 1997c, Section 7.3.5.1.1). Based upon the geotechnical report, for a uniform 3,000 psf load, the estimated immediate settlements will be about 0.25 in. or less along the perimeters of the potential WTB footings. Utilizing a 5 ft by 5 ft sq. spread footing with a maximum load of 60,000 lbs., the resulting bearing value will be 2,400 psf which is less than the 3,000 psf, therefore immediate settlement will be less than 0.25 in. (CRWMS M&O 1999h, Section 7.5.1).

This conclusion must be verified by a site-specific geotechnical evaluation for the WTB.

6.3.6 Facility Program Area Summary

Table 6-4 summarizes the provided floor areas and ceiling heights indicated in the figures for the WTB. Sections 6.3.1 through 6.3.4 indicate the minimum square footages required by each individual functional space contained in the WTB systems analysis. The adjacency requirements that define efficient functional relationships between individual spaces and system areas are described in the individual sections. The provided floor areas indicated are net square footages and do not include allowances for building structure (i.e., walls, columns) needed to determine the gross square footage for the entire facility.

The net total, taken from Table 6-4, is 74,900 ft^2, and the square foot number has been rounded to two significant digits.

Table 6-4. WTB Facility Program Area Summary

Areas/Spaces		**Floor Area (Ft^2)**			**Space Height (Ft)**
Room No.	**Room Title**	**Length**	**Width**	**Ft^2**	**Height**
PROCESS AREA					
LLW					
T-101	Solid LLW Processing	150'-0 "	88'-0"	13,200	30'-0"
T-102	Chemical Liquid LLW Processing	*105'-0"	*84'-0"	8,820	20'-0"
T-103	Recyclable Liquid LLW Processing	*150'-0"	*86'-0"	12,900	(recycled water tanks)
	Subtotal			**34,920**	
Mixed and Hazardous Waste					
T-104	Mixed and Hazardous Wastes Staging	45'-0"	84'-0"	3,780	20'-0"
	Total LLW Process Area			**3,780**	
FACILITY SUPPORT AREAS					
Security					
T-105	Security Portal	*5'-0"	*15'-0"	150	9'-0"
T-106	Security Portal	8'-0"	10'-0"	150	9'-0"
T-107	Office	10'-0"	15'-0"	150	9'-0"
	Subtotal			**450**	
Operations					
T-108	Part Storage	10'-0"	15'-0"	150	9'-0"
T-109	Men's Change Room	*19'-0"	*39'-0"	741	9'-0"
T-110	Women's Change Room	14'-0"	38'-0"	532	9'-0"
T-111	Coverall Storage	8'-0"	12'-0"	96	9'-0"
T-112	Lunchroom	34'-0"	36'-0"	1,224	9'-0"
T-113A	Janitor Closet	5'-0"	10'-0"	50	9'-0"

Table 6-4. WTB Facility Program Area Summary, continued

Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
T-113B	Janitor Closet	10'-0"	10'-0"	100	9'-0"
T-114	Forklift Staging	*20'-0"	*67'-0"	1,340	12'-0"
T-115	Shipping and Receiving	28'-0"	75'-0"	2,100	12'-0"
T-129	Forklift Access Corridor	117'-0"	15'-0"	1,755	9'-0"
	Subtotal			**8,088**	
	Two Stairways (unassigned)	Total Square Footage		400	
	Subtotal			**400**	
Administration					
Plant/Process Maintenance Supervisors Offices					
T-116	Not used				
T-117	Supervisor Office No. 1	10'-0"	10'-0"	100	9'-0"
T-118	Supervisor Office No. 2	10'-0"	10'-0"	100	9'-0"
T-119	Plant Manager Office	23'-0"	10'-0"	230	9'-0"
T-120	Plant Management Supervisor Office	13'-0"	16'-0"	208	9'-0"
T-121	Staff Support Open Office	18'-0"	34'-0"	612	9'-0"
T-122	Health Physics Office	15'-0"	20'-0"	300	9'-0"
T-123	QA Office	15'-0"	10'-0"	150	9'-0"
T-124	Inventory Control Office	15'-0"	10'-0"	150	9'-0"
T-125	Copy/Storage Room	24'-0"	12'-0"	288	9'-0"
T-126	Instrument Calibration	11'-0"	23'-0"	253	9'-0"
T-130	Vestibule	15'-0"	31'-0"	465	9'-0"
	Corridors unassigned	Total Square Footage		924	9'-0"
	Subtotal			**3,780**	
HVAC EQUIPMENT AREAS					
T-200	Facility Support Area HVAC	48'-0"	25'-0"	1,200	15'-0"
T-201	Process Area HVAC Supply	48'-0"	112'-0"	5,375	15'-0"
T-202	Process Area HVAC Exhaust	150'-0"	90'-0"	13,500	15'-0"
	Facility Support Air Equipment	Unassigned areas		990	15'-0"
	Subtotal			**21,065**	
MISCELLANEOUS BUILDING SUPPORT AREAS					
Fire Protection					
T-127A	Fire Riser Room	10'-0"	10'-0"	100	20'-0"
T-127B	Fire Riser Room	10'-0"	10'-0"	100	20'-0"
	Subtotal			**200**	

Table 6-4. WTB Facility Program Area Summary, continued

Areas/Spaces		Floor Area (Ft^2)			Space Height (Ft)
Room No.	Room Title	Length	Width	Ft^2	Height
Electrical					
T-203	Electrical Power Distribution	25'-0"	60'-0"	1,500	15'-0"
T-204	Electrical Switch gear	25'-0"	20'-0"	500	15'-0"
	Subtotal			**2,000**	
Communication					
T-128	Communication Room	10'-0"	10'-0"	100	9'-0"
	Subtotal			**100**	
Elevator					
	One Elevator (unassigned)	8'-0"	10'-0"	80	
	Subtotal			**80**	
TOTAL WTB *This dimension is an average due to the irregular shape of space. (Total floor area provided, not including building structure.)				**74,900**	

6.4 FACILITY INTEGRATION

Integration of the SNF into one facility was a consideration that had many factors impacting the successful outcome of this decision. The success of this effort was very important and it was determined that the primary factors that tied together all the essential design issues and components were the site considerations. The site considerations are the governing factors in integration or collocation of the facilities. The figures included in Attachment I indicated a collocated WHB and WTB. In addition, a decision was made to delete the Carrier Preparation Building (CPB) from the project scope of work and therefore no analysis is included or considered for facility integration.

6.4.1 Waste Handling Building and Waste Treatment Building Integration

The WTB was considered to be a viable candidate for functional integration with the WHB due to the potential operational efficiencies pertaining to liquid and solid waste transfer, staffing similarities, and similar operational functions. However, the analysis of the efficiencies gained in these areas would be minimal in that the liquid and solid waste transfer between the buildings is not difficult to achieve if the facilities are separate, and there is no significant functional overlap between the WHB and WTB staffing and operations. The other considerations that preclude integration of the facilities are: 1) each facility is a significant building and are of different structural systems; 2) design and construction of the facilities would be more complicated due to facility size and the limited site area available; and 3) the access to each facility would be restricted to three sides.

As indicated above, negative drawbacks associated with the integration of the WHB and WTB on the basis of functional efficiencies is not a driving factor. Nevertheless, the site considerations appear to identify stronger reasons to collocate the WHB and WTB. The consideration or reasons are: a) there are site rail access restrictions; and b) the minimization of the building footprint founded on un-compacted muck materials (CRWMS M&O 1997c, Section 7.5.2).

Another issue not considered for integration into the WHB was the truck and rail carrier washdown facility. The restricting issue focuses on site rail access. Also at issue is the consideration or requirement for multiple wash down stations that are needed if the carrier washdown function is located within the WHB. Finally, this analysis evaluates the space program requirements for the WHB and WTB separately in order to provide the ability for each facility to function as a stand-alone unit. Collocating of the facilities in response to site considerations is shown on the figures (Attachment I, Figures 1-4 and 1-11). If it is determined through further study that collocating of the facilities is optimal, additional analysis will be required to determine the most optimal integration of functional areas between the two facilities.

6.5 SITE DEVELOPMENT

6.5.1 Site Layout

6.5.1.1 Site Layout Functional Description

The MGR Site Layout System incorporates the necessary civil engineering features and arrangements required for supporting the surface repository facilities and systems for safe and efficient operations. The site layout is organized around the subsurface accesses, and is configured considering owner and radiological exposure boundaries, flood/fault zones, topographic features, and meteorological patterns. In addition, it supports surface and subsurface operations and the required facility and transportation arrangements (CRWMS M&O 1999g, Summary).

The integrated layout of radiological and support facilities provides maximum efficiency for the MGR operations while minimizing environmental, endangered species, and archaeological impacts. The site layout is designed to maximize pre-closure radiological safety and to deter post-closure human disturbance of the MGR. The site layout is also designed to limit impacts to the waste handling operations caused by worst-case environmental conditions (CRWMS M&O 1999g, Summary).

The repository surface facilities are located in four discrete operational areas: the North Portal Operations Area, the South Portal Development Operations Area, the Emplacement Shaft Surface Operations Area, and the Development Shaft Surface Operations Area (Attachment I, Figure I-10). The North Portal Operations Area is the largest and most complex surface facility area, covering about 80 acres and including approximately 19 structures. This area is located adjacent to the North Portal, where the waste is transferred underground for emplacement. The operations area includes a protected area and a BOP area. The protected area is where the waste is received from off-site transportation and placed in DCs. The BOP area includes structures and systems that will support repository operations. The South Portal Development Area is the second largest surface facility area, covering about 20 acres and including approximately 8 structures. This area is located adjacent to the South Portal to support the excavation of the underground and the operation of the development ventilation intake fans. This area supports the development of the subsurface repository and will be unmanned after underground excavation is complete. The Emplacement Shaft Surface Operations Area covers about 3 to 4 acres located at the opening of the north shaft and includes two structures. This area is provided for the emplacement side ventilation exhaust fans and to support the maintenance of these fans. The Development Shaft Surface Operations Area covers about a half-acre located at the opening of the south shaft and includes at least 1 structure. This area is provided to house the headframe and shaft conveyance needed for underground emergency personnel egress and inspection access. The area also includes the exhaust for the underground ventilation system and electrical equipment (CRWMS M&O 1999g, Summary).

6.5.1.2 Site Condition Before Repository Construction

This section describes the existing and planned ESF North Portal surface facilities that could impact the repository surface facilities layout. The facilities are shown in the *Repository Surface Design Site Layout Analysis* (CRWMS M&O 1998d, Attachment I, Figure 3).

In general, the ESF facilities are designed as non-qualified, non-permanent, non-nuclear facilities with a 25-year maintainable life. It is expected that these facilities could be used for non-nuclear operations at the repository. With planned modification and structural systems and components upgrade, these facilities could likely comply with the repository surface facility maintainable design life needs (CRWMS M&O 1998d, Section 7.1).

6.5.1.3 Storm Water Drainage and Flood Control

6.5.1.3.1 Probable Maximum Flood Flood Plain Determination

The determination of the flood level for PMF is based on the *Repository Surface Design Site Layout Analysis* (CRWMS M&O 1998d, Section 7.4.1).

The North Portal pad intersects the flood levels, thereby causing the water to flow around the pad. The surface profiles of Midway Valley Wash will rise due to the constriction of flow caused by the pad area that is superimposed on the inundation zone. During final design, the floor elevation of the high-hazard buildings may be adjusted to reflect any changes in water profiles.

The new North Portal pad configuration is shown in the *Repository Surface Design Site Layout Analysis* (CRWMS M&O 1998d, Attachment I, Figure 3). The radiologically controlled area (RCA) and the BOP area, are above the inundation zone because the top of the pad is above the water level, causing the water to flow around the pad. The northeast corner of the floor of the WHB is set approximately 1.5 ft above the maximum elevation of the flood stage. The remaining buildings in the RCA are set at the same floor elevation as the WHB. The pad for the

BOP area is set a minimum of 3 ft below the floor elevation of the WHB to account for the dock height at the southeast corner of the building.

A railroad will be constructed on a compacted fill embankment across the Midway Valley Wash and a bridge will be provided to allow for passage of drainage water. This bridge and embankment will also cause a flow restriction.

Additional studies based on economic consideration will be performed to determine the effects of constriction from the enlargement of the pad and the embankment, and whether the bridge needs to be enlarged to allow for a higher volume of drainage water to mitigate flow restriction.

The proposed North Portal pad slopes will be protected from erosion due to flooding by building retaining walls or by implementing stream bank stabilization.

6.5.1.3.2 Existing North Portal Pad Drainage

The drainage design for the North Portal pad protects the portal from a PMF. Portal protection is accomplished by constructing two open channels around the perimeter of the pad.

The drainage basin for the pad is divided into two sub-basins. One sub-basin (approximately 11.5 acres in size) generates the runoff affecting the northernmost portion of the pad. Runoff flow from the other sub-basin (approximately 4 acres in size) affects the southernmost portion of the pad. (CRWMS M&O 1998d, Section 7.4.2)

Peak discharge of each sub-basin was determined in the *Repository Surface Design Site Layout Analysis* (CRWMS M&O 1998d, Section 7.4), and the results indicate that the water needs to be diverted. Two channels were designed to protect the pad from estimated discharges.

One channel is designed to start from the southwest corner of the pad and to be built around the entire western and northern side of the pad for an approximate length of 2,230 ft. The channel is to be located 15 to 30 ft away from the top of the cut on the west side of the pad.

The second channel is designed to start from the southwest corner of the pad and to be built around the southern side of the pad for a length of approximately 820 ft. The channel is designed to be located a safe distance away from the edge of the pad and to protect the toe of the fill on the lower half of the southern side of the pad from erosion.

Both channels require the use of a rip rap apron for their entire length, except were there is excavation in rock. Both channels have been constructed as part of the ESF. No modifications will be required to adapt these channels for protection of the Repository North Portal Surface Facilities from the PMF.

6.5.1.3.3 Retention Pond

The size of the retention pond is determined by the volume of storm water runoff from the Radiological Controlled Pad generated by a storm of duration of one hour. The area of the retention pond is 29.3 acres. (CRWMS M&O 1998d, Section 7.4.5)

6.5.1.3.4 North Portal Site Layout

The North Portal area is relatively flat (about 2 percent slope) and is located in Midway Valley between Midway Valley Wash and Exile Hill. The surface facilities are currently located above the inundation zone for the PMF. The existing fill underneath the existing North Portal pad will require stabilization and additional compacted fill will be required for the BOP area. Rail and truck access to the area will be from the east through Midway Valley, south of Alice Hill. (CRWMS M&O 1998d, Section 7.5)

Attachment I, Figure I-11 identifies the surface facilities by site reference number (e.g., 211 for the WTB). The RCA is located adjacent to the North Portal and extends northerly to enclose Security Station 3 (220-3C). The RCA includes four discrete nuclear facilities: the WHB (211), the WTB (215-1), the Transporter Maintenance Building (220-4C), and the CPB (215-2). The RCA, secured by fencing, also includes the parking areas for waste transportation trucks and railcars.

The WHB is located just east of the existing change house, placing the WHB as close as possible to the portal while preserving the change house. The WTB was located next to the WHB to facilitate and minimize the movement of personnel and materials between these related facilities. The Transporter Maintenance Building is located to be accessible to the waste transporter rail lines.

The BOP area is located southeasterly and adjacent to the RCA. This BOP location was selected to promote radiological safety by considering the prevailing wind directions, as shown by the wind rose in the *Repository Surface Design Site Layout Analysis* (CRWMS M&O 1998d, Attachment I, Figure 6). The facilities within the BOP house the non-nuclear operations needed to support waste operations and site personnel.

6.5.1.4 Repository Site Layout

The repository surface facilities are located in four discrete operational areas as described below and as shown in Figure I-10, Attachment I. This figure also shows the relationship of these areas to the emplacement (North) and development (South) portals, subsurface ramps and emplacement areas, emplacement and development shafts, and muck conveyor routing, muck storage area, and lag storage area. (CRWMS M&O 1998d, Section 7.6)

6.5.1.4.1 North Portal Operations Area

The North Portal Operations Area is the largest and most complex surface facility area, covering approximately 80 acres and including 19 (17 new and 2 existing) structures. This area is adjacent to the North Portal, where the waste is brought underground for emplacement. The operations area includes an RCA and a BOP area. The RCA is where the SNF and civilian and DHLW materials are received from off-site transportation and placed in DCs. North of this area is a potential site for lag storage of approximately 350 acres shown in Figure I-10, Attachment I. (CRWMS M&O 1998d, Section 7.6.1)

The BOP area includes structures and systems that will support repository operations in all areas (e.g., general administration, medical center, training center, shops, motor, central warehouse, and centralized utilities).

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas (CRWMS M&O 1998d, Section 7.6.1).

6.5.1.4.2 South Portal Development Operations Area

The South Portal Development Operations Area is the second largest surface facility area, it includes 8 structures. This area is located adjacent to the South Portal to support the excavation of the underground and the operation of the development ventilation intake fans. The area functions independently and includes the basic facilities needed for personnel support, maintenance, warehousing, material staging, security, and transportation. This area will normally be staffed with support personnel, plus all subsurface construction personnel during the development/emplacement phase, and will be unmanned after underground excavation is completed. Most personnel will move directly from off-site to this area. General supplies will be transferred from the North Portal operations area and transported by truck to the South Portal Development Operations Area.

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas (CRWMS M&O 1998d, Section 7.6.2).

6.5.1.4.3 Development, Intake and Exhaust Shaft Surface Operations Area

There are a total of seven areas for Emplacement, Intake and Exhaust Shaft Surface Operations. One for Development, three for Intake and three for Exhaust. (CRWMS M&O 2000h, Figure 1).

Each area will be approximately 1.5 acres that include fans, power supply, head frame and hoist system. The area is normally unoccupied. Personnel and materials are dispatched as needed from the North Portal Operations Area to conduct inspections or maintenance.

6.5.1.4.4 Repository Muck Storage Area

An area of approximately 400 acres is available for the Repository Muck Storage Area. Minimal flood protection, in the form of drainage ditches, is sufficient to protect it from any local flooding caused by the 100-year storm. (CRWMS M&O 1998d, Section 7.6.5)

6.5.1.4.5 Potential Storage Area

A potential storage area of 350 acres is available to provide the ability to retrieve and store all the waste that may be emplaced in the repository. Waste retrieval capability must be maintained for a period of time starting when the first WP is emplaced and extending until the start of the closure operation. The length of the retrievability period is set at 50 years in 10 CFR (Code of Federal Regulations). The DOE has extended this period of retrievability to 100 years from the emplacement of the first WP. The area is shown in Attachment I, Figure I-10 (CRWMS M&O 1998d, Section 7.6.9).

6.5.1.4.6 Site Parking

Site parking will be provided to accommodate the minimum parking capacity for truck and rail equipment. Parking areas will be sized to provide buffer staging between the waste receipt gate and the CPB and between the CPB and the WHB (CRWMS M&O 1998d, Section 7.6.10).

6.5.1.4.7 Topsoil Storage Area

The existing topsoil storage area is shown on Attachment I, Figure I-10. This area will be expanded to accept the additional repository volume needs. (CRWMS M&O 1998d, Section 7.6.11)

6.5.1.4.8 Bridge Crossing

A bridge will be provided for railroad and highway crossing above the Midway Valley Wash. This bridge was located in a compacted fill embankment to allow passage of the PMF. The length of the bridge will be determined by future flood routing studies. (CRWMS M&O 1998d, Section 7.6.12)

7. CONCLUSIONS

The results of this analysis are intended to support the concept of operations and wet design layouts as developed for the VA design phase, with updates for the Site Recommendation phase to incorporate changes to building areas resulting from the impacts of EDA-II and the modified waste stream.

Use of any data from this report for input into documents supporting procurement, fabrication, or construction is required to be controlled as to be verified (TBV) or to be determined (TBD) in accordance with AP-3.15Q, *Managing Technical Product Inputs:* "This document may be affected by technical product input information that requires confirmation. Any changes to the document that may occur as a result of completing the confirmation activities will be reflected in subsequent revisions. The status of the input information quality may be confirmed by review of the Document Input Reference System database."

This section describes this *WHB/WTB Space Program Analysis for Site Recommendation*, and summarizes the changes to the VA SPA (CRWMS M&O 1997c). The two primary changes to the baseline relate to the mix of the design basis waste stream and the impacts resulting from EDA-II. This new analysis for the WHB and WTB now indicates the reduction in the ATS from 3 lines to 2 lines, and a reduction in the CTS from 2 lines to 1 line. The figures included in Attachment I also indicate the change in approach with regard to how the waste stream is currently being handled, with the addition of a Pool Fuel Storage Area. The pool area consists of 4 pools that are required to accommodate the staging, transfer, and lag storage of cask units containing the bare spent nuclear fuel that is awaiting processing. Also required in this area are a Non-standard Fuel Pool (in the ATS) and an Off-normal Canister Handling Cell (in the CTS).

Other notable changes include the relocation of the Empty DC Preparation Area, which is now adjacent to the Load DC Staging Area. This relocation was required when the pool storage areas were added. There are changes to the HVAC floor area, which has increased from 124,000 sq ft to 241,200 sq ft. The increase in square footage is partly due to the additional HVAC requirements needed to support the Pool Fuel Storage Area. The building circulation that is located throughout the WHB increased from 18,000 sq ft to 59,600 sq ft. The circulation areas, both vertical and horizontal, have been modified to show greater definition and response to the life safety requirements for personnel, and circulation requirements for equipment movement and maintenance/servicing.

The WTB had very few changes, which are considered minor in relation to the overall facility layout. The WTB figures have been changed to reflect the same level of definition that is required for the WHB figures to show functional space and adjacencies.

While there are no TBVs or TBDs generated within this analysis, the resolution of any unresolved TBVs or TBDs in referenced work may require a revision of this work. Selection of a different design concept or waste stream may also require revising the spaces and/or adjacencies defined and allocated in this analysis.

The two following sections present a summary overview of the total space allocation for each facility. The square footages indicated are rounded to two significant digits for simplification in this summary only.

7.1 WASTE HANDLING BUILDING

The design analysis for the WHB (Section 6.2) indicates the required minimum floor areas anticipated for all of the required functional spaces from the VA SPA (CRWMS M&O 1997c) including the supporting functional relationship housed in the WHB. Additionally, the WHB analysis indicates essential spaces within specific functional areas and includes the Primary Areas, Primary Support Areas, Facility Support Areas, HVAC Equipment Areas, and the Miscellaneous Building Support Areas. The combined net floor area provided is 645,600 ft^2.

The following system area breakdown summarizes one segment of the combined net floor area provided in the WHB: the Primary Areas include the CCHS, with a net floor space of 15,700 ft^2; the ATS, with a net floor space of 84,300 ft^2; the CTS, with a minimum net floor space of 14,800 ft^2; the DCHS, with a net floor space of 51,100 ft^2; and the WPRS, with a net floor space of 2,000- ft^2. The combined net floor area provided for these systems is 167,900 ft^2.

The next system area, the Primary Support Area, includes spaces required to support the main operation of the primary areas. Examples of the areas included are empty DC preparation, cross transfer corridors, crane equipment maintenance, hot maintenance shops, operating galleries, and control room. The combined net floor area that is provided is 73,100 ft^2.

The Pool Support Areas provide space for fuel transfer pool equipment. The total floor space provided for these areas is 18,700 ft^2.

In the Facility Support Areas the following breakdown includes: the Radiation Protection area, with a net floor area of 4,800 ft^2; Security, with a net floor area of 2,100 ft^2; Operations, with a net floor area of 6,700 ft^2; Administration, with a net floor area of 8,000 ft^2; Maintenance, with a net floor area of 13,800 ft^2; and building circulation (corridors, hallways, stairs, and airlocks/vestibule) with a net floor area of 81,100 ft^2. The combined net floor area provided is 116,500 ft^2.

The HVAC Equipment Areas include space for air conditioning, handling, and filtering equipment for all areas of the facility. The combined net floor space provided for this area is 241,300 ft^2.

The Miscellaneous Building Support Areas include space for building equipment such as fire protection, electrical, communication systems, elevators, pipe chase, and utility corridors. The combined net floor area provided for these systems is 28,200 ft^2.

The Facility Program Area Summary, Table 6-2, provides an overview of the entire WHB net floor area and room heights.

The WHB includes both concrete and steel frame systems. Wall thickness used in the analysis is based on either radiation shielding or structural estimates. Also, mat footings are used in this analysis for the building foundation system. The structure of the building, including walls and roof systems, are not included in the net area tabulation.

7.2 WASTE TREATMENT BUILDING

The design analysis for the WTB (Section 6.3) indicates the required minimum floor areas anticipated for all of the required functional spaces from the VA SPA (CRWMS M&O 1997c), including the supporting functional relationship housed in the WTB. The analysis indicates spaces within specific functional areas that include the Process Areas, Facility Support Areas, HVAC Equipment Areas, and the Miscellaneous Building Support Areas. The combined net floor area provided is 74,900 ft^2.

The Process Area is divided into several areas, which include space for: chemical liquid LLW equipment with a net floor area of 8,800 ft^2; solid LLW treatment equipment, which is provided with a net floor area of 13,200 ft^2; and recyclable liquid LLW treatment equipment, with a net floor area of 12,900 ft^2. Also included in this area are pathways for forklift access between the process areas. These pathways are provided with a net floor area of 5,900 ft^2, and the last area, the mixed waste staging area, is provided with a net floor area of 3,800 ft^2. The combined net floor space provided for the entire area is 38,700 ft^2.

The Facility Support Areas of the WTB are provided with the following net floor areas: Security, 500 ft^2; Operations, 8,100 ft^2; Administration, 3,800 ft^2; and building circulation, 1,100 ft^2. The combined net floor space for this area is 13,500 ft^2.

The HVAC Support Area includes space for air handling and filtering equipment for all areas of the facility. The combined net floor space for this area is 21,000 ft^2.

The Miscellaneous Building Support Areas include space for building equipment such as fire protection, electrical, and communication systems. The combined net floor area provided for these systems is 2,400 ft^2.

The Facility Program Area Summary, Table 6-4, provides an overview of the entire WTB including the minimum required net floor area and height.

The design analysis anticipates that the WTB primary structural systems will consist of a two-story steel framed structure and utilize a spread footing foundation system. The building structure, including walls and roof systems, has been excluded from the net area tabulation.

The inventory control office (T-124) is provided to accommodate inventory control of incoming and outgoing waste materials processed in the WTB. The floor space provided for this area is 100 ft^2.

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WHB/WTB Space Program Analysis for Site Recommendation
ANL-WHS-AR-000001 REV 00

ATTACHMENT I
FIGURES

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FIGURES

CRWMS SURFACE NUCLEAR FACILITIES
GENERAL ARRANGEMENT FIGURES

FIGURE LIST

ROOM LEGEND

WASTE HANDLING BUILDING

PRIMARY AREAS

CARRIER/CASK HANDLING SYSTEM (CCHS)

H-100A CARRIER BAY

ASSEMBLY TRANSFER SYSTEM (ATS)

H-040 VACUUM PUMP ROOM
H-101 (A.B) CASK AIRLOCK
H-102 (A.A2.B.B2) CASK PREP AND DECONTAMINATION
H-103 (A.B) CASK UNLOAD POOL AREA
H-103 (A1.B1) POOL, STAGING & CASK UNLOAD
H-104 (A.B) INCLINE TRANSFER CANAL
H-105 (A.B) DC LOAD CELL
H-106 (A.B) DC DECONTAMINATION CELL
H-183 FUEL STORAGE POOL AREA
H-183 (A.B.C.D) FUEL BASKET STORAGE POOL
H-183E NON-STANDARD FUEL POOL
H-183 (F.G) FUEL BASKET TRANSFER CANAL
H-183H NON-STANDARD FUEL BASKET TRANSFER CANAL
H-183J NON-STANDARD FUEL HANDLING AREA
H-205 (A.B) ASSEMBLY HANDLING CELL (AHC)
H-206 (A.B) AHC CRANE MAINTENANCE BAY
H-301 (A.B) POOL AREA CRANE MAINT BAY

CANISTER TRANSFER SYSTEM (CTS)

H-100B CASK TRANSFER CORRIDOR
H-103C CANISTER TRANSFER (CT) CELL, LOWER LEVEL
H-103D CANISTER STAGING
H-104C OFF-NORMAL CANISTER TRANSFER TUNNEL
H-107A CASK AIRLOCK
H-108A CASK PREP & DECONTAMINATION
H-205C CANISTER TRANSFER CELL UPPER LEVEL
H-205C1 OFF-NORMAL CANISTER HANDLING CELL
H-209A CT CELL CRANE MAINTENANCE BAY

DISPOSAL CONTAINER HANDLING SYSTEM (DCHS)

H-110 DC HANDLING CELL
H-111 WP TRANSPORTER LOADING CELL
H-112 WP TRANSPORTER AIRLOCK
H-113 LOADED DC STAGING AREA
H-115 EMPTY DC PREPARATION AIRLOCK
H-117 EMPTY DC PREPARATION
H-208 (A.B.C.D.E.F.G.H) WELDER #1-8
H-301 DC HANDLING CELL CRANE MAINTENANCE BAY

WASTE PACKAGE REMEDIATION SYSTEM (WPRS)

H-114 WP REMEDIATION CELL

PRIMARY SUPPORT AREAS

H-116 CONTAMINATED EQUIPMENT ROOM
H-118 (A.B.C.E.F.G.H) OPERATING GALLERY
H-119 WASTE HANDLING OPERATION CNTR
H-120 CONTAMINATED EQUIPMENT & DECONTAMINATION
H-120A STAGING AREA (HOT SUPPORT)
H-122 MAINTENANCE EQUIP STORAGE
H-123 TOOL STORAGE
H-124 MAINTENANCE SHOP
H-125 LLW COLLECTION & PACKAGING
H-126 FORKLIFT STAGING & SERVICING
H-203 WELDER MAINTENANCE BAY
H-207 (A.B.C.D.F.G.H.I.J) OPERATING GALLERY
H-211 WELDER MATERIALS STORAGE
H-213 WELDER MAINTENANCE HOT SHOP
H-402 ASSEMBLY & CANISTER TRANSFER CORRIDOR
H-403 DC HANDLING & WP REMEDIATION EQUIPMENT TRANSFER CORRIDOR

POOL SUPPORT AREAS

H-020 POOL TREATMENT EQUIP ROOM
H-083 POOL TREATMENT EQUIP ROOM
H-084 (A.B) POOL TREATMENT EQUIP ROOM
H-085 CORRIDOR

FACILITY SUPPORT AREAS

MAINTENANCE

H-019 EQUIPMENT MAINTENANCE SHOP
H-019B INSTRUMENT MAINTENANCE SHOP
H-121 SHIPPING & RECEIVING
H-159 TOOL STORAGE
H-160 MAINTENANCE MATERIAL STORAGE
H-161 (A.B) HEPA FILTER STORAGE
H-162 JANITOR CLOSET
H-163 SHIPPING/RECEIVING
H-164 WASTE STAGING
H-165 GAS BOTTLE STORAGE

OPERATIONS

H-016A MEN'S CHANGE ROOM
H-016B WOMEN'S CHANGE ROOM
H-017 (A.B) COVERALL STORAGE
H-133 (A.B) HEALTH PHYSICS LABORATORY
H-134 (A.B.C.D) LABORATORY TECHNICIANS OFFICE
H-135 LABORATORY MATERIAL STORAGE
H-136 FIRST AID ROOM & OFFICE
H-137 OPERATIONS LUNCHROOM
H-138 JANITOR CLOSET

ADMINISTRATION

H-018 (A.B) SUPERVISOR OFFICE
H-018B SUPERVISOR OFFICE
H-139 ENTRY LOBBY
H-140 (A.B) SUPERVISOR OFFICE
H-141 PLNT OPERATIONS MANAGER OFFICE
H-142 (A.B) QA/QC OPERATIONS OFFICE
H-143 (A.B.C.D) OPERATIONS STAFF OFFICE
H-144 STAFF SUPPORT-OPEN OFFICE
H-145 (A.B) SECRETARIAL OFFICE
H-146 (A.B) DOE MANAGER OFFICE
H-147 (A.B.C.D) DOE STAFF OFFICES
H-148 (A.B) DOE STAFF SUPPORT-SECRETARIAL
H-149 DOE STAFF SUPPORT-CLERICAL
H-150 CONFERENCE ROOM
H-151 OPERATIONS CLERK OFFICE
H-151A DOCUMENT CONTROL
H-152 COPY ROOM
H-153 STORAGE ROOM
H-154A RESTROOM, WOMEN
H-154B RESTROOM, MEN
H-155 LUNCHROOM
H-156 JANITOR CLOSET

RADIATION PROTECTION

H-010 REGULATED CHANGE ROOM
H-011 RADIATION PROTECTION PORTAL
H-012 PERSONNEL DECON ROOM
H-013 PERSONNEL RADIATION PROTECTION EQUIPMENT STORAGE
H-014 HEALTH PHYSICS OFFICE
H-015 (A.B) PROTECTIVE CLOTHING STORAGE
H-129 CALIBRATION SHOP
H-302 REGULATED CHANGE ROOM
H-305 REGULATED CHANGE ROOM
H-405 REGULATED CHANGE ROOM

SECURITY

H-130 (A.B) SECURITY PORTAL
H-131 SECURITY ALARM STATION
H-132 (A.B) OFFICE

HVAC EQUIPMENT AREAS

H-157 COLD SUPPORT HVAC
H-171 TERTIARY CONFINEMENT EXHAUST
H-171A ELECTRICAL DISTRIBUTION HVAC
H-171 (B.C) STACK MONITOR ROOM
H-200 TERTIARY CONFINEMENT SUPPLY
H-201 TERTIARY CONFINEMENT EXHAUST/RECIRCULATING
H-204 HYDRONIC EQUIPMENT ROOM
H-300 PRIMARY/SECONDARY CONFINEMENT SUPPLY
H-308 (A.B) PRIMARY CONFINEMENT EMERGENCY SUPPLY
H-383A FUEL STORAGE POOL TERTIARY CONFINEMENT SUPPLY
H-383B FUEL STORAGE POOL TERTIARY CONFINEMENT EXHAUST
H-400 SECONDARY CONFINEMENT EXHAUST
H-400A PRIMARY CONFINEMENT EXHAUST
H-400 (B.C) EMERGENCY CONFINEMENT EXHAUST

MISCELLANEOUS BUILDING SUPPORT AREAS

AIRLOCK AND VESTIBULE

H-086 VESTIBULE
H-100C ACCESS CORRIDOR
H-100 (D.E.F) VESTIBULE
H-101 (D.E.F.G.H) AIRLOCK
H-116A ACCESS CORRIDOR
H-183K VESTIBULE
H-217 AIRLOCK
H-220 AIRLOCK
H-223 VESTIBULE
H-228 VESTIBULE
H-303 AIRLOCK
H-304 VESTIBULE
H-307 AIRLOCK
H-309 ACCESS CORRIDOR
H-310 VESTIBULE
H-312 VESTIBULE
H-313 VESTIBULE
H-317 VESTIBULE
H-404 AIRLOCK
H-406 AIRLOCK
H-407 AIRLOCK

COMMUNICATIONS

H-170 COMMUNICATION ROOM

CORRIDORS & HALLWAYS

H-050 CORRIDOR
H-051 CORRIDOR
H-052 CORRIDOR
H-053 CORRIDOR
H-054 CORRIDOR
H-120B CORRIDOR
H-127 ACCESS CORRIDOR
H-128 ACCESS CORRIDOR
H-181 ACCESS CORRIDOR
H-182 ACCESS CORRIDOR
H-218 ACCESS CORRIDOR
H-219 ACCESS CORRIDOR
H-221 ACCESS CORRIDOR
H-224 ACCESS CORRIDOR
H-225 ACCESS CORRIDOR
H-226 ACCESS CORRIDOR
H-227 ACCESS CORRIDOR
H-306 ACCESS CORRIDOR
H-314 ACCESS CORRIDOR
H-315 ACCESS CORRIDOR
H-316 ACCESS CORRIDOR
H-401 (A.B.C.D.E.F) ACCESS CORRIDOR

ELECTRICAL

H-168 ELECTRICAL POWER DISTRIBUTION
H-169 (A.B) EMERGENCY GENERATOR
H-172 (A.B) SAFETY ELECTRICAL EQUIPMENT

FIRE PROTECTION

H-167 (A.B.C.D.E.F.G) FIRE RISER
H-267 (C.D.E.F) FIRE RISER
H-367G FIRE RISER

PIPE CHASE

H-075 PIPE CHASE

WASTE TREATMENT BUILDING

PROCESS AREA

T-101 SOLID LLW PROCESSING
T-102 CHEMICAL LIQUID LLW PROCESSING
T-103 RECYCLABLE LIQUID LLW PROCESSING
T-104 MIXED & HAZARDOUS WASTE STAGING

FACILITY SUPPORT AREA

SECURITY

T-105 SECURITY PORTAL
T-106 SECURITY PORTAL
T-107 OFFICE

OPERATIONS

T-108 PARTS STORAGE
T-109 MEN'S CHANGE ROOM
T-110 WOMEN'S CHANGE ROOM
T-111 COVERALL STORAGE
T-112 LUNCHROOM
T-113 (A.B) JANITOR CLOSET
T-114 FORKLIFT STAGING
T-115 SHIPPING/RECEIVING
T-129 FORKLIFT CORRIDOR

ADMINISTRATION

T-116 NOT USED
T-117 SUPERVISOR OFFICE
T-118 SUPERVISOR OFFICE
T-119 PLANT MANAGER OFFICE
T-120 PLANT MANAGEMENT SUPERVISOR OFFICE
T-121 STAFF SUPPORT-OPEN OFFICE
T-122 HEALTH PHYSICS OFFICE
T-123 QA OFFICE
T-124 INVENTORY CONTROL OFFICE
T-125 COPY/STORAGE ROOM
T-126 INSTRUMENT CALIBRATION
T-130 VESTIBULE

HVAC EQUIPMENT AREAS

T-200 FACILITY SUPPORT AREA HVAC
T-201 PROCESS AREA HVAC SUPPLY
T-202 PROCESS AREA HVAC EXHAUST

BUILDING SUPPORT AREAS

FIRE PROTECTION

T-127 (A.B) FIRE RISER ROOM

ELECTRICAL

T-203 ELECTRICAL POWER DISTRIBUTION
T-204 ELECTRICAL SWITCHGEAR

COMMUNICATIONS

T-128 COMMUNICATION ROOM

FIGURE I-1
WASTE HANDLING/WASTE TREATMENT BLDG
TITLE SHEET

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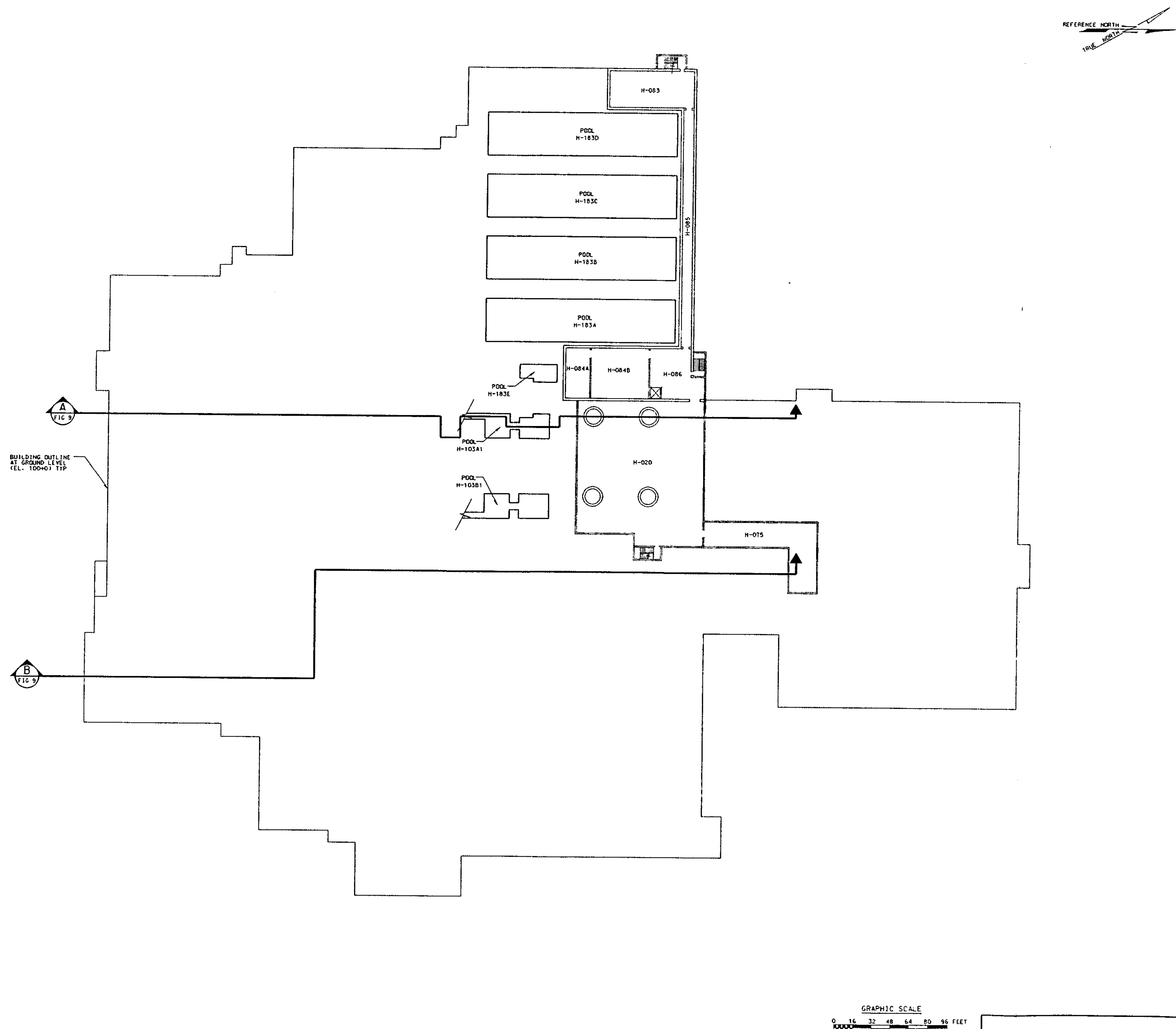

FIGURE I-2
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 50+0

SAUERT t:*reps*arch*dgn*sr*spa*whb.dgn 08-MAY-2000 09:22

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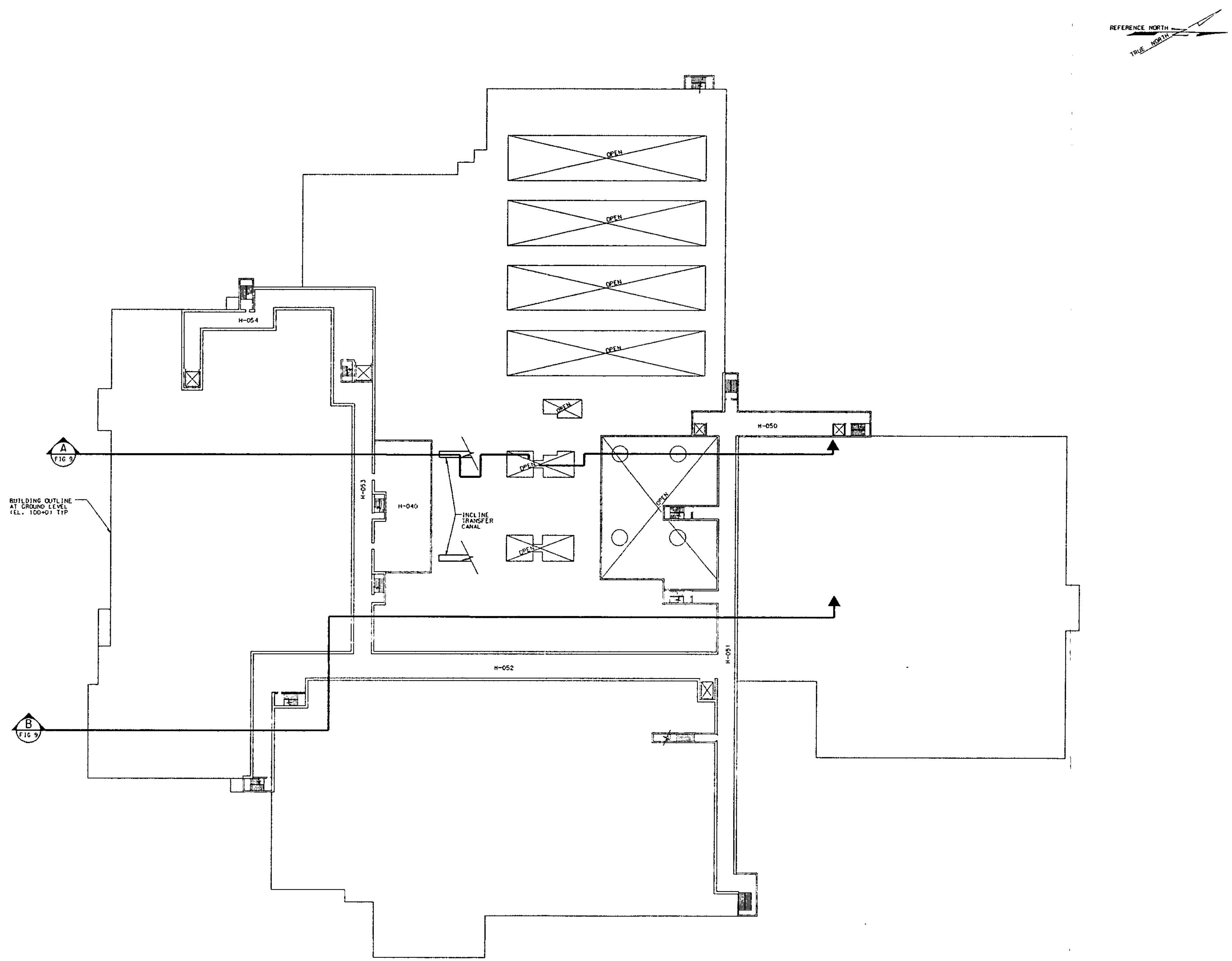

FIGURE I-3
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 80+0

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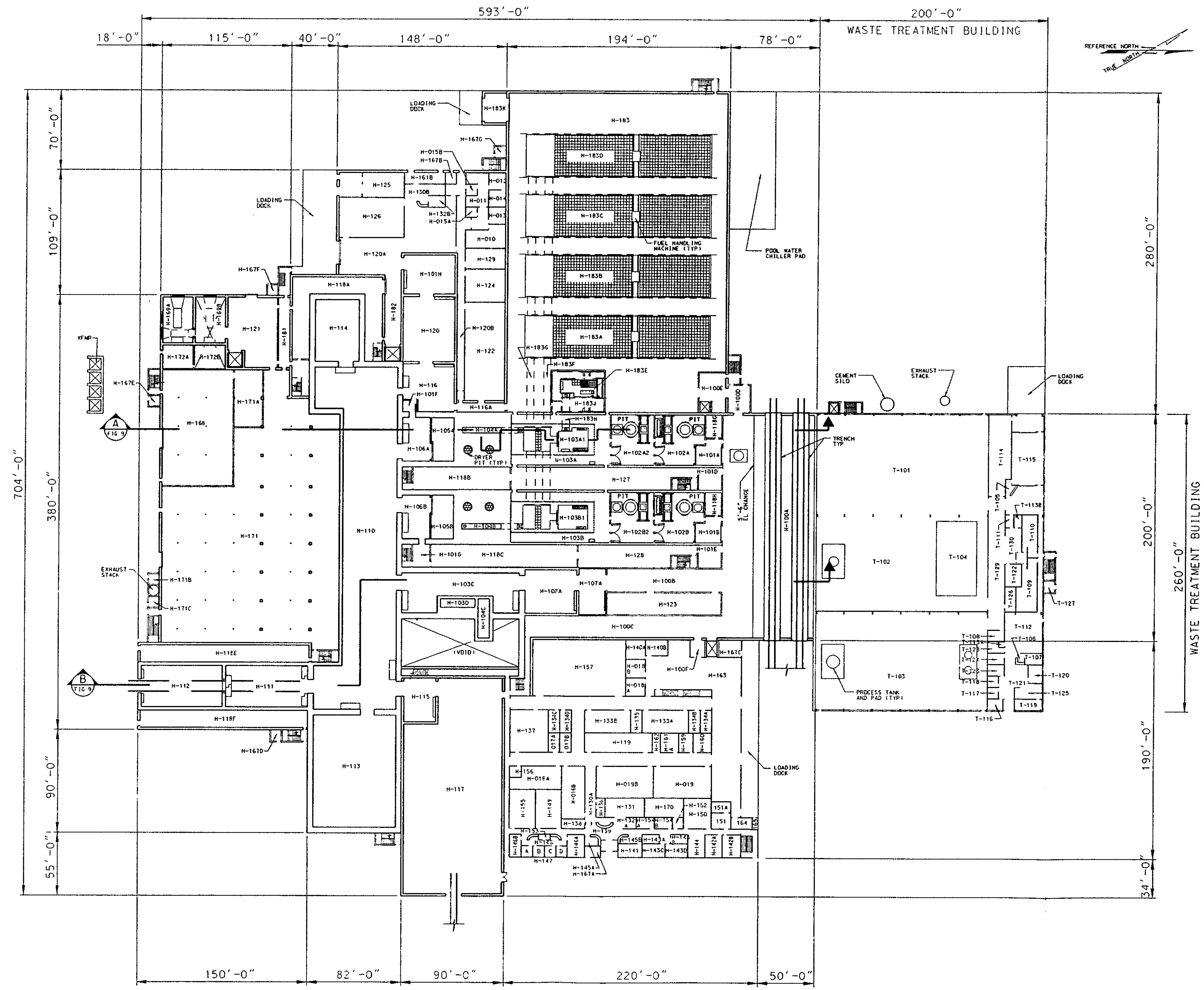

FIGURE I-4
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 100+0

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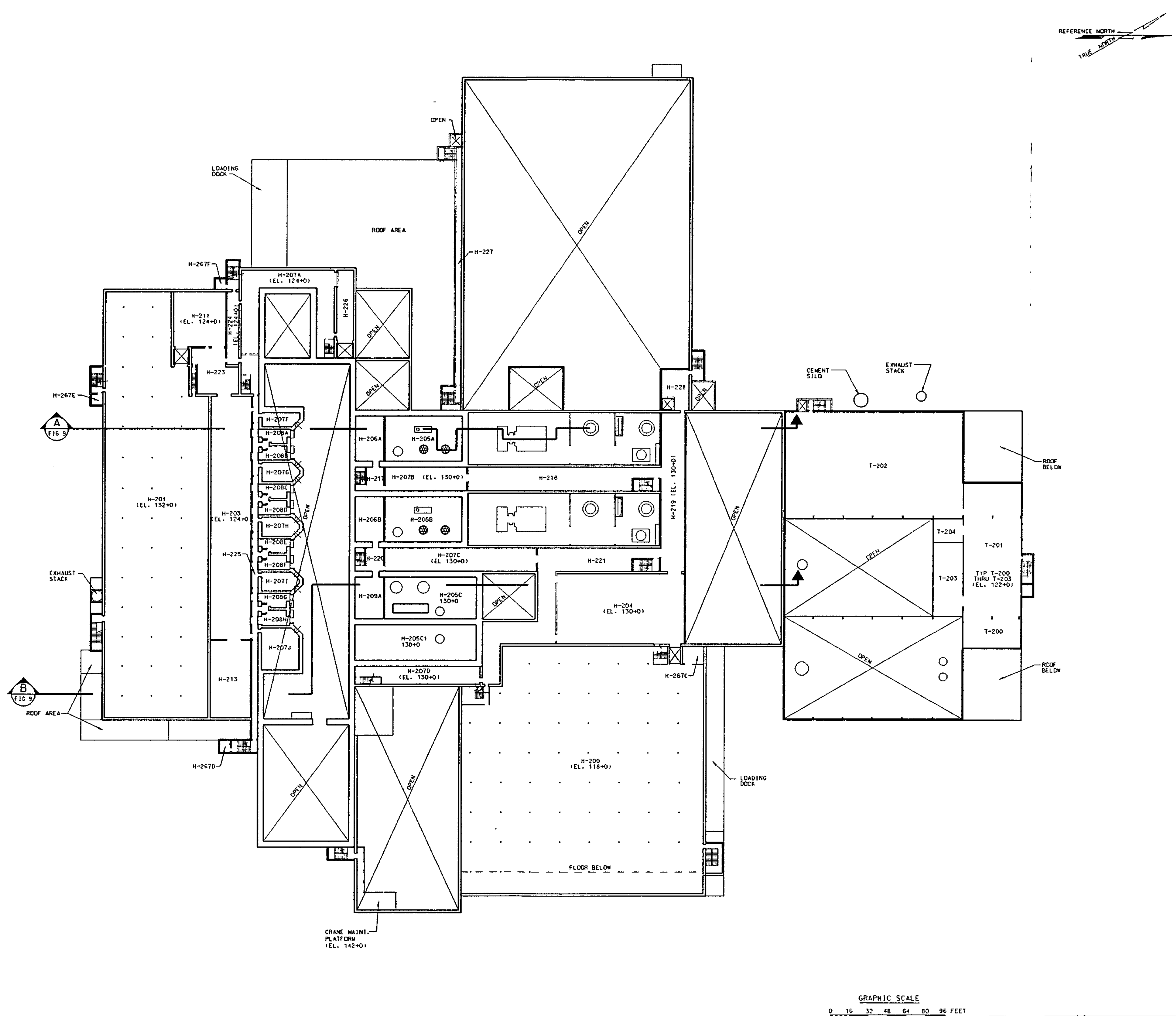

FIGURE I-5
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 130+0

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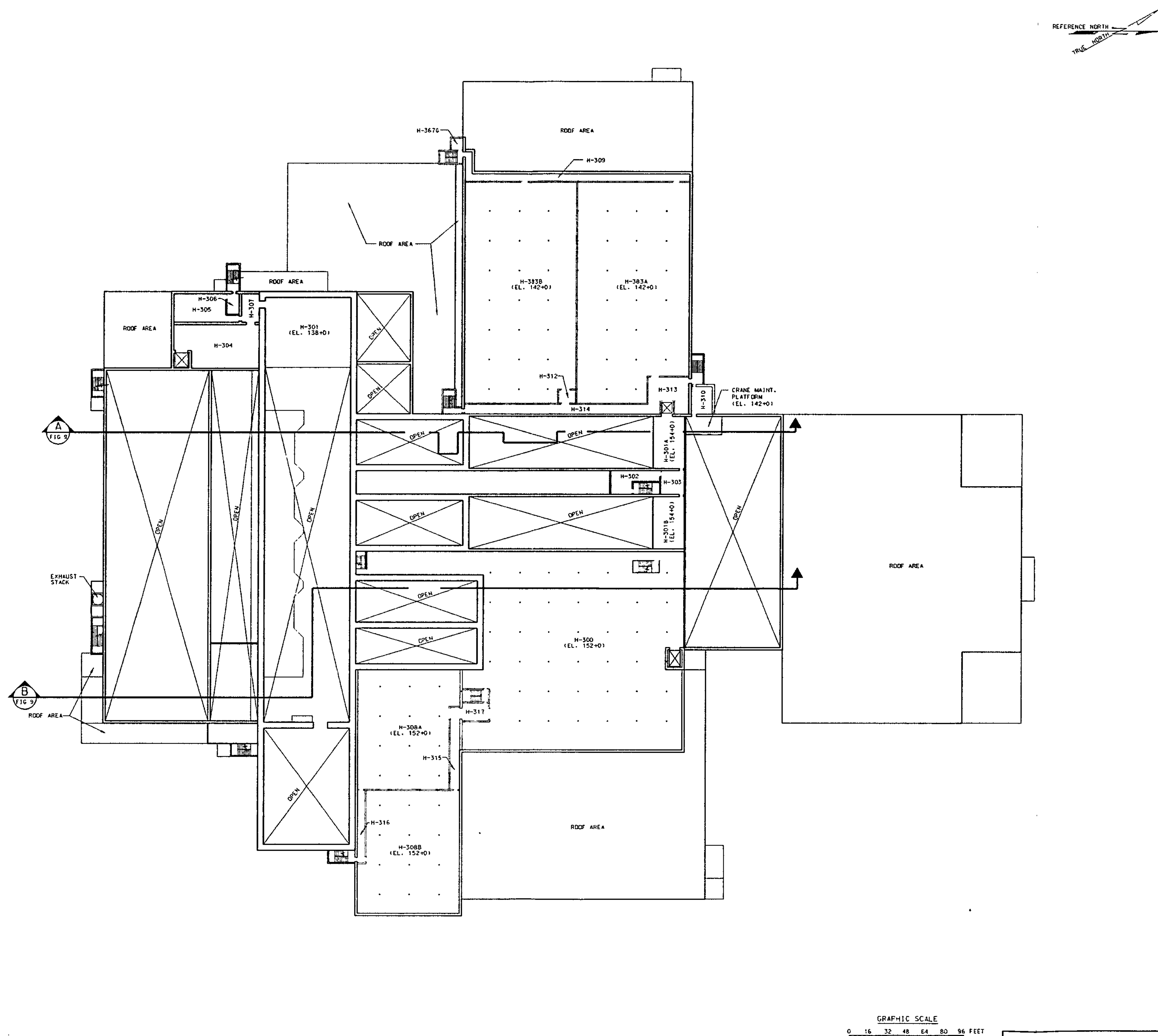

FIGURE I-6
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 142+0

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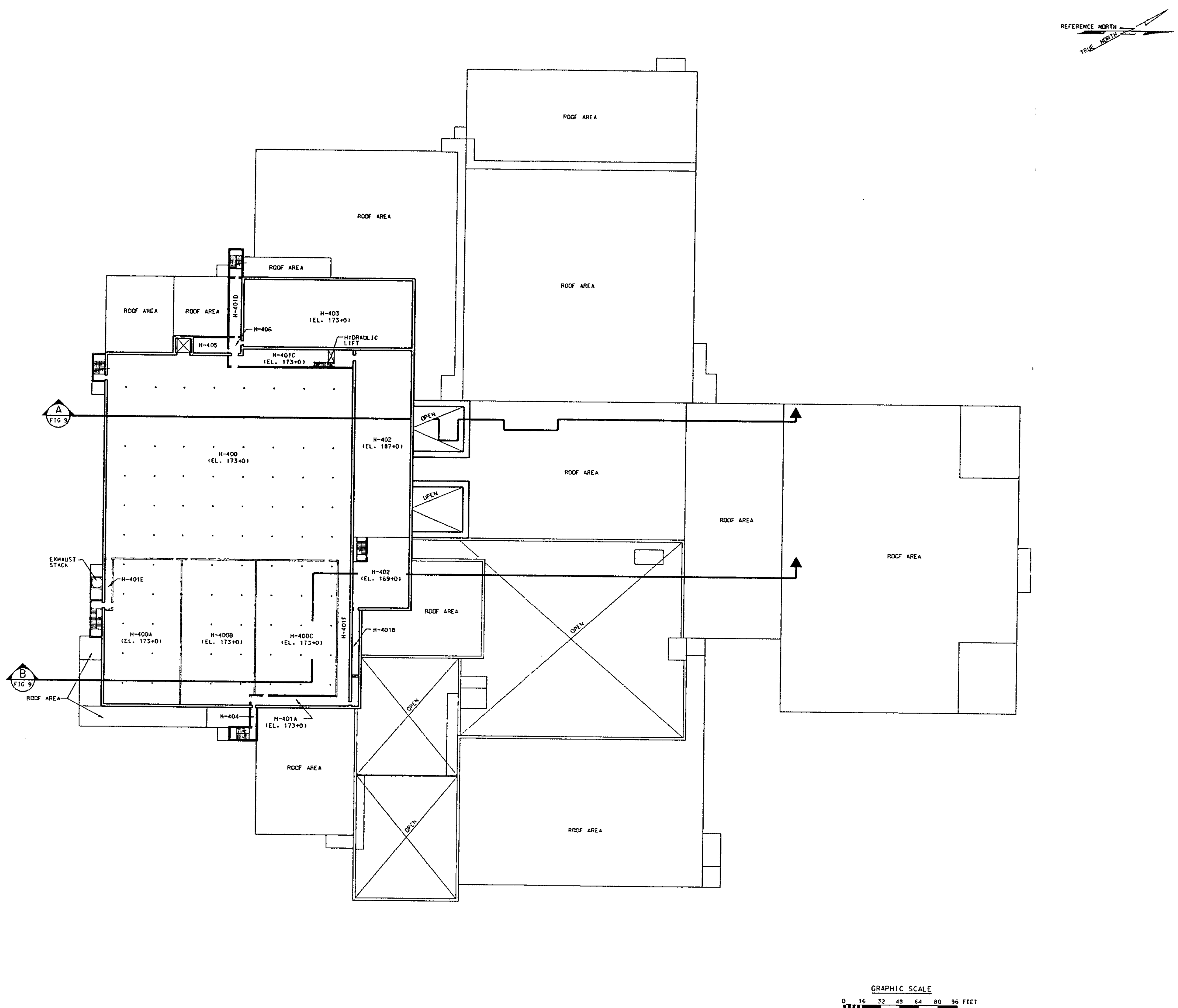

FIGURE I-7
WASTE HANDLING/WASTE TREATMENT BLDG
FLOOR PLAN AT EL. 173+0

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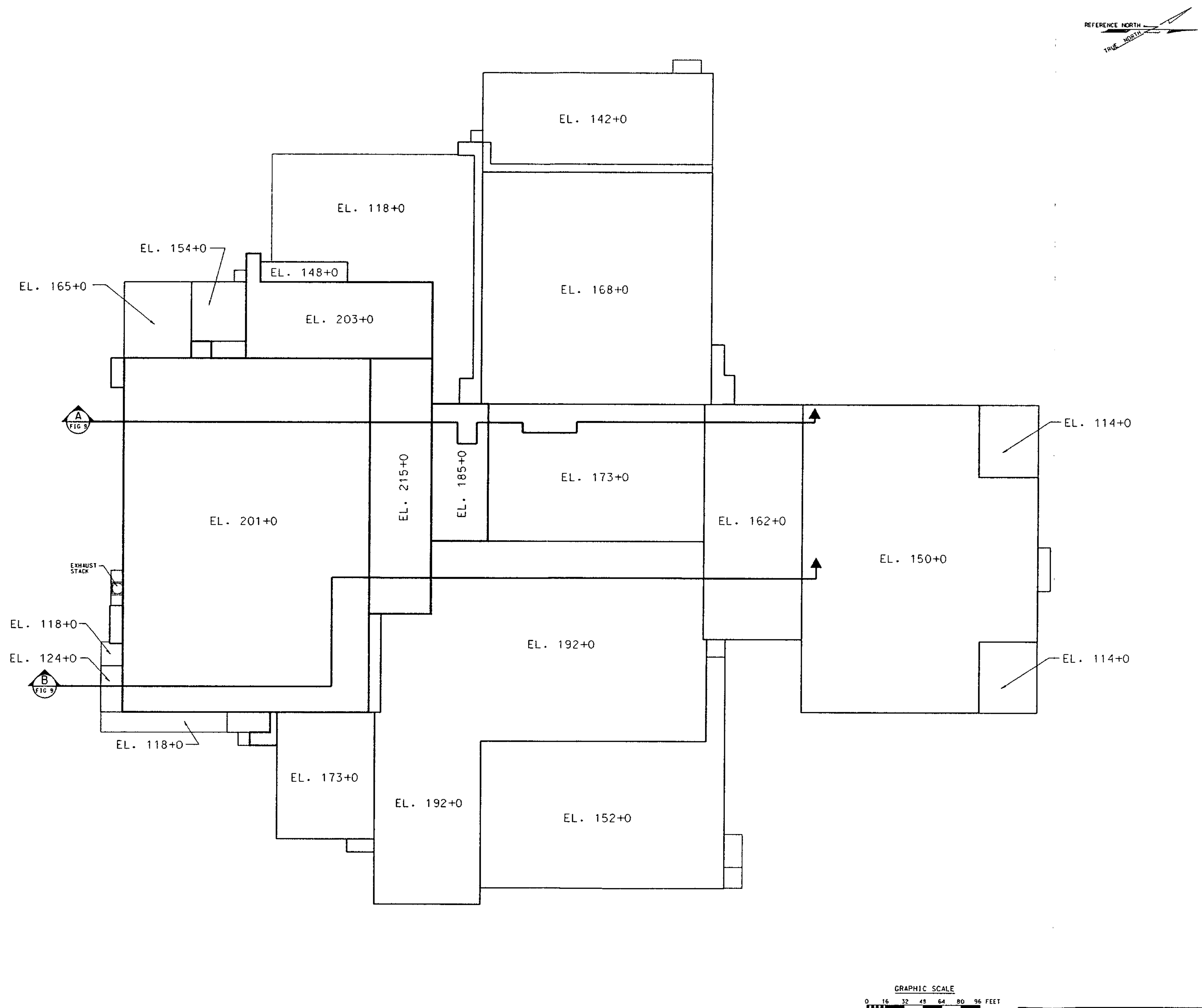

FIGURE I-8
WASTE HANDLING/WASTE TREATMENT BLDG
ROOF PLAN

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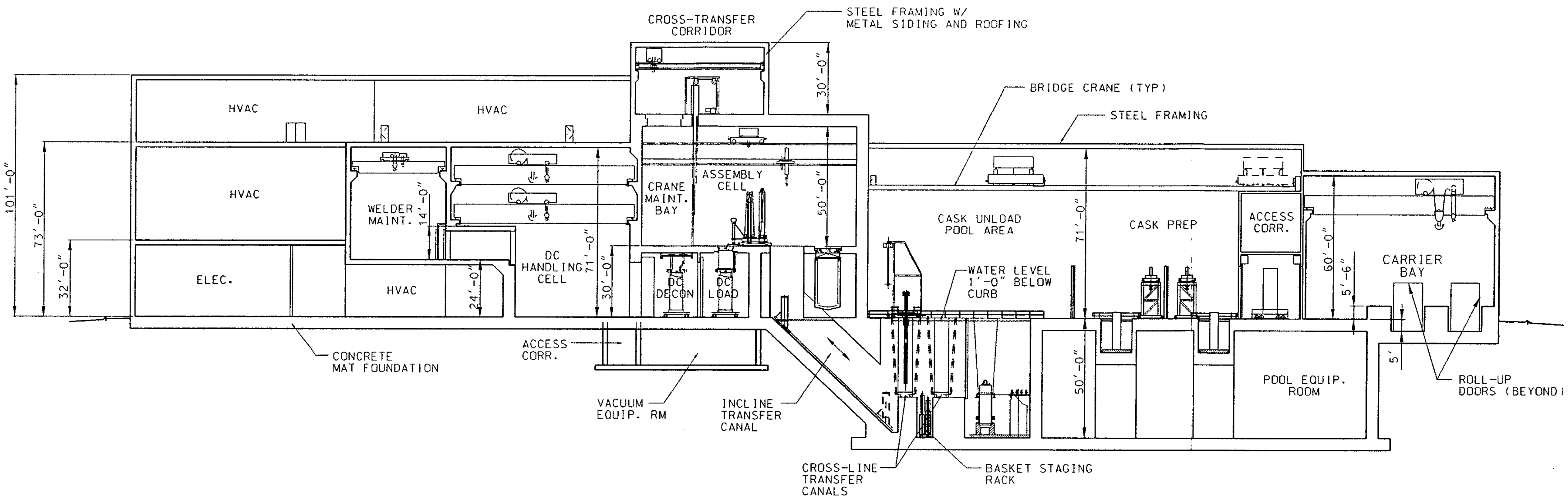
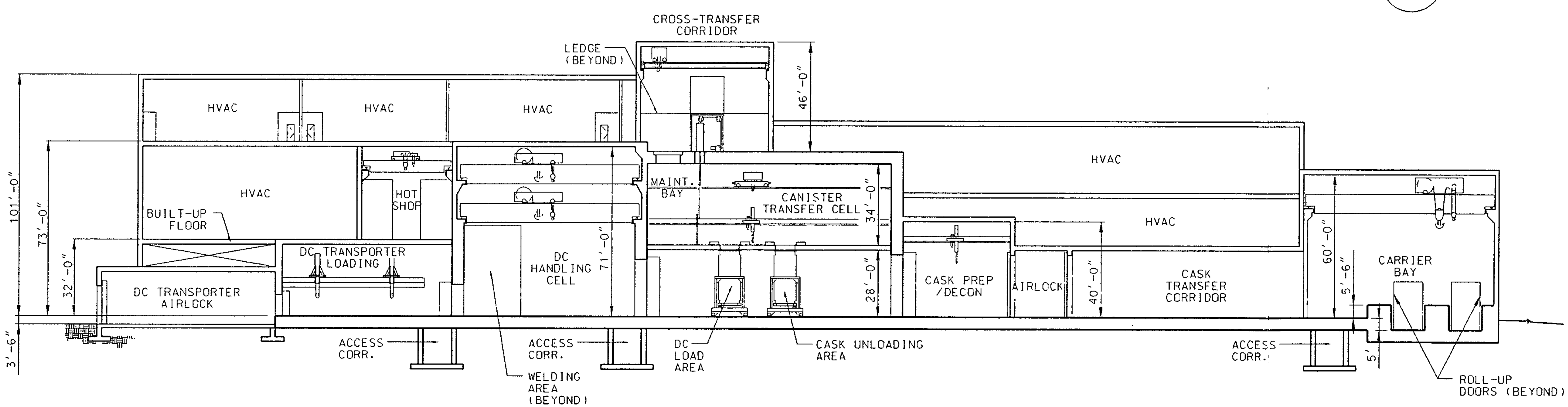


BUILDING SECTION - ASSEMBLY TRANSFER

A
FIG 4



BUILDING SECTION - CANISTER TRANSFER

B
FIG 4

GRAPHIC SCALE
0 8 16 24 32 40 48 FEET

FIGURE I-9
WASTE HANDLING/WASTE TREATMENT BLDG
BUILDING SECTIONS

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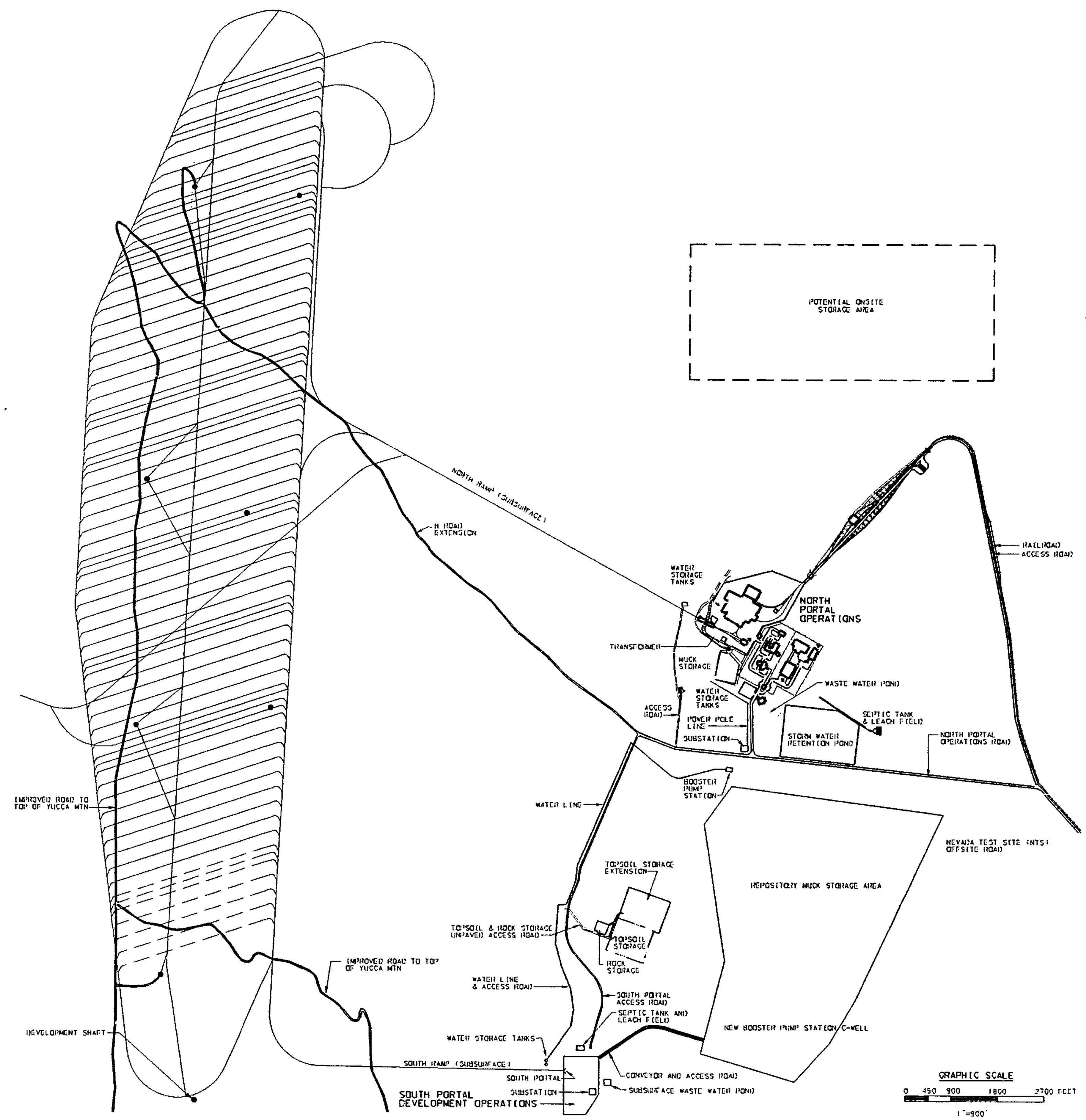

FIGURE I-10
REPOSITORY
OVERALL SITE PLAN

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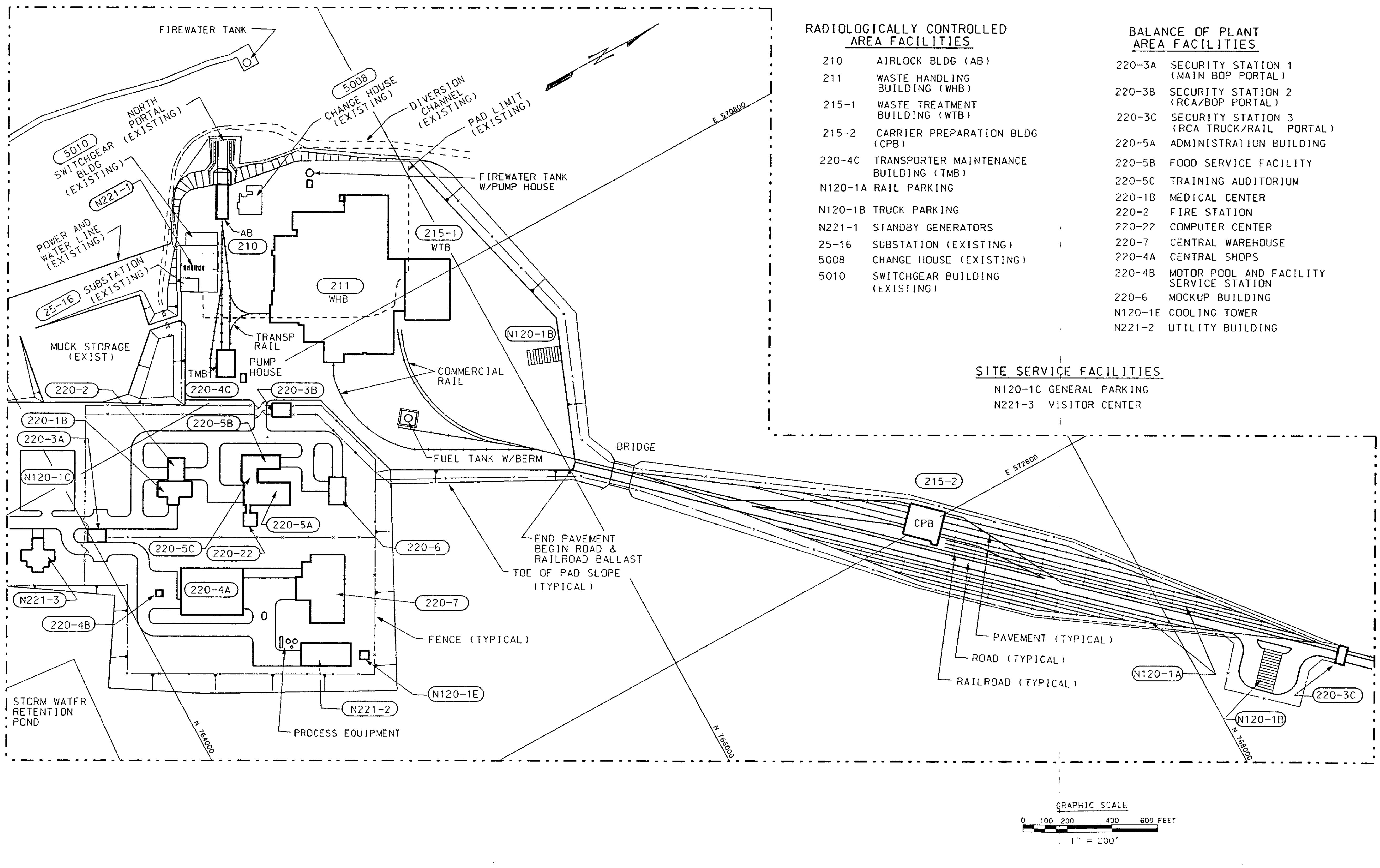

FIGURE I-11
NORTH PORTAL REPOSITORY
AREA SITE PLAN

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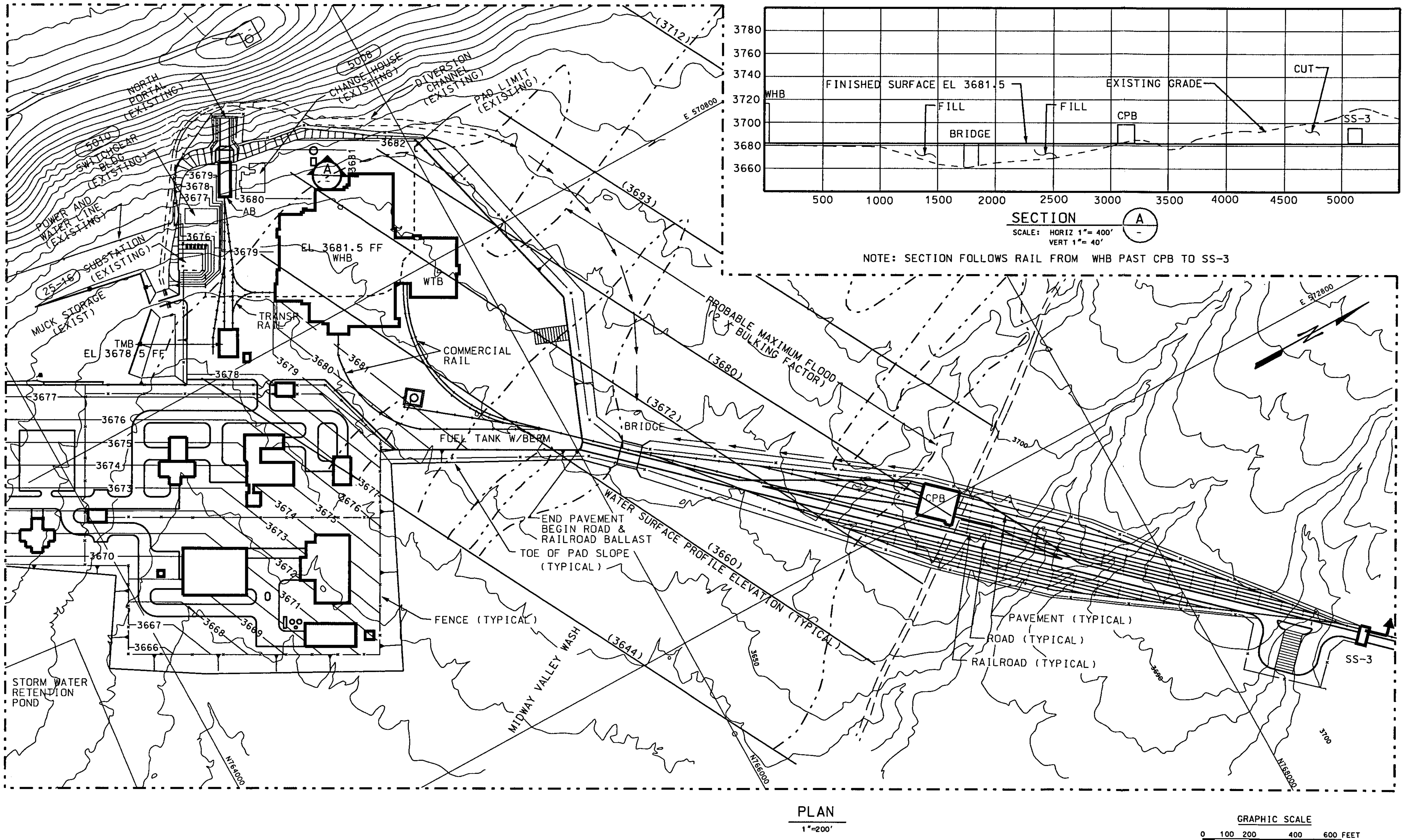

FIGURE I-12
NORTH PORTAL REPOSITORY
GRADING PLAN

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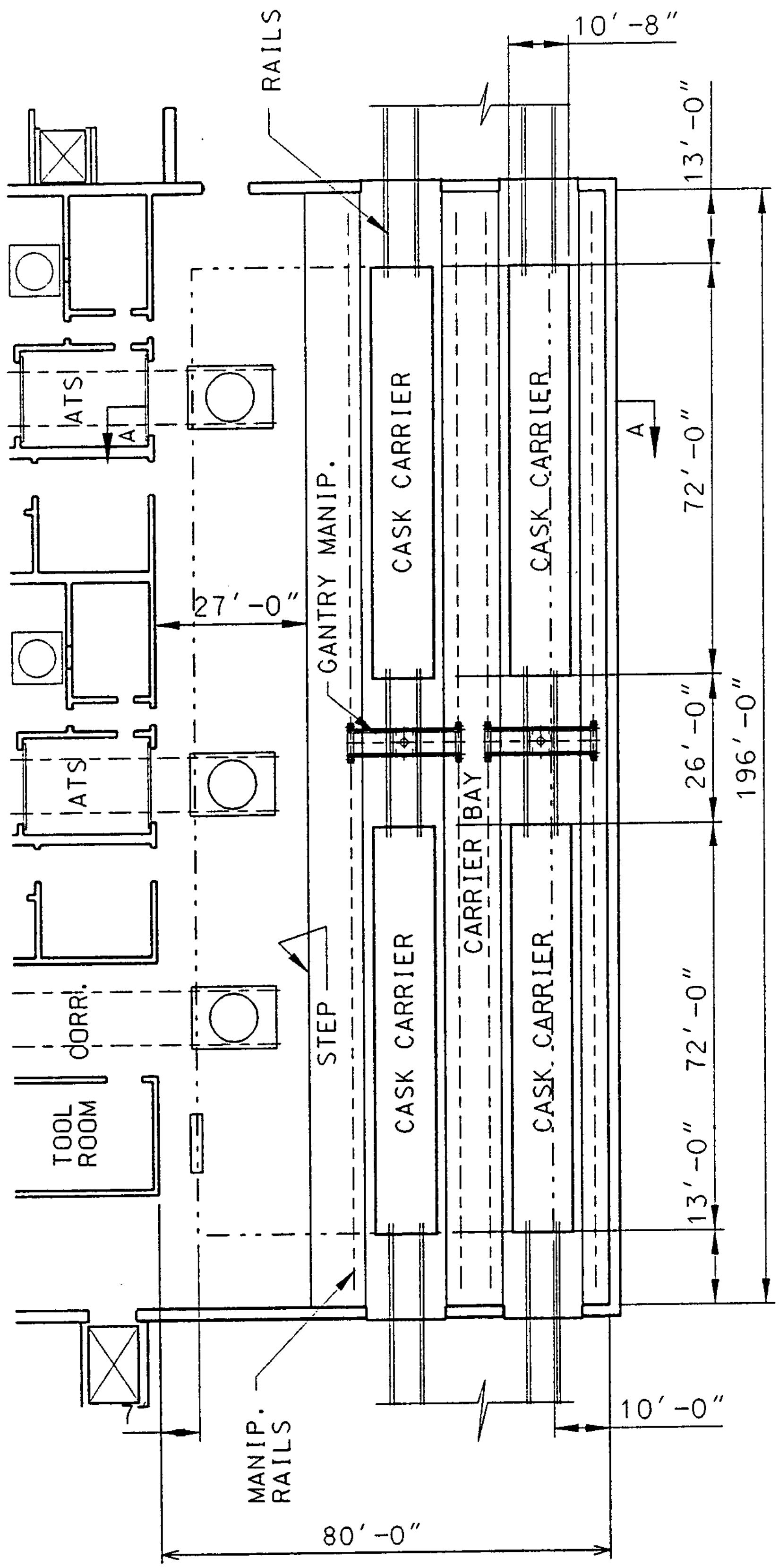

FIGURE I-13
CARRIER BAY PLAN

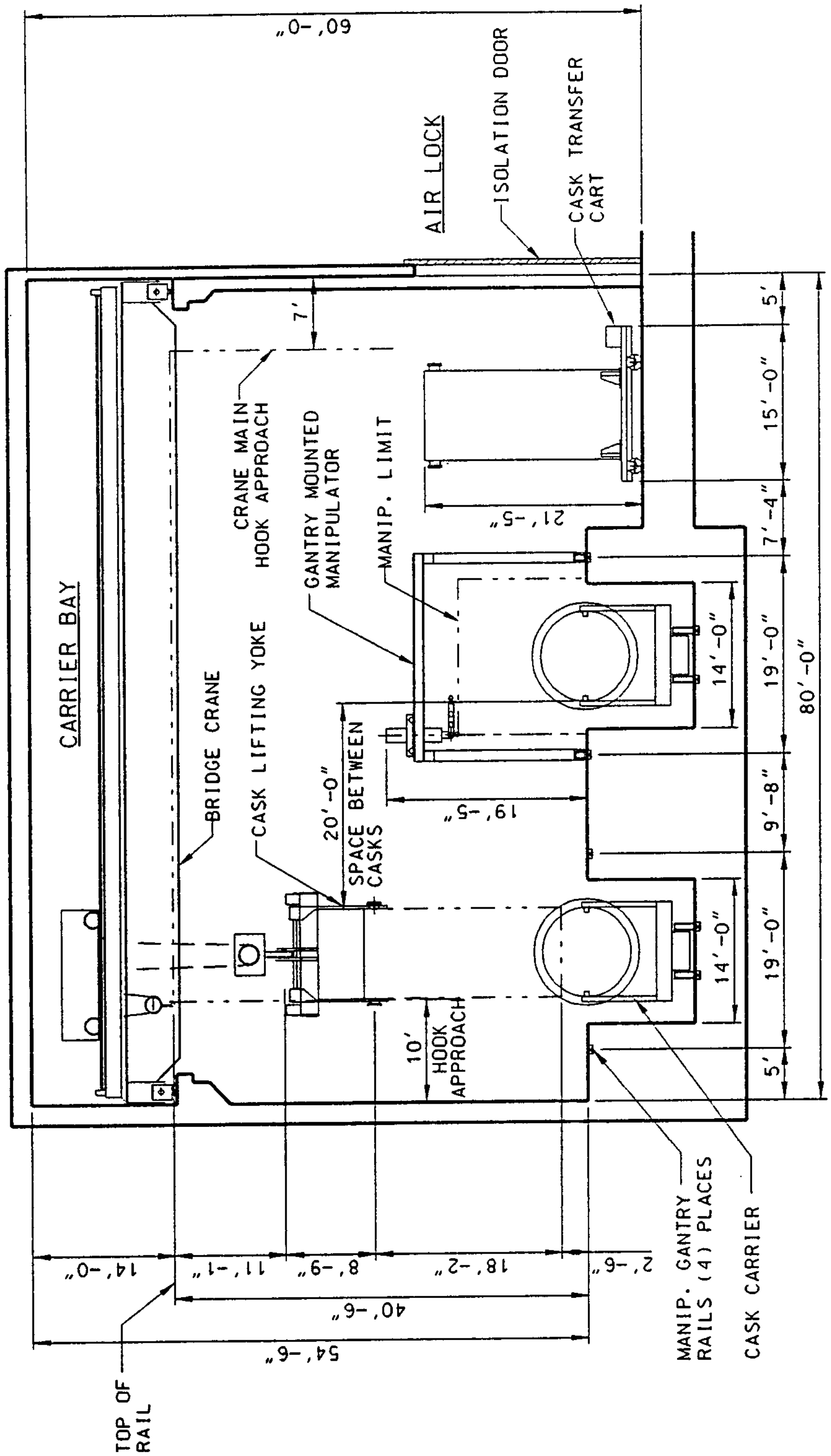

FIGURE I-14
CARRIER BAY SECTION

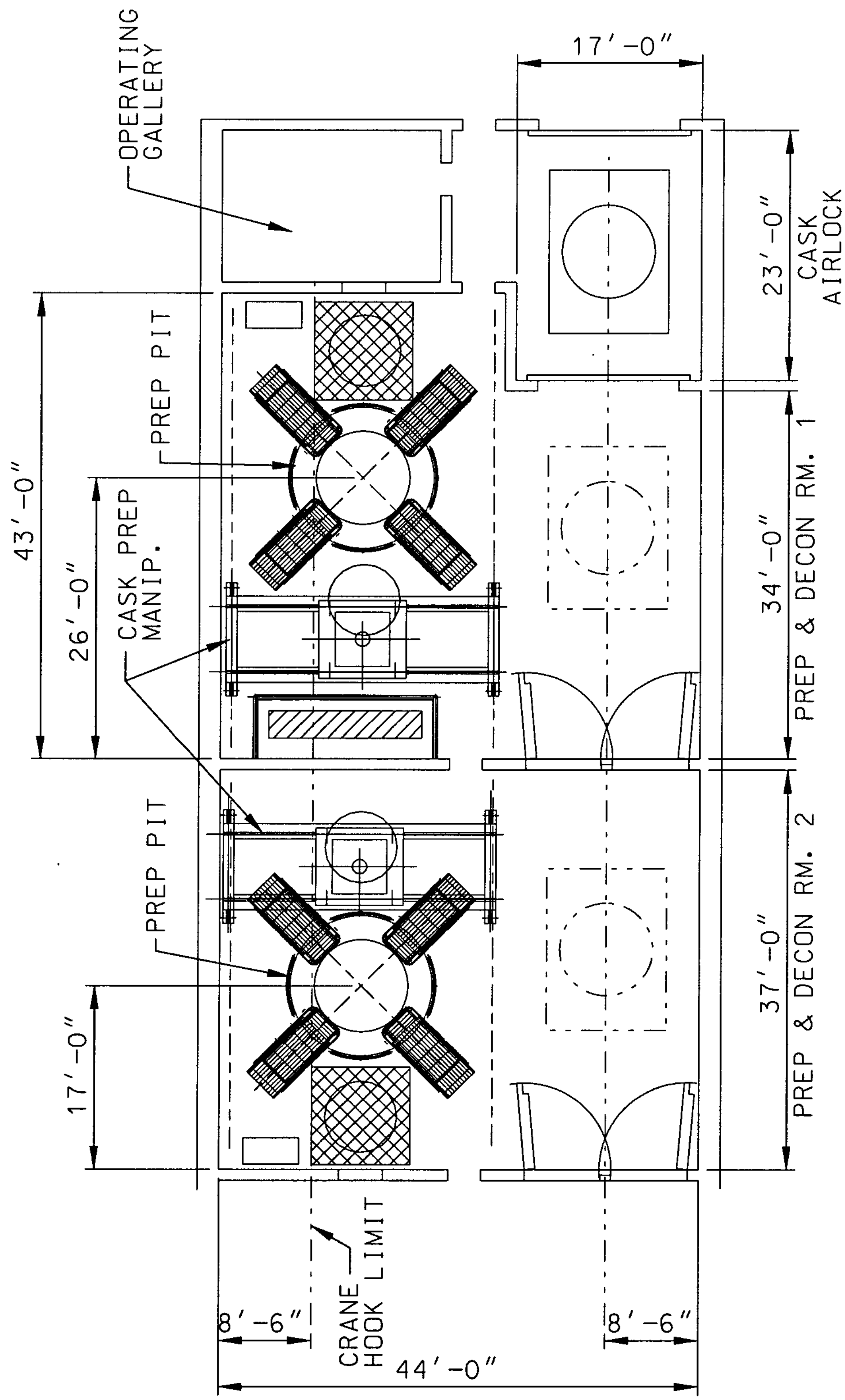

FIGURE I-15
CASK PREPARATION AND
DECONTAMINATION ROOMS PLAN

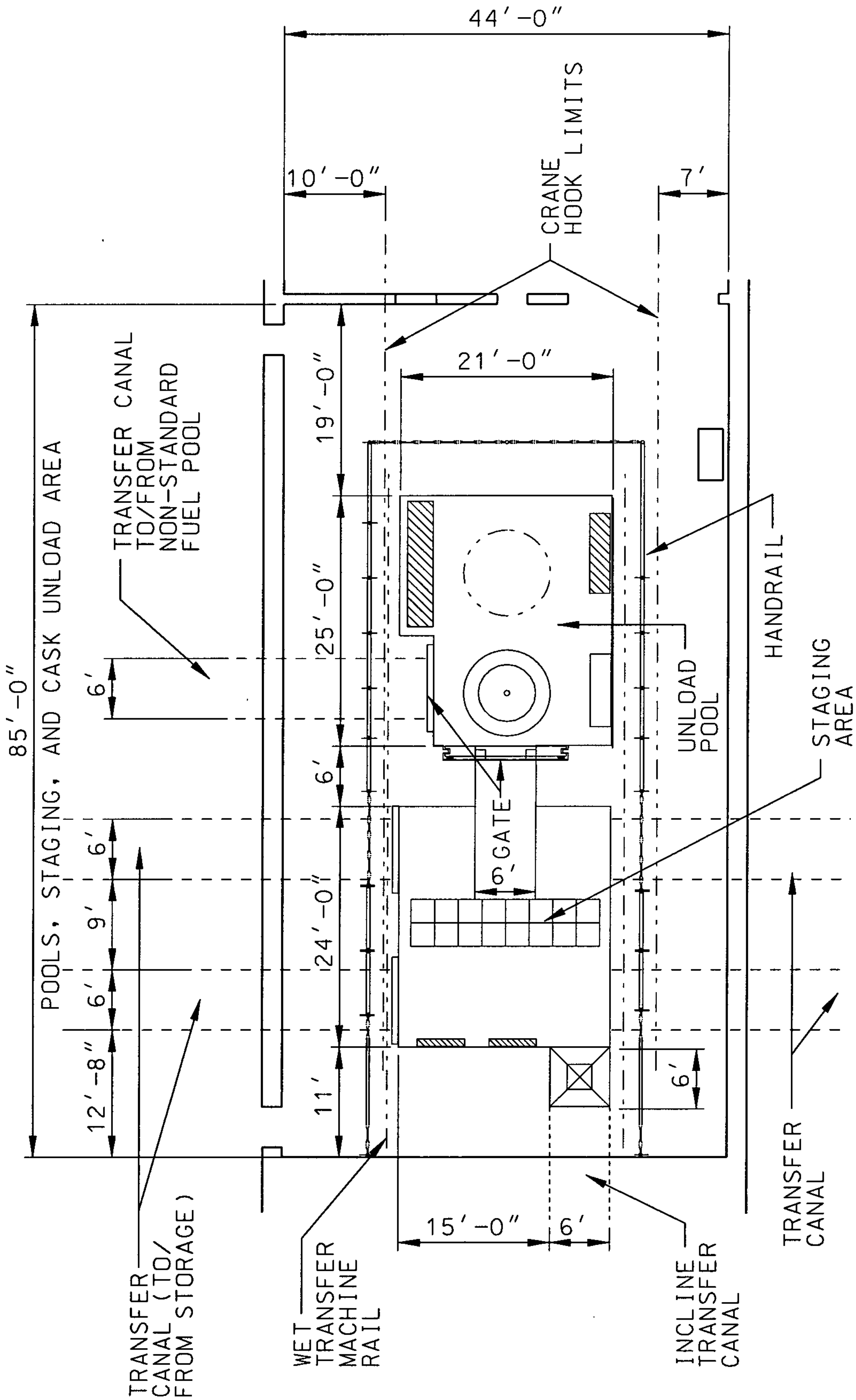

FIGURE I-16
CASK UNLOADING AREA
PLAN

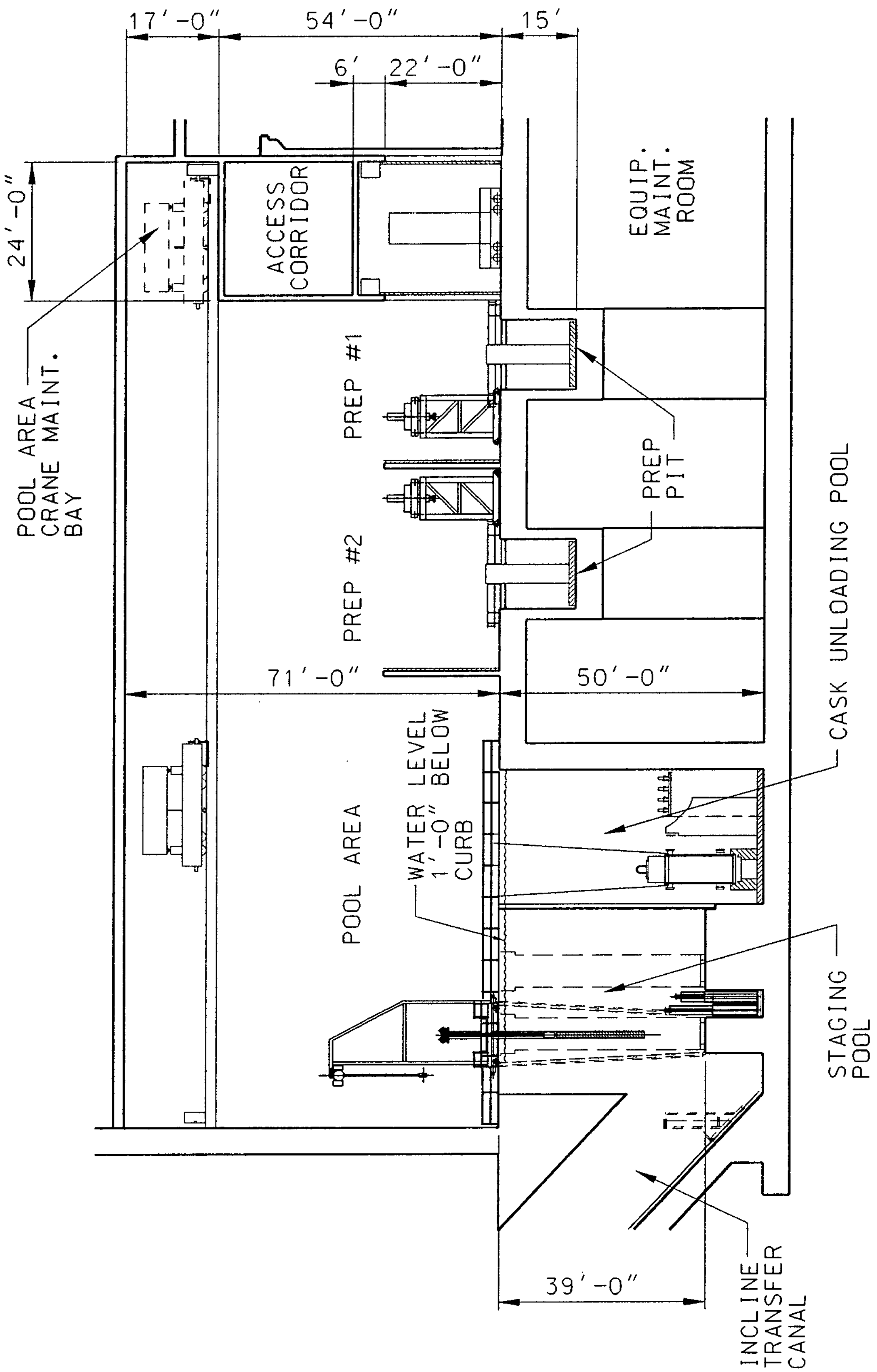

FIGURE I-17
CASK PREPARATION AND UNLOADING AREA SECTION

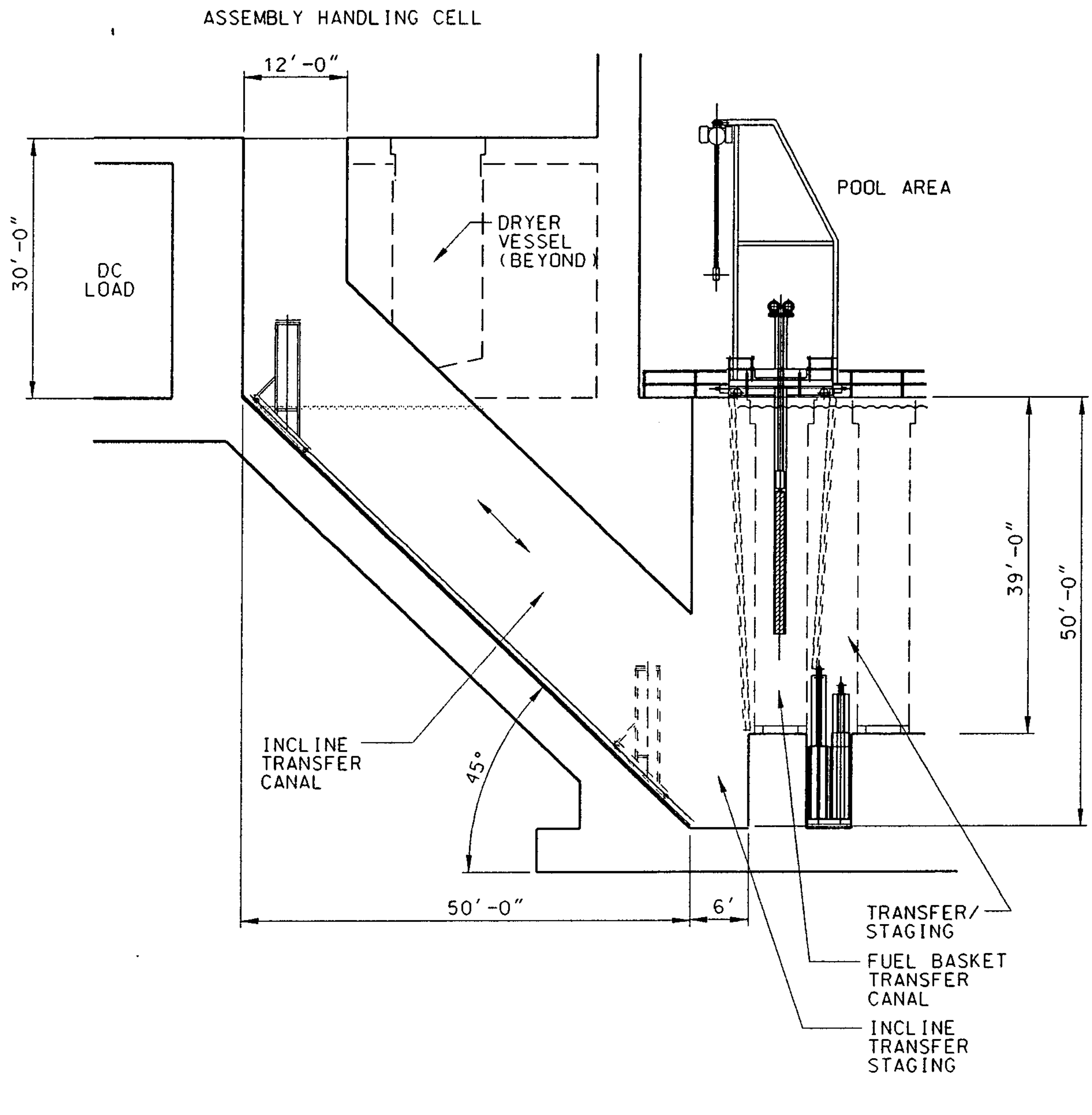

FIGURE I-18
INCLINE TRANSFER CANAL SECTION

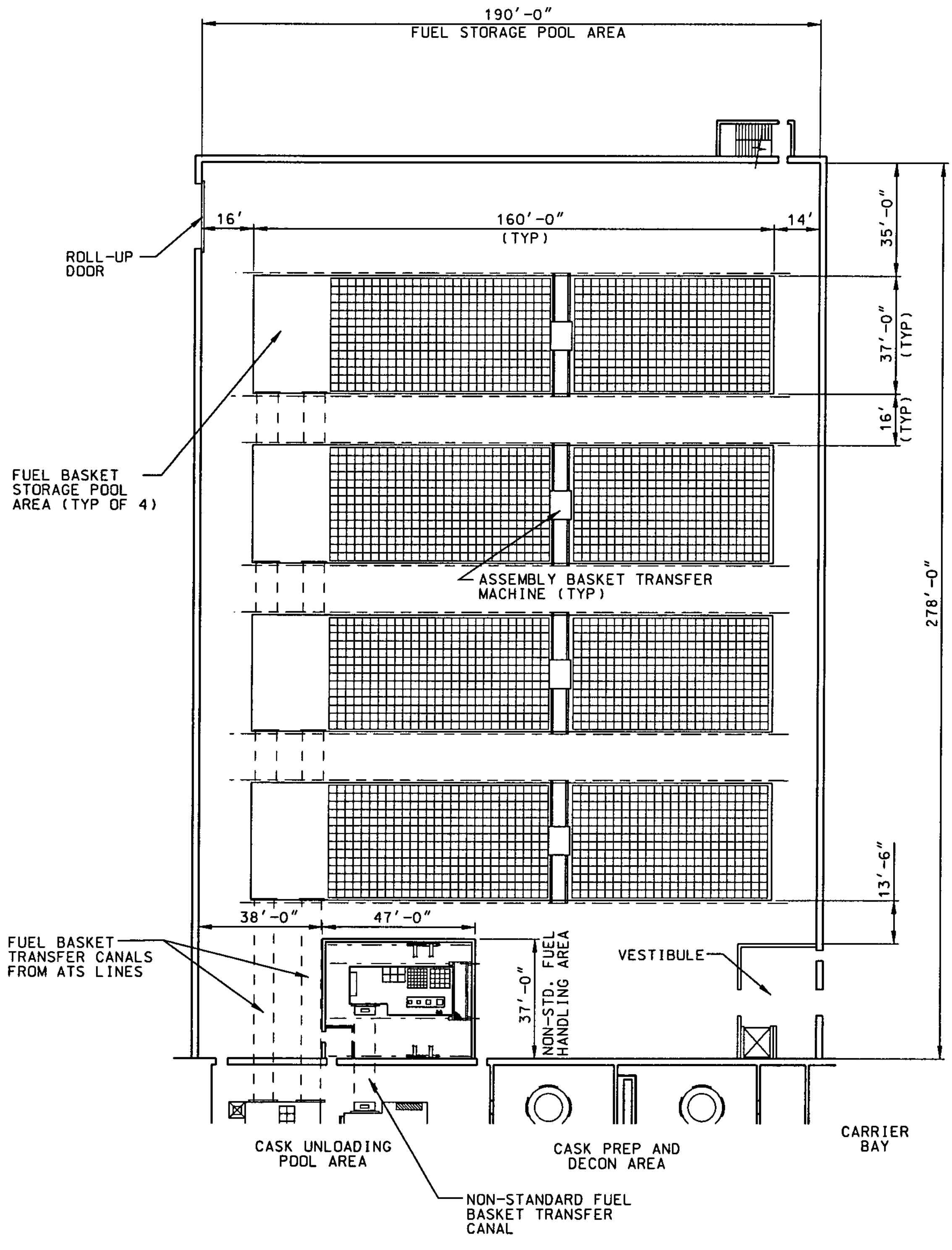

FIGURE I-19
FUEL BASKET STORAGE POOL AREA

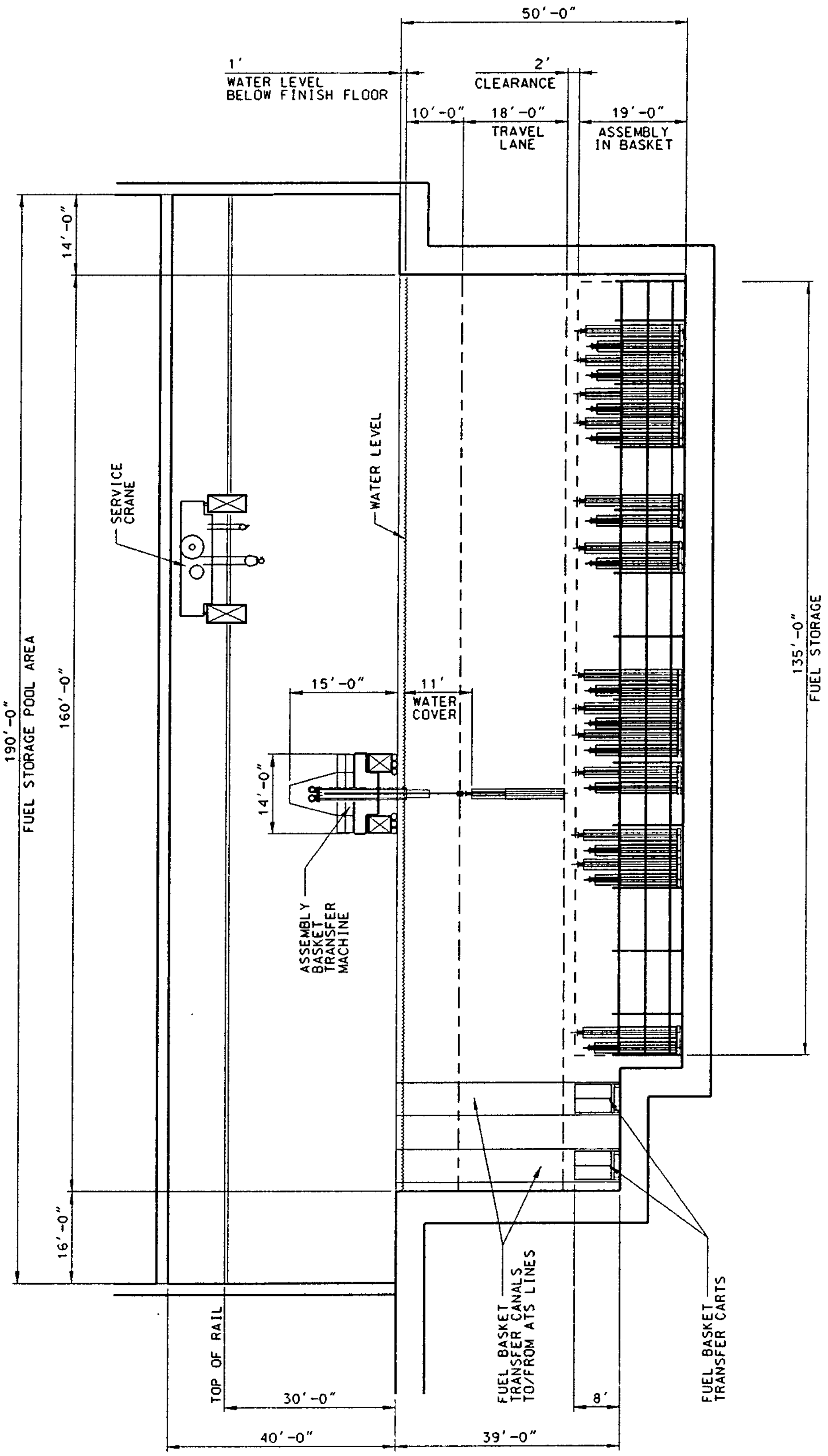

FIGURE I-20
FUEL BASKET STORAGE POOL AREA SECTION

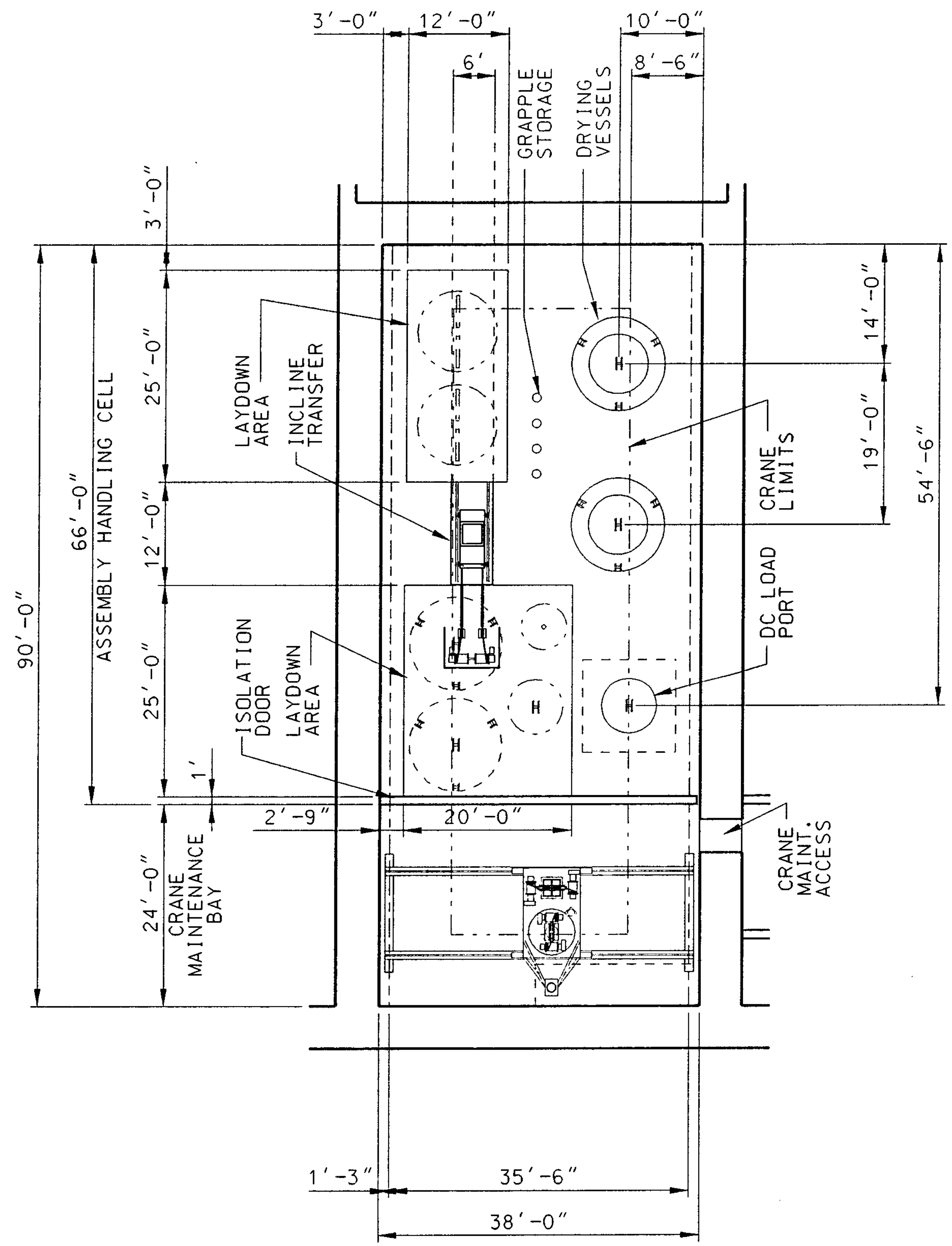

FIGURE I-21
ASSEMBLY HANDLING CELL PLAN

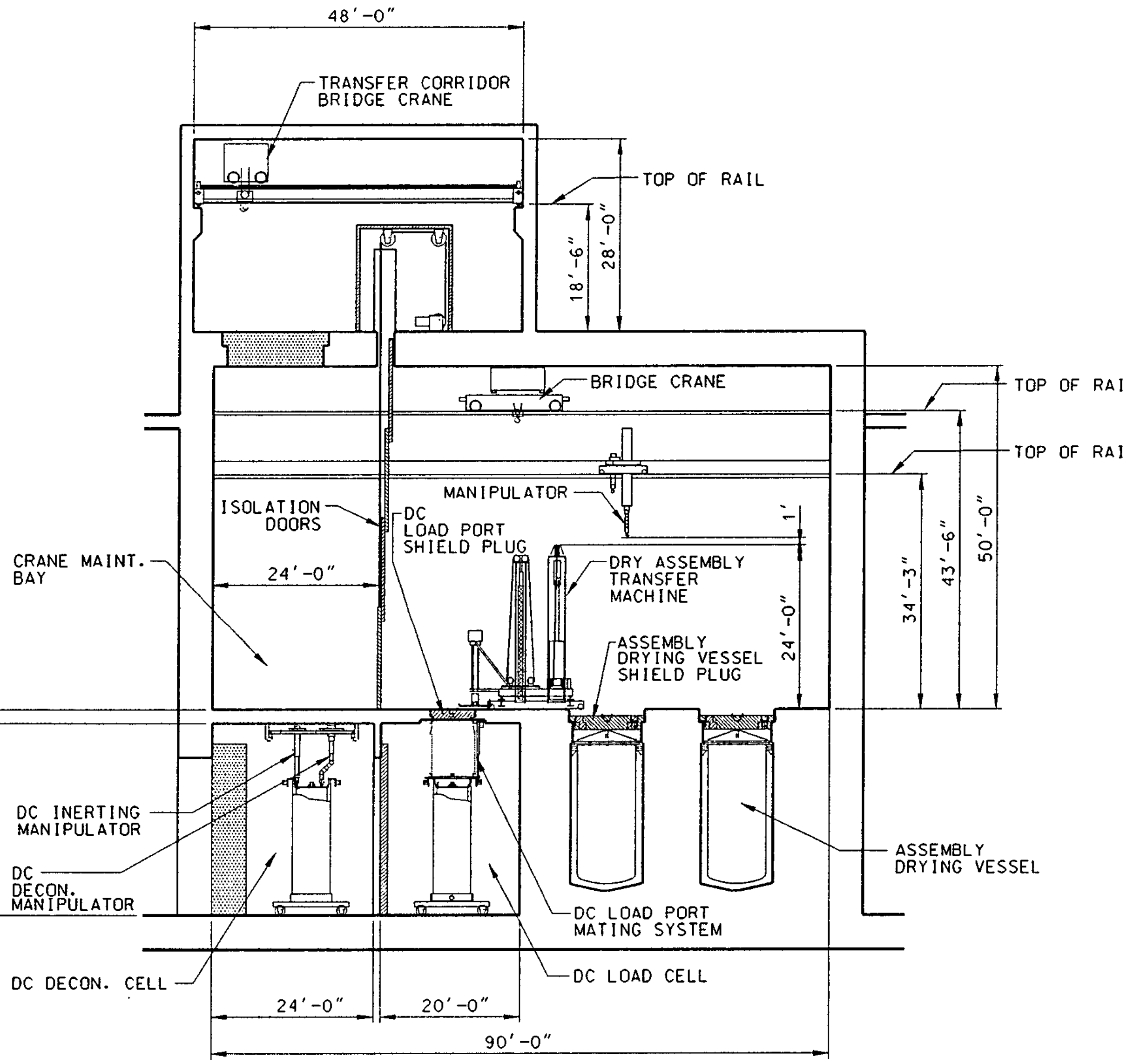

FIGURE I-22
ASSEMBLY HANDLING CELL SECTION

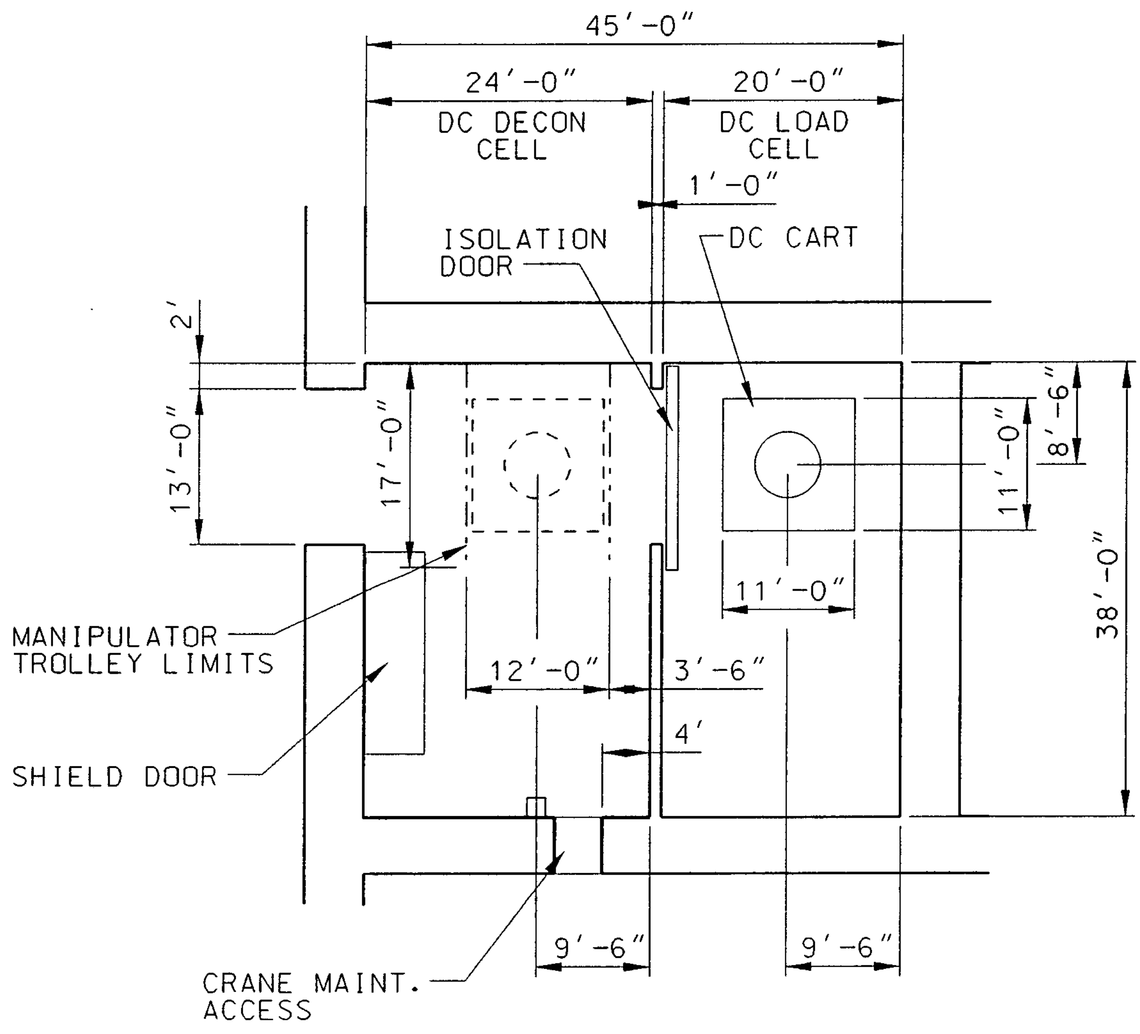

FIGURE I-23
DISPOSAL CONTAINER LOAD AND DECONTAMINATION CELLS PLAN

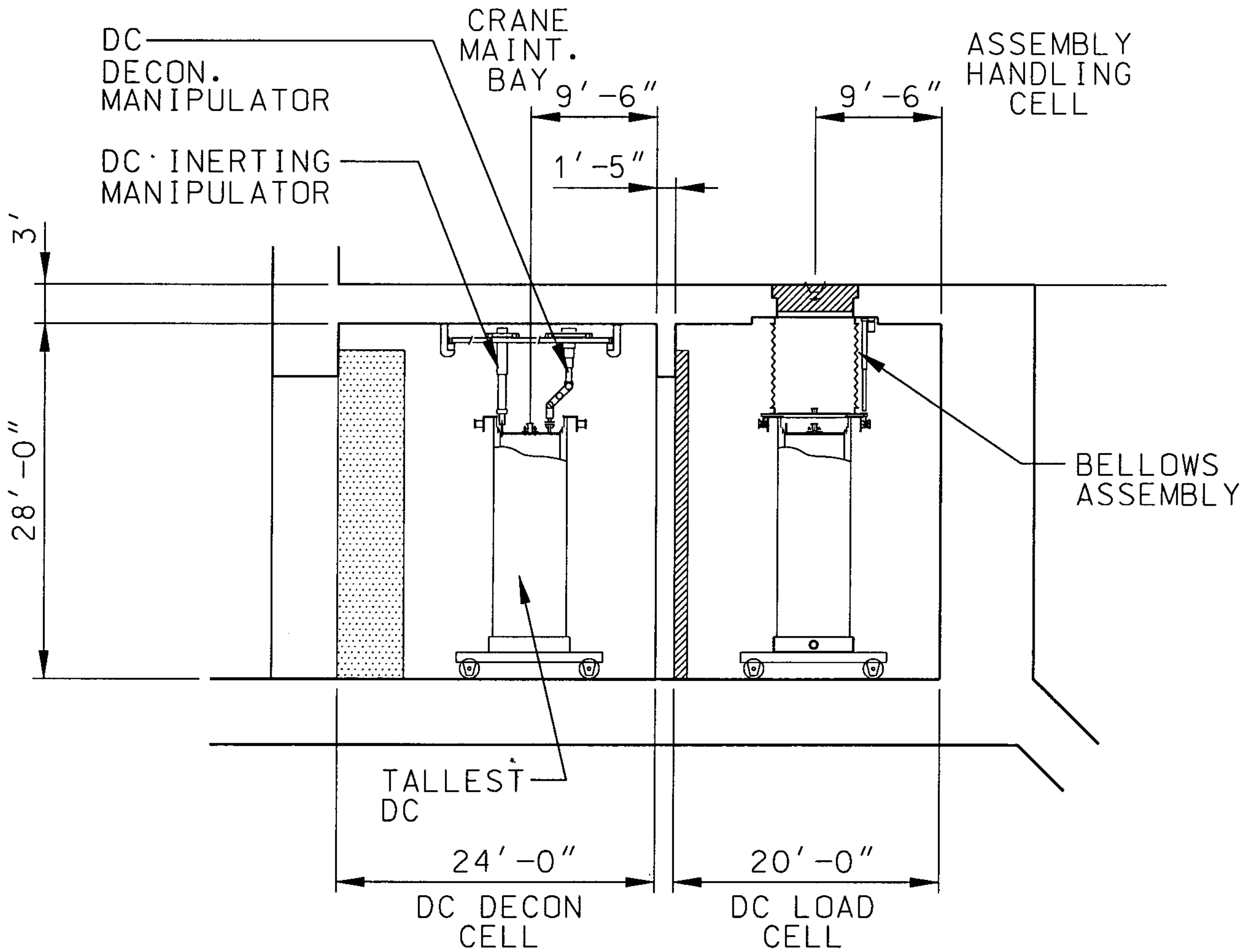

FIGURE I-24
DISPOSAL CONTAINER LOAD AND DECONTAMINATION CELLS SECTION

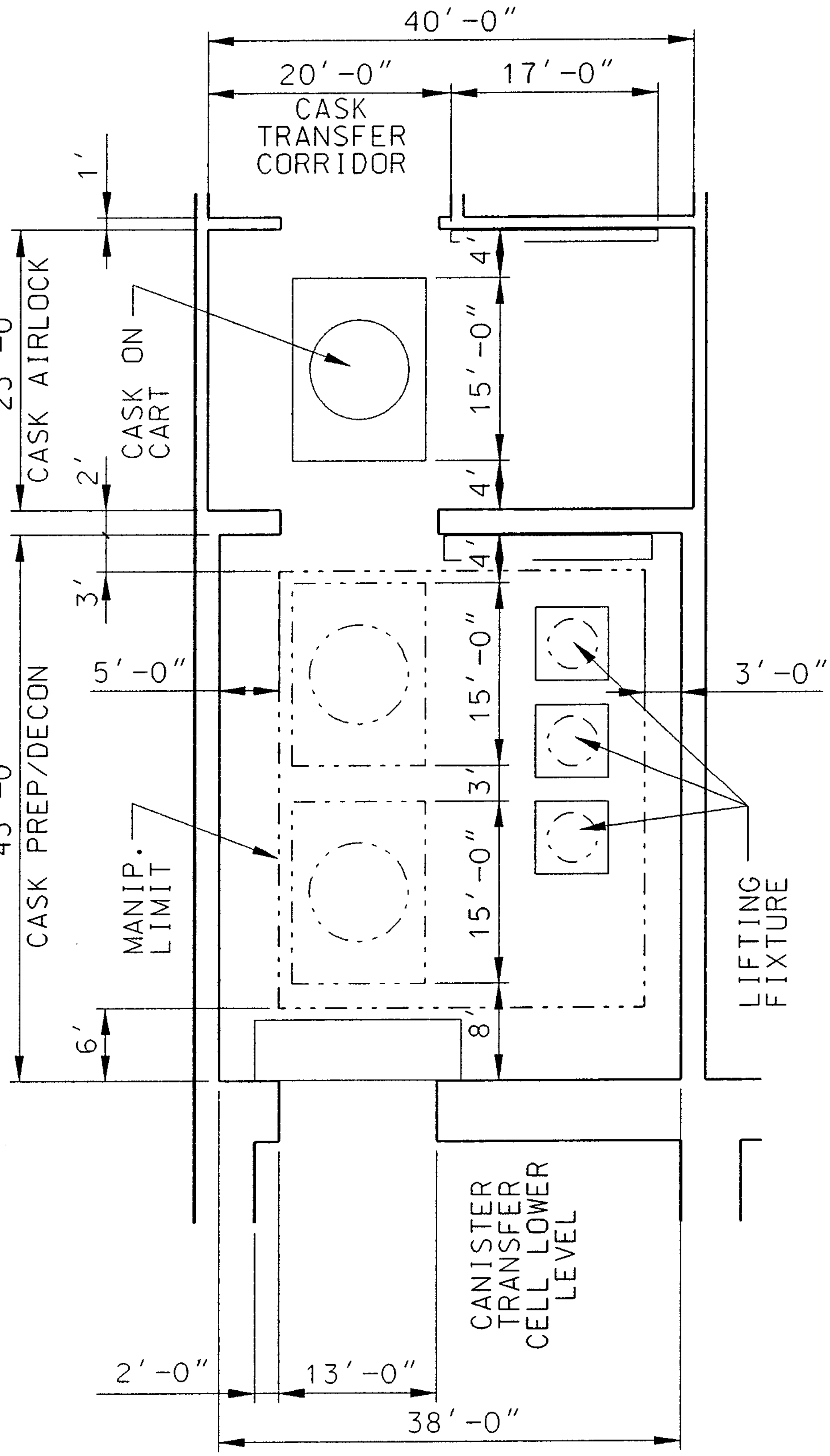

FIGURE I-25
AIRLOCK, CASK PREP AND DECONTAMINATION AREA PLAN

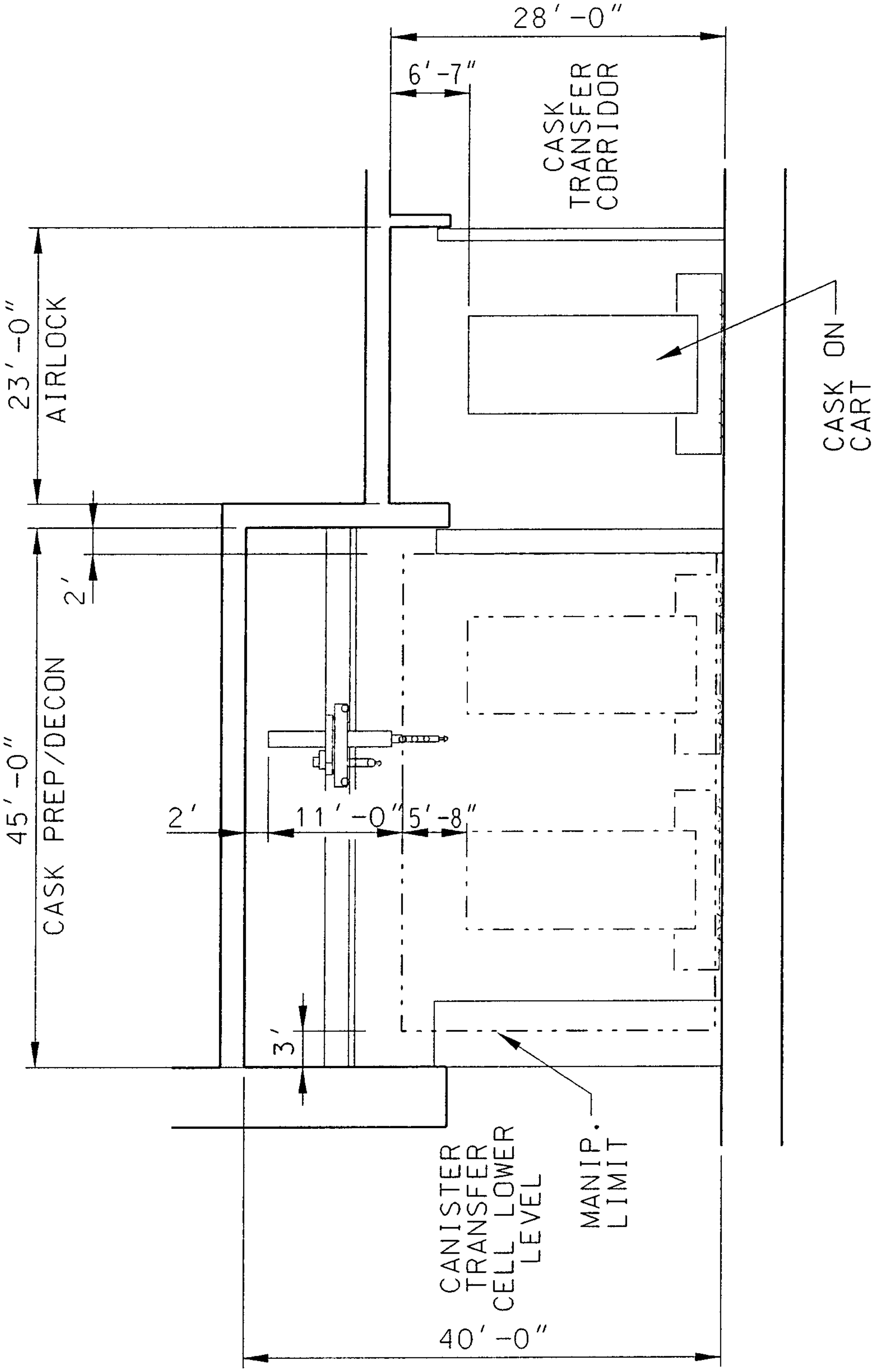

FIGURE I-26
AIRLOCK, CASK PREP AND DECONTAMINATION AREA SECTION

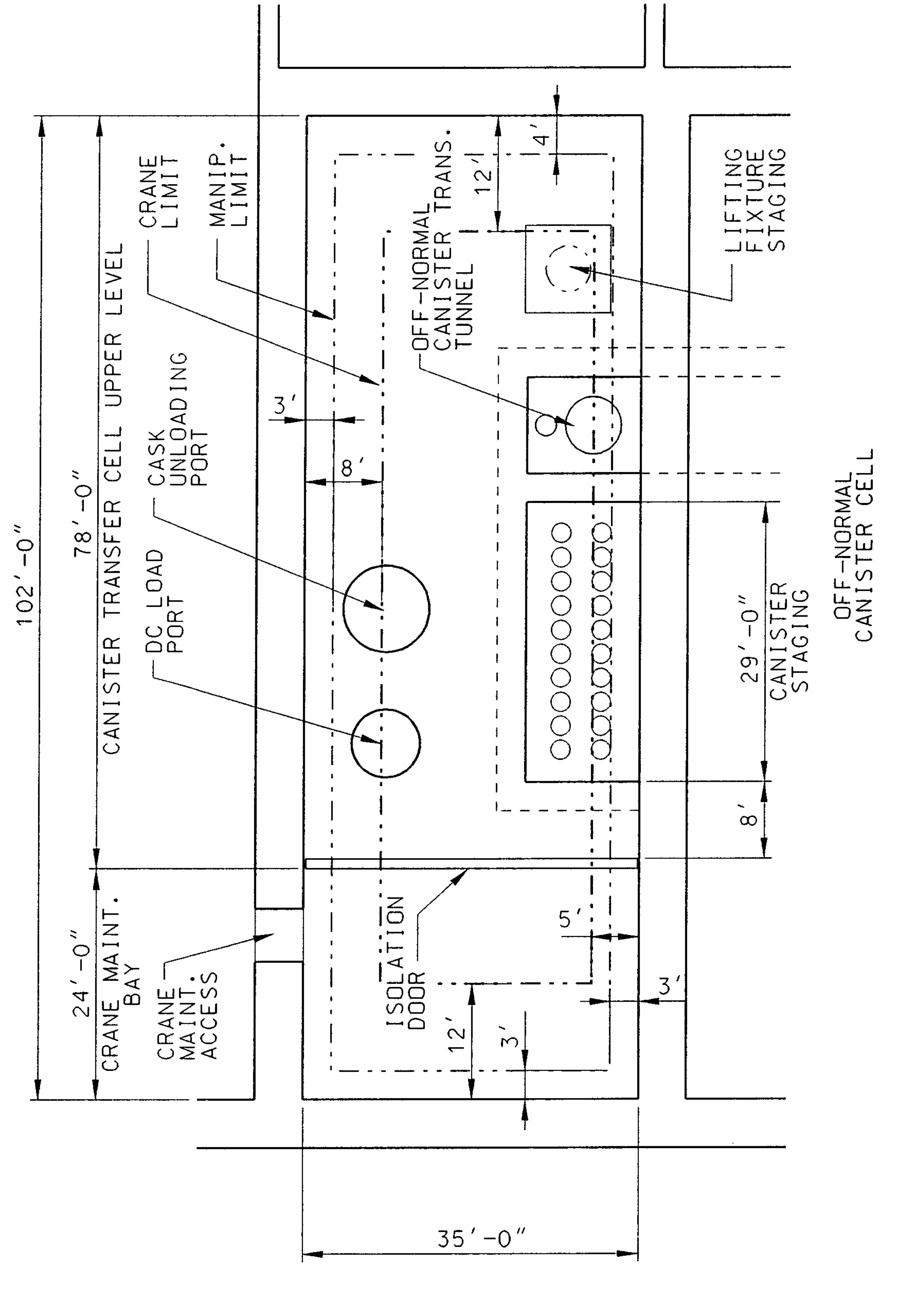

FIGURE I-27
CANISTER TRANSFER CELL
UPPER LEVEL PLAN

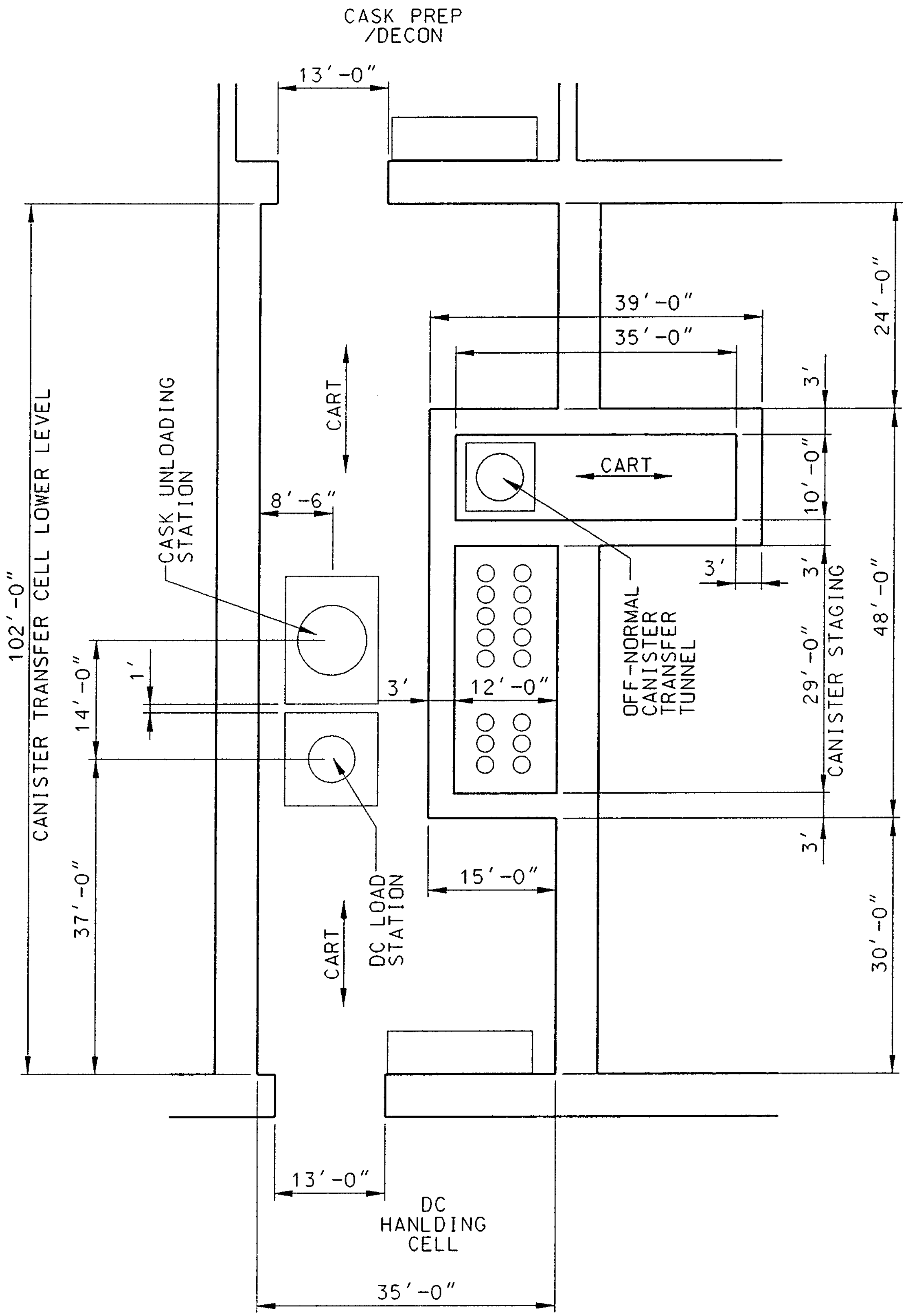

FIGURE I-28
CANISTER TRANSFER CELL
LOWER LEVEL PLAN

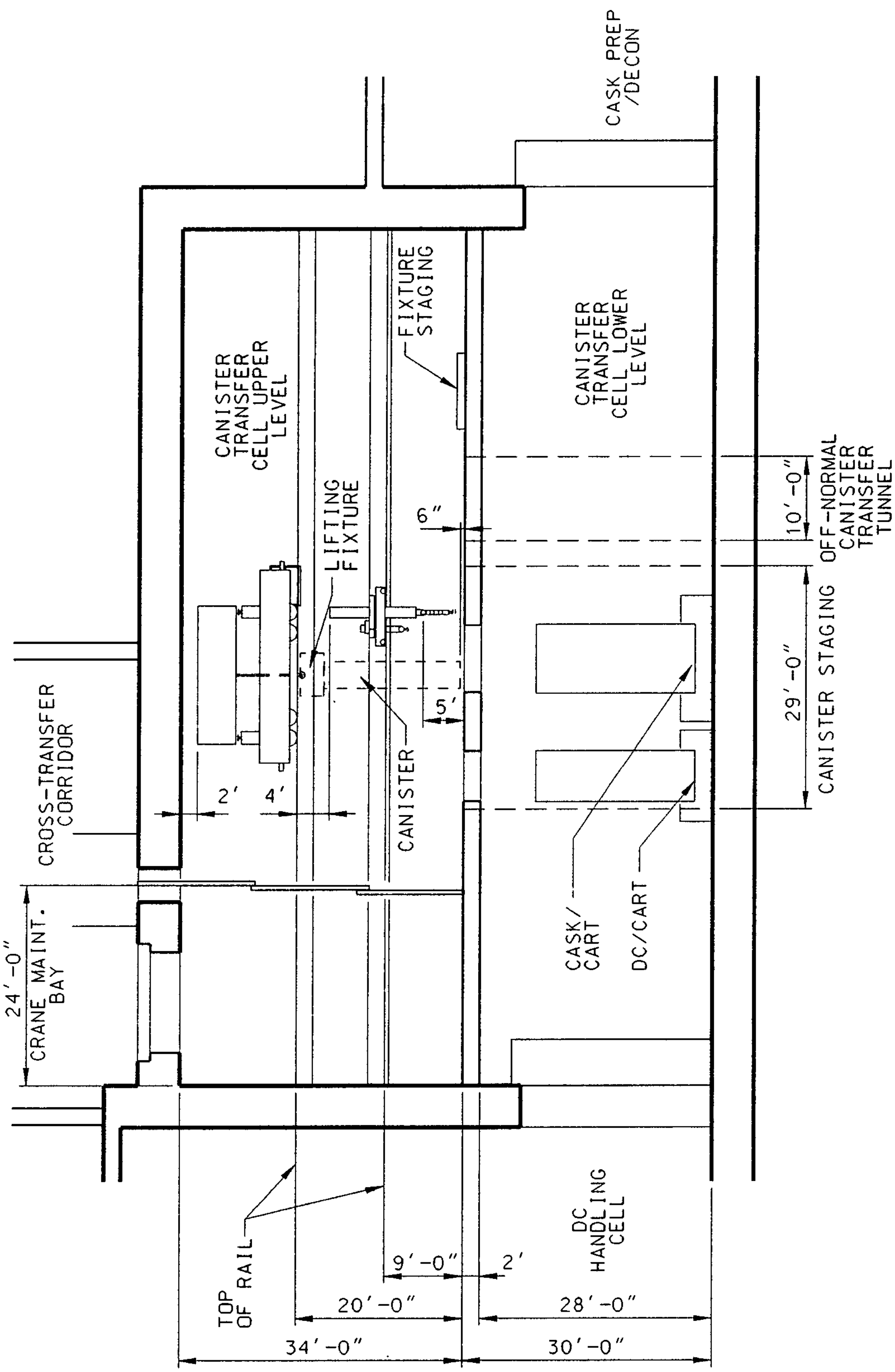

FIGURE I-29
CANISTER TRANSFER CELL SECTION

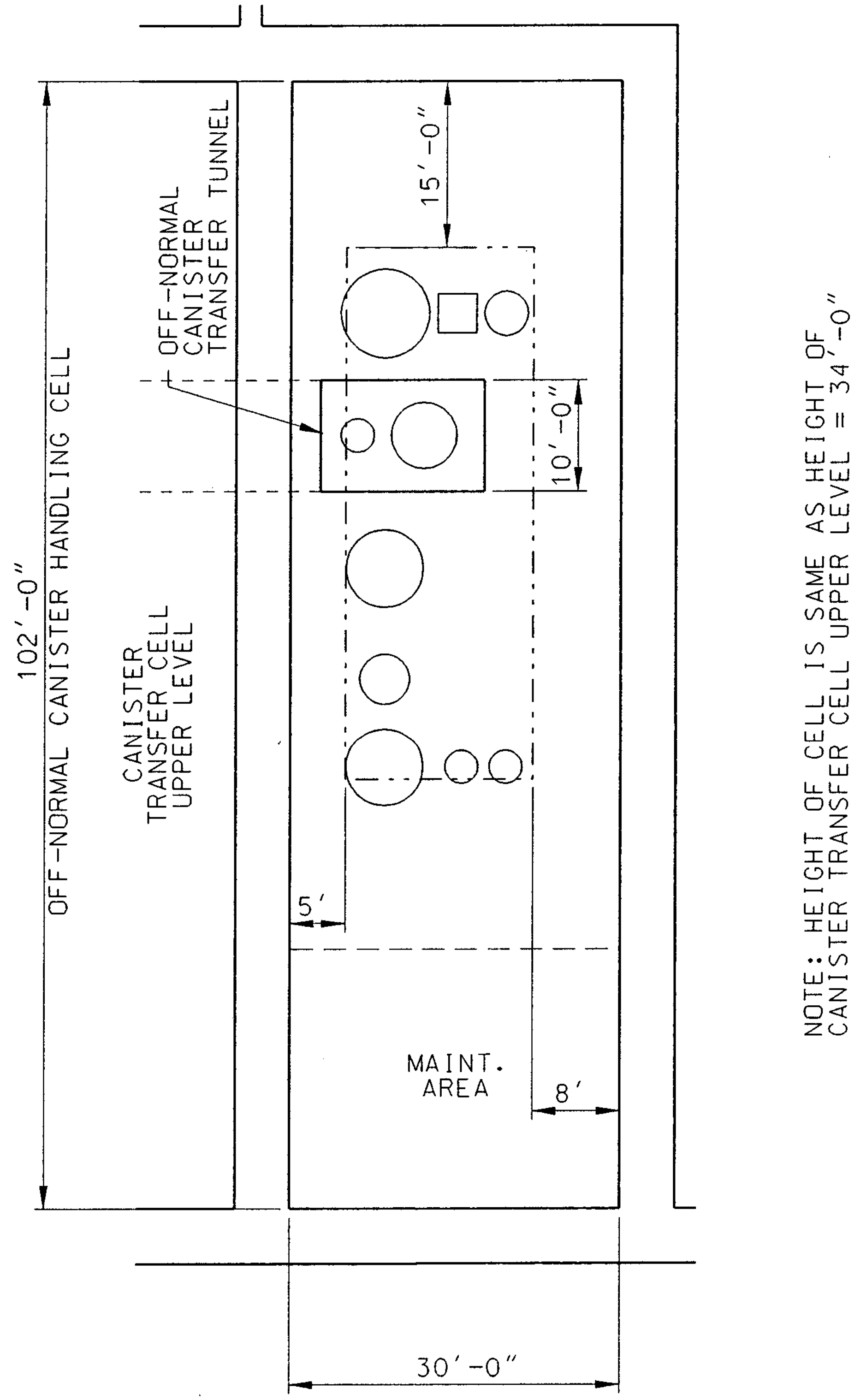

FIGURE I-30
OFF-NORMAL CANISTER HANDLING CELL PLAN

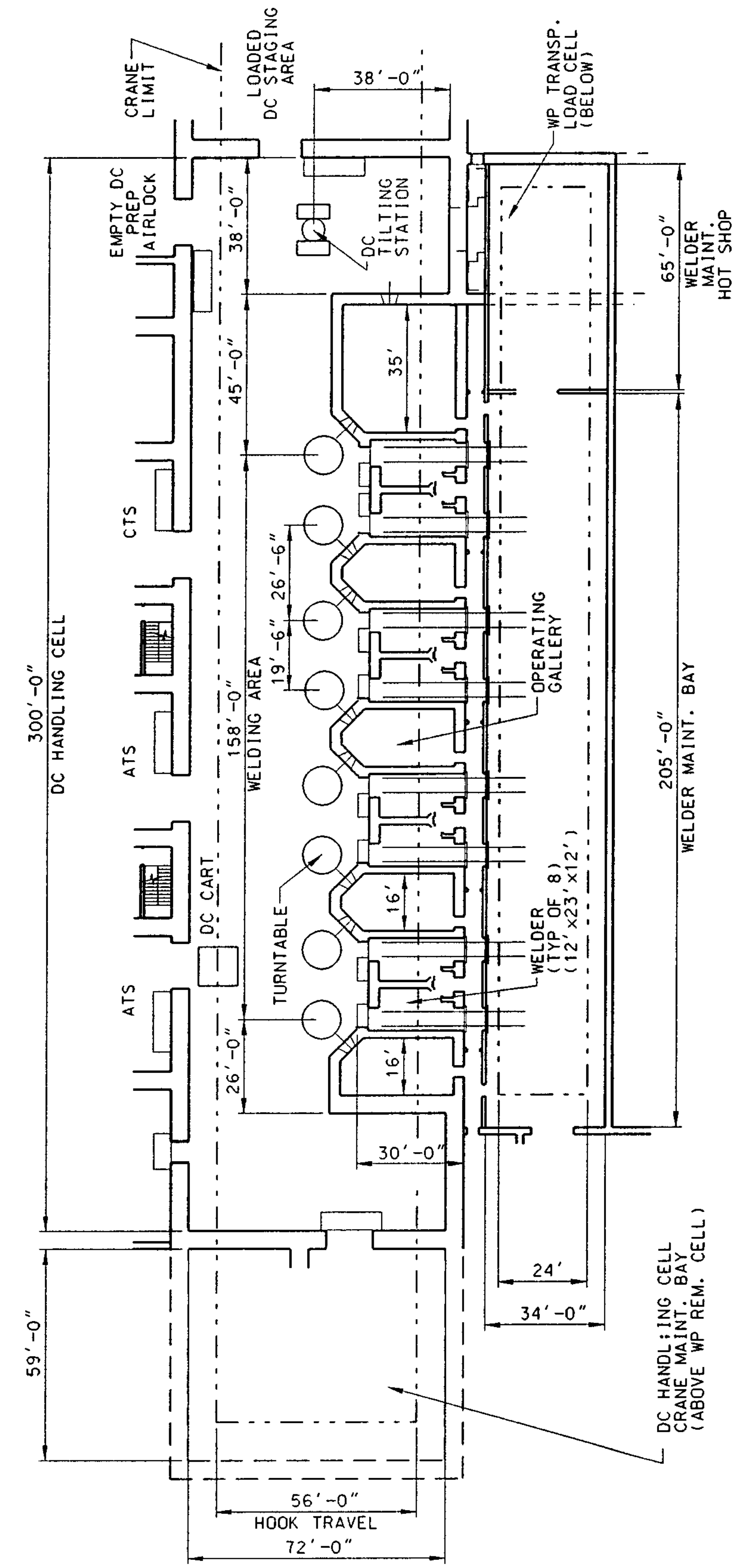

FIGURE I-31
DISPOSAL CONTAINER HANDLING CELL PLAN

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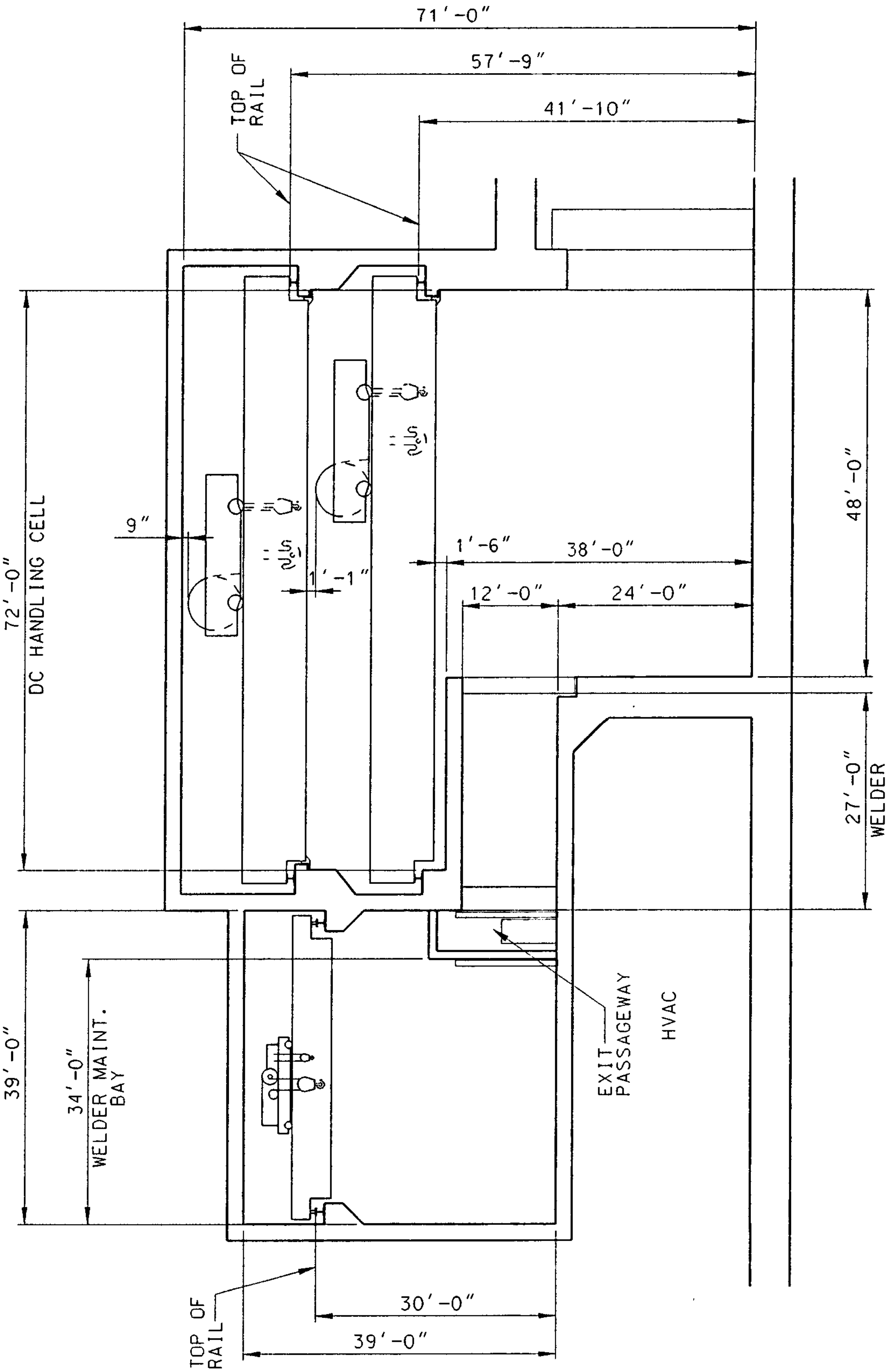

FIGURE I-32
DISPOSAL CONTAINER HANDLING CELL SECTION

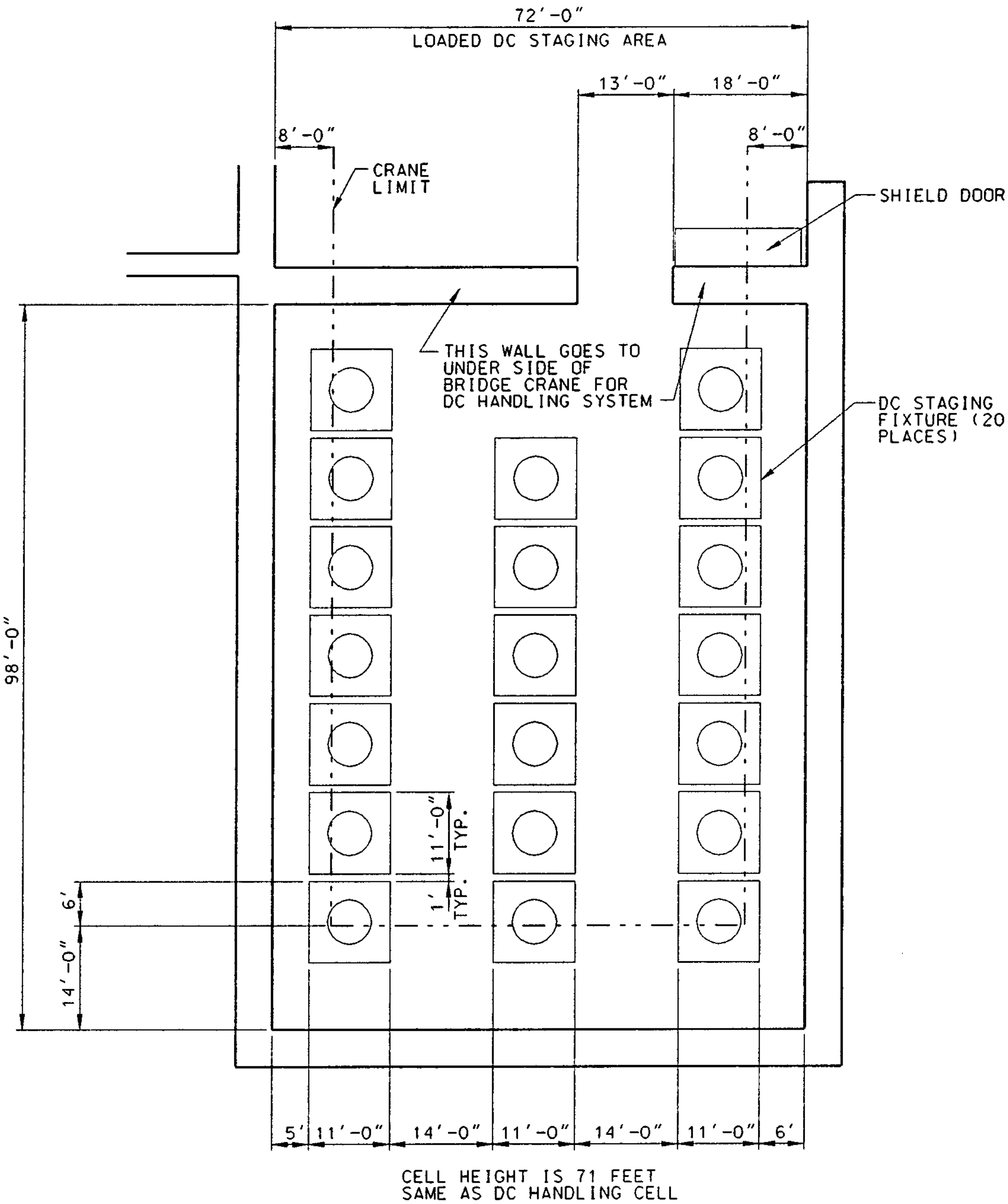

FIGURE I-33
LOADED DISPOSAL CONTAINER
STAGING AREA PLAN

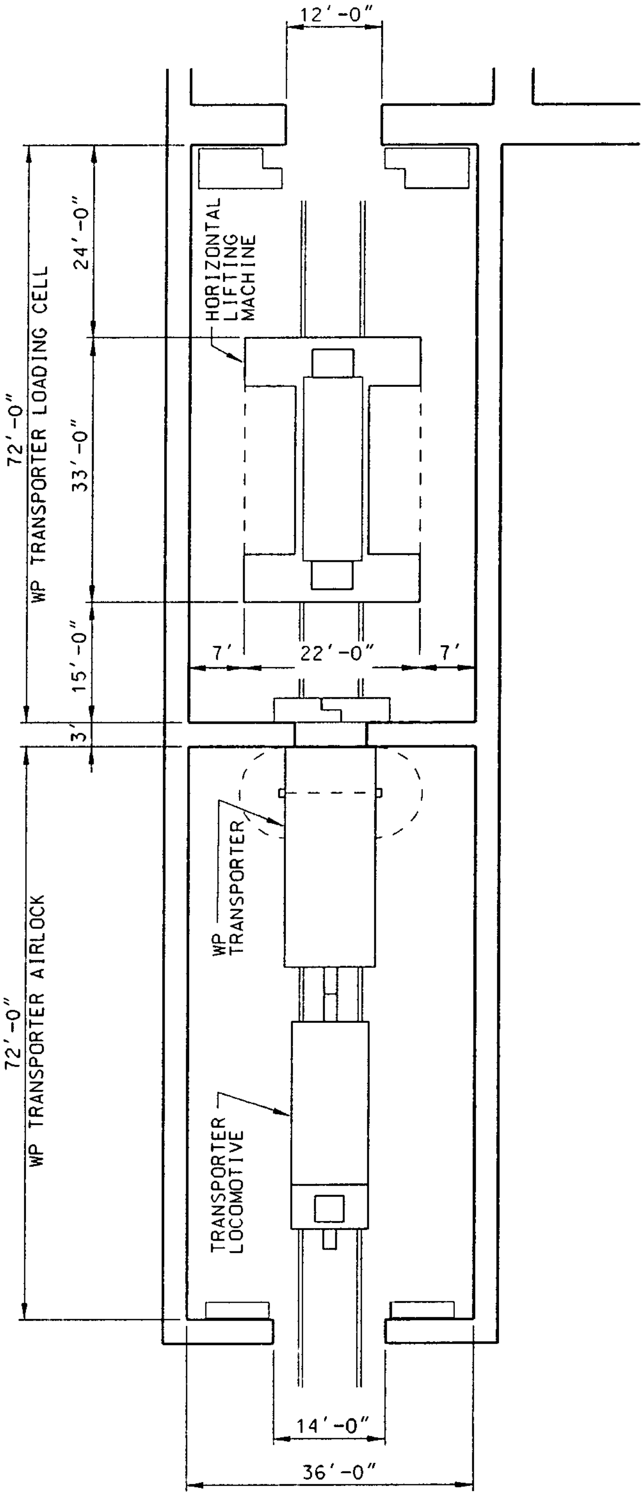

FIGURE I-34
WASTE PACKAGE TRANSPORTER
LOADING CELL AND AIRLOCK PLAN

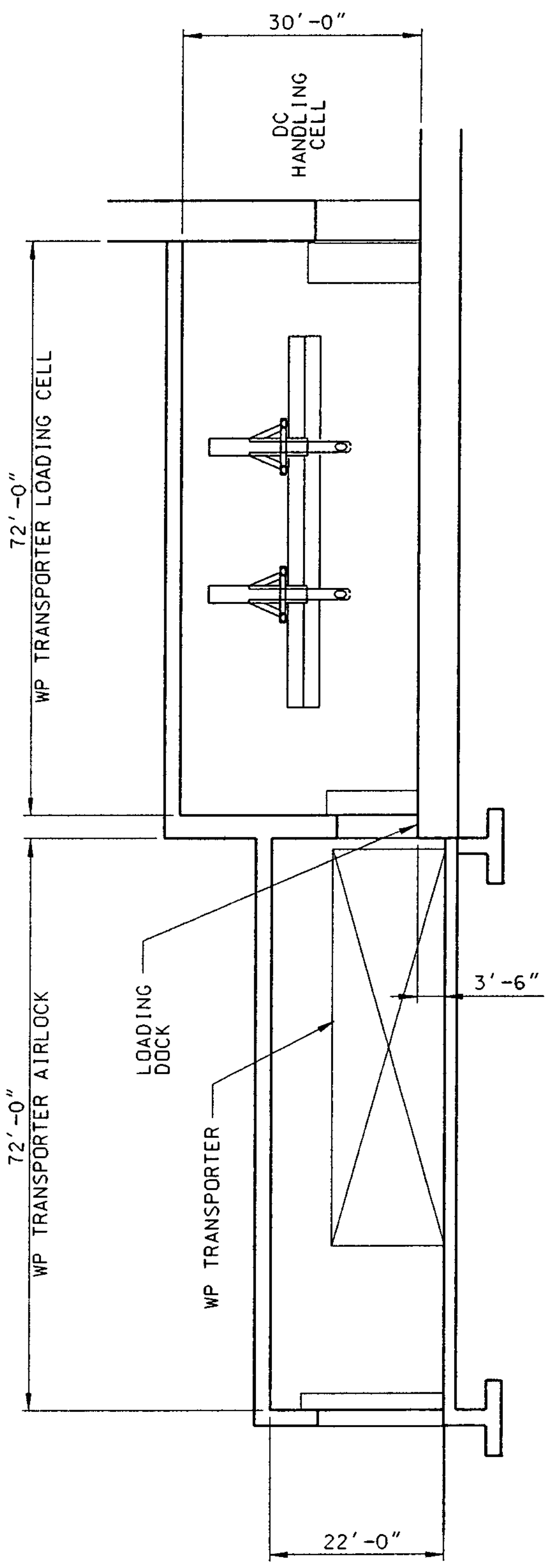

FIGURE I-35
WASTE PACKAGE TRANSPORTER LOAD CELL AND AIRLOCK SECTION

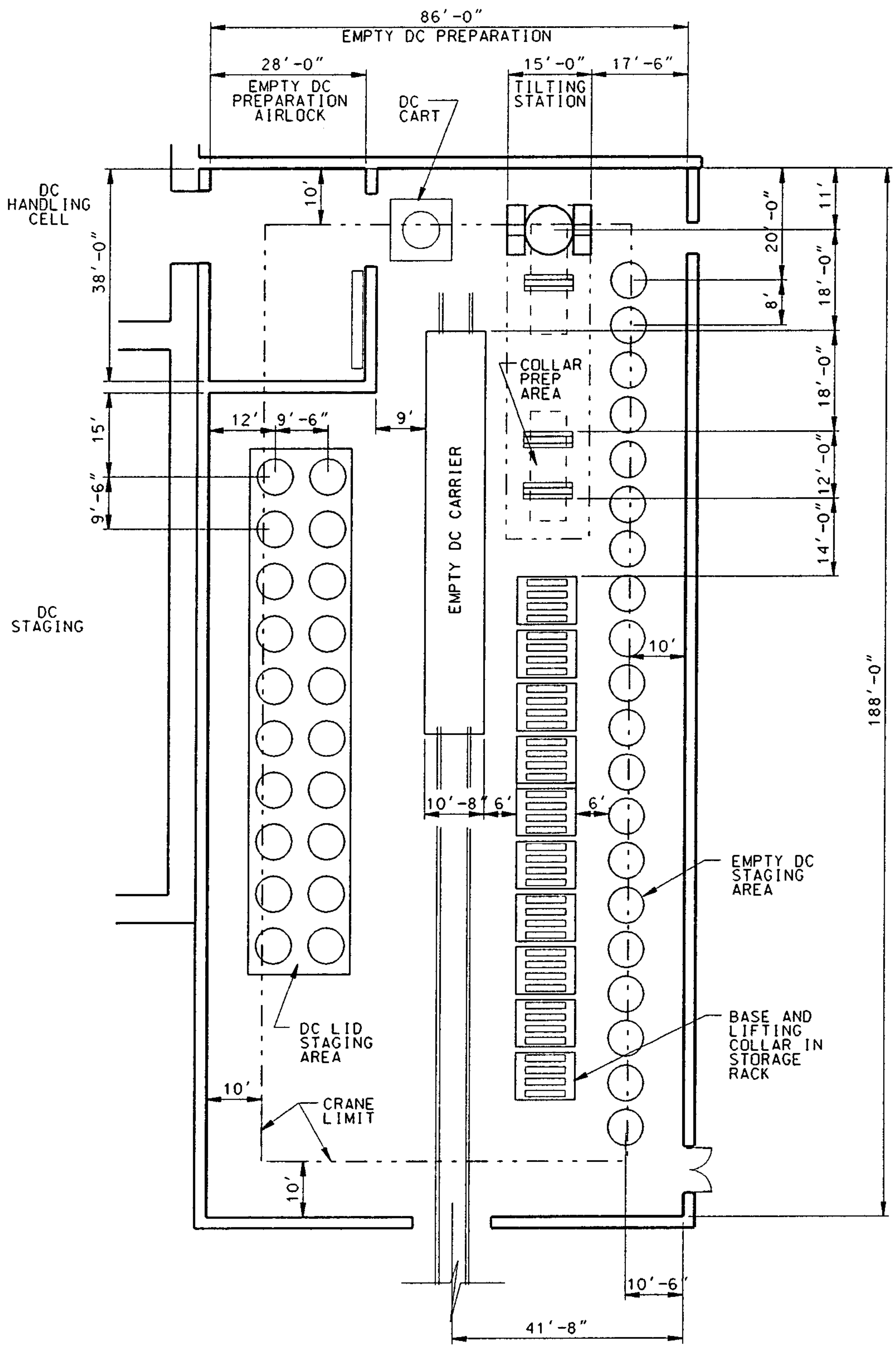

FIGURE I-36
EMPTY DISPOSAL CONTAINER
PREPARATION PLAN

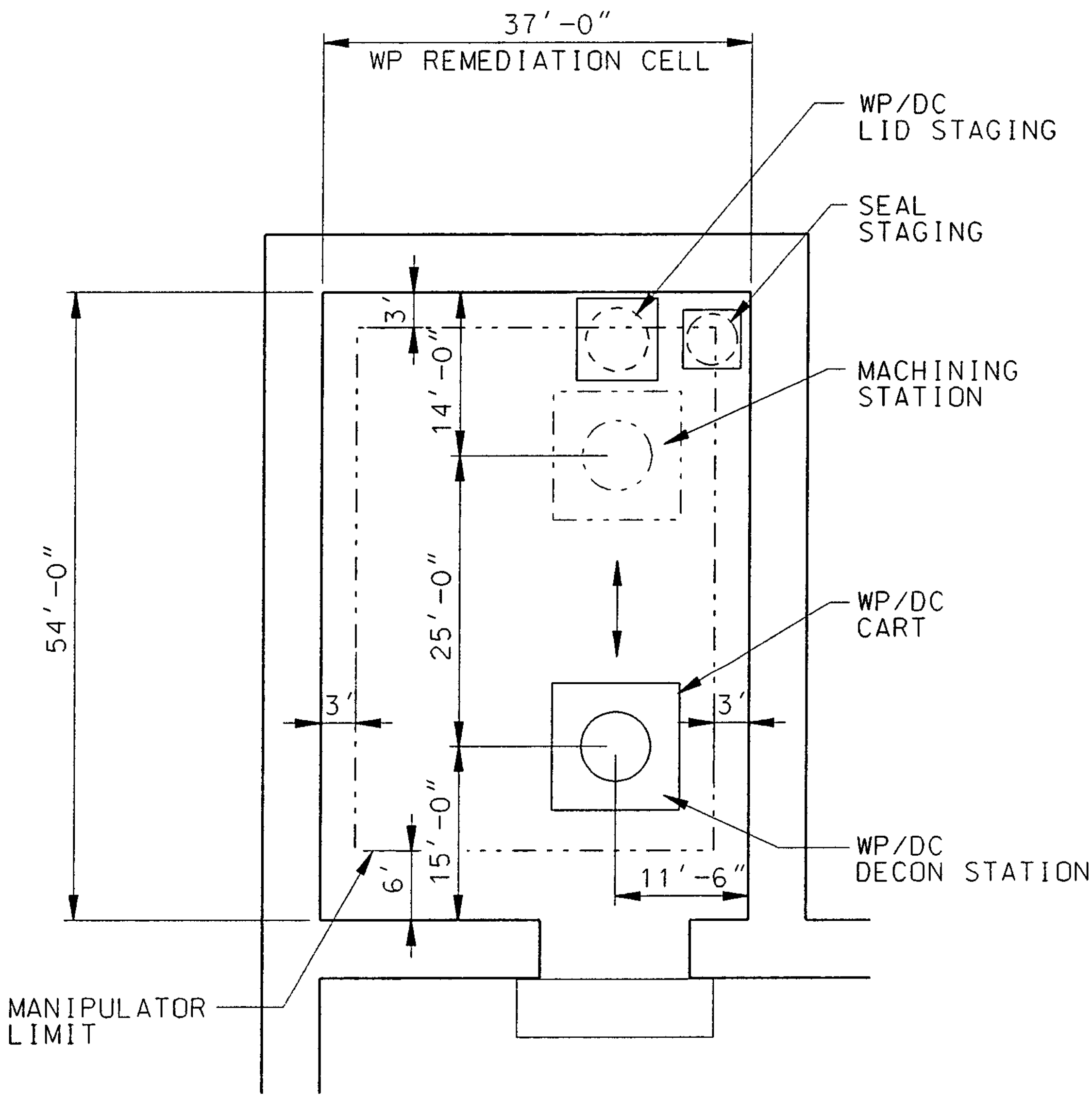

FIGURE I-37
WASTE PACKAGE REMEDIATION
CELL PLAN

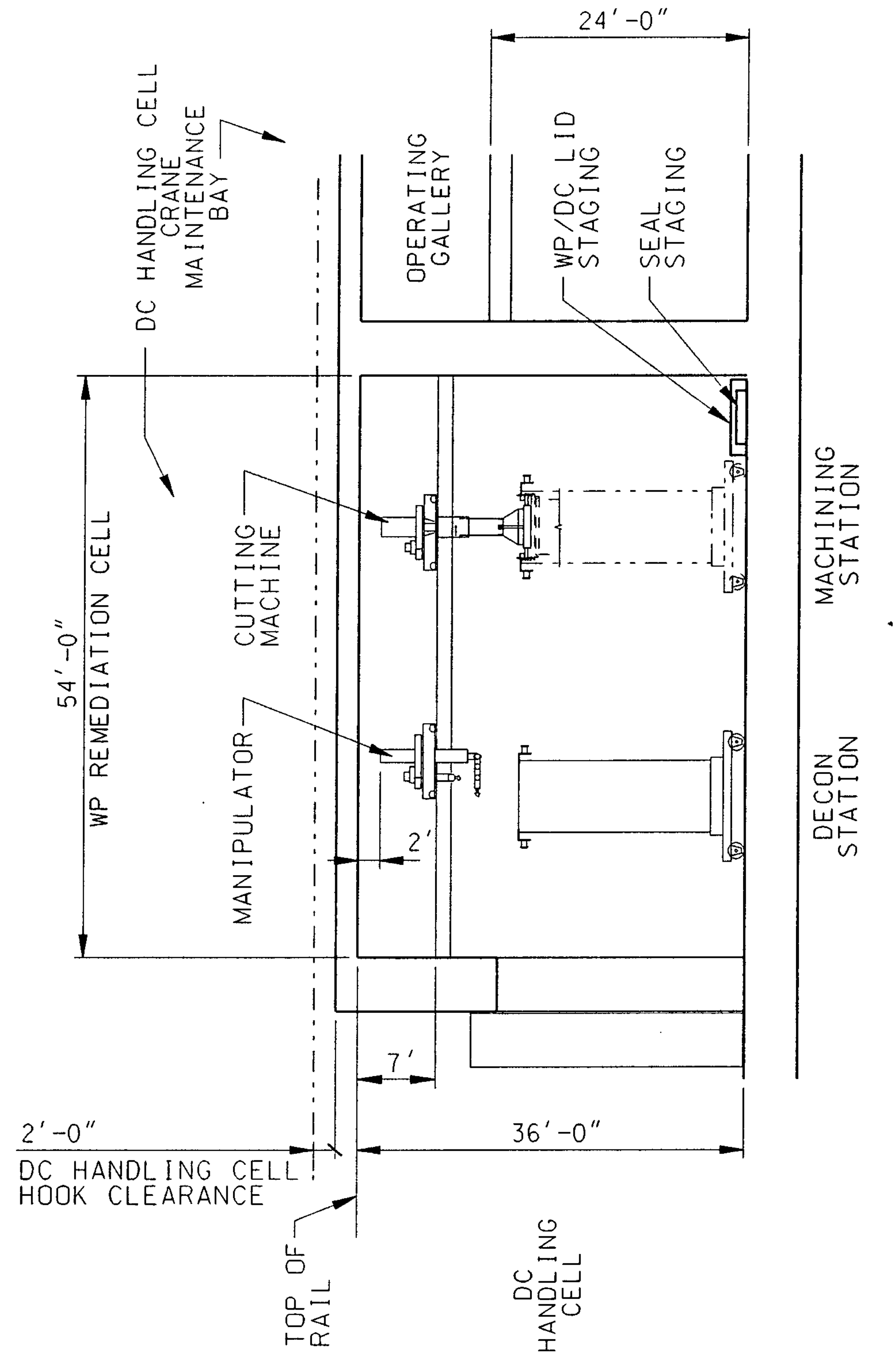

FIGURE I-38
WASTE PACKAGE REMEDIATION CELL SECTION

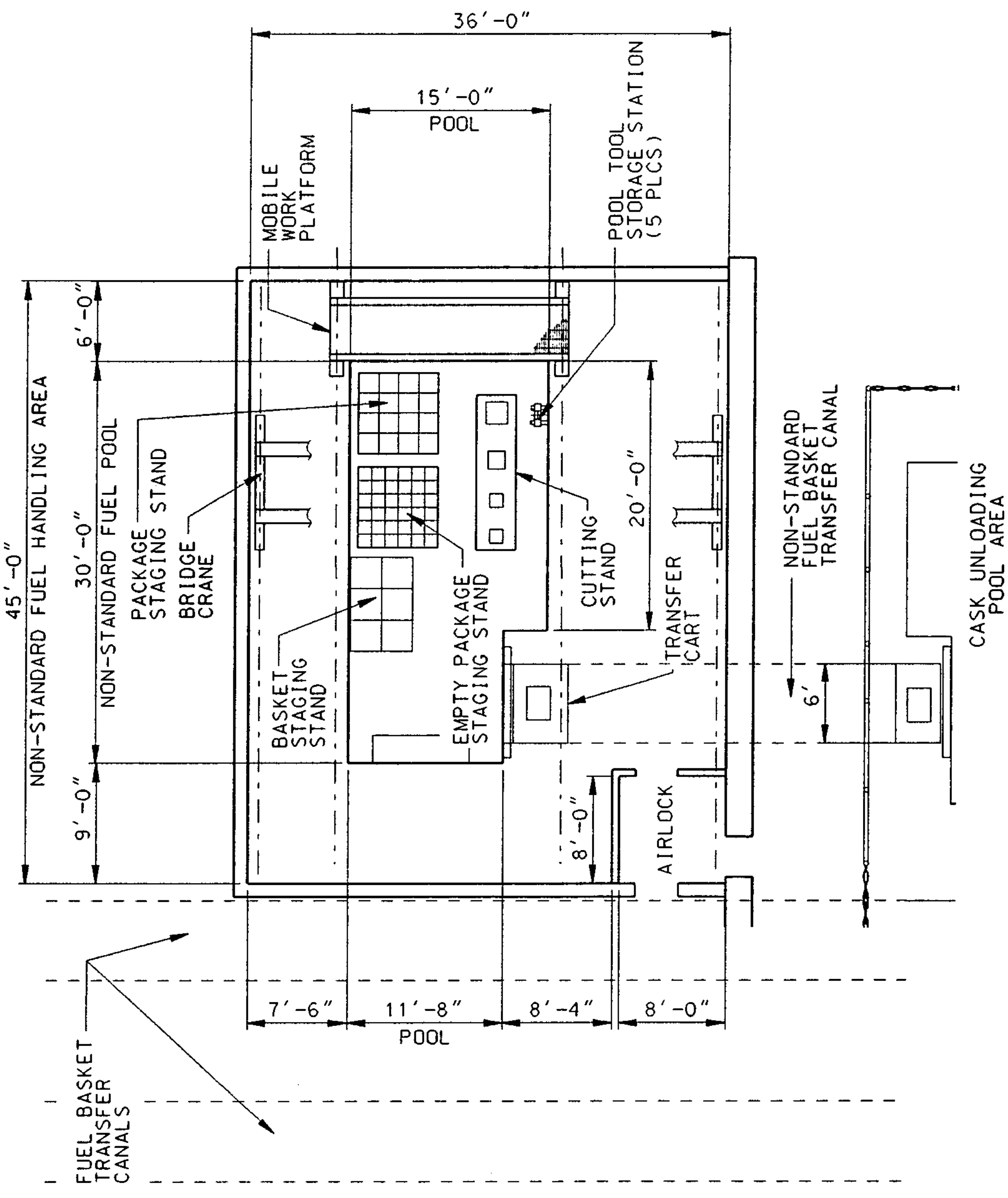

FIGURE I-39
NON-STANDARD FUEL
HANDLING AREA PLAN

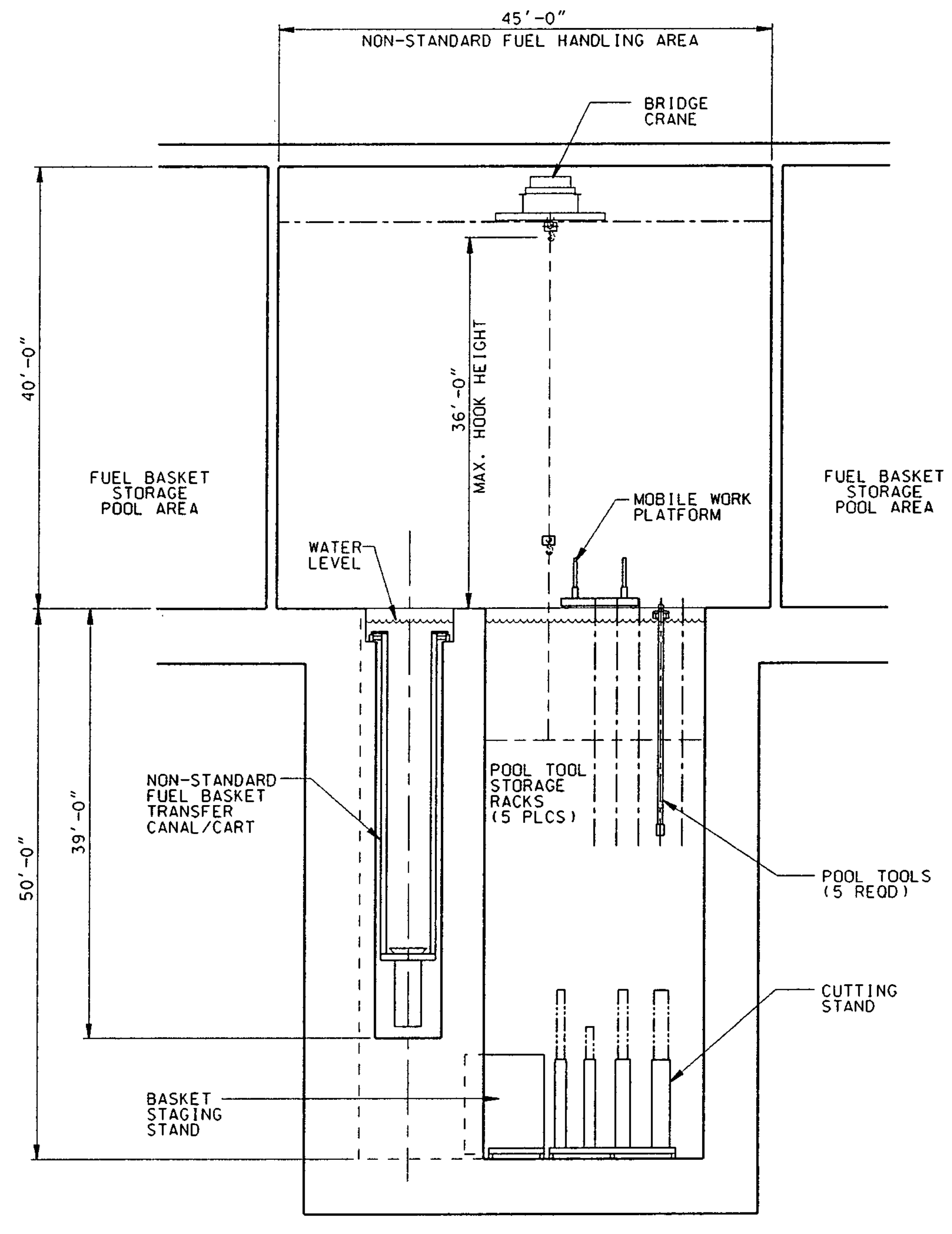

FIGURE I-40
NON-STANDARD FUEL
HANDLING AREA SECTION

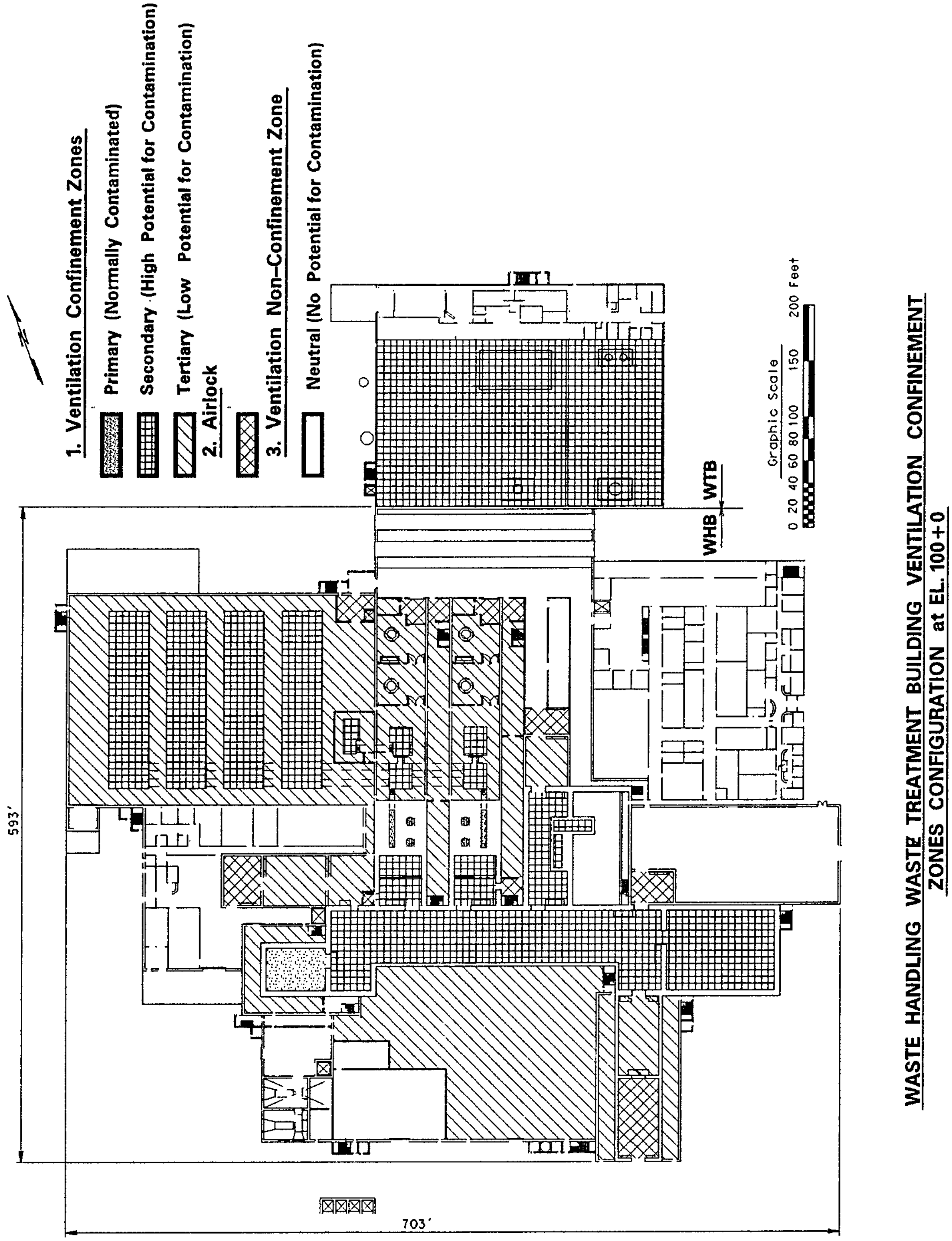

FIGURE I-41
WASTE HANDLING/WASTE TREATMENT BUILDING VENTILATION CONFINEMENT ZONES CONFIGURATION at EL. 100+0

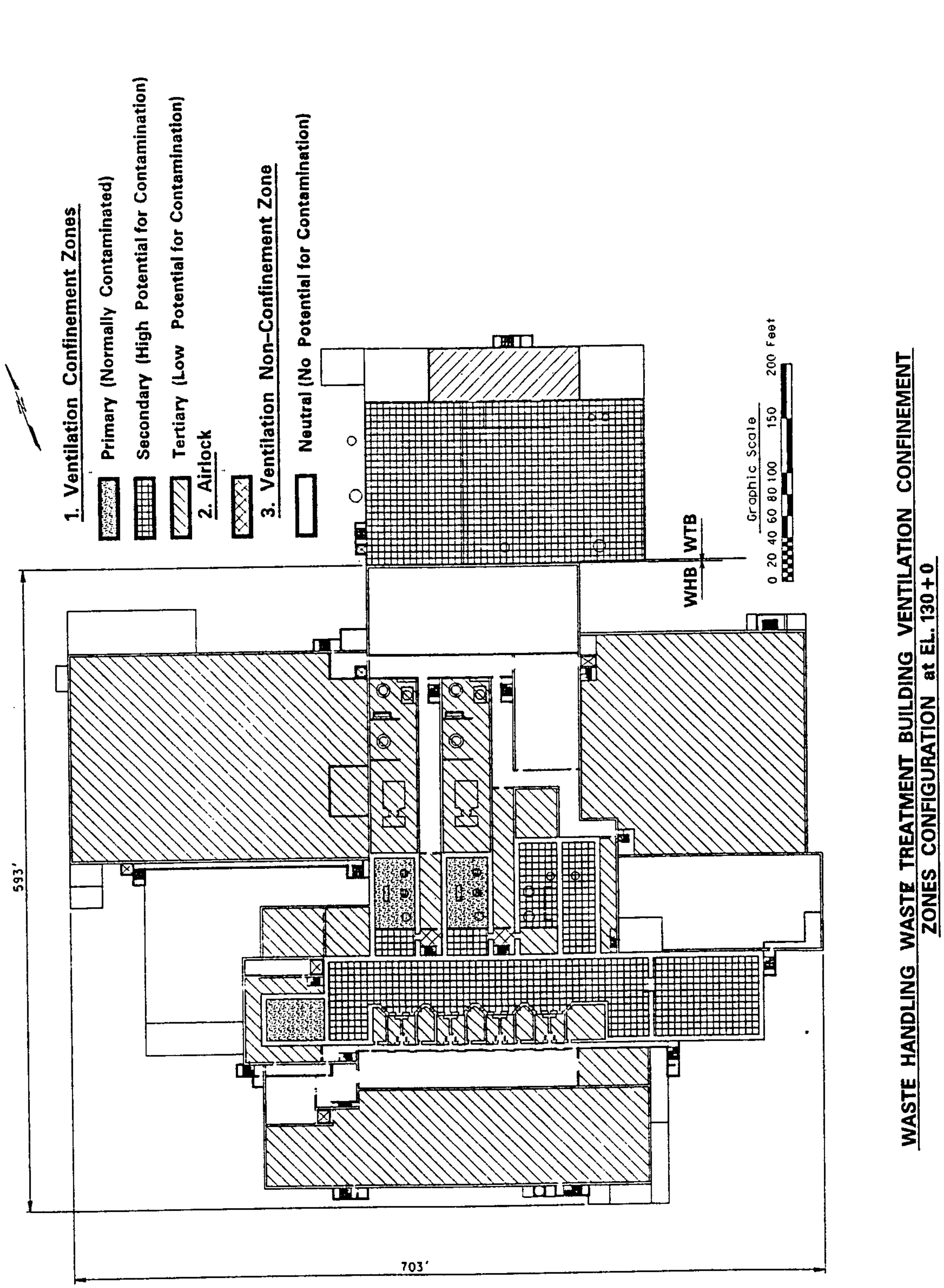

FIGURE I-42
WASTE HANDLING/WASTE TREATMENT BUILDING VENTILATION CONFINEMENT ZONES CONFIGURATION at EL. 130+0

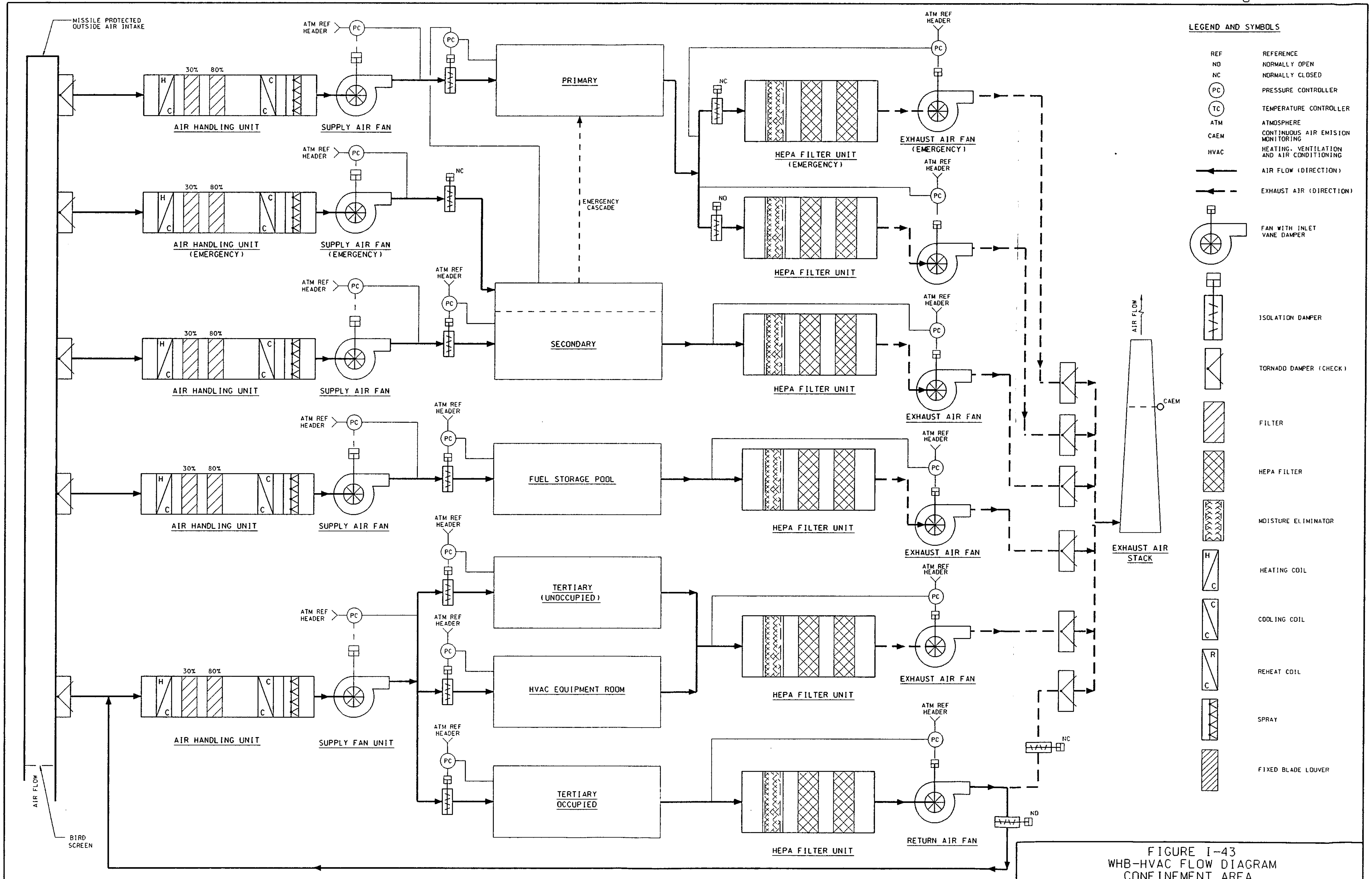

FIGURE I-43
WHB-HVAC FLOW DIAGRAM
CONFINEMENT AREA

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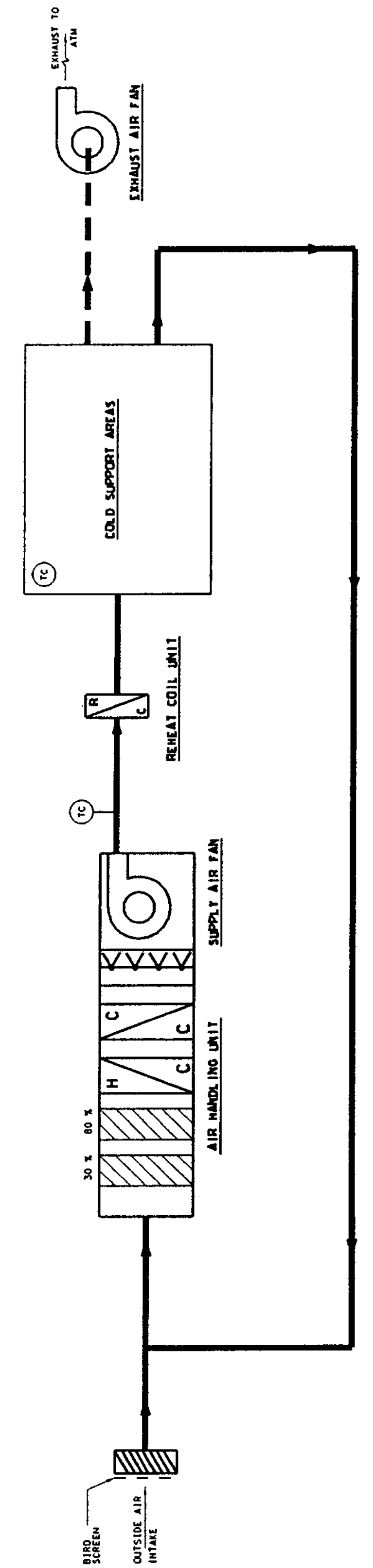

FIGURE I-43a
WHB-HVAC FLOW DIAGRAM
NON-CONFINEMENT AREA

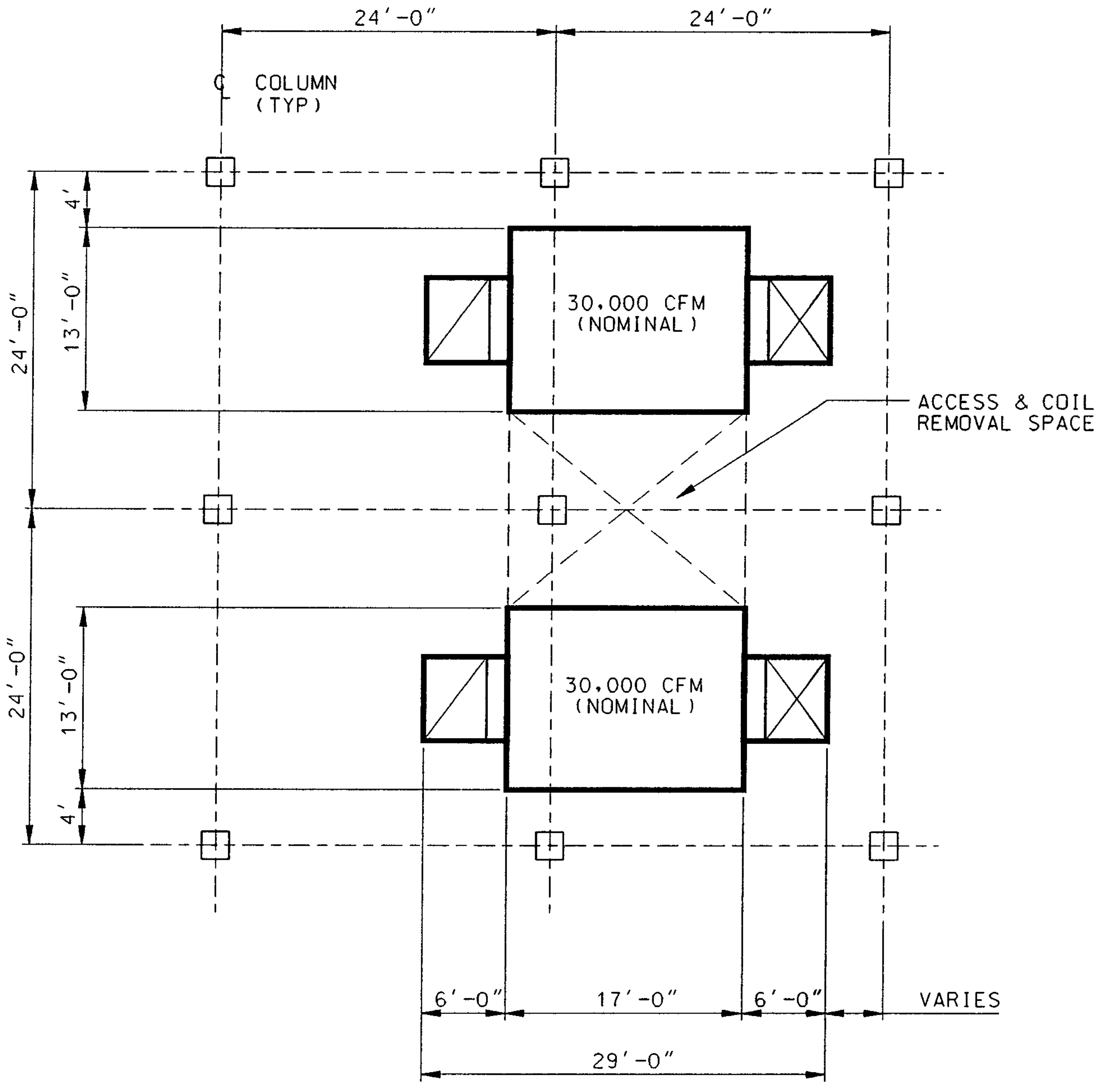

FIGURE I-44
AIR HANDLING UNITS

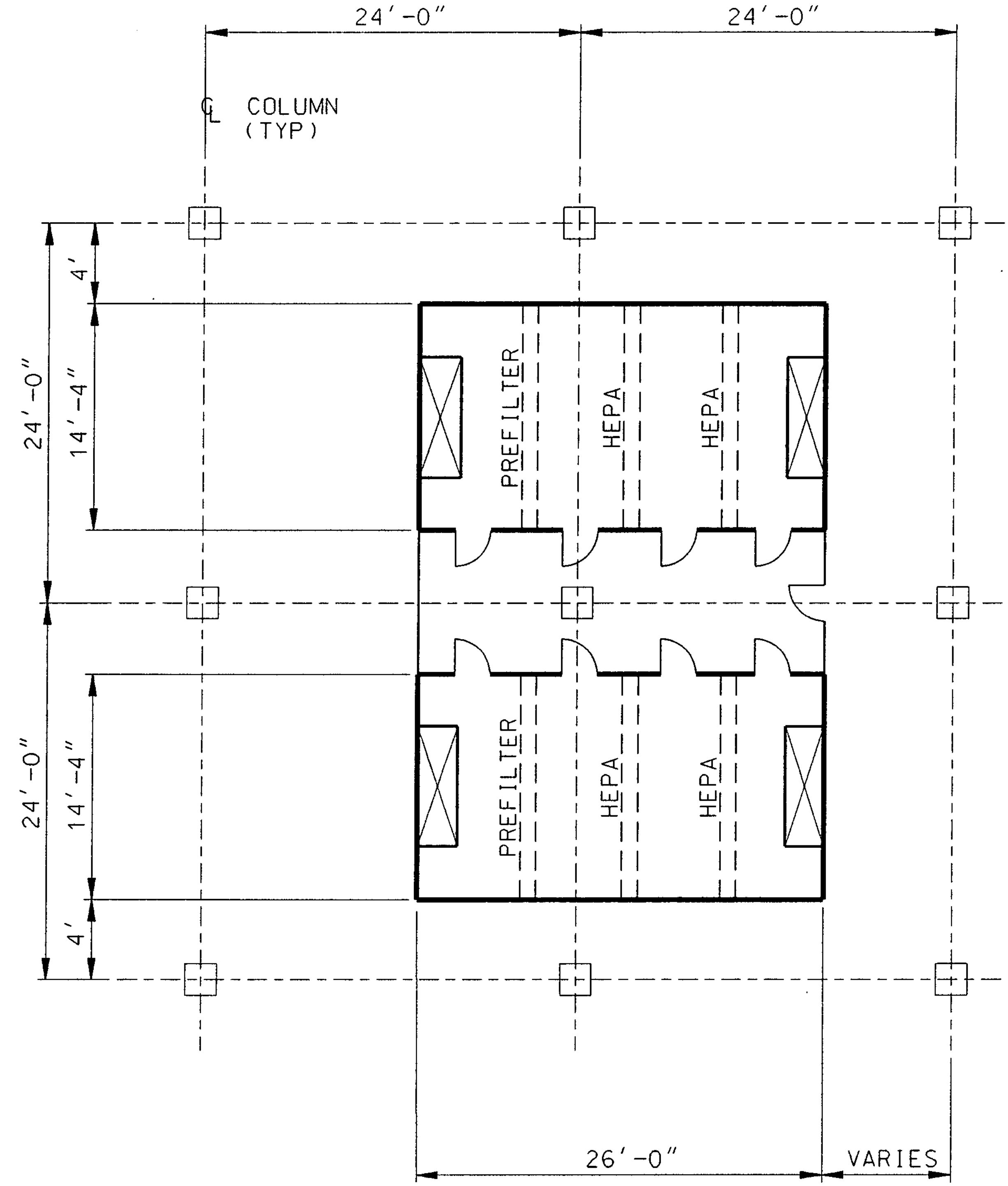

FIGURE I-45
2-STAGE HEPA FILTER
(EXHAUST)

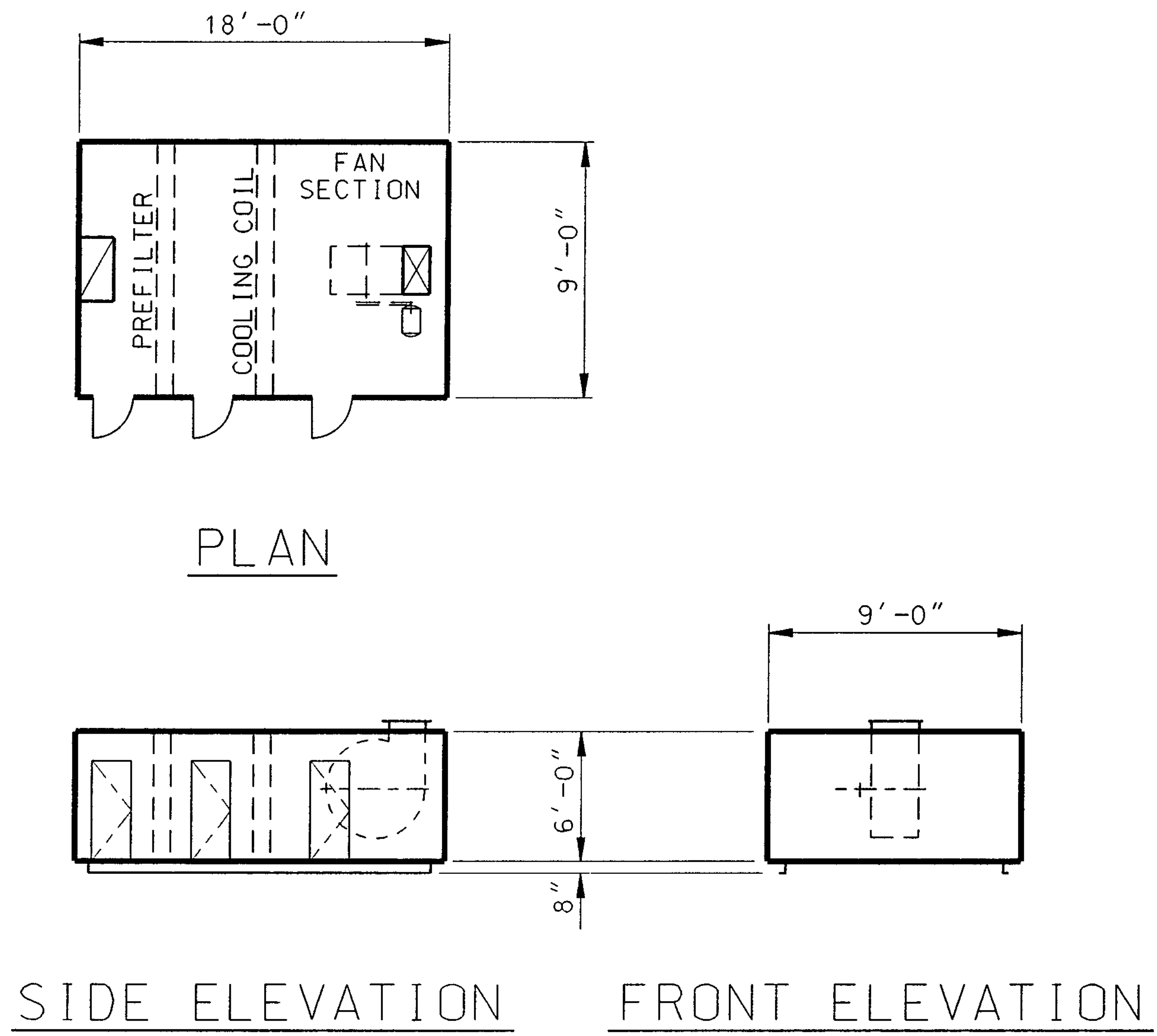

FIGURE I-46
FAN COIL UNIT

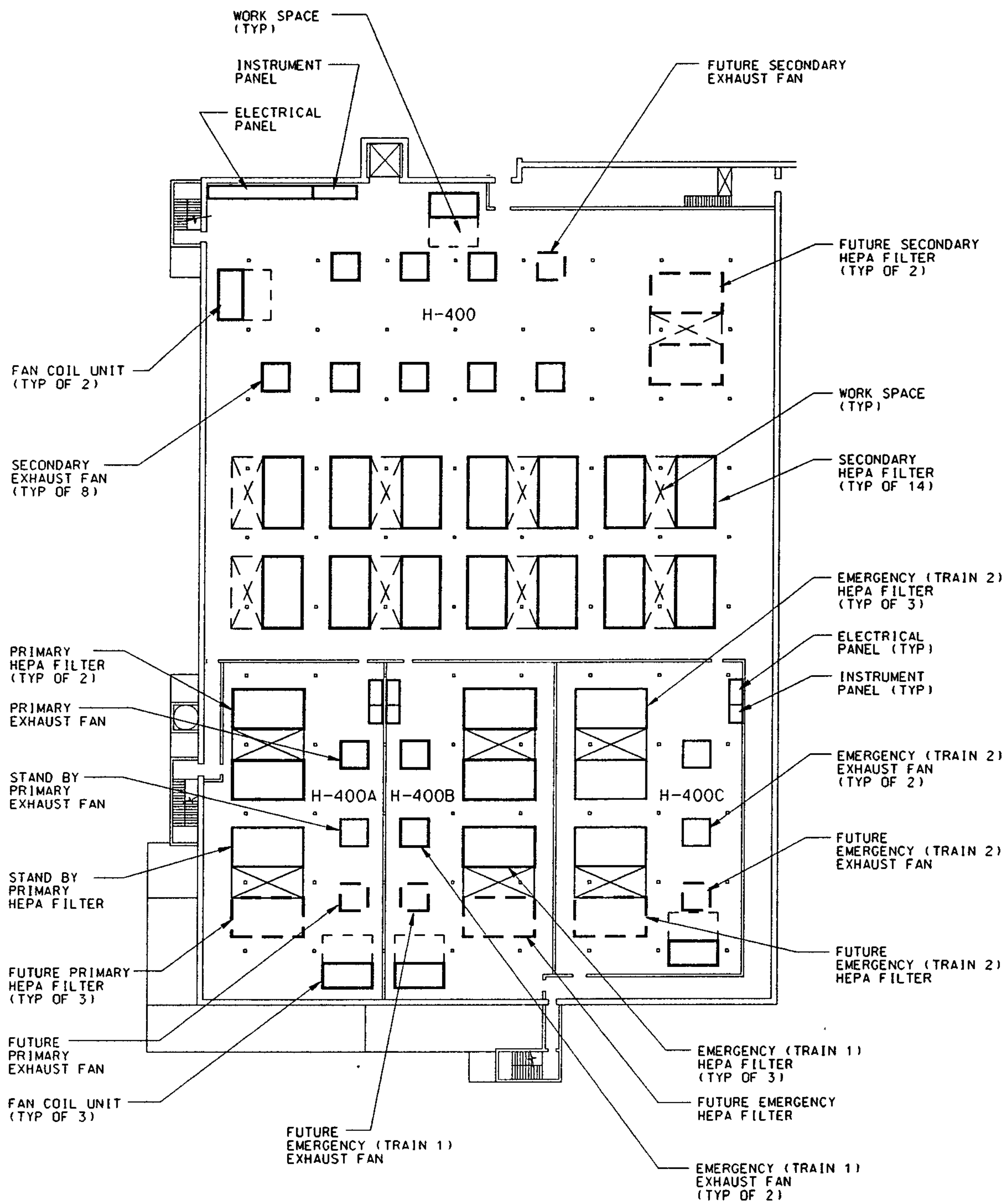

FIGURE I-47
PRIMARY/SECONDARY
CONFINEMENT EXHAUST at EL.173+0

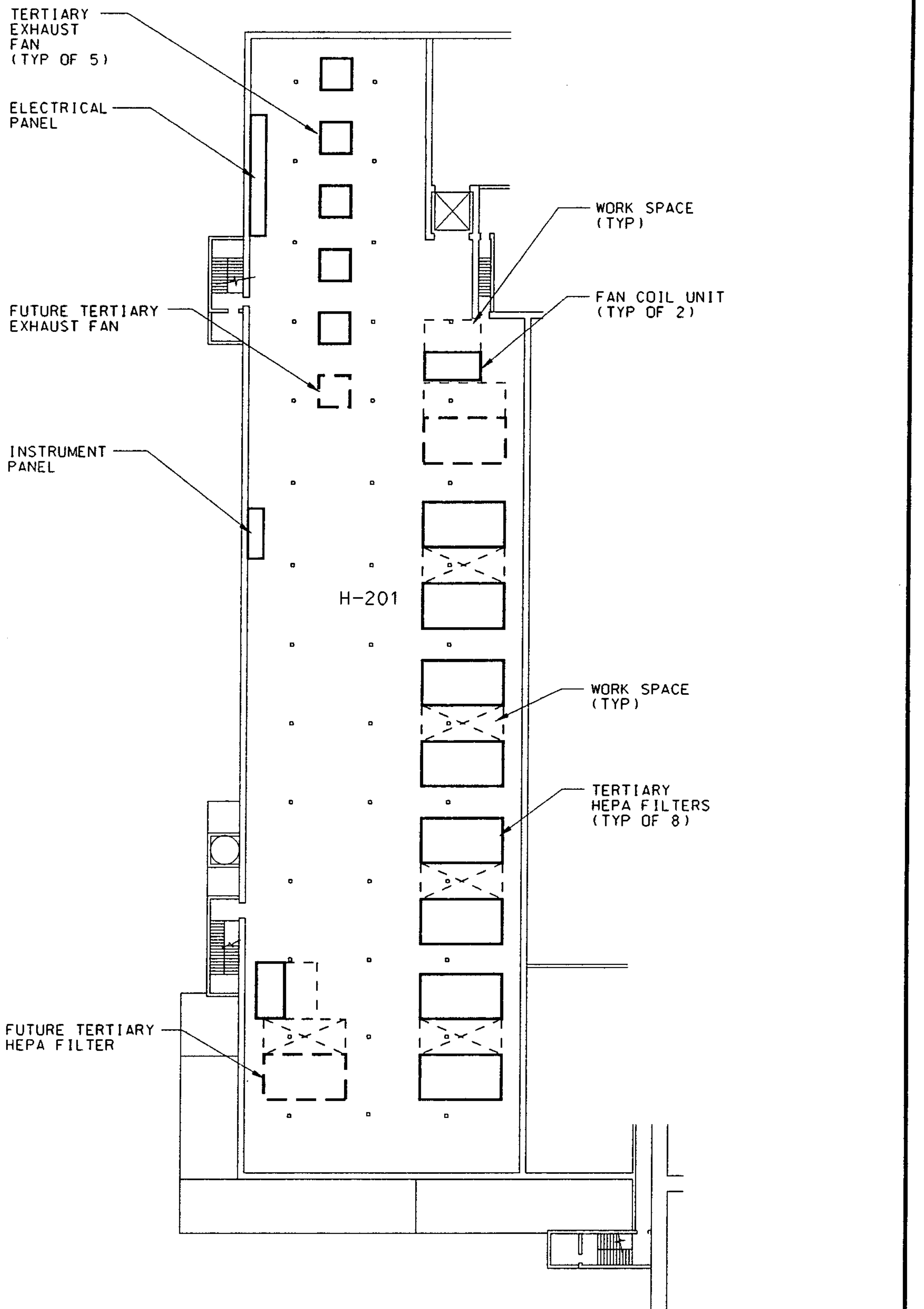

FIGURE I-48
TERTIARY CONFINEMENT EXHAUST RECIRCULATING at EL. 132+0

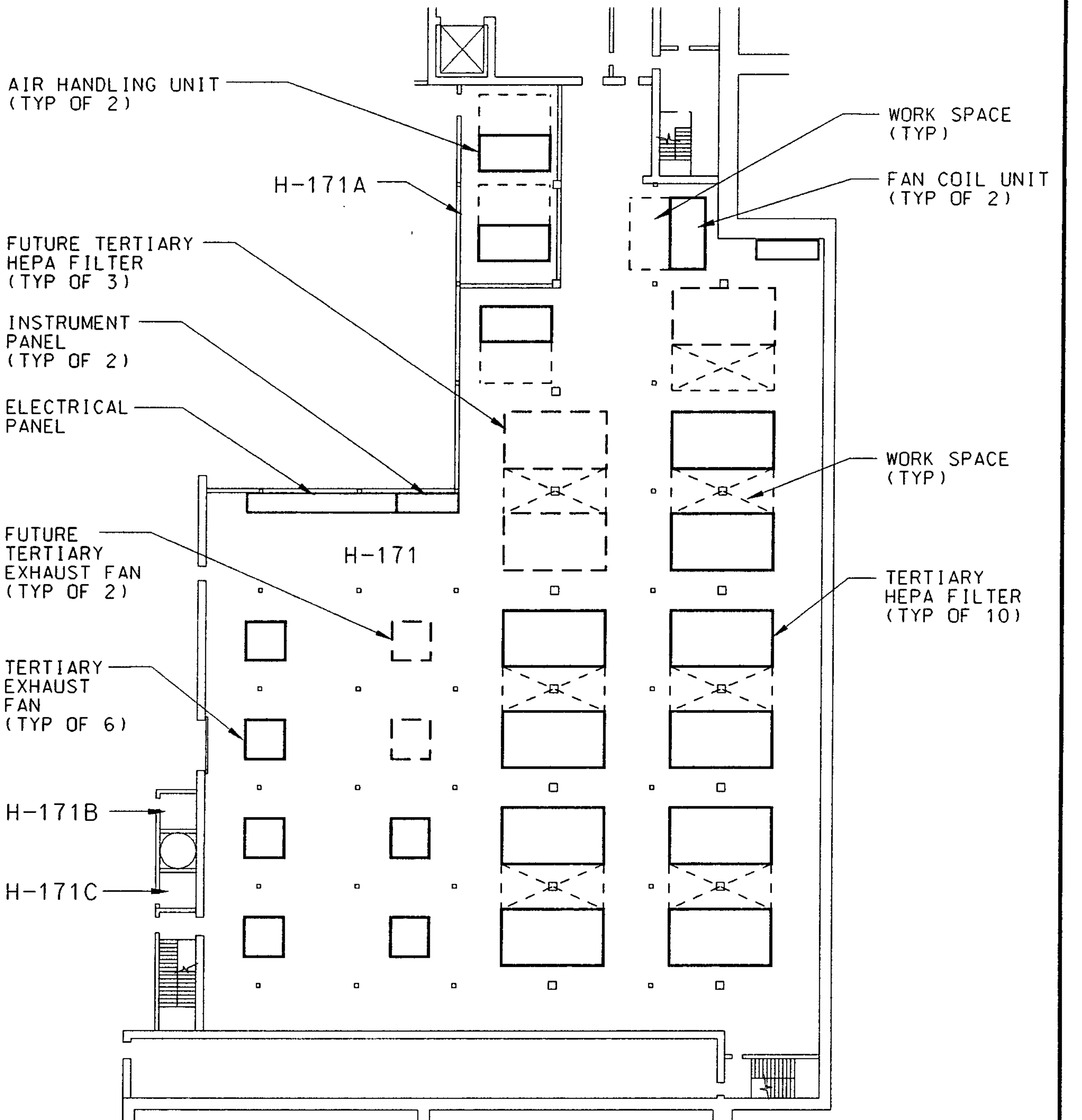

FIGURE I-49
TERTIARY CONFINEMENT EXHAUST
at EL. 100+0

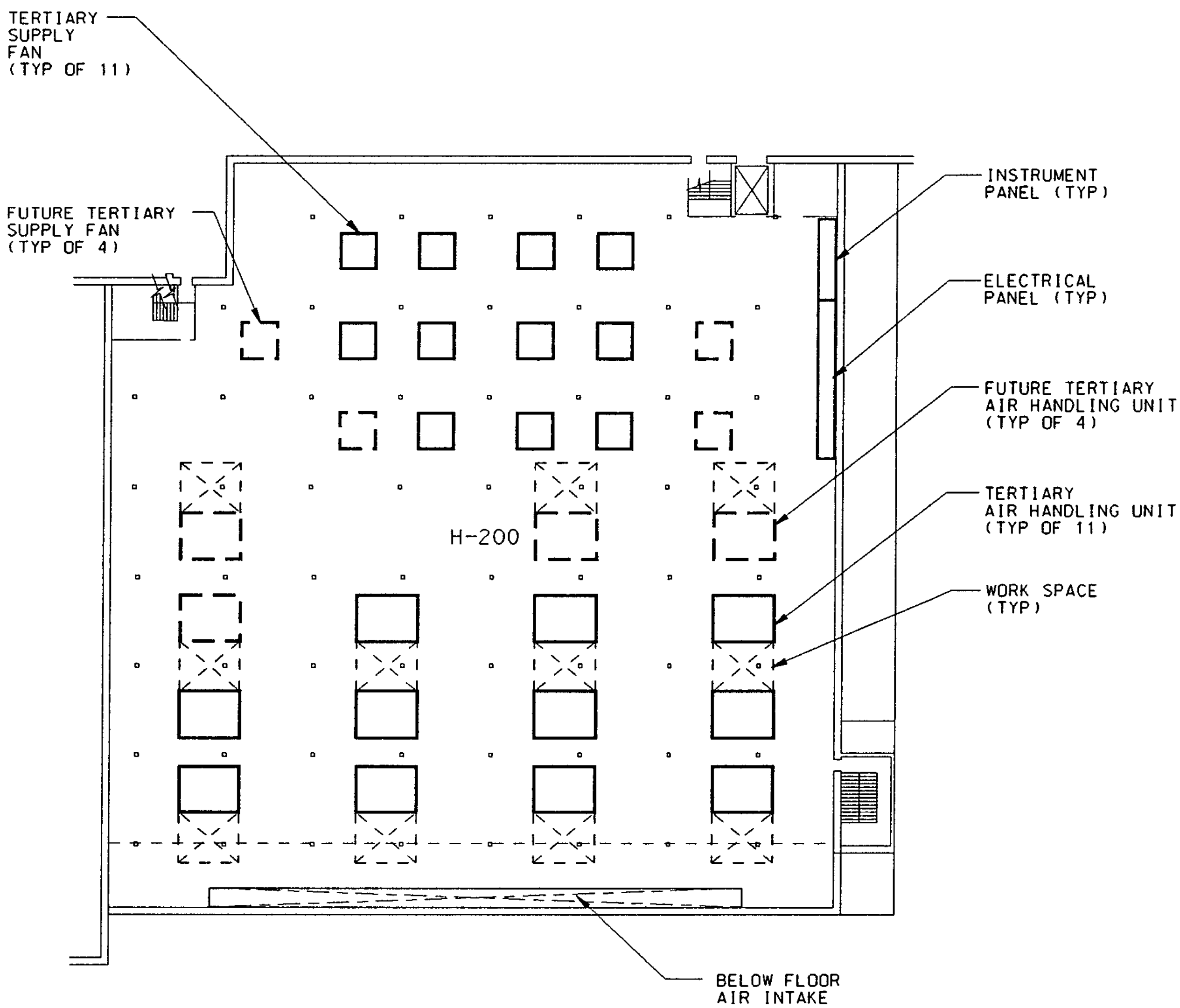

FIGURE I-50
TERTIARY CONFINEMENT SUPPLY
at EL. 118+0

08-MAY-2000 10:08 CAD FILE: t:*reps*arch*dgn*sr*spa*hvac2tersp.dgn

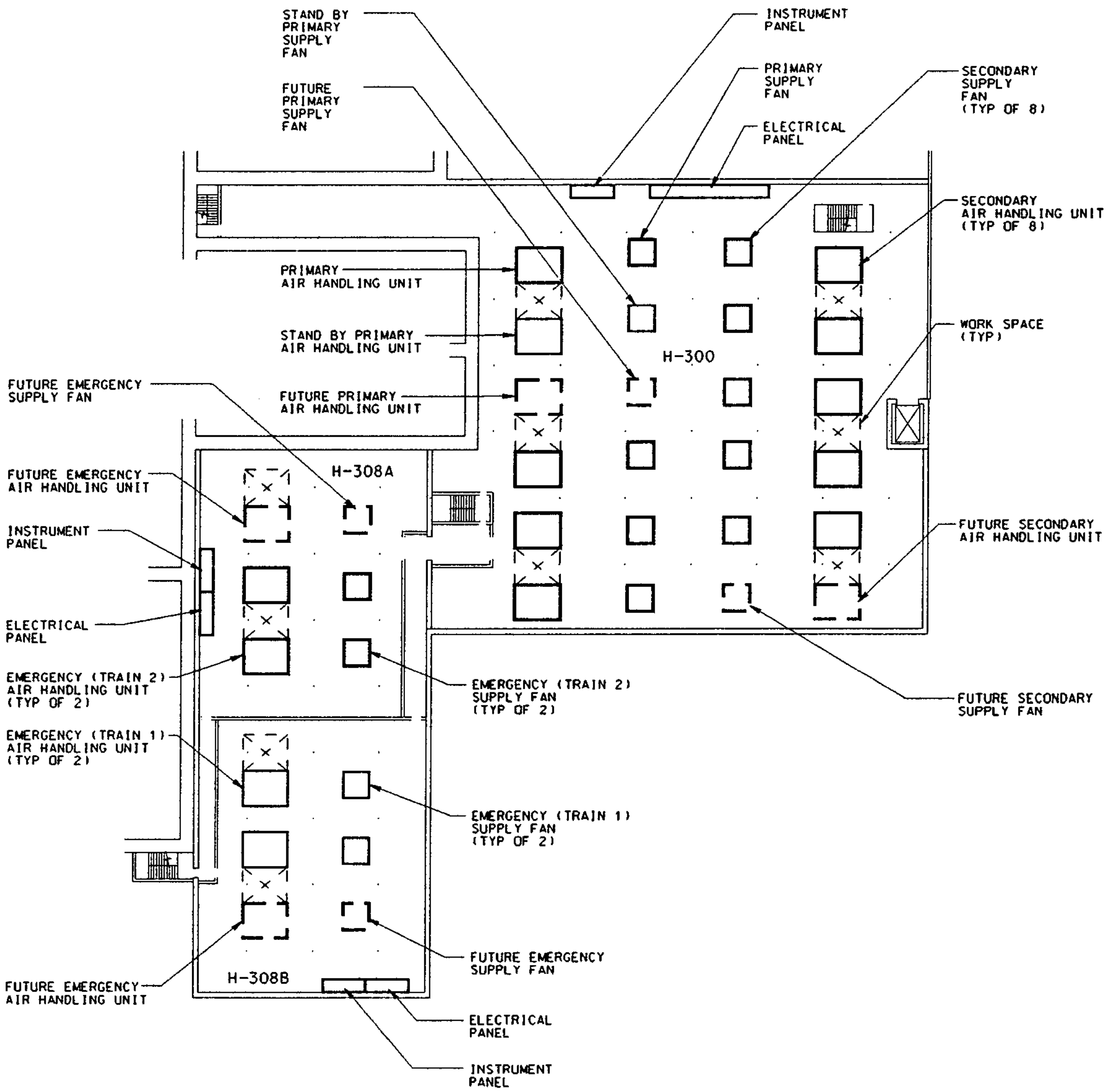

FIGURE I-51
PRIMARY/SECONDARY CONFINEMENT SUPPLY at EL. 152+0

08-MAY-2000 10:18 CAD FILE: t:*reps*arch*dgn*sr*spa*hvac3prsesp.dgn

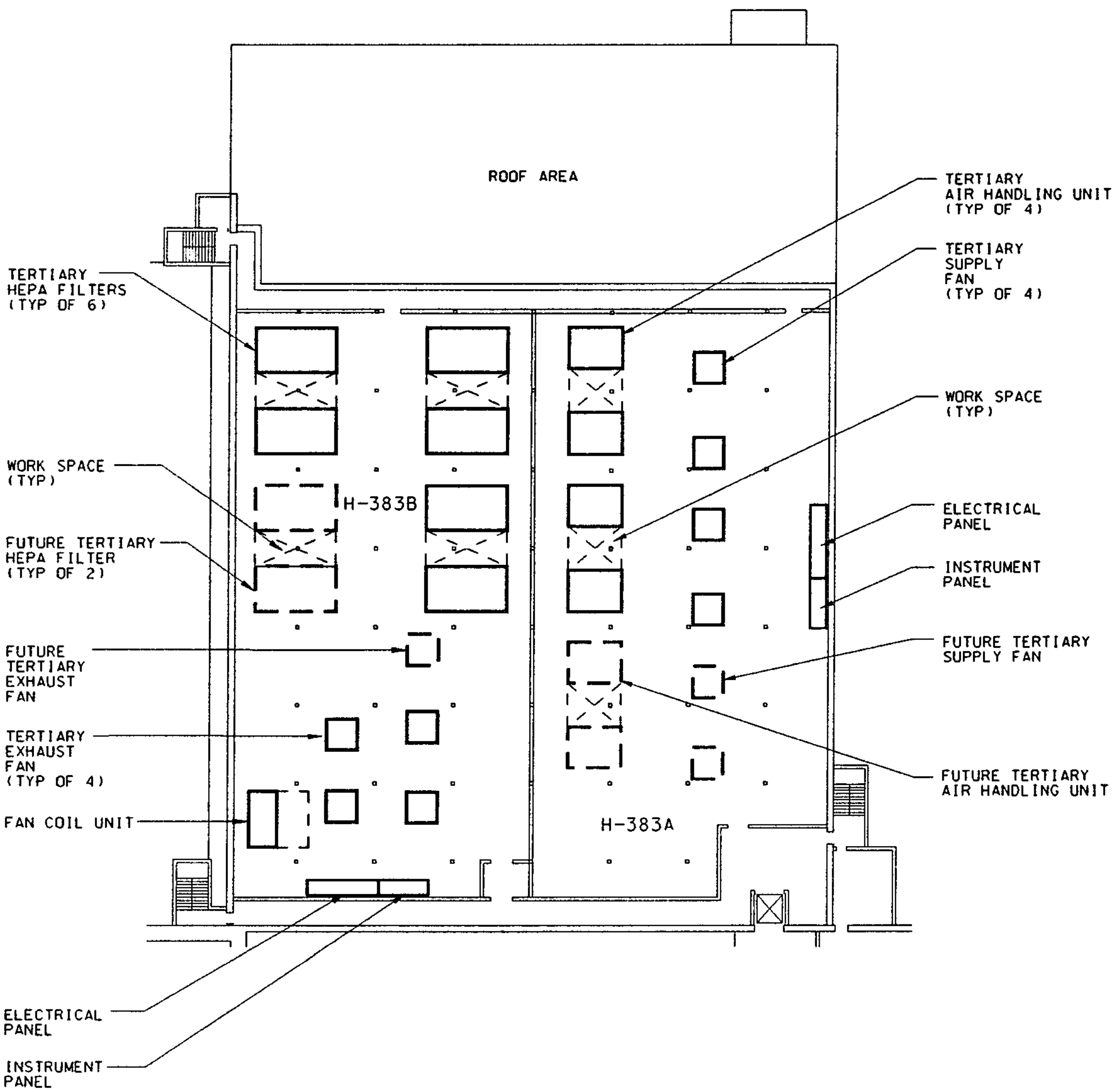

FIGURE I-52
FUEL STORAGE POOL TERTIARY CONFINEMENT SUPPLY/EXHAUST at EL. 142+0

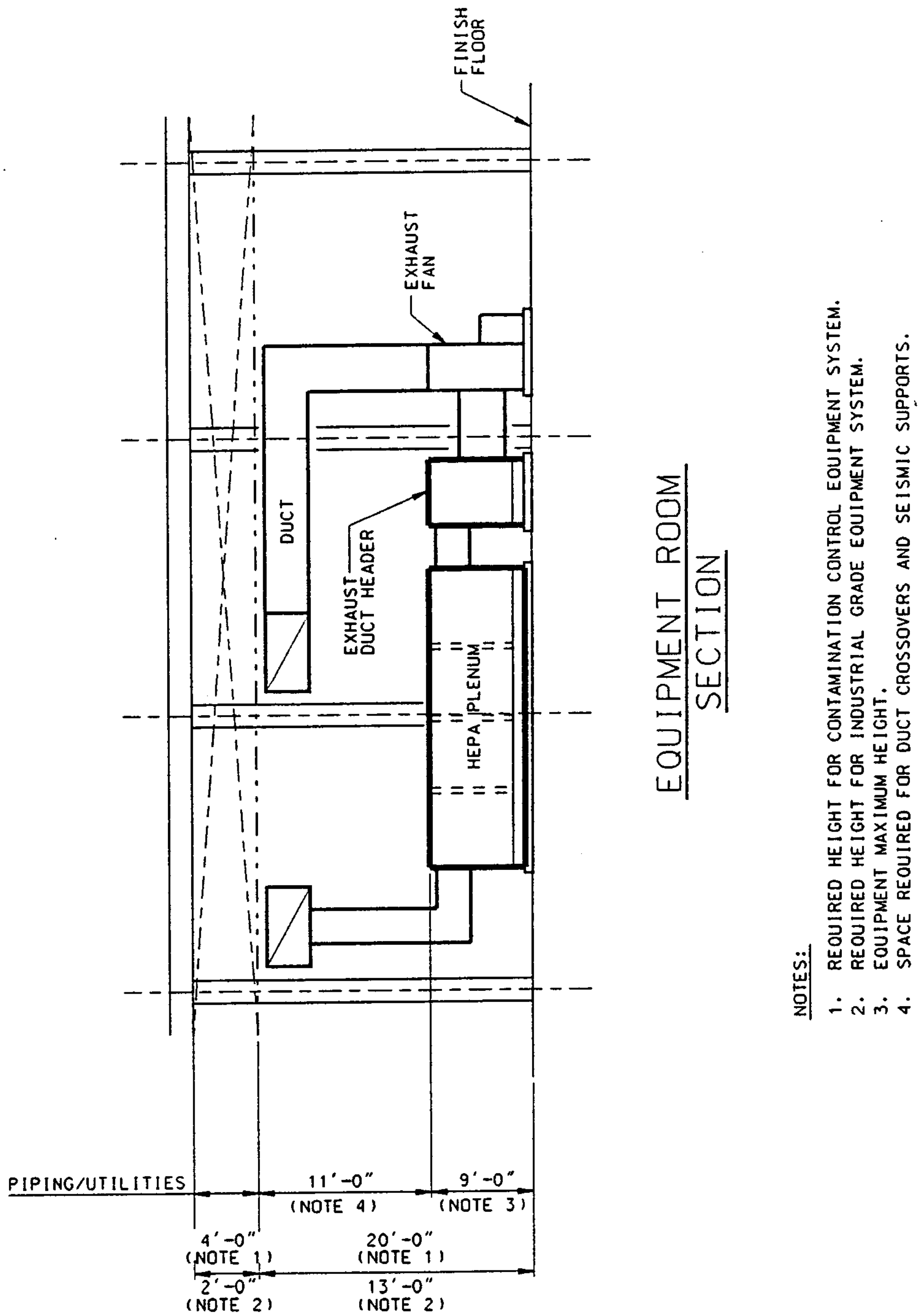

FIGURE I-53
EQUIPMENT ROOM
SECTION

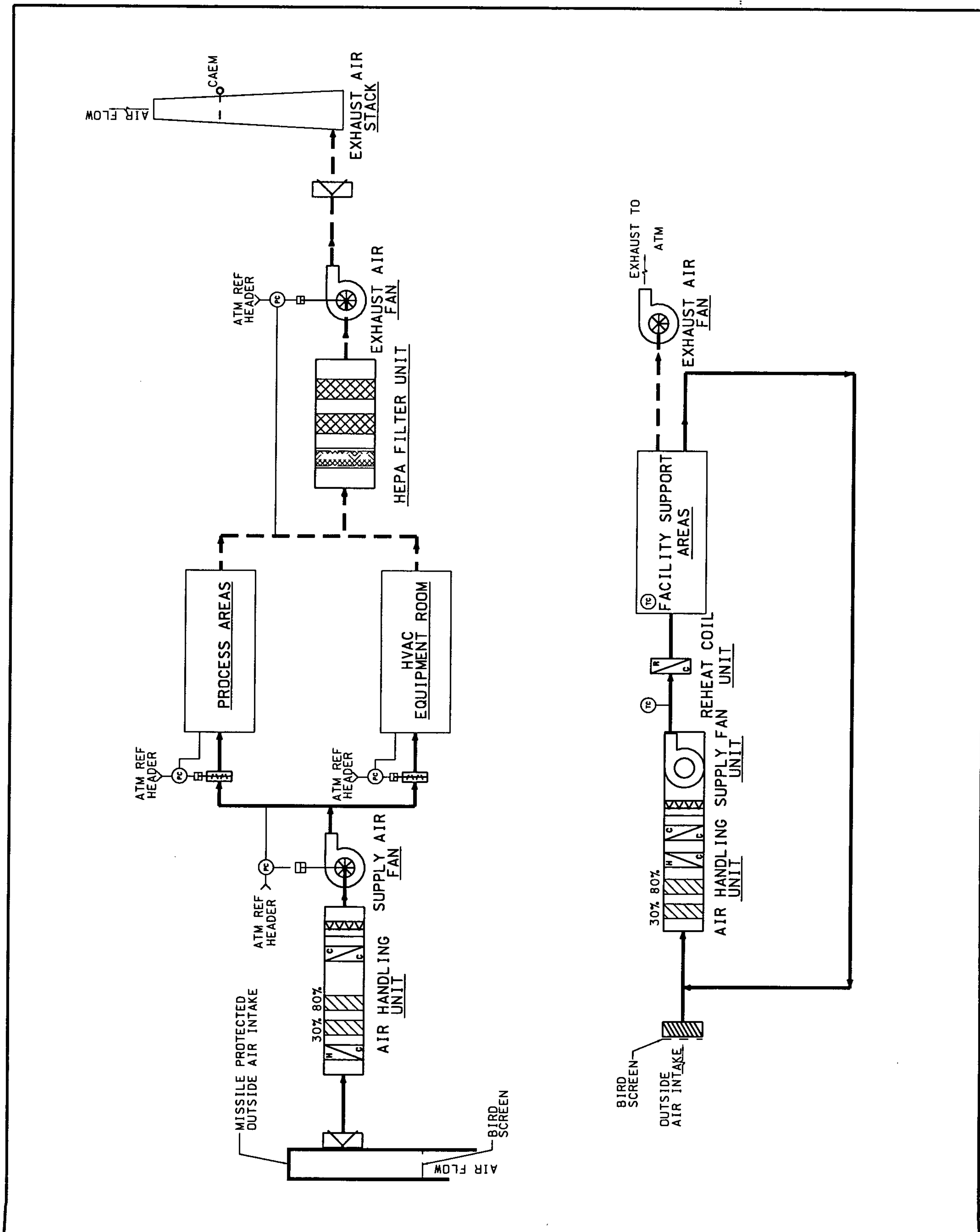

FIGURE I-53a
WTB-HVAC FLOW DIAGRAM

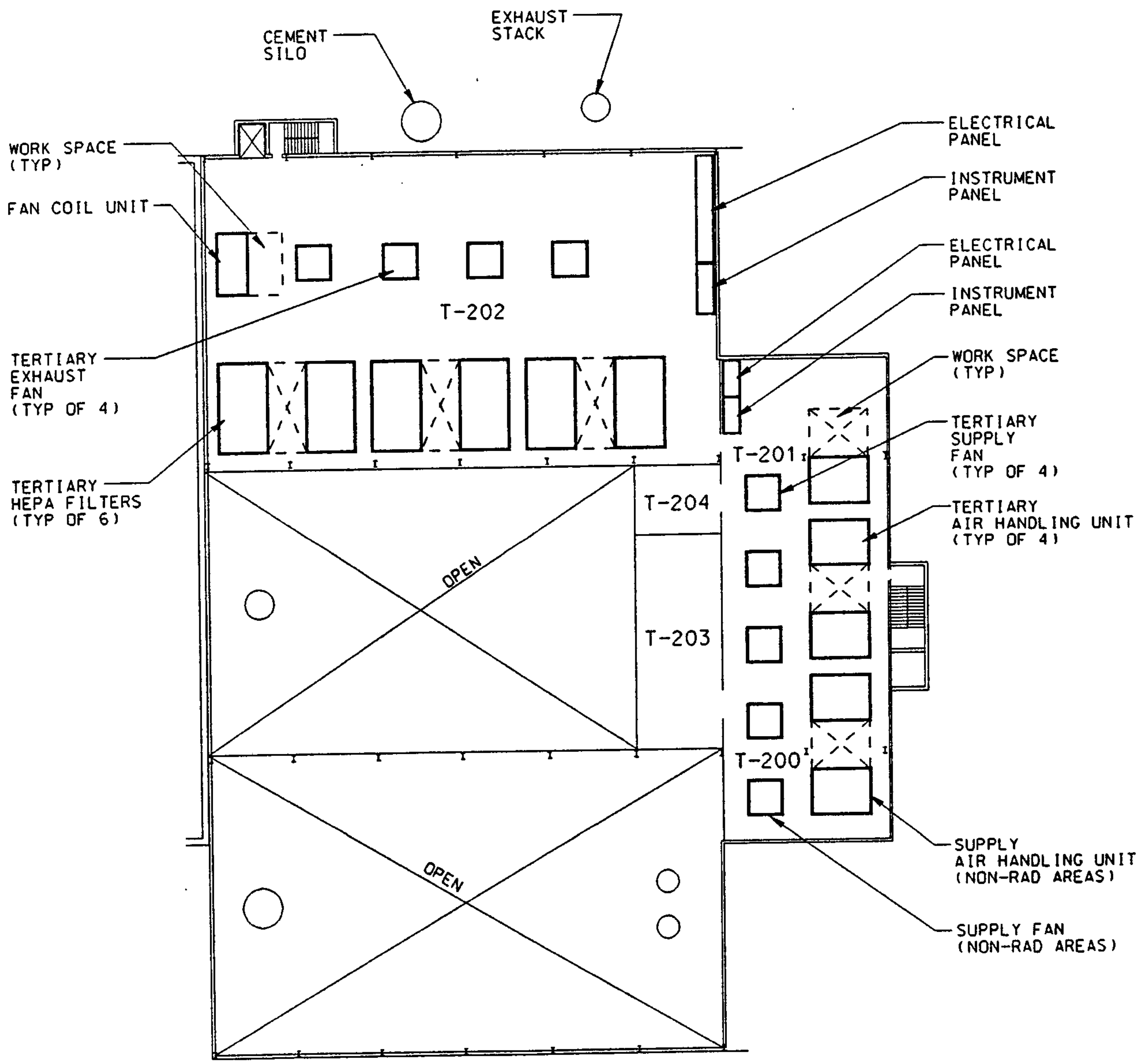

FIGURE I-54
WTB CONFINEMENT SUPPLY AND EXHAUST

WHB/WTB Space Program Analysis for Site Recommendation
ANL-WHS-AR-000001 REV 00

ATTACHMENT II
RADIOLOGICAL SAFETY RECOMMENDATIONS

1. RADIOLOGICAL SAFETY RECOMMENDATIONS

1.1 CRITERIA

The following criterion is from information found in the *Waste Handling Building System Description Document* (CRWMS M&O 2000j).

> The system shall be designed in accordance with the project ALARA program goals and the applicable guidelines in "Information Relevant to Ensuring that Occupational Radiation Exposure at Nuclear Power Stations Will Be as Low as is Reasonably Achievable" (Regulatory Guide 8.8).

1.2 PRELIMINARY SHIELD WALL ASSESSMENT

A preliminary shield wall estimate was made in CRWMS M&O 1997c, Attachment V. Results indicated in CRWMS M&O 1997c, Attachment V, that a 5-ft (152.4cm) concrete wall thickness is able to satisfactorily reduce the radiation to an acceptable level.

It was recommended in CRWMS M&O 1997c, Attachment V, that the wall thickness at the upper levels (>30 ft [914.4cm]) be reduced to at least 3 ft (91.44cm) because of the distance from the radiation source to the dose point and because of the angle through the wall between the source and the dose point dramatically increases the effective shield thickness.

1.3 UPDATED SHIELD WALL ASSESSMENT

An updated shield wall summary was made in CRWMS M&O 2000j, Section 7.

The initial calculations performed in CRWMS M&O 2000j, Section 7 were selected on the basis of need by the design team. The purpose was to provide the design teams with the necessary information to assure an efficient and effective design.

The shielding models are the building blocks for the more sophisticated shielding calculations that will follow when the design is developed to a point where the geometric dimensions, the materials, and other influencing factors are known.

The models were established in such a way that other configurations in the Waste Handling Building (WHB) could be estimated by comparison of similar parameters. Areas of the WHB ground elevation not evaluated during this analysis will be evaluated during the ongoing design process.

The recommended shielding walls' thickness for the WHB from CRWMS M&O 2000j, Section 8 are shown in Table II-1.

Table II-1. Waste Handling Building Shielding Summary

SR Room Designation	VA Room Designation	Shield Thickness Recommended
WP Remediation Cell (H-114)	WP Remediation	3'0" (91.44 cm)
DC Handling Cell (H-110) West Wall	DC Handling Cell West Wall	3'0" (91.44 cm)
DC Handling Cell (H-110) South Wall	DC Handling Cell South Wall	3'0" (91.44 cm)
DC Load Cell (H-105A & H-105B)	DC Load	3'0" (91.44 cm)
DC Decontamination Cell (H-106A & H-106B)	DC Decontamination	3'0" (91.44 cm)
Cask Prep and Decontamination H-108A)	Canister Cask Preparation Cell	1'1.2" (33.53 cm)
Canister Transfer Cell Upper Level (H-205C)	DHLW Canister Transfer Cell	3'0" (91.44 cm)
Canister Storage (H-103D) East and West Walls	DHLW Canister Staging Cell East and West Walls	3'5" (104.14 cm)
Canister Storage (H-103D) North and South Walls	DHLW Canister Staging Cell North and South Walls	3'0" (91.44 cm)
Canister Transfer Cell Upper Level	DHLW Canister Transfer Cell Ceiling	2'0" (60.96 cm)
Canister Transfer Cell Lower Level (H-103C)	Canister Handling Area	4'0" (121.92 cm)
Loaded DC Staging Area (H-113)	DC Staging Cell	3'0" (91.44 cm)
Assembly Handling Cell	Drying Vessels/Transfer Canal	5'0" (152.4 cm)
Operating Gallery (H207)	DC Handling Cell - Operator Gallery Floor and Side	4'0" (121.92 cm)

Subsequent analysis in CRWMS M&O 2000j, as summarized in the section above, reduced the wall thickness in certain areas.

As the design of the WHB progresses, further calculation will be required to recommend required shield wall or door thickness in areas not addressed in this release and to re-evaluate those areas changed due to the evolving WHB.