ORNL/TM-11019
ORO/TOPO-5404.0

FEASIBILITY STUDY

for

A TRANSPORTATION OPERATIONS SYSTEM CASK MAINTENANCE FACILITY

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ACRONYMS

A-E	Architect-Engineer
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BWR	Boiling Water Reactor
CCTV	Closed Circuit Television
CDR	Conceptual Design Report
CFR	Code of Federal Regulations
CHLW	Commercial High-Level Waste
CMC	Construction Management Contractor
CMF	Cask Maintenance Facility
CoC	Certification of Compliance
CPP	Continuous Power Panel
DHLW	Defense High-Level Waste
DOE	United States Department of Energy
DOT	United States Department of Transportation
EIS	Environmental Impact Statement
EMAD	Engine Maintenance Assembly and Disassembly Facility (NTS)
ES	Martin Marietta Energy Systems, Inc.
FFTF	Fast Flux Test Facility
FPPC	Fixed Price Prime Contractor
FSAR	Final Safety Analysis Report
FWMS	Federal Waste Management System
FY	Fiscal Year
GVW	Gross Vehicle Weight
HEDL	Hanford Engineering Development Laboratory
HEPA	High-Efficiency Particulate Air
HLW	High-Level Waste
HP	Health Physics
HVAC	Heating, Ventilating, and Air Conditioning
INEL	Idaho National Engineering Laboratory
LWT	Legal Weight Truck
MCC	Motor Control Center
MGDS	Mined Geologic Disposal System
MRS	Monitored Retrievable Storage
NBS	National Bureau of Standards
NFPA	National Fire Protection Association
NQA-1	Quality Assurance Program Requirements for Nuclear Facilities
NRC	United States Nuclear Regulatory Commission
NTS	Nevada Test Site
NWPA	Nuclear Waste Policy Act
OC	Operating Contractor
OCRWM	Office of Civilian Radioactive Waste Management
OSR	Operational Safety Requirments

ACRONYMS (continued)

OWT	Over Weight Truck
PSAR	Preliminary Safety Analysis Report
PWR	Pressurized Water Reactor
QA	Quality Assurance
QC	Quality Control
RAM	Reliability, Availability, and Maintainability
Rem/MTU	Roentgen Equivalent in Man per Metric Ton of Uranium
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
SARP	Safety Analysis Report for Packaging
SGN	Société générale pour les techniques nouvelles
SNF	Spent Nuclear Fuel
TAN	Test Area North (INEL)
TEC	Total Estimated Cost
TOPO	Transportation Operations Project Office
TOS	Transportation Operations System
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSLCC	Total System Life Cycle Costs
UBC	Uniform Building Code
UPS	Uninterruptable Power System
WBS	Work Breakdown Structure
WVDP	West Valley Development Project

EXECUTIVE SUMMARY

The U. S. Department of Energy (DOE), Office of Civilian Radioactive Waste Management (OCRWM) is responsible for the development of a waste management program for the disposition of spent nuclear fuel (SNF) and high-level waste (HLW). The program will include a transportation system for moving the nuclear waste from the sources to a geologic repository for permanent disposal. Specially designed casks will be used to safely transport the waste. The cask systems must be operated within limits imposed by DOE, the Nuclear Regulatory Commission (NRC), and the Department of Transportation (DOT). A dedicated facility for inspecting, testing, and maintaining the cask systems was recommended by the General Accounting Office (in 1979) as the best means of assuring their operational effectiveness and safety, as well as regulatory compliance. (Federal Actions are Needed to Improve Safety and Security of Nuclear Materials Transportation, EMD-79-18, 3/5/79).

In November of 1987, OCRWM requested a feasibility study be made of a Cask Maintenance Facility (CMF) that would perform the required functions. The CMF System Requirements and Description (ORNL/TM-10855) specified that the design concept would be for a stand-alone facility built on a "green field" site. The purpose of the study was to select and develop a preliminary design concept to allow preparation of a budget estimate of project costs. The information developed would also serve as an initial basis for the conceptual design criteria and development of a project schedule. Finally, the results of the study provide a basis which should be useful in future efforts to define interfaces between the transportation system, other OCRWM systems, and the waste generators.

At the outset of the feasibility study, the project team reviewed available documentation on similar facilities and applications, visited existing cask maintenance facilities in the United States, and discussed alternatives with the operators and other recognized experts in the field. Because development of the overall OCRWM waste management system is still in the formative stage, assumptions had to be made about some aspects of the facilities. Information gathered from all of the sources and the assumptions that were made were recorded in a set of significant issues papers (SIPs) that were maintained throughout the study. The SIPs then were used to evaluate alternatives and select a design concept.

A significant decision in selecting the design concept was whether to perform cask reconfiguration functions, i.e., the change of fuel baskets or fuel spacers, in a wet or dry operating environment. After evaluation of the two approaches (or options), the wet

approach was selected for the following reasons: (1) better overall control of potential radioactive contaminants, (2) greater operational flexibility, and (3) greater cost effectiveness.

Before completing the study, a technical review was conducted of the selected design concept. It produced several recommended changes. Appendix A provides the minutes of the review which itemizes the issues discussed. The project team's response to each issue has been added.

The cost of constructing a stand-alone CMF on a "green field" site is estimated to be $83 million dollars in constant FY 89 dollars. This includes $8 million for preliminary (expense funded) project activities and $75 million for the capital cost of facility. An analysis was made of the potential savings in capital project costs that could result from collocation of the CMF with an existing facility rather than putting it on a relatively distant (or independent) "green field" site. Two different collocation arrangements were considered. One was for a CMF physically adjacent to an existing facility and the other was for a CMF located within the perimeter (shared site, same fence) of an existing facility. Based on this cursory evaluation it appears that an appreciable savings - approximately 10% - will occur only in the case where the CMF shares the same site with an existing facility.

No attempt was made to estimate the savings that might result from partially integrating CMF functions with those of another facility because such a complex analysis was beyond the budgeted scope of this feasibility study. However, the "green field" CMF cost estimate has been developed in sufficient detail to permit future analysis of this possibility.

Design and construction of the CMF is estimated to take 110 months from the start of conceptual design to the start of operations if the project is pursued as a government owned contractor operated (GOCO), major system acquisition by the OCRWM. This time could vary significantly depending upon several factors that were identified during the study as uncertainties. These include potential delays due to regulatory review, constraints resulting from interfaces with other components of the waste management system, the management structure selected for the acquisition, and the level of risk acceptable in implementing an accelerated schedule.

It was assumed that all design efforts, construction, and the operation of the facility would be accomplished under fixed price contracts by competitive-bid-selected contractors.

1. INTRODUCTION

1.1 BACKGROUND

The U.S. Department of Energy (DOE), Office of Civilian Radioactive Waste Management (OCRWM) is responsible for the development of a waste management program for the disposition of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). This responsibility is derived from the Nuclear Waste Policy Act (NWPA) of 1982 (Public Law 97-425).

OCRWM is planning, developing, and implementing a national SNF and HLW transportation system as part of the waste management program. The transportation operations portion of this system will accept SNF and/or HLW from the waste generators and transport it using a specially designed shipping cask system to either a Monitored Retrievable Storage (MRS) facility or a national geologic repository for deep permanent disposal.

The cask system is being designed to provide approved packages for safe transport of SNF and HLW between different facilities and to protect the environment under both normal and accident conditions. The cask system will consist of (1) several types of casks, (2) associated cask transport vehicles (truck-trailer, railcar, or barge), and (3) any associated ancillary equipment (vacuum drying systems, lifting devices, etc.).

The Transportation Operations System (TOS) will transport SNF and HLW safely using the cask system during the operational lifetime of the waste management system. The TOS will operate within the licensing and regulatory limits imposed by certificates of compliance (CoCs) granted by the Nuclear Regulatory Commission (NRC) and within the regulations imposed by the Department of Transportation (DOT) and other Government regulatory agencies.

Casks, ancillary equipment and transport vehicles must be maintained in proper condition to retain system operational effectiveness and safety. The mission of the Cask Maintenance Facility (CMF) is to meet this requirement through (1) servicing, (2) testing, (3) maintenance, (4) repair, (5) modifications, (6) configuration control of all cask system elements, and (7) to prepare any cask system elements for decommissioning and disposal when that cask system element is deemed permanently unfit for use. Services and maintenance of transport vehicles will be limited to those activities required to prevent above normal radiation exposure to the general public.

This study is based upon the previous work of many organizations and individuals in the existing SNF transportation system. Several particularly important documents served as the foundation for this work. These include operational studies referenced to establish the functions and methods of cask maintenance used in the proposed facility design. They are: Cask Fleet Operations Study (Nuclear Assurance Corporation, 1988), and A Cask Fleet Operations Study (Transnuclear Inc., 1988). Two DOE reports were used to establish many of the system and interface assumptions in this study. The reports are: Generic Requirements for a Mined Geologic Disposal System, (OGR/B-2) Rev. 3, dated 3/5/87, DOE document No. DOE/RW-0090, Appendix B-2, and Analysis of Radiation Doses from Operation of Postulated Commercial Spent Fuel Transportation Systems (Schneider 1987). Finally, the early reports led by Paul McCreery, describing fleet servicing facilities and operations were referenced to establish the fundamental design approach for the facility. They are: Interface Criteria for Shipping Casks and Fuel Handling Facilities (McCreery, P. N., et al. 1979a), Studies and Research Concerning BFNP Advanced Cask Handling Studies (McCreery, P. N. 1979b), Fleet Servicing Facilities for Servicing, Maintaining and Testing Rail and Truck Radioactive Waste Transport Systems: Functional Requirements, Technical Design Concepts, and Options Cost Estimates and Comparisons (McCreery, P. N. et. al. 1980a), and Studies and Research Concerning BNFP; Cask Handling Equipment Standardization (McCreery, P. N. 1980b).

1.2 PURPOSE AND SCOPE

The purposes of this feasibility study were to provide an initial concept, estimate a construction cost and an acquisition schedule for the CMF, and to facilitate definition of the interfaces between the transportation system and the waste generators, the repository, and an MRS. The study has been performed in a manner that permits the data, design, and estimated costs that result from the study to be used in the total transportation system decision-making process. This feasibility study also provides a foundation for the design to be used in developing a Conceptual Design Report (CDR). The CDR will be prepared as a subsequent design refinement of the CMF.

There is a significant amount of design detail in this document, however, this design is not prepared to represent the final configuration of the CMF. The design detail given was generated because the process of doing so has been shown, through past experience, to be the most effective and accurate means of obtaining a credible estimate of the construction cost and acquisition schedule for a facility.

The interfaces between the CMF and the remainder of the OCRWM waste management system have not yet been fully defined. However, this feasibility study provides some of the background necessary for those interfaces to be defined at a later date. The interfaces include those with an MRS, the repository, the waste generators, and the cask system. Where necessary, assumptions have been made concerning those interfaces.

The reference transportation system used herein is based on information organized in Transportation Operations Functions of the Federal Waste Management System, ORO/TOP-5403.0, and on the wisdom and experience of individuals experienced in transportation of radiological materials. Cask maintenance activities and alternatives have been derived from those sources as well as prior work in the area, as reported in the references listed in Section 11.1.

The CMF has been defined for this study as a stand-alone facility on a "green field" site where utility services are available at a reasonable distance from the site, but no other facility exists. The CMF may eventually be located adjacent to or integrated with another facility. The joint use and cost sharing of services already located at that site would then be possible, and a reduction in the total OCRWM waste management system costs could occur. This study has been formulated to permit separate identification of costs and functions which could be shared with a collocated or integrated facility. This method will permit those costs to be accurately factored into any future analyses of waste management system alternatives. However, the identification of possible configurations of collocated or integrated facilities is beyond the scope of this document.

Redirection and refinement of the definitions and activities of the transportation system will occur through the natural evolutionary process of the waste management program. As this occurs, the final configuration of the transportation system will be improved and design bases for the CMF system may change.

It is not intended that the information provided in this report be considered a mandate to redirect or redesign any aspect of the remainder of the transportation system; but rather, it is to aid in the cooperative effort to implement an integrated, smoothly operating waste management system.

1.3 JUSTIFICATION

Shipping casks and ancillary equipment must be maintained in order to retain operational effectiveness and to assure safe operation. The CoC for each cask as issued by the NRC establishes certain maintenance requirements which must be performed. A centralized facility to perform these cask maintenance activities is recommended for the OCWRM waste transportation system for the following reasons:

1. Cask maintenance in the United States is currently performed in a diverse fashion at many different locations, including nuclear reactor sites, for a limited fleet of commercially owned casks. This maintenance is often performed at facilities which were designed and constructed for purposes that differ significantly from cask maintenance. It is not deemed feasible and indeed may not be possible to continue this practice for a fleet the size of that envisioned for the OCRWM transportation system.

2. The need for a dedicated facility for cask maintenance was recognized by the General Accounting Office (GAO) ten years ago (1979). Since then, no changes have occurred which negate the recommendation by the GAO, when it expressed concern over cask maintenance for the system which was to transport SNF for reprocessing (Federal Actions are Needed to Improve Safety and Security of Nuclear Materials Transportation, EMD-79-18, 3/5/79).

3. A centralized maintenance facility will provide better management of maintenance operations, more efficient support equipment utilization, a reduced total radiation exposure to personnel and better system scheduling than will a distributed system.

4. A dedicated facility will be better able to respond to special situations than will a distributed system. This is especially applicable in the event that special support functions are needed, for a cask that is "enroute" between facilities, because no duplication of services are required and resources can be allocated for those special support functions.

5. The current level of SNF transportation activity is much smaller than that presently occurring in either France or the United Kingdom. The waste transportation programs in each of these countries utilize facilities dedicated to cask maintenance. As the OCRWM transportation system matures, it will be required to transport significantly more SNF than that currently transported in France or the United

Kingdom. Thus, when faced with a parallel decision, others have chosen to utilize a dedicated facility for cask and ancillary equipment maintenance.

6. In the event that a facility for cask maintenance is not provided, maintenance would be performed in facilities whose primary purpose and equipment are designed for other activities. The additional operational costs, reduced control, scheduling problems, increased radiation dose to maintenance workers, and reduced assurance of safety are deemed qualitatively as unacceptable risks to the proper operation of the OCRWM waste management system.

Thus, the current study was undertaken to evaluate what will be required to satisfy the requirements of providing centralized maintenance to the OCRWM shipping cask system.

The Draft 1988 Mission Plan Amendment (DOE/RW-0187, June 1988) indicates that OCRWM shall have a "transport capability" established in FY 1998 and that a "fleet operational" condition shall occur in FY 2003. The House Committee on Appropriations report which accompanied the Energy and Water Development Appropriation Act for 1990, directed DOE to submit a report within 60 days of enactment describing how DOE planned to respond to concerns of the Committee regarding implementation of the NWPA. In response to this request, a report was issued on November 28, 1989, entitled Report to Congress on Reassessment of the Civilian Radioactive Waste Management Program. DOE/ RW-0247 (OCRWM 1989). The report included a revised program schedule that indicated the OCRWM would:

1. have the "Capability to Initiate Transport/Storage System" in January, 1998; and
2. have the "Capability to Ship 1200 Metric Tons of Uranium per Year from Reactors" in September, 2000.

Based upon the late 1989 plans of OCRWM, it is assumed that the CMF will need to be operational no later than September, 2000, in order to support the 1200 MTU/year operational capability. Prior to this time, it is assumed that maintenance of cask systems supporting the capabilities to initiate transport/storage system operation and to ship with new casks will be accomplished using limited interim capabilities available through contracts with the FWMS.

1.4 APPROACH TO ACCOMPLISHMENT OF THE FEASIBILITY STUDY

This CMF feasibility study has been performed using a classic systems engineering approach as outlined in DOE Order 4700.1, Project Management System, dated 3-6-87. A set of functions for the transportation system were developed previously and reported in Transportation Operations Functions of the Federal Waste Management System, ORO/TOP-5403.0 (Shappert, et al. 1988). Functional requirements for the CMF were then defined in the document Transportation Operations System Cask Maintenance Facility: System Requirements and Description, ORO/TOP-5401.0 (Attaway 1988).

The requirements of ORO/TOP-5401.0 were then evaluated as to their impact on specific facility design areas and a series of "Significant Issue Papers" (SIP's) were written. Each SIP addressed a single facility configuration question that required resolution prior to fully defining the facility. Conclusions were derived from each SIP where possible, and a facility concept was synthesized in an iterative manner from the aggregate of all SIP's.

In conjunction with the generation of the SIP's, site visits were made to six of the facilities located in the U.S. at which cask operations have been or are being performed. These visits permitted discussions with personnel experienced with cask operations and actual observation of facilities which perform some of the functions of a CMF, but at a scale much smaller than that envisioned for support of the OCRWM mission.

Near the end of the definition phase of the feasibility study, a technical review was held, involving expert representatives from several of the facilities which were visited and from other OCRWM components which have an interface with the transportation system.

This report documents the results of these activities, defines areas where further study is needed, and delineates areas where the interfaces with other OCRWM components require resolution.

1.5 DOCUMENT STRUCTURE

This document is organized in such a manner that the reader is provided with a logical progression of how the CMF feasibility study was pursued.

A great deal of preliminary information concerning the requirements, constraints, operational considerations and interfaces of the CMF was compiled as a part of a systems requirements document (Attaway 1988). The key requirements from that document and their original sources were used to define the CMF as a system and are provided in Sect. 2.

A significant number of assumptions were made concerning areas that interface with the CMF or have an impact upon the CMF configuration. The explicit specification of those assumptions is given in Sect. 3. Their definition will permit future detailed studies to evaluate the impact of those assumptions on the CMF and on other elements of the waste management system in an organized manner.

Section 4 provides operational and physical descriptions of the CMF. These descriptions cover the base-case facility and some of the alternatives considered in selecting the base-case. The alternatives are briefly compared and a description of the trade-off methodology is given. A justification is provided for selection of the base-case configuration.

Preliminary assessments for project risk, safety, fire, health, quality assurance, environmental concerns, reliability, availability, and maintainability are identified in Sect. 5.

Section 6 covers the basic uncertainties which have been identified to date and remain to be resolved for the CMF.

The method of accomplishment for the project, a preliminary project schedule, and a summary of the cost estimate for the project are provided in Sects. 7, 8, and 9, respectively. Details required for the design process are covered in subsequent sections and the appendixes of this document. Special attention is called to the technical review report and responses included as Appendix A.

2. SYSTEM DEFINITION

The CMF system definition is outlined in this section. The defining requirements are based on the CMF SRD (Attaway, 1988), and the functional requirements which are defined in related TOS documentation. Additional details related to typical TOS equipment, such as casks and transport vehicles, are included in Appendix C. Appendix D elaborates on some possible cask tests which may be required at the CMF.

2.1 LEGAL AND REGULATORY REQUIREMENTS

The TOS is authorized by the Nuclear Waste Policy Act (NWPA) of 1982 (Public Law 97-425). The CMF will be built and operated as part of the system being developed by the OCRWM in accordance with and under the authority granted by this law.

The TOS will accept shipments of SNF and HLW in accordance with contracts between DOE and the waste generators and owners. Unloaded casks and related necessary cask-handling equipment will be provided to the waste generator. The waste generator will be responsible for loading the cask and for preparation of the proper documentation for the shipment. DOE will then take title to the SNF or HLW, will assume the responsibilities of the shipper, and will transport the waste to the repository or an MRS facility.

The types of waste to be accepted include (1) intact fuel assemblies, (2) canned fuel assemblies, (3) consolidated fuel, (4) non-LWR SNF, (5) activated metals, (6) miscellaneous wastes, (7) Defense High-Level Waste (DHLW), and (8) Commercial High Level Waste (CHLW). The CMF will perform its specified mission for casks used to transport all of these waste types to the repository, or an MRS, and for casks used to transport SNF from an MRS to the repository.

The CMF will be required to operate in accordance with the applicable rules and regulations of the NRC, DOE, and other federal agencies as well as applicable state and local laws. Specific important requirements expected to be applied to the facility are described in this section.

2.1.1 Transportation System Requirements

Figure 2.1 shows the overall functional flow diagram for the TOS which demonstrates the close coupling of support operations (3.0 in Fig. 2.1) with the entire FWMS (Shappert 1988). The CMF is a major element in fulfilling the support functions as a part of support operations.

The estimated number of SNF shipments per year, assuming a shipping rate of 3000 MTU/year, is given in Table 2.1. (Schneider 1987) However, it is also recognized that under several postulated scenarios, both the PWR/BWR ratio of total shipments and the ratio of rail to total shipments, may vary significantly from year to year. This infers that the CMF may process very few of certain cask types in some years and a larger number in other years.

Table 2.1 Annual spent fuel shipments in the postulated reference System (Schneider 1987)

Spent fuel type	Shipments/year		
	Rail	Truck	Total
PWR	195	584	779
BWR	125	387	512
Total	320	971	1291

PWR = Pressurized reactor; BWR = Boiling water reactor

The following requirements for the TOS have impact upon the CMF.

1. Late 1989 OCRWM program plans include the capability to: (1) initiate transportation/storage in January, 1998; and (2) ship 1200 metric tons of uranium in September, 2000. Based on these plans, it is assumed that the CMF will need to be operational no later than September, 2000, in order to support the 1200 MTU/year operational capability. Prior to this time, it is assumed that maintenance of cask systems supporting the capabilties to initiate transport/storage system operation and to ship with new casks will be accomplished using limited interim capabilties available through contracts with the FWMS. Only limited waste acceptance is assumed for the MRS facility. Report to Congress on Reassessment of the Civilian Radioactive Waste Mangement Program, DOE/RW-0247, (OCRWM 1989).

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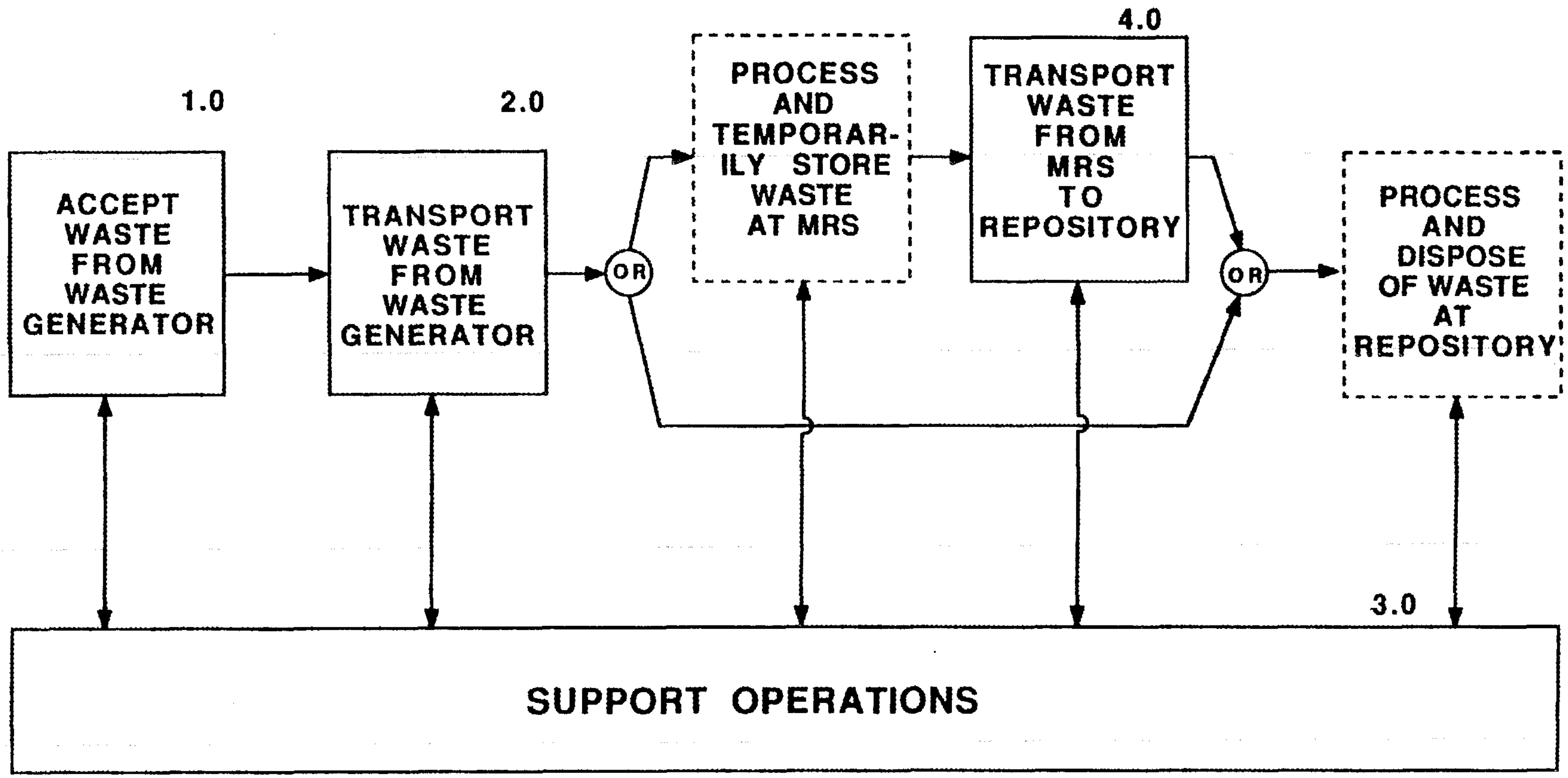

Fig. 2.1. Functions of the Transportation Operations System

2. The TOS will accept SNF and HLW in accordance with contracts executed pursuant to 10 CFR Part 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste. The TOS will accept defense high-level waste (DHLW) in accordance with an acceptance plan to be developed at a future date.

3. The TOS will transport SNF and HLW on a schedule consistent with a waste acceptance plan, which is to be developed jointly by DOE and the waste generators, in accordance with 10 CFR 961 and its future modifications.

4. Cask system components, other vehicles, and services will be acquired by the FWMS under government procurement regulations.

5. An MRS and/or the MGDS will provide for unloading of the casks and certain routine servicing functions, including cleaning and possibly internal reconfiguration, in accordance with RW-0090, Appendix B2 (Roy F. Weston, Inc. 1986).

2.1.2 Operating License

The facility will be licensed by the NRC under 10 CFR Part 30 - Rules of General Applicability to Domestic Operations Licensing of Byproduct Material. The operating license is discussed in more detail in Sect. 6.2.1.

2.1.3 Shipping Requirements

Shipping requirements for the SNF and HLW casks are established primarily by CFR Title 49. Parts, 173, 174 and 177 and will be applied to the casks and vehicles both when shipped and when received. The requirements to be applied to the interior of nominally empty casks are uncertain. Internal contamination limits are discussed in Appendix E.

2.1.4 Cask Compliance Requirements

The CMF will test and maintain casks as required to retain the certificates of compliance (CoC) in accordance with 10 CFR Part 71.12 - Packaging and Transportation of Radioactive Material and 49 CFR Part 173.417 General Requirements for Shipments and Packaging - Authorized Packaging - Fissile Materials.

2.1.5 Other Requirements

State, tribal, and federal requirements concerning the design and operation of the CMF not specifically referred to above or in the feasibility study have been assumed to be of minimal impact on the proposed design. Clearly, this assumption does not apply to facility operations where new or unevaluated regulations may have a substantial impact.

2.2 FUNCTIONAL REQUIREMENTS

The functions to be performed by the CMF are defined by the CMF Systems Requirements and Description (Attaway 1988). Basically the facility will be responsible for the maintenance and documentation of all TOS cask system components. The significant functions within this responsibility are described in this section.

2.2.1 Maintenance

The CMF will provide a complete maintenance operation for all cask system components including transport trailers, railcars, and auxiliary equipment such as lifting yokes. The existing SNF fleet has shown that regular maintenance is required on many types of equipment, including:

. cask valves,
. cask o-rings,
. cask fasteners and helicoils,
. lifting yoke hydraulics,
. personnel barriers, and
. railcar carriages.

The CMF will be equipped to perform maintenance in the following manner:

. evaluate maintenance requirements through inspections and tests,
. prepare written and approved maintenance procedures,
. acquire and certify spare parts,
. perform maintenance operations,
. perform quality assurance certification tests and inspections, and
. maintain records of all maintenance operations.

The CMF will be required to comply with regulatory and licensing requirements for reporting and documentation. It will also be required to evaluate maintenance trends and update maintenance reminder files.

2.2.2 Repairs

Cask systems have been demonstrated to periodically require repairs, such as:

- refinishing cask sealing surfaces,
- replacement of cask dip tubes, (tubes used to extract fluids from a low point of the cask cavity)
- rework of personnel barrier equipment, and
- repair of transport equipment.

All repairs will be performed in accordance with the procedures and requirements listed in Section 2.2.1 for maintenance. The primary difference will be that repairs will require additional planning and may require more sophisticated maintenance equipment.

2.2.3 Testing

Testing will be required for casks in order to periodically confirm and document continued conformance of the cask with its CoC. This testing will be performed at the CMF or under the control of the CMF at other locations. The major tests expected to be performed on cask system components in the CMF, or supported by CMF personnel and equipment, are not currently defined. It is assumed that most of the tests will be similar to those applied to existing casks for CoC requalification and maintenance verification, including vacuum, pressure, and load checks. Radiation shielding and nuclear criticality testing may also be required for the cask CoC.

A thermal test has previously been required every two years to verify the heat load capacity of some casks. At the present time, this test is not required. If required, thermal testing would be performed at the CMF. Appendix D provides additional detail concerning many of the anticipated tests.

2.2.4 Transport Cleaning and Painting

The CMF will perform transport railcar and trailer refurbishment as required for safe and reliable functioning of the TOS. Vehicle cleaning is a necessary requirement for both the presentation of the proper public image and to enable inspectors to do a thorough job. Repainting will be required due to normal wear and aging as well as to recoat local areas where paint has been removed for inspection or repair. The paint removal operation will require special provisions to control contamination trapped in the coating.

2.2.5 Cask Reconfiguration

Individual casks will be reconfigured occasionally to accept different types of fuel assemblies. Reconfiguration can mean either the changeout of a basket or the replacement of spacers. Reconfiguration may occur at the Repository, an MRS, or the CMF. The CMF shall be capable of providing all reconfiguration services required for cask operations, including storage, cleaning and other maintenance of contaminated cask components which have been exchanged during reconfiguration.

2.2.6 Documentation

The complete cask system record documentation, including (1) the CoC, (2) design, drawings, and specifications (3) manuals, and (4) procedures shall be maintained by the CMF. A separate copy of all documentation verifying regulatory compliance shall be maintained by the CMF at a physically separate location, such that a fire or other catastrophe at the CMF will not destroy the only organized set of CMF documentation.

2.2.7 Decontamination

The CMF will be required to clean and decontaminate casks to meet regulatory requirements or to facilitate repairs, testing or maintenance. Cleaning and decontamination will be necessary in the following areas:

. transport vehicle (road dirt and spot contamination),
. cask exterior (road dirt and "weepage"),
. cask interior ("crud" and junk),

. ancillary equipment (general contamination),and
. personnel barrier interiors (road dirt and general contamination).

The CMF will be required to collect and contain all radionuclides removed from the cask systems during cleaning and decontamination operations. Decontamination requirements for the vehicles will be defined by 49 CFR 174.715 (railcars) and 177.843 (trucks); and, by 49 CFR 173.443 for the cask interior.

2.2.8 Waste Disposal

The radionuclide waste collected within the CMF will be processed for disposal off site. No wastes will be disposed of or stored permanently on-site. The waste processing facilities will provide for the proper separation of waste types for the least expensive disposal. Wastes will be concentrated as much as possible then solidified for transport. No waste will be shipped off-site in liquid form.

2.2.9 Cask System Rework

The CMF will be responsible for the rework or modification of cask systems as required by necessity or regulatory request. The CMF will supervise all work and perform all tests and inspections to certify that the completed modifications are acceptable. The facility may however be required to subcontract major work where special or very large machinery is required. The CMF will maintain all necessary records and communications with the regulatory agencies.

2.2.10 Decommissioning and Disposal

The CMF will prepare cask systems for decommissioning and disposal. Normal decommissioning operations include decontamination, size reduction and packaging. Decommissioned casks will not be permanently stored on site.

2.2.11 Equipment Storage

The CMF will provide storage for spare and temporary out-of-service cask system components. The primary components requiring storage will be:

. casks,
. cask skids,
. transport trailers and railcars,
. lifting yokes, and
. certified spare parts.

The storage will be within the secured boundary of the facility and designed to protect the components as necessary from environmental or operational damage. Certified spare parts will require controlled access.

2.2.12 Off-site Functions

CMF personnel will be required to participate in the resolution of special situations which will periodically occur off-site. These will include accidents involving cask systems at other facilities or on the road; repair of cask systems at off-site locations and special cask loading or inspection operations at other facilities or at off-site locations.

2.2.13 Functions Not Performed by the CMF

There are several TOS activities that relate to the operations designated for the CMF which have either been explicitly excluded from the facility requirements or are not yet designated for any facility in the system. These functions are described below.

2.2.13.1 Administrative activities

The activities of TOS vehicle tracking (if required), scheduling, dispatching, and communications are not included as a part of the CMF functions. The CMF design does, however, provide for site-specific functions, such as local traffic management, records management, quality assurance, and purchasing. Refer to 6.0 for more detail.

2.2.13.2 Excluded activities

In accordance with the NWPA, the CMF will not normally perform functions which can reasonably be expected to be performed by commercial vendors. These include, but are not limited to:

1. truck tractor, tug boat, barge, and rail engine maintenance;
2. new cask design, documentation, initial acceptance and certification, and testing, (destructive, thermal, and shielding),
3. in-transit vehicle and cask decontamination and cleanup, and
4. in-transit vehicle maintenance and repair

2.2.13.3 Off-site maintenance

The CMF will not provide special equipment specifically designed for off-site decontamination or maintenance operations. Special decontamination, mobile shop or inspection equipment will be provided by other facilities or subcontractors.

2.3 OPERATIONAL REQUIREMENTS

The nature of the administrative interfaces with the waste generators, the day-to-day operational personnel, and the nature of the material transported by the waste management system will all result in the need for a high level of safety for the public, as well as a public perception of the fact that the high level of safety is being maintained.

Thus, in addition to the normal operational considerations of a facility which is responsible for handling radioactive materials, the CMF as part of the transportation system will be continuously visible to multiple political entities, including federal, state and local officials, Indian nations, and private specific-purpose citizen groups. Cohesive, coordinated interactions with these groups is a necessary function of the TOS; coordination of these interactions will be performed by DOE.

2.3.1 System Operating Schedule

The document Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program, Volume I, Appendix A (DOE 1987), offers guidance for the overall transportation system schedule. Those affecting the CMF include: (1) the transportation system will operate 360 d/year, and (2) transport vehicles, when in transit, will be in service 24 h/d, but not necessarily moving. CMF operating schedule assumptions are discussed in Sects. 3.1 and 3.3.

2.3.2 Project Quality Assurance

Quality assurance (QA) will provide confidence that strict compliance with recognized standards has been maintained in the design and operation of each system to meet the required functions of the CMF. It is important, however, to maintain only that level of assurance warranted by the needs of the overall TOS and the individual task at hand.

As such, the level of QA required for the CMF shall be determined using a graded approach in accordance with the then-applicable QA requirements such as those in ANSI NQA-1 and 10 CFR Part 71. More stringent requirements shall be imposed on those activities deemed to be more critical to safety or the success of achieving the CMF mission; less stringent QA requirements shall be imposed on those areas where failure of an activity would not have major negative consequences on safety or the accomplishment of the CMF mission.

2.3.3 Reliability, Availability, and Maintainability

In order to properly fulfill its mission, the TOS must achieve a certain level of total system availability. Availability is attained through achieving given levels of both reliability and maintainability. DOE Order 6430.1A, General Design Criteria, will be applied to all aspects of the facility design.

Once the definition of each element of the TOS has been made, the reliability of CMF components, the entire CMF, and the entire TOS will be evaluated. Adjustments will then be made to the allocations given to individual TOS components and facilities, so that total TOS reliability meets reasonable criteria. These criteria have yet to be established.

Maintaining high TOS reliability is only part of what is required to be assured that a reasonable level of TOS availability is achieved. Should a component of the system become inoperative or require periodic maintenance, it must be restored to operational readiness within a reasonable period of time. Thus, criteria for the reasonable level of maintainability of TOS facilities and components will also be required.

2.3.4 Safeguards and Security

Safeguards and security requirements for the CMF are defined in 10 CFR 73 (Physical Protection of Plants and Materials), the DOE Order 5632.1A (Protection Program Operations) and DOE Order 6430.1A (Design Criteria). The requirements apply to three basic areas; (1) physical protection of equipment, materials and classified information, (2) protective forces and (3) protective systems performance tests.

Significant safeguards and security considerations which will apply to the design and operation of the CMF are listed below:

1. The CMF will not handle or store loaded casks or spent nuclear fuel. The facility will therefore contain only the limited quantities of radioactive material resulting from the cleaning of casks as required for maintenance and testing.

2. The CMF will store important records concerning the design and performance of the shipping casks and transportation vehicles. This information could potentially be used to assist sabotage of the transportation system.

3. The CMF will store casks, transport vehicles and auxiliary systems. This equipment will require protection while on site and appropriate inspection before shipping and at arrival.

4. CMF facility operators will be knowledgeable of the schedule and movement of casks within the TOS. This information will require protection.

2.4 CASK SYSTEMS DEFINITION

This section contains a general description of the TOS cask system currently being planned. More cask system design detail is provided in Appendix C (spent fuel shipping cask description).

2.4.1 FWMS Cask Types

Description of each of the casks which may be acquired for the FWMS are given below. The unit, ton, is equal to 2000 lb. The CMF shall be capable of processing a minimum of two cask designs for each cask category, even though no commitment to the development of those casks has been made at this time.

Legal weight truck (LWT) casks. The LWT cask system will consist of a tractor, trailer, SNF cask, and ancillary equipment with a maximum gross vehicle weight of 40 tons. The SNF shipping cask will weigh approximately 28 tons with the remainder representing the tractor, trailer, and ancillary equipment.

Over weight truck (OWT) casks. Any OWT cask system was assumed to consist of a tractor, trailer, SNF cask and ancillary equipment with a maximum gross vehicle weight of up to 60 (still to be confirmed) tons. The SNF shipping cask will weigh up to 40 tons, with the remaining 20 tons in the tractor, trailer, and ancillary equipment.

Rail/barge casks. The rail/barge cask system will consist of a rail/barge cask with a weight limit of 100 tons, a four-, six- or eight-axle railcar, and support equipment, such as a skid to facilitate intermodal transfers.

Dual purpose casks. A possible option for the transport of SNF from reactors is the dual-purpose cask system that can be used either for shipping or storage of SNF. The transporter for this system would be an 8-axle railcar with a gross vehicle weight of approximately 200 tons and a 125 ton-cask limit.

HLW truck casks. DHLW and CHLW will be canistered at the point of origin and transported directly to the repository. If truck transportation is used, the transporter would be similar to the type of LWT described previously. The cask expected for use with truck transport is estimated to weigh about 25 tons, with a capacity for one HLW canister.

HLW rail/barge casks. HLW rail transport casks will have a capacity of four canisters and a weight limit of 100 tons. The transporter would be a four-, six-, or eight-axle railcar.

From-MRS rail/barge casks. SNF will be transported from an MRS facility to the repository by dedicated trains. The dedicated trains would consist of five eight-axle railcars, as an upper limit, although a six-axle car would also be possible. The cask used in the dedicated rail system will be a 150-ton shipping cask.

2.4.2 FWMS SNF Cask Specifications

The prototype cask Request for Proposal (RFP no. DE-RP07-86ID12625) Development of From-Reactor Casks does not deal specifically with the details of the cask design. It does, however, specify the following important characteristics that bear on the CMF design:

1. All interconnecting and joining features must be remotely operable.

2. Envelope sizes for casks are provided as follows:

Cask	Max. Cask Diam. (ft)	Impact Limiter Diam. (ft)
LWT, legal weight truck	6	8
OWT, over weight truck	6	8
100-ton rail/barges	8.5	10
125-ton dual purpose	10	12
150-ton MRS to repository[a]	11	12

[a]Not included in RFP - provided here for completeness of information.

3. All openings into cask interiors will be at the top end of the cask.

4. New cask designs will have unique lifting fixtures. This situation should be expected for all future designs because of the substantial differences in size and weight requirements between designs and the difficulties of coordinating various engineering services.

5. Cask designs will have unique transport platforms and stringent requirements for tie-downs and impact limiters. These features lead to integration of transport vehicle beds with the cask mountings. Hence, tie-downs and impact limiters will be dedicated to a single cask and vehicle design, rather than being generic and interchangeable among types of casks.

The RFP design specifications are treated as definition in the feasibility study. Additional cask design assumptions are provided in Appendix C.

2.4.3 Existing Cask Designs

Approximately six existing cask designs and between 20 and 30 casks are in use in the United States as of January, 1988. While similar in function and appearance, all vary in important respects, such as size, external surface features, lifting features, and lid design. Most of the existing casks are smaller than the casks currently under development as a part of the OCRWM Cask System Development Program. The CMF shall accommodate these existing casks on an occasional basis through the future addition of specific-purpose fixtures.

2.4.4 Cask and Basket Lengths

Most fuel assemblies are 160 to 178 in long; new casks are being designed to carry fuel elements in this range of lengths; however, there are several fuel assemblies that exceed these dimensions. These longer fuel assemblies (182 to 199 in) may be handled by adding an extension to the cask. These longer assemblies make up a small proportion of the total amount of SNF to be transported and solutions for transporting them will be developed on a case-by-case basis at a later date (OCRWM 1987).

2.4.5 Interface Control

The following characteristics of the waste transportation system are subject to interface control within the FWMS in accordance with the generic requirements for the MGDS (Roy F. Weston, Inc. 1986, Revised March 1987). The following items are constraints imposed upon the MGDS. It is expected that a forthcoming Waste Management Systems Requirements document will contain similar baselined assumptions.

Shipping Casks

1. weight empty, fully loaded;
2. capacity of intact assemblies, consolidated rods, and/or canisters;
3. external dimensions;
4. internal dimensions;
5. handling features;
6. closure configuration;
7. cask cavity sampling provisions; and
8. ancillary equipment characteristics.

Transportation Vehicles

1. dimensions;
2. gross weight:
   - trailer/tractor;
   - tie downs and personnel barriers;
3. wheel loadings;
4. axle loadings;
5. turn radii;
6. arrangement of cask on vehicle; and
7. tiedown features.

Cask/Vehicle Fleet

1. quantity of each cask, design;
2. cask utilization rate;
3. loading times;

4. unloading times;
5. cask shipment rates;
6. cask decontamination levels:
   - internal; and
   - external.

2.5 TECHNOLOGY REQUIREMENTS

No requirements have been identified for additional technology which would need to be developed in order to provide a functional CMF. There are, however, several areas where technological development could have a positive effect on the efficiency and safety of the facility. Of these, the most important is the design of the cask systems; an area outside the responsibility of the CMF design team. Of particular interest are methods of reducing external contamination due to weeping, lid closure designs which will reduce removal and installation time and effort, and impact limiter and personnel barrier designs which will remain on the transport vehicle and be simple to install and remove. Technology-improvements within the CMF could be applied to the automation of some of the cask handling equipment. This too would have to be done in cooperation with the cask, MGDS and MRS designers.

Designs for important facility systems such as the pool, external cask cleaning booth, waste processing equipment and vehicle cleaning operation can be based on similar installations in use today. However, improvements and adaptations will be made as part of the normal facility design process. Thus, although it is possible to design and build a suitable CMF using existing technology the operations of the facility can be expected to be both more efficient and safer after further improvements have been made.

2.6 PROJECT CONSTRAINTS

The CMF project constraints are the same that apply to all similar facilities in the early phases of design and planning; (1) developing the relationship with related facilities and equipment in the TOS, (2) meeting the scheduled startup plan, and (3) complying with the necessary regulatory requirements. This document is intended to be a starting point for addressing all these constraints by providing a realistic design concept on which future communications and planning can be based.

Section 3.0 Assumptions and Appendix C Cask Descriptions delineate basic assumptions concerning other facilities and equipment in the TOS with respect to the CMF. This information thus provides the CMF perspective on item (1) above. This information will be developed further as the CMF project progresses. Sections 7.0 Method of Accomplishment and 8.0 Project Schedule provide a basic plan, fitting the design and construction of the CMF into the overall TOS startup and operations. This schedule is based on historical data from previous projects of similar scope and complexity. The most significant unknown factor within this schedule is related to item (3) above, regulatory requirements. With the completion of this study and the beginning of the conceptual design, communications should be started and maintained with the appropriate regulatory agencies.

The CMF does not face any extraordinary constraints. With proper attention to planning and communications, the project should meet all operational requirements and be completed on schedule.

2.7 PROJECT TERMINATION PLAN

A project termination plan in accordance with DOE order 4700.1 will be required for the performance of the CMF construction and startup contracts. The development of the plan will be the responsibility of the project manager. It will address the disposition of the unfinished construction and incomplete contracts. The primary goal of the plan will be the expeditious and efficient termination of the project with the least negative affect on personnel and cost.

3. ASSUMPTIONS

The following section provides a description of the assumptions which act as a foundation for the CMF feasibility study. These assumptions cover those areas where legal or regulatory requirements have not yet been fully defined and approved, or where the current state of the waste management program has not yet progressed sufficiently to provide specific guidance. The assumptions which follow are organized into areas of interest and applicability and provide the background for how the transportation system and CMF are assumed to operate.

3.1 TRANSPORTATION SYSTEM OPERATIONS

The following assumptions were primarily derived from the Analysis of Radiation Doses from Operation of Postulated Commercial Spent Fuel Transportation System (Schneider 1987):

1. The FWMS will have an operating capacity of approximately 3400 MTU/yr (3000 MTU/yr of SNF and 400 MTU/yr of HLW). The CMF must be responsive to the delivery of casks from the repository and/or MRS to support this level of operation.

2. Individual casks and vehicles will operate for an average of 300 d/year. During the remainder of the time (65 d/yr) the casks are not operating for a variety of reasons, including major maintenance and servicing, holidays, and compliance inspection and testing.

3. Truck shipments are carried out by general commerce; rail shipments are by general freight. The CMF will therefore receive casks by the same means. Dedicated trains are being considered for from-MRS shipments. The CMF will be capable of accepting the unloaded casks from a dedicated train shipment.

4. Casks will be loaded with SNF or HLW at the generator sites, usually in pools. Casks will be unloaded dry at the receiving facility by mating to a hot cell port. Casks loaded at an MRS will also be loaded dry. Dry transport is the current practice and is expected for the future. Current experience and safety studies indicate that dry unloading is preferred at the repository and an MRS. Thus, at the CMF casks will be received and shipped dry.

5. The repository and an MRS will verify that casks have been completely unloaded and that cask interiors have been cleaned to established requirements after unloading and prior to shipment to the CMF.

6. Usually, the internal components of a cask which is used for transporting one type of waste will be changed when a different type of waste is to be transported in that cask.

3.2 CASK FLEET

The cask fleet will be composed of a variety of cask types and sizes. Each cask type will be part of a cask system which will include the transport trailer or railcar as well as the personnel barriers, impact limiters, yokes and other necessary equipment. A description of the cask fleet used as a basis for this study is provided in Appendix C.

The most important assumptions concerning the cask fleet are as follows:

1. The cask fleet will have 75 active casks. This is an average number based on analyses of several scenarios. It represents a mixed fleet (truck and rail) serving both an MRS and repository and does not allow for a significant amount of lag storage at the repository or an MRS.

2. The fleet may consist of up to 12 or more types of casks:
   - two LWT cask designs,
   - two OWT cask designs,
   - two Rail/barge cask designs,
   - two transportation/storage cask designs (dual purpose),
   - one MRS to Repository cask design,
   - one High Level Defense Waste cask design, and
   - two non-standard cask designs.

   The primary implication of this assumption is that it establishes the requirement that the CMF must be able to process a wide variety of cask types and sizes. The detailed design for the listed cask types were not available for this study.

3. The largest cask to be processed, and thus the one used to size many of the CMF processing systems, is the 150-ton MRS-to-repository design (see Dwg. No. X3E-12824-053)

4. The existing commercially owned cask fleet may be used during the initial start-up of the transportation system; therefore, casks in the existing fleet may also be processed at the CMF.

3.3 CMF OPERATING SCHEDULE

The following assumed operating schedule is based on the observation that the CMF functions and throughput separate logically into three categories for both staffing and scheduling. The three categories are described below.

3.3.1 Vehicle receiving (21 shifts/week)

The transportation system will operate 24 hours a day, 360 days per year. Consequently, the CMF must be open to receive shipments at virtually all times. The feasibility study includes out-of-doors storage for both trucks (15 bays) and trains (15 bays) where off-shift arrivals can be secured pending inspection and survey. This will save the operating cost of full-time health physics and inspection coverage.

3.3.2 Vehicle unloading and loading (5 shifts/week)

Vehicle handling within the CMF will be performed primarily during a single shift each day. Major functions will include relocation of vehicles; staging of trailers and railcars for shipment, and loading or unloading of casks. The normal single day arrival rate of one or two casks can easily be accommodated given the normal 1 to 2 hours loading/unloading time for each cask.

Concentration of the vehicle handling tasks into a single shift per day will minimize the operating cost of the facility by limiting the off-shift staff. It could, however, slow the turn-around time for casks by up to 32 hours.

3.3.3 Cask processing (15 shifts/week)

Cask processing operations such as testing, cleaning, and repair will be performed three shifts per day, five days per week. These operations will be relatively time consuming and could therefore fully occupy critical equipment. CMF processing personnel should be fully trained and qualified to perform multiple tasks to insure good plant efficiency, since the plant will usually have only a few casks in place at any one time, each with a different maintenance need. For example, a single cask may undergo a full cycle of operations from external cleaning through basket change-out and minor repair to inspection in a single day. The remaining six shifts per week could be used for peak periods and plant maintenance.

3.4 SYSTEM THROUGHPUT

The rate at which casks will require different types of maintenance and inspection is a matter of assumption until the cask systems maintenance needs are better defined. The following assumed rates (Table 3.1) are roughly based on the experience of current operations (Nuclear Assurance Corp. (NAC), 1988, Transnuclear (TN), 1988). The tabulated values represent maximums for the stated time period rather than simple fractions of the annual rate. The weekly rate was (in most cases) used to determine the facility capacity (Sect. 4.7).

Table 3.1 CMF processing throughput

Process	Annual	Monthly	Weekly	Daily
Receiving	150[a]	24[a]	7[a]	2[a]
External cleaning	200	36	10	3
Internal cleaning	100	15	7	2
Basket/spacer change-out	50	10	3	1
Major repair (>1 d)	10	2	1	1
Minor repair (<1 d)	75	10	4	1
CoC testing	75	10	4	1
Rework (>1 week)	5	1	1	1

[a] The throughput rate is the assumed maximum for the given process in the listed period. The rates for different process are not additive.

The reasoning behind the rate estimated for some of the more important operations is discussed below.

1. Receiving - The annual rate of two cycles per cask was used based on discussions with and estimates by existing fleet operators and OCRWM representatives. The minimum number of annual visits will be one per cask for CoC testing. The second visit was assumed necessary for one or more of the other processes listed.

2. External cleaning - Most casks received at the CMF will arrive after approximately ten SNF shipments. It is likely that a majority will require an external cleaning. It is also assumed that some casks will be cleaned prior to shipment from the CMF; thus, the total annual rate was set at 67% of both incoming and exiting casks, for a total of 200 cycles.

3. Internal cleaning - Internal cleaning may involve any of several types of operations from a simple flushing using the cask drain/fill system to an aggressive decontamination with portable electropolishing equipment. Thus, the cask may be internally cleaned at the external cleaning station, in the pool, or in a repair and inspection station. It is assumed, based on experience, that virtually all internal cleaning is done to prepare for other maintenance tasks. Assuming that this is true for all basket change-outs and for half of all repairs, an annual rate of 100 cycles is established.

4. Basket/spacer change-out - This process is particularly difficult to estimate because the amount of reconfiguration assistance to be provided by an MRS and the MGDS is uncertain. Further, it is highly dependent on future decisions concerning the size and composition of the cask fleet as well as the manner in which delivery schedules are coordinated among the waste generators. The assumed rate of 50 change-outs per year was determined in discussions with individuals experienced with current SNF and HLW shipping operations and with OCRWM representatives.

5. Major repair - The current fleet has demonstrated high reliability; however, repairs requiring more than 1 day to complete are periodically necessary. Besides a time definition of more than 1 day, it is assumed that a major repair will require special equipment such as a cask rotator. Examples of major repairs could include rework of a sealing surface or trunnion replacement. The assumed rate is 10 casks per year.

6. Minor repair - Small repairs requiring less than 1 day will likely be performed in association with other operations. Such things as replacing fasteners, valves, and seals are examples of minor repairs. It was assumed that each cask in the fleet will require a minor repair once per year.

7. CoC testing - It is assumed that CoC testing of casks will remain on the annual basis used for the existing fleet. Even if the rate is switched to the once per 10 shipment standard used elsewhere in the world, the average testing rate per cask will still be approximately once per year based on current projections.

8. Rework - The assumed rate is 5 casks per year. It is based on cask changes due to regulatory requirements rather than cask failures. The currently operating fleets have demonstrated that cask systems are highly reliable and therefore rarely require rework due to accidents or damage.

3.5 PROCESSING TIMES

The detailed processing times, like the system throughput, will not be firmly established until each cask system design and the functions to be performed on each cask system are better defined. The values specified in Table 3.2 are assumptions based on current operating experience, prototype cask designer estimated operating times, and practical experience (Nuclear Assurance Corp. (NAC), 1988, Transnuclear (TN), 1988). The total value of ~18 to 23 hours to process an average cask are consistent with other time estimates (Schneider 1987). Table 3.3 lists average of minimum times for processing different types of casks through SNF loading or unloading operations at existing facilities. The normal CMF functions are not the same but will be similar particularly with regard to cask handling, surveying, and cleaning; thus, the values provide a fair comparison.

Table 3.2 Summary of assumed operational time periods for the CMF

Activity	No. people	Time (min.)
Cask/vehicle receiving		
Security inspection	1	35
Incoming HP survey	1	30[a]
Wait for HP results	0	30
Total		65
Vehicle preparation bay		
Move loaded veh. to proc. bldg.	2	15
Retract personnel barriers	2	15
Remove impact limiters	2	10
Move vehicle to unloading bay	2	5
Total		45
Vehicle unloading bay		
Remove cask tie-downs	2	30
Attach yoke to crane	1	10[a]
Engage lift beam to cask	3	10
Remove cask from trailer	3	5
Transfer cask to external decon	1	15
Wash vehicle (veh. prep. bay)	2	50[a]
Move unloaded truck to storage	1	15[a]
Total		60
External cask decontamination/cleaning		
Manual decon	2	15 to 120[b]
Automatic decon	2	20[b]
Dry cask	2	10
Measure interlid press. and cont.	1	10
Loosen and remove outer lid	2	20
Measure int. press and vent	1	20[a]
Loosen inner lid bolts	2	10
Move cask to pool	2	15
Total		85 to 185

Table 3.2 (continued)

Pool operations		
Fill cask and submerge	2	60
Remove inner lid	2	50
Remove lid/yoke/crane	2	10
Subtotal		120
Optional functions:		
Replace lid seal	2	30
Wet vacuum cask	2	60
Inspect cask interior	2	10 to 120
Move cask to deep well	2	20
Remove basket	2	20
Move basket to storage	2	30
Retrieve basket from storage	2	30
Install basket	2	10
Move cask to shallow pool	2	20
Subtotal		230 to 340
Engage crane/yoke/lid	2	10
Install inner lid	2	80
Drain cask	2	20[a]
Remove cask from pool	2	10
Dry cask to exterior decon	2	10
Subtotal		110
Total (basket changeout)		340 to 450
Exterior decon station		
Install and torque lid bolts	2	50
Retrieve outer lid	2	10
Install and torque lid bolts	2	50
Lid tightness test	2	20
Decontamination	2	20[a]
HP survey	1	30
Wait for HP survey results	0	30
Retrieve crane/yoke	2	20[a]
Move cask to loading bay	2	25
Total		215

Table 3.2 (continued)

Loading bay		
Move vehicle to bay	1	15[a]
Position cask on trailer	3	10
Disengage yoke and crane	3	5
Engage tiedowns	2	30
Engage impact limiters	2	10
Move vehicle to storage	1	10
Total		65
Inspection bay		
Move vehicle to insp. bay	1	15[a]
HP survey	1	45[c]
Wait for survey Results	0	45[c]
Attach labels	2	5
Close personnel barrier	2	10
Inspect vehicle	2	30
Attach placards	2	10
Move vehicle to storage	1	10
Total		65 to 155
Total cycle time for one cask		1060 to 1360 min (17.7 to 22.7 h)

[a] Operations performed simultaneously with primary functions.
[b] Alternate operation
[c] Optional operation

Table 3.3. Comparison of some prior analyses of cask and spent fuel handling estimates at wet handling facilities (Schneider 1987)

Cask type	No. and type of SFAs [a] carried	Total time for cask turnaround (h)
Truck TN-8	3 PWR	15.8
Truck TN-9	7 BWR	15.8
Truck TN-9	7 BWR	14.8
Truck TN-9	7 BWR	21.2
Truck TN-8	3 PWR	20.1
Truck NLI-1	1 PWR	16.4
Truck NLI-2	2 BWR	16.6
Truck NAC-1	1 PWR	14.4
Truck NAC-1	2 BWR	14.6
Truck NAC-1	1 PWR	12.8
Truck	2 PWR	13.0
Truck (OWT)	4 PWR	13.5
Rail IF-300	7 PWR	35.5[b]
Rail IF-300	18 BWR	35.5[b]
Rail NLI-10/24	10 PWR	27.7[c]
Rail NLI-10/24	24 BWR	27.7[c]
Rail IF-300	7 PWR	25.8
Rail IF-300	18 BWR	28.5
Rail NLI-10/24	10 PWR	35.9
Rail NLI-10/24	24 BWR	39.4
Rail IF-300	7 PWR	22.9
Rail IF-300	14 PWR	24.6

[a] SFAs = Spent fuel assemblies

[b] A contamination barrier was not used when placing the cask into a spent fuel pool.

[c] Assuming the availability of a contamination barrier on the cask while immersed in the pool.

3.6 CASK AND TRANSPORT VEHICLE CONTAMINATION

Removal, containment, solidification and disposal of contamination from casks and vehicles is required of the CMF. The following information provides outline assumptions for the types and quantities of radionuclides to be handled by the CMF.

3.6.1 Spent Nuclear Fuel

The CMF will not handle loaded casks; therefore, spent nuclear fuel will only be present in the form of trace amounts of powder or small particles as described in Sect. 3.6.4 of this section.

3.6.2 Internal Radionuclides

Characterization studies are currently underway to accurately define the composition and activity of the material normally found inside SNF shipping casks. Basically, there are two major constituents, "Crud" and fission products. Crud is a solid material which forms on the outside of reactor fuel rods. It sloughs off the assemblies into the shipping casks during transport operations as a fine powder (comparable to dry cocoa mix). PWR crud is predominantly a nickel-substrated spinel (approximately $Ni\ Fe_2\ 0_4$) while BWR crud is mostly a hematite (Fe_20_3) which usually occurs in greater quantities. The activity in the crud expected on the spent fuel will primarily result from cobalt-60 and manganese-54 (Sandoval 1988). The fission products likely to be present will primarily be isotopes of Cesium.

3.6.3 External Radionuclides

External contamination on the cask and transport vehicle is regulated by 49 CFR 173.443. Based on the experience of the current transportation fleet with these requirements, contamination removed at the CMF from the exterior of the shipping vehicles, casks, yokes, lifting fixtures, and tools is expected to be a source of small but measurable quantities of radionuclides. The predominate contributor in this category will be the external contamination resulting from weeping from the surface of the cask. This type of contamination is apparently initiated when casks are submerged at the fuel storage pools. The mechanics of weeping are not fully understood.

The removable external contamination requirements for radioactive packaging are cited in 49 CFR 173.443. Basically, this section sets limits at less than 0.01 μCi per sq cm for beta-gamma-emitting radionuclides (as measured with dry wipes) and, at less than 0.001 μCi per sq cm for alpha-emitting radionuclides (as measured with dry wipes). Both these limits have been proven to be realistically achievable in the current transportation system using conventional decontamination methods.

3.6.4 Internal Transuranics

Fuel assemblies known, by the waste generators, to be damaged will be placed in canisters prior to being loaded in the shipping casks. The generic requirements for the MGDS (Roy F. Weston, 1986) specify that the repository or the MRS will remove all fuel from the casks prior to shipment to the CMF. This requirement is assumed to include removal of TRU contamination resulting from ruptured or broken fuel rods. For the purposes of the CMF feasibility study, it was assumed that while trace amounts of powder and small particles may be present in casks arriving at the CMF, pieces of fuel, including pellets, will be removed either by the repository or an MRS.

The present shipping cask fleet has experienced only one significant incident of TRU contamination. That event resulted from the oxidation of a fuel assembly inside a cask (Klingensmith 1980). Measures have been implemented to prevent a reoccurrence of that event. However, it is difficult, if not impossible, to predict either the frequency or severity of future TRU-contamination incidents. For this study, no predictions were made. This feasibility study assumes that the possibility of such incidents is remote and that they will be handled on an ad hoc basis.

3.6.5 "Junk"

The experience of the existing cask fleet operators indicates that casks will accumulate a small amount of miscellaneous "junk". Items such as wrenches, personnel dosimeters, bolts, and broken glass have been found at the bottom of casks. It is assumed that the CMF will be responsible for detection and removal of this type of material.

3.6.6 Transport Contact Maintenance Contamination Limits

The requirements for allowable contamination for contact maintenance on transport vehicles at non-NRC licensed shops are defined in 49 CFR 173.443. The limits currently applied at some facilities to vehicles such as cask truck trailers and railcars is 0.5 mrad/hour of fixed contamination, and no measurable amount of smearable contamination. Vehicles which are sent to commercial maintenance facilities will be inspected and decontaminated, if necessary, to meet these or similar limits.

3.7 TRANSPORTATION EQUIPMENT STORAGE

The transportation system will require a surge capacity of extra casks, trailers, and railcars. The CMF will be the prime location for storage of these units. The following assumptions concerning the storage of equipment at the CMF were made.

1. Spare trailers or railcars will be required for each cask system design. This is based on the SNF cask specification (DOE Idaho) that casks of the same design are interchangeable among trailers or railcars for that cask design.

2. All stored equipment will require secure storage. Different levels of security will be required for different types of equipment.

3. The CMF will be capable of processing groups of casks at one time. This results in a requirement for multiple railcar storage, dedicated yard tractors for railcars and trailers, and the ability to selectively remove (and replace) each cask from (onto) its trailer or railcar.

4. The CMF will have the capability to store approximately 10 additional casks off railcars or trailers in a non-operational area inside the process building. The facility must also provide covered storage for all ancillary equipment.

3.8 CONTAMINATED WASTE DISPOSAL

Contaminated waste will be generated primarily by two types of operations in the CMF: (1) cask internal cleaning, and (2) cask and vehicle external cleaning. The outputs from the two operations are expected to be separately processed at a solidification facility. In addition, the CMF will generate solid waste in the form of such things as equipment, wipes and protective clothing. All contaminated waste will be removed in solid form from the CMF site. This waste will be packaged and transported to a disposal site approximately four times annually by a commercial rad-waste shipping operation.

An additional waste stream of "mixed waste" may be produced if certain chemical cleaning fluids or hydraulic oils are used in the CMF process, shipping equipment, or in the cask systems themselves (yokes, etc.). Mixed waste is a combination of radionuclide and Resources Conservation and Recovery Act (RCRA) hazardous materials. Currently, a disposal site has not been certified for mixed waste. For the feasibility study, it was assumed that either the TOS will be designed to avoid the generation of mixed waste (i.e., forbid the use of RCRA fluids) or a designated mixed waste disposal site will be opened and available to the TOS.

3.9 FACILITY EVALUATION AND OPTIMIZATION

The CMF has been designed for operation as a stand-alone facility. Should it be decided to integrate or collocate the CMF with another of the OCRWM facilities, a reoptimization study may be required. Of particular importance is the basic assumption used in this study that all utilities including rail and highway service exist to within 0.5 miles of the site.

4. OPERATIONAL AND PHYSICAL DESCRIPTION OF PROJECT

The CMF has been designed to perform all the functions designated by the transportation operations system (Sect. 2.2). It will be a self-contained "green field" facility with stand-alone waste processing, vehicle storage, cask processing, and system support capabilities. This section of the feasibility study describes the operational and physical characteristics of the project.

4.1 OPERATIONAL DESCRIPTION

The functional flow diagram for the CMF is shown in Figure 4.1. The activities shown in the diagram correspond with the functions designated for the CMF in Section 2.0 Of the Systems Requirements Document (Attaway 1988). Most of the functions defined in that document require special, dedicated equipment; therefore, the proposed facility layout (Fig. 4.2) was designed to correspond directly with the flow diagram thus providing an efficient material flow pattern.

The proposed (Fig. 4.3) facility combines all operations in two buildings; one for processing casks, the other for servicing vehicles. The cask Process Building will be serviced by heavy lift cranes which will unload and load casks from vehicles and move them between operational stations. The process building also includes the support facilities required for cask servicing. The Vehicle Maintenance and Inspection Building houses vehicle functions which do not require heavy lift capacity and are performed on a different schedule than the operations of the process building.

Vehicle storage will be located in the yard of the CMF. Space will be provided for both railcars and highway tractors and trailers.

4.1.1 Receiving and shipping operations

Shipping cask vehicles will arrive at the CMF in accordance with the schedules and requirements of the TOS. The cask vehicles will be either highway transporters or railcars. The CMF will also receive highway transport vehicles with auxiliary cask equipment and commercial shipments of supplies, chemicals, spare parts and other process support material.

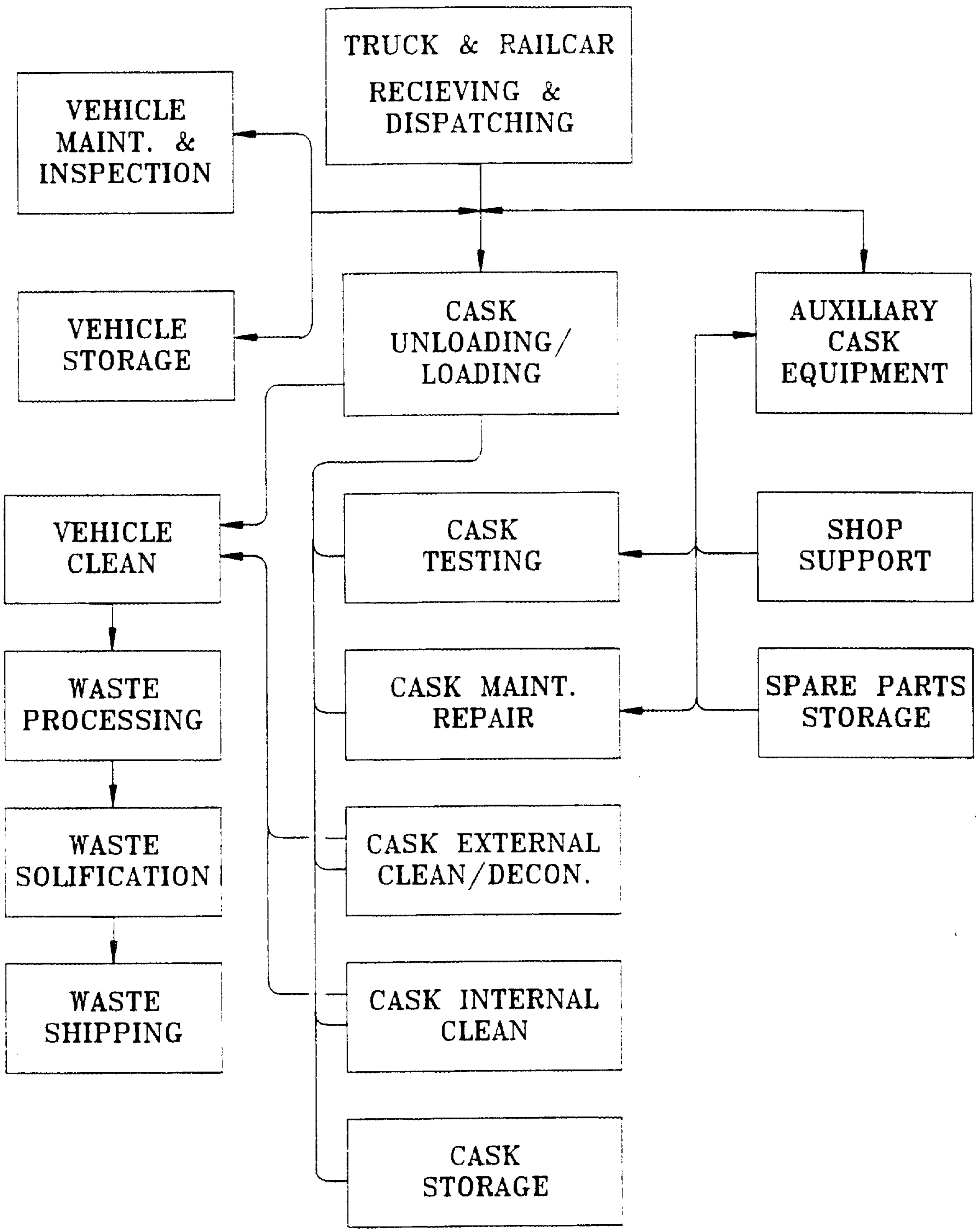

Fig. 4.1. Functional flow diagram.

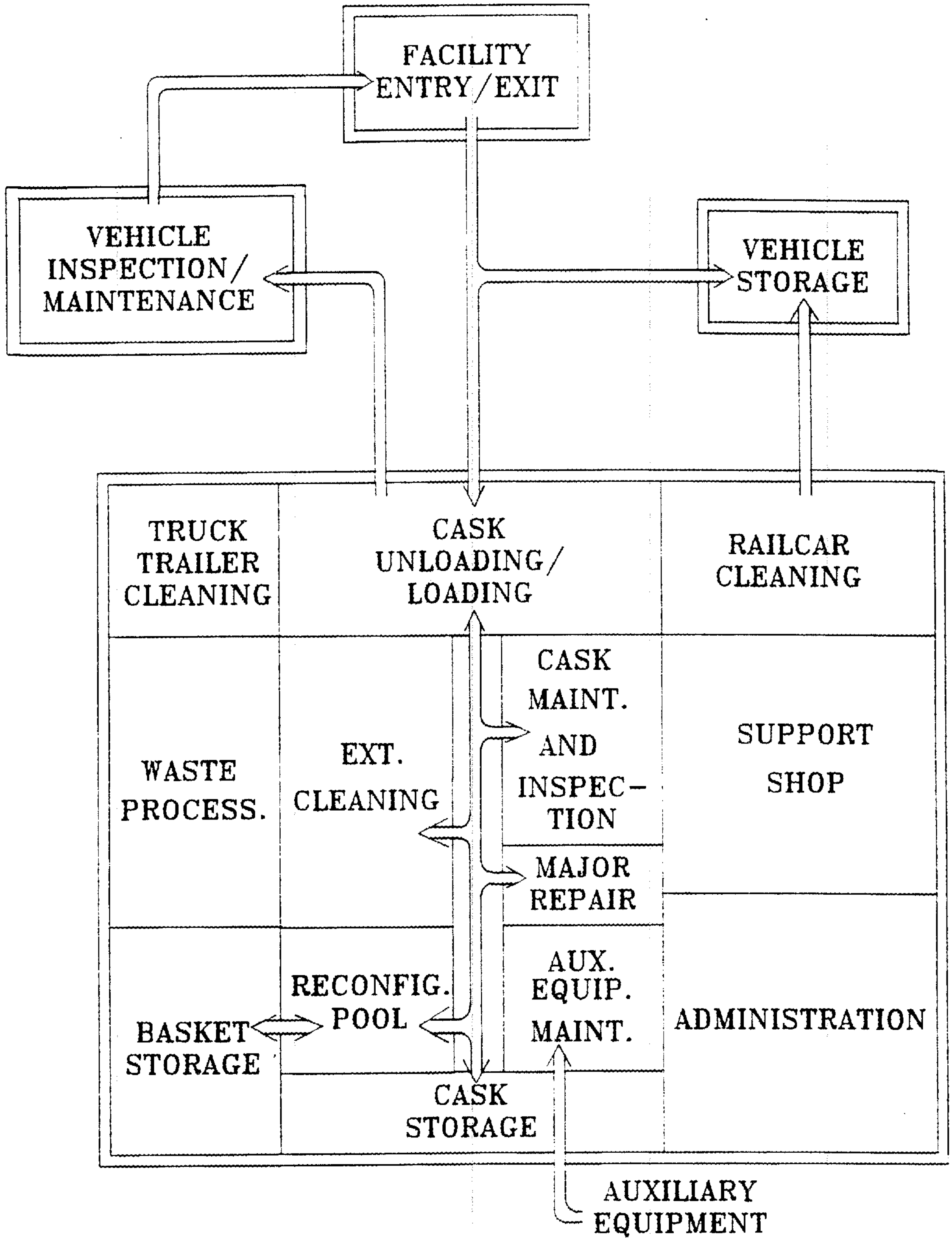

Fig. 4.2. Material flow diagram.

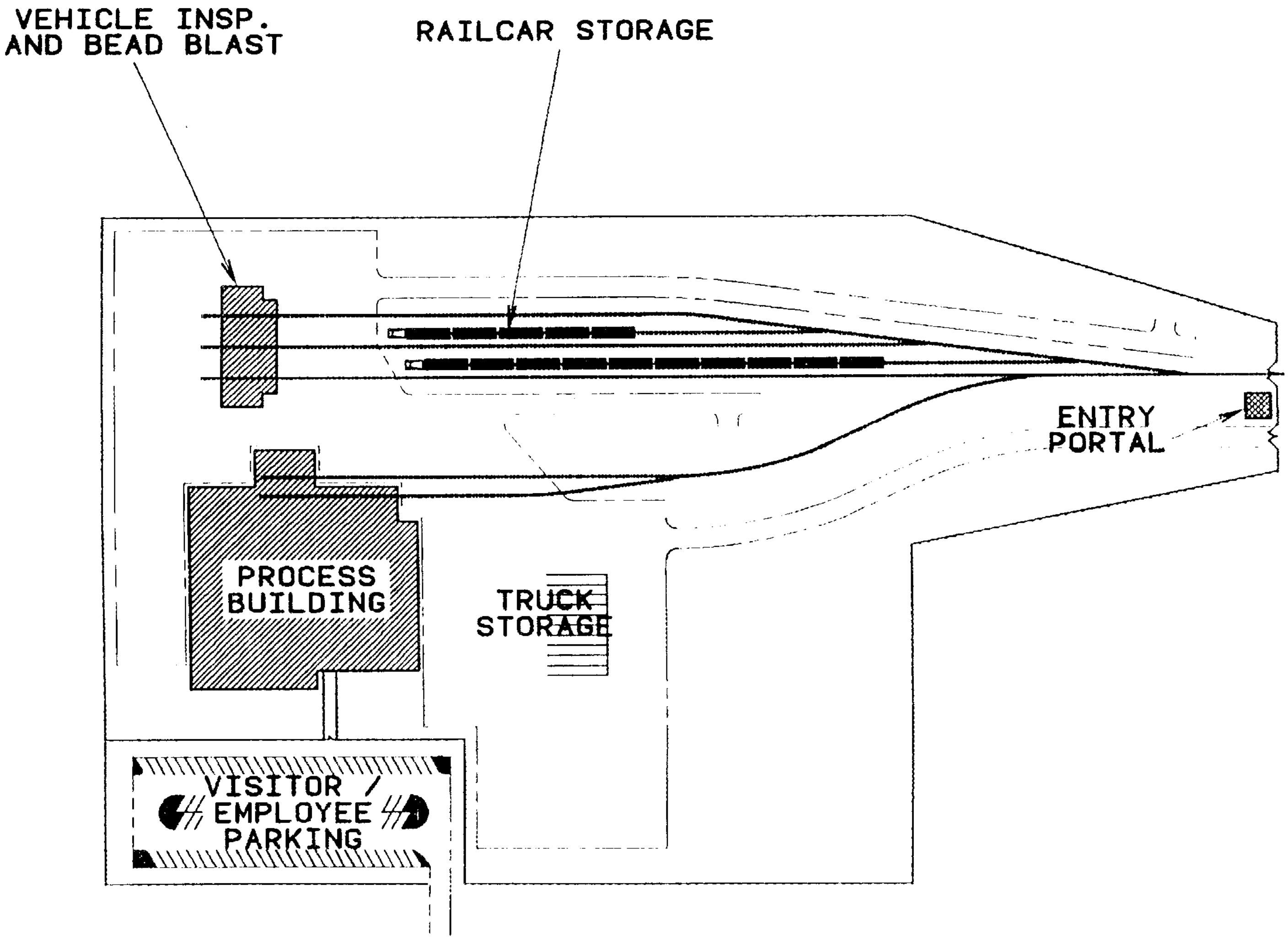

Fig. 4.3. CMF site plan.

Shipping cask and auxiliary cask equipment vehicles will receive both a full contraband and health physics inspections soon after arrival. In accordance with federal regulations the inspection will take place within 18 hours of arrival and include radiation and contamination level determination. Other vehicles will receive only an appropriate sign-in inspection. Following inspection, commercial delivery vehicles will be directed to the appropriate unloading area or dock. Cask transport vehicles will be transferred to yard tractors and moved to storage or the processing building.

Departing shipping casks vehicles will be cleared through the exit station following inspection and clearance at the vehicle maintenance and inspection building.

Vehicle traffic will also be verified and logged using the CMF data base system which will link the entry/exit station with central tracking files. The tracking files will log vehicles and casks throughout stays in the CMF by receiving progress and location information from access terminals located at all the principal processing and inspection operations in the facility. Updates will be entered via an access code only by authorized personnel. The initial and final entries will be made by the entry/exit guards.

4.1.2 Vehicle Storage Operations

Storage for both railcars and highway tractors and trailers will be provided inside the security fence of the CMF. The storage areas will serve both temporary duty for vehicles during cask processing and long term for situations such as storage of infrequently used special cask systems, systems awaiting licensing, and out-of-service casks awaiting decommissioning.

The two storage areas will be monitored by guards via CCTV and daily patrols. Each area will also be serviced by dedicated yard tractors for onsite movement of trailers and railcars. The yard tractors will limit the exposure of highway tractors and mainline rail engines to contamination.

4.1.3 Process Building Operations

The process building will have nine principal functional areas corresponding to the nine types of activities specified for the facility. Figure 4.4 identifies these areas.

. vehicle unloading/loading,

. vehicle cleaning,
. cask external cleaning,
. cask maintenance, testing and repair (including internal cleaning),
. cask reconfiguration (including internal cleaning),
. contaminated waste processing,
. cask and spare parts storage,
. shop support, and
. auxiliary equipment maintenance.

Note that the central area of the process building is serviced by heavy lift bridge cranes while the service areas are not. The casks will be handled only in the central bay.

4.1.3.1 Unloading/loading

Vehicles will enter the process building at the unloading/loading bay. The personnel barrier and impact limiters will be retracted and the cask tie-downs removed. A process bay bridge crane will then be equipped with the correct lifting yoke from the lifting fixture storage area. The door between the unloading/loading bay will be opened when the cask is ready and the transfer will be made to the process bay.

Dirt from the vehicle cleaning bays and outside environment will be controlled by closing the doors between the unloading/loading bay and the vehicle cleaning bays when the doors to the process bay are open.

4.1.3.2 Vehicle cleaning

The CMF will have two vehicle cleaning bays, one for road trailers and the other for railcars. The bays will be used to perform two types of cleaning. First, road dirt will be removed from the exterior of the trailers and railcars with high pressure water spray. This cleaning will be performed only if it is required to permit a close examination of each vehicle or if the vehicle has an excessive accumulation of dirt. The second cleaning will be performed, as needed, on the interior of personnel barriers following an HP survey. The interior cleaning will be performed manually and may result in the removal of both road dirt and spot contamination.

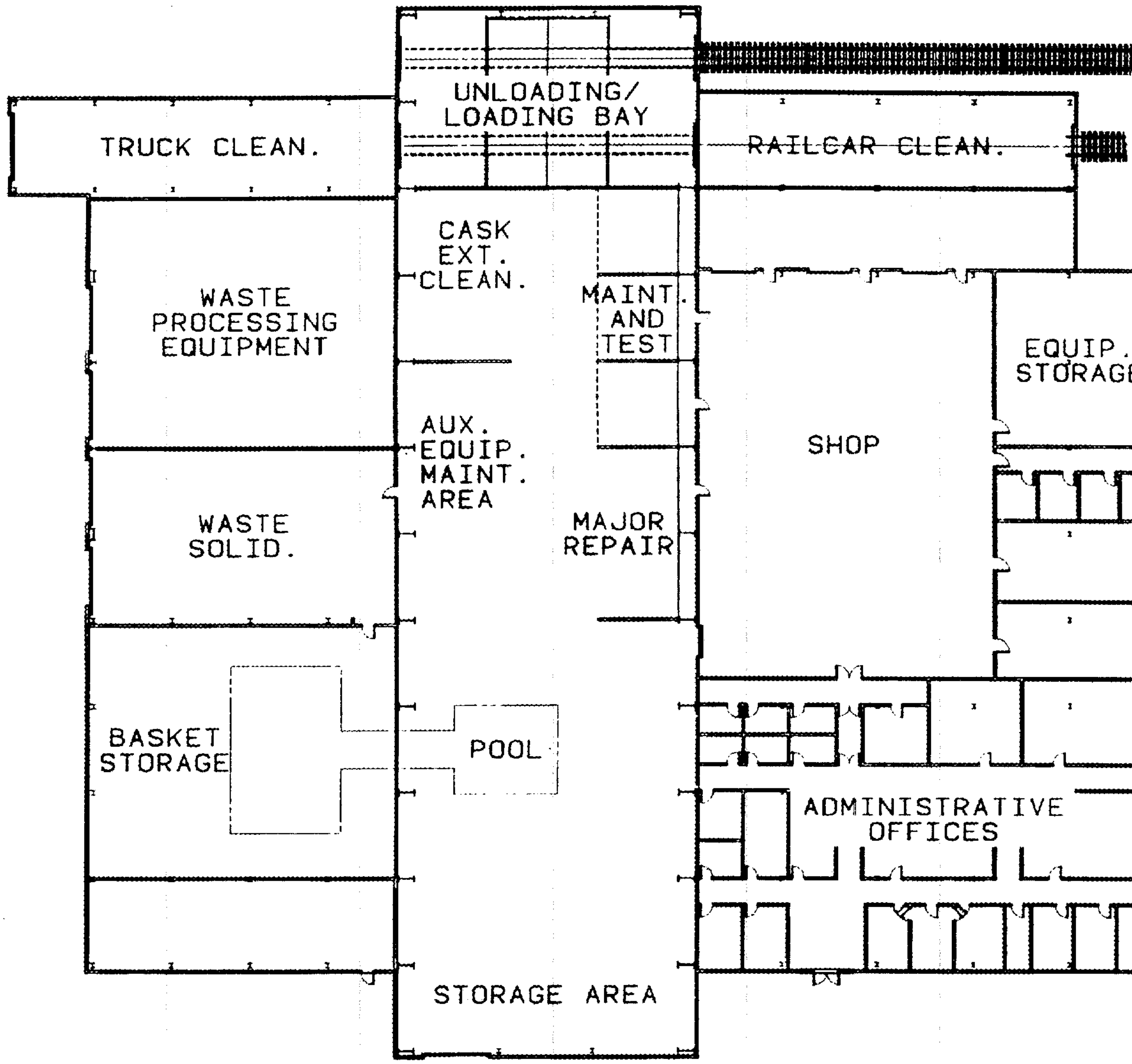

Fig. 4.4. Process building layout.

The wash water from the vehicle cleaning bays will be collected in a sump. The sump will be connected to the liquid waste processing facility where the water will be cleaned and discarded.

4.1.3.3 Cask external cleaning

The shipping casks will be moved from vehicles to the external cleaning area only if an excessive amount of road dirt is found or if the entry HP survey located areas of contamination which may require special treatment. The external cleaning operation will provide both an automatic high pressure water spray and a platform for efficient manual spot decontamination. The cleaning area will be equipped to collect waste water and liquids in a sump from which they can be transferred to the waste processing operation.

Casks may be moved from the cleaning area to any of the other facilities in the process building depending on servicing needs. Additional inspection may also be performed in the area, for example, the outer lid may be removed and the interior of the cask surveyed through taps in the inner lid. The interior of the cask may also be flushed with either water or an aggressive decontamination agent.

Cask exteriors may also be cleaned after processing or if weeping causes the level of contamination to rise above acceptable limits.

4.1.3.4 Maintenance/testing bays

The primary processing area in the CMF will be the maintenance/testing bays. These bays will be used to perform the tasks which have traditionally been most frequently required on shipping casks; CoC testing and minor maintenance such as valve and seal replacement. The bays will also be equipped with sumps to collect contaminated waste resulting from decontamination operations or testing (ie. water drained after a hydrostatic test).

The maintenance and testing bays will be located near the loading/unloading bay to minimize cask travel and adjacent to the shop to provide direct access to the support facilities. Shop support is particularly important for the calibration and repair of instruments, gages and torque wrenches as well as to provide common machine shop service. The spare parts store room will also be located near the maintenance and testing bays to provide easy access to the most common use area.

4.1.3.5 Reconfiguration pool

A pool will be used to provide shielding when casks are opened for reconfiguration or basket changeout. The pool will also serve to contain the friable crud and other contaminants which will be present in the SNF casks. The pool will have three different areas. The portion located in the process bay will have two depths; one for access to the top of casks at the water line and the other for deep submersion to allow removal and handling of baskets entirely underwater. The back of the pool outside of the process bay, will be used to store out-of-service baskets in retainer racks. Between these two areas will be the basket inspection and cleaning area where baskets can be removed from the pool into a dry penthouse where controlled manned access will be possible for basket inspection and repair.

The pool will be connected to a dedicated waste processing system which will continuously filter, clean and recycle the pool water. A large surge tank will also be connected to the pool to control the level of the water during cask entry, exit and during some operations at the top of the cask in the pool. If the basket storage area is filled it will be possible to transfer baskets to enclosed pipes for dry storage in the same bay.

Although, basket changeout will be the primary function of the pool it may also be used to provide personnel shielding from open casks during other types of CMF functions. For example the removal of junk such as a eyeglasses or broken glass from a cask may require water shielding due to the potentially extensive period of time required to perform this type of "hands-on" task.

4.1.3.6 Contaminated waste processing

All the contaminated waste generated at the CMF will be processed for shipment and disposal off-site. No waste will be permanently stored or deposited on site.

The CMF will collect liquid and solid waste at the locations at which the wastes are produced. The waste will then be transported or piped to a dedicated processing facility where the solid waste will be stabilized and packaged and the liquid waste will be concentrated and solidified with grout. The processing facility will include storage capacity for operational hold-up since most functions will be performed in batch processes.

Waste shipments from the CMF will be made by commercial carriers.

4.1.3.7 Cask and spare parts storage

Spare parts for all normal CMF operations will be stored on-site at locations close to their point of use. Major categories of parts include:

- Cask and cask system components: This category includes such things as valves, fasteners and flanges. Most of these parts will be controlled with locked storage and certified documentation. The components storage area will be located close to the maintenance and testing stations.

- Cask basket storage: Baskets will be stored for casks which are designed to carry more than one type of SNF and/or HLW. The used baskets will be contaminated and will require shielded and contained storage either under water or in enclosed containers. The baskets will be stored in or near the reconfiguration pool.

- Vehicle components: The CMF will stock a limited supply of vehicle parts such as belts, tires and hoses. This supply will be used to support the minor maintenance expected to be part of the pre-shipment inspection process. The vehicle spare parts will be stored in the vehicle maintenance and inspection building.

- Cask lifting fixtures: The CMF will be required to maintain a supply of lifting yokes both for on-site use and to support operations at waste generators. Yokes for the most common cask types will be stored near the unloading/loading bay while back-up stock and infrequently used yokes may be stored at the back of the process area.

- Casks: Out-of-service and special casks will be stored either in the process building, on trailers or railcars, or on specially designed skids. The process building storage area will be at the back of the high bay within reach of the heavy lift bridge cranes but out of the process areas.

4.1.3.8 Shop support

Fabrication, testing and repair support services will be located in the process building. The support services will include common machine tools such as lathes, grinders and drill presses to provide for part fabrication and repair. Testing capability will be available for calibration of gages and instruments. Repair tools and expertise will be available for maintenance of special equipment such as vacuum pumps, instruments and lifting yokes. The shop support facilities will be located adjacent to the process high bay near the maintenance and testing bays where the majority of critical operations will be performed.

4.1.3.9 Auxiliary equipment maintenance

Existing SNF cask operations have indicated that the auxiliary equipment used to support cask operations will require as much effort to maintain as the casks. This equipment includes such things as lifting yokes, adapter tools and equipment, and vacuum pumping systems. The CMF will have a dedicated area in the process high bay for maintaining this equipment. It will be serviced by a separate loading dock to reduce the interference of this work with the cask servicing operations.

4.2 FACILITY DESCRIPTION

The CMF will have two major buildings and two vehicle storage areas on an approximately 20-acre fence-secured site (see drawing No. C3E-12824-A001). Upon arrival, the vehicles will be searched and a radiological survey performed. The vehicle will then be moved to storage or to the process building for cask decontamination, cleaning, inspection, test, or repair. Cask systems, including trailers which have been processed, will be inspected and surveyed in the inspection building prior to release. The CMF will also have secondary capabilities for performing maintenance, repair, inspection and storage of cask-handling equipment in the process building as well as minor maintenance on truck and railcar trailers in the inspection building.

The CMF design is based on manual operation, but does not preclude automation of certain functions. Studies (Thunborg, S. 1987, Yount, J. A. 1984) have been completed which note the potential benefits of automation, particularly reduced personnel exposure. However, because the CMF casks will not contain either SNF or HLW, automation could not be justified at this stage of design. Other economic or technical factors may be found in future design work which will cause some operations to be mechanized.

4.2.1 Process Building

The process building is the primary facility on the CMF site (see Dwg. No. S3E-12824-B001). It will house all the cask servicing and testing operations as well as the waste processing, shop support and administration facilities.

The feasibility study design for the process building is based on an efficient flow pattern, principally for the casks and secondarily for the waste. The most used work area in the process building will be the test and maintenance bays where many of the designated CMF activities will be performed. Consequently, these bays are located adjacent to the unloading/loading bay to minimize the primary cask travel path. They are also located adjacent to the shop support facilities to provide easy personnel access.

The waste processing equipment is located near all the major waste generators (pool, maintenance and inspection bays, vehicle cleaning bays and external cleaning booths) to minimize the piping runs. This equipment is housed in a separate room to isolate both the exposure and contamination.

The auxiliary equipment maintenance area is located away from the main cask operations but close the shop support facilities. A separate loading dock is provided for dedicated auxiliary equipment shipping vehicles.

Storage areas are located near to the primary use facilities but away from the cask flow. Casks will be stored at the rear of the high bay and controlled cask component stores will be located in the shop area. Baskets will be stored in or near the back of the reconfiguration pool.

The process building was designed to permit integration of the CMF into the MGDS or an MRS without a major change in configuration. This integration could be accomplished by sharing the CMF loading and vehicle preparation facilities with the attached operation. Cask transfers could then be made either between operations or from the transport vehicles into either facility. Similarly, the process building design lends itself to modification for collocation without a significant configuration change. Reductions in office and shop requirements as a result of collocation could be easily accommodated, since these areas are housed in a separate space from the process operations.

4.2.1.1 Structural

The process building will be constructed of structural steel framing. Walls are to be 8 in thick, precast, reinforced concrete panels with 2 in of fiberglass insulation. The roof is to consist of 2 in of cast-in-place concrete, metal decking, and 3 in of fiberglass insulation. The process building will consist of four distinct areas: (1) the "west wing", (2) the "east wing", (3) the central, high bay corridor and, (4) the pool area.

The "west wing" is to be 242 x 97.5 x 50 ft tall. Included in the west wing are: (1) the waste processing equipment room, 66 x 78 ft, (2) the mechanical equipment room, 22 x 78 ft, (3) the basket storage area, 66 x 78 ft, truck cleaning bay, 97.5 x 22 ft and (4) waste solidification space, 44 x 78 ft. The mechanical equipment room is to consist of two levels, each 25 ft in height. All other rooms are single story. The basket storage area houses one primary 10-ton bridge crane. Total floor space provided in the west wing is 21,021 ft^2.

The "east wing" is to include: (1) an area for offices, computers, records, etc., 66 x 120 x 20 ft tall, (2) a shop area, 72 x 132 x 30 ft tall, (3) storage/change room area, 48 x 110 ft, and (4) railcar cleaning bay 22 x 96 ft. A metal housing, 30 x 30 x 15 ft tall is to be provided on the roof of the east wing adjacent to the central high-bay area to house mechanical equipment. Total floor space provided in the east wing is 25,344 ft^2.

The central high-bay area is 70 x 286 x 55 ft tall and includes space for cask unloading, cleaning, storage, and maintenance. Rigid frame "bents" will provide support for building loads as well as for two 175-ton bridge cranes. Both bridge cranes are to be supported on the same rail at the same height. Total floor space provided in central high-bay area is 20,020 ft^2.

The pool will be located in the high-bay and 'west' wing. It will have a concrete structure and a stainless steel liner. Both the structure and the liner will be water tight to provide redundant containment. The top of the pool will be approximately 4 ft above grade for personnel safety and convenience. The pool will have a filled volume of 34,000 ft^3. A detailed description of the pool and pool operations is provided in Sect. 4.3.4.

The CMF structures will be designed with strict adherence to DOE Order 6430.1A with guidance from UCRL 15910, 53582, and 53526 regarding design-base tornado speeds, seismic response spectra, etc., for the specific site selected for the CMF.

4.2.1.2 Cask-Handling Cranes

Lifting cranes provided in the process building are as follows:

A. 175-ton bridge crane:
   Location: high-bay corridor
   Rail: Bethleham 171 lb
   Hook height: 30 ft (min. from floor level)
   Span: 70 ft
   Hook travel: 51 ft
   Bridge travel: 220.5 ft
   Hoisting speed: 10 ft/min (variable)
   Directional speed: 100 ft/min (variable)
   Translational speed: 50 ft/min
   Radio control operation

B: 175-ton bridge crane (back-up for (A), see above data).

C: 25-ton bridge crane:
Location: west wing
Rail: ASCE, 85 lb.
Hook height: 55 ft
Span: 66 ft
Hook travel: 57 ft
Bridge travel: 67.5 ft
Hoisting speed: 15 ft/min
Directional speed: 50 ft/min
Translational speed: 50 ft/min

D: Two 10-ton bridge cranes (one for each pool section)

4.2.1.3 Plant Monitoring Instrumentation

A central control system computer and terminal access will be provided to monitor and control all critical process elements as well as some general plant utilities. A separate data base system for cask tracking and records storage is described in Sect. 4.6.

The central control system will use programmable controllers as interface units and will thus only provide higher level control. All automatic safety features and failure modes will be driven by the slave units so that failure of the main system will not constitute a system collapse. All critical signals in the system will also be redundant and will cause fail-safe modes of operation independent of the slave units (i.e., high levels in tanks or sumps will provide automatic interlock controls) in accordance with DOE Order 6430.1A. The system will have graphics overlays to depict the system configuration at the control console, as well as alarm indications at the console (see drawing Nos. I3E-12824-123/4).

All contaminated liquid process wastes will be monitored and controlled through the various stages of the process. Monitoring and control requirements are the same for both the "internal" and "external" process loops. Instrumentation for these process systems (see drawing Nos. I3E-12824-123/4) include:

A. Liquid-level monitoring, display, and controls in the pool and process tanks (level controls are to be redundant).

B. Pressure monitoring and display of the differential pressure across all process system filters and zeolite columns.
C. Automatic system pump controls with fail-safe interlocks, and manual override switches.
D. Waste sampling at the exit and entrance of the zeolite column chains and at the exit of individual columns.
E. Analysis and display of the pH of the system before and after the zeolite column chain.
F. System flow monitoring and display.
G. Centrally automated control valving for system configurations from control console (i.e., zeolite column configuration).
H. Beta and gamma radiation monitoring at the exit from the zeolite columns.
I. Moisture and high-liquid-level detection in all process sumps, with external system interlocks (i.e., not passing through the slave units) as well as control system inputs.
J. Temperature monitoring and indication of the main process flows.
K. Leak detection of all the doubly contained piping and tankage will be accomplished by pressure monitoring of the piping annulus by both a transmitter with alarm and pressure switch (see drawing No. I3E-12824-122).
L. Pressure relief valves on all the zeolite columns (redundant).
M. Off-gas system pressure monitoring and display on all of the process waste tanks (see drawing No. I3E-12824-121).

Local air monitors will be provided with integral tape recorders and level indicators (alpha and beta/gamma), local alarms and status indicators, and digital alarm inputs to the central control system. These monitors will be placed strategically throughout the facility to get area representative samples as closely as possible.

Stack monitoring and surveillance instrumentation (see drawing No. I3E-12824-121) will be provided for both of the facility stacks and will have local indication and alarming as well as inputs to the central control system. The systems will provide on-line surveillance, as well as historical samples, in accordance with the pertinent guidelines and standards.

Personnel portal monitors will be provided at all two-way accesses to the office and shop areas. The units will have local alarms and status indicators as well as having alarm status inputs to the central control system.

Moisture and vapor monitoring will be provided for both fuel tanks and their associated doubly contained piping (see drawing No. I3E-12824-122). Alarm inputs will be provided to the central control system. Leak and high-level detection will also be provided for the diesel generator day-tank sump, with the alarms and tank pump controls being tied into the central control system. Interlocks external to the control system will be provided to insure pump shut-off in the event of a tank leak.

Pressure instrumentation (indication and control system input) will be provided throughout the ventilation system for the facility, which will provide the necessary information for facility balancing by the use of manual loading stations to various damper control actuators. Also, automatic ventilation blower control will be available through the central control system (see drawing No. I3E-12824-122)

Monitoring and control of several facility utilities will be provided through system failure alarms which will be tied into the central control system. Individual utilities will have their own associated instrumentation for monitoring and controlling. The utilities included in this category are:

A. chilled water system,
B. demineralized water system,
C. plant air system,
D. utility electric power (alarm indication should come from the backup generator control panel),
E. uninterruptible power supply system (which will serve all critical instrumentation),
F. evaporator system,
G. solidification system, and
H. cooling tower system.

Security monitoring instrumentation will be provided as follows:

A. Badge readers will be provided to facilitate and monitor employee entrance and exit from the facility.
B. Facility gate position switches will be provided to aid in forced entry detection.
C. Gate control will be provided by control boxes at the facility gates which will be key-operated by facility security personnel.
D. Surveillance cameras (with VCR's and scanning monitoring) will be located strategically around the plant for area surveillance.

Various process display panels and equipment racks will be provided for mounting the process monitoring instrumentation. Remote alarm panels will be provided from the central control system to alert critical personnel of system problems.

4.2.1.4 Electrical

The electrical equipment and distribution systems for the process building are described in this section:

Utility equipment room

The utility equipment room will have two levels identified as the first floor and the mezzanine (see drawing No. E3E-12824-Z001). The first floor will be devoted primarily to heating, ventilation, and air conditioning (HVAC) equipment, but it will also contain the two diesel-generator units located near the outside wall. The mezzanine will contain the 480-V switchgear, three motor control centers, two automatic transfer switches, one uninterruptible power system (UPS), and distribution panels CPP (Continuous Power Panel) and PDP (Power Distribution Panel).

Electrical power distribution

Power will be distributed to process equipment by means of rigid galvanized conduit, routed from the motor control centers in the utility equipment room. Generally, local non-fusible disconnect switches will be installed for equipment hard wired to the power service but out of sight from the source. An overhead arrangement of power bus duct, supported from the ceiling, will provide the required 480-V service for most shop equipment. Power feeders in the office area will generally be routed above suspended ceilings to connect to HVAC equipment or to distribution panels.

Lighting system

Power for the lighting system will be derived from the 480-V system by means of dry-type transformers located throughout the facility as required, to serve the various lighting distribution panel boards. Fluorescent lighting fixtures will be used in areas containing grid-type suspended ceilings.

General lighting for the cask handling areas will be provided by means of high-bay-type fixtures. These fixtures will be high-pressure, sodium luminaries mounted below the bridge crane rails and along each side wall so as not to interfere with crane movements. Similar fixtures may be mounted on the under side of the crane assemblies to serve as emergency lighting during power outages. Fixed or portable supplemental lighting will also be provided where required. High-bay lighting will be switched at the distribution panels; supplemental lighting may be provided with local switching. Lighting in the Utility and Process Equipment Areas will be provided by means of open-type, industrial-grade fluorescent fixtures.

Receptacles

Conventional 15-and 20-A, 120-V, single and duplex receptacles as well as the 20-A, 208-V, single and three-phase receptacles will be supplied from the lighting distribution panels. The 480-V, three-phase receptacles will be supplied from motor control centers or from 480-V distribution panels. A minimum of three duplex-receptacles will be provided in each office. Conventional 120-V duplex outlets will be surface mounted around the interior perimeter of the test and maintenance area, the pool cleaning area, the storage areas, and the bead blast and inspection building. Four power service stations will be installed in the test and maintenance area. Each station will consist of one 20-A, 120-V, single-phase outlet, one 20-A, 208-V, single-phase outlet, one 20-A, 208-V, three-phase outlet, and one 30-A, 480-V, three-phase outlet. Both three-phase outlets will each be connected to the load terminals of 30-A non-fused disconnect switches.

Communications

The receptionist station in the administrative lobby shall be the focal point for all communications. This station will contain a central unit with paging capability. Additional paging capability will be provided from each of the major operating areas. A communications terminal cabinet will be located in a closet (dedicated for the purpose) in the administrative area. The cabinet will interconnect with the "local area" telephone system.

4.2.1.5 Environmental control

The design of the process building environmental control system will be in accordance with the Department of Energy General Design Criteria 6430.1A. All air conditioning systems will consist of air handling units, filters, cooling coils, heating coils, distribution system, and control system. Cooling will be provided by chilled water. Heating will be provided by hot water. Two 100-ton water chillers will be located in the mechanical equipment room (see drawing No. H3E-12824-G001). Two natural, gas-fired boilers will be located in the mechanical equipment room. Ventilation for confinement areas will be provided by exhaust fans located in the mechanical equipment room. Exhaust from confinement areas will be HEPA filtered using bag-in, bag-out-type filter housings. The filter houses will contain a roughing filter and two banks of HEPA filters in series. General ventilation consisting of roof- or wall-mounted exhaust fans will be provided for areas not requiring containment.

Maintenance area

The maintenance area will be air conditioned and will be maintained at a negative pressure relative to the atmosphere. Air exhausted from this area will be filtered through HEPA filters.

Process area

The process area will be air conditioned and ventilated and will be maintained at a negative pressure relative to the atmosphere. Air exhausted from this area will be filtered through HEPA filters.

Shop area

The shop area will be air conditioned and ventilated and will be maintained at a negative pressure relative to the atmosphere. Air exhausted from this area will be filtered through HEPA filters.

Administrative area

The administrative area will be air conditioned. Rest rooms located within this area will be ventilated. The conference and computer rooms located within this area will have separate air conditioning systems.

Vehicle preparation and unloading areas

The vehicle preparation and unloading area will be ventilated and heated.

4.2.1.6 Plant maintenance shop facilities

Plant maintenance activities will be performed in both the process support shop and vehicle maintenance shop facilities. This will permit the efficient use of personnel and the consolidation of supervision and quality assurance activities in a minimum number of locations.

Maintenance of facility equipment such as lifting fixtures, pumps, process equipment, and cranes will be located in the process building shop. Contaminated and uncontaminated shop equipment will be located in different areas to reduce the possibility of unnecessary spread of contamination and to simplify health physics procedures. This equipment will include most common tools such as lathes, drill presses, and grinders and will be capable of performing routine fabrication and repair. Major fabrication will be procured from an outside source. Special maintenance stations, located in the process shop, are discussed in Sect. 4.3.7. Included in this category are electropolish tanks, valve test stands, torque wrench, and gage calibration equipment.

4.2.1.7 Personnel office facilities

The CMF will have office space provided for all the functions specified in the Systems Requirements and Description Document (Attaway 1988). The space requirements were developed by first assuming a work force for the facility, then assigning space in the appropriate area. Basically, the majority of the personnel will be based in the process building, where they will be divided between administrative functions located in the office area, and servicing functions located in the process areas.

The assumed personnel contingent for the CMF in a stand-alone arrangement is discussed in Sect. 4.7. Twenty-two of the eighty-six person workforce required for a "green field" facility will be located in the 7000 ft^2 office facility with the remainder distributed among the processing areas and grounds. Contamination of offices will be controlled using monitored step-on/step-off zoning. The only special equipment located in the office areas will be the process and data storage computing systems. This equipment will require dedicated heating, ventilating, and air conditioning (HVAC) (see Sect. 4.2.1.5) and special security (see Sect. 5.6).

4.2.1.8 Controlled storage

Cask systems will include specific components such as valves and seals which will require certified replacements. These components will be purchased and tested in accordance with qualified procurement procedures. Commensurate storage practices will require controlled access storage. Consequently, the process building will have a 1760 ft^2 secured room located in the shop. Personnel access will be regulated by administrative procedures and electronic code entry switches. A running inventory will be maintained by the CMF data base system.

4.2.2 Vehicle Inspection and Bead Blast Building

The vehicle inspection and bead blast facility will be a three-bay service facility designed to perform inspection and maintenance on the cask transport vehicles, trailers, and rail cars, as well as site vehicles and yard tractors (see drawing No. S3E-12824-B003). This work will include minor repair, maintenance, pre-shipment inspections, paint removal, and repainting. All major trailer repairs, regularly scheduled railcar maintenance, truck tractor, and rail engine repair and maintenance will be performed off-site by contract vendors.

The vehicle inspection and bead blast building will include two bays for vehicle maintenance and one bay for bead blasting and repainting. The inspection area will be equipped with full- length pits and rail access. Also included will be a spare parts supply for the vehicles (note: cask system spare parts will be stocked in the process building.). The bead blast bay will be provided with recycle blasting equipment and HEPA-filtered ventilation. Blasting operations will be performed with the bay doors closed to contain the potential spread of contamination.

4.2.2.1 Structural

The vehicle inspection and bead blast building is to be constructed of structural steel framing. Walls are to be 8 in-thick, precast, reinforced concrete panels with 2 in of fiberglass insulation. The roof will consist of a 2 in-thick, cast-in-place, reinforced concrete slab over a metal deck with 3 in of fiberglass insulation. The walls and ceiling of the bead blast bay will be covered to prevent the accumulation of dirt and contamination.

Three centrally located bays, each 37 x 80 x 25 ft tall will be provided for bead-blast and inspection procedures. In addition to the three primary bays there will be two 16 x 67 x 25 ft tall areas for office space and storage. Total floor space provided in the vehicle facility is 11,024 ft^2.

4.2.2.2 Bead blast equipment

The bead blast equipment will be a conventional paint removal operation using metal shot to reduce the amount of dust generated. The blasting will be performed manually by personnel protected with suitable clothing and breathing apparatus. Industrial experience indicates that the beads can be used seven times before being disposed of as contaminated solid waste.

The bead blast facility will be used on a limited basis, since the TOS equipment is expected to be painted with coatings having lives of up to eight years. Thus, the expected use rate for major repainting operations is only once per month. This rate will be intermittently supplemented by other operations, such as minor paint removal for vehicle inspection and maintenance.

4.2.2.3 Environmental control

The vehicle inspection building will be heated and ventilated (see drawing No. H3E-12824-G002). Exhaust from the confinement areas will be filtered through a bag filter and HEPA filters. An exhaust fan will be located adjacent to the mechanical equipment room. The bag filter and HEPA filters enclosures will be located in the mechanical equipment room. Heat will be provided by two gas-fired boilers located in the mechanical equipment room. General ventilation will be provided through roof-mounted exhausters. The area used for painting will have an exhaust system designed for removal of fumes and dust.

A vacuum system will be required to collect the beads in the blast area. The vacuum system will be located in the mechanical equipment room and will contain a cyclone-type separator, bag filter, roughing filters, HEPA filters, and an exhaust fan.

4.2.2.4 Electrical

Power for the vehicle building will be routed from the 480-V switchgear on the mezzanine of the process building, underground in a concrete duct bank (approximately 700 ft) and terminate at MCC #4. This same duct bank will also carry the fire alarm, telephone, and paging circuits required for the building. Distribution of power from MCC #4 will be routed in conduit, either exposed or embedded in walls or floor, as determined by local conditions.

4.2.2.5 Instrumentation

Local air monitors will be provided to protect personnel from possible airborne contamination.

4.2.3 Guard Post

The guard post will be located at the main vehicle entry to the CMF site. The entrance will service both rail and truck delivers. It will house:

1. a station for up to three guards,
2. a driver-waiting lounge for off-shift arrivals and departure delays due to HP and maintenance inspections,
3. restroom facilities, and
4. a data link to the process computer for log-ins/outs.

The post will be manned continuously in order to receive vehicles on the TOS schedule of 24 h operation 360 d per year. General plant surveillance will be performed with a system of CCTV cameras strategically located throughout the facility.

CMF operating personnel and visitors on foot will be monitored from a post inside the process building.

4.2.3.1 Structural

The guard post building will be 30 x 30 x 15 ft in height and will consist of structural steel framing with brick veneer. Windows will be located on three sides to permit visual monitoring of the main entry and building entry.

4.2.3.2 Electrical

The power service for the guard post will run underground from the main process building, and will connect to MCC #1. Power will be available by way of the reserve power generator during a failure of the normal power source.

4.3 PROCESS FACILITIES AND EQUIPMENT

4.3.1 Cask Unloading/Loading

Transfer of casks from vehicles in the unloading bay to the process bay will be accomplished with the two 175-ton bridge cranes operating through one of two doors in the process bay (see drawing Nos. S3E-12824-B001/2). The doors will be opened when the roll-up doors to the unloading bays are closed and the casks are ready to be either loaded or unloaded. The cask lifts will be made by operators positioned in the high-bay at the opening of the doors.

4.3.2 External Vehicle Cleaning

After casks are removed, transport vehicles will be checked and, if necessary, manually washed with hot water using hand-held spray nozzles to remove road dirt. Vehicle cleaning will be performed in one of the vehicle cleaning bays to isolate this inherently dirty operation from the cask processing area. The used wash water will be collected in the vehicle wash holding sump. Mud and gravel that may be present in the wash water will be removed by a mud separator. Wash water will then be pumped to the External Wash Recycle System for treatment as shown on drawing J3E-12824-101 and the treated water recycled to the vehicle preparation bay. Cleaning and decontamination inside the transport personnel barriers will be performed manually if required.

4.3.3 External Cask Cleaning Booth

Exterior surfaces of casks will be surveyed by health physics. Casks that have greater than permitted removable surface contamination limits will be decontaminated in the external cleaning booth (see Fig. 4.4). For widely distributed contamination, an automatic high-pressure water spray system, located in the external cleaning booth, will be used. The automatic system will use a ring of water spray nozzles operating at a minimum of 10,000 psi. The nozzle ring will move vertically and rotate slightly to achieve full surface coverage. The external cleaning booth will also be equipped with a platform, which will provide access to all areas of the cask, except the bottom, for manual spot cleaning, if this is found to be more effective than automatic cleaning. The waste water generated during cleaning will gravity drain to a sump and be pumped to the External Wash Recycle System for treatment as shown on drawing J3E-12824-101.

Eng. Dwg. CMF 4.1

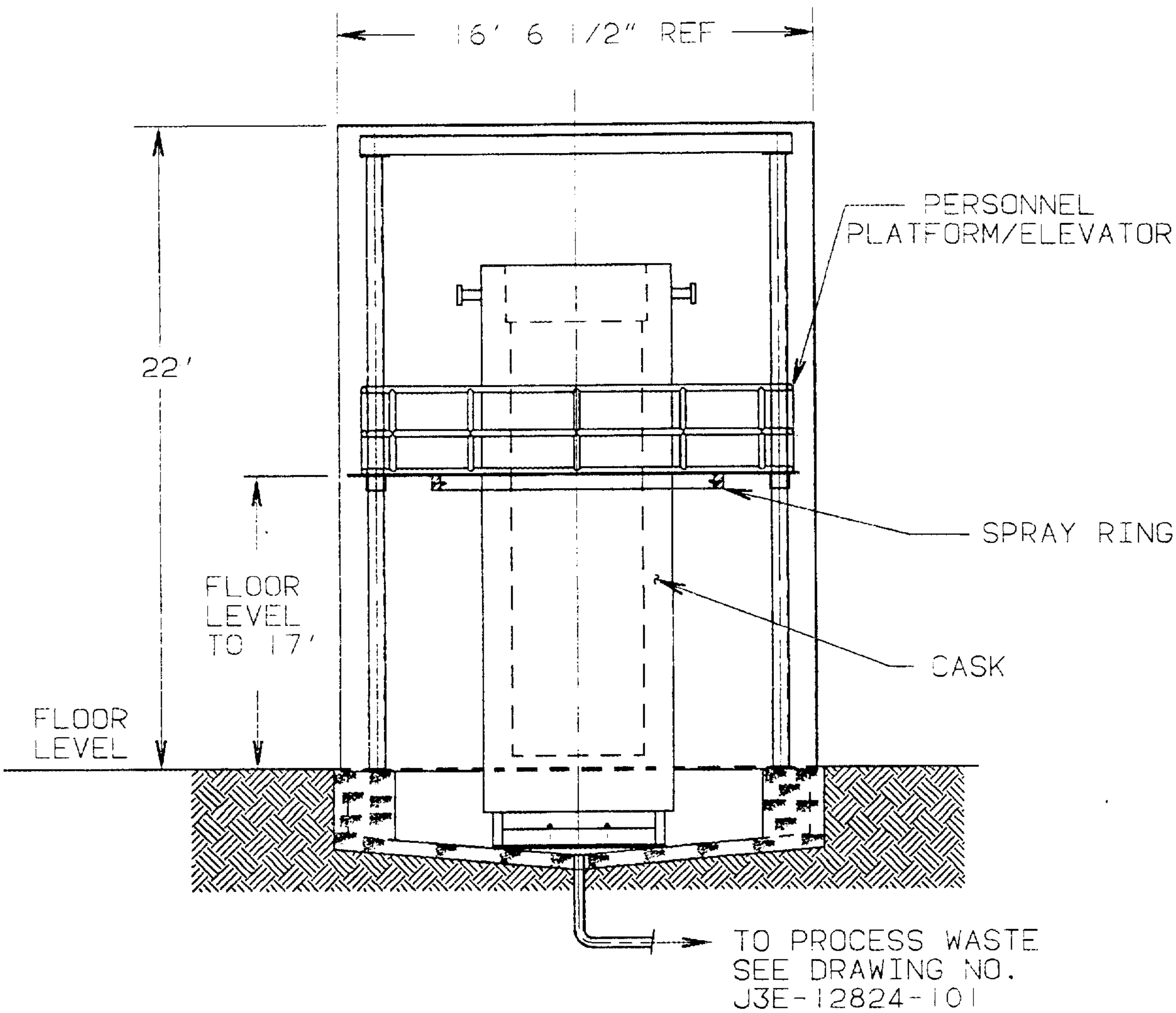

Fig. 4.5. External cask cleaning booth.

4.3.4 Process Pool

The process pool will have three principle areas: (1) maintenance and inspection, (2) basket removal and inspection, and (3) basket storage (see Figs. 4.6 and 4.7). The cask maintenance and inspection area will be located inside the high bay within the 175-ton crane access zone (see Fig. 4.4). It will have a capacity of two casks, each positioned on separate stands (crash pads). Each work station will have a fold back platform for personnel access and tool positioning. The platforms will be motor driven and arranged to clear the pool bridge crane in both the retracted and deployed positions. The cask maintenance and inspection area of the pool will also have two portable ring drains, which will collect a majority of the crud escaping from the open casks during cleaning operations. A schematic of a ring drain is shown in Fig. 4.8. It will attach loosely to the top of casks, with adaptors designed for each type of cask.

Placement of the ring partially below water level will insure that leakage will be from the clean pool into the ring and drainage from the ring will be from the contaminated cask. The drained water will be pumped directly to the process water treatment system. Confinement of the contaminated cask flushing water will reduce the extent of pool contamination and background radiation. The cask maintenance and inspection area will be 22 x 25 x 20 ft deep.

The basket removal area of the pool will be a 36 ft-deep pit into which casks can be moved by the 175-ton bridge cranes. Baskets can be removed and installed at this depth, without exposure to the process cell atmosphere, using the 10-ton pool bridge crane or the auxiliary hoist on the main bridge crane. Baskets are transferred to and from the basket storage area through a 7 ft-wide canal with a powered, transfer trolley. The trolley will be located near the top of the transfer canal and will be powered by electric motors located outside the pool. A dry cask inspection/maintenance booth measuring 12 x 12 ft will be located over the transfer canal for controlled hands-on access to contaminated baskets (Transnuclear 1988). The booth will have a grate floor equipped with a hatch, through which the baskets will be removed from the pool via a dedicated hoist inside the booth. Personnel access will be controlled through an air-lock change room attached to the booth.

The basket storage area in the pool has the capacity of approximately 35 baskets. If more space is required for special or seldom-used baskets, sealed, dry cylinders can be used for out-of-pool storage. The 10-ton overhead bridge crane will be used to handle baskets and other equipment in the storage area. The basket storage area will be 26 x 40 x 18 ft deep. The walls and floor will be lined with stainless steel.

Eng. Dwg. CMF 4.2

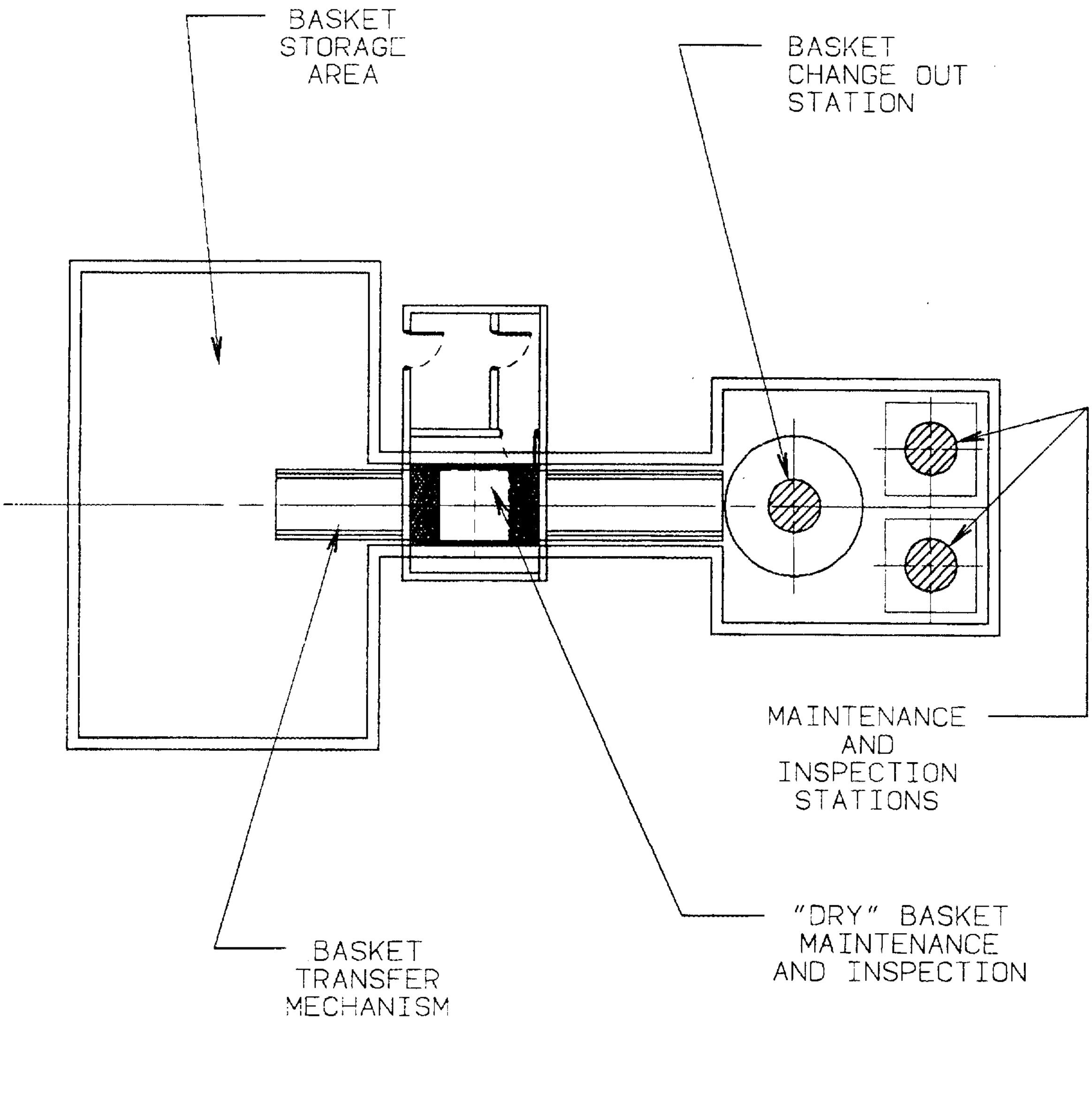

Fig. 4.6. Process pool-plan.

Eng. Dwg. CMF 4.3

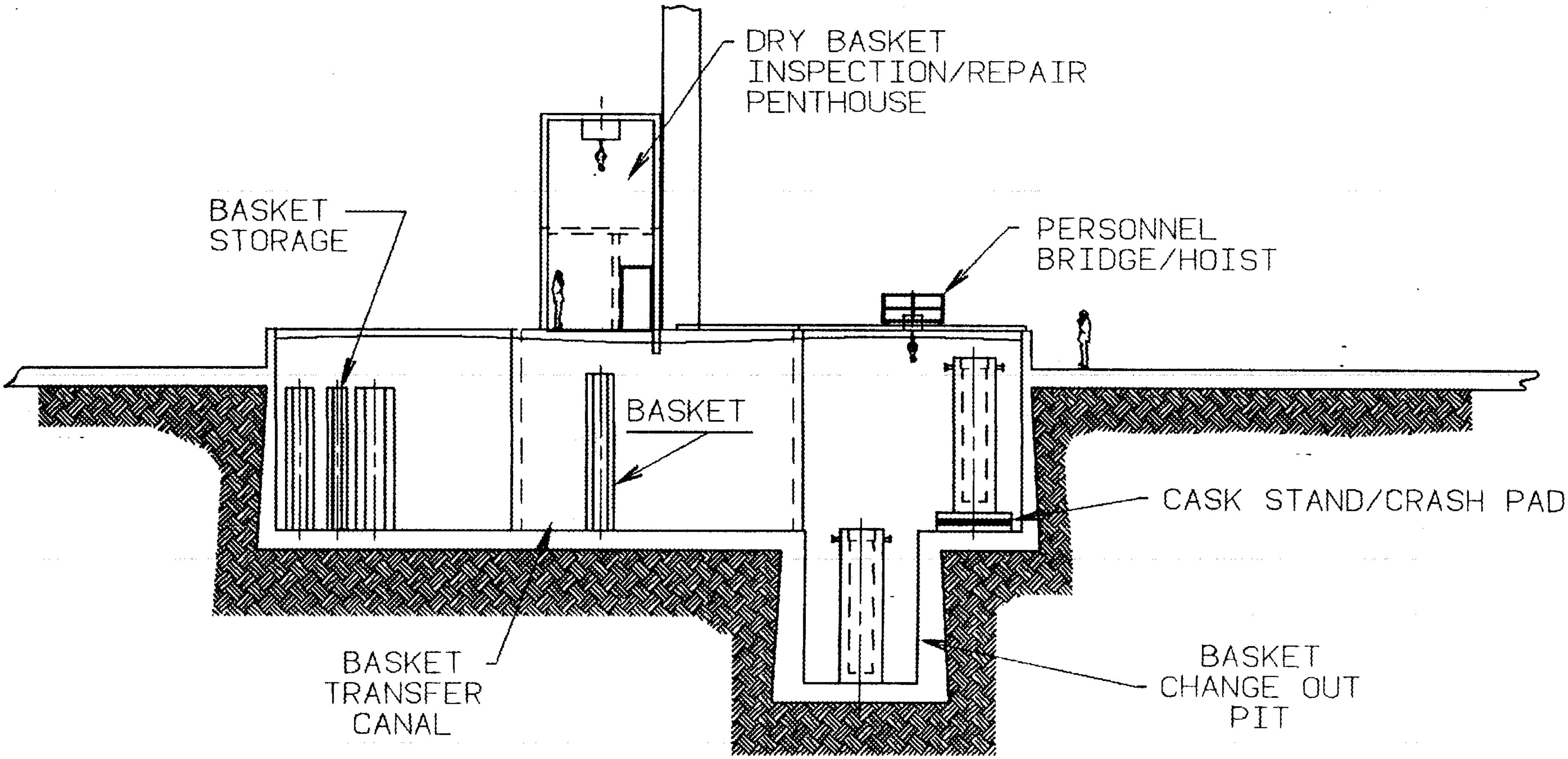

Fig. 4.3. Process pool-elevation.

Eng. Dwg. CMF 4.4

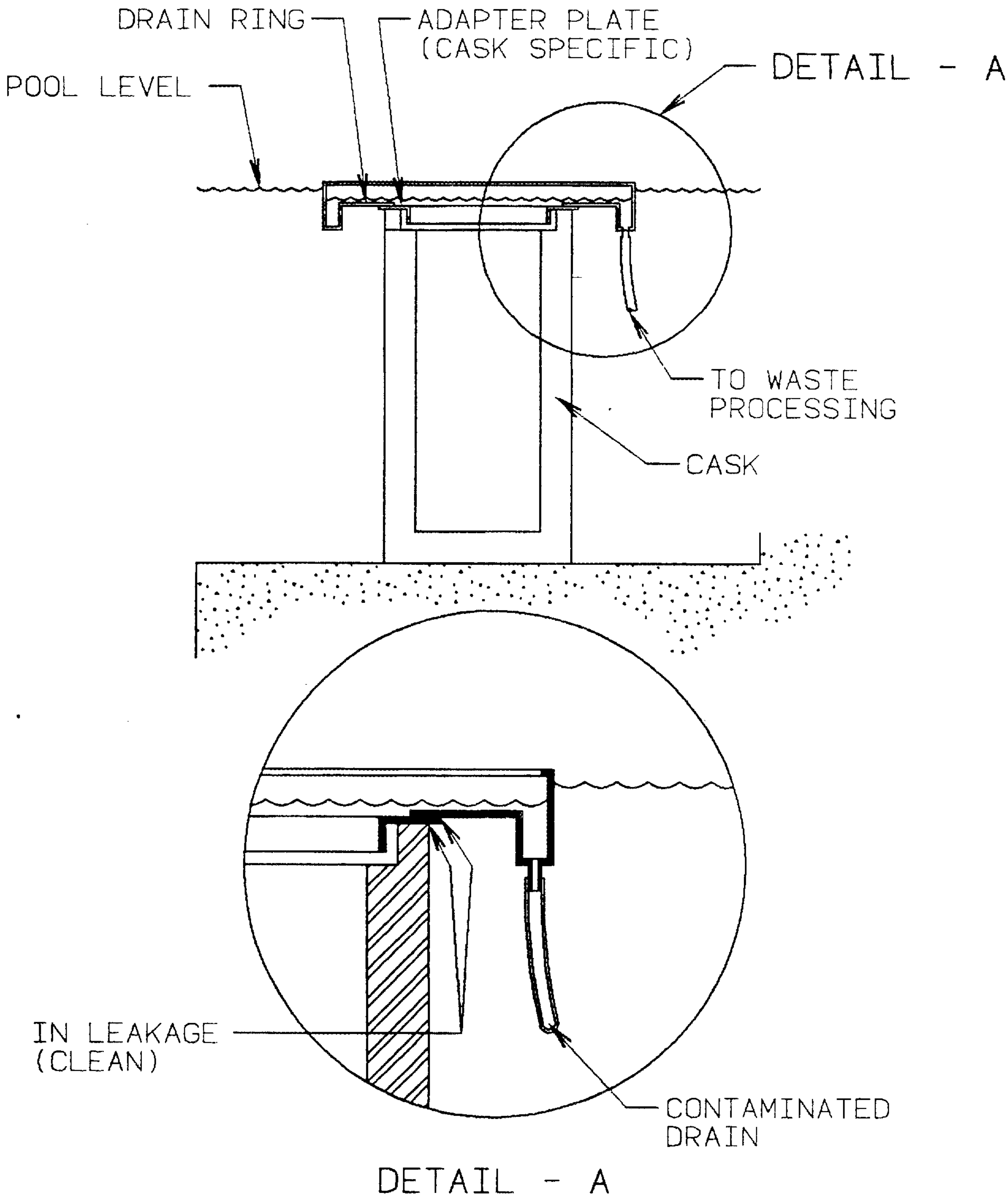

Fig. 4.8. Cask contamination ring drain.

4.3.5 Test and Repair Bays

The test and repair area will have four bays; three will be equipped primarily for routine cask maintenance and testing, while the remaining bay will be similarly equipped but with the addition of more space for heavy work and major repairs. The equipment in the bays is depicted in Fig. 4.9.

4.3.5.1 Personnel access platforms

Platforms designed specifically to fit around vertically positioned casks will be located in each bay. The platforms will have radial adapters for adjustment to different cask diameters. They will also have ramps for access to all areas of the cask. Since the casks will be positioned in 14 ft deep pits, the top of the casks, where most work is performed, will be conveniently located at 3 to 4 ft above floor level. The pit and floor level platform will also secure the vertical casks in the event of a seismic event.

4.3.5.2 Utilities

All utilities will be manifolded through the test and repair area. Each bay will also be equipped with a collection basin and drain to the process waste facility.

4.3.5.3 Hoists

Each bay will be equipped with a dedicated 10-ton jib hoist. The hoists will supplement the main process bay 175-ton cranes.

4.3.5.4 Cask rotator

A single-cask rotator mechanism will be located in the major repair bay for work which requires casks to be in the horizontal position. This could include both routine pressure tests and major repairs, where a horizontal orientation will facilitate personnel access. The rotator will be equipped with adjustment mechanisms for adapting to different cask types.

Eng. Dwg. CMF 4.5

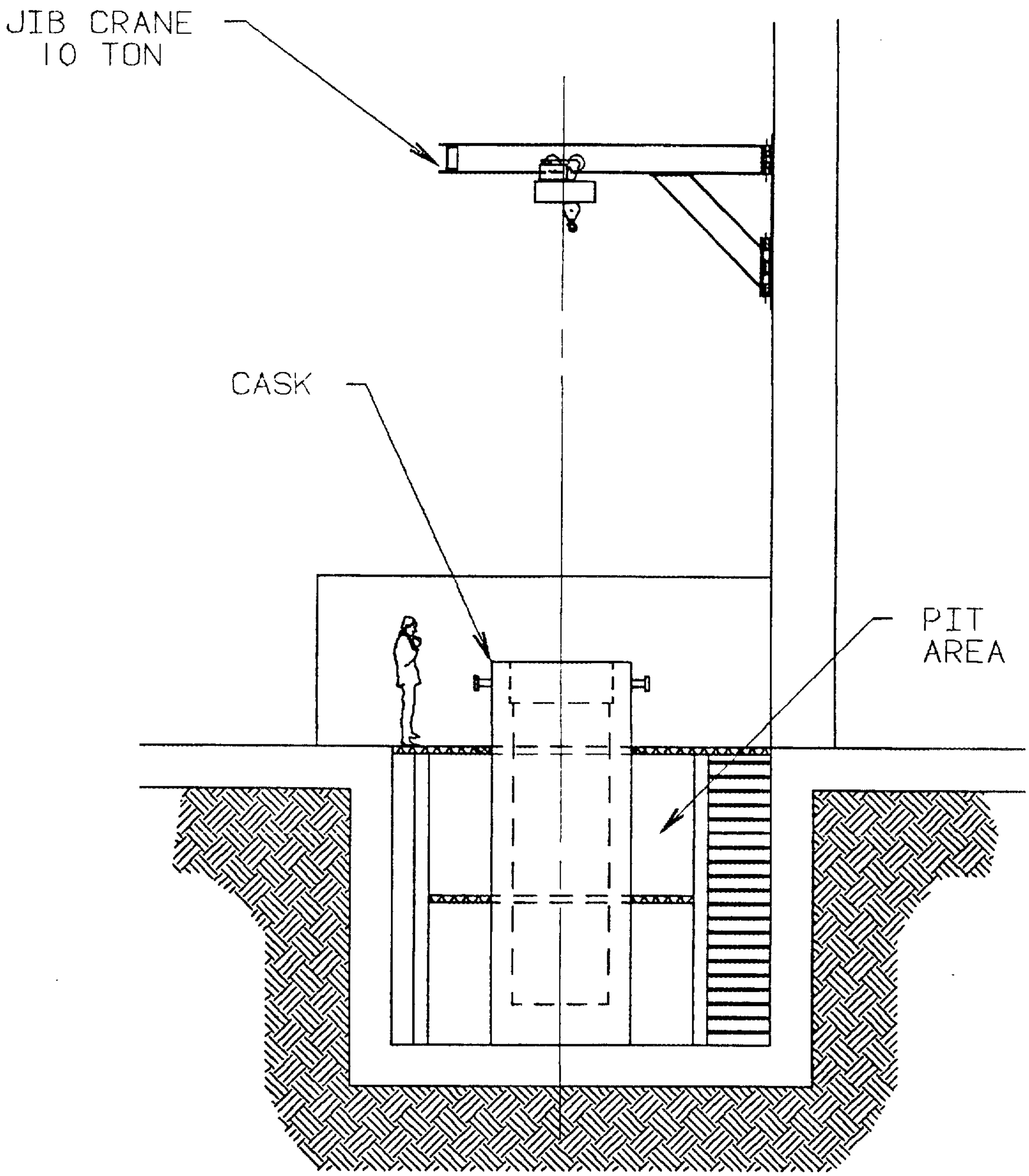

Fig. 4.9. Test and repair bay.

4.3.5.5 Instrumentation

A number of instrumentation items, as described below, will be provided for cask maintenance and testing. Some possible cask tests are presented in Appendix D.

Pressure-indicating instrumentation will be provided for use in pressure testing the casks. This instrumentation will consist of an appropriately ranged indicator on a piping flange which will mate with cask connectors.

Plug leak-test instrumentation will consist of a vacuum pump and a special vacuum bell, fitted for the plug-size, and a vacuum indicator tied to a recorder.

Leak/vacuum testing instrumentation will consist of (1) a vacuum pump, (2) a vacuum indicator tied to a recorder, (3) a helium source, and (4) a helium detector.

Flow indicators with totalizers will be provided for the various water removal pumping systems in the facility.

4.3.6 Auxiliary Equipment Repair and Test Area

Cask systems will be equipped with several auxiliary components, including lifting yokes and impact limiters. The present shipping fleet has shown that the auxiliary equipment requires as much time to maintain as the casks. Therefore, the CMF will have a 4600 ft^2 area dedicated to the maintenance and storage of this equipment. The auxiliary equipment area will be served by a separate truck-loading bay, since this equipment may be transported on different vehicles than are used for the casks. An exception are the impact limiters which may be removed in the cask unloading bay and moved through the process area for maintenance and testing. Some of the test and repair equipment located in the area is described below.

Yoke Load Test Fixtures (see Fig. 4.10) will be provided to load test all yokes within the TOS. The fixtures may be hydraulically operated and will include the necessary overload protection and test gaging (Transnuclear 1988).

The auxiliary equipment test area will have access to all cask test gear, such as helium leak detectors and vacuum pumps. The auxiliary equipment area will be serviced by the 175-ton bridge cranes with 25-ton auxiliary hoists.

4.3.7 Maintenance Shop

The maintenance shop will be divided into two areas; one "hot" (designated for contaminated equipment), the other "cold" (uncontaminated). It will be equipped with the usual assortment of standard shop tools, such as lathes, grinders, and drill presses. Heavy machinery work will be subcontracted. Special equipment provided in the shop is described below:

4.3.7.1 Electropolishing system

An electropolishing system will be used at the CMF for decontaminating auxiliary equipment components, such as basket spacers, or small hand tools that become contaminated in use. The electropolishing system will consist of a 100-gal electropolishing tank, a 100-gal rinse tank, a 200-gal phosphoric acid storage tank, two metering pumps, two 0.5 μm cartridge-type filters, a DC power supply, and an agitator for mixing the electrolyte.

Radioactive contamination, on the surface or trapped within surface imperfections on the auxiliary equipment, will be removed and released into the electrolyte by surface dissolution. Phosphoric acid (40 to 80%) will be used for the electrolyte in the electropolishing tank, and the object to be decontaminated will serve as the anode. The passage of electric current will provide anodic dissolution of the surface matter.

Items to be electropolished would first be rinsed or sprayed with hot water; then using hot water and detergent, rinsed, and finally electropolished. The electropolishing solution will be recycled, and the spent fluids will be drained and sent to the rad waste processing system to be processed.

4.3.7.2 Gage test station

A calibration station will be provided for the certification of pressure gages.

4.3.7.3 Wrench calibration station

Torque wrenches will be recalibrated periodically at a test station located in the maintenance shop.

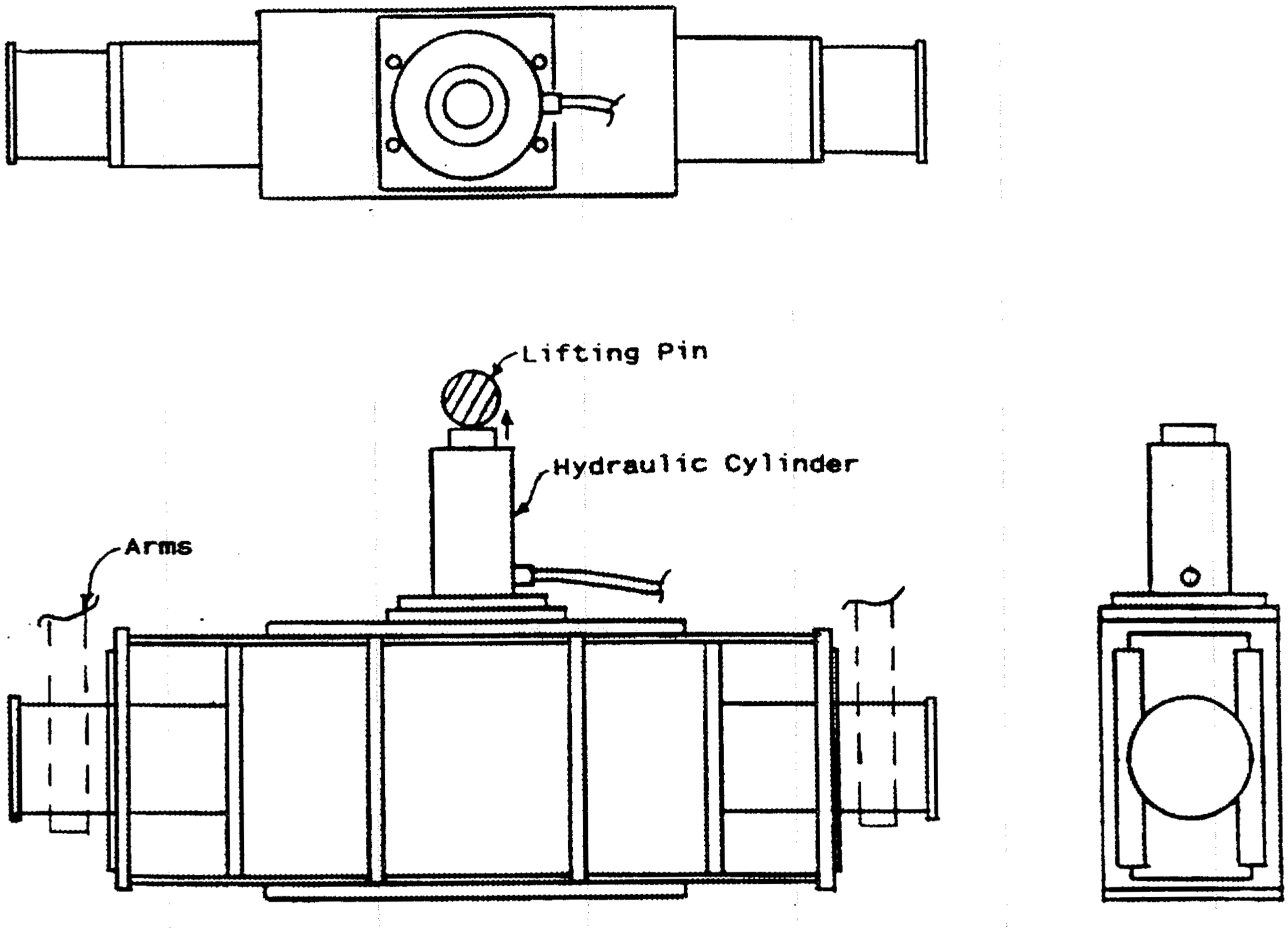

Fig. 4.10. Yoke test fixture.

4.3.7.4 Valve test station

A station will be provided for the leak test and repair of cask valves. The station will be enclosed in an environmental hood.

4.3.7.5 Health physics laboratory

An HP lab will be located in the maintenance shop, where it will be readily accessible for use by technicians throughout the CMF. The laboratory will be equipped to perform tests required to support cask handling and repair such as, wipe counting, chemical analysis, and dosimetry.

4.3.8 External Wash Water System

The external wash water system consists of two basic operations: (1) filtration and (2) ion-exchange. Waste wash water from the external cleaning booths and the truck wash areas will be pumped at a maximum rate of 100 gpm to a mud separator and then through two pressure-type roughing filters. After filtration, the wash water will be sent to an ion-exchange column for removal of radiological contamination. Any residual zeolite resin fines that might remain in the treated water will be filtered by two polishing filters. The treated water will be recycled to a holding tank at the Vehicle Unloading/Loading Station as shown on drawing J3E-12824-101.

4.3.8.1 Oil/mud separator

An oil/mud separator rated at 100 gpm will be used for removal of oil and mud from the water used for the Vehicle Wash Station.

4.3.8.2 Pressure filters

Two automatic pressure filters will be used for the initial filtration of the wash water. Each unit will operate at a normal service flow of 3 gpm/ft^2 of filtering area and a maximum service flow of 5 gpm/ft^2 when one unit is out of service for backwash and/or maintenance.

The filter vessel will be a cylindrical shell, 6 ft diam x 6 ft high. Construction will be welded from 304L stainless steel plate.

The filter is designed for normal downflow through the filter bed and vertical upflow for backwashing. When the pressure drop across a filter increases 5 to 6 psi over the normal pressure drop with a clean filter cartridge, or the quality of the effluent has deteriorated, the filter will be backwashed for cleaning at a flow rate of 200 gpm for 10 min, using the backwash pumps. A rinse cycle of 100 gpm for 3 min. will follow. During normal operation, only one filter will be used; and the second filter will be used when the other filter is being backwashed.

4.3.8.3 Settling tank

The settling tank, having a 3000 gal capacity, will collect sludge from the pressure filters during the backwash cycle. The tank will be of 304L stainless steel construction with stainless steel internals and will be 8 ft diam, 9 ft high. Solids collected in the settling tank will be pumped to the solidification facility. The treated liquid will be pumped through the two polishing filters (Sect 4.3.8.5).

4.3.8.4 Ion-exchange columns

The columns will be schedule 40 carbon steel, ASME-coded pressure vessels with an internal epoxy coating. The zeolite column will be 78 in OD and 62 in high, with room for 50 inches of bed depth and a 6 in void for resin mixing. Each column will be rated at 100 gpm and will contain 1500 gal (185 ft^3) of chabazite resin. One column will be operating while the other one is in a standby mode.

4.3.8.5 Cartridge-type filters

Two polishing filters will be used to filter any zeolite fines that might be present in the treated water from the ion-exchange process. Each filter is rated for a 100 gpm flow rate and a 0.5 μm rating. The filters will use disposable 40-in-long cartridge elements mounted in a 304L stainless steel tank. They will operate in a one-on/one-stand-by mode.

4.3.8.6 Evaporator and condenser

Two evaporator systems will be used to remove the dissolved solids that will accumulate in the recycled wash water. Each will operate in a side stream, producing (1) a clean condensate stream and (2) an impurities stream. The clean condensate will either be returned to the external wash system or become makeup for the pool water system. The impurities will be processed in the solidification facility. The evaporator is a cylindrical vessel, 4 ft in diameter with a dished-bottom head and a removable flanged-top head, also dished, having a height of 5 ft. Flanged nozzles are provided in the top head for feed inlet, vapor outlet, and for instrumentation, monitoring (1) liquid-level, (2) density, and (3) temperature. The evaporator is designed for a maximum feed rate of 83 gph at a boilup rate of 77.5 gph, using saturated steam at 50 psia. The operating volume is 220 gal. The material of construction will be 304L stainless steel.

An overhead condensing system, vertically mounted and cooled by process water, will be designed for total vapor condensation and condensate subcooling. Each condenser will be approximately 5 ft long and 6 in diameter. The material of construction will be 304L stainless steel. The evaporator system will be operated in a one on/one in standby mode.

4.3.8.7 Holding tank

A 5000 gal holding tank will be used as a surge tank for clean water to be recycled back to the Vehicle Unloading/Loading Station. The material of construction will be epoxy-coated carbon steel.

4.3.9 Pool Water Treatment System

The pool water treatment system, as shown on drawing J3E-12824-100, consists of filtration and ion-exchange treatment processes. Ultraviolet light will be used to prevent algae and bacteria growth. Pool water will be pumped at a maximum rate of 200 gpm through one of two parallel pressure filters. After filtration, the pool water will be sent to an ion exchange system for removal of radiological contamination. Any residue of zeolite fines that might remain in the treated water will be filtered by one of two parallel polishing filters. The treated water will be recycled to the pool. A 10,000-gal storage tank will provide for pool level-control during cask removal and insertion. A 3000-gal settling tank will collect sludge from the pressure filters during the backwash cycle. Water from the settling tank will be pumped to the polishing filters for filtration. Makeup water to the pool will be provided by a demineralizer system. A pH adjustment system will be provided for addition of chemicals to the pool for pH balance.

4.3.9.1 Pressure filters

Two automatic pressure filters will be used for the initial filtration of the wash water. Each unit will operate at a normal service flow of 3 gpm/ft^2 of filtering area and a maximum service flow of 5 gpm/ft^2 when one unit is out of service for backwash and/or maintenance. The filter vessel will be a cylindrical shell, 6 ft diam x 6 ft high. Construction will be welded from 304L stainless steel plate.

The filter is designed for normal downflow through the filter bed and vertical upflow for backwashing. When the pressure drop across a filter increases 5 to 6 psi over the normal pressure drop with a clean filter cartridge, or the quality of the effluent has deteriorated, the filter will be backwashed for cleaning at a flow rate of 200 gpm for 10 min, using the backwash pumps. A rinse cycle of 100 gpm for 3 min. will follow. During normal operation, only one filter will be used; and the second filter will be used when the other filter is being backwashed.

4.3.9.2 Settling tank

The settling tank having a 3000 gal capacity will collect sludge from the pressure filters during the backwash cycle. The tank will be of 304L stainless steel construction with stainless steel internals and 8 ft diam, 9 ft high.

4.3.9.3 Ultraviolet light source package

An ultraviolet light (UV) source will be included in the pool water treatment process for disinfection and microbiological destruction. The packaged unit will include an automated, single-chamber system using a single-arc tube unit rated to process 250 gpm of water. The material of construction of the unit will be stainless steel. The UV system is controlled by a UV monitor linked to audible and visual alarms. With the use of the UV unit, the microbiological purity of the pool water will be maintained.

4.3.9.4 Pool water surge tank

The surge tank will hold approximately 10,000 gal of treated water for makeup water addition to adjust water level in the pool for receipt of a cask. The tank will be constructed from 304L stainless steel.

4.3.9.5 Ion-exchange columns

The interior wash recycle ion exchange system consists of two parallel trains of five disposable ion exchange columns each (see drawing No. J3E-12824-100). The ion-exchange system will treat a maximum of 200 gpm of pool water with both trains operating. A zeolite resin will be used in each column as the ion-exchange media. Each train is independently operated in the "merry-go-round" technique with four of the five columns on-line in series at any given time. When the concentration of radionclides in the effluent from the last column on-line reaches the control limit, the fifth column, containing fresh zeolite, is brought on line in the last position. The number one column is taken off line, and the remaining columns are then moved forward one position by rerouting the process flow. The spent column is dewatered and an absorbent added to the column as a added safety factor to hold any free liquid before it is removed and sent off-site for permanent disposal.

The columns will be schedule 40 carbon steel, 200 ft^3 ASME-coded, pressures vessels with an internal epoxy coating. Each column will contain 1500 gal (185 ft^3) of zeolite resin. Residence time needed per column is 10 min.

4.3.9.6 Dewatering pump

A dewatering pump will be used to pump remaining liquids from the spent zeolite columns prior to disposal. The pump will be an air-powered double diaphraphm pump, rated at 120 gpm with a 50 ft head. The material of construction will be 304L stainless steel. A spare pump will be included in the cost estimate.

4.3.10 Solidification Facility

The liquid waste slurry from the settling tank and evaporator will be pumped to the solidification facility. All liquid waste piping routed underground will be doubly-contained stainless steel piping, type 304L. Solidification system equipment including grout mixers and pumps will be provided. The solidification operation will be performed in batches as required to process accumulated waste (see Sect. 4.3.12).

4.3.11 Water Demineralizer

A standard, packaged water demineralizer will be located in the process equipment room. The unit will deliver up to 100 gpm and will be equipped with a 10,000 gal storage tank. The demineralized water will be used for pool makeup and cask cleaning operations.

4.3.12 Contaminated Waste Storage

The CMF will not permanently store contaminated waste. However, temporary storage will be provided as required for logical processing and shipping. The storage area will be located in a shielded bay in the waste processing area of the main process building. The quantity of waste permitted on-site will be determined during the licensing process.

4.4 UTILITIES

4.4.1 Electrical Power Service

Electrical service to the site will be furnished by the local power company. It is assumed that a dual service will be provided at 13.8 kV, three-phase. Service will be sized for sufficient capacity to supply the entire facility.

The power distribution system will include a double-ended substation containing two 1500-kVA transformers for receiving the incoming 13.8-kV services (see drawing No. E3E-12824-Z001). Each transformer will be sized to carry the entire load of the facility. The secondary distribution voltage will be 480 V, three-phase.

4.4.1.1 Substation transformers

Each transformer will be rated at 1500 kVA. The primary will be 13.8 kV, three-phase, delta connected. The secondary will be 480 V, three-phase wye connected.

4.4.1.2 Substation switchgear

The switchgear assembly will consist of two main breakers; one tie breaker; two main bus assemblies, each rated at 2000 A and connected together through the tie breaker; and the required number of feeder breaker units to serve the utility and process loads for the total facility. The switchgear assembly will be indoors.

4.4.1.3 Electrical system loading

Power will be distributed to the various system loads by means of motor control centers, distribution panelboards, and a power bus duct. Drawing E3E-12824-Z001 is a representation of the estimated system in one-line diagram form. The connected loads on the system are estimated to be as follows:

Motor control center #1 . . . . 400 kVA @ 480 V
Motor control center #2 . . . . 120 kVA @ 480 V
Motor control center #2A . . . . 400 kVA @ 480 V
Motor control center #3 . . . . 250 kVA @ 480 V

Motor control center #4	200 kVA @ 480 V
Power panel #PDP	120 kVA @ 480 V
Lighting panel #1	30 kVA @ 120/208 V
Lighting panel #2	55 kVA @ 120/208 V
Lighting panel #3	70 kVA @ 120/208 V
Lighting panel #4	30 kVA @ 120/208 V
Lighting panel #5	30 kVA @ 120/208 V
Power panel #CPP	75 kVA @ 120/208 V

Summary of Loads:

Main building	Power	1290 kVA
	Lighting	160 kVA
Bead blast facility	Power and lighting	200 kVA
Security	Power and area lighting	125 kVA
Estimated total connected load		1875 kVA

4.4.1.4 Reserve (standby) power

Some process and facility loads have been designated as critical to the safe shutdown of plant operations in the event of a failure of electrical power. These loads will be served from MCC #1, which will be backed up by a standby diesel-generator unit and an automatic transfer switch. A failure of the normal power system will automatically start the generator unit. The load transfer will usually occur within 30 s after the power outage.

Emergency lighting will be provided by the lights mounted on the under side of the bridge cranes in the high bay area. These lights will be connected to the crane power which is also supplied through MCC #1. A number of fluorescent fixtures throughout the facility (including the computer room) will be designated for connection to the reserve power panel.

4.4.1.5 Uninterruptible (continuous) power

Some equipment in the facility will not be able to tolerate a power disruption, of even a short duration, without compromising the quality, effectiveness and safety of performance. Environmental monitoring systems and computer systems are typical examples. The requirement of an uninterruptible power source will be met through the application of an uninterruptible power source (UPS) in conjunction with a diesel engine-generator unit. The UPS unit will function to maintain continuous power during the interval between failure of the normal source and the assumption of the load by the generator unit. The application of the generator unit will permit sizing the UPS battery system for minutes of operating time as opposed to a few hours. Uninterruptible power will be distributed from panel CPP.

4.4.1.6 System grounding

A triad ground station shall be located at each of the two main power transformers. Each shall be connected to their respective power transformer grounding pads on the transformer frames.

A ground grid shall be provided for the main process building. The grid will consist of interconnected ground rods, uniformly spaced around the perimeter of the building. The vertical steel columns of the framing structure and the triad transformer grounds will be connected to this loop. The security fencing around the site will also be grounded in accordance with DOE Order 6430.1A, Section 203.

4.4.2 Piping

4.4.2.1 Cooling tower water system

Two cooling towers (100-ton capacity each) will be provided (see drawing No. P3E-12824-C001). Each system will be capable of providing approximately 60% of the total building cooling needs. Pumps, strainers, and associated piping will be provided for each system. A chemical injection system will be provided to reduce the corrosion due to oxygen and biological contaminants in the water.

4.4.2.2 Chilled water system

Chilled water will be provided to the cooling coils of the HVAC air handlers. The chilled water piping system will be a closed loop recirculating supply and return system. The system will include a surge tank for pressure surges and to serve as an air release point. A chemical injection system will be provided for corrosion protection. Dielectric unions will be provided to prevent localized corrosion at dissimilar metal connections.

4.4.2.3 Natural gas

A natural gas distribution system will be provided to supply fuel to the gas-fired water heaters, which will provide hot water for the recirculating hot water heating system.

4.4.2.4 Hot water recirculating system

A hot water recirculation system, complete with all piping, valves, pressure surge control, and corrosion control, will be provided to supply hot water to the HVAC heating coils, hot water heater, and hot water radiators. The hot water distribution system will be sized to supply hot water at a temperature of 120°F.

4.4.2.5 Potable water

A potable water distribution piping system will be provided to supply the rest rooms, change rooms, water fountains, and safety shower and eye-wash stations. The potable water distribution system will also be connected through a backflow preventer to supply the building process water system. Standard plumbing fixtures will be provided for the rest rooms and change rooms. Showers will be provided in the change rooms. Electric water heaters will be installed to provide potable hot water for the rest rooms and change rooms. Safety showers and eye-wash stations will be installed in (1) the high-bay area, (2) shop area, (3) process equipment and (4) pool areas, near the vehicle entrance, and (5) in the bead blast facility. A personnel decontamination shower will be located in the process bay. The drain will be connected to the Rad Waste Treatment System.

4.4.2.6 Process water

A process water distribution system will be provided to supply the demineralizers, test bays, shop, vehicle preparation bays, and other areas requiring process water.

4.4.2.7 Sanitary sewer

All drains from the rest rooms and change rooms will be routed to the sanitary sewer system.

4.4.2.8 Insulation

Insulation will be installed on all potable water (hot and cold) piping, recirculating hot water system piping, and chilled water system piping.

4.4.2.9 Diesel fuel

A 2,000 gal double-wall, diesel fuel tank system will be provided for the emergency generators. The tank will be provided with corrosion protection, overflow control, leak detection ports, liquid level indicator port, and confinement chamber for all primary tank connections.

4.4.2.10 Gasoline storage

A 2,000 gal, double-wall unleaded gasoline fuel storage tank will be provided. A dispenser will be provided for on-site fuel requirements.

4.4.2.11 Holding pond

The site will have a 200,000 gal holding pond. The pond will catch excess runoff from buildings and vehicle storage areas. The pond will be used to contain contaminated or polluted spills on-site for proper monitoring and disposal. It will accept the full fire protection water storage volume of 150,000 gal in addition to runoff from other sources such as rain or broken pipes.

4.4.2.12 Emergency runoff tank

A 10,000 gal tank will be located near the process and bead blast buildings to catch and store potentially contaminated or polluted runoff from either building. The tank was sized to accept the normal sprinkler discharge resulting from a reasonable fire. In the event of a much larger incident the runoff would be diverted to the holding pond.

4.4.3 Fire Protection

The CMF will be designed to meet the requirements of DOE 6430.1A for non-reactor nuclear facilities. The fire protection for the facility is described below.

4.4.3.1 Fire alarm system

A master fire alarm box and control panel will be located in the administrative lobby. The control panel will contain an annunciator assembly. These units will connect to the "local area" fire alarm system.

A zoned sprinkler system will include water flow switches connected to the fire alarm control panel for alarming and annunciating a fire condition.

Manual pull boxes will be located in all major operating areas (near exits) and connected also to the fire alarm control panel.

Smoke and heat detectors will also be installed in the vicinity of the computer systems and connected to the fire alarm control panel.

The fire alarm devices in the bead blast facility will consist of water flow switches on the sprinkler headers and manual pull boxes. Circuit connections to these devices will be routed by way of the concrete-encased duct bank to the fire alarm control panel in the administrative lobby. These will be connected for alarm and annunciation.

4.4.3.2 Process building

The process building will be protected by a wet-pipe sprinkler system meeting the requirements of NFPA 13 for ordinary hazard occupancies. The sprinklers in the areas where sprinkler water can become contaminated by building contents will be of the self-restoring type. The primary supply for the sprinkler system will be the underground distribution system. A secondary supply to the sprinkler system for this building will also be provided.

4.4.3.3 Bead blast building

The bead blast building will be protected by a wet-pipe sprinkler system meeting the requirements of NFPA 13 for extra hazard occupancies. The sprinkler system will be supplied by the underground water distribution system.

4.4.3.4 Alternate water supply

The secondary water supply will consist of a 150,000 gal, in-ground, concrete tank located 50 to 100 ft from the process building. A 1000 gpm, vertical-shaft, turbine fire pump will be located above the tank to supply water for the process building sprinkler system. The pump will be electrically powered by the primary power source and will be connected to the emergency generator. Piping between the building and the pump will be run above ground on pipe supports. Other equipment at the tank will be (1) a fire department connection to the sprinkler system for the process building and (2) a pump suction connection to allow the fire department to draw from the tank.

4.5 SITE DESCRIPTION

The CMF is assumed to be a stand-alone facility, thus the facility layout will accommodate most sites meeting the minimum space requirements (see drawing No. C3E-12824-A001). The facility will have road and railway access. In addition, the site will be provided with potable water, sanitary sewage, and stormwater drainage. The facility will include a perimeter security fence and employee parking.

4.5.1 Earthwork

The site will be cleared and grubbed, and will include erosion control measures to minimize environmental impact on the surrounding area. The pre-developed and post-developed runoff for various design storms will be examined with retention basins constructed as necessary to conform to DOE design criteria 6430.1A.

Grading will be performed to attain subgrade and finished grade elevations. The subgrade will be compacted to provide sufficient bearing capacity for the proposed buildings, the asphalt concrete surface areas, and the railroad access.

4.5.2 Fencing

Perimeter security fencing will consist of a 7 ft high chain-link fence with three-strand barbed wire. Gates for two-way vehicle traffic will be 30 ft wide with 5 ft wide pedestrian gates.

4.5.3 Utilities

Potable water and sanitary sewer service will be provided for the process building, bead blast and inspection building, and the guard house. It is assumed that the appropriate water and waste water treatment facilities will be provided at the site. The potable water and sanitary sewer service lines will be placed at the alignment and grade following standard engineering practices.

Underground storm sewers will be installed to collect roof drainage from the proposed buildings as well as to intercept surface drainage from the site. The collected stormwater will be transported off-site directly or via the holding pond.

The study estimate does not include either water treatment or sanitary sewage treatment.

4.5.4 Roads and Parking

Road access will be furnished between the site and the local roadway system. The paved storage area will have minimum normal capacity for 15 trucks and will be centrally located within the CMF.

The drive surface will be asphalt and designed to provide adequate bearing capacity for an overweight truck with a cask (70 tons GVW). The drive surface will permit the turning movements and travel paths required to access the process building, the bead blast and inspection building, and the truck storage areas.

Protective posts will be located at building entrances and as required to segregate truck parking.

Entrances and exits will be of reinforced concrete where excessive twisting and turning of vehicles is expected.

Employee parking for 100 cars will be located outside the security fence.

4.5.5 Railroad

A railroad spur will be constructed to provide rail access to the site. On-site tracks will provide access to the process building and the bead blast and inspection building. There will be additional turnouts and side rails within the security fence for storage of up to 15 rail cars. An off-site 'Y' will be provided for reversing railcars as required for handling. The track will be 100 lb rail minimum, with horizontal curves having a maximum degree of curve equal to 12 degrees. The railroad track space requirements consume a majority of the CMF site. Location of the CMF at a less than ideal site could increase the space requirement.

4.5.6 Site Area Lighting

All roadways and parking areas within the fenced compound will be illuminated. The plant site perimeter fence will also be illuminated. Generally, this lighting will be accomplished by means of single and multiple high-pressure sodium luminaries mounted atop metal poles.

4.6 DATABASE SYSTEM

A database system will be provided to track the casks passing through the facility and log the required maintenance histories. Requirements of this system are discussed below.

4.6.1 Computer Hardware

The system will have tandem file-handling processors to greatly reduce downtime. The system will have sufficient memory to hold maintenance files for up to 200 casks (estimate 2000 records per cask). The system will also hold drawings for the casks, facility, and equipment as required, (estimated 500 to 1000 drawings) and will have CAD terminal ability to update and plot those drawings from either of two CAD work stations.

4.6.2 Computer Software

The system will provide traffic planning software. The software will be compatible with the TOS traffic planning system. The database will provide maintenance reminder files and will automatically update those files according to the scheduled maintenance routines. The system will have maintenance and reminder files, as discussed above, for the test equipment, thus providing National Bureau of Standards (NBS) traceable records of that equipment.

The system will have maintenance, test, training, equipment repair/calibration procedures, equipment specifications, and maintenance order blanks stored (Transnuclear 1988). The forms will be generated in hardcopy from any of six access terminal laser printers or on the maintenance terminal laser printer. The forms will be readily accessible to the proper operating personnel.

4.7 MANPOWER REQUIREMENTS

Table 4.1 tabulates the estimated manpower requirements for the CMF for each of the major siting options. These figures were used to approximate the office space requirements for the facility. Comments from current cask handling operators and practical experience were used to estimate the CMF work force.

Table 4.1 CMF operating personnel

Function	"Green field"	Collocated	Integrated
Administration	4	4	2
Engineering	3	3	3
Quality assurance	11	11	8
Purchasing	1	1	1
Security	8	0	0
Facility maintenance	4	4	3
Health physics	8	8	4
Yard operations	6	6	2
Process operations	16	16	16
Licensing and regs.	2	2	2
Traffic	3	3	3
Shop	6	6	3
Supervision	8	8	4
Records/computer ops	6	4	4
Totals	86	78	57

4.8 FACILITY SIZING JUSTIFICATION

The CMF has been sized for the feasibility study through a practical application of conventional industrial methods rather than through the use of a formal model. A more accurate analysis will not be possible until the TOS design has progressed further.

There are three important types of information required to size a facility; (1) the rate of process throughput, (2) the normal operating schedule and (3) the time rate required to perform process functions. The time rate data shown in Table 3.2 is roughly based on the operational experience of existing facilities and time analyses of prototype cask designers. The assumed operating schedule and the anticipated throughput are both taken from Section 3.0. Note that in some cases, redundancy rather than operating capacity was the deciding factor in adding more than one piece of equipment.

4.8.1 Vehicle Cleaning Bay

(Size: Two bays, operating time: 95 min.)

Justification: The cleaning bays will be capable of handling between four and eight vehicles in the allotted one shift per day. This is adequate for a maximum rate of four vehicles per day. There will be one bay designed solely for trucks and a second bay capable of serving both trucks and railcars. This design will provide for redundancy for trucks and simplified scheduling of multiple vehicles into and out of the process building.

4.8.2 Loading/unloading Bay

(Size: Two bays, operating time: 50 min. unload/45 min. load)

Justification: The process building will handle only one cask loading/unloading operation at a time due to building width, bridge crane size, operational safety, and crew size. Existing cask handling operations estimate that it will take less than 1 hour to load or unload a cask. Given this time, a single bay will be able to handle twice the maximum daily rate of four casks in the allotted single shift or three times the maximum weekly rate of seven casks in five shifts. The second bay is provided by the bridge crane overrunning area. It will be used only if the primary bay is down for maintenance or in unusual operating conditions.

4.8.3 Cask Exterior Cleaning

(Size: two booths, operating time: 90 min.)

Justification: Based on existing operations, an automated exterior cleaning booth can be expected to clean an average cask in approximately 90 min, including installing and removing the cask. This rate is compatible with the maximum daily throughput of four casks for a single shift operation; however, ten additional shifts are available if required. A second booth is provided for special contamination problems requiring unique and time consuming handling (i.e., manual decon).

4.8.4 Pool Operations

(Size: two casks, operating time: 210+ min.)

Justification: The pool may be used for a wide variety of operations involving the interior of the cask. However, for a majority of casks, the pool will be used simply to reconfigure the internal structures. With the pool in operation fifteen shifts per week, a total of 105 hours will be available to handle the maximum of seven casks, or approximately 16 hours per cask. This period is two to three times greater than is estimated to be required by current cask handling facilities to be required for normal operations. If, however, one of the two processing stations is occupied by a cask undergoing long-term or special work, the capacity of the pool will be compatible for the estimated throughput.

4.8.5 175-Ton Bridge Cranes

(Size: two each, operating time: unknown)

Justification: The cranes will be the primary mode of transportation for the casks inside the process building. It is anticipated that the majority of the crane operating time will be spent in cask loading/unloading. Assuming the loading/unloading operation will require extended dwell time during a normal operating period of 1 hour, this will leave insufficient time for other operations at peak plant operation. Consequently, a second crane is specified. Its usefulness is enhanced by the location of the loading/unloading bay at the far end of the process bay, thus leaving the majority of the operating areas open for dual-crane operation. Additionally, bridge cranes have traditionally been high maintenance items, thus the second crane will act as a spare backup.

4.8.6 Basket Storage Pool

(Size: 1000 ft^2)

Justification: The storage pool is sized to take a mix of possible basket sizes up to 72 in in diam. Space will also be available for the storage of spacers. The normal storage load is assumed to be a maximum of 35 baskets using racks, which will permit removal of individual structures without sorting unwanted structures. More space will be available if baskets are stored in the aisles between racks. The assumed storage space is based on the assumption that not all the 75 active casks (i.e. MRS - repository) will require change-out baskets; and that special baskets, which are rarely used, can be stored out of the pool in containers, if the pool storage area becomes full.

4.8.7 Bead Blast Facility

(Size: one bay, operation time: unknown)

Justification: The bead blast facility is intended to be used for unusual maintenance problems and periodic truck and railcar painting. Repainting operations are expected to occur once per month with the remaining time available for vehicle maintenance activities.

4.8.8 Inspection Facility

(Size: two bays, operating time: 65 to 155 min.)

Justification: The inspection facility will have two bays, one for vehicle exit inspections, and the other for maintenance and repair. Operating five shifts per week, the facility will be required to handle up to two vehicles daily, thus providing 4 hours inspection time for each vehicle. The time could be extended by overtime or use of the second bay, if it is available.

4.8.9 Truck Storage Area

(Size: fifteen truck parking spaces)

Justification: The parking area will normally hold the equivalent of a two week throughput. If additional space is required, truck trailers can be parked in less convenient areas on-site.

4.8.10 Cask Test Stations

(Size: three bays, operating time: 24 to 72 hours)

Justification: The annual number of CoC tests expected is estimated to be 75, or the same as the total number of casks in the system. Assuming 100% contingency for additional testing and minor repairs in the test bays, the total individual testing cycles will be 150. It is estimated that the normal test cycle will require between 1 to 3 days at three shifts per day for an average total of 900 shifts annually. Since the three bays will provide 2250 shifts annually a contingency of 250% will be available. If additional space is required, the major repair bays, or the open maintenance area, may be used.

4.8.11 Major Repair Station

(Size: one bay)

Justification: It is conservatively estimated that a maximum of 15 casks annually are expected to need major repair or rework, requiring more than 15 shifts of labor. Assuming cask rework will require up to a month of labor this rate will occupy a single bay full-time. Additional long-term work may be performed in the handling equipment maintenance area or the cask maintenance and inspection bays.

4.8.12 Yard Truck Tractor

(Size: two units)

Justification: A yard tractor will be used, primarily on a single shift each day, to park and locate trucks. This will include staging of cask trailers in the process building for cleaning and unloading. Assuming that the tractor will have to be attached to the cask trailer throughout this operation, the equivalent of one unit will be occupied full time. Thus, a second unit will be required for all other activities and as a backup in the event of breakdown. Note that the study assumes that the yard tractors will be maintained on-site.

4.8.13 Yard Train Tractor

(Size: one unit)

Justification: A yard train tractor will be located on site to move cars during the five loading and unloading shifts each week. The single engine will be backed up by commercial rail equipment. Note that the CMF design assumes that the vehicle inspection building will have the capability to maintain the yard train tractor on-site. This should reduce down-time.

4.9 ALTERNATIVES

Alternative methods for processing casks have been developed and successfully implemented in existing cask maintenance facilities over a period of approximately 20 years. With this background, there are few remaining CMF design issues which require resolution. This section reviews three which remain open; (1) "wet" vs "dry" processing, (2) hydraulic cask lifts vs elevator platforms, and (3) cask transport with bridge cranes or rail carts. The first reflects an important difference in approaches taken at existing facilities, while the last two represent potential improvements in operating efficiency and safety.

4.9.1 Processing Methods

The processing method used to contain contamination and to shield operating personnel is important to the cost and operation of a cask maintenance facility particularly for reconfiguration activities. Variations of two basic methods have been widely used. Submersion of contaminated components in a pool of water, ie., "wet" processing, is the most common technique. "Dry" processing, or shielding the components with a containment cell, is also an old method, which is increasingly being applied to spent fuel handling and storage. It should be noted that the CMF will use wet processes to clean and flush casks regardless of the containment method used. Consequently, the implementation of a "dry" system will reduce but not eliminate the need for liquid processing and waste disposal.

The CMF feasibility study is based on the "wet" processing method. The decision to use this technique was based on a conservative adherence to current technology. Although the merits of both systems are summarized in this section, one of the principal recommendations of this study is that the "dry" process be explored in more detail, taking into account the French facility at La Hague and the possible sites of the CMF. The "dry" processing study will be required in order to permit a reasonable decision to be made concerning the containment method to be used in the conceptual design. The recommendation for additional study is made with recognition of other "wet" vs "dry" trade-off studies done in the past (Lambert, R. W. 1981 and Allen, G. C. 1980). These past studies have been based on handling spent fuel; therefore, the results from both a cost and personnel radiation dose standpoint have been only marginally applicable to a cask maintenance facility which will not process fuel.

4.9.1.1 "Wet" processing

"Wet" processing is the method predominately used at present for the handling of spent nuclear fuel. It is an old technique, which uses simple technology; thus, it is both reliable and easy to maintain. In addition, the shielding water provides an efficient medium for cooling fuel recently removed from reactors. While these reasons are important at reactors, the West Valley Demonstration Project and the General Electric-Morris facilities emphasize another important advantage - crud containment. The majority of the radioactive contamination present in cask maintenance operations will be in the form of a fine powder. The powder will be composed of nickel and iron, with smaller amounts of copper and chromium. The radioactivity is produced primarily by cobolt-60, manganese-54 (Sandoval 1988) and fission products. The powder is friable and would therefore create a severe contamination problem if released into the atmosphere of a processing plant (Klingensmith 1980). Water both contains powder well and provides a medium to remove the powder from the interior of casks under controlled conditions (wet vacuum).

The primary operational objection to a pool-based operation is the processing time spent wetting and drying casks. The wetting operation can consume over 1 hour, because the cask must be filled slowly to avoid venting crud to the atmosphere and to cool the cask slowly, if it has been heated by spent fuel. Cooling will not be a consideration in the CMF since spent fuel will not be handled. The drying operation can also consume significant time, if the cask is not heated by fuel and if the cask must be shipped dry. Another important drawback to pool operations, is that some of the crud floats to the surface of the pool, where it creates a ring of contamination at the water line. This type of contamination has produced background radiation fields of up to 2 mrem/h in existing facilities.

4.9.1.2 "Dry" processing

"Dry" processing can be based on the use of several types of equipment, including shielded glove boxes and containment cells. Hanford Engineering and Development Laboratory (HEDL) uses a glove box for the Fast Flux Test Facility (FFTF) casks, because the casks are small and clean (since the fuel is canned during shipment). Neither of these conditions is relevant to the CMF. Due to the potentially high level of radiation possible inside spent fuel shipping casks (100+ rad/h) the only feasible system for the CMF would require a shielded containment cell in which all operations could be performed remotely.

The French use a remotely operable hot cell in the cask maintenance facility integrated with the Cogema processing plant (Lemaistre 1987, Blomeke 1987). Although the details of its design and operation were not evaluated for this study, some basics are known to be similar to the cell layout which is planned for the MRS (if built) and MGDS facilities. A cask is unloaded from the transport vehicle onto a cart, which is moved under a cell overhang (see Dwg No. X3E-12824-011). The cask is sealed to a port on the bottom of the cell and the port is opened. The inner lid of the cask is then removed and operations, such as basket removal, decontamination or repair are performed using remote manipulators and closed-circuit television (CCTV) monitors. Representatives of Cogema and Société générale pour les techniques nouvelles (SGN) have stated that the primary purpose of using the hot cell, as opposed to the pools, is to reduce personnel exposure. They estimate that annual doses can be reduced to a total of 50 mrem from the 2 to 5 rem experienced by pool operators. A possible "dry" CMF process building layout is shown in Dwg. No. X3E-12824-059.

Hot cell operations such as those at Cogema present two significant problems for a CMF. First, the cask-to-cell sealing operation is critical to the confinement of contamination; therefore, a limited number of cask types (and thus seal types) greatly improves efficiency. The French now process four types of casks in the Cogema hot cell; but, plans call for this to be reduced to only two types of casks. This restriction is apparently overcome by maintaining all other casks in the existing "wet" maintenance operation. With the possibility of a large number of cask types (ten+) to be handled by the American CMF, a dedicated hot cell with no pool backup could be difficult to design and operate. The second objection to a hot cell operation is the high capital and equipment maintenance costs. Totally remote hot cells (no manned entry) require state-of-the-art servo manipulators, bridge cranes, and CCTV monitoring systems. A penthouse for maintenance access to the equipment further increases the total facility cost. In addition, a remotely operated cell requires specialized maintenance support, including specially trained operators and dedicated repair facilities. If a CMF operation is integrated into a hot-cell-based shipping facility such as an MRS, the MGDS, or at the Cogema facility the draw backs of high capital and maintenance costs could be ameliorated, since many similar facilities will already be present. Conversely, the "green field" siting, assumed for the feasibility study, would be required to provide costly stand-alone support for the more complex dry system.

The final decision to use pool-based operations for the feasibility study was based on the judgement of the current commercial cask-handling operations and the limited knowledge of the cost and design of a containment cell facility. The decision was complicated by the lack of a specified site, and more specifically, a decision concerning integration or collocation with an MRS or the repository. A detailed study of a containment-cell-based CMF should be undertaken prior to the conceptual design.

4.9.2 Cask and Personnel Elevators

The feasibility study design for the test and maintenance bays assumes that a majority of the cask work will be done at the top of the casks. The bays therefore have pits which will leave the top few feet of an average cask above floor level. A platform with an adjustable inside opening will be positioned at floor level and at convenient intermediate levels below floor level for personnel access. Similarly, the external cleaning booth is equipped with a powered elevator to transport personnel to working positions on the cask. Hydraulic lifts were evaluated as a potential alternative method of elevating casks in both locations. A hydraulic lift having the capacity to hoist the 300,000 lb MRS/MGDS casks would eliminate the need for personnel to either climb stairs or be elevated up the side of the casks. By locating lifts in floor recesses, personnel could reach all areas of the cask more safely and productively from a single level.

The current cask maintenance operations at most facilities use fixed platforms which require personnel to move to different heights on the side of the stationary vertical cask. Recommendations have been made to provide a system better than fixed platforms by the addition of powered lifts which would move personnel to the necessary height with less effort. There are, however, two problems with elevating personnel along the casks. First, the operators can be located up to 18 ft above the cask base, with the potential of falls or dropping hardware on other personnel below. And second, the time and energy required to move both personnel and tools to different heights is potentially inefficient.

A hydraulic lift designed to move casks below floor grade would solve the problems of operators working inefficiently at heights. However, hydraulic systems have problems peculiar to contaminated facilities. First, oil-based systems cannot be considered due to the problems associated with the disposal and handling of mixed contaminated waste. And second, the alternative, water-based systems are difficult to maintain.

Water-based hydraulic systems use a mix of 95% water and 5% emulsion (required for lubrication). The mix is unstable, therefore it must be continuously recirculated and blanketed with nitrogen gas. Furthermore, the fluid must be changed every six months, thus adding approximately 2500 gal of liquid to the waste processing facility. The details of the emulsion content are unknown, but they will need to be investigated for possible mixed waste classification. In addition, safety issues related to potential failures resulting from hydraulic system difficulties were not fully resolved.

Based on the conservative approach used throughout the feasibility study it was decided to base cask access on mechanically driven personnel platforms or pits. The option of using water- or oil-based hydraulics in the CMF can be reviewed in the conceptual design phase, since none of the processes involved fundamentally rely on the lifting mechanism used.

4.9.3 Cask Handling

Two methods are available for moving casks within a processing facility, overhead cranes and rail carts. The feasibility study was based on cranes because, of the greater flexibility in locating the casks at any position in the process building. There is an added benefit of having cranes available for moving other equipment, such as yokes and test gear. Some of the advantages and disadvantages of both transport systems are given below.

Rail carts, specially designed for cask transport to specific locations in a facility, are used in the Cogema plant in France and are planned to be used in an MRS and the MGDS. The requirement to place casks under cell overhangs drives the design toward the use of carts since bridge cranes will not work. The carts offer the additional advantage of permitting the movement of casks as needed, rather than as the bridge crane is available. This is particularly important in high throughput operations. The primary disadvantage of rail carts is the limitation that the casks can only be moved to positions serviced by rails. This is a fatal requirement for a pool-based operation, which cannot have rail access.

Bridge cranes provide for maximum flexibility in positioning casks and other equipment anywhere in the process building regardless of floor height. Additionally, the CMF, like an MRS and the MGDS, will require a bridge crane to load and unload casks from transport vehicles; thus, a significant portion of the total cost of providing crane transport capacity in the CMF is established. There are three important disadvantages of using bridge cranes for cask transport. First, operations will be slowed, since the crane will be able to make only one lift at a time. Second, bridge cranes have traditionally been relatively high maintenance items, thus a backup crane may be required (as in the case of the CMF). And third, cranes can present a safety hazard since they are not confined to fixed routes, thus extensive operator training and supervision is required. Safety restrictions may also be placed on the operation of both cranes at the same time thus reducing the advantage of increased flexibility.

The decision to use bridge cranes in the CMF will have to be reviewed if the facility is integrated with the MRS or MGDS. Further more, the decision will have to be changed if a containment cell rather than a pool is used for cask processing.

5. PRELIMINARY ASSESSMENTS

Preliminary assessments have been made of key aspects of the proposed CMF. The purpose of the studies was to identify requirements and significant issues that need to be addressed in planning, designing, procuring, constructing, operating and decommissioning the facility. The requirements and issues identified should be further defined through assessments made during conceptual design. Where uncertainties exist or there is a lack of technical information, additional study or evaluation should be made in time to assure the availability of the needed information during conceptual design.

When reviewing the results of the assessments, which are summarized in the following sections, there are some important points about the facility in general that should be kept in mind. They are as follows:

1. The assessments are for the CMF only. The CMF is an integral part of the transportation system being developed and implemented for a federal waste management system. Other assessments are being, or will be, done for the overall waste management system.

2. The CMF will be handling casks unloaded of spent fuel only; therefore, special nuclear materials are not a major consideration in the design or operation of the facility.

3. Most cask systems received at the facility will be contaminated to some extent with radioactive materials; but, the amount of contamination will be limited due to restrictions placed on other components of the waste management system. The CMF will be designed to monitor, control, and properly dispose of radioactive materials; but it is not a nuclear materials processing plant.

4. The fact that CMF will be receiving only unloaded casks and that cask contamination levels will be limited due to requirements placed on the other components of the waste management system make the CMF unique within the system. Because of this uniqueness, it is difficult to determine the extent to which some regulations governing the overall waste management system should be applied to the CMF. This determination should be made and agreed to by the appropriate regulatory agencies as soon as possible.

The following sections are summaries of the preliminary assessments.

5.1 PROJECT RISKS

A preliminary risk assessment for the CMF was conducted to determine the general level of potential risks associated with the execution of the project and subsequent operation of the facility. The risks considered were limited to those peculiar to a new-start project for a stand-alone, "green field" facility. Should it be decided to make the CMF part of another facility an additional assessment will be required. The following general areas of potential risk were identified:

1. failure to comply with federal, state, or local regulations,

2. failure to meet interface requirements with other components of the Transportation Operations Project Office and overall Waste Management System,

3. failure to meet established, recognized codes for the design of the facility and its components, and

4. failure of critical components to meet established performance criteria.

Because the CMF will only be handling unloaded casks, the nature of the risks involved is only marginally greater than that generally associated with similar industrial facilities. However, the presence of contaminated cask system components at the CMF introduces the potential for additional risks primarily to CMF employees and, to a much lesser degree, the general public. The additional risks can be termed marginal only if proper precautions are followed in handling the small amounts of radioactive materials that will be involved.

Based on the preliminary assessment, the CMF will most likely be classified as a critical facility. This will result from two CMF characteristics: (1) its operational interface with the overall FWMS and (2) the presence of radioactive contamination on or in some components processed through the facility and, consequently, in the waste generated from the process. The most difficult aspect of designing the CMF will be the cost-effective incorporation of features required to provide adequate control for the amount of radioactive contaminants that will be involved. To assure adequate but not excessive (and costly), control; it is recommended that an assessment be made during conceptual design to, (1) establish within reasonable limits the amount of contamination to be expected, (2) determine the level to which regulatory requirements will be applied to the CMF, and (3) document the results of the first two steps and develop a rationale for cost-effective design based on those results.

Having accomplished the above, a Risk Assessment and Plan (RA/P) will be prepared in which all elements of the project are evaluated to determine if the perceived potential problems may produce unacceptable risks. For any risk of failure judged unacceptable, action plans will be developed to reduce the risk to an acceptable level.

The required action deemed necessary to eliminate, mitigate, and/or control the risk, will be planned, documented, and monitored throughout the remainder of the project. The RA/P will be specific in defining the actions to be taken for risk prevention and will indicate the responsible organizations and individuals (including required approvals) and the scheduled completion date for each action. Because of the potentially protracted nature of the CMF project, it is essential that these completion dates be tied to key project milestones - such as, the completion of conceptual design, the 60% design milestone, the issue of a design package certified for construction, etc. - so that changes in schedule will automatically carry over to the RA/P.

Each organization or discipline on the project team at the time the RA/P is developed or revised should participate in the process to take advantage of the cumulative knowledge and experience of the team. As a minimum, the RA/P will include a listing of all activities, structures, systems, subsystems, or components considered to present a problem in design, procurement, construction, operation, or proof of performance. Potential problems will then be assessed in terms of probability of occurrence and severity of consequences. The results of the assessment will be taken into consideration in the proposed design concept.

The following list of critical facility components were identified during the preliminary assessment:

1. process pool;
2. process-bay bridge cranes;
3. HVAC systems in:
   - Process bay,
   - process chemical room, and
   - contaminated storage bay;
4. waste processing equipment;
5. process control computer; and
6. emergency power.

This list will be used as the starting point for developing the list of components to be considered in the risk assessment performed during conceptual design.

5.2 SAFETY

A preliminary assessment was made of potential CMF safety hazards based on the design concepts for the facility during the feasibility study. The CMF provides for the servicing (i.e., external/internal cleaning, basket/spacer changeout), repair, and CoC testing of the shipping casks used to transport SNF and HLW in the FWMS. It consists of two buildings: the process building and the vehicle inspection and bead blast building. The process building will receive the unloaded shipping casks, service them (i.e., basket/spacer changeout and/or external/internal cleaning), repair them, or conduct the required periodic CoC testing. The process building will also house the waste treatment and solidification system used to collect radioactive contaminated waste generated in the process and solidify it for disposal off-site. The vehicle inspection and bead blast building will inspect and maintain the vehicles (truck trailers or railcars) and periodically repaint the vehicles.

5.2.1 Process Description

The average annual processing rate will be 2 CMF visits per cask for a total of 150 casks per year (based on a maximum of 75 active casks in the transportation system). The most casks arriving at a single time will be five in a unit train. The most casks arriving in a week and month are 7 and 24, respectively. The average cask will be processed in 8 hours.

Spent fuel residue or TRU waste contamination resulting from damaged fuel rods will be a rare occurrence. Thus, fissile material is not expected.

CMF operations can be placed into four broad categories: (1) vehicle receiving, (2) vehicle unloading and loading, (3) cask processing, and (4) vehicle processing. Each type of operation can be performed separately, but not independently, and is associated with a different type of schedule.

5.2.1.1 Vehicle receiving

The CMF will be open to receive shipments at all times. Vehicles received during the off-shifts will be searched and a preliminary radiological survey will be performed when they arrive. The vehicles will then be stored on site until they can be inspected and given a more thorough survey when they are unloaded. The radiological survey will include both a dose rate determination and a removable contamination survey.

5.2.1.2 Vehicle unloading and loading

Vehicle handling within the CMF will be performed during the primary shift each day. Two 175-ton, high-bay bridge cranes will be used to transfer casks from the vehicles to the process bay. After the casks are removed, the transport vehicles will be inspected and cleaned, as needed, with hot water to remove road surface dirt and grime.

The exterior surfaces of the casks will be surveyed at the vehicle unloading station prior to unloading operations. Casks that have radiation levels greater than the NRC and DOT removable radioactive surface contamination limit will be spot-decontaminated immediately or globally decontaminated in the external cleaning booth as necessary. The external cleaning booth will allow for manual decontamination or automatic high-pressure water spray decontamination. Decontamination solutions should not contain RCRA-hazardous or TSCA-listed materials.

5.2.1.3 Cask processing

Cask processing operations such as testing, cleaning, and repair will be performed three shifts per day, five days per week. These operations will be relatively time consuming and will therefore fully occupy critical equipment such as the pool, vacuum pumps, and bridge cranes.

Cask testing will include pressure, leak and load testing, as well as other tests specified by the CoC and those dictated by the nature of the specific maintenance or repair operations.

Wash wastewater will be filtered using an oil/mud separator and two pressure filters. The wastewater will then be sent to an ion exchange column to remove radiological contamination. The treated water will be recycled to the Vehicle Unloading/Loading Area. Sludge from the pressure filters will be collected in a settling tank. This sludge will then be pumped to the solidification facility.

Pool water will also undergo filtration (pressure filters) and ion exchange processes. The treated water will be recycled to the pool. Again, a settling tank will be used to collect sludge from the filters. The sludge will then be pumped to the solidification facility.

5.2.1.4 Vehicle processing

Vehicle processing will include cleaning, inspection, and routine maintenance of the railcars and trailers. All scheduled maintenance on railcars and truck tractors will be performed offsite by contract vendors. Major repairs of any type will also be done offsite.

There will be two types of vehicle cleaning. First, road dirt will be removed from the exterior of the trailers and railcars with high pressure water spray. This cleaning will be performed only if it is required to permit a close examination of each vehicle or if the vehicle has an excessive accumulation of dirt. The second cleaning will be performed, as needed, on the interior of personnel barriers following a HP survey. The interior cleaning will be performed manually and may result in the removal of both road dirt and spot contamination.

The wash water from the vehicle cleaning bays will be collected in a sump. the sump will be connected to the liquid waste processing facility where the water will be cleaned and discarded.

When the vehicles have been cleaned, they will be inspected and routine maintenance and minor repairs will be performed as indicated above. A facility for repainting the railcars and trailers will be available. It will include conventional bead blasting equipment for use in paint removal. The bead blasting and repainting will be performed in a bay specially equipped for these purposes including HEPA filtered ventilation. The bead blasting will be performed manually by personnel protected with suitable clothing and breathing apparatus. Contaminated waste produced by the bead blast process will be minimized by design and will be collected and disposed of offsite. All cask transporting vehicles, whether loaded or unloaded, will be inspected before they leave the CMF.

5.2.2 Facility Description

The <u>process building</u> is the primary facility on the site. It will receive trucks or railcars in the vehicle preparation bays where the personnel barriers will be retracted and a contamination survey made. The process building will consist of four distinct areas (see Dwg 53E-12824-B001): (1) the west wing, (2) the east wing, (3) the central high bay corridor, and (4) the pool area (within west wing/high bay corridor). The west wing includes the waste processing equipment room, waste solidification equipment, the mechanical equipment room, and the basket storage area. The east wing includes the office and computing area, shop area change rooms, and storage space. The central high-bay area includes space for cask unloading, cleaning, storage, and maintenance. The pool has three principle areas: maintenance and inspection, basket removal and inspection, and basket storage.

Ventilation for containment areas will be provided by exhaust fans located in the mechanical equipment room. Exhaust from containment areas will be HEPA filtered using bag-in-bag-out filter housings. The filter houses will contain a roughing filter and two banks of HEPA filters in series. The maintenance, process, and shop areas will be maintained at a negative pressure relative to atmosphere.

The vehicle inspection and bead blast facility will be a three bay service operation designed to perform inspection and maintenance on the cask transport railcars and trailers. Two of the bays will be for maintenance, while the third bay will be for bead blasting and repainting. In addition to the three bays, space for offices and storage will be provided.

The bead blast will be provided with HEPA-filtered ventilation. Blasting operations will be performed with the bay doors closed to contain potential contamination.

A central control system will be provided to monitor and control all critical process elements. All contaminated liquid process wastes will be monitored and controlled throughout the process. Local air monitors will be located throughout the facilities. Stack monitoring and surveillance instrumentation will be provided for both of the facility stacks and will have local and system failure alarm input in to the central control system.

5.2.3 Hazard Analysis

This project is in the feasibility stage, making some of the specific hazards, as well as the candidate safety class items, uncertain. Specifically, more information is needed concerning the nature and level of cask internal and external contamination before a hazard level can be established.

However, several hazards definitely exist and must be mitigated in the design. The primary hazard is the presence of radioactive materials which necessitates confinement, shielding, and processing these materials in preparation for offsite disposal. The vehicle and cask washing areas, and the processing pool will generate contaminated liquid wastes. As a minimum, the contaminated liquid waste recycle system - in particular, the sludge transfer system - will probably require safety class piping and continuous monitoring. The bead and blast facility will generate contaminated dust, necessitating confinement (probably requiring safety class ventilation components). In addition, the sludge solidification process may introduce the potential hazard of rapid vaporization of liquids with the resulting pressurization of equipment.

Because of the probable need for safety features to mitigate the hazards (radiation and radioactive contamination) associated with cask cleaning and maintenance, and the bead blasting and solidification activities, a Preliminary Safety Analysis Report (PSAR) will be required for this project. The PSAR will be written during the conceptual design phase of the project, and will require close involvement of the safety staff in the design effort to assure that any necessary safety class items, or special administrative controls for safety (if they are required) are established at appropriate phases of the design. As more information on the actual facility hazards is identified during the PSAR effort, a determination of the facility hazard level will be made and the necessity for additional safety documentation determined.

5.3 QUALITY ASSURANCE

The QA program developed for the CMF will be compatible with the QA program adopted for the TOS and the overall OCRWM program and the "Quality Assurance requirements for the Civilian Radioactive Waste Management Program". A graded approach will be used to apply the QA requirements of ANSI/ASME NQA-1, 10 CFR 71, or other sponsor-dictated QA requirements documentation. That is, each technical work element of the CMF development effort will be evaluated to determine its objectives. Evaluation of each work element will consider engineering risk assessments when making decisions. A QA Program Plan will be developed based on the evaluations, and QA requirements will be selectively imposed on the work elements. More stringent QA requirements will be imposed on those work elements which are determined to be most critical to mission success or the failure of which would have significant consequences to safety or waste isolation.

Until the CMF development has proceeded beyond the conceptual stage, with appropriate risk assessments, or direction is given by the sponsor, a final determination of Q-Level cannot be made. However, the nature of the CMF mission (maintaining the operational effectiveness and safety of the cask system used to transport spent nuclear fuel) indicates a Q-level 1 or 2 designation. In either case, all 18 QA elements will be applied; it is only in the depth and breadth of application that the differences will become apparent. Decisions as to the level of QA requirements to be imposed will be made jointly by the QA representative and Project Management. As development of the CMF evolves from the Feasibility Study stage through final design and on to construction and operation, the QA

Plan and procedures will also be evolving. The QA representative and Project Management will recommend and jointly approve modifications to the QA Plan and procedures at logical points in the program.

QA requirements will be imposed on contractors and subcontractors through procurement documents. The contractors and subcontractors will be required to document the approach they propose to use in meeting the specified QA requirements. Their QA planning will thus be subject to the same approval as their technical proposals prior to contract award. Surveillance will be the primary method used to verify contractor and subcontractor compliance with QA requirements.

5.4 ENVIRONMENTAL

A preliminary environmental review of the CMF project focused on environmental considerations for the construction and operation of the facility and on pertinent environmental regulations. The results are summarized in Sects. 5.4.1 and 5.4.2. Based on these results, recommendations for activities to be accomplished before or during conceptual design are listed in Sect. 5.4.3.

5.4.1 Environmental Considerations

Wastes that will be accepted in the transportation system include: (1) canned intact fuel assemblies, (2) uncanned intact fuel assemblies, (3) consolidated fuel, (4) non-Light Water Reactor spent fuel, (5) activated metals, (6) miscellaneous wastes, (7) defense high-level waste, and (8) high-level waste from the DOE facility at West Valley, New York. The high-level waste will first be placed in a canister, the canister sealed, and the canister will then be placed in the cask.

The cask systems to be serviced by the CMF will be used to transport the above wastes. The casks will be unloaded when they arrive at the facility; but, in practically all cases, the cask systems will be internally and externally contaminated. External contamination will be limited to specific levels by NRC requirements placed on the overall system. In addition, specifications for internal contamination that apply to the repository and MRS (where the casks will be unloaded prior to being sent to the CMF) will also be a controlling factor.

An estimated 150 casks will be processed in the CMF annually. Inspection and maintenance will include radiological surveys and decontamination of casks, cask internal structures, and ancillary equipment. Decontamination of the cask exteriors may require the use of solvents, chemicals, wipes, gloves, rags, and other cleaning materials. It will generate low-level radioactive waste (LLW) in both solid and liquid form. Decontamination of cask interiors will also generate low-level waste. Trace amounts of transuranic waste or high-level waste may also be mixed in with the LLW. This waste will also be in solid and liquid form.

A preliminary waste management evaluation of the CMF and its waste streams that was performed as part of the CMF Feasibility Study focused on streams which will require careful attention during the conceptual design phase of the project. A waste flow diagram for a hypothetical CMF is given in Fig. 5.1.

Pre-conceptual design indicates that the external and internal decontamination system, the pool water treatment system, and railcar and trailer maintenance at the CMF will generate both solid and liquid streams of low-level radioactive waste. Transuranic waste, and possibly solid and liquid high-level waste, could be generated by the internal decontamination and pool water treatment systems. These waste streams will require treatment for re-use or processing for disposal. The radionuclides contained in these streams have the potential to expose man to radiation along the pathways represented schematically in Fig. 5.2.

The radiological impacts of the CMF will need to be assessed by estimating the radiological dose commitments to individuals and groups expected to result from exposure to radionuclides released during normal operations, and by postulating the consequences of accidents that involve the release of radiation. The concentrations of radionuclides in the air, on the soil surface, and in nearby waters at various distances and directions from the CMF should be used to estimate doses.

Non-radiological issues that will need to be assessed include land use, the impacts of non-radiological waste streams, effluents and emissions, and public acceptance of the facility.

Eng. Dwg. CMF 5.1

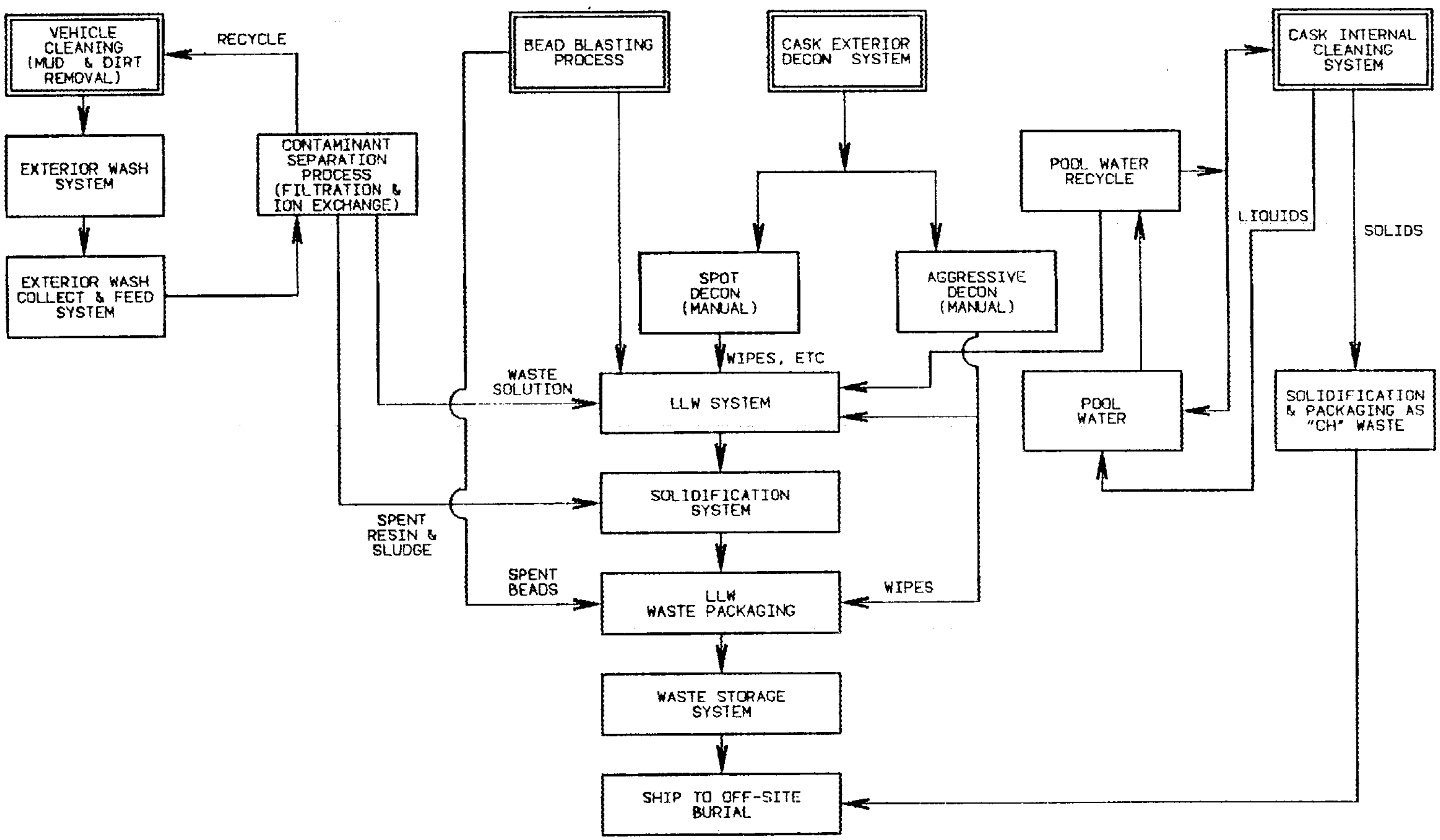

Fig. 5.1 Radionuclide waste flow diagram

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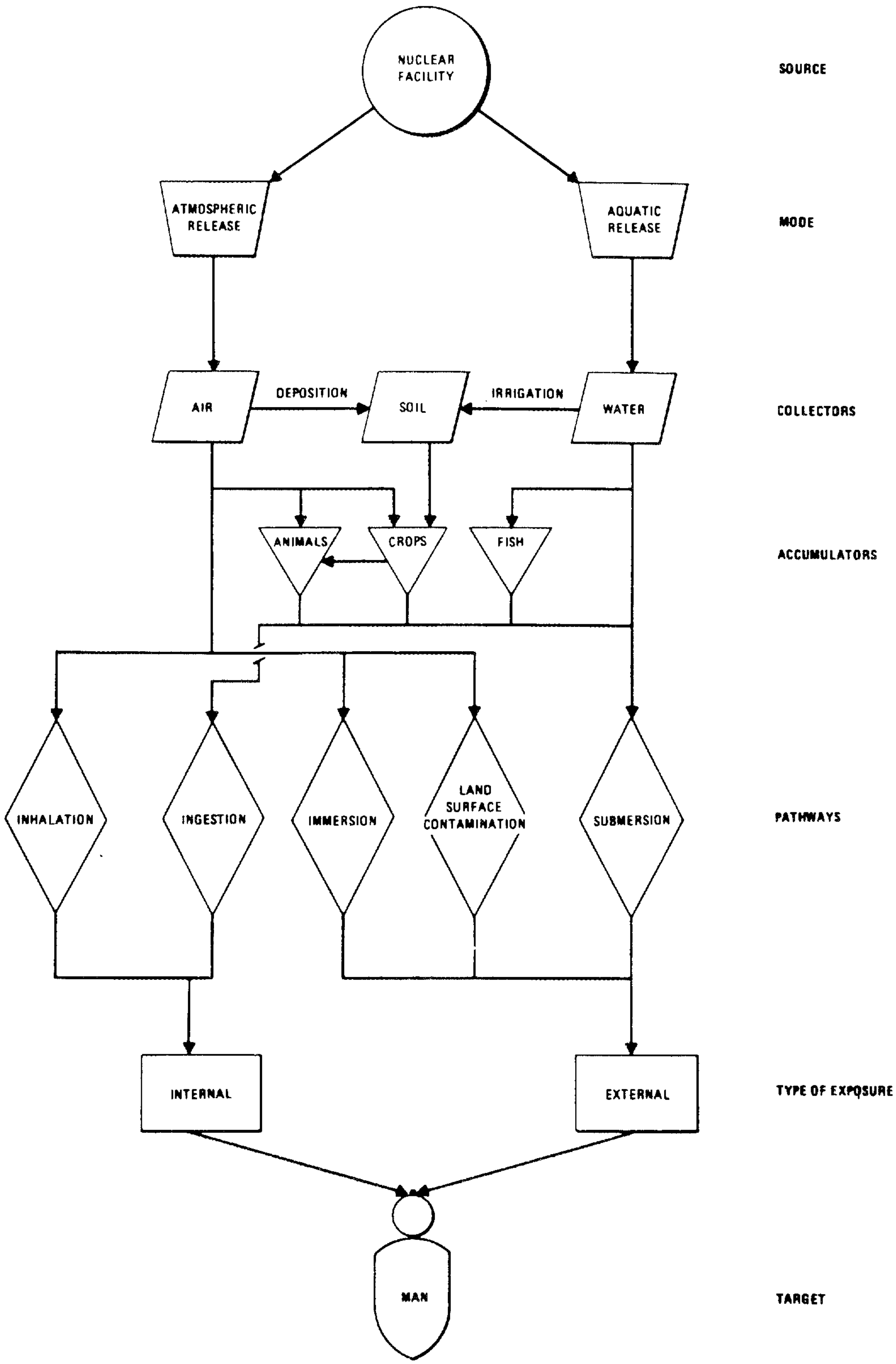

Fig. 5.2 Assessment methodology used to calulate the radiological impact of a nuclear facility on man

Site selection for the CMF could be a significant technical issue during the development of a waste management system. Conceptual design cannot be completed on a definitive basis without it. When various potentially viable CMF sites are identified, the following criteria, which relate to potential environmental concerns, should be considered:

1. proximity to the MRS and repository (minimal transport required),
2. geological suitability (subsurface) to the proposed construction,
3. suitability of the terrain to construction,
4. depth to the water table (potential pathway to man),
5. distance from off-site populations, especially sensitive receptors,
6. distance from surface waters (potential pathway to man),
7. ecological acceptability (wetlands, threatened and endangered species, critical habitats), and
8. archaeological and historic resources.

The environmental impact analysis for the CMF will require specific information regarding the facility and the site where it is located. Typical information needs are presented in Table 5.1.

Table 5.1 National Environmental Policy Act (NEPA)
Information requirements

I. **Facilities Description and Site Layout**
  - A. Structures and components
  - B. Environmental protection systems
  - C. Utility and service systems
  - D. Emissions and effluents, including radiation
  - E. Waste management system

II. **Site Characteristics**
  - A. Geography and demography
    - 1. Site locations and general description - counties, cities
    - 2. Population distribution - annular sectors (0-10, 10-50 miles)
  - B. Community resources
    - 1. Industrial facilities
    - 2. Transportation network with 25 miles
    - 3. Infrastructure (schools, etc.)
    - 4. Historic resources
  - C. Meteorology
    - 1. Climate
    - 2. Air quality and applicable standards
    - 3. Monitoring data
  - D. Hydrology
    - 1. Surface Water
      - type, location, hydrologic characteristics
      - quality and use
      - location of flood planing, flood history
    - 2. Ground water
      - regional aquifers, quality, flood history
      - hydrologic characteristics
  - E. Geology and seismology
    - 1. Topography and regional geology
    - 2. Tectonic structures
    - 3. Regional seismicity
  - F. Aquatic and terrestrial ecology
    - 1. Population, habitat
    - 2. Endangered/threatened species
  - G. Background radiation level (air, water, soil)

III. **Safety/hazard analysis (PSAR)**
  - A. Construction
  - B. Operation
  - C. Transportation
  - D. Surveillance and maintenance
  - E. Emergency plans and procedures (evacuation)

IV. **Alternatives to the proposed action**
  - A. Sites
  - B. Technology
  - C. Other

NOTE: EA = environmental assessment, EIS = environmental impact statement, PSAR = preliminary safety analysis report.

5.4.2 Environmental Regulations

For the CMF project, the DOE, as a federal agency, will be required to comply with many environmental regulations established by federal legislation and with statutes and codes enforced by state and local authorities. These include, but are not limited to, requirements set forth in the laws and executive orders described in the following sections.

5.4.2.1 National Environmental Policy Act of 1969 (NEPA)

The National Environmental Policy Act of 1969 (Pub. L. 91-190) is the basic national charter for the protection of the environment. It establishes a federal environmental policy, sets goals, and provides the means for carrying out the policy. The NEPA environmental review process is intended to help public officials make thoughtful decisions that are based, in part, on a clear understanding of the environmental consequences of a proposed federal action.

All federal agencies are subject to the mandate of NEPA, and all must abide by the President's Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), which provide the direction for incorporating environmental review in the planning and execution of federal actions, and set forth procedures for establishing legal documentation of such review. All activities undertaken as part of the national high-level waste management program, including construction and operation of the CMF, must undergo environmental review in accordance with NEPA, the CEQ regulations and all applicable DOE Orders. Figure 5.3 indicates the major steps taken in a typical DOE environmental review process. The first step in the process involves the preparation of an Action Description Memorandum (ADM), which serves as a scoping document of potential issues associated with the proposed action. A decision follows as to whether the appropriate level of NEPA documentation will be an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). The EIS represents a more detailed analysis of impacts than the EA; and, during the EIS review, public input regarding issues is solicited.

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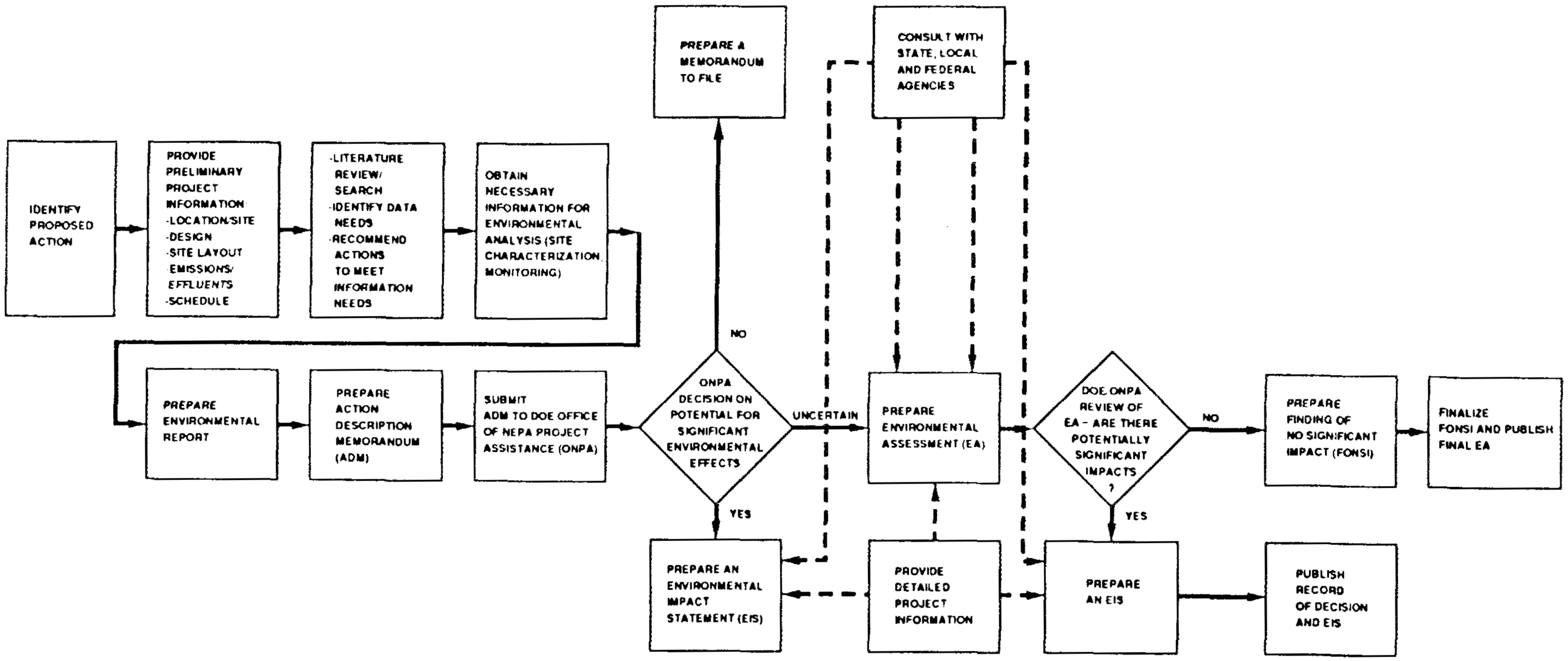


ONPA = Office of NEPA Project Assistance

Fig. 5.3 Major steps in DOE environmental review process.

5.4.2.2 The Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recover Act (RCRA) [PL 94-580, 42 USC 6901], enacted on October 21, 1976, and amended in 1978, 1980, and 1984, establishes a regulatory system to track hazardous wastes from the time of generation to disposal. The intent of RCRA is to protect human health and the environment from the adverse effects of uncontrolled industrial waste and to conserve energy sources and materials. RCRA Subtitle C regulations are defined in Title 40 of the Code of Federal Regulations (CFR). The RCRA hazardous wastes are defined on the basis of characteristics exhibited (40 CFR 261.21-261.24) or by listing (40CFR 261.31-261.33). RCRA regulations apply to all waste generators unless their wastes are excluded from the definition of solid or hazardous waste under 40 CFR 261.4 or are conditionally exempt small-quantity hazardous waste generators under 40 CFR 261.5.

RCRA regulations are enacted and enforced by the Environmental Protection Agency (EPA). Authorized state hazardous waste programs give individual states the responsibility for administering RCRA regulations. RCRA requirements subject both governmental and nongovernmental facilities to federal, state, and local requirements. RCRA Sec. 6001, Application of Federal, State, and Local Law to Federal Facilities, states that all branches of the federal government having jurisdiction over any solid waste management facility or disposal site shall comply with federal, state and local solid waste or hazardous waste disposal requirements in the same manner and to the same extent as any person subject to such requirements.

Because source, special nuclear materials and by-product materials are regulated under the Atomic Energy Act (AEA) of 1954, they are excluded from RCRA hazardous waste rules (40 CFR 261.4). However, mixed wastes containing both RCRA hazardous waste and radioactive waste constituents are subject to the RCRA regulations. Under the current regulatory framework, the hazardous constituents of mixed wastes are regulated by EPA, but the mixed waste must also meet the requirements of DOE orders for radioactive wastes. Consequently, mixed waste is under the joint jurisdiction of DOE and EPA. Negotiations continue among EPA, DOE, and the Nuclear Regulatory Commission (NRC) to resolve the mixed waste issue.

The management of mixed wastes is complex. Because of their double hazard involving both hazardous and radioactive wastes and dual regulatory enforcement by the EPA and DOE, the management of mixed wastes has been somewhat limited. Land Disposal Restrictions (40 CFR 268) prohibit the storage of restricted waste, placing installations storing mixed waste into noncompliance.

During the construction and operation of CMF, both hazardous and mixed wastes may be produced. There are some processes/areas that generate wastes that are potential candidates for such classification. For example, pool water treatment system (Sect. 4.3.9), solidification facility (Sect. 4.3.10), water demineralizer (Sect. 4.3.11), diesel fuel area (Sect. 4.4.2.9), and gasoline storage area (Sect. 4.4.2.10) may produce hazardous wastes, and other processes/areas such as electropolishing system using phosphoric acid (Sect. 4.3.7.1) and cask and personnel elevators containing water-based hydraulic fluid (Sect. 4.9.2) that could be radioactively contaminated may generate mixed wastes. Waste streams identified as hazardous must be handled in accordance with RCRA regulations, and mixed wastes will be subject to dual regulation as discussed above. Transportation of RCRA or mixed wastes should comply with rules stated at 40 CFR 263 and in 49 CFR 171-179, DOE Order 1540.1 "Materials Transportation and Traffic Management", and DOE Order 5480.3 "Safety Requirements for the Packaging and Transportation of Hazardous Material, Hazardous Substance, and Hazardous Waste."

5.4.2.3 Other federal environmental requirements

Executive Order 12088. This EO requires every federal agency to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the following federal laws:

1. Toxic Substances Control Act (15 USC 2601 et seq.),
2. Federal Water Pollution Control Act (33 USC 1251 et seq.), as amended by the Clean Water Act of 1977 (33 USC 1251 et seq.),
3. Public Health Services Act, as amended by the Safe Drinking Water Act (42 USC 300(f) et seq.),
4. Clean Air Act (42 USC 7401 et seq.), as amended by the Clean Air Act Amendments of 1977 (PL 95-95),
5. Noise Control Act (42 USC 4901 et seq.), and

Executive Order 12088 also requires compliance with guidance regarding radiation in Sect. 2174 (h) of the Atomic Energy Act of 1954, as amended [42 USC 202 (h)].

For the construction and operation of the CMF, compliance with regard to each of the above acts will be evaluated during the NEPA review process and will be reported in the NEPA documentation that results from the review.

Executive Orders 11988 and 11990. These EOs require that federal agencies avoid actions which produce short- or long-term adverse impacts to floodplains and wetlands, if there is a practical alternative. The DOE issued regulations in 10 CFR 1022 for effecting compliance with these orders. An analysis of impacts to floodplains and wetlands is usually performed in conjunction with the NEPA review and incorporated into the NEPA document.

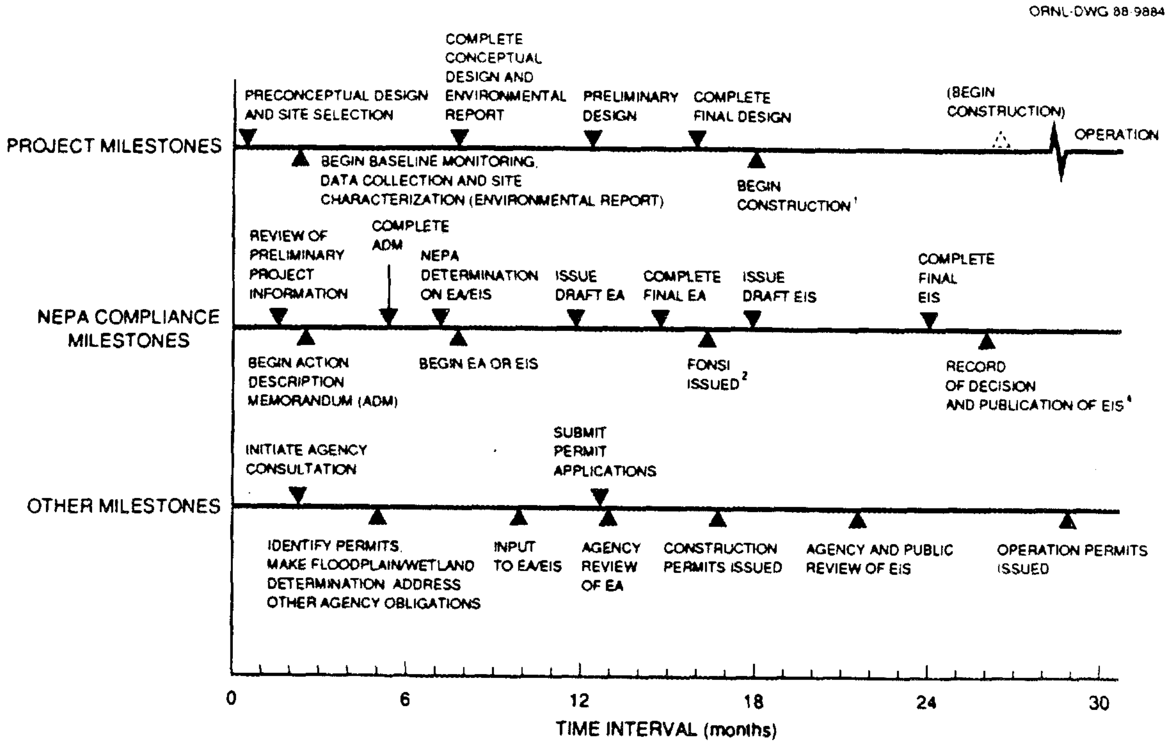
Endangered Species Act. The Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), is intended to prevent the further decline of endangered and threatened plant and animal species, and to help in the restoration of populations of these species and of their habitats. The Act, which is jointly administered by the Departments of Commerce and the Interior, requires that a federal agency consult with the U. S. Fish and Wildlife Service (FWS) to determine whether endangered and threatened species are known to occur or have critical habitats on, or in, the vicinity of the site of a proposed action. Consultation with the FWS is factored into the ecological impact analysis that is conducted as part of the NEPA review and reported in NEPA documentation.

Historic Preservation Act. Section 106 of the Historic Preservation Act of 1966 (16 USC 470 (f) et seq.) requires that federal agencies with jurisdiction over a federal action provide the Advisory Council on Historic Preservation, and the State Historic Preservation Officer, with an opportunity to comment on the effects that the action may have on properties included in, or eligible for inclusion in, the National Register of Historic Places. This can also be carried out as part of the NEPA review process and included in NEPA documentation.

Transportation Regulations. The integrated system of high-level waste and spent fuel management will require transportation of hazardous radioactive materials from generating sites to an MRS and the final repository. Transport of unloaded, contaminated shipping casks to and from the CMF will be by rail or by truck. Packaging, handling, and transportation of the wastes will be regulated by the U.S. Department of Transportation as indicated in 49 CFR Parts 100-199. The NRC radioactive waste transportation regulations (10 CFR 71) will also apply.

NRC Certification of Compliance. Enforcement through the CoCs protects the worker and the public from the hazards of radiation exposure that could result from the handling and transportation of hazardous materials. The CoC is the regulatory document used by the NRC Division of Safeguards and Transportation to permit spent fuel to be transported. The CoC contains a description of the type, form, and maximum quantity of material that can be transported in a cask; the operating restrictions on the cask; and the specifications for, or reference to, the operation, inspection, and maintenance of the cask. These requirements thereby restrict the level of radiation hazards associated with a cask by assuring the cask's integrity and by limiting its radioactive load.

Integration of Project Planning and Development with Environmental Review. The NEPA process must be integrated into project planning and development very early to ensure that environmental issues and requirements are considered during design and to avoid or prevent future delays (see CEQ regulations, 40 CFR Pt. 1501.2). A generic illustration of the relationship of project milestones and the environmental review process for a major facility, such as the CMF, is shown in Figure 5.4. Terms used in the figure are explained in Table 5.2. The preliminary schedule proposed for the CMF project is shown in Sect. 8, Figure 8.1.



1 THIS ACTION IS DEPENDENT ON THE ISSUANCE OF A FINDING OF NO SIGNIFICANT IMPACT (FONSI). IF AN EIS IS PREPARED, CONSTRUCTION MAY NOT BEGIN UNTIL SEVERAL MONTHS LATER

2 FINDING OF NO SIGNIFICANT IMPACT. DETERMINATION MADE ONLY FOR AN EA

3 BECAUSE OF PUBLIC INVOLVEMENT IN SCOPING AN EIS AND LEGAL REQUIREMENTS FOR COMMENT PERIODS, THE PROJECTED COMPLETION OF A DRAFT EIS MAY BE UP TO 6 MONTHS LATER THAN COMPLETION OF AN EA

4 A RECORD OF DECISION IS MADE FOR ONLY AN EIS

NOTE. ADM = Action Description Memo; EA = Environmental Assessment; EIS = Environmental Impact Statement; FONSI = Finding Of No Significant Impact; NEPA = National Environmental Policy Act

Fig. 5.4 Typical project and environmental process milestones for a major facility

Table 5.2 Definition of terms used in Figure 5.4

Memo-to-file is a unique DOE mechanism to preclude the preparation of an environmental assessment. The use of the memo-to-file is limited to circumstances where it is immediately clear that a proposed action will have no significant environmental impacts. The memo-to-file should contain a statement to that effect along with a brief rationale.

Action Description Memorandum (ADM) serves as the basis for a determination of the required level of NEPA documentation. It should be prepared as early as possible in the planning process of an action. An ADM should contain a concise description of the proposed action, the location of the action, and any known potential issues or problems.

Environmental Assessment (EA) serves to briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact, serve as agency's compliance with NEPA when no environmental impact statement is necessary, or facilitate preparation of an environmental impact statement when one is necessary.

Finding of No Significant Impact (FONSI) briefly presents the reasons why an action will not have a significant effect on the environment and, therefore, does not require the preparation of additional documentation.

Environmental Impact Statement (EIS) is a detailed written statement to insure that the policies and goals defined in NEPA are included in the programs and actions of the federal government. It provides discussion of environmental impacts and informs decision makers and the public that reasonable alternatives were considered.

Record of Decision (ROD) follows an environmental impact statement and is prepared at the time an agency makes its decision on a proposed action, The record of decision states the decision, identifies all alternatives considered, and discusses environmental mitigation measures to be employed.

Conceptual Design is the formative stage in the design of a facility. It is prepared using operating funds for the purpose of developing and quantifying the physical construction requirements of the project, a budget quality cost estimate, and a schedule of key design and construction activities. Conceptual design is based upon user requirements established and accepted by management, and establishes the location, size, capacity, and functional needs of the project.

Preliminary Design continues the design effort utilizing the conceptual design and the project design criteria as a basis for project development. It develops topographical and subsurface data and determines the requirements and criteria which will govern the definitive design. Tasks include preparation of preliminary planning and engineering studies, preliminary drawings and outline specification, life-cycle cost analysis, preliminary cost estimates, and scheduling for project completion. Preliminary design provides identification of long-lead procurement times and analysis of risks associated with continued project development.

Final (Definitive) Design continues the development of the project based on approved preliminary design. It includes any revisions required of the preliminary effort; preparation of final working drawings, specification, bidding documents, cost estimates, and coordination with all parties which might affect the project; development of firm construction and procurement schedules; and assistance in analyzing proposals or bids.

Construction is any combination of engineering, procurement, erection, installation, assembly, or fabrication activities involved to create a new facility or to alter, add to, or rehabilitate an existing facility.

5.4.3 Recommended Activities Before or During Conceptual Design

Based on a preliminary study of important environmental considerations and regulations, the following activities should be accomplished before conceptual design is completed:

1. Integration of NEPA review milestones into the project timetable.
2. Site selection and characterization.
3. Characterization of potential emissions, effluents, and waste streams, and identification of environmental pathways to man and the ecosystem.
4. Initiation of the environmental assessment/impact statement.
5. Plan of action for management (handling, treatment, disposal) of low-level, transuranic, and high-level waste from the CMF.
6. Identification of environmental permits and approvals necessary for construction and operation.

5.5 RELIABILITY, AVAILABILITY, AND MAINTAINABILITY

The design for the CMF proposed in this study is conservatively based on standard or proven equipment and techniques; therefore, the overall facility reliability, availability, and maintainability (RAM) is expected to be very good. A true RAM analysis is not feasible prior to conceptual design due to lack of detail; however, a preliminary overview was made (see Table 5.3). The overview serves only to highlight the provisions made to address RAM concerns for major pieces of equipment. A full RAM analysis will be required for the conceptual design report in accordance with DOE Order 6430.1A.

Table 5.3 Overview of RAM factors in the CMF

System/Equipment	Importance[a]	RAM Factors[b]	Comments
Bead blast	3	2	Very low use rate
175-ton bridge crane	1	1	Redundancy available
Cask int. clean. sys.	1	2	Redundancy available
Cask ext. clean. sys.	1	2	Redundancy available
Yard rail tractor	1	2	Replacement available
Yard truck tractor	1	2	Over-road tractor av.
Pool bridge	1	3	Manual over-ride
10-ton bridge	2	3	Low importance
Large entry doors	1	3	Manual over-ride
Vacuum pumps	1	2	Redundancy available
Computer system	1	1	Parallel processors
Waste process	1	2	Parallel equipment
Compressed air	1	2	Redundancy available
Cask scaffolding	1	3	Redundancy available
Lifting fixtures	2	3	Easily repaired
Process bldg. HVAC	1	3	Built-in redundancy
Clear well	1	3	Redundancy available
Transport cleaner	2	2	Redundancy available

[a]Importance is evaluated with respect to the primary facility functions:

"1" Constant use
"2" Daily use
"3" Infrequent use

[b]RAM factors are evaluated roughly as follows:

"1" Frequently out of service
"2" Periodically out of service
"3" Infrequently out of service

5.6 SAFEGUARDS AND SECURITY

A preliminary assessment of safeguards and security requirements has been made to determine the level of protection needed for the CMF. The facility will be servicing unloaded casks only; therefore, no special nuclear materials will be present and safeguards requirements will not apply. Security will be needed to control access to the site and to selected process areas within the site; to prevent theft and sabotage to the facility and cask systems being serviced or stored on site; and, to protect classified communications systems and information in printed documents and in computer-based systems or storage devices. Established requirements should assure compliance with 10 CFR 73 (Physical Protection of Plants and Materials), the 5632 Series of DOE Orders and DOE Order 6430.1A, Section 283. The basic security requirements are outlined below.

Basic Security Requirements

A dedicated security force will control access to the facility and provide on-site surveillance. Headquarters for the security force will be in the guard post at the main entrance. The security force will have an independent communication system. The guard post will also serve as the base station for security systems - closed circuit television (CCTV), communications, alarm systems, etc.

The site will be secured by a 7-ft chainlink fence topped by three strands of barbed wire. All access portals will have gates, and the gates will be attended or securely locked. The fence and gates will be lighted and under surveillance of a CCTV system. A perimeter road will be constructed inside the fence to facilitate surveillance patrolling and response to attempted intrusion.

All people and vehicles entering and leaving the site will be monitored and subject to search. Routine access for pedestrians and over the road vehicles will be through the main entrance only. Proper identification before entering will be required.

Employees will be required to wear security badges with photos while in the plant. The badges will be presented upon entry to visually verify identification and to electronically log each employee in. All visitors will have their identification verified before entering. They will be logged in upon entering the site and will be logged out upon leaving the site. While in the plant, visitors must wear a "Visitors" badge and must be accompanied by a regular employee at all times.

All vehicles that are not part of the facility fleet will be inspected and logged in when entering the site and will be inspected and logged out when leaving the site. The facility will receive cask transport vehicles 24 hours a day, 7 days a week. Vehicles arriving during off-shift will be stored on site in special areas under surveillance of the CCTV system until they can be properly surveyed and inspected. Facility vehicles will be specially marked or licensed to permit ready identification.

Computer and communications systems and equipment used to process, store, or transmit classified information will be designed to provide the required level of protection. Appropriate storage will be provided for classified documents and computer storage devices containing classified information.

The need for additional guard posts within the site to control access to the process will be investigated during conceptual design. At this time the need for controlling access within the site is primarily a health and safety issue rather than security.

Health physics requirements will be incorporated into security requirements where appropriate. For instance, radiation detectors may be issued with and worn on security badges. And, in case of on-site control, health physics monitoring stations may be operated in conjunction with guard posts.

6. UNCERTAINTIES

Many aspects of the TOS are undefined at the present time. In order for the feasibility study to proceed, it was necessary for many assumptions to be made to fill in these areas. These assumptions are presented in Sect. 3. This approach is acceptable for the feasibility study because of the large contingency factor and limited amount of design detail involved. However, it will not be acceptable for the conceptual design, because of the higher degree of accuracy expected and required. This section highlights the specific areas in which uncertain assumptions need to be resolved. The site issue (Sect. 6.1) is considered to be particularly important.

6.1 SITE DESIGNATION

The feasibility study is based on a "green field" site. This is conventional procedure for feasibility studies, because it allows maximum freedom for design innovation and provides costing for all systems. Designation of a specific site is, however, critical for accurate evaluation and estimation of many important factors such as:

1. distance to highway connections,
2. distance to rail connectors,
3. grading requirements,
4. waste-handling capability,
5. shared-operations capability, and
6. special construction requirements (seismic, severe weather, etc.).

Costs related to the above uncertainties have been accounted for in the feasibility study using standard factors or assumed allowances. Future design efforts will require more specific information. Several siting studies (H&R Tech 1987, Office of Transportation Systems and Planning (OTSP) 1987) have been made; however, continuing changes in the TOS configuration require further evaluation. Consequently, prior to beginning the conceptual design, a specific site should be selected to permit a realistic evaluation of potential design factors. This is especially true if the site is collocated or integrated, in which case the decision will have a particularly important impact on the building design as well as the site facilities.

6.2 CONTAMINATION

The design of the CMF is highly dependent on the level and type of contamination occurring or permitted in the transportation system. In particular, there are three areas of concern due to lack of definition or understanding; (1) facility licensing requirements, (2) acceptable levels of contamination in unloaded casks, and (3) anticipated levels of contamination occurring on the exterior of shipping casks and transporters. It is assumed that realistic resolutions are available for these concerns; however, the details of the resolutions could significantly change the design or operation of the CMF.

6.2.1 Facility Licensing Requirements of the CMF

The proposed CMF is not specifically covered in the current NRC licensing regulations contained in Title 10 of the Code of Federal Regulations. Part 30 "Rules of General Applicability to Domestic Licensing of Byproduct Material" generally covers the types of contamination expected to be predominant in the CMF and has been applied to similar facilities. It does not; however, apply to all the radioactive materials which could be expected in rare (but possible) situations. Consequently, the nature of the NRC operating license, including both the content and the schedule of the review and approval process are currently uncertain. The primary effect of the licensing process is assumed to be on the overall design and construction schedule. It is recommended that the licensing process be initiated prior to the beginning of the conceptual design.

6.2.2 Cask Internal Contamination

The amounts of permissible radionuclides inside the SNF shipping casks during transit within the transportation system currently specified by the MGDS requirements (Roy F. Weston, Inc. 1987) are based on 49 CFR 173.427 "empty" cask standards. This study assumed, as a practical matter, that new, less stringent standards will be applied in the future (see Appendix E). Whatever the limits, a standard will be applied throughout the TOS that will define the permissible amount of crud and junk accumulation in casks, and consequently, the amount of cleaning required at the CMF.

Another concern involving internal contamination is the possibility and extent of contamination resulting from damaged or ruptured spent fuel bundles. Severe cask decontamination complications resulted from an event in 1980 when a PWR assembly with several failed rods contaminated the pool and handling bay at Battelle Columbus Laboratories during SNF unloading operations. Since the time of that accident, precautions have been implemented to reduce the possibility of a reoccurrence. Despite these measures, it is assumed that incidents involving SNF may occur in the future, with similar complications for cask cleanup and operational interruption.

The problem of spent fuel releases inside casks during shipping or handling requires more definition. Of particular relevance to the CMF is the extent of involvement required for special cleaning and decontamination. Specifically the use of process equipment such as the pool or external cleaning booths could affect the design of the facility.

6.2.3 Cask External Contamination

The amount of cask external contamination is controlled by 49 CFR 173.443, which is discussed in Appendix B. External contamination has been shown to be present in the existing SNF shipping fleet, primarily in the form of radionclides which "weep" from the surface of casks after decontamination. Weeping begins to occur immediately after the cask has been cleaned and continues until the next cleaning at a rate dependent on the ambient conditions, the temperature of the cask, the history of the cask (more weepage with use), and other factors including the materials of construction.

This study was based on the experience of the present shipping cask operators. Thus, it is assumed that casks can normally be cleaned in < 2 hours to a level which will permit shipment. Special cases may require more time, but casks can always be cleaned to the required limit with manual techniques using aggressive decon agents.

Studies are currently underway to develop methods of reducing or eliminating weeping. If successful, the methods could reduce the amount of operating time throughout the TOS system and the CMF in particular. Capital cost could also be reduced if equipment, such as the spare external cleaning booth, could be eliminated.

6.3 DETAILS OF THE CASK DESIGNS

Cask design details, such as standard fastener sizes, seals, trunnion tie-downs, and basket-lifting arrangements, are currently being defined for the from-reactor spent fuel casks. Design information related to other types of casks for the FWMS is even less defined. The

CMF systems expected to rely on detailed cask information in conceptual and construction design include:

1. lid removal and handling,
2. basket handling and cleaning,
3. cask loading and unloading,
4. trunnion replacement
5. compliance testing, and
6. spare parts storage.

In all the cases above, the CMF feasibility study was based on in-service cask designs and on limited preliminary information from the prototype cask development program. The study was also based on a conservative, all-manual approach to cask handling, which avoided special equipment design but does not preclude the use of automatic equipment. More cask design information will enable later facility designers to better evaluate potentially more efficient automatic methods. Studies have already been performed which suggest several promising methods of remote and automatic operation (Young 1984, Thunborg 1987, McCreery 1979b, McCreery 1980b). Therefore, it is suggested that the CMF team be directly involved with the spent fuel shipping cask development project to insure compatibility of design and concept.

6.4 CASK RECONFIGURATION

The rate at which the casks will be reconfigured could not be accurately determined during the feasibility study. Change out responsibility has been spread throughout the TOS system with no specific requirements being placed on any particular facility. Thus, future redirection in cask reconfiguration assignments could affect the CMF by both significantly increasing or decreasing the assumed 50 changeouts per year. Because reconfiguration is an important CMF function, a change could significantly affect the size of the CMF or, as a minimum, require major changes in the subsystems.

A coordinated TOS program should be established to determine the expected overall rate of cask reconfiguration and the rate at each system location. Important considerations will include (1) cask design, (2) scheduling of shipments, (3) size of basket storage areas at the MGDS, CMF, and MRS, (4) spacer installation sites, and (5) the total spare basket stock in the TOS.

6.5 LOCATION OF UNDESIGNATED TOS FUNCTIONS

The definition and siting of many undesignated TOS functions represent a significant uncertainty for the system. The CMF, in particular, would appear to be one of the logical sites for some of these, including traffic control, system administration, procurement, quality assurance, public relations, and driver training.

This feasibility study does not address any of the undesignated functions except for the requirements of the facility itself. Undesignated functions could be defined and located within the system in conjunction with the CMF siting study. This would permit a more accurate definition of both the CMF and the total TOS physical plant.

6.6 DRY CELL CASK-HANDLING OPERATIONS

The use of dry containment cells rather than a pool for cask processing could not be adequately addressed by the feasibility study team. This method was briefly considered; but, was ultimately set aside for two reasons. First, the general consensus of the present, domestic, cask operators was that a pool system was reasonable and is considered a mature technology. And second, an evaluation of newer dry handling facilities and technologies such as used at several foreign operations could not be made by the study team. Although the principal function of the pool or containment cell will be basket change out and storage, the required operation has a significant effect on both the total capital and operating costs of the entire CMF.

A detailed study of the dry processing approach could clarify this issue for the conceptual design. A study could include contracting for a report to be prepared by Numatec, concerning the operation and justification of the Cogema dry maintenance facility. A comparison of the La Hague dry and wet cask maintenance operations would be of particular interest. A planning and design team could visit both Cogema's La Hague plant and British Nuclear Fuels Ltd's. (BNFL) cask maintenance facility to study operations at a scale similar to that expected for the OCRWM CMF. Evaluation of the Test area North (TAN) and Engine Maintenance Assembly and Disassembly Facility of Nevada (EMAD) operations would also be useful.

It should also be noted that the wet vs dry trade-off might depend heavily on the siting of a CMF, since a facility which is fully integrated into a dry MRS or MGDS, may require a different process than an independently or collocated facility, thus adding more importance to the siting decision discussed in Sect. 6.1 (Parsons 1985). Further, the uncertainties related to internal reconfiguration (Sect. 6.4) could also have a major effect on the type of process selected.

6.7 HEAVY-HAUL AND BARGE-BASED TRANSPORTATION

Methods and responsibilities for the maintenance and storage of site-specific special equipment, such as barges and heavy-haul trucks (if used), are currently undefined. It was assumed for this study, that site-specific equipment will be serviced at the point of use and not at the CMF. Thus, this issue did not bear significantly on the physical design of the CMF.

The CMF designers and planners should be involved in decisions concerning the use of, and the responsibility for, site-specific equipment. The ramifications of increased off-site functional requirements will have important implications in the advanced stages of the facility design and operations planning.

6.8 CHARACTERISTICS OF THE CASK FLEET

The size and makeup of the transportation operation system cask fleet will remain an uncertainty for the foreseeable future. The feasibility study is based on a total operating fleet of 75 casks as derived from current studies. Obviously, significant changes in the fleet size and configuration will potentially result in changes in the CMF size and design. Consequently, the CMF designers and planners should be kept abreast of changes in the cask fleet size and configuration projections.

6.9 PROVISIONS FOR EMERGENCY RESPONSE

This study was based on the assumption that CMF personnel may be required on request to provide expert advice and quality assurance consultation at (1) emergencies involving shipping cask systems occurring on in-transit casks or vehicles, (2) resolving vehicle accidents, and (3) repairing damage to cask systems occurring at reactor or unloading sites. It was additionally assumed that the CMF would not accept loaded casks or casks containing other than trace amounts of spent fuel. Consequently, the design of the facility does not specify special field service equipment, such as mobile decontamination facilities or maintenance machinery. Neither does it provide facilities or equipment qualified to handle spent fuel.

A basis for assigning specific emergency response responsibilities to all the facilities within the TOS needs to be developed. Of particular importance is the issue of handling and disposition of damaged casks containing spent fuel.

6.10 NON-STANDARD CASKS

The TOS does not have a specified envelope for cask designs. Although unlikely, this opens the possibility for casks with features which could complicate CMF operations. For example, the reference casks used in the feasibility study design are all approximately 18 ft long; radically different lengths may require special adapters or handling procedures.

Envelope dimensions for future cask designs could be established for the transportation operations systems. Such specifications would enable cask designers to provide for adapters and fixtures to incorporate non-standard casks into the transportation system.

6.11 FACILITY OPERATIONAL DATE

The schedule for the start-up, and phasing to full operation of the CMF remains uncertain. The specific dates for these activities are required to establish the design and fabrication schedule in the near term. Special start-up procedures may also be critical for the determination of the method of accomplishment to be used.

A start-up scenario should be established prior to the beginning of the conceptual design. This will permit the design team to incorporate provisions for phased construction and the management team to provide for special operations. Most importantly, it will insure that the CMF is constructed on time at the minimum cost.

7. METHOD OF ACCOMPLISHMENT

7.1 GENERAL

The CMF as presented in this feasibility study would be a stand-alone facility built on a "green field" site. Since the site has not been designated, it is assumed to be separate from existing or planned DOE operations. Consequently, the project would be basically a field operation requiring extensive contractor participation from early pre-conceptual activities through the start of operations. It is assumed that the pre-conceptual studies, conceptual design, design, and construction of the CMF be accomplished by the United States Department of Energy (DOE) and qualified firms or agencies working under one or more fixed-price prime contracts (FPPC), unless specified otherwise. To the extent feasible, all studies, design, procurement, and construction would be awarded on the basis of competitive bids. Following is the assumed division of responsibilities and work.

7.2 UNITED STATES DEPARTMENT OF ENERGY (DOE)

DOE, in keeping with its primary responsibility for overall project management, will coordinate all activities related to pre-conceptual studies, conceptual design, design, and construction of the CMF. In addition, DOE will: (1) prepare or arrange for the preparation of all criteria for studies, conceptual design, and design; (2) review and approve all pre-conceptual, conceptual design, and Title I, II, and III engineering documents; and, (3) administer all prime contracts. All participants will be under prime contract to DOE; and DOE will direct all aspects of the project, including specific approval of work assignments to participants and approval of work performed.

7.3 OPERATING CONTRACTOR

The operating contractor will be selected no later than the start of the project planning and pre-design phase and will perform the functions listed in DOE 4700.1, Chapter V, Part A.3.g, as assigned by DOE. This includes preparation of the design criteria for Title I and II Design and the procurement of process, specialized, and long lead-time equipment. In addition, the operating contractor will prepare the project transition plan (DOE 4700.1, Chapter II, Part H.2.b.), all required transition procedures, and all facility operating procedures. The operating contractor will also be responsible for site security during construction and for all training of operating personnel in preparation for facility startup and operation.

7.4 CONSTRUCTION MANAGEMENT CONTRACTOR (CMC)

A FPPC construction management contractor (CMC) will be employed by DOE at the start of the planning and pre-design phase and will perform the functions listed in DOE 4700.1, Attachment V-2, Item 4, as assigned by DOE. This includes subcontracting with DOEs approval for all regular procurement and construction work, including such general items as temporary utilities, field construction facilities, debris removal, general safety and environmental requirements, and other similar project requirements not provided for in bid packages.

7.5 ARCHITECT-ENGINEERS (A-Es) AND CONSULTANTS

One or more A-Es and, where appropriate, specially qualified consultants will perform the pre-conceptual studies, conceptual design, and Titles I and II design, including preparation of all final working drawings, specifications, estimates, and contract documents for the construction and/or installation of land improvements, outside utilities, new buildings, building additions and modifications, special facilities, and other structures. The assigned A-E will also provide Title III services, including: inspection activities relating to construction, checking and approval of shop drawings and construction contractor's field drawings, and preparation of record drawings that incorporate approved field changes.

7.6 FIXED PRICE SUBCONTRACTORS (FPSCs)

FPSCs contracted by the CMC, with DOE approval, will perform all regular procurement and all construction and installation work, including temporary field facilities, transportation and utility services, tie-ins to utility distribution systems, and general services required in support of construction.

8. PROJECT SCHEDULE

Three factors must be established before a definitive schedule can be developed for the CMF. They are: (1) the required start of CMF operations; (2) the CMF site location; and (3) the form of management to be used to design, construct and operate the facility (i.e., the method of accomplishment). It is possible, though, to develop a generic schedule suitable for planning purposes until these factors are established. An estimated generic schedule, called the base schedule developed during the feasibility study, is shown in Fig. 8.1. The base schedule can be adjusted in a linear fashion for any other assumed start date. The activities and their estimated duration are listed in Table 8.1.

Table 8.1 also shows schedule savings which might be achieved by acceleration of the CMF system acquisition activities. These savings could be effected at a moderate level of programmatic risk for both cost over-run and/or schedule slippage.

The base schedule has been developed in conjunction with the proposed method of accomplishment given in Sect. 7.0 and uses a foundation of wide experience on similar construction projects. Once the CMF site has been designated, the projected duration of the overall base schedule is 101 months from the start of the preparation of design criteria for conceptual design until the completion of construction. Another nine months is estimated to be required for the cold startup that is to be accomplished, giving a total of 110 months before the start of operation. The total time between the start of preparation of design criteria for conceptual design and start of operation under the moderate risk scenario is estimated to be 100 months.

Both the base schedule and the moderate risk accelerated schedule have been estimated by a team of engineers experienced with actual DOE construction projects. That actual experience reflects the requirements imposed upon the DOE by its own internal regulations and Federally imposed restrictions and laws. Both schedules reflect the assumption that OCRWM budget approval for construction projects is not directly tied to the Congressional line-item budget approval cycle imposed upon other DOE sponsored programs.

No attempt has been made to quantify the additional costs associated with the accelerated schedule as shown. It is felt that the cost increase associated with the moderate risk accelerated schedule should not exceed 10% of those costs derived for acquisition under the conservative schedule.

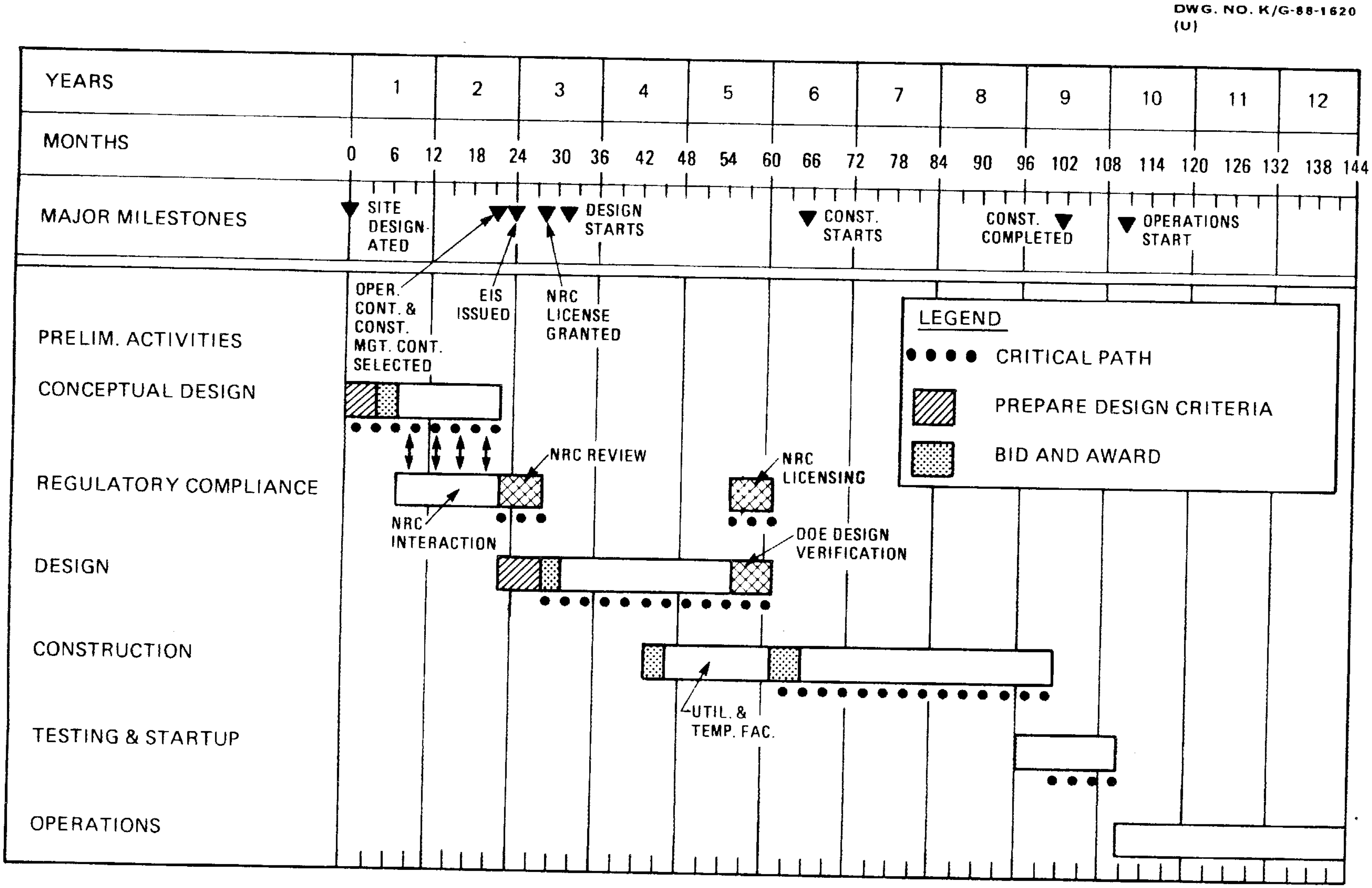


Fig. 8.1 Estimated CMF project schedule - base case.

Table 8.1 Estimated CMF project schedule
Duration by Phase in Months

Phase	Activity Duration	Base Schedule: Incremental	Base Schedule: Cumulative	Savings Under Moderate Risk
Conceptual design:	22	22	22	-2
Prepare design criteria	4			
Bid and award contract	3			
Conceptual design	15			
Regulation compliance:	21	6	28	-1
NRC interaction	15[a]			
NRC review	6			
Titles I and II Design:	39	33	61	-3
Prepare design criteria	6[a]			
Bid and award contract	3			
Title I & II design	24			
DOE design verification and NRC Licensing	6			
Construction:	57	40	101	-3
Utilities & temp. facilities				
Bid and award contract	3[a]			
Const./install	14[a]			
Permanent facilities				
Bid and award contract	4			
Construction	36			
Testing and startup:	15	9	110	-1
Acceptance testing	6[a]			
Integrated testing\cold startup	9			
		110		-10

Total time for moderate risk schedule: 100 months

[a]Overlaps with preceding phase.

It should be noted, also, that there is only limited experience with NRC licensing of this type of facility. It has been assumed that only six months will be needed following conceptual design for NRC review and licensing, but this could change. Variations in actual experience from the assumed six months may have a direct impact on the overall schedule duration. Also, if the CMF is collocated with or integrated into the MRS, the CMF licensing might be part of the MRS licensing action.

There will also be constraints to project schedule due to the multiple interfaces with TOS and the overall FWMS. These constraints can be satisfied through effective planning and coordination as the project baseline schedule is finalized.

8.1 PRELIMINARY PROJECT ACTIVITIES

Site specific conceptual design can begin anytime after the site is designated. A number of preliminary studies were identified during the CMF feasibility study which should be accomplished before the start of definitive design. Two of these that should be completed before the start of conceptual design are:

1. a study to assess the licensing and siting requirements that will be imposed upon a CMF and to determine the life cycle costs associated with the various licensing and siting options, and

2. further evaluation of the dry concept to permit a detailed trade-off analysis of the "wet" vs "dry" modes of operation for a cask maintenance facility. This study should also include a comparative analysis of personnel radiation exposure for the two concepts.

Additional studies for compiling and documenting existing information and experience on procedures and methods for decontaminating cask systems and physically testing the cask systems and their components, would also be very useful prior to conceptual design. This information will eventually be required for effective, definitive, Title I and II design, and for use by the operating contractor in preparing the procedures needed for training personnel and the eventual start-up and operation of the facility. Therefore, it is recommended that the studies be completed prior to initiating conceptual design.

It is assumed for the proposed schedule that the required preliminary studies will have been completed before the start of conceptual design.

8.2 CONCEPTUAL DESIGN

Conceptual design is estimated to require twenty-two months, including four months for preparing the conceptual design criteria and three months to bid and award the contract. Other activities that will be in progress during this time include (1) the environmental analyses and documentation and (2) assessments for safety, quality assurance, risk management, integrated testing, and security. The results of the analyses and assessments will be incorporated into the conceptual design report. The Environmental Impact Statement (EIS), if required, should be completed about two years after the site is designated. Assuming conceptual design starts shortly after site designation, the EIS would be issued within two months of the completion of conceptual design. Activities for selecting an operating contractor and a construction management contractor should also be accomplished during conceptual design.

Under the moderate risk schedule, conceptual design could be shortened by approximately two months.

8.3 REGULATORY COMPLIANCE

Regulatory compliance covers all efforts to meet federal, state, or local requirements applicable to the CMF. Plans for activities to be accomplished during this phase should be developed during the licensing and siting study discussed in Sect. 8.1. Of prime concern is fulfilling NRC licensing requirements. A key assumption is that the NRC licensing will be based upon the Conceptual Design; hence, interaction with the NRC early in the program will be critical for success. It is assumed, therefore, that interaction with the NRC will begin during the Preliminary Project Activities phase (Sect. 8.1) and will continue through conceptual design. Then after conceptual design is complete, the NRC will need another six months to review and approve the conceptual design. Environmental documentation requirements will also be fulfilled during this time. Studies should be completed of all federal, state, and local requirements for permits to construct and operate the facility so that plans can be made for their timely acquisition.

Under the moderate risk schedule, the incremental time required for achieving regulatory compliance approval could be shortened by approximately one month.

8.4 TITLES I AND II DESIGN

As soon as conceptual design is complete, work should be initiated on the preparation of design criteria for Title I and II design. The total design phase, from the preparation of criteria through DOE verification of design and NRC licensing, should require thirty-nine months. The first six months, during which the design criteria will be prepared, will overlap the NRC review following conceptual design. In addition to the preparation of the design criteria during this time, work should also be initiated on a project management plan. Ideally, the operating contractor and construction management contractor will be selected by the start of the design phase and will participate in these activities. It is recommended that the operating contractor prepare the design criteria and the construction management contractor prepare the project management plan. The operating contractor would also support the design review process and the preparation of the final safety analysis report (FSAR), perform any advance or special procurement, and prepare a project transition plan. The construction management contractor would perform the constructability review of design and would initiate any needed preliminary construction activities, such as providing utilities and any required temporary facilities at the construction site.

Under the moderate risk schedule, the incremental time required for Titles I and II design could be reduced by approximately three months.

8.5 CONSTRUCTION

About halfway through Titles I and II Design, the construction management contractor will begin the bid and award process for construction and installation of utility and transportation services to the site and any required temporary facilities. As soon as DOE completes the verification of design, the contracting process for the CMF proper will be initiated. Construction of the CMF proper is estimated to require forty months, including the initial bid and award period. During this time, the operating contractor will be involved in several activities required to assure the successful start of operations. These include:

(1) acquisition of all required operating permits and licenses from local, state and federal regulatory agencies;
(2) preparation of operating policies and procedures;
(3) recruitment, selection, and training of employees; and,
(4) procurement of operating inventories including spare parts required for cask and vehicle maintenance.

Project related activities will include:

(1) follow-up support for advance or special procurement;
(2) technical support of construction activities, as needed;
(3) preparation of operating safety requirements;
(4) implementation of the project transition plan;
(5) support of preoperational and acceptance testing; and,
(6) preparation of as-built drawings.

Under the moderate risk schedule, the incremental time required for the CMF construction could be reduced by approximately three months.

8.6 TESTING AND STARTUP

Acceptance testing will overlap the end of the construction period by six months. When construction is complete, another nine months is estimated to be required for integrated testing of all system and a "cold" startup, which will involve the use of uncontaminated casks.

Under the moderate risk schedule, the incremental time required for the CMF testing and startup would be decreased by one month.

9. COST ESTIMATE SUMMARY

An estimate of the cost for designing and building the CMF was developed based on (1) the system requirements and outline description of the facility contained in Sects. 2 through 4, (2) the proposed method of accomplishment in Sect. 7, and (3) the assumed project base schedule in Sect. 8. The cost was first estimated in constant FY 1989 dollars and then escalated over the project cycle to determine the effect of inflation. For purposes of this analysis, the following escalation rates were used: 5.0% for FY 1990 and 1991; and, 5.5% thereafter.

The total estimated cost for designing and building the CMF in constant FY 1989 dollars is $83 million. Escalated over the project cycle assuming the start of operations would be in the first quarter of FY 2003 this becomes $143 million.

The estimate was developed using two basic categories - preliminary project activities (normally funded from expense budgets) and capital project activities. Traditionally, project activities beginning with Titles I and II Design through the completion of construction are funded from capital budgets. The breakdown of the two categories is as follows:

	Cost ($ x 1000)	
	FY 1989	Escalated
Preliminary (Expense) Activities	$ 8,000	$ 10,400
Capital Project Activities	75,000	132,600
Total	$83,000	$143,000

It should be noted that there is no allowance for preoperational activities in the above cost except for selection of the operating contractor, which was assumed to occur during the conceptual design phase. Major preoperational activities that would run concurrent with the capital project, but which are not in the CMF cost estimate include:

- startup and operation planning,
- acquisition of operating permits and licenses,
- preparation of operating safety requirements,
- preparation of operating policies and procedures,
- personnel recruitment, selection and training,
- procurement of operating inventories and spare parts, and
- startup support.

9.1 PRELIMINARY PROJECT ACTIVITIES COST ESTIMATE

A summary of the estimated schedule and cost of preliminary CMF project activities is presented in Table 9.1. Estimates of preliminary project costs made during a feasibility study are normally developed using a set of factors based on experience with similar projects. Usually the factors range between 4 to 10% of the estimated capital cost of the project and can run even higher for complex, state-of-the-art projects. The estimate for preliminary CMF project activities fall within the normal range, including a 25% allowance for contingency. The allowance for contingency is considered appropriate not because of complexity, but due to the atypical characteristics of the CMF as a "green field", one-of-a-kind facility.

9.2 CAPITAL PROJECT ACTIVITIES COST ESTIMATE

A summary of the estimated capital project costs in constant FY 1989 dollars is presented in Table 9.2. More detailed summaries, including the escalated cost, are given in Appendix F. The complete detailed estimate in both constant FY 1989 dollars and escalated dollars is available as a separate document. Following is an outline of the assumptions or bases used in developing the estimate of capital costs.

9.2.1 General Assumptions

The stand-alone facility described in Sect. 4 will be constructed on a "green field" site. Construction will be strictly a field operation and all support will have to be made available at the site. Engineering and support activities included in the capital cost are based on current guidance available from the DOE Independent Cost Estimating (ICE) group.

9.2.2 Engineering

The Engineering Cost shown in Table 9.2 is for Titles I and II Design services and Title III Inspection services. It is assumed that these services will be performed by an architect-engineer (A-E) under a fixed price prime contract to DOE. Engineering cost is estimated to be 15% of combined total construction costs (without construction management) plus the cost utility and transportation services to the site.

Table 9.1 CMF Preliminary Project Activities Estimated Schedule and Cost

		Cost ($ x 1000)	
	Schedule*	FY 1989	Escalated*
Preconceptual			
Feasibility Study	3/88 - 3/89	500	500
Feasibility Followup Studies -	10/89 - 9/93	500	555
Site Criteria and Selection	10/91 - 9/93	500	600
Subtotal Preconceptual		1500	1655
Conceptual Design**	10/93 - 10/95	2850	3850
NRC Liaison	5/94 - 2/96	200	275
Major Contractor Selection	1/94 - 6/95	450	605
Project Planning	7/95 - 2/96	600	850
Project Coordination and Integration	3/88 - 2/96	840	1085
Contingency	3/88 - 2/96	1560	2080
Total Preliminary (Expense Funded) Project Activities	3/88 - 2/96	8000	10400

* Schedule and escalated cost are based on the assumption that the project site is selected no later than September, 1993.

** Conceptual design phase includes site characterization, environmental documentation, preliminary safety analysis report and the initial readiness review.

Table 9.2 CMF Summary Capital Cost Estimate
By Participant
(Constant FY 1989 $ in thousands)

	OC	A-E	FPSCs	CMC	DOE	Total
I. Engineering		6400				6400
II. Land and land rights					1000	1000
III. Utility and transportation Services to site			1300			1300
IV. Construction						
A. Improvements to land			4500			4500
B. Buildings			12800			12800
C. Outside utilities			2900			2900
D. Equipment			20900			20900
E. Construction mgt.			400	4300		4700
Subtotal Construction			41500	4300		45800
V. Project Integration and Support	4100 [a]				1400	5500
Total w/o Contingency	4100	6400	42800	4300	2400	60000
VI. Contingency	1000	1600	10700	1100	600	15000
Grand Total	5100	8000	53500	5400	3000	75000

Legend: DOE - U. S. Department of Energy
OC - Operating Contractor
A-E - Architect Engineer
CMC - Construction Management Contractor
FPSCs - Fixed Priced Subcontractors

[a] Includes $1,400,000 for site security during construction.

9.2.3 Land and Land Rights

Land for the CMF site will be acquired by DOE. The site will be composed of 20 acres of secured area, 5 acres of railroad right-of-way, and a 75 acre buffer zone. The cost per acre is assumed to be $10,000.

9.2.4 Utility and Transportation Services to the Site

It is assumed the land will be adjacent to a public road and that a railroad and all required utilities will be within one-half mile. The facility will bear the cost of improving the road for heavy truck traffic. DOE will acquire right-of-way for access to the railroad and pay for the track connecting the facility to the railroad. Right-of-way for utility services will be granted along the road or railroad right-of-way.

9.2.5 Construction

Construction costs are based on constructing the facility described in Sect. 4. The construction categories listed are those normally used by DOE. All technology required for constructing the facility and fabricating the equipment already exists. Construction management will be performed by a fixed priced prime contractor to DOE. All construction, installation, and fabrication will be by fixed price subcontractors to the CMC with DOE approval. However, special or advance procurement, if required, will be the responsibility of the operating contractor. All such procurement contracts will also be approved by DOE.

It is assumed that construction management contractor (CMC) responsibilities will include overall project reporting. Construction management cost is estimated to be 10% of the construction cost including utility and transportation services to the site. In addition, there is an allowance of $400,000 for temporary facilities.

9.2.6 Project Integration and Support

Project integration and support includes all coordination and technical support activities. It will be performed by DOE with the support of the operating contractor as assigned. Specialized consultants may also be used. Operating contractor support is expected to include, as a minimum, design review and technical support for the A-E, preparation of the project transition plan, liaison with regulatory agencies and other components of the TOS, preparation of the final safety analysis report (FSAR), and site security during the construction project. The total project integration and support costs minus site security were estimated to be about 7.5% of all other costs excluding contingency.

9.2.7 Contingency

An allowance of 25% was made for contingency because the project is still in the preconceptual phase. Though practically all of the required technology exists, further project definition is needed before the contingency is reduced.

The uncertainties associated with some of the estimated contingency are discussed in Sect. 6. It is assumed that most of the uncertainties will be resolved without significant cost increases. Particularly important uncertainties are listed below:

1. Site selection (Sect. 6.1) involves a wide range of cost factors. Notable items include the purchase of land ($1m) and the assumption that utilities will be readily available.

2. Facility licensing (Sect. 6.2.1) could affect the basic design of the building by requiring increased safeguards or containment features. In addition, more complicated or restrictive operating requirements could lead to higher capital costs for more space or equipment.

3. Configuration and design of the cask fleet (Sects. 6.3, 6.4, 6.8, and 6.10) will have an obvious impact on the size and configuration of the facility. Areas of potential concern are casks which require special handling tools, a fleet radically different in size from the assumed 75 casks, and basket reconfigurations which either require significantly more or less changeouts than the facility is currently designed for (50 per year).

4. A change from a pool to a dry cell based processing operation will, according to comparative evaluation studies (Allen, G. C. 1980, Lambert, R. W. 1981) increase the overall cost of the process building (see Sect. 6.6).

5. Inclusion of presently unassigned TOS management functions to the CMF will increase the cost of the facility by requiring more administrative space (see Sect. 6.5).

9.3 "GREEN FIELD" VERSUS COLLOCATED FACILITY COST ANALYSIS

An analysis was made of the potential savings in capital project costs that could result from collocation of the CMF with an existing facility rather than putting it on a relatively distant (or independent) "green field" site. Two different collocation arrangements were considered. One was for a CMF physically adjacent to an existing facility and the other was for a CMF located within the perimeter (shared site, same fence) of an existing facility. To make the analysis, a breakdown of the major components of the "green field" (GF) facility was used as the baseline, and an estimate was made of the amount of each GF component (0 to 100%) that would still be required if the CMF were collocated. Table 9.3 gives the results of the analysis. It appears, based on this cursory evaluation, that an appreciable savings - approximately 10% - will occur only in the case where the CMF shares the same site with an existing facility.

9.4 "GREEN FIELD" VERSUS INTEGRATED FACILITY COST ANALYSIS

No attempt was made to estimate the savings that might result from integrating CMF functions with those of an existing facility. While this arrangement will most likely produce the greatest possible savings, a meaningful evaluation will require development of an extensive set of assumptions to determine the most appropriate facility for integration with the CMF and the degree of integration to be achieved. Having made these two basic assumptions, a detailed functional analysis of both facilities would have to be made. Such an analysis is beyond the budgeted scope of this feasibility study. However, the "green field" CMF cost estimate has been developed in sufficient detail to permit future analysis of this possibility.

Table 9.3 Cost Analysis of "Green Field" vs Collocated CMF
(Constant FY 1989 $ x 1000)

	"Green Field"(GF) (Stand Alone)		Collocated			
			Adjacent But Separate		Shared Site, Same Fence	
	Used	Detailed		% GF		% GF
Land	1,000	1,000	1,000	100	0	0
Util & Transport Services to Site	1,300	1,298	649	50	0	0
Improvements to Land	4,500	4,543	4,543	100	4,003	88
Fencing		(*150*)	(*150*)	100	(*0*)	0
Roads & Parking on Site		(*1,559*)	(*1,559*)	100	(*1,169*)	75
Site Development		(*2,834*)	(*2,834*)	100	(*2,834*)	100
Buildings	12,800	12,793	12,793	100	12,625	99
Process		(*10,172*)	(*10,172*)	100	(*10,172*)	100
Administration		(*744*)	(*744*)	100	(*744*)	100
Inspection & Bead Blasting		(*1,709*)	(*1,709*)	100	(*1,709*)	100
Guard Portal		(*168*)	(*168*)	100	(*0*)	0
Equipment	20,900	20,892	20,337	97	20,129	96
Process		(*10,654*)	(*10,654*)	100	(*10,654*)	100
Data Base System		(*1,760*)	(*1,320*)	75	(*1,320*)	75
Chem Processing		(*6,980*)	(*6,980*)	100	(*6,980*)	100
Veh. Insp. & Bead Blasting		(*852*)	(*852*)	100	(*852*)	100
R R Yard Engine & Plant Vehicles		(*646*)	(*531*)	82	(*323*)	50
Utilities	2,900	2,871	2,800	98	2,386	83
Storm Drains & Sewers		(*172*)	(*172*)	100	(*172*)	100
Area Lighting		(*305*)	(*305*)	100	(*228*)	75
Telecom. Lines		(*674*)	(*674*)	100	(*674*)	100
Cathodic Protection		(*22*)	(*22*)	100	(*22*)	100
Gasoline Station		(*44*)	(*0*)	0	(*0*)	0
Instr. (diesel, gas tanks)		(*54*)	(*27*)	50	(*27*)	50
Diesel Tank for Generator		(*20*)	(*20*)	100	(*20*)	100
Fire Water Distribution		(*209*)	(*209*)	100	(*209*)	100
Fire Water Tank & Accessories		(*337*)	(*337*)	100	(*0*)	0
Natural Gas Line		(*18*)	(*18*)	100	(*18*)	100
Railroad		(*1,016*)	(*1,016*)	100	(*1,016*)	100
Subtotal	43,400	43,397	42,122	97	39,143	90
Const. Mgt. - 10% Const., Util. & TF	4,300	4,280	4,112	96	3,914	92
- Temp. Facility (TF)	400	400	100	25	100	25
Engineering - 15% Const., Util. & TF	6,400	6,420	6,168	96	5,886	92
Proj. Int. & Sup. - DOE Mgt. 2.5%	1,400	1,363	1,312	96	1,226	90
- Op. Cont. 5.0%	2,700	2,725	2,625	96	2,452	90
- Const. Site Security	1,400	1,331	1,331	100	555	42
Subtotal w/o Contingency	60,000	59,916	57,770	96	53,276	89
Contingency - 25% of above	15,000	14,978	14,443	96	13,319	89
Total Estimated Cost (TEC)	75,000	74,894	72,213	96	66,595	89

10. DESIGN CODES AND STANDARDS

The impact of the following standards on design is unknown at this time. However, these standards and codes must be addressed during the design phase. Additional laws and regulations are specifically cited throughout the study and are therefore not repeated here. Most notably, Sect. 5.0 outlines important quality and environmental standards which will be applied to the facility.

ACI Building Code Requirements for Reinforced Concrete
ASIC Specifications and Standards
AMCA Standards
Uniform Building Code
American National Standards Institute
American Welding Society Standards
American National Standards
ASTM Standards
Illuminating Engineering Society
Institute of Electrical and Electronics Engineers' Standard
National Plumbing Code
National Electrical Code
National Electrical Manufacturer's Association
National Fire Protection Association, National Fire Codes
Occupational Health and Safety Standards
American Society of Heating, Refrigerating and Air Conditioning
    Engineer's (ASHRAE) Handbook of Fundamentals
ASHRAE Guide and Data Book - Applications
ASHRAE Guide and Data Book - Equipment
ASHRAE Handbook - Systems
Industrial Ventilation - American Conference of Governmental
    Industrial Hygienists
Air Moving and Conditioning Association (AMCA) Standards Handbook
    - Publication 99
AMCA Fans and Systems - Publication 201
AMCA Directory - Publication 261
Sheet Metal and Air Conditioning Contractor's National Association
    (SMACNA) High Velocity Duct Construction Standards
SMACNA Low Velocity Ducted Construction Standards
AMACNA Ducted Electric Heat Guide for Air Handling Systems

Air Conditioning and Ventilating Systems - National Fire Protection Association (NFPC) No. 90A

Blower and Exhaust Systems - NFPA No. 91

National Electric Code - NFPA No. 70

Underwriters Laboratories, Inc. - List of approved Equipment

Factory Mutual Engineering Corporation - List of Approved Equipment

Nuclear Air Cleaning Handbook ERDA 76-21

SMACNA Standards

Southern Standard Building Code

Associated General Contractors (AGC) of America, Mixer Manufacturers' Bureau, Concrete Mixer Standards

National Bureau of Standards (NBS)

National Ready Mix Concrete Association, Truck Mixer and Agitator Standards of the Truck Mixer Manufacturer's Bureau

Steel Joist Institute

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Schneider, K. J. et al. 1987. Analysis of Radiation Doses from Operation of Postulated Commercial Spent Fuel Transportation Systems, Main Report. DOE-CH/TPO-001, Pacific Northwest Laboratory and DOE Chicago Operations Office.

11.1 REFERENCES (continued)

Shappert, L. B., et al. 1988. Transportation Operations Functions of the Federal Waste Management, ORNL TM-10811, ORO/TOP-5403.0.

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11.1 REFERENCES (Continued)

U. S. DEPARTMENT OF ENERGY ORDERS

4700.1 Project Management Systems

5631.1A Protection Program Operations

6430.1A General Design Criteria

CODE OF FEDERAL REGULATIONS

Title 10

Chapter I - Nuclear Regulatory Commission

Part 30 - Rules of general applicability to domestic licensing of by-product material.

Part 71 - Packaging and transportation of radioactive material.

Part 73 - Physical protection of plants and materials.

Chapter III - Department of Energy

Part 961 - Standard Contract for disposal of spent nuclear fuel and/or high level radioactive waste.

Chapter X - Department of Energy (General Provisions)

Title 49

Chapter I - Research and Special Programs, Administration, Department of Transportation.

Subchapter C - Hazardous Materials Regulations.

Part 173 - Shippers-general regulations for shipments and packaging.

Part 174 - Carriage by rail.

Part 177 - Carriage by public highway.

12. DRAWINGS

The drawings listed in Table 12.1 represent the basic design developed as part of the feasibility study. The fundamental aspects of facility design were emphasized: process material flow, space allowances, utility sizing and building configuration. Based on experience these elements have the most affect on the cost and layout of the facility. Thus, basic drawings were prepared to address each of these items.

Several areas of facility design were not developed. For example, personnel flow patterns were not analyzed for optimum layout, nor was the segregation of "hot" and "cold" shop facilities designed. These along with many site specific design options, such as railroad layout and utility access, will have to wait on the more detailed conceptual design effort to be resolved.

This section also includes some drawings which were used in the preparation of the study but are not part of the facility design. The two cask drawings and the two "dry" process drawings are provided only as background information for the narrative.

Table 12.1 List of drawings

NUMBER	DESCRIPTION
BUILDING DRAWINGS:	
C3E-12824-A001	CMF SITE PLAN
S3E-12824-B001	CMF PROCESS BUILDING MAIN FLOOR PLAN
S3E-12824-B002	CMF PROCESS BUILDING CROSS SECTION
S3E-12824-B003	VEHICLE CLEAN FACILITY MAIN FLOOR PLAN
FLOW DIAGRAMS:	
X3E-12824-030	FUNCTIONAL FLOW DIAGRAM

Table 12.1 List of drawings (continued)

FACILITY OPERATIONAL EQUIPMENT DRAWINGS:

X3E-12824-061	CASK EXTERNAL CLEANING BOOTH
X3E-12824-063	TEST STATIONS
X3E-12824-065	PROCESS POOL

ELECTRICAL:

E3E-12824-Z001	POWER DISTRIBUTION SYSTEM

INSTRUMENTATION AND CONTROLS:

I3E-12824-120	COMPUTER AND CONTROL SYSTEM BLOCK FLOW DIAGRAMS
I3E-12824-121	GENERAL PLANT MONITORING
I3E-12824-122	GENERAL FACILITY MONITORING INSTRUMENTATION
I3E-12824-123	PROCESS INSTRUMENTATION DIAGRAM - INTERNAL FLOW PROCESS
I3E-12824-124	PROCESS INSTRUMENTATION ZEOLITE COLUMN INSTRUMENTATION

PROCESS:

J3E-12824-100	POOL WATER TREATMENT SYSTEM
J3E-12824-101	EXTERNAL WASH WATER FLOW SHEET

Table 12.1 List of drawings (continued)

ENVIRONMENTAL CONTROL:

H3E-12824-G001	VEHICLE CLEAN FACILITY HVAC SCHEMATIC
H3E-12824-G002	PROCESS BUILDING HVAC SCHEMATIC

PIPING:

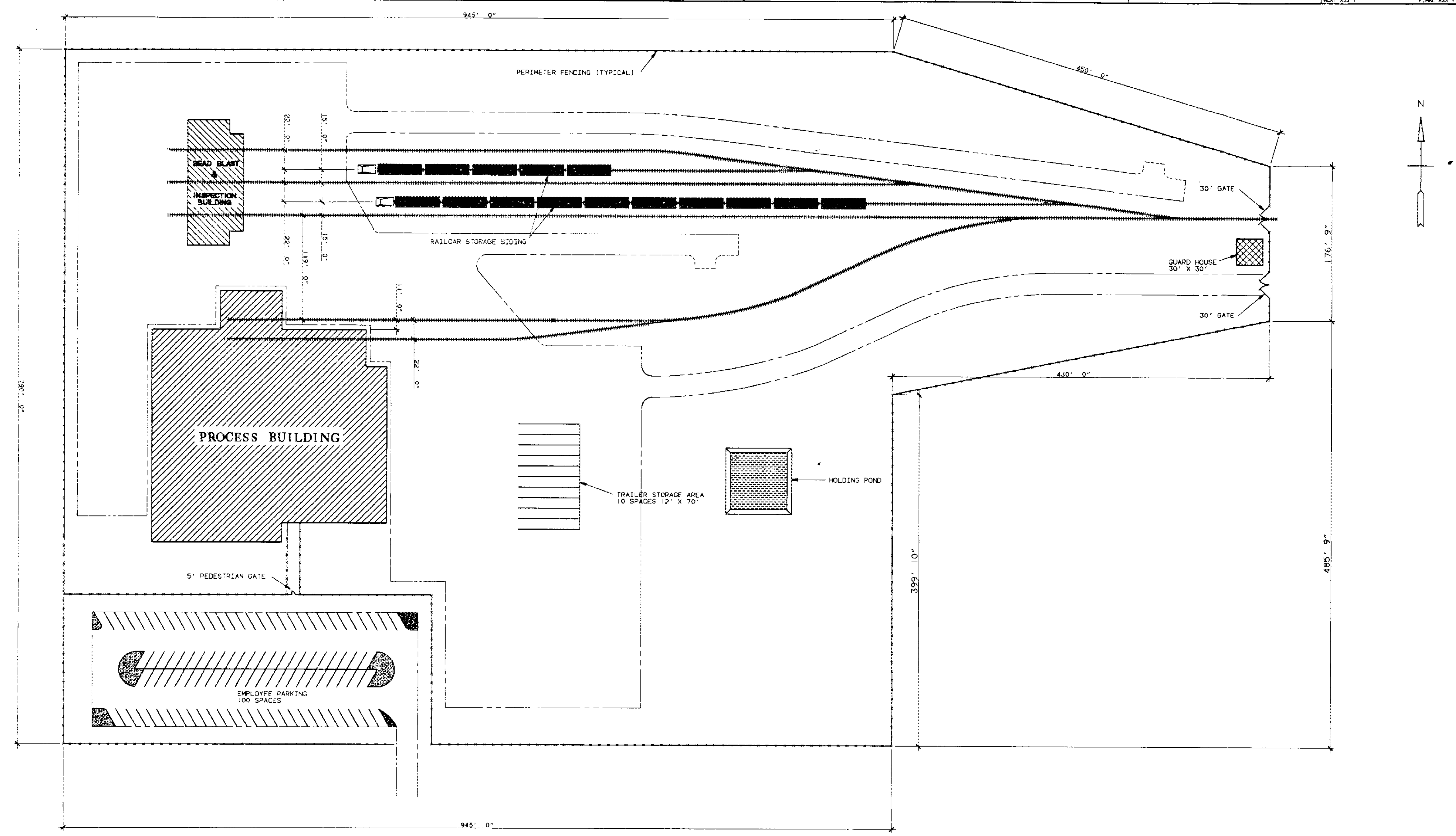
P3E-12824-C001	VEHICLE CLEAN FACILITY UTILITY PIPING SCHEMATIC
P3E-12824-C002	PROCESS BUILDING UTILITY PIPING PLAN
P3E-12824-C003	PROCESS BUILDING EQUIPMENT AND PIPING L/O

DRY PROCESS:

X3E-12824-059	CMF DRY PROCESS BUILDING
X3E-12824-011	DRY PROCESSING CELL

CASKS:

X3E-12824-053	MRS-RESPOSITORY SHIPPING CASK
X3E-12824-054	LEGAL WEIGHT CASK ON TRUCK



LEGEND

PROPOSED RAILROAD TRACK
PROPOSED ASPHALT
PROPOSED FENCE

TOTAL ACREAGE = 18.96

FACILITY PLAN

S C A L E 1" = 40'-0"

SECTION AND DETAIL KEY: NUMBER OF SECTION OR DETAIL; DRAWING ON WHICH SECTION OR DETAIL IS TAKEN; DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

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THIS DOCUMENT CONTROLLED BY
CHANGE CONTROL SYSTEM__________
ENGINEERING PROCEDURE__________

REV	DESCRIPTION (REVISION OR ISSUE PURPOSE)	BY
A	APPROVED FOR FEASIBILITY STUDY	
0	ISSUED FOR APPROVAL	RDL

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS X/XX
XX DECIMALS .XX
XXX DECIMALS .XXX
ANGLES XX° -XX'
BREAK SHARP EDGES MAX
FINISH RMS

DES	RA MILLER	09/10/88
DRW	DOUG LEGG	09/10/88
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		

DRAWING APPROVALS — DATE

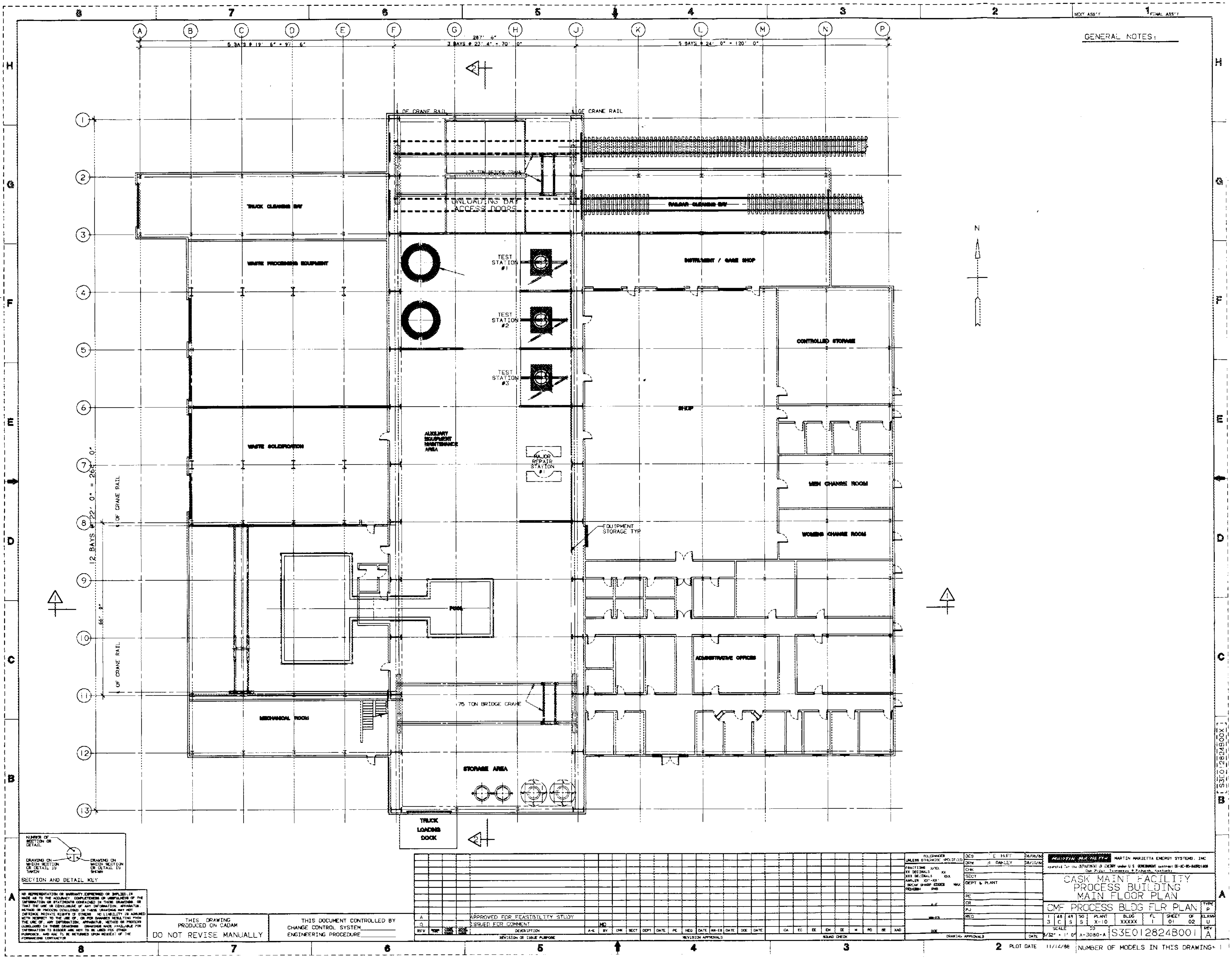
MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAINTAINCE FACILITY
SITE PLAN

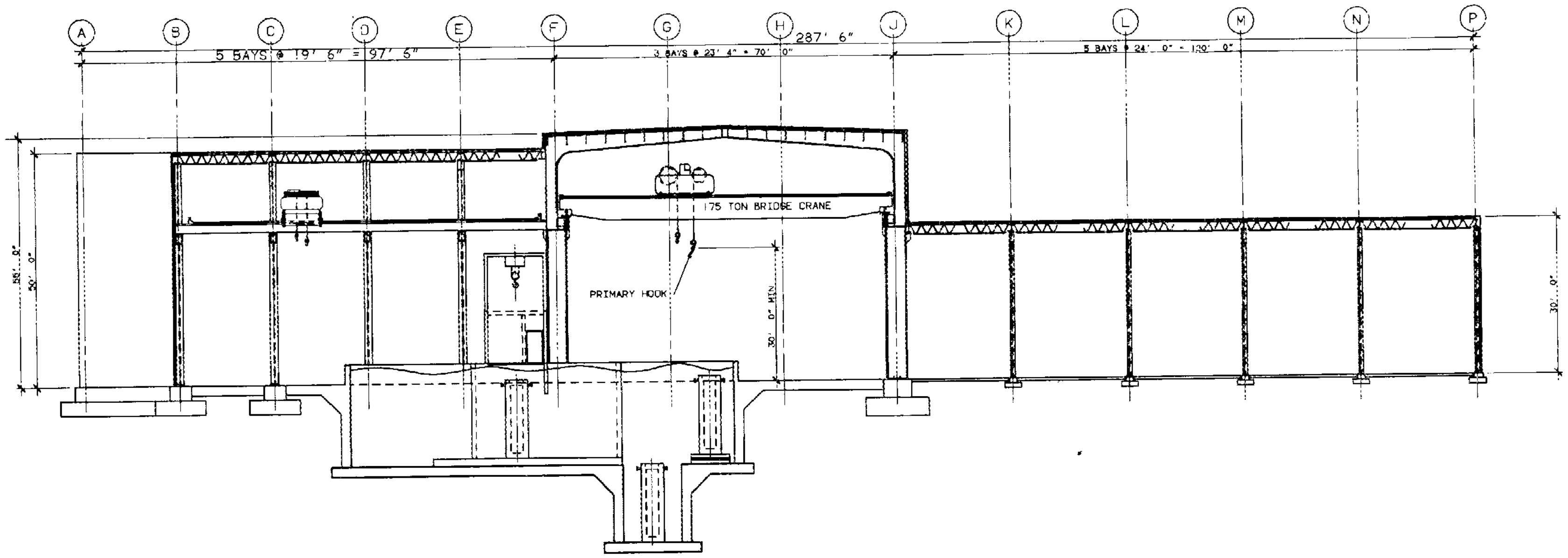
SITE PLAN

TYPE P | 1 3 | 48 C | 49 P | 50 T | PLANT ORNL | BLDG AREA | FL 0 | SHEET 01 OF 01 | CLASS U
SCALE NOTED | ID A0080 4A1 | C3E012824A001 | REV A

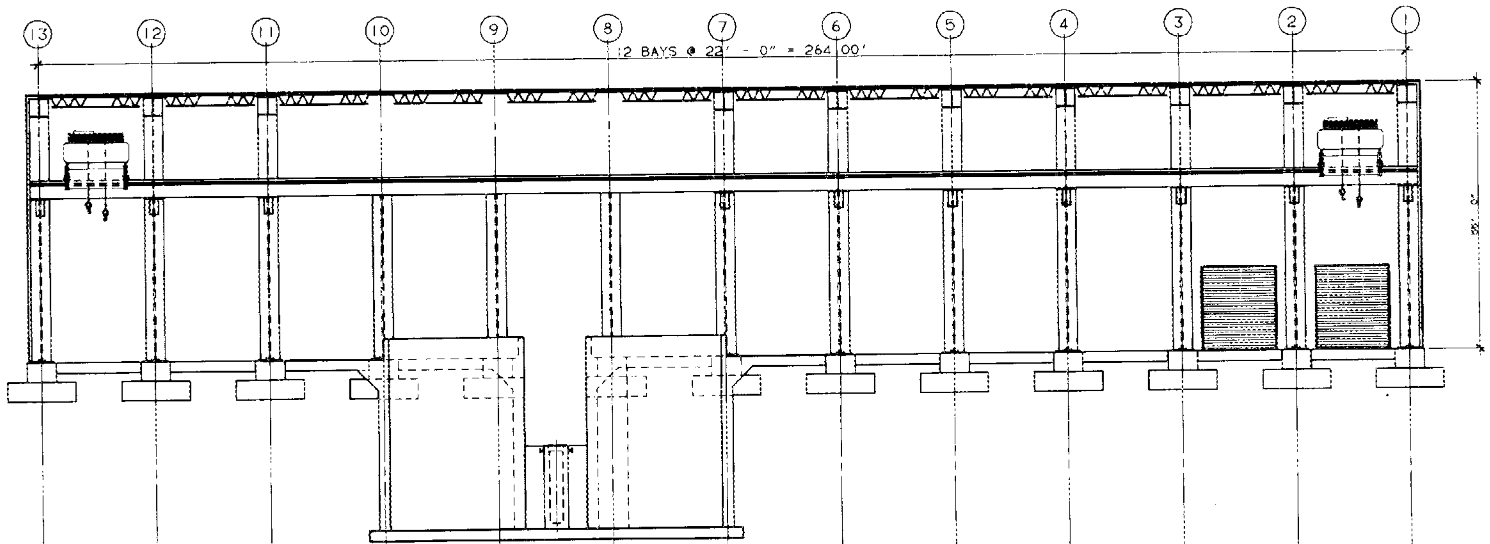
NUMBER OF MODELS IN THIS DRAWING= 2


GENERAL NOTES:
5 BAYS @ 19' 6" = 97' 6"
287' 4"
3 BAYS @ 23' 4" = 70' 0"
5 BAYS @ 24' 0" = 120' 0"
12 BAYS @ 22' 0" = 264' 0"
℄ OF CRANE RAIL
75 TON BRIDGE CRANE
UNLOADING BAY ACCESS DOORS
TRUCK CLEANING BAY
RAILCAR CLEANING BAY
WASTE PROCESSING EQUIPMENT
TEST STATION #1
TEST STATION #2
TEST STATION #3
INSTRUMENT / GAGE SHOP
CONTROLLED STORAGE
SHOP
WASTE SOLIDIFICATION
AUXILIARY EQUIPMENT MAINTENANCE AREA
MAJOR REPAIR STATION #1
MEN CHANGE ROOM
WOMENS CHANGE ROOM
EQUIPMENT STORAGE TYP
POOL
ADMINISTRATIVE OFFICES
MECHANICAL ROOM
STORAGE AREA
TRUCK LOADING DOCK
N
SECTION AND DETAIL KEY
THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY
THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM
ENGINEERING PROCEDURE
A APPROVED FOR FEASIBILITY STUDY
0 ISSUED FOR COMMENT
DES E. HUFT 08/06/86
DRW A. OAKLEY 08/10/86
MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky
CASK MAINT FACILITY
PROCESS BUILDING
MAIN FLOOR PLAN
CMF PROCESS BLDG FLR PLAN
PLANT X-10
BLDG XXXXX
FL 1
SHEET 01 OF 02
SCALE 3/32" = 1' 0"
A-3080-A
S3E012824B001
REV A
PLOT DATE 11/14/86
NUMBER OF MODELS IN THIS DRAWING= 1

GENERAL NOTES:



SECTION 1 B001 B002
SCALE 3/32" = 1'-0"



SECTION 2 B001 B002
SCALE 3/32" = 1'-0"

NUMBER OF SECTION OR DETAIL
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
SECTION AND DETAIL KEY

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REV				DESCRIPTION	A-E	BY	CHK	SECT	DEPT	DATE
A				APPROVED FOR FEASIBILITY STUDY						
0				XXX		XXX				

REVISION OR ISSUE PURPOSE — REVISION APPROVALS — SOUND CHECK

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ±X/XX
XX DECIMALS ±.XX
XXX DECIMALS ±.XXX
ANGLES ±XX°-XX'
BREAK SHARP EDGES MAX
FINISH RMS

DES	T E HUFF	10/03/86
DRW	M OAKLEY	10/10/86
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		

A-E
DOE
DRAWING APPROVALS — DATE

MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAINT FACILITY
PROCESS BUILDING
CROSS SECTION

CMF PROC BLDG CROSS SECT — TYPE P

1	46	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	C	S	S	X-10X	XXXXX	1	02	02	U

SCALE	ID		REV
3/32" = 1' 0	A-3080-A	S3E01282B002	A

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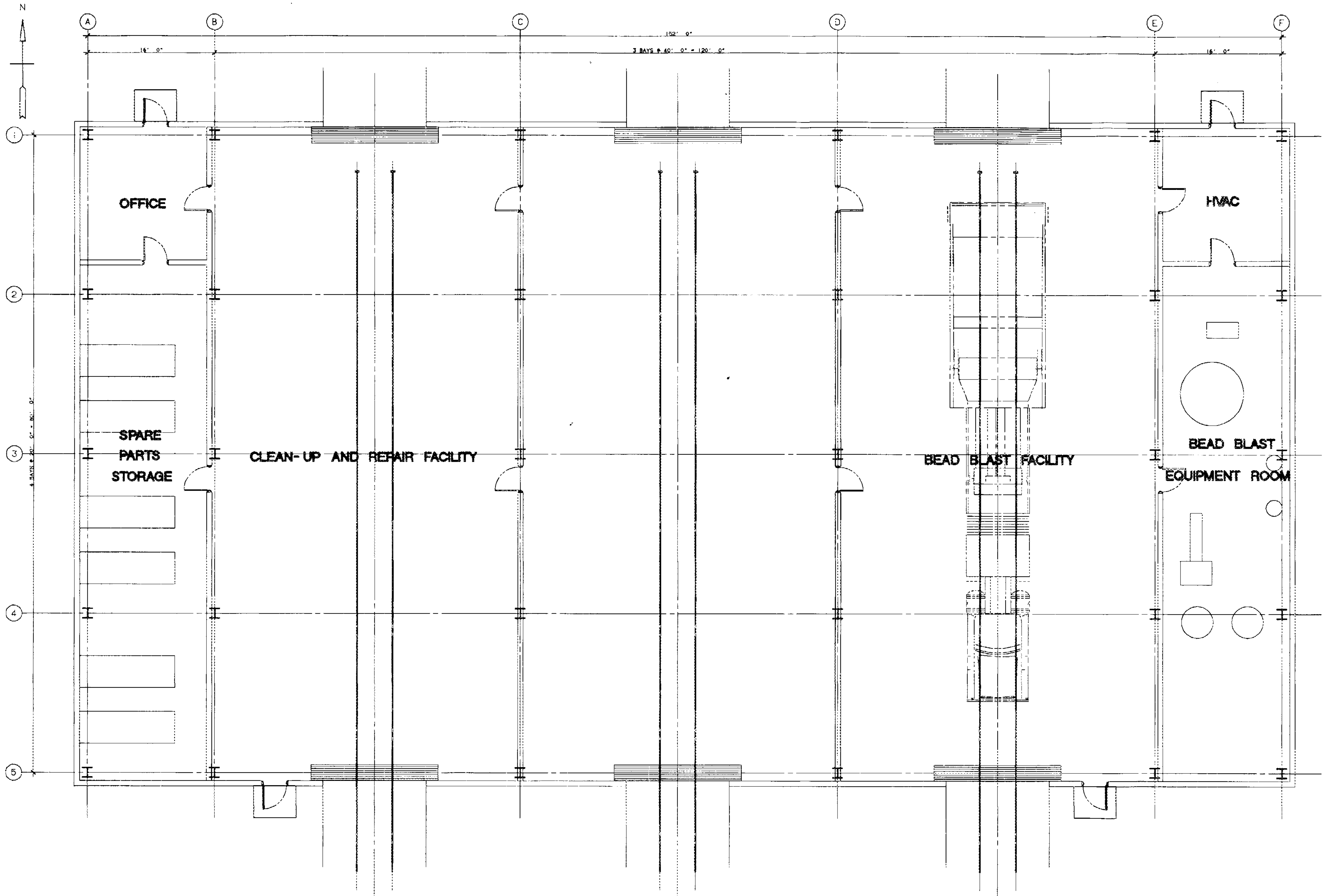

NUMBER OF SECTION OR DETAIL
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
SECTION AND DETAIL KEY

PLOT DATE 12/6/88

REV				DESCRIPTION		BY
0				ISSUED FOR APPROVAL		MQ
0				ISSUED FOR COMMENT		MQ

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THIS DOCUMENT CONTROLLED BY
CHANGE CONTROL SYSTEM________
ENGINEERING PROCEDURE________

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS X/XX
XX DECIMALS XX
XXX DECIMALS XXX
ANGLES XX°-XX'
BREAK SHARP EDGES MAX
FINISH RMS

A-E
MM-ES
DOE

DES	T E HUFF	08/15/88
DRW	M OAKLEY	08/15/88
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		
DRAWING APPROVALS		DATE

MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee & Paducah, Kentucky

CASK MAINT. FACILITY
VEHICLE MAINT & INSP FAC
FLOOR PLAN

CMF VEH MAINT & INSP FAC — TYPE P

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	C	S	S	X-10	XXXXX	1	01	01	U

SCALE	ID		REV
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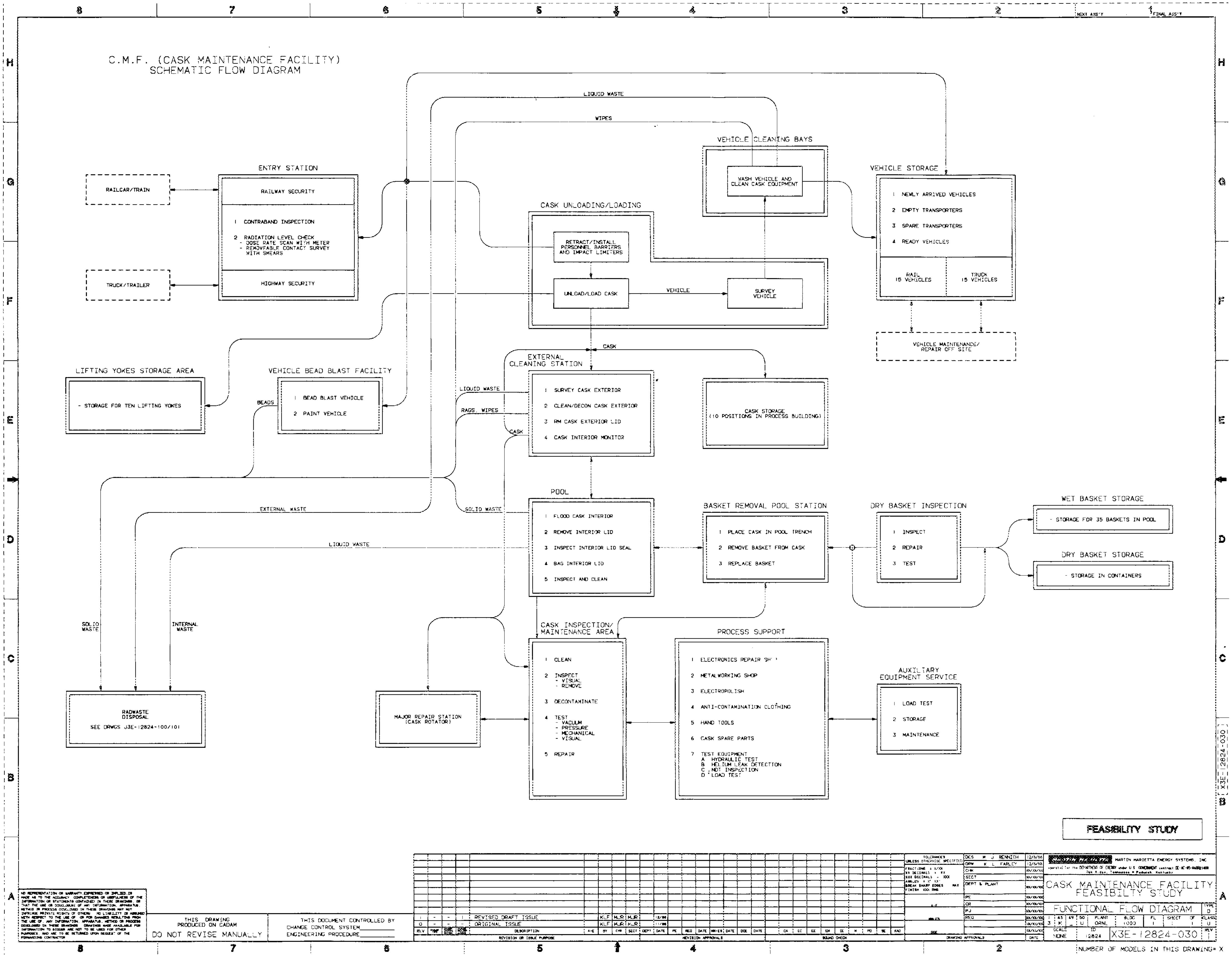
NUMBER OF MODELS IN THIS DRAWING= 1



C.M.F. (CASK MAINTENANCE FACILITY)
SCHEMATIC FLOW DIAGRAM
LIQUID WASTE
WIPES
VEHICLE CLEANING BAYS
WASH VEHICLE AND CLEAN CASK EQUIPMENT
VEHICLE STORAGE
1 NEWLY ARRIVED VEHICLES
2 EMPTY TRANSPORTERS
3 SPARE TRANSPORTERS
4 READY VEHICLES
RAIL 15 VEHICLES
TRUCK 15 VEHICLES
VEHICLE MAINTENANCE/ REPAIR OFF SITE
ENTRY STATION
RAILCAR/TRAIN
RAILWAY SECURITY
1 CONTRABAND INSPECTION
2 RADIATION LEVEL CHECK
- DOSE RATE SCAN WITH METER
- REMOVEABLE CONTACT SURVEY WITH SMEARS
TRUCK/TRAILER
HIGHWAY SECURITY
CASK UNLOADING/LOADING
RETRACT/INSTALL PERSONNEL BARRIERS AND IMPACT LIMITERS
UNLOAD/LOAD CASK
VEHICLE
SURVEY VEHICLE
CASK
LIFTING YOKES STORAGE AREA
- STORAGE FOR TEN LIFTING YOKES
VEHICLE BEAD BLAST FACILITY
BEADS
1 BEAD BLAST VEHICLE
2 PAINT VEHICLE
EXTERNAL CLEANING STATION
LIQUID WASTE
RAGS, WIPES
CASK
1 SURVEY CASK EXTERIOR
2 CLEAN/DECON CASK EXTERIOR
3 RM CASK EXTERIOR LID
4 CASK INTERIOR MONITOR
CASK STORAGE (10 POSITIONS IN PROCESS BUILDING)
EXTERNAL WASTE
SOLID WASTE
LIQUID WASTE
POOL
1 FLOOD CASK INTERIOR
2 REMOVE INTERIOR LID
3 INSPECT INTERIOR LID SEAL
4 BAG INTERIOR LID
5 INSPECT AND CLEAN
BASKET REMOVAL POOL STATION
1 PLACE CASK IN POOL TRENCH
2 REMOVE BASKET FROM CASK
3 REPLACE BASKET
DRY BASKET INSPECTION
1 INSPECT
2 REPAIR
3 TEST
WET BASKET STORAGE
- STORAGE FOR 35 BASKETS IN POOL
DRY BASKET STORAGE
- STORAGE IN CONTAINERS
SOLID WASTE
INTERNAL WASTE
CASK INSPECTION/ MAINTENANCE AREA
1 CLEAN
2 INSPECT
- VISUAL
- REMOVE
3 DECONTAMINATE
4 TEST
- VACUUM
- PRESSURE
- MECHANICAL
- VISUAL
5 REPAIR
PROCESS SUPPORT
1 ELECTRONICS REPAIR SHOP
2 METALWORKING SHOP
3 ELECTROPOLISH
4 ANTI-CONTAMINATION CLOTHING
5 HAND TOOLS
6 CASK SPARE PARTS
7 TEST EQUIPMENT
A HYDRAULIC TEST
B HELIUM LEAK DETECTION
C NDT INSPECTION
D LOAD TEST
AUXILIARY EQUIPMENT SERVICE
1 LOAD TEST
2 STORAGE
3 MAINTENANCE
RADWASTE DISPOSAL
SEE DRWGS J3E-12824-100/101
MAJOR REPAIR STATION (CASK ROTATOR)
FEASIBILITY STUDY
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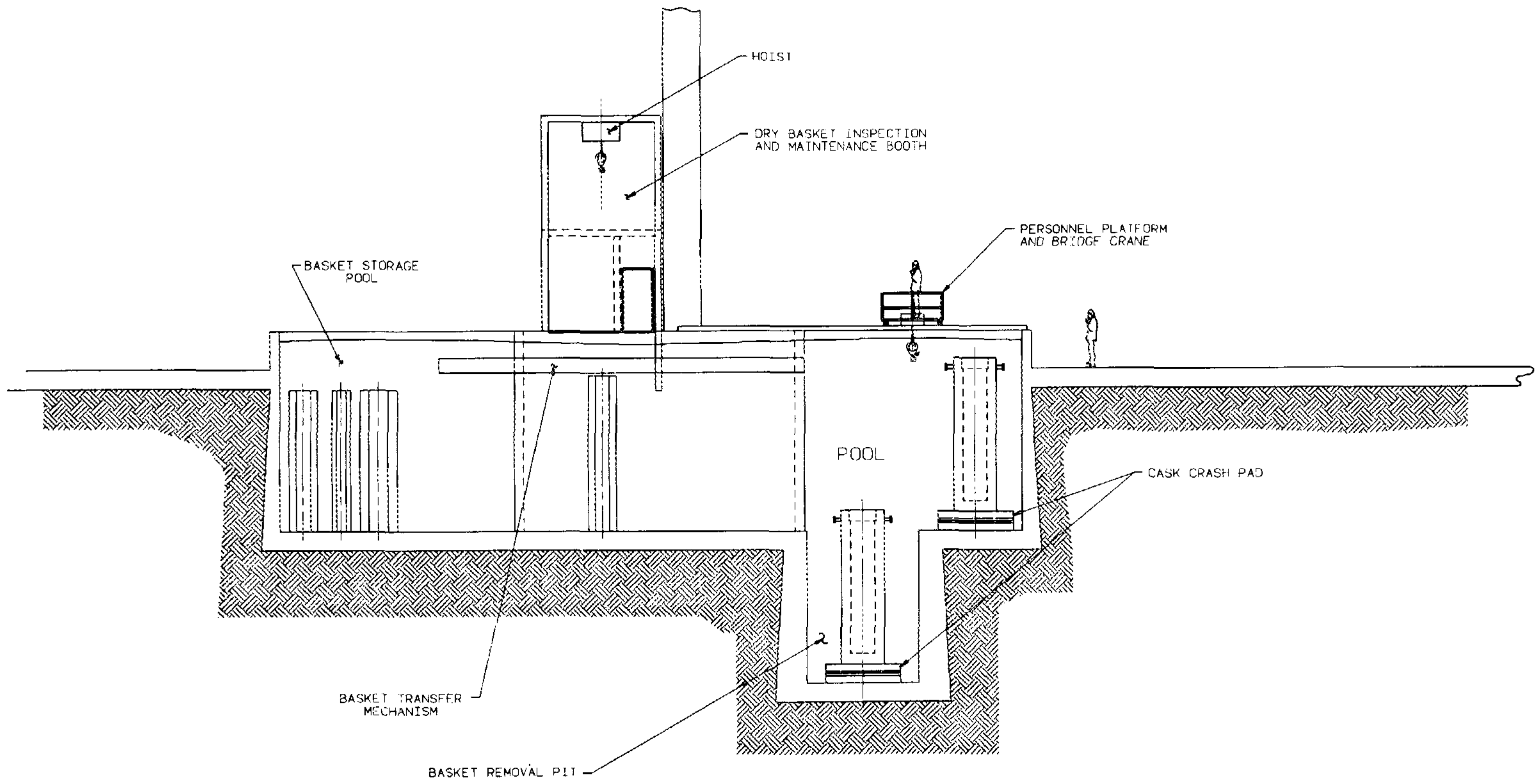
ENGINEERING PROCEDURE
REVISED DRAFT ISSUE
ORIGINAL ISSUE
DES M J RENNICH
DRW K L FARLEY
MARTIN MARIETTA ENERGY SYSTEMS, INC
CASK MAINTENANCE FACILITY
FEASIBILTY STUDY
FUNCTIONAL FLOW DIAGRAM
X3E-12824-030
NUMBER OF MODELS IN THIS DRAWING= X



SECTION "A A"
PROCESS POOL

ISSUED FOR FEASIBILITY STUDY

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ENGINEERING PROCEDURE EP-C-18

DES	M J XENNICH 09/07/86
DRN	R W TAYLOR 11/28/86
CHK	
SECT	
DEPT & PLANT	
PE	
CR	
PJ	
RED	

MARTIN MARIETTA ENERGY SYSTEMS, INC

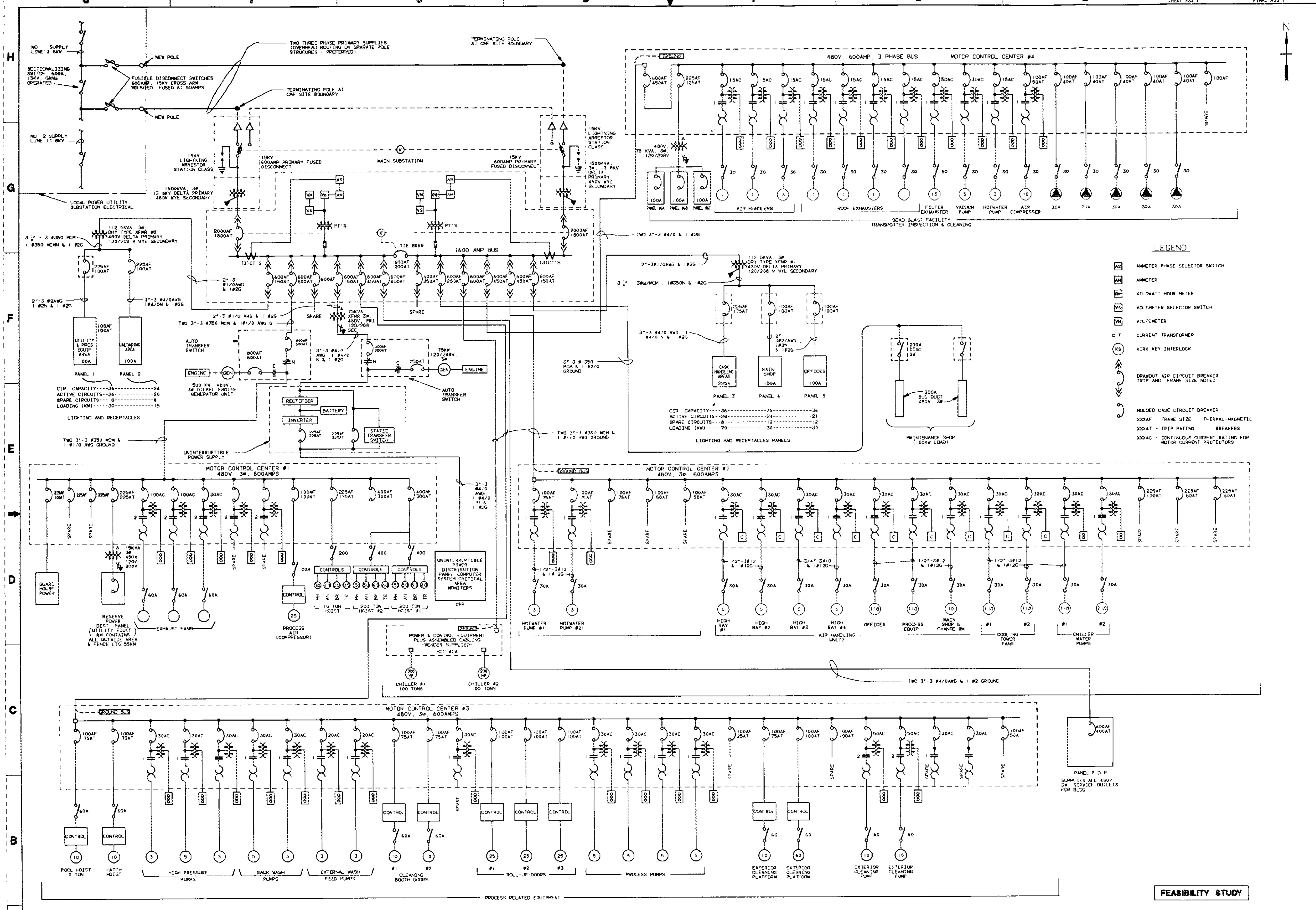
CASK MAINT. FACILITY
FEASIBILITY STUDY
PROCESS POOL

PROCESS POOL

TYPE	PLANT	BLDG	FL	SHEET	OF	CLASS	SCALE	ID	REV
A	ORNL	100C	1	0	0	U	1/64"=1'	12824	0

X3E012824-065

NUMBER OF MODELS IN THIS DRAWING= 1



FEASIBILITY STUDY

DES	D E TROUTMAN	8/88
DRW	L MOUA	8/88
CHK	D E TROUTMAN	8/88
SECT	D E TROUTMAN	8/88
DEPT & PLANT	D R NORRIS	8/88
PE		
CR		
PJ		
REQ		
DRAWING APPROVALS		DATE

MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAINTENANCE FACIL
POWER DISTRIBUTION SYS
ONE LINE DIAGRAM

CMF POWER DISTRIBUTION SYS — TYPE D

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	F	P	A	ORNL	A	A	0	0	U

SCALE NONE — ID A5103A — E3E012824Z001 — REV 0

0 — ORIGINAL ISSUE — DRN 8/88

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ENGINEERING PROCEDURE EP-C-18

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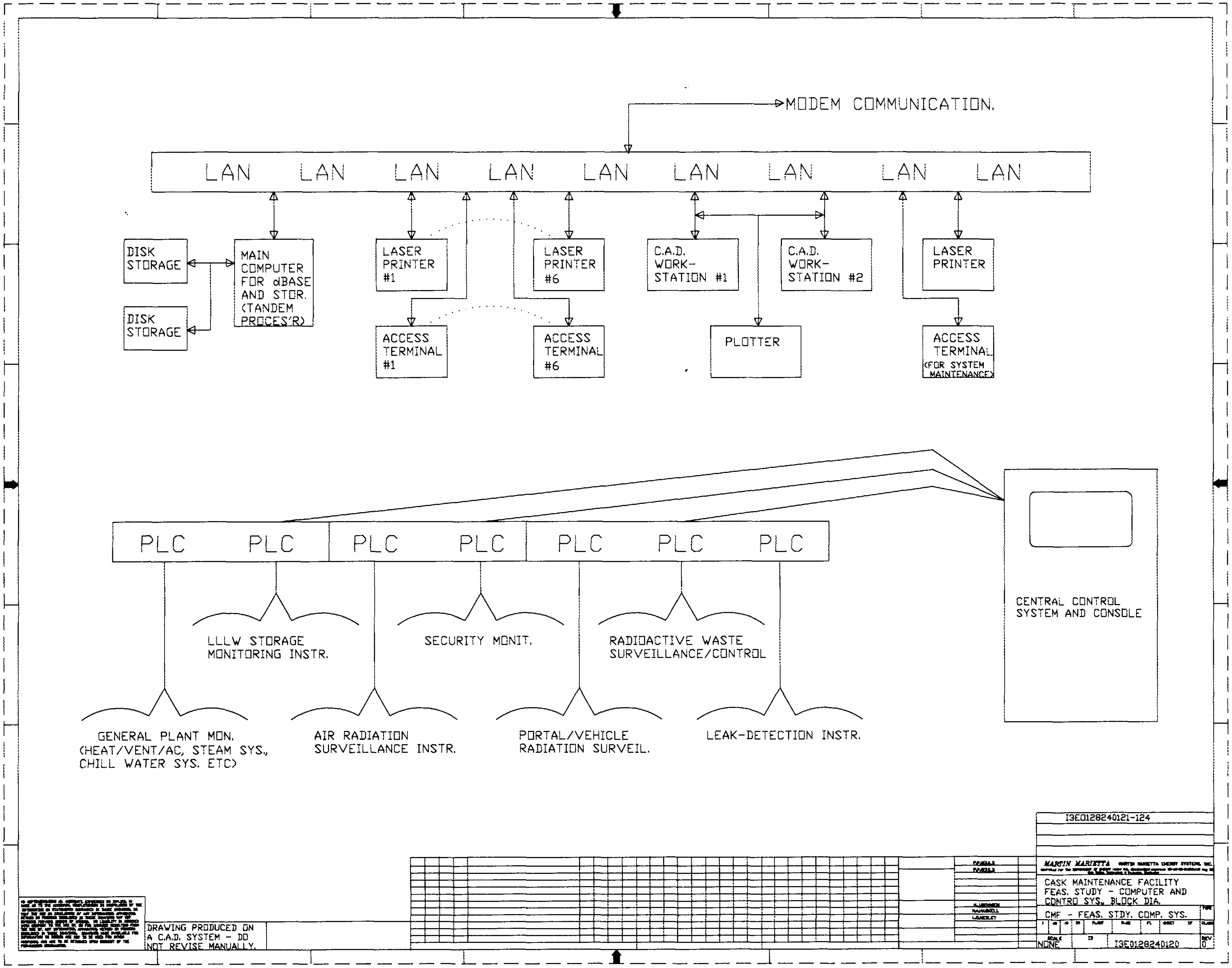
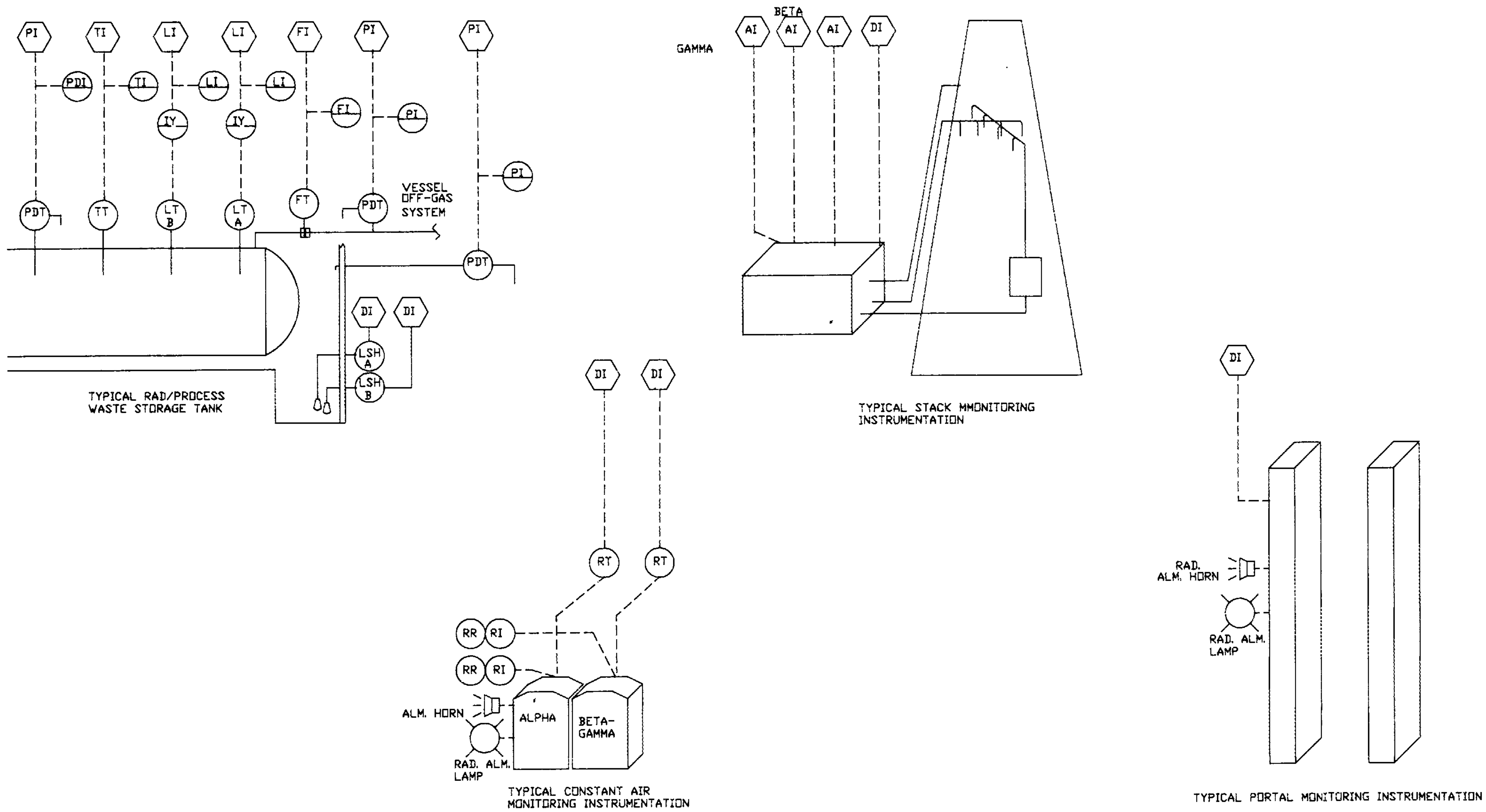
83991

NUMBER OF MODELS IN THIS DRAWING= 1


MODEM COMMUNICATION.
LAN LAN LAN LAN LAN LAN LAN LAN LAN
DISK STORAGE
DISK STORAGE
MAIN COMPUTER FOR dBASE AND STOR. (TANDEM PROCES'R)
LASER PRINTER #1
LASER PRINTER #6
C.A.D. WORK-STATION #1
C.A.D. WORK-STATION #2
LASER PRINTER
ACCESS TERMINAL #1
ACCESS TERMINAL #6
PLOTTER
ACCESS TERMINAL (FOR SYSTEM MAINTENANCE)
PLC PLC PLC PLC PLC PLC PLC
CENTRAL CONTROL SYSTEM AND CONSOLE
LLLW STORAGE MONITORING INSTR.
SECURITY MONIT.
RADIOACTIVE WASTE SURVEILLANCE/CONTROL
GENERAL PLANT MON. (HEAT/VENT/AC, STEAM SYS., CHILL WATER SYS. ETC)
AIR RADIATION SURVEILLANCE INSTR.
PORTAL/VEHICLE RADIATION SURVEIL.
LEAK-DETECTION INSTR.
DRAWING PRODUCED ON A C.A.D. SYSTEM - DO NOT REVISE MANUALLY.
I3E0128240121-124
MARTIN MARIETTA
CASK MAINTENANCE FACILITY FEAS. STUDY - COMPUTER AND CONTRO SYS. BLOCK DIA.
CMF - FEAS. STDY. COMP. SYS.
SCALE NONE
I3E0128240120
REV 0



NOTES:
1. THE USE OF A HEXAGON IMPLIES AN INPUT OR OUTPUT OT A CONTROL SYSTEM SLAVE MODULE (I.E. A PROGRAMMABLE CONTROLLER).

DRAWING PRODUCED ON A C.A.D. SYSTEM - DO NOT REVISE MANUALLY.

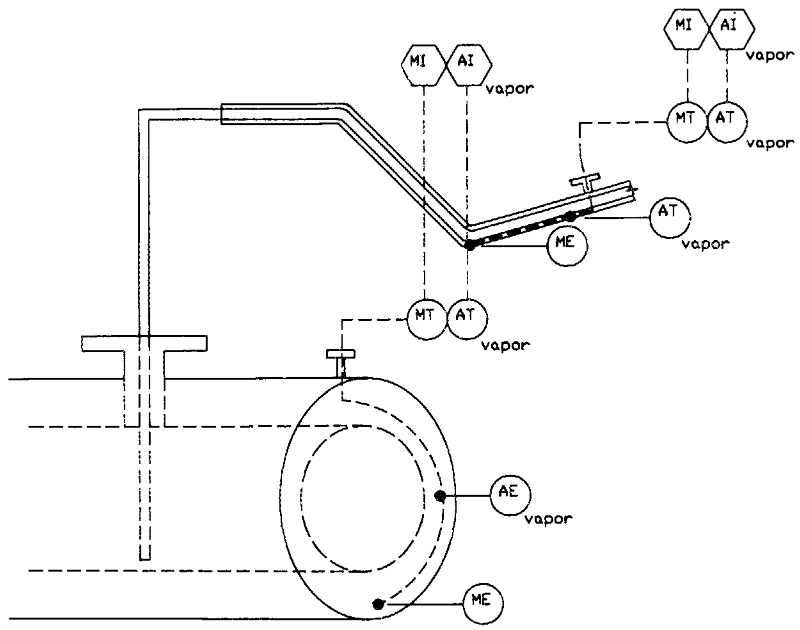
I3E0128240120

MARTIN MARIETTA

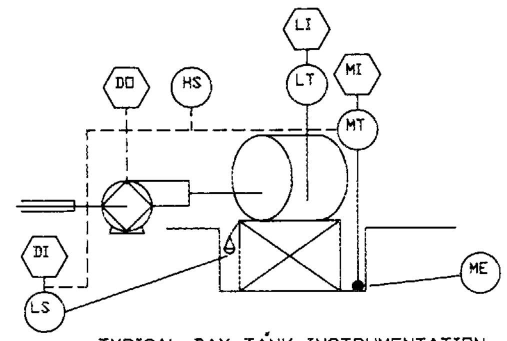
CASK MAINTENANCE FACILITY
FEAS. STUDY FOR GENERAL PLANT MONITORING.

CMF - FEAS. STDY. GEN. MONIT.

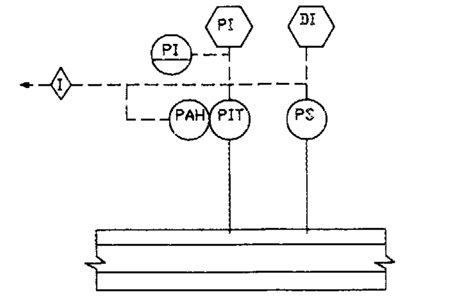
SCALE			REV
NONE		I3E0128240121	0



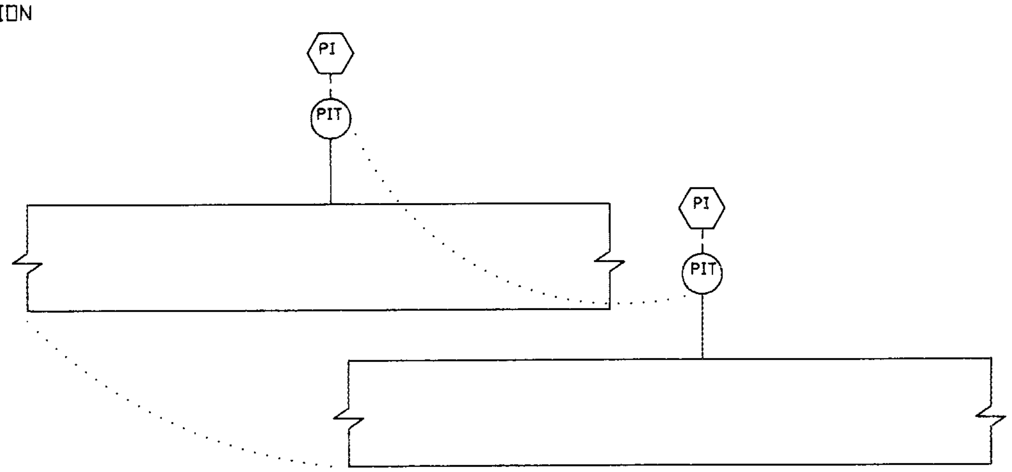
TYPICAL UNDERGROUND FUEL TANK LEAK-DETECTION INSTRUMENTATION



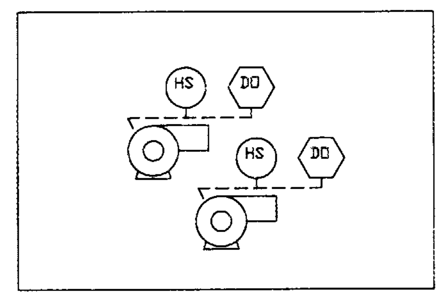
TYPICAL DAY-TANK INSTRUMENTATION FOR DEISEL GENERATOR



TYPICAL DOUBLE CONTAINED PIPING LEAK-DETECTION INSTRUMENTATION



TYPICAL VENTILATION SYSTEM PIPING-MONITORING INSTRUMENTATION



TYPICAL EXHAUST FAN MANUAL/AUTOMATIC CONTROL INSTRUMENTATION

NOTES:
1: THE USE OF A HEXAGON IMPLIES AN INPUT OR OUTPUT TO A CONTROL SYSTEM SLAVE UNIT (I.E. A PROGRAMMABLE CONTROLLER).

DRAWING PRODUCED ON A C.A.D. SYSTEM - DO NOT REVISE MANUALLY.

REVISIONS | APPROVALS | DRAW CHECK

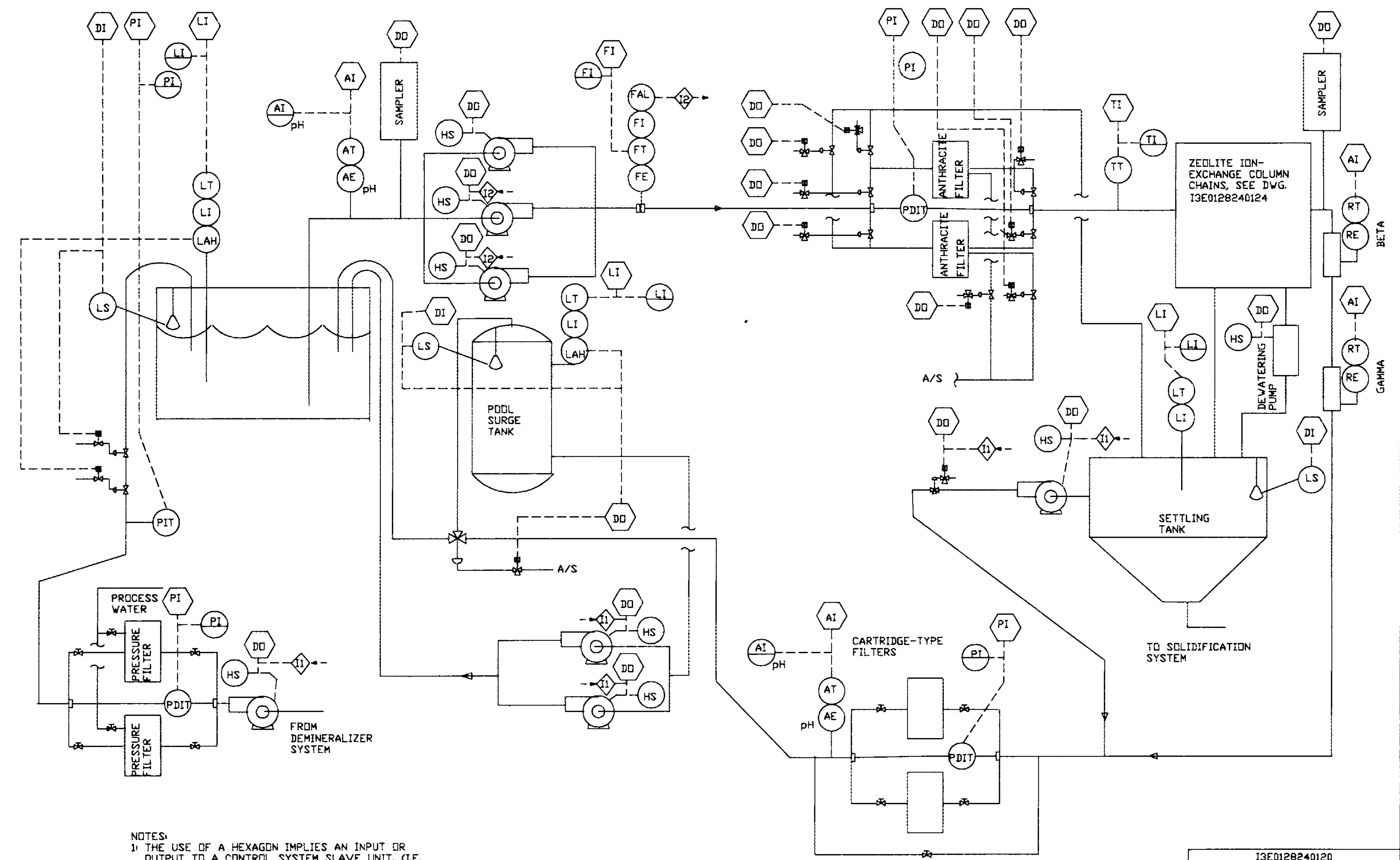
I3E0128240120
I3E0128240121

MARTIN MARIETTA

CASK MAINTENANCE FACILITY
FEAS. STUDY - GENERAL FACILITY
MONITORING INSTRUMENTATION

CMF - FEAS. STDY. GEN. FAC. MON

SCALE NONE | D | I3E0128240122



NOTES:
1) THE USE OF A HEXAGON IMPLIES AN INPUT OR OUTPUT TO A CONTROL SYSTEM SLAVE UNIT. (I.E. A PROGRAMMABLE CONTROLLER.

DRAWING PRODUCED ON A C.A.D. SYSTEM - DO NOT REVISE MANUALLY.

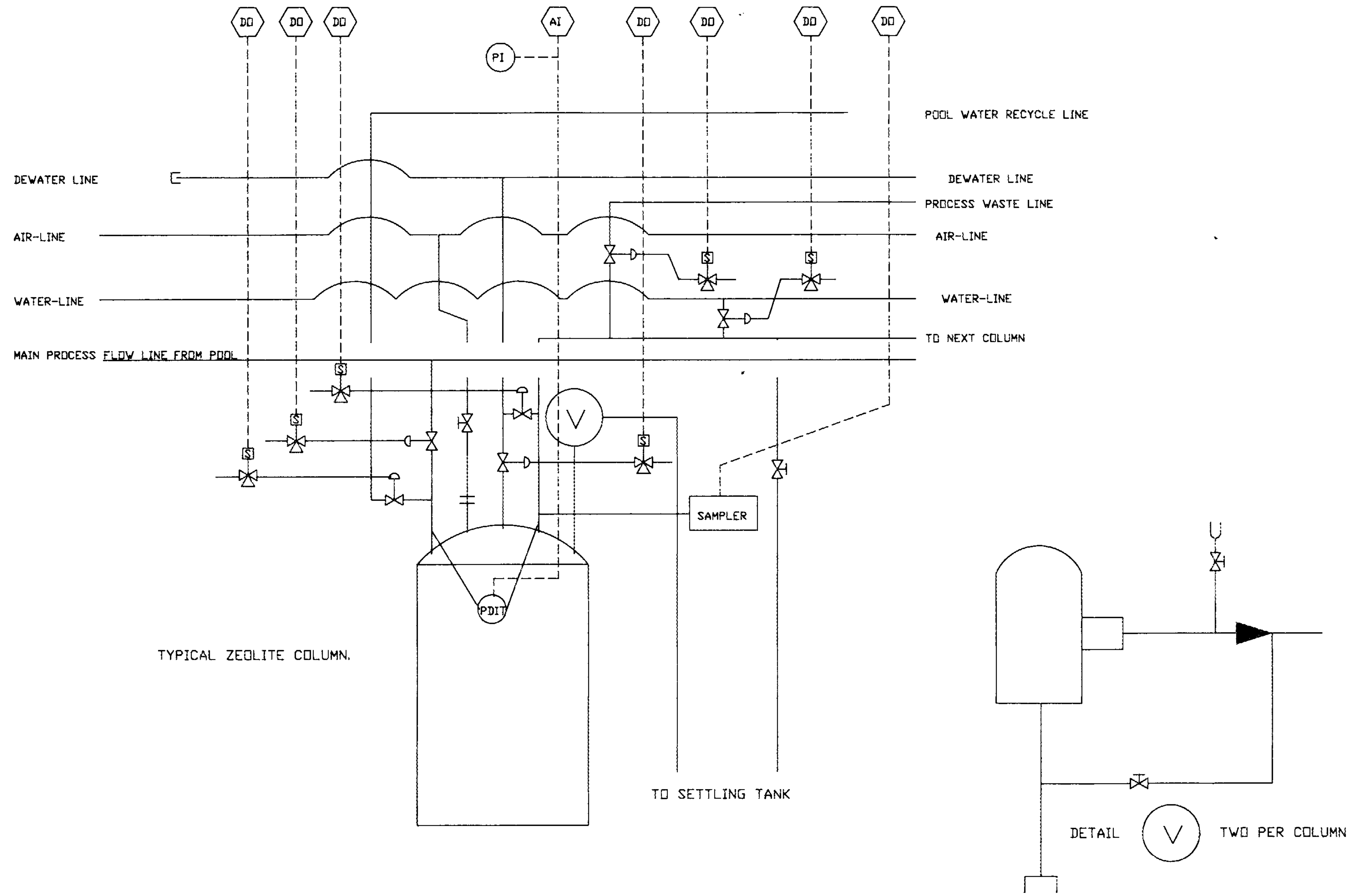
I3E0128240120
I3E0128240124
J3E0128240XXX

MARTIN MARIETTA

CASK MAINTENANCE FACILITY
FEAS. STUDY FOR PROC. INSTR.
DIA. - INTERN. PROCESS FLOW

CMF -FEAS. STDY. PID-INTERN.

SCALE NONE | I3E0128240123 | REV 0



NOTES:
1. HEXAGONS ARE USED HERE TO INDICATE PROCESS CONTROL SYSTEM INPUTS OR OUTPUTS.

DRAWING PRODUCED ON A C.A.D. SYSTEM - DO NOT REVISE MANUALLY.

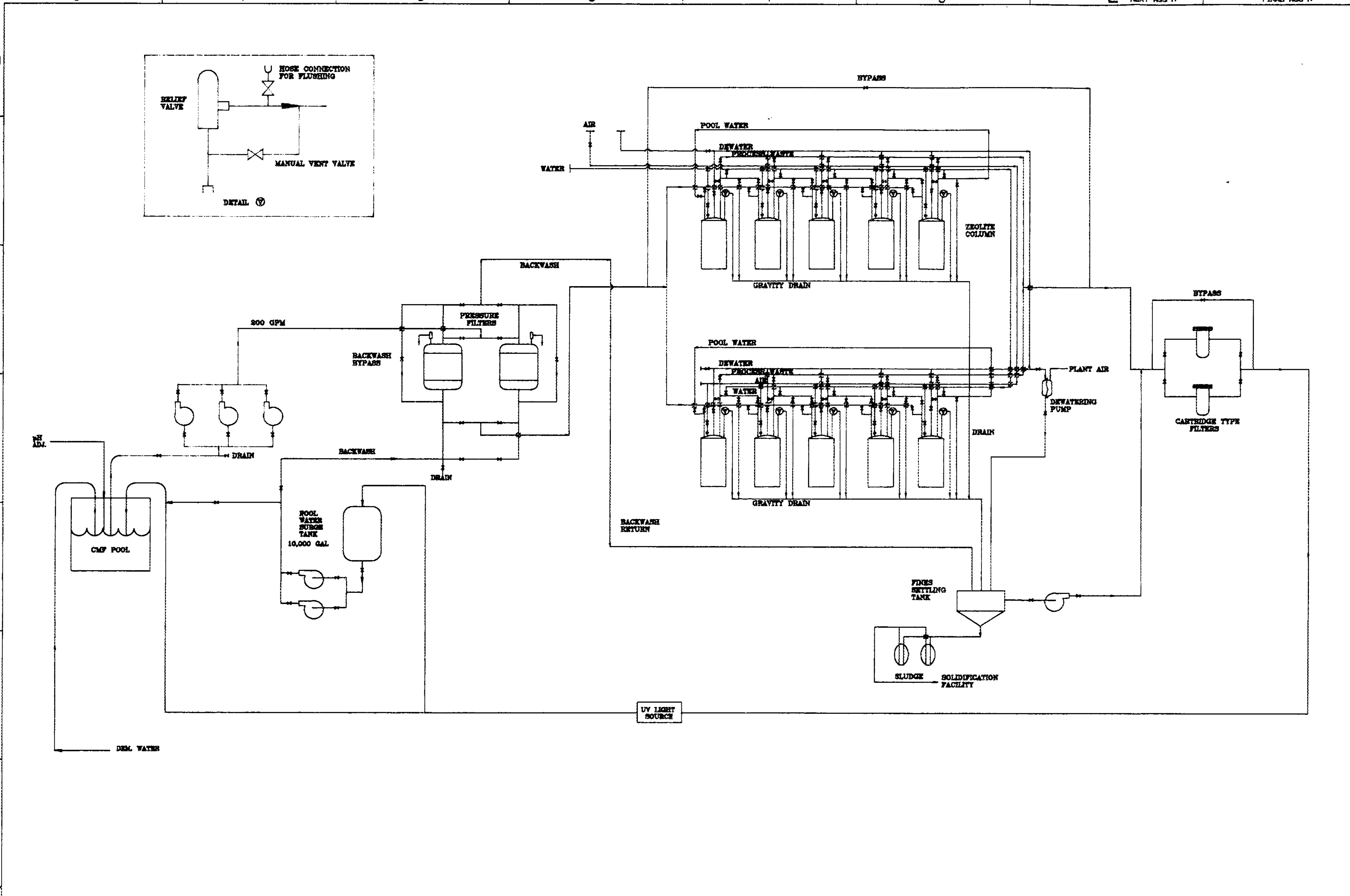
I3E0128240120
I3E0128240123

MARTIN MARIETTA — MARTIN MARIETTA ENERGY SYSTEMS, INC.

CASK MAINTENANCE FACILITY
FEAS. STUDY FOR PROCESS INSTR.
ZEOLITE COLUMN INSTR.

C.M.F. - FEAS. STDY. ZEOL. CLMS.

SCALE	ID		REV
NONE		I3E0128240124	0

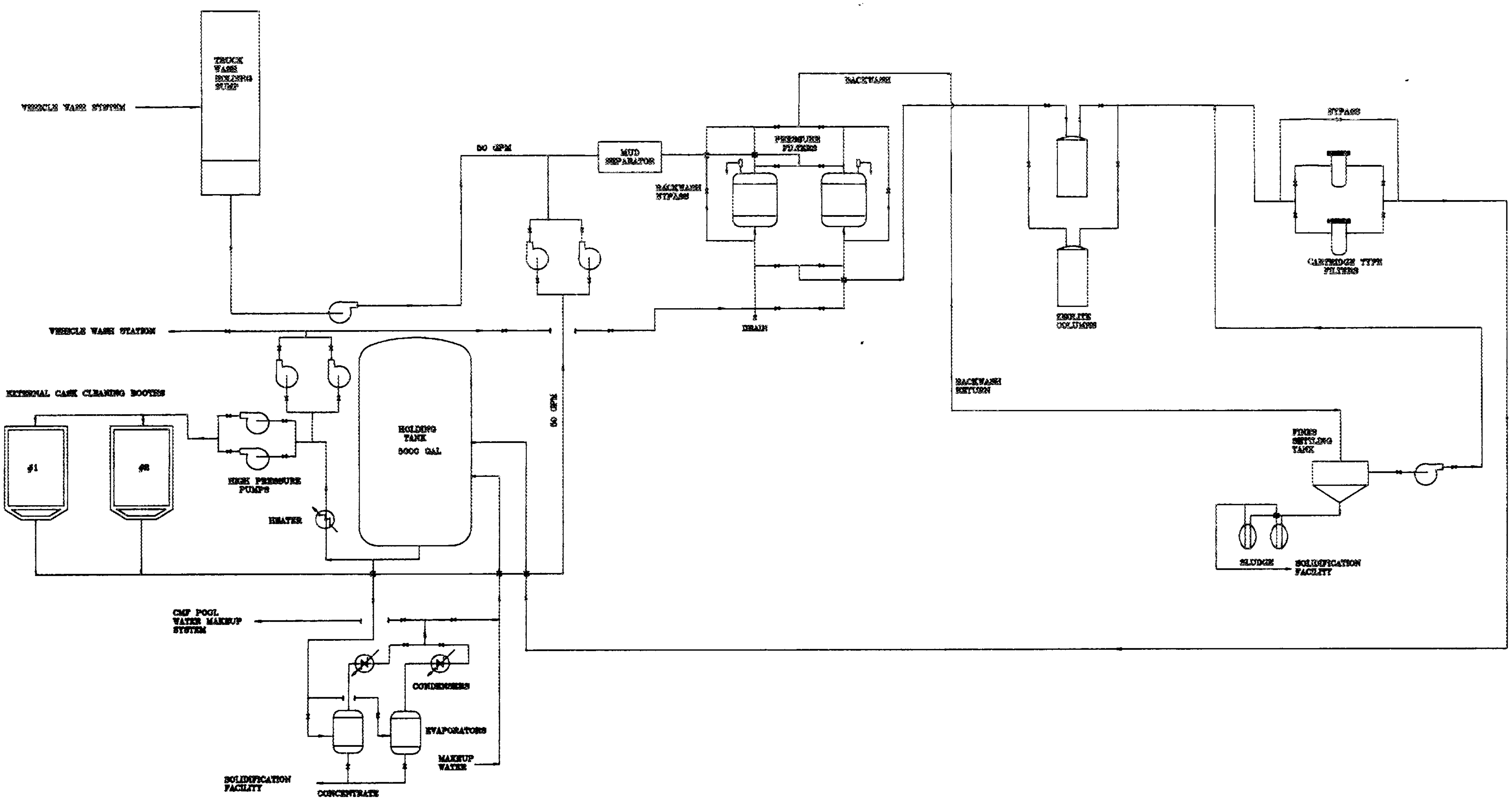


DO NOT REVISE MANUALLY

MARTIN MARIETTA ENERGY SYSTEMS, INC.

CASK MAINTENANCE FACILITY
FEASIBILITY STUDY
POOL WATER TREATMENT SYSTEM
CMF-FEAS STUDY-INT WASTE FLOW

SCALE				REV
NONE	12824	J3E-12824	100	0



[redacted]

DO NOT REVISE MANUALLY

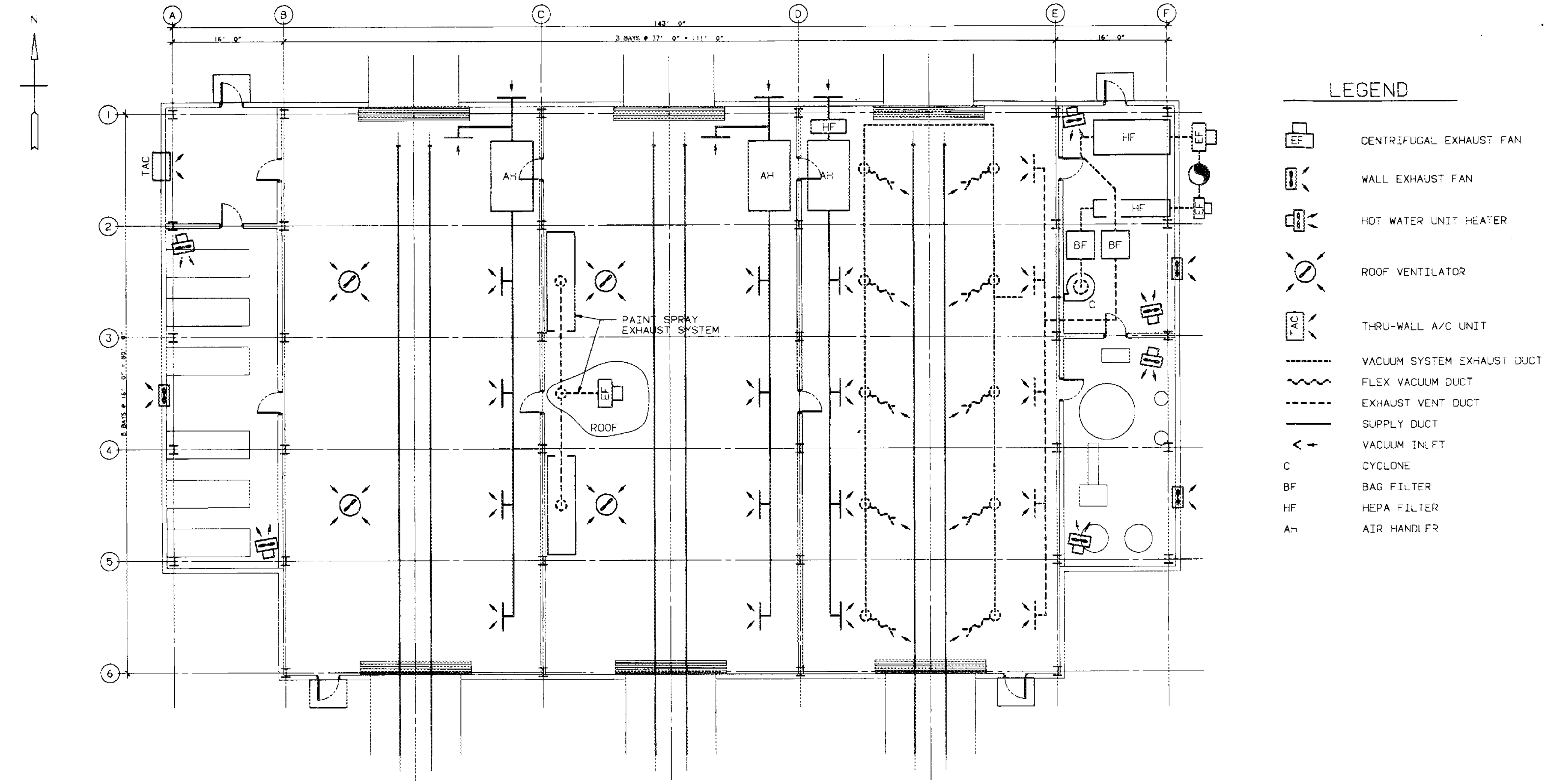
MARTIN MARIETTA ENERGY SYSTEMS, INC.

CASK MAINTENANCE FACILITY
FEASIBILITY STUDY
EXTERNAL WASH WATER FLOW SHEET
CMF-FEAS STUDY-EXT FLOW SHEET

SCALE			
NONE	12824	J3E-12824	101

PLANT ORNL · SIZE A · REV 0

J3E-12824 101



PLAN

SCALE: 3/16" = 1'-0"

THIS DRAWING PRODUCED ON CADAM

DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM 4

ENGINEERING PROCEDURE EP-C-18

SECTION AND DETAIL KEY

REV				DESCRIPTION
0	C	4		CONCEPTUAL

DES CLAPP 08/24/88

DRN BEELER 08/24/88

MARTIN MARIETTA ENERGY SYSTEMS, INC

CASK MAINT. FACILITY
VEHICLE MAINT & INSP FAC
HVAC SCHEMATIC

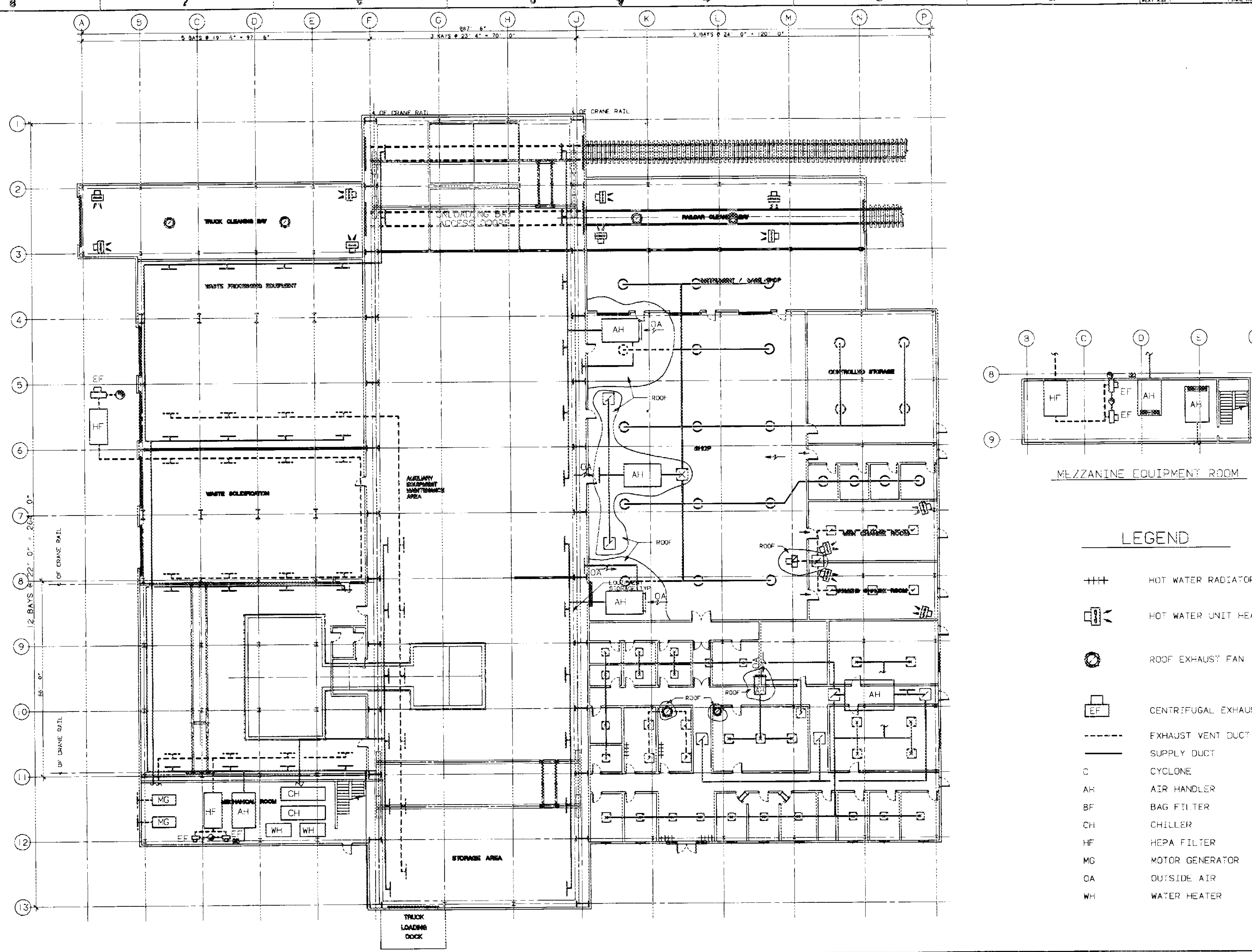
CMF VEH MAINT/INSP FAC H&V

TYPE P

PLANT XXXX | BLDG XXXXX | FL 1 | SHEET 01 OF 01 | CLASS U

SCALE NOTED | ID A-3080-A | H3E012824G001 | REV 0

NUMBER OF MODELS IN THIS DRAWING= 1



LEGEND

(symbol)	HOT WATER RADIATOR
(symbol)	HOT WATER UNIT HEATER
(symbol)	ROOF EXHAUST FAN
EF	CENTRIFUGAL EXHAUST FAN
- - - -	EXHAUST VENT DUCT
———	SUPPLY DUCT
C	CYCLONE
AH	AIR HANDLER
BF	BAG FILTER
CH	CHILLER
HF	HEPA FILTER
MG	MOTOR GENERATOR
OA	OUTSIDE AIR
WH	WATER HEATER

SECTION AND DETAIL KEY: NUMBER OF SECTION OR DETAIL; DRAWING ON WHICH SECTION OR DETAIL IS TAKEN; DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

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THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM 4
ENGINEERING PROCEDURE EP-C-18

REV			DESCRIPTION
A			APPROVED FOR FEASIBILITY STUDY
0	C	4	CONCEPTUAL

REVISION OR ISSUE PURPOSE — REVISION APPROVALS — SQUAD CHECK

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ±/XX; XX DECIMALS ±XX; XXX DECIMALS ±XXX; ANGLES ±XX°-XX'; BREAK SHARP EDGES MAX; FINISH RMS

DES	DC CLAPP	08/25/89
DRW	JPL/JDD	08/25/89
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		

DRAWING APPROVALS — DATE

MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

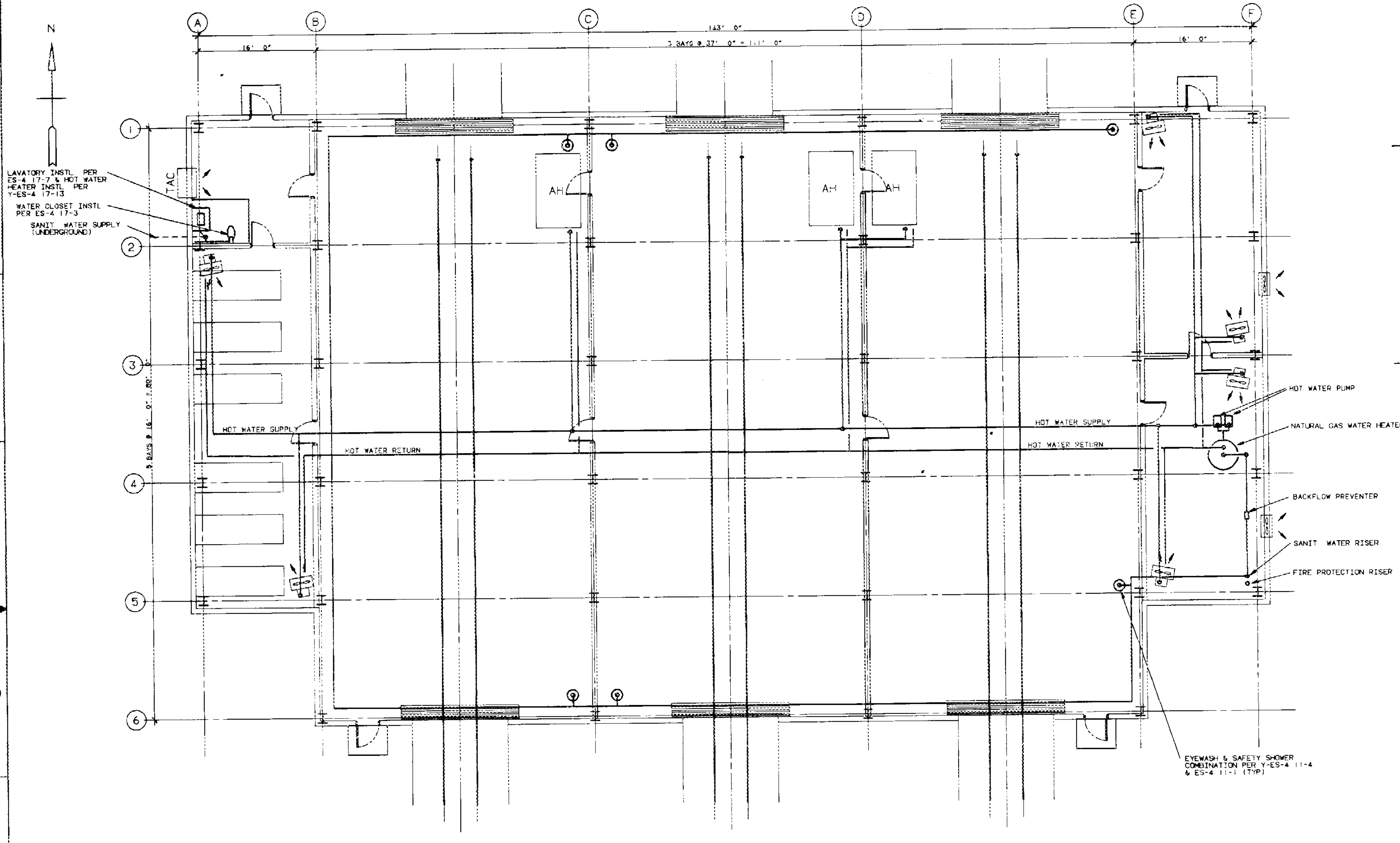
CASK MAINT FACILITY PROCESS BUILDING HVAC SCHEMATIC

CMF PROCESS BLDG FLR PLAN — TYPE P

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	H	A	D	X-10	-	1	1	1	U

SCALE 3/32" = 1' 0" — ID A-3080-A — H3E012824G002 — REV A

NUMBER OF MODELS IN THIS DRAWING= 2



PLAN

SCALE: 3/16" = 1'-0"

LEGEND

———	NEW PIPING
AH	AIR HANDLER
(symbol)	HOT WATER UNIT HEATER

REFERENCE DRAWINGS

H3E012824G001	HVAC
S3E012824B003	STRUCTURAL
C3E012824A001	SITE

FOR FEASIBILITY STUDY ONLY

SECTION AND DETAIL KEY: NUMBER OF SECTION OR DETAIL; DRAWING ON WHICH SECTION OR DETAIL IS TAKEN; DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

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THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM 4
ENGINEERING PROCEDURE EP-C-18

REV	DESCRIPTION	A-E	BY
0	ISSUED FOR FEASIBILITY STUDY CONCEPTUAL		LRO

REVISION OR ISSUE PURPOSE — REVISION APPROVALS — BOARD CHECK

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ±1/32; XX DECIMALS ±.XX; XXX DECIMALS ±.XXX; ANGLES ±XX°-XX'; BREAK SHARP EDGES MAX

DES	BJ PONT	09/02/88
DRW	LR OWENS	09/02/88
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		

DRAWING APPROVALS

MARTIN MARIETTA ENERGY SYSTEMS, INC.
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAINT. FACILITY
VEH MAINT & INSP FAC
PIPING SCHEMATIC

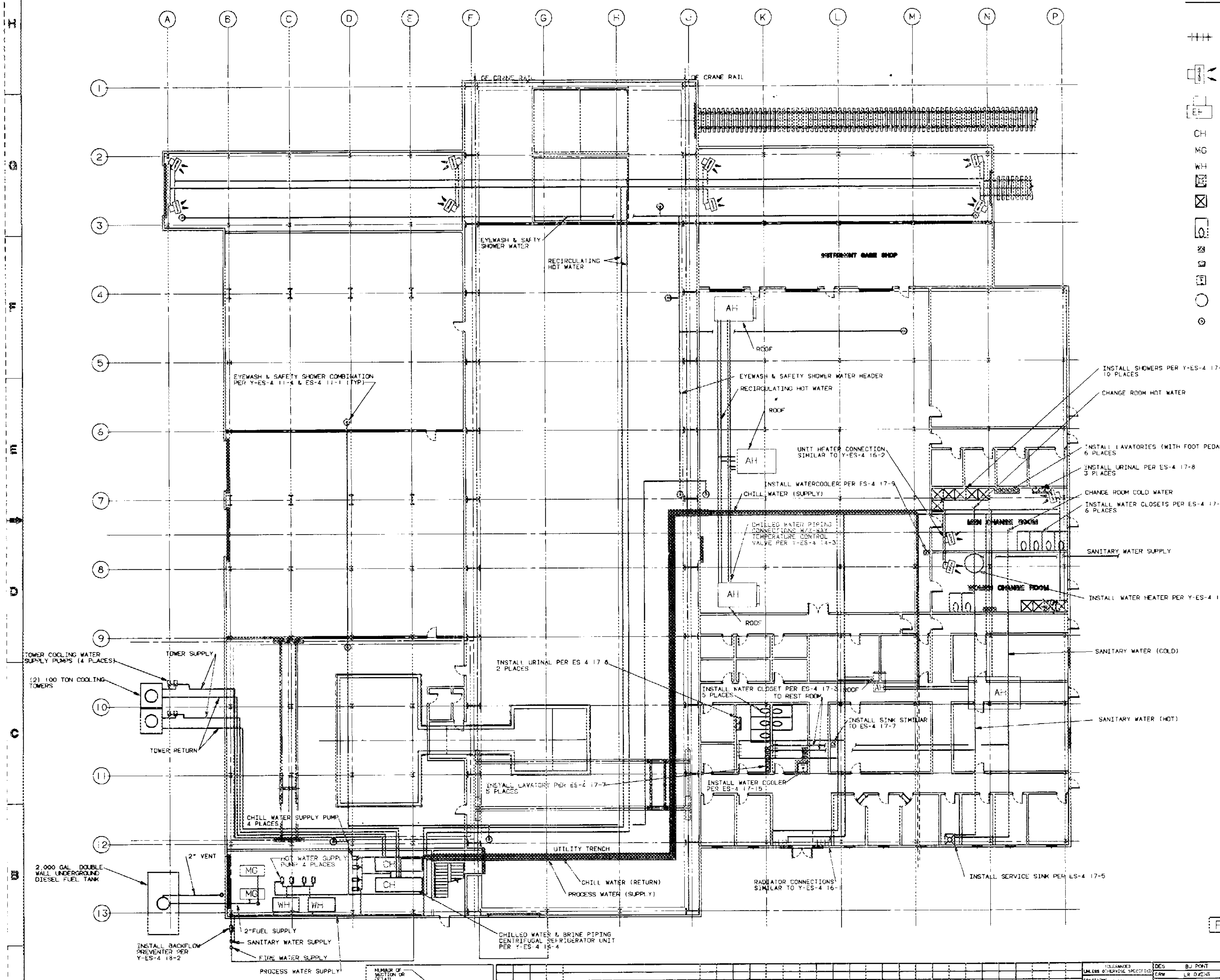
CMF VEH MAINT & INSP PIPE — TYPE P

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	H	A	S	X-10	AREA	1	0	0	U

SCALE	ID	DRAWING NO.	REV
NOTED	A-3060-A	P3E012824C001	0

NUMBER OF MODELS IN THIS DRAWING= 1

P3E012824C001



LEGEND

┼┼┼	HOT WATER RADIATOR
	HOT WATER UNIT HEATER
EF	CENTRIFUGAL EXHAUST FAN
CH	CHILLER
MG	MOTOR GENERATOR
WH	WATER HEATER
	SERVICE SINK
☒	SHOWER
	WATERCLOSET
	LAVATORY
	URINAL
	WATER COOLER
○	WATER HEATER
⊙	EYEWASH & SAFETY SHOWER COMBINATION

REFERENCE DRAWINGS:

H3E012824G002
S3E012824B001
C3E012824A001

FOR FEASIBILITY STUDY ONLY

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THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM 4
ENGINEERING PROCEDURE EP-C-18

REV				DESCRIPTION	A-E	BY
A				APPROVED FOR FEASIBILITY STUDY		
0				ISSUED FOR FEASIBILITY STUDY		LRO
-	C	4		CONCEPTUAL		LRO

REVISION OR ISSUE PURPOSE

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS X/XX
XX DECIMALS XX
XXX DECIMALS XXX
ANGLES XX°-XX'
BREAK SHARP EDGES MAX
FINISH RMS

DES BJ PONT 09/02/94
DRW LR OWENS 09/02/94
CHK
SECT
DEPT & PLANT
PE
CR
PJ
REQ
DRAWING APPROVALS

MARTIN MARIETTA ENERGY SYSTEMS, INC
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee & Paducah, Kentucky

CASK MAINT FACILITY PROCESS BUILDING UTILITY PIPING PLAN

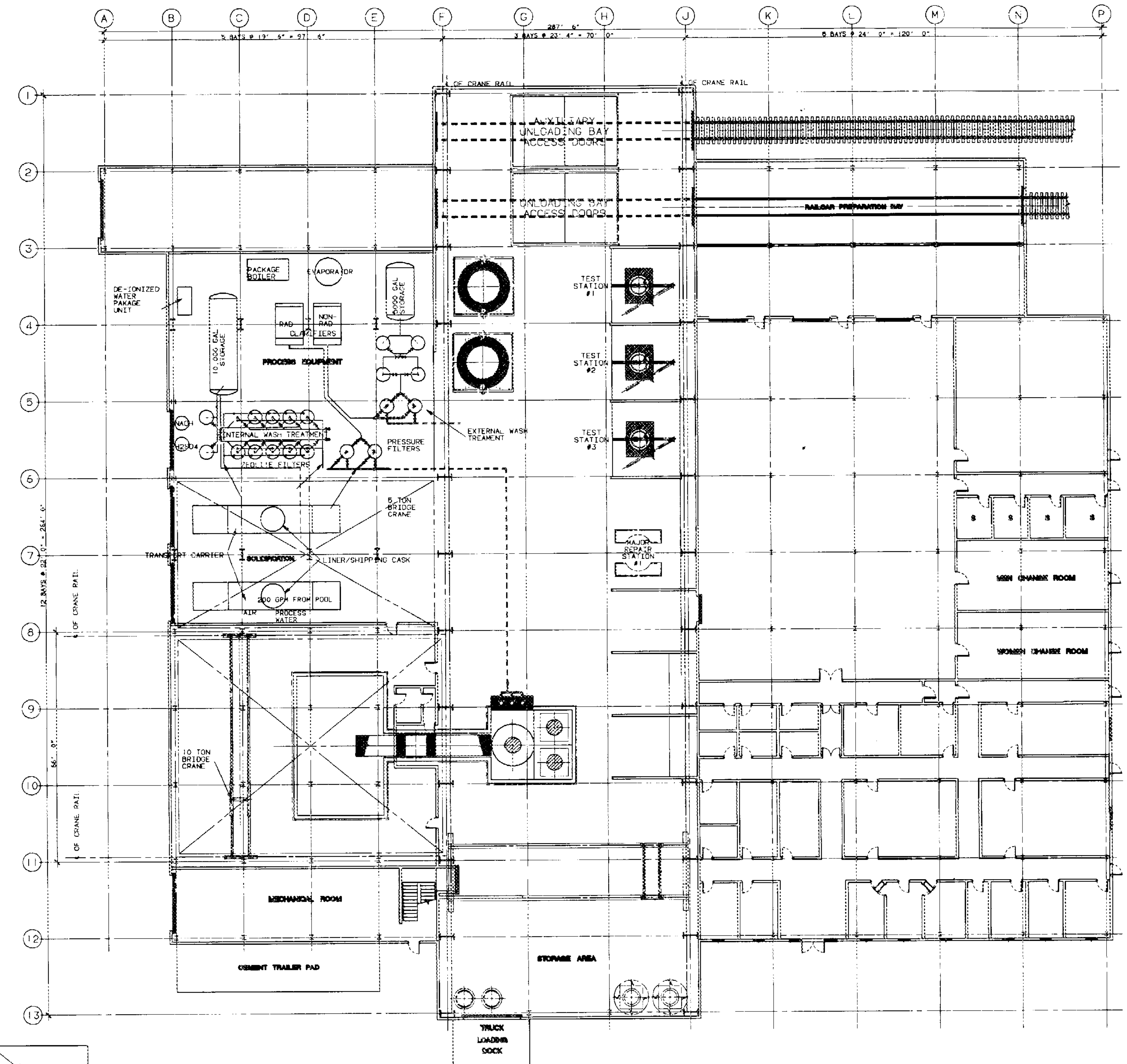
CMF PROC. BLDG UTL.PIPING — TYPE P

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	P	X	X	X-10	AREA	1	0	0	U

SCALE 3/32" = 1' 0" — ID A-3080-A — P3E012824C002 — REV A

NUMBER OF MODELS IN THIS DRAWING= 2

GENERAL NOTES:



SECTION AND DETAIL KEY

NUMBER OF SECTION OR DETAIL
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

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THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY
CHANGE CONTROL SYSTEM ________
ENGINEERING PROCEDURE ________

REV	DESCRIPTION
A	APPROVED FOR FEASIBILITY STUDY
0	ISSUED FOR COMMENT

REVISION OR ISSUE PURPOSE — REVISION APPROVALS — SQUAD CHECK

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS X/XX
XX DECIMALS XX
XXX DECIMALS XXX
ANGLES XX°-XX'
BREAK SHARP EDGES MAX
ROUGHNESS RMS

DRAWING APPROVALS		DATE
DES	J FARMER	5/88
DRN	J FARMER	10/88
CHK		
SECT		
DEPT & PLANT		
PE		
CR		
PJ		
REQ		

MARTIN MARIETTA ENERGY SYSTEMS, INC.
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

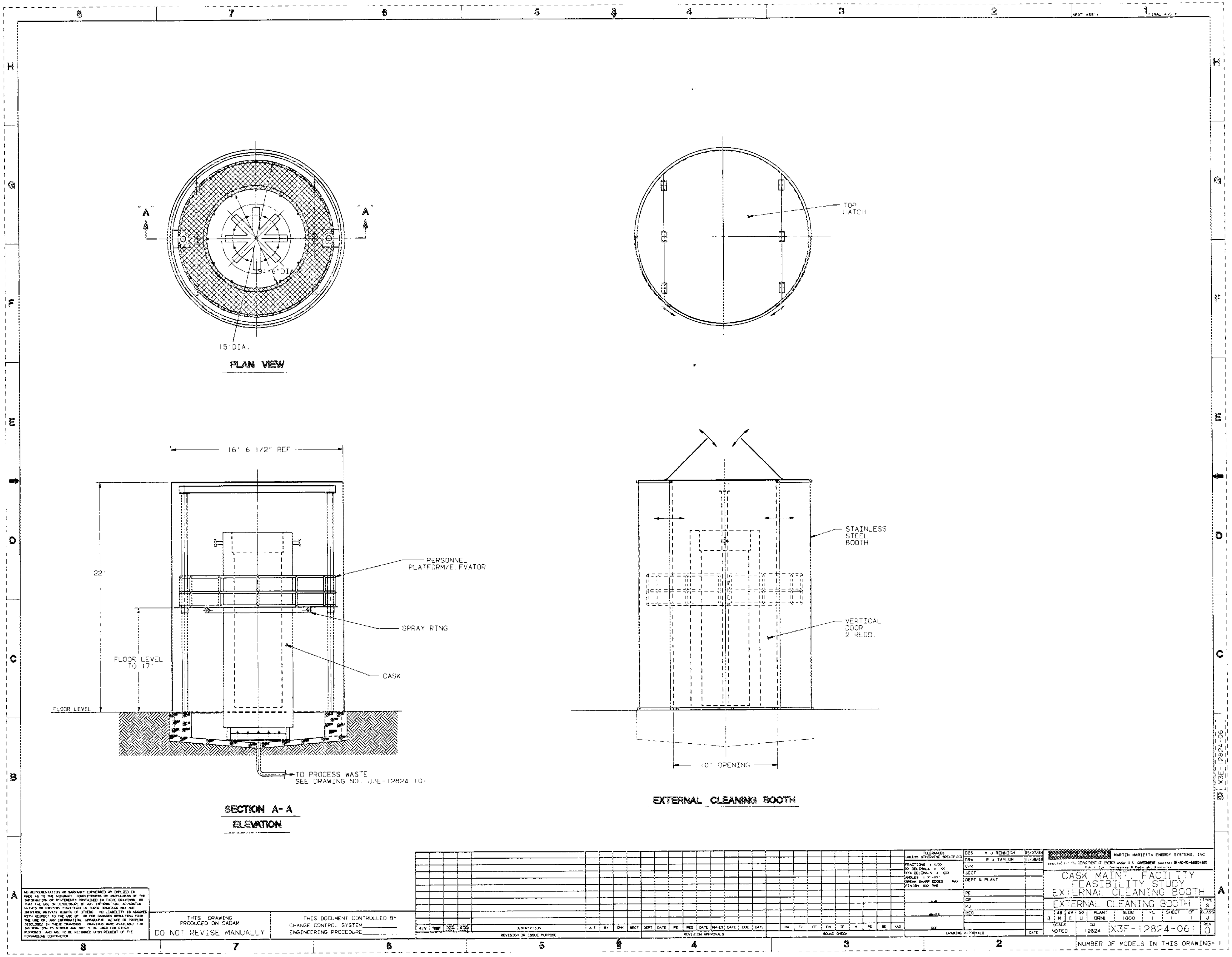
CASK MAINT FACILITY PROCESS BUILDING EQUIPMENT & PIPING L/O

CMF PB EQUIP & PIPING L/O — TYPE P

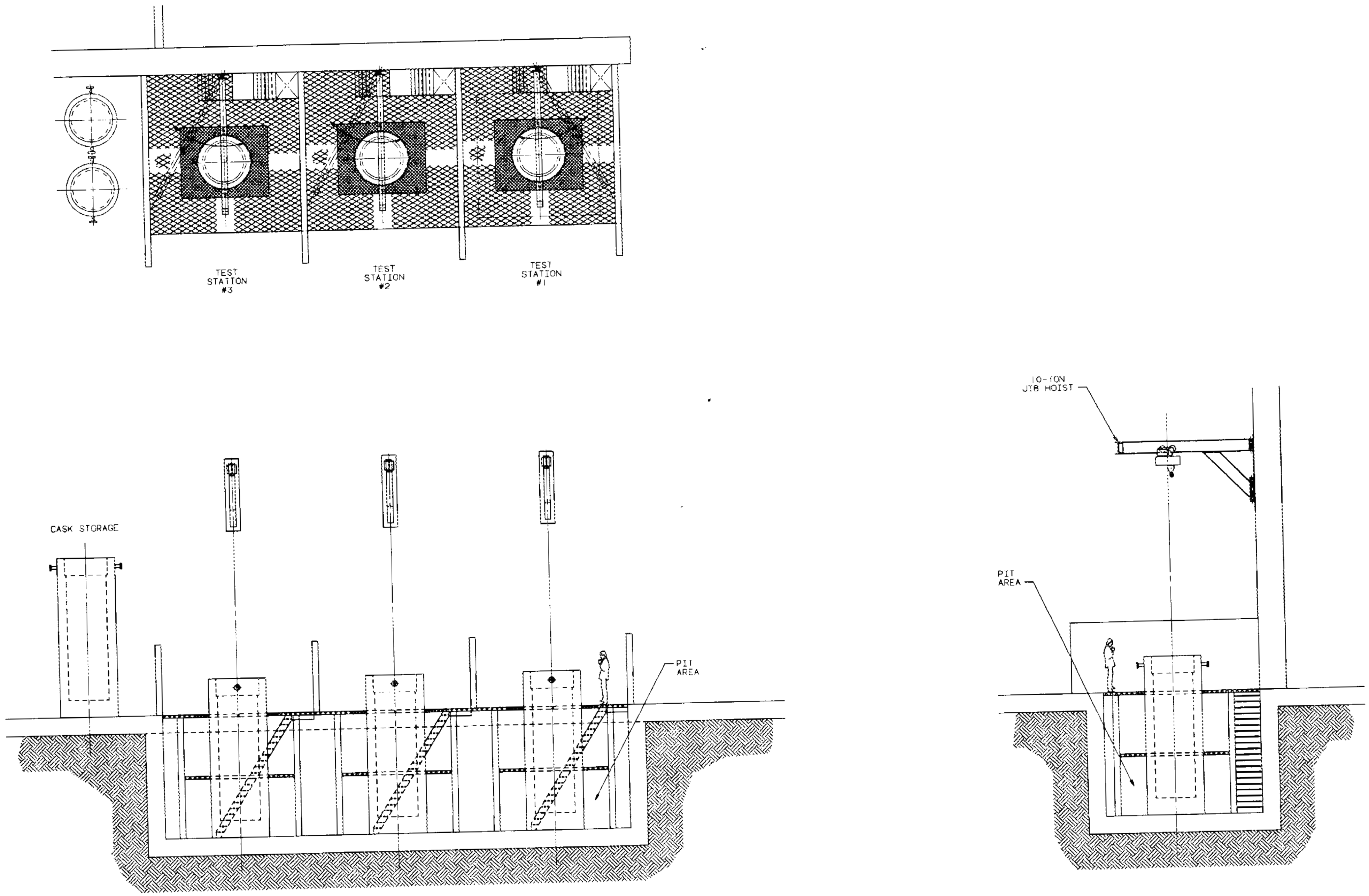
1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	P	X	X	ORNL	AREA	1	00	00	U

SCALE 3/32" = 1' 0" — ID A-3080 A — P3E0:2824C003 — REV A

NUMBER OF MODELS IN THIS DRAWING= 2



"A"
"A"
15'-6" DIA.
15' DIA.
PLAN VIEW
TOP HATCH
16' 6 1/2" REF
22'
PERSONNEL PLATFORM/ELEVATOR
SPRAY RING
FLOOR LEVEL TO 17'
CASK
FLOOR LEVEL
TO PROCESS WASTE
SEE DRAWING NO. J3E-12824-10
SECTION A-A
ELEVATION
STAINLESS STEEL BOOTH
VERTICAL DOOR 2 REQD.
10' OPENING
EXTERNAL CLEANING BOOTH
THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY
THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM
ENGINEERING PROCEDURE
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ± X/XX
XX DECIMALS ± XX
XXX DECIMALS ± XXX
BREAK SHARP EDGES MAX
FINISH XXX RMS
DES M J RENNICH 09/07/88
DRW R W TAYLOR 11/08/88
CHK
SECT
DEPT & PLANT
PE
CR
PJ
REQ
DRAWING APPROVALS
DATE
MARTIN MARIETTA ENERGY SYSTEMS, INC
Oak Ridge, Tennessee • Paducah, Kentucky
CASK MAINT. FACILITY
FEASIBILITY STUDY
EXTERNAL CLEANING BOOTH
EXTERNAL CLEANING BOOTH
TYPE S
PLANT ORNL
BLDG 1000
SHEET 1 OF 1
CLASS U
SCALE NOTED
ID 12824
X3E-12824-06
REV 0
NUMBER OF MODELS IN THIS DRAWING= 1



CASK EXTERIOR MAINTENANCE AND TESTING AREA

MARTIN MARIETTA ENERGY SYSTEMS INC

CASK MAINT FACILITY
FEASIBILITY STUDY
TEST STATIONS

TEST STATIONS

DES	XXXXXXXXXX
DRW	RON TAYLOR
CHK	
SECT	
DEPT & PLANT	
PE	
CR	
PJ	
REQ	

1	48	49	50	PLANT	BLDG	FL	SHEET	OF	CLASS
3	M	X	X	ORNL	1000	1	0	0	U

SCALE	ID	DRAWING NO.	REV
1/4"=1'-0"	12824	X3E 12824-063	0

TYPE S

NUMBER OF MODELS IN THIS DRAWING= 1

THIS DRAWING PRODUCED ON CADAM
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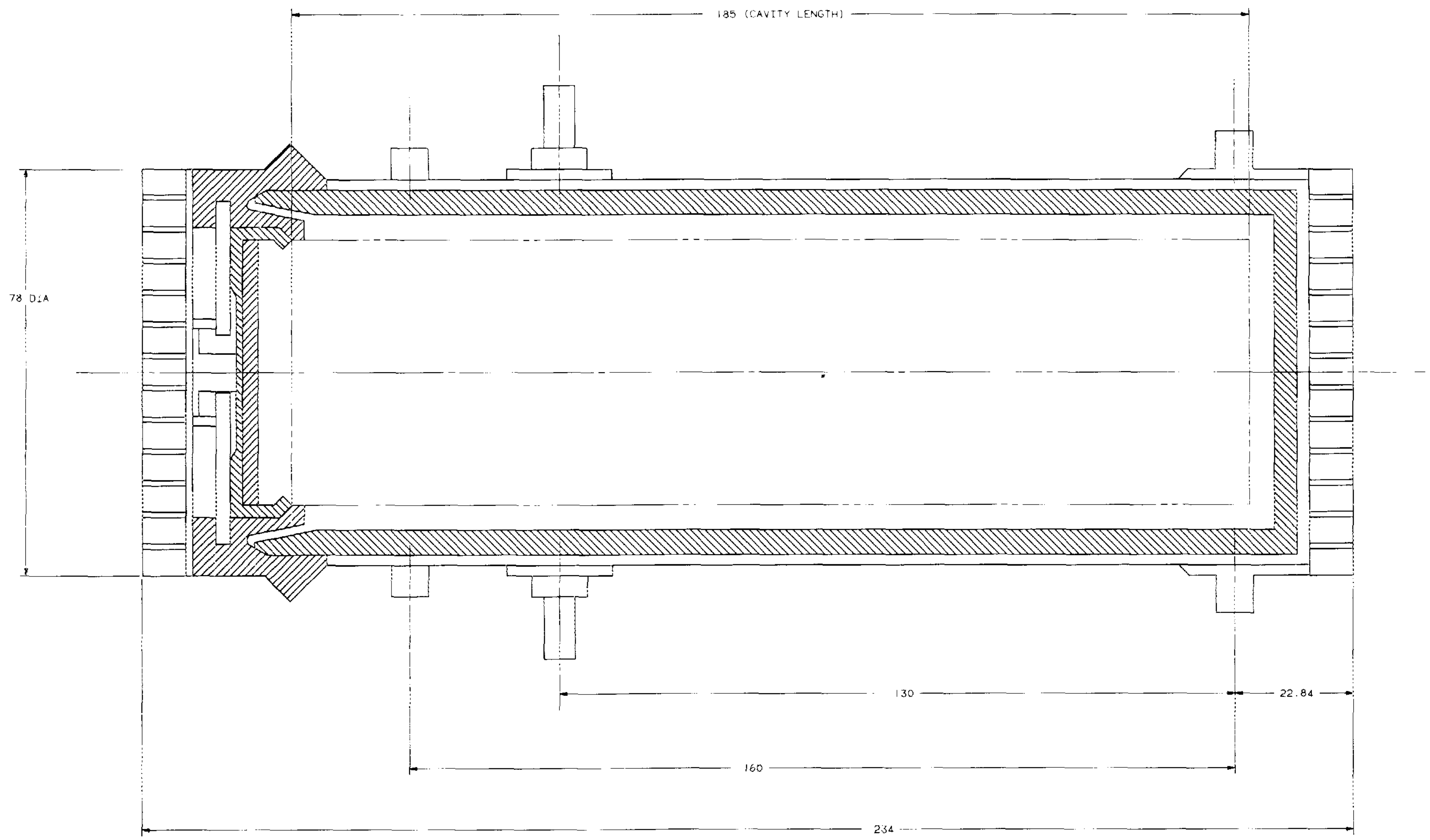
CHANGE CONTROL SYSTEM
ENGINEERING PROCEDURE



SECTIONAL VIEW
MRS/REPOSITORY CASK

WEIGHT..............150 TONS

APPROXIMATE DIMENSIONS SHOWN

THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY
CHANGE CONTROL SYSTEM________
ENGINEERING PROCEDURE________

DES WILLIAMSON
DRN C D DAVIS

MARTIN MARIETTA ENERGY SYSTEMS, INC

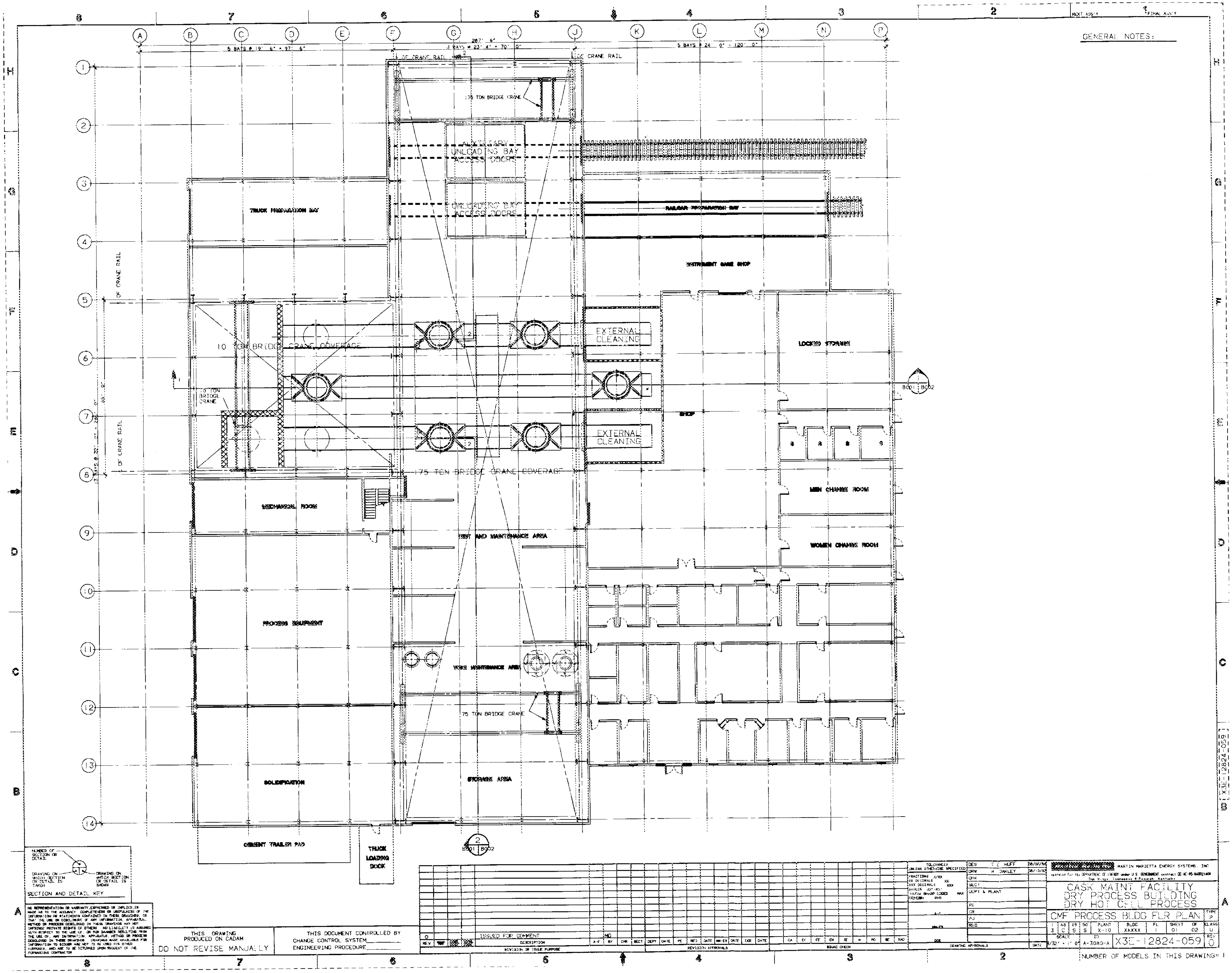
CASK MAIN FACILITY
FEASIBILITY STUDY
MRS-REPOSIT, SHIPPING CASK

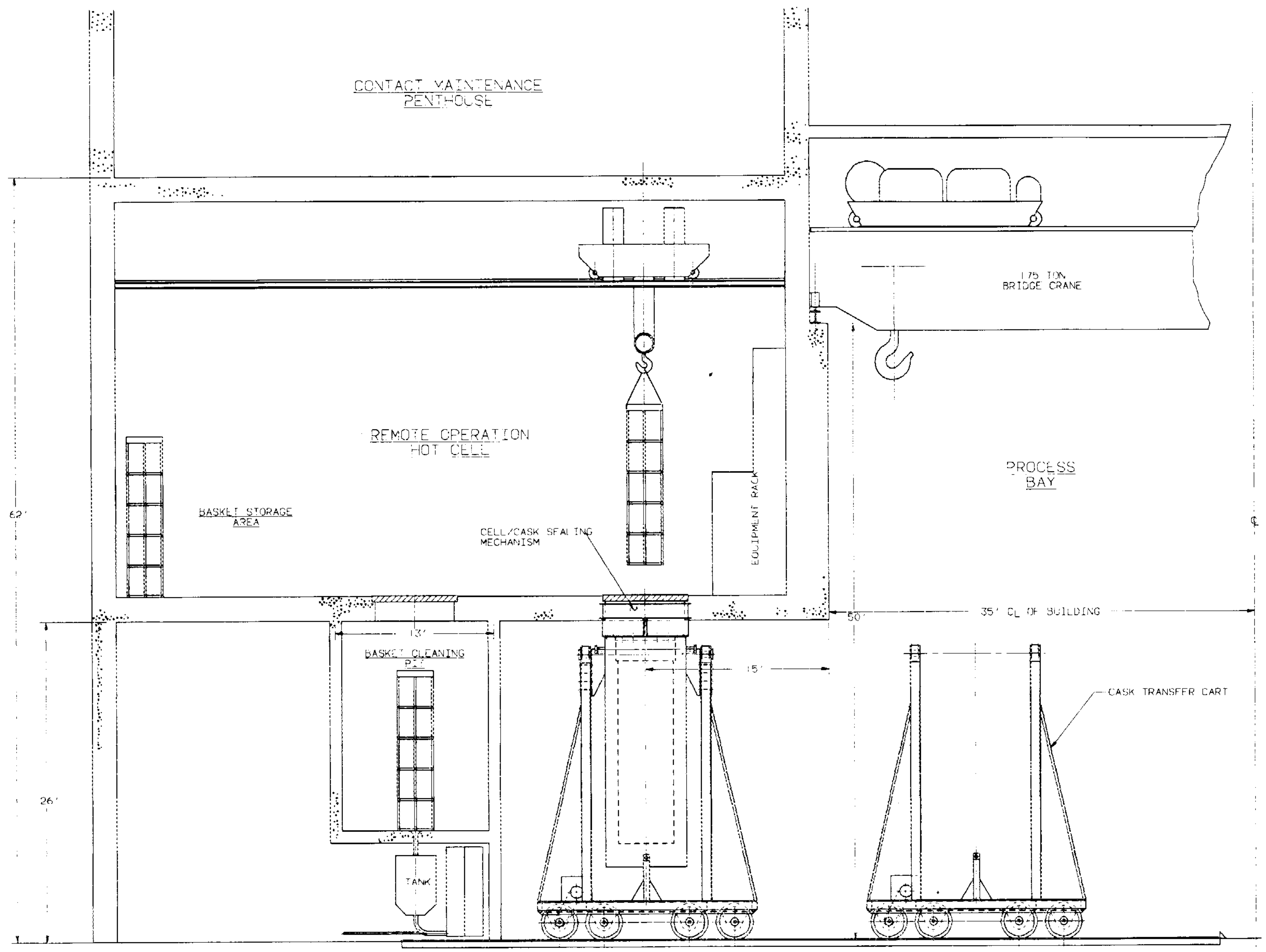
MRS REPOSITORY CASK

TYPE S
CLASS U
PLANT ORNL
SCALE NONE
ID 12824
X3E-12824-053
REV 0

NUMBER OF MODELS IN THIS DRAWING= X

• • WORK PACKAGE AUTHORIZATION • •


GENERAL NOTES:
175 TON BRIDGE CRANE
AUXILIARY UNLOADING BAY ACCESS DOORS
UNLOADING BAY ACCESS DOORS
TRUCK PREPARATION BAY
RAILCAR PREPARATION BAY
INSTRUMENT CASE SHOP
10 TON BRIDGE CRANE COVERAGE
10 TON BRIDGE CRANE
EXTERNAL CLEANING
LOCKED STORAGE
SHOP
175 TON BRIDGE CRANE COVERAGE
MECHANICAL ROOM
MEN CHANGE ROOM
WOMEN CHANGE ROOM
TEST AND MAINTENANCE AREA
PROCESS EQUIPMENT
YOKE MAINTENANCE AREA
75 TON BRIDGE CRANE
SOLIDIFICATION
STORAGE AREA
CEMENT TRAILER PAD
TRUCK LOADING DOCK
SECTION AND DETAIL KEY
THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY
THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM
ENGINEERING PROCEDURE
ISSUED FOR COMMENT
TOLERANCES UNLESS OTHERWISE SPECIFIED
DES T. E. HUFF
DRW M. OAKLEY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
CASK MAINT FACILITY
DRY PROCESS BUILDING
DRY HOT CELL PROCESS
CMF PROCESS BLDG FLR PLAN
PLANT X-10
BLDG XXXXX
SHEET 01 OF 02
ID A-3080-A
X3E-12824-059
REV 0
NUMBER OF MODELS IN THIS DRAWING= 1



SECTIONAL VIEW OF DRY PROCESSING CELL

THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM
ENGINEERING PROGRAM

DES	M RANNICH 05/04/88
DRW	WHITSON JG 05/04/88
DEPT & PLANT	
DRAWING APPROVALS	DATE

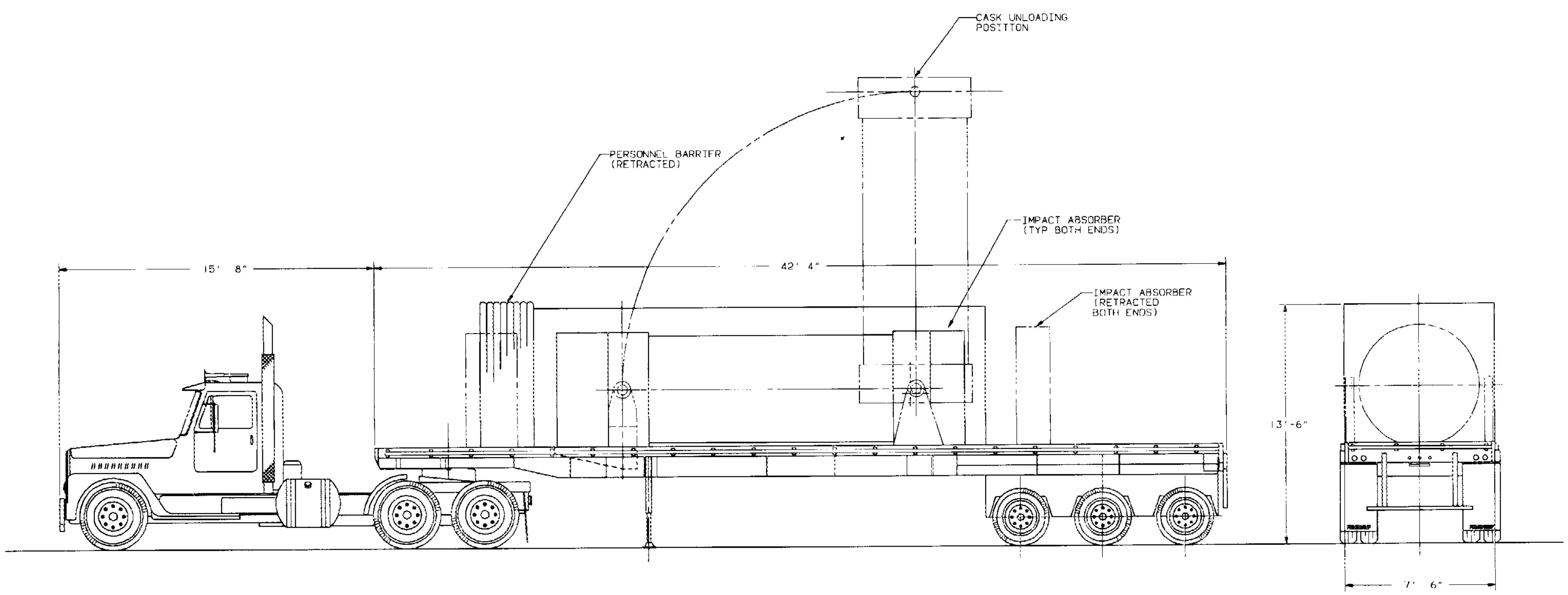
MARTIN MARIETTA ENERGY SYSTEMS INC
operating for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE AC 05 84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAINT. FACILITY
FEASIBILITY STUDY
DRY PROCESSING CELL

CMF HOT CELL SECTION A

PLANT	BLDG	SHEET	TYPE	CLASS	SCALE	ID	DWG NO.	REV
ORNL	1000	1	A	U	1/32" = 1'	12824	X3E 12824-011	0

NUMBER OF MODELS IN THIS DRAWING= 1



END ELEVATION OF TRAILOR

LEGAL WEIGHT TRUCK CASK ON TRAILER

SCALE: 1/2" = 1'-0"

APPROXIMATE DEMENSIONS SHOWN

THIS DRAWING PRODUCED ON CADAM
DO NOT REVISE MANUALLY

THIS DOCUMENT CONTROLLED BY CHANGE CONTROL SYSTEM ______
ENGINEERING PROCEDURE ______

DES	WILLIAMSON	04/11/86
DRW	C D DAVIS	04/11/86

MARTIN MARIETTA ENERGY SYSTEMS INC

operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC05-84OR21400
Oak Ridge, Tennessee • Paducah, Kentucky

CASK MAIN FACILITY
FEASIBILITY STUDY
LEGAL WT CASK ON TRUCK

LEGAL WEIGHT CASK ON TRUCK

SCALE	ID		REV
1/2" = 1'	12824	X3E-12824-054	0

NUMBER OF MODELS IN THIS DRAWING: X

Appendix A

EXPANDED TECHNICAL REVIEW MEETING REPORT

The following is an expansion of the Technical Review Meeting Report, showing the Feasibility Study team's responses to comments and questions. The documents used in the Peer Review are available from the Transportation Operations Project Office, Oak Ridge, Tennessee.

STUDY TEAM RESPONSES ARE SHOWN IN CAPS.

CASK MAINTENANCE FACILITY (CMF) FEASIBILITY STUDY
MINUTES OF THE DESIGN CONCEPT CONTRACTOR PEER REVIEW MEETING

The subject technical review was conducted in Oak Ridge, Tennessee, on August 31 and September 1, 1988. A list of attendees is provided as Attachment 1 to these minutes, and the agenda, as Attachment 2.

Ron Pope and Rick Rawl welcomed the attendees, reviewed the purpose of the meeting, and provided a brief history of the feasibility study. Larry Shappert discussed the proposed review procedures and gained their acceptance from the review team. The approved procedures are provided as Attachment 3 to these minutes.

Reid Attaway provided a summary of the system functional requirements and the assumptions and uncertainties associated with the CMF system definition. Comments on this presentation are as follows:

1. CMF Assumption No. 2 - Ralph Best questioned whether 1998 was a logical target date for the Transportation Operation System (TOS) to begin to accept spent nuclear fuel (SNF) and commercial high-level waste (CHLW). This comment was not resolved.

    RESPONSE: ALTHOUGH THE NWPA REQUIREMENT FOR 1998 ACCEPTANCE OF WASTE HAS NOT BEEN CHANGED, THE DRAFT MISSION PLAN AMMENDMENT INDICATES THAT: THE CURRENT PROGRAM ASSUMPTIONS NOW INCLUDE THE FACT THAT A LIMITED SHIPPING CAPABILITY WILL BE AVAILABLE IN THE 1998 TIMEFRAME BASED UPON THE EXISTENCE OF AN OPERATING MRS FACILITY.

2. CMF Assumption No. 3 - This assumption stated that "the CMF shall not be required to handle, maintain, repair, or store loaded casks." The review team noted that some incidental maintenance such as changing a leaky valve would be needed on loaded casks at some prearranged location.

    RESPONSE: THE CAPITAL INVESTMENT REQUIRED TO DESIGN AND CONSTRUCT THE CMF TO HANDLE SPENT FUEL WOULD BE VERY HIGH DUE TO MORE RESTRICTIVE REQUIREMENTS. A STUDY OF PROBLEMS RELATED TO HANDLING DAMAGED CASKS WITH FUEL INSIDE IS RECOMMENDED BY THE FEASIBILITY STUDY TEAM (SEE SECTION 6.9). INTERACTION WITH THE UTILITIES AND THE MGDS WILL BE REQUIRED ON THIS SUBJECT.

3. CMF Assumption No. 4 - The review team discussed whether field maintenance would be performed by field services personnel or CMF personnel. It was determined that personnel performing field maintenance must be qualified and QA must be involved (i.e., proper coordination must be maintained) between the field maintenance function and the QA function. This relationship is an example of an operational interface that must be considered during the allocation of functional requirements.

    RESPONSE: THIS UNCERTAINTY WILL REMAIN UNTIL THE STRUCTURE FOR MANAGEMENT OF THE TRANSPORTATION SYSTEM HAS BEEN DEFINED AND RESPONSIBILITY FOR FUNCTIONS HAVE BEEN DEFINED.

4. CMF Assumption No. 5 - Gene Rodriguez stated that in the repository Conceptual Design Report, (the current baseline repository design) reconfiguration of casks is not addressed. He pointed out that the Generic Requirements Document (U. S. Department of Energy/RW-0090) states that the repository "should" be capable of replacing cask removable components, such as baskets and sleeves, and "should" include provisions for lag storage of those components, as opposed to "shall." The design requirements were derived for the repository Conceptual Design. This item requires further study and could be affected by the location of the CMF.

RESPONSE: CASK RECONFIGURATION ACTIVITIES REQUIRE COORDINATION WITH THE MGDS AND OTHER TRANSPORTATION OPERATIONS. SECTION 6.4 RECOMMENDS A GENERAL TOS STUDY OF THIS SITUATION. THE CURRENT CMF CONCEPT ASSUMES THE CMF WILL RECONFIGURE CASKS.

5. CMF Uncertainty No. 1 - The review group discussed the licensing requirements for the CMF and agreed that the primary uncertainty is whether they are governed by 10CFR30, 40, or 70 since none were written with the CMF in mind. Larry Danese stated that he thought a by-product materials license is at least required (10CFR30). In any case, the licensing will probably be affected by the source term chosen to describe what will be handled at the CMF. It was a consensus that this uncertainty should be determined as soon as possible.

RESPONSE: SEE SECTION 6.2.1 ON FACILITY LICENSING - THE UNCERTAINTY REMAINS AND IS BEYOND THE SCOPE OF THE FEASIBILITY STUDY EFFORT. LICENSING UNDER PART 30 HAS BEEN ASSUMED FOR THIS STUDY.

6. CMF Uncertainty No. 2 - This uncertainty deals with how much radioactive material remains in the cask when it arrives at the CMF. Tom Tehan and Larry Danese stated that they had not found spent fuel remnants in casks, but had found lots of "junk." Consensus was that if fuel is found in an "unloaded" cask, it must be handled as an abnormal event and must be planned for as an eventuality.

RESPONSE: SPENT FUEL RELEASE INTO THE CASK WILL BE TREATED ON A CASE BY CASE BASIS. THE POOL WILL PROVIDE A FLEXIBLE AND SAFE MEANS OF PROTECTING THE PERSONNEL AND ENVIRONMENT DURING THE SPECIAL OPERATIONS REQUIRED TO ISOLATE AND CONTAIN TRU WASTE FOR SHIPMENT AND DISPOSAL. DECONTAMINATION METHODS AND REQUIREMENTS ARE DISCUSSED IN APPENDIX A.2.

7. CMF Uncertainty No. 3 - This uncertainty has to do with control of interfaces between the CMF and casks, baskets, etc. Bob Jones stated that casks are currently being designed with no interaction between those who must operate and maintain the casks (e.g., the CMF operators) and the cask designers. He stated that interaction with the cask designers should be taking place now. Jones further stated

that this uncertainty did not address issues of importance in cask decontamination (e.g., studs vs bolts) and perhaps should be stated more generally. Standardization in cask design is important.

RESPONSE: DIRECT INTERACTION BETWEEN THE CMF DESIGN TEAM AND THE CASK DESIGNERS IS RECOMMENDED IN SECTION 6.3. A CLOSE WORKING RELATIONSHIP WILL ASSIST BOTH TEAMS IN THE DESIGN OF COMPATIBLE SYSTEMS.

8. CMF Uncertainty No. 4 - This uncertainty questioned whether Transportation Operation System (TOS) integrated testing will be further integrated with that of the MGDS. Ralph Best pointed out that this uncertainty was associated with Assumption No. 2 (item 1 above).

RESPONSE: THIS AREA IS STILL TO BE RESOLVED AND MUST BE COORDINATED WITH THE ENTIRE FWMS REQUIREMENTS. GOOD ENGINEERING PRACTICE STRONGLY SUGGESTS THAT THE TOS INTEGRATED TESTING SHOULD BE INTEGRATED WITH THAT OF THE MGDS.

Mark Rennich presented the design basis of the CMF and significant issues. Comments and questions concerning this presentation and the Significant Issue Papers (SIPs) are given below.

1. Ron Pope indicated that the cask drawings in the presentation should reflect current cask data from Idaho.

RESPONSE: THE FEASIBILITY STUDY REPORT AND DESIGN HAS BEEN BASED ON THE LATEST CASK INFORMATION AVAILABLE.

2. Concerning the "Basis for Current Study Design" presentation chart, it was noted that the Morris Plant should be added to the list of facilities visited.

RESPONSE: THE VISIT TO THE MORRIS FACILITY IS RECOGNIZED IN THE FEASIBILITY STUDY ACKNOWLEDGEMENTS.

3. SIP No. 27 - Water Transport Access - This issue provoked a long discussion, mainly concerning rail, since any casks transported by barge would be transferred to rail for

the last leg of the trip into a CMF. Tom Tehan stated that rail transport must be considered in depth. Rail capability can be a long lead item; one must consider how long it takes to get in place and what services are available. It was stated that we should look at the MRS siting criteria and adapt this to our use. [Consensus agreement] Tehan stated that Morris costs for rail maintenance would be between $10,000 to $15,000 per year. He said we would probably own 3 to 4 miles of track. Tehan also indicated that sidings are important, and parent railroad tie-ins are critical due to potential abandonment. He stated that cask weights over 125 tons were very hard to handle. Tehan also said that barge maintenance was an expensive item.

> RESPONSE: PLANNING FOR RAIL SERVICE INSTALLATION IS BEYOND THE SCOPE OF THE FEASIBILITY STUDY; HOWEVER, RAIL SERVICE IS ASSUMED TO BE AVAILABLE WITHIN 0.5 MILES OF THE SITE. IT IS ASSUMED THAT THE ISSUE OF RAIL SERVICE WILL BE ADDRESSED AS PART OF THE SITE SELECTION PROCESS. BARGE MAINTENANCE IS ASSUMED TO BE PERFORMED IN THE AREA THE BARGES ARE USED AND NOT AT THE CMF SITE WHICH MAY NOT HAVE WATER ACCESS (SECTION 2.8).

4. SIP No. 20 - Handling Loaded Casks - Ralph Best indicated that he believes the NRC will require the CMF to accept small quantities of fuel (pellets). However, the consensus was that the casks may contain residual activity and only trace amounts of fission products. (See also CMF Uncertainty No. 2 previously discussed.)

Reuben Peterson stated that no place is set up to handle accident scenarios (i.e., a place designated to house a loaded cask after it has been in an accident). This issue needs to be addressed.

> RESPONSE: THE ISSUE OF LOADED CASK HANDLING AT THE CMF IS DISCUSSED IN SECTION 6.9. THIS STUDY ASSUMED THAT LOADED CASKS WOULD NOT BE HANDLED AT THE CMF (SECTION 2.3.3); HOWEVER, IT DOES ASSUME THAT LIMITED AMOUNTS OF SPENT FUEL WILL BE PRESENT ON RARE OCCASIONS. THE SPENT FUEL, IN THE FORM OF PELLETS AND POWDER, WILL BE REMOVED AND ISOLATED FOR SHIPMENT AND DISPOSAL ON AN INDIVIDUAL CASE BASIS. A MORE DETAILED ANALYSIS OF THIS PROBLEM IS RECOMMENDED BY THE STUDY TEAM.

5. SIP No. 17 - Ron Pope noted that there is a close relationship between regulatory compliance and cask maintenance. The CMF must be involved in SARP modifications and the tracking of the C of C's.

   RESPONSE: THE DIRECT CONNECTION BETWEEN THE REGULATORY REQUIREMENTS AND CASK MAINTENANCE IS RECOGNIZED IN THE OPERATING ASSUMPTIONS FOR THE PROPOSED FACILITY (SECTION 2.0). IT IS FURTHER REFLECTED IN THE LOCATION OF A DATA STORAGE FACILITY IN THE CMF DEDICATED TO MAINTAINING ALL RECORDS RELATED TO THE CASKS INCLUDING REGULATORY TESTS AND CERTIFICATES.

6. SIP No. 16 - Cask Repair Functions - Bob Jones stated that we must pay particular attention to the classification and QA of parts, in addition to our concern about stock levels.

   RESPONSE: THE FEASIBILITY STUDY DEFINES A SPECIAL AREA FOR THE STORAGE OF Q.A. CERTIFIED SPARE PARTS (DRAWING S3E-12824-B001). THE ASSUMED OPERATING PERSONNEL LIST (TABLE 4.1) ALSO SPECIFIES A PURCHASING AGENT AS REQUIRED FOR PROCUREMENT OF Q.A. CERTIFIED EQUIPMENT.

7. SIP No. 10 - Bob Jones pointed out that any repair or maintenance activities, whether done at the CMF or elsewhere, must be done by trained people in accordance with QA plans. Tom Tehan stated that utilities would not touch safety items related to casks, the owners must take care of these problems. Ralph Best stated that the CMF should have the capability to send people to the field when needed. (See also CMF Assumption No. 4, previously discussed).

   RESPONSE: STAFFING FOR OFF-SITE MAINTENANCE OPERATIONS WAS CONSIDERED PRIMARILY AN OPERATING CONSIDERATION. CONSEQUENTLY, THE PHYSICAL LAYOUT OF THE FACILITY WAS NOT EFFECTED. A DETAILED ANALYSIS OF THE OPERATING COSTS INCLUDING MANPOWER STAFFING WILL BE REQUIRED AS PART OF THE CONCEPTUAL DESIGN. THE COST IMPACT ON THE FACILITY PRIMARILY IN OFFICE SPACE IS EXPECTED TO BE MINIMAL.

8. SIP No. 8 - Testing Requirements - Bob Jones stated that thermal testing should not be planned for in the CMF since it was difficult to accomplish and has no real benefit. It was then stated by the review team that thermal, blackness, and shielding test requirements were not adequately defined at this time and should not be included in the feasibility study (blackness and shielding testing had already been excluded by the design team).

> RESPONSE: THE THERMAL, BLACKNESS AND SHIELDING TEST REQUIREMENTS WERE DROPPED FROM THE FEASIBILITY STUDY.
>
> THE TIMING OF SPECIFIC TESTS IS NOT CONSIDERED IN THE STUDY REPORT SINCE ACCURATE INFORMATION CONCERNING SPECIFIC TESTS IS IMPOSSIBLE TO OBTAIN AT THIS TIME. THE ASSUMED TESTS SHOWN IN APPENDIX D ARE BASED ON CURRENT TEST REQUIREMENTS.

It was noted that the requirement for performing tests annually may not be correct, and Tom Tehan recommended that the wording be changed to "periodically." This item received consensus agreement. Mark Rennich pointed out that the feasibility

study personnel needed to make some assumptions for study purposes, and "annually" seem reasonable.

The review team recommended that the words "after initial acceptance" be added to the statement that "CMF will perform all nondestructive cask tests."

9. SIP No. 15 - Cask Lifting Fixture Handling - The review team noted that the statement "yokes <u>may</u> be contaminated" should be changed to "yokes <u>will</u> be contaminated."

> RESPONSE: THE PROCESS BUILDING DESIGN WAS CHANGED TO DOUBLE THE AREA DESIGNATED FOR AUXILIARY EQUIPMENT MAINTENANCE (SEE DRAWING NO. S3E-12824-B001). THIS AREA IS IN THE CONTROLLED ZONE AND WILL BE EQUIPPED TO HANDLE CONTAMINATED EQUIPMENT.

It was further stated that ANSI N14.6 and NUREG 0612 define the requirements for lifting fixtures.

The question was raised as to whether the use of extensions was planned in order to keep the crane hook from getting wet. It was stated that they would be used. It was observed that different yokes may be required for different cask systems. The statement was made that a considerable amount of time was required for building storage boxes to ship yokes and ancillary equipment in a shipping campaign.

10. SIP No. 29 - Non-Stainless-Steel Cask Handling - Ralph Best noted that there will be casks other than spent fuel casks that have to be handled (e.g., low-level waste from the CMF). Reid Attaway stated that the low-level waste handling will be a procured service. It was noted that this should be added to the conclusions. It was further noted by the review team that high-level-waste casks, as well as spent fuel casks, will be handled by the CMF.

RESPONSE: THE DISPOSAL OF LLW IS EXPECTED TO BE A PROCURED SERVICE. IN THE CASE OF A PROCURED SERVICE NO CAPITAL COST WILL BE ADDED TO THE FACILITY. (SECT. 3.8).

11. SIP No. 9 - Transport Vehicle Storage - It was recommended that the statement "vehicles are weak point in system" be deleted. Reuben Peterson said that casks and vehicles of a particular design must be interchangeable feature and this feature should be a written requirement. It was pointed out that interchangeability in a particular cask design should pertain to baskets, impact limiters, and spacers also.

This SIP also triggered a discussion on the storage of baskets and energy absorbers.

RESPONSE: THE BASIC ASSUMPTIONS (SEE SECTION 3.0) OF THE FEASIBILITY STUDY STATE THAT THE CASK SYSTEMS WILL USE INTERCHANGEABLE PARTS WITHIN A SPECIFIC DESIGN AS SPECIFIED BY THE CASK PROCUREMENT DOCUMENTATION (DOE-IDAHO).

THE FEASIBILITY STUDY NO LONGER MAKES REFERENCE TO THE RELATIVE RELIABILITY OF THE TRANSPORT SYSTEM OR SYSTEM COMPONENTS.

THE DISCUSSION OF ENERGY ABSORBER STORAGE CONCLUDED WITH THE STATEMENT OF THE ASSUMPTION (SEE APPENDIX A.3) THAT THE ABSORBERS WOULD STAY WITH THE TRANSPORT VEHICLES DURING UNLOADING/LOADING AND

CASK PROCESSING. THIS ASSUMPTION IS FUNDAMENTAL TO EFFICIENT OPERATION OF THE CMF BY REDUCING THE HANDLING TIME AND STORAGE SPACE REQUIREMENTS. IT IS NOT INCLUDED IN THE CASK SYSTEM PROCUREMENT DOCUMENTS AVAILABLE TO THE FEASIBILITY STUDY TEAM. SINCE IT APPEARS TO APPLY TO THE ENTIRE TOS THE STUDY TEAM RECOMMENDS THAT IT BE ADDED AS A FORMAL REQUIREMENT.

IF THE INTERCHANGABILITY OF CASK COMPONENTS IS NOT MAINTAINED THE COMPLEXITY OF CMF OPERATIONS AND THUS THE COST OF BUILDING AND OPERATING THE FACILITY WILL INCREASE.

12. The review team noted that the drawing labeled "overweight truck" was actually a "heavy-haul truck." It was recommended that the drawing be replaced with a drawing of an overweight truck.

RESPONSE: REFERENCES TO THE HEAVY HAUL VEHICLES WERE REMOVED FROM THE FACILITY DESIGN. AS STATED IN THE ASSUMPTIONS (SEE SECTION 2.2) HEAVY HAUL VEHICLES, LIKE BARGES, WILL BE USED LOCALLY AT GENERATOR SITES ONLY; THEREFORE, MAINTENANCE AND STORAGE WILL ALSO BE PROVIDED AT THE LOCAL SITE. THE UNCERTAINTIES ASSOCIATED WITH BARGES AND HEAVY HAUL TRUCKS ARE NOTED IN SECTION 6.7.

13. SIP No. 5 - Cask Processing Rate - The assumed 4 cycles per year per cask seemed high to most on the review committee. It was suggested that a better assumption would be 1 cycle/year for maintenance and 2 changeout cycles/year, but even that seemed high to some. Experience with casks outside the United States should be used to help firm up numbers.

It was also noted that if baskets were designed to make cleansing easier, it would have a positive impact on processing times. Also, the need to transport spacers and other items must be considered by CMF personnel.

RESPONSE: THE CYCLE RATE WAS CHANGED TO TWICE ANNUALLY PER CASK AND THE DESIGN OF THE FACILITY

CHANGED ACCORDINGLY (SEE SECTION 3.4). THE UNCERTAINTIES RELATED TO THE NUMBER OF CASKS IN THE TOS SYSTEM ARE NOTED IN SECTION 6.8.

THE FEASIBILITY STUDY RECOMMENDS INVOLVEMENT OF THE CMF DESIGNERS IN THE CASK PROCUREMENT REVIEW PROCESS TO INSURE COORDINATION OF DESIGNS AND PROCEDURES (SEE SECTION 6.3)

THE FEASIBILITY STUDY DESIGN PROVIDES FOR A SEPARATE LOADING DOCK FOR AUXILIARY EQUIPMENT SUCH AS SPACERS AND YOKES (SEE DRAWING NO X3E-12824-B001).

14. SIP No. 22 - Operating Schedule - The review team pointed out that health physics personnel would be required on each shift, seven days per week, instead of the 5 shifts per week indicated since vehicles are received at anytime.

RESPONSE: THE PROPOSED OPERATING STAFF WAS INCREASED TO INCLUDE EIGHT HEALTH PHYSICS TECHNICIANS (SEE SECTION 4.6). THIS STAFFING LEVEL WILL PROVIDE FOR WEEKEND COVERAGE OF INCOMING SHIPMENTS.

15. SIP No. 14 - Systems Scheduling - Ralph Best stated that the "Annual" report noted should be called the "Annual Capacity Report," and the quarterly and monthly reports deleted since these latter two have no official standing.

RESPONSE: ALL REFERENCES TO REPORTING WERE DROPPED FROM THE FEASIBILITY STUDY SINCE IT IS IRRELEVANT TO FACILITY DESIGN AND STAFFING.

16. SIP No. 11 - Office and Personnel Space Requirements - The review team alerted us to use care not to duplicate functions or personnel with other parts of the program (e.g., training).

RESPONSE: MANPOWER REQUIREMENTS FOR THE CMF WERE ASSUMED TO ESTABLISH THE OFFICE AND SHOP SPACE REQUIREMENTS (SEE SECTION 4.6). THE SPECIFIC NUMBERS ARE ESTIMATES AND WILL HAVE TO BE REVISED DURING THE CONCEPTUAL DESIGN WHEN THE EXACT FUNCTIONS OF THE CMF ARE ESTABLISHED. SOME FUNCTIONS SUCH AS TRAINING,

PURCHASING AND Q.A. WILL OVERLAP OTHER TOS FUNCTIONS AND WILL THEREFORE REQUIRE SEPARATE STAFFING AT SEVERAL FACILITIES.

17. SIP No. 4 - Cask Designs - Paul Standish noted that the legal weight truck cask should be 25 tons and the overweight truck cask should be 40 tons, instead of the 40 and 75 ton numbers, respectfully, used on the chart. Characteristics of the "From Reactor Casks" being designed for DOE were provided (see Attachment 4).

It was also pointed out that existing casks had been omitted from the assumed cask types and that the "no basket" notation on MRS/Repository and high-level defense waste casks should be changed to "no interchangeable basket."

RESPONSE: THE NOTED CHANGES HAVE BEEN MADE IN THE FEASIBILITY STUDY (SEE APPENDIX C).

18. SIP No. 12 - Cask Ownership - It was noted that the word "ownership" may need further definition. The need for continuity of information on the design basis of the casks for the owner and operator was discussed. Cask "responsibility" was listed as a subject for requirements allocation. Tom Tehan stated that cask maintenance or repair cannot be done without the owner's blessing (i.e., those responsible for maintaining the Certificate of Compliance).

RESPONSE: OWNERSHIP OF THE SHIPPING CASKS IS A COMPLEX ISSUE WHICH EFFECTS THE CMF IN ONE MAJOR AREA: RESPONSIBILITY FOR THE CASK QUALITY. THIS INCLUDES MAINTENANCE OF THE OFFICIAL RECORDS, APPROVAL AUTHORITY FOR REPAIRS AND MAINTENANCE, AND STORAGE OF ANY CERTIFIED REPLACEMENT PARTS. THE ASSUMPTIONS FOR THIS STUDY STATE THAT ONLY THE CMF WILL HAVE THIS RESPONSIBILITY (SEE SECTION 3.0). OTHER RELATED ISSUES SUCH AS PROCUREMENT OF NEW CASKS AND DISPOSAL OF RETIRED CASKS DO NOT BEAR ON THE DESIGN OR COST OF THE CMF AND THEREFORE WERE NOT CONSIDERED IN THE STUDY.

19. SIP No. 6 - Internal Structures - The subject of basket changeout intervals was revisited (see SIP No. 5) and reiterated as a subject requiring further study. It was felt that if the basket could not be easily flushed of residual activity, the basket might have to be removed once a year or so just for cleaning.

The statement "Confinement will be required for stored structures" should be modified to say "Confinement and shielding ..."

<u>RESPONSE</u>: THE STUDY DESIGN PROVIDES FOR A DEEPWELL IN THE POOL FOR BASKET REMOVAL. A DRY BASKET INSPECTION AND MAINTENANCE BOOTH ABOVE THE POOL CANAL WAS ADDED TO PERMIT BETTER INSPECTION AND CLEANING.

SECTION 6.4 NOTES THE UNCERTAINTIES ASSOCIATED WITH BASKET CHANGEOUT AND RECOMMENDS A TOS STUDY TO RESOLVE SEVERAL SPECIFIC ISSUES.

20. SIP No. 19 - Automatic (Remote) Operations - It was noted that if remote operations are to be used, the casks must be designed to accommodate them.

Paul McCreery recommended that the phrase "where the memory of the operator takes over" be deleted from the full text of this SIP.

<u>RESPONSE</u>: THE CMF IS DESIGNED TO INCORPORATE NO AUTOMATIC OR REMOTE OPERATIONS. THIS IS BASED ON THE UNDERLYING CONSERVATIVE APPROACH USED THROUGHOUT THE STUDY. SPECIAL EQUIPMENT CAN BE ADDED TO THE SYSTEM AS REQUIRED BY THE CASK DESIGNS WHEN THE INFORMATION BECOMES AVAILABLE. SECTION 6.3 NOTES THE NEED FOR DIRECT INVOLVEMENT OF THE CMF DESIGNERS IN THE CASK DEVELOPMENT PROCESS.

21. SIP No. 18 - Seismic Considerations - The review team stated that "design base earthquake" should not be based on Oak Ridge data alone, but should be a composite envelope of several appropriate locations, including the Yucca Mountain site.

RESPONSE: REFERENCES TO SPECIFIC SITE DATA FOR SEISMIC DESIGN WERE DELETED FROM THE STUDY.

A review of the wet vs dry processing study was presented by Mark Rennich. Comments/questions of this presentation were:

1. The presentation indicated that wet processing entailed a minimum capital investment and dry processing a maximum capital investment. Ralph Best questioned the validity of this statement.

   RESPONSE: REFERENCES TO THE RELATIVE COST OF THE WET AND DRY SYSTEMS WERE DELETED DUE TO THE ABSENCE OF FIRM FIGURES.

2. Mark Rennich stated that a consensus of American industry favors wet processing based on known experience. Fully remote maintenance cells including pass-throughs, manipulators, etc., are very complicated. However, a fully integrated repository/-CMF/MRS would probably lean toward dry processing since maintenance cells will already be in place.

   RESPONSE: NO RESPONSE REQUIRED.

3. The statement "compatible with rest of spent fuel systems" should be changed to "compatible with reactor portion of spent fuel systems" on the wet-vs-dry processing chart that was presented.

   RESPONSE: THIS STATEMENT WAS DELETED FROM THE STUDY.

Karen Lott discussed significant issues related to decontamination and waste consideration. Comments/questions concerning this presentation were:

1. SIP No. 2 - Level of Decontamination - It should be specified that the 2200 dpm/100 cm^2 requirement is "dpm beta gamma."

   It was pointed out that the wording of 10CFR961, Article III.B.2; "Cask shall be suitable for use at purchaser's site" could have significant impact depending upon how it is interpreted by utilities, particularly as it relates to internal contamination.

There needs to be interaction between the CMF and the repository operations on this issue.

Ralph Best stated that "and/or user acceptance criteria" should be deleted from "Contamination level regulated by CMF operations and/or user acceptance criteria."

It was suggested that, under cask interior and auxiliary equipment, "surveyed and deconned as needed" be changed to "surveyed and cleaned as needed."

It was noted that if the CMF is co-located with the MGDS, the level of contamination of the casks coming from the MGDS may be higher, increasing CMF workload.

> RESPONSE: THE ISSUE OF CASK DECONTAMINATION AND CLEANING WAS REVISITED AFTER THE REVIEW. APPENDIX B ADDRESSES THE COMMENTS MADE IN THIS SECTION.

2. SIP No. 13 - Transport Vehicle (Trailer/Rail Car) Decontamination. It was suggested that the word "Exterior" be inserted in the SIP title just before "Decontamination."

Larry Danese suggested that the phrase "state agencies may request on-the-road decon" be deleted from the chart.

Under conclusions, it was suggested that the bullets "CMF will be responsible for on-the-road decon operations" and "CMF will not provide specialized mobile decon equipment" be deleted.

> RESPONSE: CMF FUNCTIONS ASSOCIATED WITH ON-THE-ROAD DECONTAMINATION ARE ADDRESSED IN SECTION 3.2. BASICALLY THE CMF WILL PROVIDE ONLY EXPERTISE TO CLEANUP SERVICES BEING PROVIDED BY OTHERS.

3. SIP No. 24 - Cleaning and Decontamination of Cask Exterior - It was suggested that the phrase "Arriving casks will have contamination levels up to 10^6 dpm/100 cm^2" either be deleted, or be changed to "Arriving casks have had, in rare instances, contamination levels up to 10^6 dpm/100 cm^2."

Under "Conclusions" it was noted that procedures need to be reassessed to better state what will be cleaned/deconned on arrival or departure, but almost certainly the cask would not be deconned on arrival.

Concerning the CMF target decontamination level, Tom Tehan stated that 220 dpm/100 cm^2 may not be reasonable. He said that you must go on a case-by-case basis, depending upon cask design, but agreed that the value should be some fraction of the DOT Regulation.

> <u>RESPONSE</u>: APPENDIX B ADDRESSES THE ISSUES PRESENTED IN THIS SECTION. IN SUMMARY ALL THE COMMENTS WERE INCORPORATED INTO THE FACILITY OPERATING ASSUMPTIONS.

4. SIP No. 23 - Decontamination of Cask Interior - Regarding the statement that the "CMF pool cannot be contaminated with cleaning agents", Larry Shappert remarked that there is a need to consider what reasonable level of water quality needs to be maintained in the pool.

   It was also noted that, in the title of SIP 23, "decontamination" of cask interior should be changed to "cleaning" of cask interior.

   > <u>RESPONSE</u>: THE POOL WATER PROCESSING SYSTEM HAS PROVISIONS FOR CLEANING, DEMINERALIZING AND pH CONTROL (SEE DRAWING NO J3E-12824-100). THROUGHOUT THE DOCUMENT EMPHASIS ON DECONTAMINATION WAS CHANGED TO EMPHASIS ON CLEANING. THIS IS A MORE ACCURATE TERM FOR MOST OF THE OPERATIONS PERFORMED AT THE CMF.

5. SIP No. 25 - Disposal of Contaminated Waste - It was noted that the CMF needs to access the waste stream for alpha emitters. This needs to be reflected in SIP No. 23.

   Under conclusions, the word "temporary" should replace the word "<u>Limited</u>" in the bullet "<u>Limited</u> on-site storage will be provided for contaminated solid wastes."

RESPONSE: THE NATURE OF THE RADIOACTIVE WASTE STORAGE FACILITIES LOCATED ON THE CMF SITE ARE DESCRIBED IN ACCORDANCE WITH THIS COMMENT IN SECTION 4.3.12.

A review of the CMF design concept was presented by Mark Rennich. Comments/questions concerning this presentation included:

1. Mark Rennich noted that the current design concept does not provide for a railcar wash. Paul McCreery stated that he believed the CMF should have a wash-and-straight-through rail capability like the trucks have.

   RESPONSE: A RAILCAR PREPARATION BAY WAS ADDED TO THE FACILITY DESIGN (SEE DRAWING NO C3E-12824-A001). DRIVE-THRU RAIL CAPABILITY WAS NOT ADDED DUE TO SPACE LIMITATIONS.

2. Larry Danese said that loaded trucks must be inspected within 18 hours of being received.

   RESPONSE: REVISIONS IN THE ASSUMED STAFFING LEVELS (SEE SECTION 4.6) PROVIDE FOR INSPECTION OF ARRIVING VEHICLES DAILY.

3. The review team noted that the spare parts in the bead blast, inspection, and clean-up facility should be referred to as unregulated spare parts, since they are for trucks and railcars only.

   RESPONSE: THIS CHANGE WAS INCORPORATED INTO THE FEASIBILITY STUDY.

4. Bob Jones questioned why rail does not use the same guard shack as truck. Mark Rennich replied that a worst-case scenario was used.

   RESPONSE: NO RESPONSE REQUIRED.

5. Bob Jones asked how many casks could be processed at any one time. Mark Rennich stated 8.

RESPONSE: THE MAXIMUM NORMAL FACILITY LOADING IS NOW PROPOSED TO BE 7 DUE TO THE REDUCTION IN THE SIZE OF THE POOL. THE REDUCTION WAS BASED ON THE REDUCED

FACILITY THROUGHPUT SUGGESTED BY THE PEER REVIEW COMMITTEE.

6. Bob Jones stated that it may not be feasible to do all repair from the upright cask position. Discussion revealed the need for positioning the cask in both horizontal and bottom-up positions. Mark Rennich stated that there was room for tip-over in the storage area.

   RESPONSE: A CASK TIP AND ROTATE FRAME WAS ADDED TO THE PROCESS BAY EQUIPMENT LIST (SEE SECTION 4.2.6)

7. Ralph Best said that he did not see the need for as much height in the high bay area as was indicated on the drawing. Lowering the ceiling would save money.

   RESPONSE: THE CEILING WAS DROPPED FROM 55 FEET CLEARANCE TO 30 FEET CLEARANCE (SEE DRAWING NO. S3E-12824-B002).

8. Mel Jensen stated that the change rooms were not in an optimum location. Mark Rennich replied that room locations were not set at this time.

   RESPONSE: OPTIMIZATION OF PERSONNEL FLOW PATTERNS IS BEYOND THE SCOPE OF A FEASIBILITY STUDY AND IS THEREFORE NORMALLY FIRST ADDRESSED IN THE CONCEPTUAL DESIGN. THE PURPOSE OF THE FEASIBILITY STUDY WAS TO ASSESS ONLY THE SPACE REQUIREMENTS AND THE COST OF FACILITIES.

9. Tom Tehan stated that maintenance of yokes takes more time than casks require and that a separate place in the building with a separate 10-ton crane should be provided.

   RESPONSE: THE STORAGE AREA IN THE HIGH BAY WAS DOUBLED TO INCLUDE A YOKE MAINTENANCE AREA (SEE

DRAWING NO. S3E-12824-B001). CRANE SERVICE WILL BE PROVIDED BY THE TWO HIGH-BAY BRIDGE CRANES.

10. The review team noted that the receiving area does not allow enough room for removal of personnel barriers and impact limiters. Mark Rennich replied that the whole design was based on not having to remove barrier/impact limiters at the lower level and that it must be assured that they do not have to be removed.

RESPONSE: THE ASSUMPTION THAT IMPACT ABSORBERS WILL REMAIN ON THE VEHICLE THROUGHOUT CASK PROCESSING IS STATED IN APPENDIX C. THE AMOUNT OF STORAGE SPACE REQUIRED IF THE ABSORBERS MUST BE REMOVED AS PART OF NORMAL OPERATIONS WOULD BE PROHIBITIVE. IN ADDITION THE ADDED OPERATING TIME WOULD BE UNNECESSARILY EXPENSIVE. SECTION 6.3 STATES THE STUDY RECOMMENDATION THAT THE CMF DESIGNERS HAVE INVOLVEMENT IN THE CASK DESIGN REVIEW PROCESS TO INSURE COMPATIBILITY.

11. Paul McCreery questioned whether there was room in the existing design of the preparation and unloading bays for handling two vehicles at a time instead of just one as currently planned. Mark Rennich agreed to look into this issue.

RESPONSE: A SECOND UNLOADING BAY WAS ADDED TO THE FACILITY DESIGN (SEE DRAWING NO. S3E-12824-B001).

12. Concerning operational time estimates, Reuben Peterson stated that the November ALARA report from PNL (DOE CHTP01) contained the best available time estimates.

RESPONSE: THE PNL REPORT WAS REVIEWED AND THE ASSUMED CMF OPERATING TIMES WERE ADJUSTED ACCORDINGLY (SEE SECTION 3.5).

13. Reuben Peterson questioned how cask modifications were going to be handled. Also, he stated that bead blasting contamination may be a problem and should be looked at closely.

RESPONSE: NO RESPONSE REQUIRED.

14. The review team recommended that a change room in the receiving area be added for the receiving crew dressed in whites.

RESPONSE: THE CHANGE ROOM WAS NOT ADDED SINCE A NORMAL PERSONNEL FLOW PATH WILL HAVE UNLOADING OPERATORS MOVE EASILY TO THE HIGH-BAY CHANGE ROOMS.

15. Bob Jones questioned the clearwell approach being used in the current design. He stated that this approach is possibly too complicated and expensive and is not required. Mark Rennich stated that the design team had taken a conservative approach. Jones stated that he believed a tradeoff study was in order.

RESPONSE: THE CLEARWELLS WERE DROPPED FROM THE STUDY DESIGN. THIS WAS BASED ON THE SIMPLE TRADE-OFF THAT IT WILL TAKE LONGER TO MANIPULATE A CLEARWELL (APPROX. 1 HOUR) THAN IT WILL TAKE TO CLEAN A CASK AS IT IS REMOVED FROM THE POOL (APPROX. 20 MIN.).

16. Concerning test and repair requirements at the CMF, Ralph Best noted that the information should reflect minor repair, not major.

RESPONSE: THE ASSUMED ANNUAL RATES OF MAJOR AND MINOR REPAIRS ARE STATED IN TABLE 3.1. THIS TABLE NOTES THAT MINOR REPAIRS (REQUIRING LESS THAN ONE DAY) OCCUR SIX TIMES MORE OFTEN THAN MAJOR REPAIRS (REQUIRING MORE THAN ONE DAY).

17. Concerning test equipment requirements, Larry Danese noted that radiographic equipment may not be needed since it is seldom used and contracts can be arranged for radiographic services.

RESPONSE: RADIOGRAPHIC INSPECTION EQUIPMENT WAS REMOVED FROM THE TEST EQUIPMENT LIST.

18. It was recommended by the review team that the 10,000-W-cask heater be deleted from the test equipment listing.

RESPONSE: THERMAL TESTING WAS REMOVED FROM THE TEST REQUIREMENTS. IF THERMAL TESTING IS REQUIRED IT WAS

ASSUMED THAT IT WOULD OCCUR AT ANOTHER SITE EITHER USING SPECIAL COMMERCIAL EQUIPMENT OR SPENT FUEL.

19. It was noted that the test equipment listing was for cost estimation purposes only.

RESPONSE: NO RESPONSE REQUIRED.

20. Concerning facility manpower requirements, Ralph Best stated that he believed the overall estimate was too high. He stated that co-location or sharing of people would decrease personnel requirements. Paul McCreery suggested that personnel requirements be broken out as a function of the location of the CMF (e.g., a "green field", co-located or integrated site). Tom Tehan stated that engineering, QA, and health physics personnel were underestimated. Paul McCreery stated that a minimum of eight guards were required.

RESPONSE: THE MANPOWER ESTIMATE LIST WAS REVISED TO ADDRESS ALL THE PEER REVIEWER COMMENTS STATING THAT THE NUMBERS WERE TOO LOW IN SOME CATEGORIES. TABLE 4.1 SUMMARIZES ASSUMED MANPOWER REQUIREMENTS FOR ALL THREE SITING ALTERNATIVES.

21. Under the subject of risk evaluation, which deals with the possible breakdown of equipment, Ralph Best suggested that "availability" be used instead of risk. Also, instead of using failure as a reliability criteria, it was suggested that "out of service" was more appropriate.

RESPONSE: SECTION 5.5 INCORPORATES THE SUGGESTED CHANGES.

22. It was observed that the airlock shown in the CMF drawings is for HVAC purposes and not for radiation protection.

RESPONSE: NO RESPONSE REQUIRED.

23. It was also noted that the pool "bathtub ring" problem could be a source of radiation and must be addressed.

> <u>RESPONSE</u>: A 'DONUT' DRAIN COLLAR CONNECTED DIRECTLY TO THE WASTE WATER TREATMENT PROCESS WILL BE INSTALLED AT THE TOP OF CASKS WHILE THEY ARE OPEN IN THE POOL. THIS WILL HELP CONTROL THE SPREAD OF CONTAMINATION TO THE POOL WATER AND POOL SIDES (SEE SECTION 4.3).

24. Bob Jones pointed out that drying casks at the CMF must be addressed. One ft^3 of water remaining in the cask may be considered dry, "dry" needs to be defined. He stated that drain dry is probably sufficient; there needs to be interaction between cask operations and cask design on this issue.

> <u>RESPONSE</u>: THE FEASIBILITY STUDY ASSUMED THAT THE DEFINITION OF "DRY" WILL BE ESTABLISHED IN THE FUTURE. IT FURTHER ASSUMED THAT THE DEGREE OF DRYING WILL NOT SUBSTANTIALLY AFFECT THE DESIGN OR OPERATION OF THE FACILITY.

Paul Standish/Gene Rodriguez presented a list of major issues/positions from the repository viewpoint. These positions were:

1. The baseline repository surface facility design, as presented in the Conceptual Design Report, does not address basket changeout. Other cask maintenance activities are addressed in that design.

> <u>RESPONSE</u>: AS NOTED IN SECTION 6.4, A DECISION ON THE LOCATION OF CASK RECONFIGURATION AT THE MGDS, AN MRS AND/OR THE CMF WILL HAVE A SIGNIFICANT EFFECT ON THE SIZE AND COST OF THE CMF.

2. It is expected that a damaged cask with a fuel assembly will not go to the CMF but that it will proceed to the repository. If the repository is unable to handle the loaded cask, disposition will be determined on a case-by-case basis.

RESPONSE: THE STUDY TEAM AGREES WITH THIS COMMENT BUT PROPOSES FURTHER STUDY IN SECTION 6.9.

3. As stated in the Conceptual Design Report, equipment interfaces and couplings are provided to flush the interior of all empty casks after they leave the cask-unloading hot cell.

RESPONSE: THIS AGREES WITH THE ASSUMPTIONS USED IN THE FEASIBILITY STUDY (SEE SECTION 3.6).

4. The design-basis earthquake analysis should include the Yucca Mountain earthquake criteria.

RESPONSE: SPECIFIC SEISMIC REQUIREMENTS ARE NOT ADDRESSED IN THE FEASIBILITY STUDY.

5. Nevada would like to have a listing of all the detail assumptions used in the CMF.

RESPONSE: THE FEASIBILITY STUDY LISTS ALL THE BASIC ASSUMPTIONS IN SECTION 3.0 AND APPENDIX C.

6. One of the issues discussed at the Peer Review of the CMF was the number of casks that would pass through the CMF each year. The study group assumed a cask fleet of 75 casks, and that each would go into the CMF four times a year. One of these trips would be for annual maintenance, and three times for basket changeout. the review committee considered that to be excessive and that the casks would need basket changeout less than twice a year. The Site Characterization Plan Conceptual Design Report states that the repository facility is required to provide surface storage for 100 Metric tons of Uranium (MTU) of spent fuel during Stage 1 and 750 MTU during Stage 2. This is three months worth of waste throughput. The Conceptual Design Report identifies that half of this amount will be held inside and half outside the repository receiving facility. The Conceptual Design Report also identifies 315 casks of truck storage and 70 casks of rail storage. With this being the case, 385 casks could go through the CMF just for annual maintenance. However, with this supply of casks, it would seem that basket changeout would seldom, if ever, be necessary. This could also eliminate the need for a pool in the CMF to perform

basket changeout and to store contaminated baskets. The number of casks in the fleet and the provisions for lag storage of spent fuel at the repository require further coordination with Repository Design, Cask Design, and the CMF Design personnel.

> RESPONSE: THIS COMMENT WAS RECEIVED FROM A REPOSITORY REPRESENTATIVE ON THE PEER REVIEW COMMITTEE IN FEBRUARY, 1989, AFTER THE FEASIBILITY STUDY WAS COMPLETE. CONSEQUENTLY, AN ANALYSIS OF THE AFFECT OF A LARGE FLEET OF CASKS ON THE CMF DESIGN AND OPERATIONS WAS NOT COMPLETED. CONSIDERING THE POINTS MADE IN THIS COMMENT WITH REGARD TO BASKET CHANGEOUT AND THE NECESSITY OF A POOL, IT SEEMS LIKELY THAT THE AFFECT COULD BE SIGNIFICANT. ANOTHER IMPORTANT CONSIDERATION WITH RESPECT TO A LARGE FLEET OF CASKS IS THAT THE LOW USE RATE FOR INDIVIDUAL CASKS MIGHT RESULT IN LOWER MAINTENANCE AND TESTING RATES (IE., ONCE EVERY TWO OR THREE YEARS). THUS, THE CMF PROCESSING RATE MIGHT BE LOWER THAN INITIALLY INDICATED.

Mark Rennich stated that the FSR would be completed by December.

Larry Shappert and Ron Pope made closing comments, and the review was adjourned.

All statements of qualifications were collected and transferred to Ron Pope for his records.

APPENDIX B

CONTAMINATION CONTROL OF CASK SURFACES

In order to perform inspections and maintenance on casks at the Cask Maintenance Facility (CMF), cleaning and/or decontamination of the cask exterior and interior surfaces may be needed. Regulatory guidelines for the maximum permissible limit of removable surface contamination on a cask exterior presently exist; however, the permissible limit for the surfaces of the interior is not as well defined. Surface contamination criteria that will be used for the CMF is discussed below.

I. Cask Exterior Surfaces

Exterior surfaces of each cask will be surveyed radiologically upon arrival and departure at the Cask Maintenance Facility (CMF). Casks that have radiation levels greater than the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT) removable surface contamination limit will be decontaminated.

The maximum NRC and DOT removable surface contamination limit is 2200 dpm/100 cm^2 for wipes per Code of Federal Regulations (CFR) Title 10, 71.87 (NRC reference) and 49 CFR 173.443 (DOT reference). This permissible limit is for beta-gamma emitting radionuclides. The maximum DOT surface contamination limit for all other alpha emitting radionuclides is 220 dpm/100 cm^2 for wipes. When other methods besides wipes are used, the non-fixed (removable) contamination on the external surfaces shall not exceed 22,000 dpm/100 cm^2 for beta-gamma and 2200 dpm/100 cm^2 for alpha taking the detection efficiency of the method used into account.

The normal CMF radiological survey of cask exterior surfaces will include both a dose rate determination with a meter and a removable contamination survey with smears. The radiological survey will determine if decontamination is required and whether manual or automated decontamination (decon) methods will be used. If the survey results determine that only isolated "hot spots" need decontamination, wipes alone may be used to remove the surface contamination. Initially the wipes will be used with plain water. If this is inadequate a commercial cleaning agent (non-RCRA) will be applied. In rare cases a particularly difficult problem will be handled with a portable electropolish machine. The automated high-pressure water spray system will be used to remove widely distributed surface contamination on casks. The automatic cleaning system is described in Sect. 4.0.

II. Cask Interior Surfaces

The interior of casks may require cleaning or decontamination for several reasons. Removal of radionuclides to meet the regulatory guidelines of the NRC and/or DOT may be required. These requirements (if any) will be established through individual cask certificates of compliance. In addition, the generic requirements for the MGDS Appendix B 2 (OGR B/2) cites 49 CFR 173.443 and 172.427 which set very low limits. This study assumed that the requirements of OGR B/2 will be changed in the future to higher levels (Appendix D). It also assumed that the same requirements will be placed on the MGDS and MRS as well as the CMF. Consequently, casks will arrive at the CMF in compliance with the same regulations and FWMS requirements which will be applied when the casks are shipped from the CMF; thus, additional cleaning or decontamination strictly to meet regulations or FWMS requirements will not be required. Therefore, decontamination and cleaning of casks at the CMF will be performed for handling and maintenance reasons, to prevent continuing build-up of "crud" and "junk" and to facilitate reduction of personnel exposure at utilities and FWMS facilities. Examples of operations which might necessitate cleaning are the removal of baskets for storage, extraction of a piece of "junk" and cleaning to reduce the background radiation field to enable hands-on maintenance to be performed on an open cask. In abnormal circumstances, an aggressive decontamination of a cask might be required to achieve regulatory limits not achievable at the MGDS or MRS.

Cleaning and decontamination of the interior of casks may be performed using one or a combination of several procedures. These are described below in approximate order of increasing effectiveness.

Water Flush. It is possible to remove crud simply by injecting water into a closed cask and then rapidly removing it through the built-in drain system. Since the drain connection on future casks is likely to be at the inner lid, a vacuum system is normally used to draw the water out. The water is accumulated in a vessel, while the vacuum pump and atmosphere are protected with traps and filters. This method will leave both a small amount of crud and water in the cask, the amount depending on the size of the drain tube and the design of the drain connection at the bottom of the cask. The residual water may be removed by evacuating the cask; however, this technique has been shown to be very time consuming if the cask is not heated to prevent freezing in the vacuum inlet.

Wet Vacuum. A cask may be opened underwater in the pool and the accumulated crud and fission products removed using a wet pump connected to the waste processing system. This type of cleaning operation will normally be used in conjunction with the removal of a basket. It might be assisted with a spray lance and long-handled brushes used to force crud from both the cask and basket surfaces. This procedure will certainly be applied if the baskets are to be removed from the pool into the basket inspection and repair booth, where personnel access is required.

Manual Decon/Cleaning. Manual methods will be used in special cases in which the cask requires a particular type of decontamination. For example, the current cask fleet has found that a small amount of "junk" such as wrenches, eye glasses and bolts, accumulate inside casks. This type of trash is usually removed using long-handled tools either with the cask in the pool or at a maintenance and repair station. Another example is a special cleaning required to permit personnel to work on a particular area of the cask, usually the lid area. This might be accomplished by a concentrated cleaning of the upper portion of the interior and a partial water fill to shield radiation emitting from crud in the bottom of the cask.

Aggressive Decontamination. Unusual incidents or disposal conditions may require the interior of the cask to the cleaned by extraordinary means. This could begin with the more common procedures listed above, then move to the use of commercial decon agents (non-RCRA) such as "409" household cleaner. The cleaner could be applied remotely at the external cleaning booth or directly in the repair and maintenance stations using long-handled tools and manned entry. Aggressive decontamination will not be performed in the pool. In exceptional cases a portable electropolish system could be used to remove embedded radionuclides.

Appendix C

SPENT FUEL SHIPPING CASK DESCRIPTION

This appendix contains a general description of the reference spent fuel cask system used in this study. A majority of the information was taken directly from Analysis of Radiation Doses from Operation of Postulated Commercial Spent Fuel Transportation Systems (Schneider 1987), and Generic Requirements for a Mined Geologic Disposal System (Roy F. Weston, Inc. 1986). A single generic design concept with regard to handling features is presented for both the truck and railroad casks (see Fig. C.1). The primary differences between these two types of casks are in dimensions, weights, and fuel assembly capacities. It should also be recognized that other types of casks, such as the HLDW, will be processed by the CMF. These special casks will share most of the characteristics given in this section.

The descriptive information provided here is developed only to the extent needed for the CMF Feasibility Study. No attempt is made to provide sufficient information for a further understanding of cask design or construction, nor to update the information based on the current DOE Cask System Development Program activities.

A typical spent fuel cask system will consist of:

1. A transport system (trailer, rail car or barge),
2. A cask body with shielding and containment features,
3. Closure head(s),
4. Internal fuel support mechanism (including fuel basket, sleeves, and spacers, etc.),
5. Cask ancillary equipment:

    a. Protective enclosures,
    b. Lifting and tiedown devices (trunnions, yokes, etc.),
    c. Impact limiters,
    d. Special tools,
    e. Placarding, labeling and marking,
    f. Sensors and instrumentation (if applicable),
    g. Draining, drying, inerting, and testing equipment,
    h. Contamination control and removal equipment,
    i. Operating and maintenance manuals,
    j. Skids or transport frames (if applicable),

k. Intermodal equipment (if applicable),
l. Safeguard devices,
m. Spare parts, and
n. Other miscellaneous equipment as defined in the Statement of Work in the DOE Request for Proposal (DOE Idaho Operations).

The assumed physical characteristics of the major cask types are given in Table C.1. Descriptions of the cask features and related support mechanisms that influence the handling times and methods associated with spent fuel and waste shipments follow. The general rationale for each feature is included.

Table C.1. Physical characteristics of major cask types

Type of cask	LWT	OWT	100-ton Rail/barge	Dual purpose cask and 125-ton Rail/barge
Cask diameter (ft)	6	6	8.5	10
Cask height (length) max. (ft)	(3)	(3)	(3)	(3)
Headroom, min. (ft)	22	22	22	22
Cask loading height, max. (ft)	18	18	18	18
Crane hook load, max. (tons)	--	--	100	125

(Roy F. Weston, Inc.)

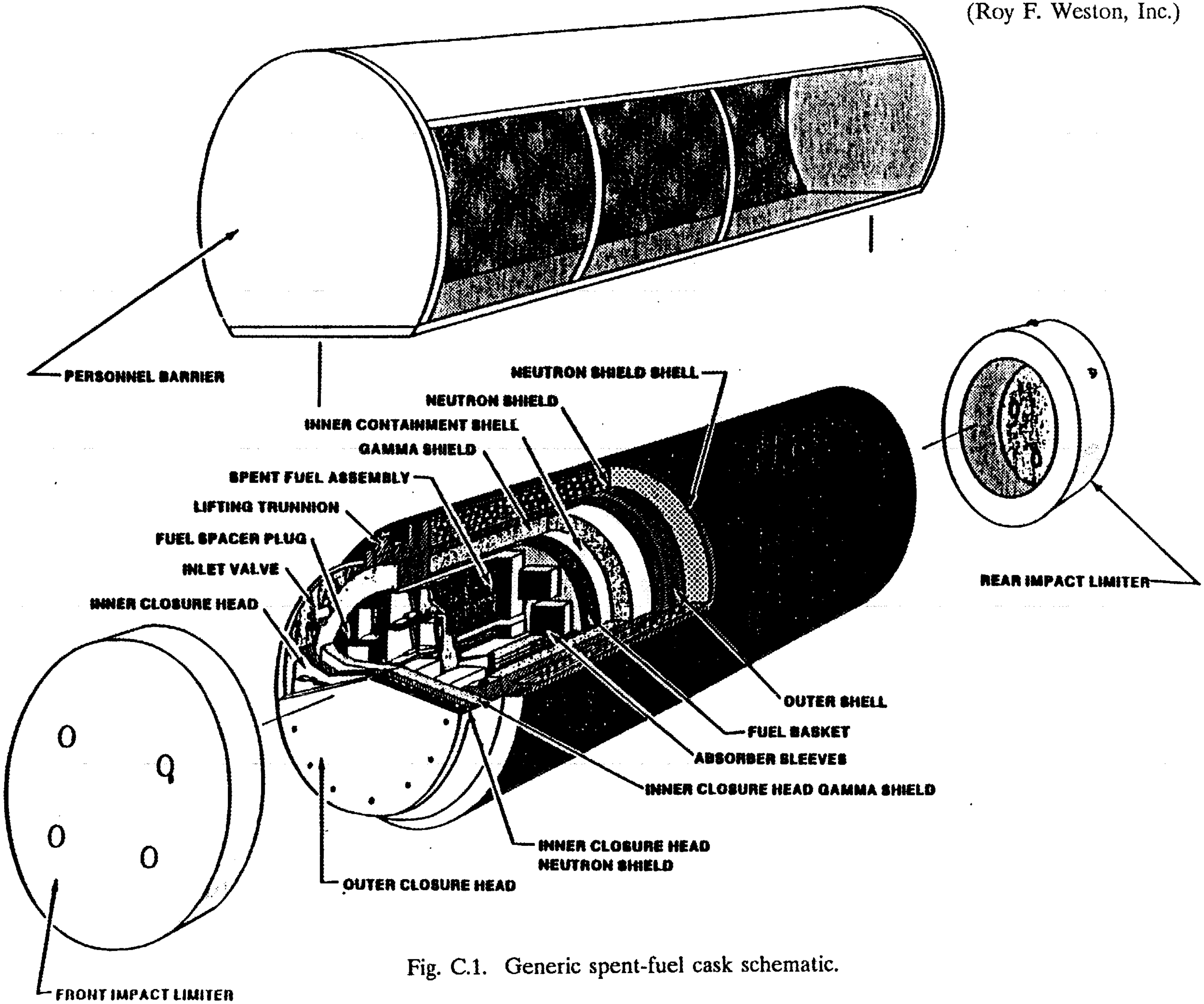


Fig. C.1. Generic spent-fuel cask schematic.

Component Interchangeability

Component interchangeability between casks of the same design is important to cask fleet operations to assure adequate spares availability and to minimize loss of cask use and interruption of shipping campaigns. It is assumed that the following components will be interchangeable between casks of the same design:

- Fuel baskets
- Fuel spacers
- Removable impact limiters
- Removable trunnions
- Valves and valve covers
- Seals
- Fittings and connectors
- Lifting gear (for specific cask type)
- Bolts/threaded inserts and similar hardware
- Shield plugs (if used)
- Blind flanges (if used)
- Transporters (railcars, trailers or barge)
- Transport frames and skids
- Ancillary equipment

Surfaces

The cask surfaces will be smooth with a minimum of crevices. The radioactive contamination of objects placed in spent fuel pools is generally proportional to the surface area of the object; therefore, the surface area of casks will be as small as possible. In addition, smooth surfaces are easier to decontaminate than irregular surfaces.

Lifting Trunnions

The casks will have four external trunnions at 90^0 intervals at the upper end for lifting, to facilitate using the redundant yoke equipment required at many reactor facilities. Two trunnions may be located at 180^0 near the bottom of some casks for support in the horizontal shipping configuration.

Lid Design (Fig. C.2)

The casks will have two lids on the upper end. The inner lid will provide the primary seal and shielding for the inner cavity, and it contains the upper neutron shield. It will have three penetrations, each with valves and quick-connect, shut-off couplings.

The primary penetration will permit pressure testing and flushing of the inner cavity. The other two penetrations will be a drain connection for sampling, flushing and drying the cavity, and a small-diameter tube for testing the integrity of the inner lid seal. All connections into the cask inner cavity will be through the inner lid. The inner lid will be held in place by 36 bolts for rail casks and 12 bolts for truck casks. The outer lid is a circular steel plate that provides protection against impact damage to the connectors on the inner lid. The outer lid will be held in place by 12 bolts for rail casks and 8 bolts for truck casks. Thermocouples will be installed in the cask wall for temperature measurements. The external thermocouple connections will be made through the top edge of the cask.

Lid Seals (Fig. C.2)

Each cask lid will have two elastomer o-ring seals. Using double seals significantly reduces the potential for leakage and also permits testing the integrity of the seals by pressurizing or evacuating the space between the seals.

Lid-Lifting Attachments (Fig. C.2)

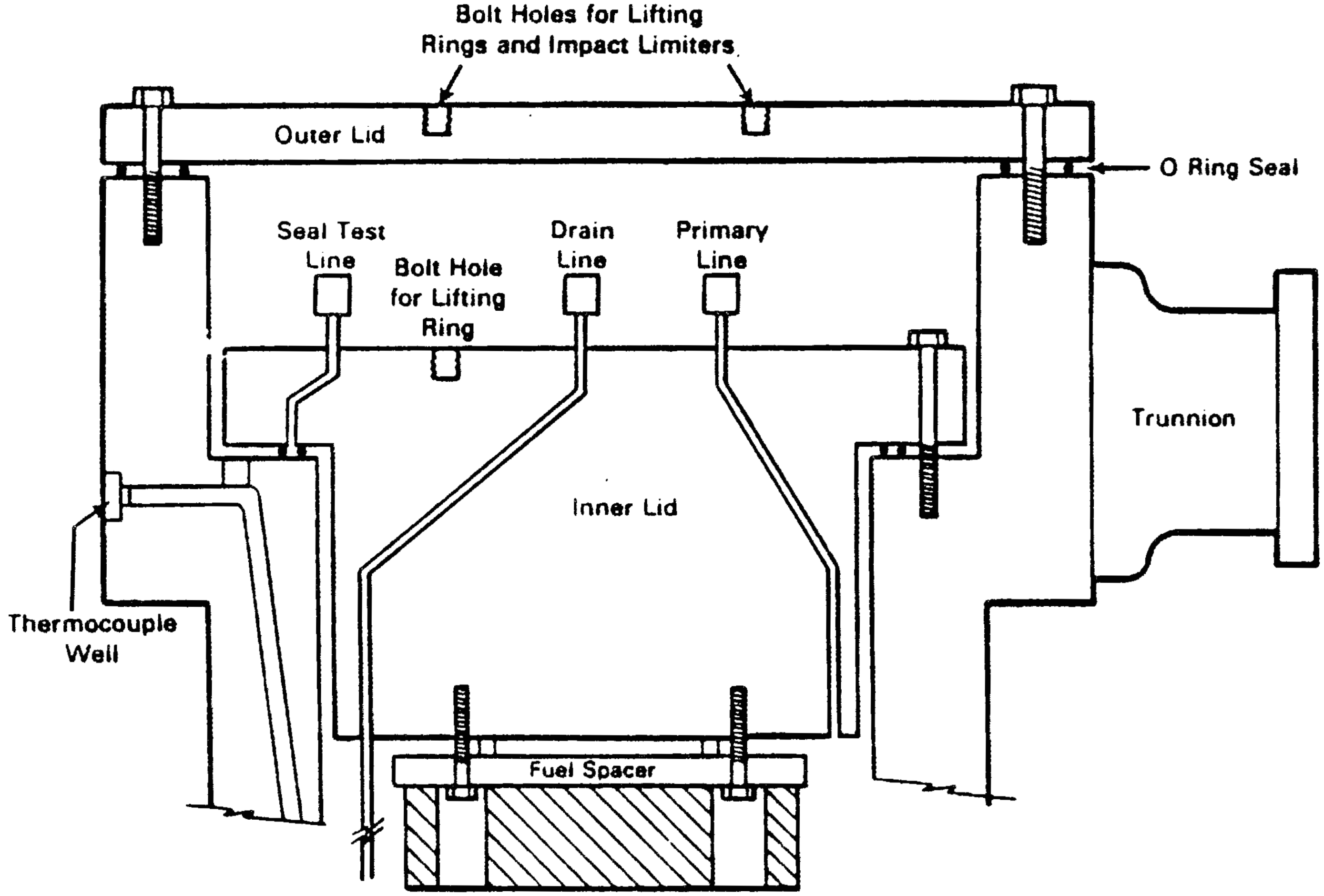
The inner lid will have shallow threaded holes for four eye bolts for attaching the lid-lifting device. Connecting a lifting device to the inner lid before it is placed in a pool expedites the lid removal and replacement.

The outer lid will have shallow threaded holes for three ring supports for lifting the lid and additional shallow threaded bolts for attaching the impact limiters.

Fuel Spacers (Fig. C.2)

The fuel placement spacers will be bolted to the inner surface of the inner lid. Installation of the fuel spacers on the lid will occur before the inner lid is installed on the cask.

(Schneider 1987)



Note. Test, flush and drain lines have capped valves

Fig. C.2. Cask lid design.

Fuel Assembly Baskets

The fuel assembly baskets will contain an arrangement of square longitudinal channels sized to contain irradiated fuel assemblies. The primary structure will be stainless steel or aluminum. Other materials to provide shielding, heat transfer, and neutron absorption may be included.

Transport Vehicles

The transport vehicles will be dedicated to carrying one type of cask. The assumed truck trailers are shown in Figs. C.3 and C.4 and described in Table C.2. The railroad flatbed cars designed to carry the maximum design weight loads for unrestricted travel are shown in Figs. C.5 and C.6 and described in Table C.3. The vehicle beds are permanently modified as appropriate for the cask tie-downs, personnel barriers and impact limiter support and/or movement mechanisms.

(Roy F. Weston, Inc.)

Parameter	Legal weight	Overweight
Axle loading:		
Steering	12,000 lb	12,000 lb
Single	20,000 lb	20,000 lb
Tandem	34,000 lb	34,000 lb
Tridem	---	51,000 lb
Vehicle gross wt., max.	80,000 lb	110,000 lb
Height, max. (ft)	13.5	13.5
Width, max. (ft)	8	8
Trailer length, max. (ft)	43	43
Overall length, max. (ft)	60	Unk.

Table C.2. Highway transport vehicle size and weight limits

(Roy F. Weston, Inc.)

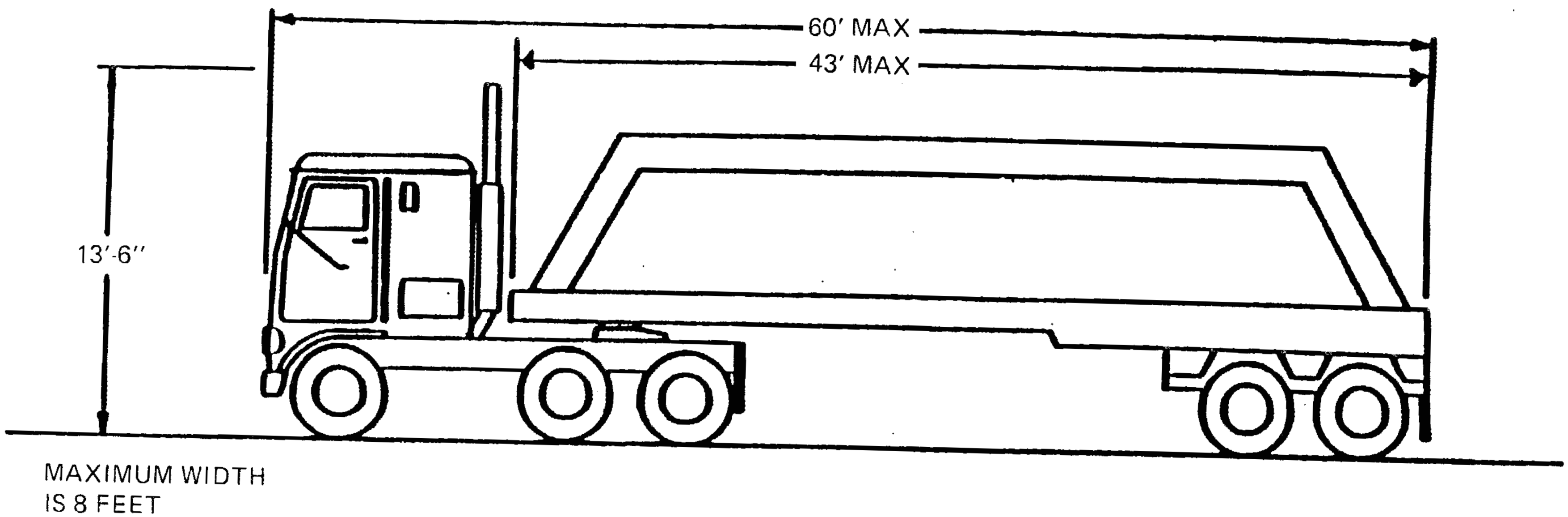
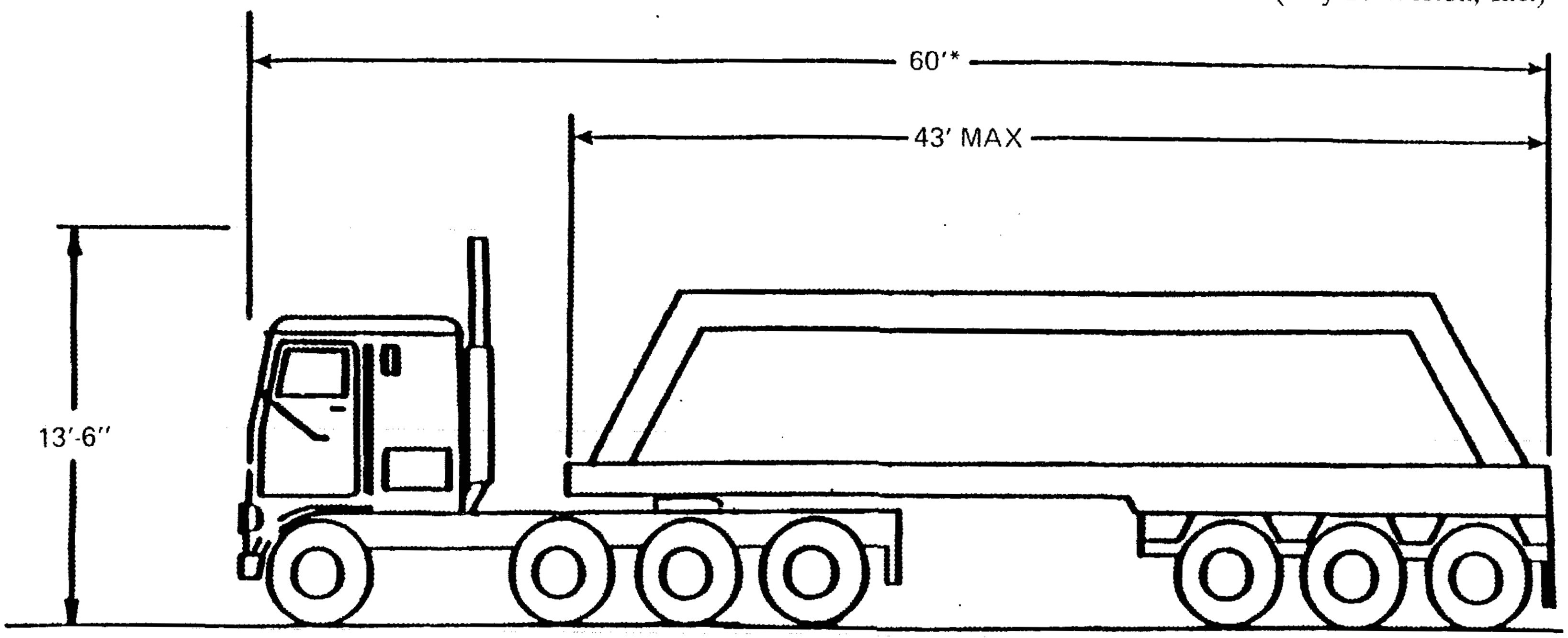


Fig. C.3. Five-axle legal weight truck.

(Roy F. Weston, Inc.)



MAXIMUM WIDTH
IS 8 FEET

*THIS IS A TYPICAL VALUE.

Fig. C.4. Seven-axle overweight truck.

Eng. Dwg. CMF C.5

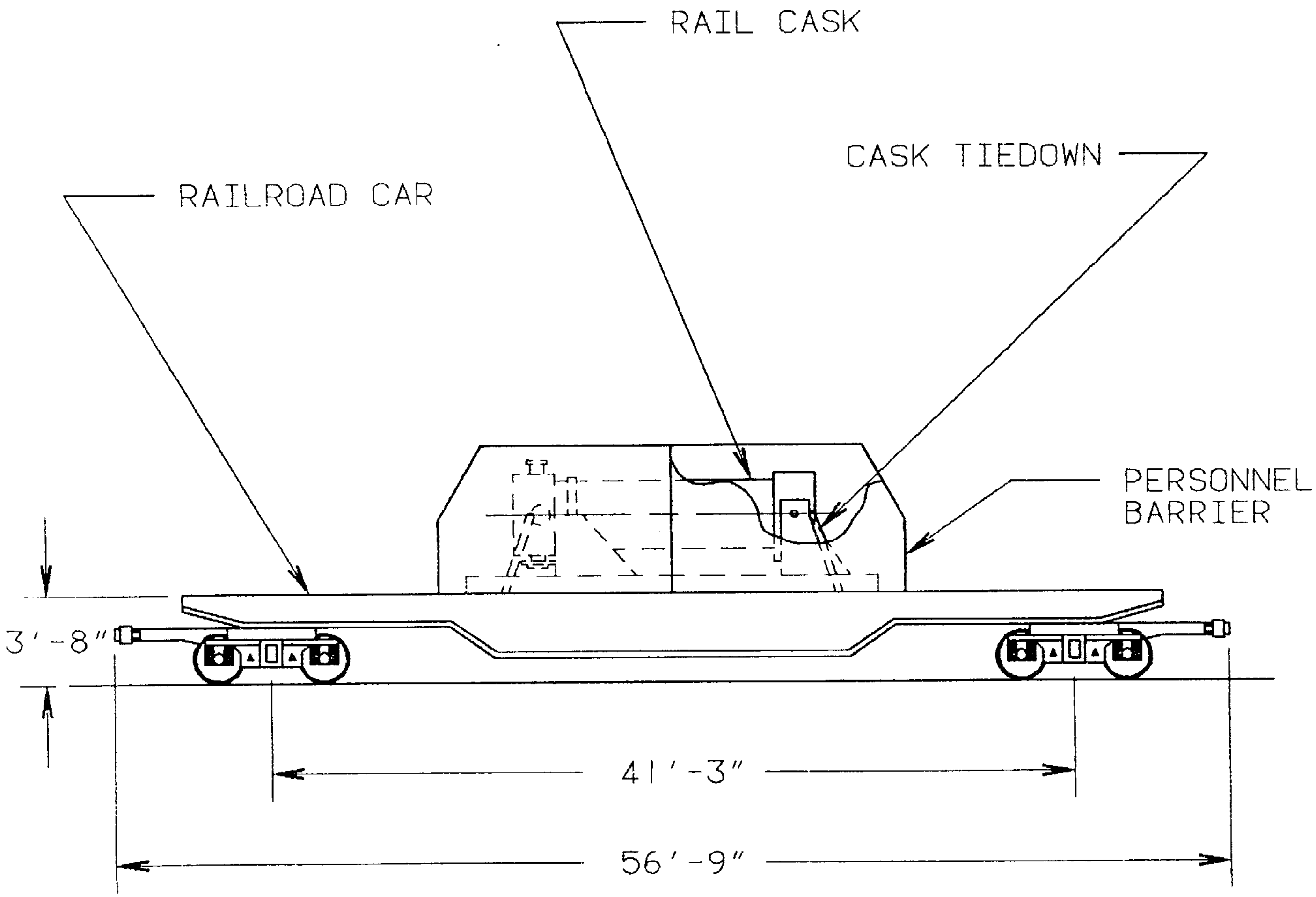


Fig. C.5. Four-axle railcar (dimensions are approximate).

Eng. Dwg. CMF C.6

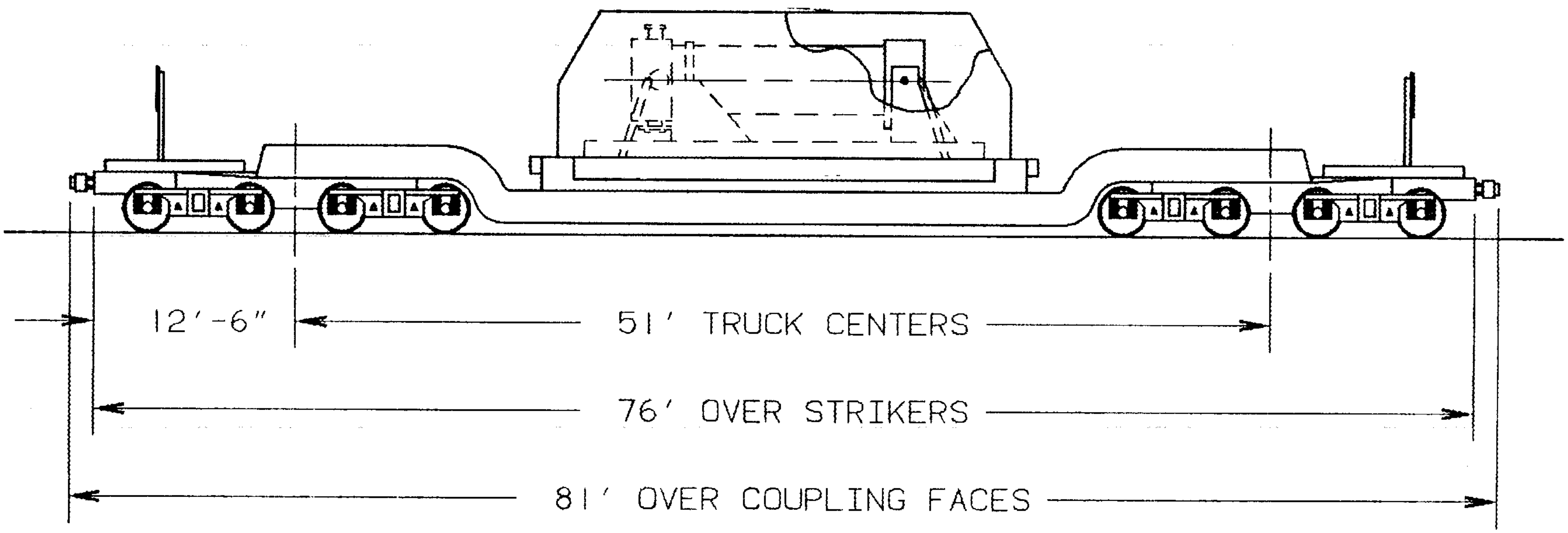


Fig. C.6. Eight-axle railcar (dimensions are approximate).

Cask Rotation (Fig. C.7)

A tilting cradle will be used for cask rotation on the transport vehicle. During removal of the cask from the transport vehicle and loading of the cask onto the vehicle, the cask must be rotated 90^0 between the horizontal and vertical position.

Cask Support on Transport Vehicle (Fig. C.7)

The ends of the cask will be supported on the transport vehicle by a saddle at the closure end and within a hollow cylindrical tilting cradle or on trunnions at the bottom end. The tilting cradle arrangement distributes the support over much of the cask surface and avoids placing concentrated loads on the trunnions during transportation.

Cask Tiedowns (Fig. C.8)

The cask tiedowns will be designed for rapid installation and removal. The cask tiedowns may consist of a band which will be placed over the cask and then pinned in place. They are designed such that all operations can be performed rapidly without the use of overhead cranes. Small keeper bolts are used to hold the pins in place.

Impact Limiters (Fig. C.9)

Impact limiters will be attached to each end of the cask. The impact limiters are cylindrical structures designed to protect the cask body and closure against impacts. The impact limiters will be mounted in mechanisms to aid installation and permit storage on the vehicle. It was assumed that the limiters will remain on the transport vehicle during cask processing.

Personnel Barrier (Fig. C.10)

The personnel barrier will be a retractable barrier that encloses the cask, supports, and impact limiters and protects against inadvertent intrusion and road grime. The general design will probably consist of a metal frame supporting a solid sheet-metal top and louvered sheet-metal sides. The barrier will probably consist of movable sections that can be retracted toward each respective end of the vehicle. They will be designed for easy retraction, without the use of overhead cranes, or other power-operated equipment. They will also be designed for rapid pinning and locking in operational configurations.

(Roy F. Weston, Inc.)

Table C.3. Rail size and weight limits

	100-ton rail	Dual purpose casks/125-ton rail
Railcar length, (1) max. (ft)	48	(2)
Railcar height, max. (ft)	(3)	(3)
Railcar width, max. (ft)	(3)	(3)
Truck center distance, max. (ft)	(3)	(3)
Height of CG (4) above rails, max.(in)	98	98
Curvability (ft)	(3)	(3)
Axle loading, max. (lb)	65,750 lb	65,750 lb
Gross weight on rails, max. (lb)	263,000 lb	394,500 lb
Axle spacing restrictions (ft)	(5)	(5)

Notes:

1. As measured from end sill-to-end sill.

2. Length should be minimized consistent with Cooper's Railway Bridge Ratings (E Ratings).

3. See AAR specifications for design, fabrication, and construction of Freight Cars, M-1001.

4. Center of gravity of railcar and lading.

5. American Railway Engineering Association (AREA) E-60, part of the Rail Transporter Guidelines.

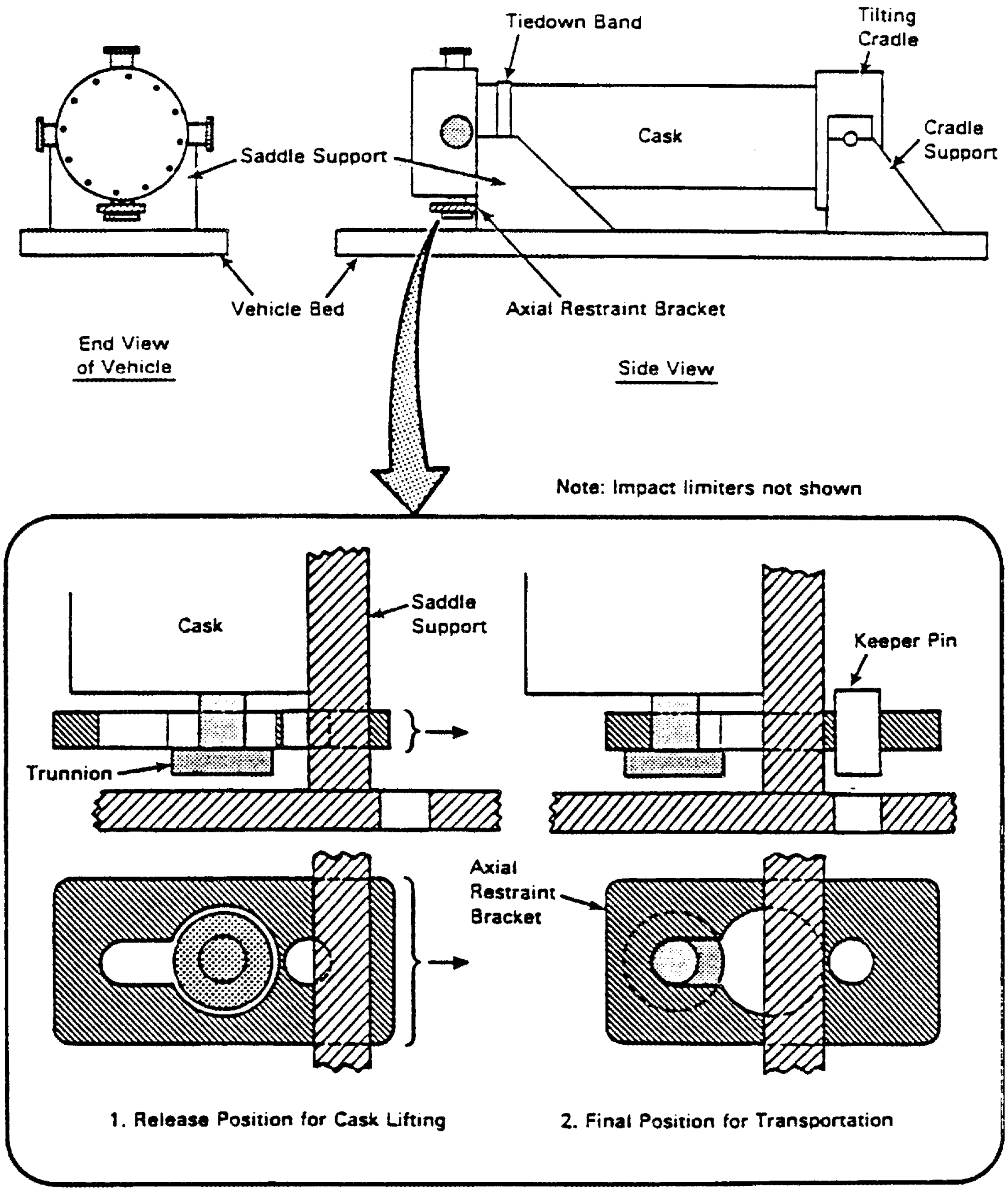


Fig. C.7. Cask support system.

(Schneider 1987)

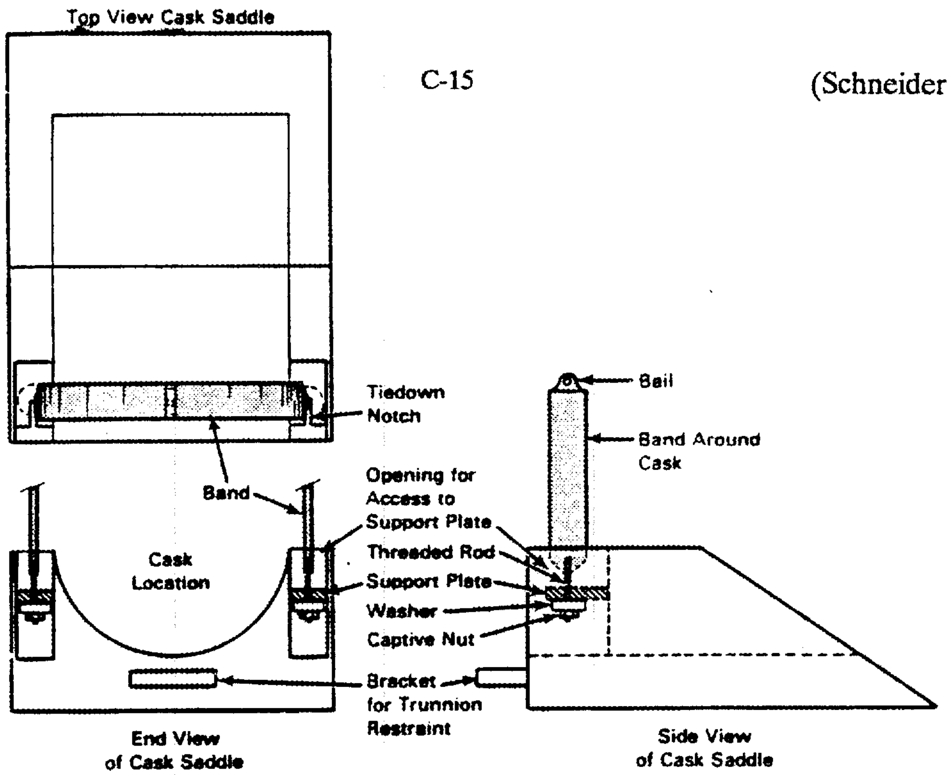


Fig. C.8. Tiedowns for Spent Fuel Transport Cask.

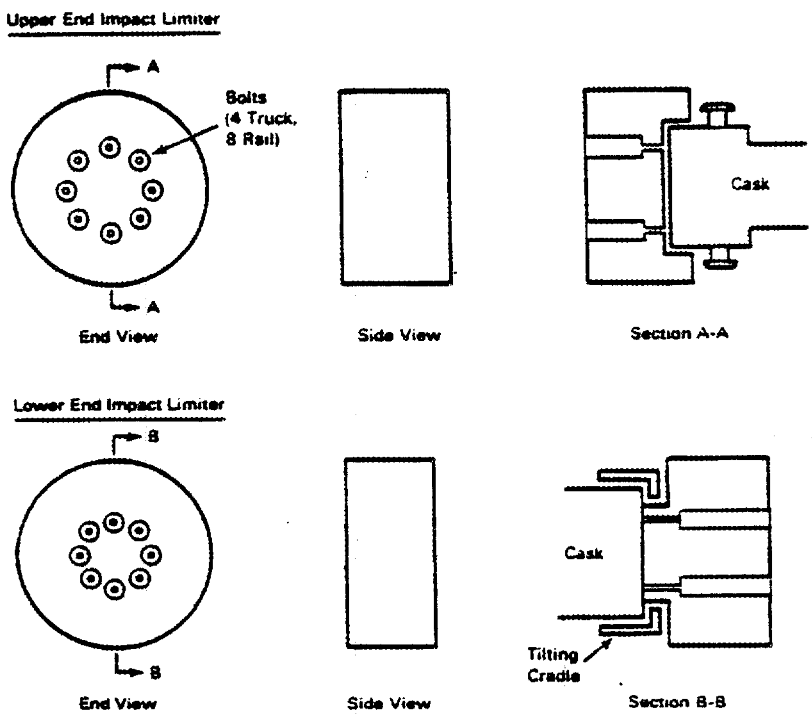


Fig. C.9. Schematic of cask impact limiters.

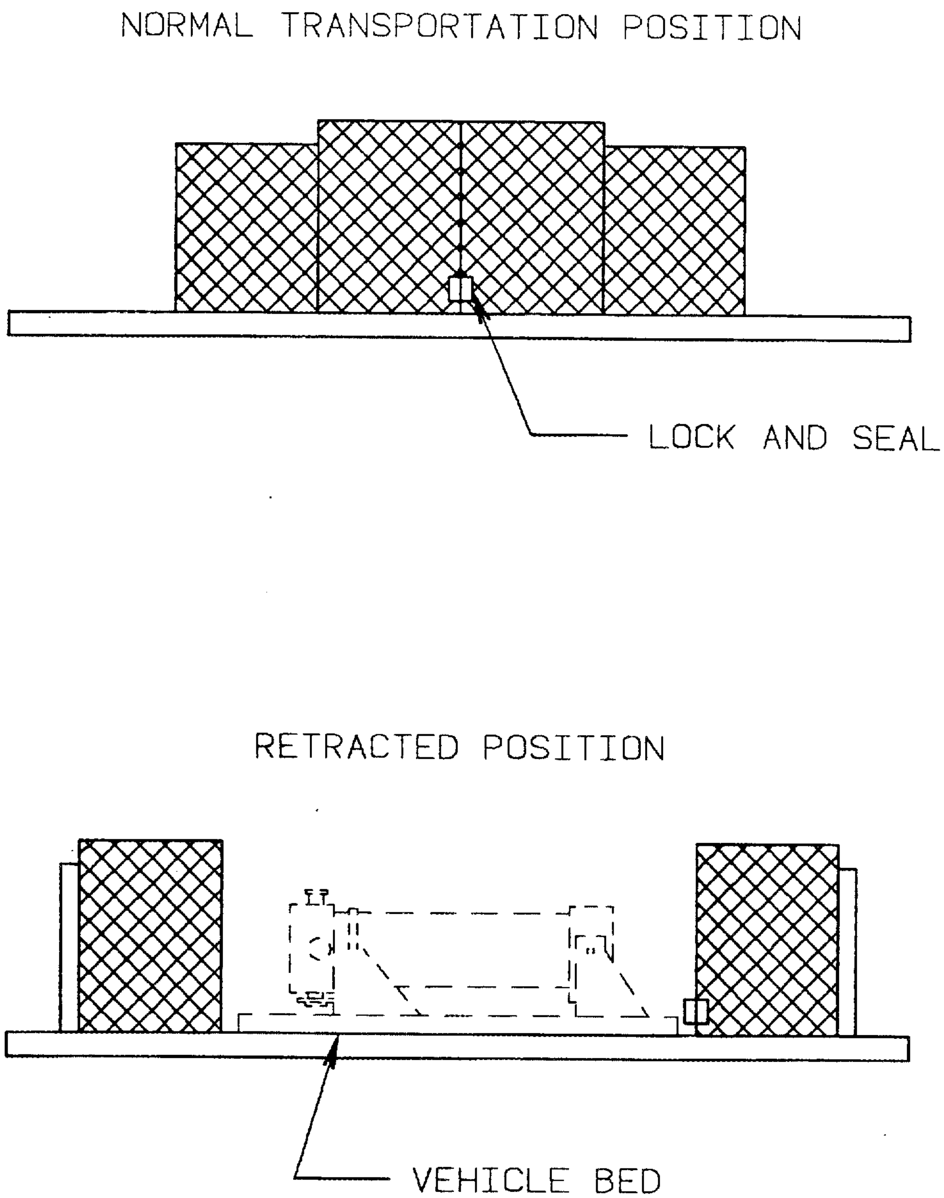


Fig. C.10. Personnel barriers for spent fuel transportation vehicle.

General Description of Lifting Yokes (Fig. C.11)

Cask systems will have dedicated lifting yokes. It is assumed that the yokes will not be interchangeable among cask types. An example of a redundant yoke required for handling loaded casks is shown in Fig. C.11. The physical characteristics of the most common yokes are given in Table C.4.

(Roy F. Weston, Inc.)

Table C.4. Characteristics of redundant lifting yokes.

	Truck Cask	Rail Cask
Height (ft.)	4	10
Width (ft.)	6	10
Weight (ft.)	2	10

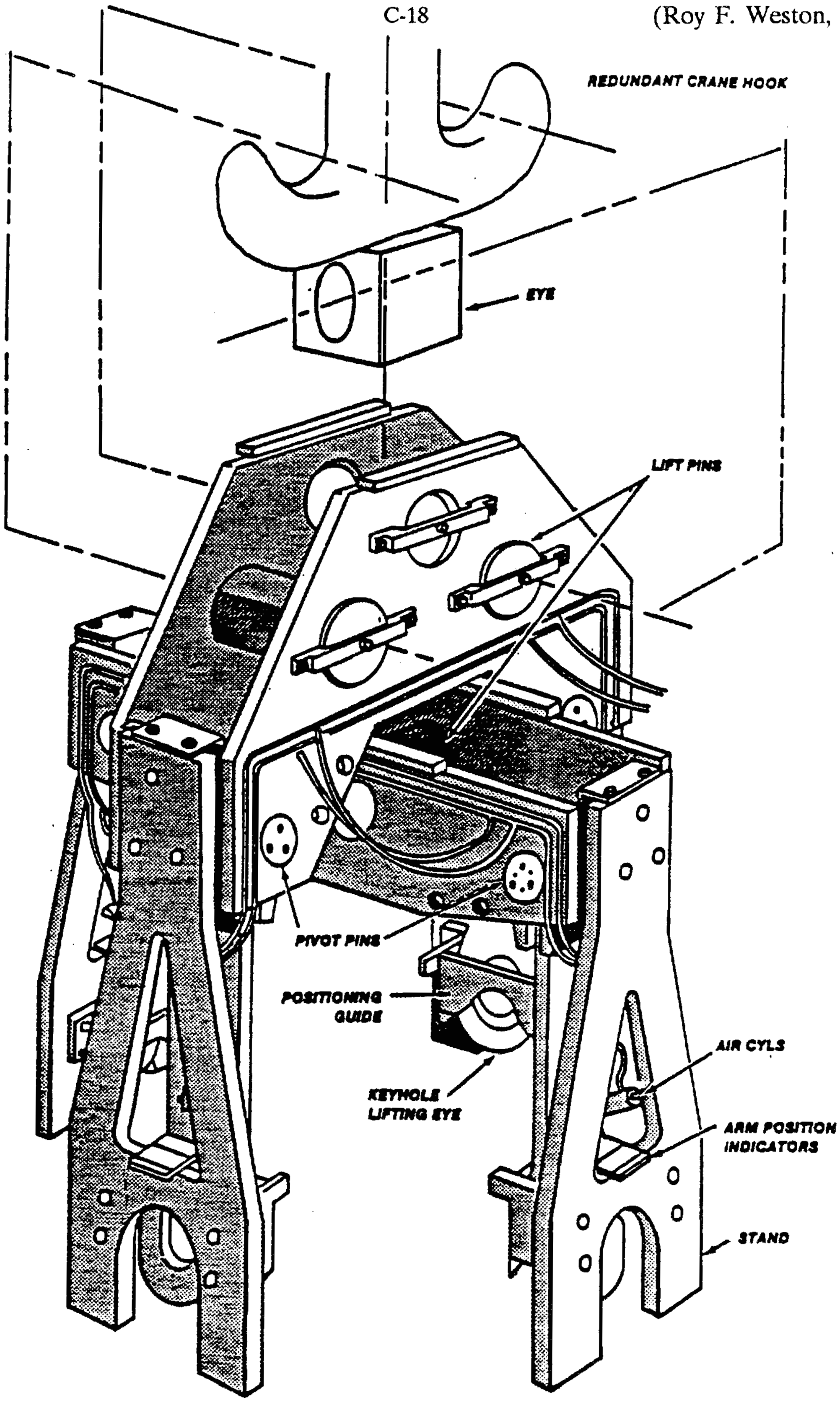


Fig. C.11. Schematic of a redundant lifting yoke.

APPENDIX D

DESCRIPTIONS OF POSSIBLE CASK TESTS

The tests to be performed on the shipping casks by the CMF or other facilities are currently undefined. The tests are, however, assumed to be similar to those specified for the existing fleet. These tests (as described in this appendix) were used as a basis for the facility study plan.

Cask Pressure Test

The cask cavity will be filled with fluid, pressurized, and the pressure variations are observed and recorded over a specified time period. The test pressure and fluid will be defined by the CoC for the cask. The test is usually considered acceptable if there is no visible leakage at the orifice or at the lid closure, no loss of pressure over a set period of time, and no permanent deformation of the cask.

Cask Leak Test

The CMF shall have the capability of leak testing each seal on every cask that is to be maintained at the CMF.

Load Tests

All lifting devices will be load tested. This requirement includes cask-handling devices, overhead cranes, and wire ropes. Trunnions, trunnion supports, and tie downs shall also be tested. Load tests may include 150% overload testing.

Weld Inspections

Structural welds will be inspected regularly. Visual and dye penetrate methods may be supplemented with mag particle and radiography.

Appendix E

AN ASSESSMENT OF THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT'S (OCRWM) REQUIREMENTS ON CASK CAVITY CONTAMINATION AFTER CASK UNLOADING AT THE MINED GEOLOGIC DISPOSAL SYSTEM

INTRODUCTION

The Office of Civilian Radioactive Waste Management has established a set of general requirements (Reference 1) for the Mined Geologic Disposal System (MGDS), i.e., for the repository. One of the requirements in Reference 1 deals with the level of contamination allowed in cask cavities after a cask has been unloaded of spent nuclear fuel (SNF), prior to its being shipped from the repository. This internal cavity contamination limit has not only a direct impact upon the manner in which the repository cask handling facility must be designed, constructed, and operated, but it also directly impacts the requirements for the Cask Maintenance Facility (CMF) currently undergoing feasibility study. The limit will also have direct implications for the Monitored Retrievable Storage (MRS) facility should one be included in the Federal Waste Management System (FWMS) since it is assumed that the internal contamination limit established for the repository would be directly reflected in the requirements applicable to unloaded casks leaving an MRS. When these requirements are imposed upon both the repository and an MRS, they establish the upper limit on cask cavity contamination for casks arriving at the CMF.

During the shipment of SNF from reactors, experience has shown that a significant amount of radioactive residue, commonly called crud, is dislodged from the SNF assemblies and accumulates in cask cavities. This crud can result in radiation levels at the open face of a cask cavity of many tens of millirem/h, and in some cases, in the low hundreds of millirem/h. Empty casks still containing crud generally do not result in a radiation hazard to man or the environment since when the lids are off, the casks are either handled under water -- such as in reactor pools, or mated to hot cells -- such as with the current design for the MGDS (Reference 2). Thus, when the cask lid is removed, both containment and shielding are provided by the reactor pool or the hot cell. With the lid bolted into place, the empty cask inherently provides more than adequate containment and shielding to allow handling and transport.

The following reviews the current requirement imposed in Reference 1 for unloaded cask cavity contamination, assesses the impact of this requirement on the expected design and operation of the FWMS, (including both the repository and the CMF), and proposes that the OCRWM take action to review and revise this requirement.

DISCUSSION

The OCRWM Generic Requirements for the MGDS (Reference 1) states (in Appendix B-2, page 16):

> "Considerations for the cask or the transporter maintenance tasks need not be given at this point of time. However, the facility should be capable of performing decontamination operations, seals change, and replacement of the cask removable components such as baskets and sleeves..."

> "The total buildup of contamination in cask cavities and on the vehicle shall not exceed the limits of 49 CFR 173.427 and 173.443 after cask unloading. The limit for the cask cavity contamination could be maintained by either vacuum-cleaning or other liquid chemical flushing operations."

The first quoted statement indicates that the repository should be capable of performing the various actions specified. While it is agreed that the repository must have the capability of performing these actions, it is questioned whether it should be planned that the repository perform these actions on a routine (i.e., on a regular, recurring) basis. The CMF could be the more logical place to perform these routine functions as part of its maintenance and reconfiguration responsibilities.

Relative to the second quoted statement, the limits specified in 49 CFR 173.443 are those limits to which the external surfaces of all packages (i.e., for SNF, of casks) must be decontaminated prior to transportation in order to satisfy the transportation regulatory requirements. The limits on internal contamination established by 49 CFR 173.427 are those which must be met should it be desired to ship a cask, emptied of SNF, in a manner such that it is excepted from various shipping paper, marking and labeling requirements; that is, shipment essentially as a clean or new package. There is very little economic or operational incentive for routinely shipping casks from the repository in such a clean condition; and, as will be illustrated below, there are probably significant economic and operational penalties to be paid for accomplishing this level of internal decontamination.

The requirements in the Department of Transportation Regulations which are cited in Reference 1 are as follows:

> "173.427 EMPTY RADIOACTIVE MATERIAL PACKAGING
> A packaging which previously contained radioactive materials and has been emptied of contents as far as practical, is excepted from the shipping paper and certification, marking and labeling requirements of this subchapter, and from requirements of this subpart, provided that .... (c) Internal contamination does not exceed 100 times the limits specified in 173.443; ...."

49 CFR 173.443 specifies the removable external radioactive contamination limits for packages and conveyances to be shipped. These values, when multiplied by 100, establish the "wipe" limits for removable internal contamination which must be satisfied to ship with relief from shipping paper, marking and labeling requirements; and it is these limits which are cited in Reference 1.

In order to determine what the actual quantitative limits are on surface contamination, the values in 49 CFR 173.443 must be adjusted to take into account the efficiency of the contamination measurement technique used. It is conservatively assumed (per guidance in Reference 3) that, with proper "wiping," only ten percent of the removable (i.e., nonfixed) contamination is actually measured. The actual contamination limits are therefore a factor of ten higher than the wipe limits shown in 49 CFR 173, but require a measurement technique with 100% efficiency in order to be used.

The actual (not wipe) limits to which a cask, emptied of SNF, must be internally cleaned prior to shipment from the repository according to the current requirement in Reference 1, are quantified as follows:

- Less than 0.01 microcuries per sq cm (22,000 dpm/sq cm) of "Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228; and thorium-230 when contained in ores and physical concentrates."

- Less than 0.001 microcuries per sq cm (2200 dpm/sq cm) of "all other alpha emitting radionuclides."

It is noteworthy that these removable contamination limits are specified in terms of activity per unit area, and not total activity in the cask. These limits are essentially the same as paragraphs 408 and 421 of the International Atomic Energy Agency's (IAEA) Regulations for the Safe Transport of Radioactive Materials, 1985 Edition, Safety Series No. 6 (Reference 4). Methods for applying Reference 4 requirements are provided in IAEA's Safety Series No. 37 (Reference 3) and the reasons behind the requirements are provided in IAEA, Safety Series No. 7 (Reference 5). A method to be used for measuring removable contamination is described in Appendix II of Reference 3; the intent is to wipe suspected surface areas to determine extent of contamination as a function of activity per unit surface area. The wiping of surfaces is generally not sufficient to determine the total activity contained inside a spent fuel cask since pockets of crud can accumulate in crevices between mating parts. These pockets are extremely dificult (if not impossible) to estimate accurately.

Thus, even if the repository could readily clean crud from the cask each time after SNF is removed and assuming that all accumulating pockets could be eliminated, testing likely areas of contamination deep within basket cavities by wiping in order to demonstrate compliance with the requirement would be extremely difficult to implement operationally. This assessment would require extensive time while the cask is mated to one of the repository (or MRS) hot cells.

To assess the problem further, it is worthwhile to assume (unrealistically) that the crud after a shipment will be uniformly distributed on the internal surfaces of the cask. The maximum available area per fuel assembly channel to be contaminated would be approximately:

1) for a PWR assembly, 43,800 cm^2; and
2) for a BWR assembly, 32,700 cm^2.

Thus, the maximum contamination which would be allowed in a cask cavity based upon the requirement in Reference 1 is approximately:

1) 0.44 mCi/PWR fuel assembly; and
2) 0.32 mCi/BWR fuel assembly.

For the current cask concepts being developed as part of OCRWM's Cask System Development Program, cask capacities being considered are as follows:

1) for the Legal Weight Truck Casks - 2 to 4 PWR assemblies or 4 to 9 BWR assemblies; and
2) for the Rail/Barge Casks - 21 to 26 PWR assemblies or 45 to 52 BWR assemblies.

Hence, the maximum range of contamination which would be allowed in a cask cavity based upon the requirement in Reference 1 is approximately:

1) 0.88 to 2.8 mCi for a legal weight truck cask, and
2) 9.24 to 16.6 mCi for a rail/barge cask.

Even if credit were taken for the other internal cask surfaces (i.e., for the outer basket surface and the inner cask surface), it is estimated that the allowable contamination levels could only approximately double from the values shown above.

Decontamination of the insides of casks which have become contaminated with crud from the SNF to levels of 1 to 30 mCi is unlikely to occur, especially by simply "vacuum-cleaning or other liquid chemical flushing procedures" as specified in Reference 1.

Furthermore, verifying that cask internals have been cleaned to such levels would probably be even more difficult.

Finally, as indicated earlier, cleaning to such levels on a routine basis at the repository (or an MRS) is just not necessary for safe handling and transport of casks.

References

1. Generic Requirements for a Mined Geologic Disposal System, OGR/B-2, DOE/RW-0090, Rev. 3, U.S. Department of Energy, Washington, D.C., March 1987.

2. Site Characterization Plan Conceptual Design Report, SAND84-2641, Sandia National Laboratories, Albuquerque, New Mexico, September 1987.

3. Advisory Material for the IAEA Regulations for Safe Transport of Radioactive Material (1985 Edition), Third Edition, International Atomic Energy Agency, Vienna, Austria, June 1987.

4. Regulations for the Safe Transport of Radioactive Material, 1985 Edition, Safety Series No. 6, International Atomic Energy Agency, Vienna, Austria, February 1985 (as modified and amended by the 1986 Supplement thereto).

5. Explanatory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (1985 Edition), Second Edition, International Atomic Energy Agency, Vienna, Austria, October 1987.

Appendix F

CAPITAL COST ESTIMATE SUMMARIES

The capital cost for designing and constructing the CMF was first estimated in constant FY 1989 dollars and then escalated over the project cycle to determine the effect of inflation. For purposes of that analysis, it was assumed that Titles I and II Design would start in the third quarter of FY 1996 and that the start of operations would be first quarter FY 2003 (see the generic schedule in Fig. 8.1). DOE prescribed escalation rates were used. The rates are: 4.0% for FY 1989; 5.0% for FY 1990 and 1991; and, 5.5% thereafter.

The estimated capital cost in constant FY 1989 dollars is $75 million. Escalated over the project cycle this becomes $132 million. Provided here are summaries of the estimated costs developed during the feasibility study. The complete detailed estimate is available as a separate document.

Included in the information which follows is the project work breakdown structure (Page F-2) and summary tables for both cases, the constant FY 1989 dollars (Page F-3) and escalated dollars (Page F-4). Please note the dollars shown in Table 9.2 were rounded from the actual estimated dollars shown on Page F-3 and some adjustments in format were made. They are:

1. Land and Land Rights is shown as a separate category in Table 9.2,

2. the cost of utility and transportation services to the site were broken out from "Outside Utilities" on page F-3 and shown as a separate category in Table 9.2, and

3. the "Special Facilities" and "Standard Equipment" cost on page F-3 were combined under "Equipment" in table 9.2.

Following the summary sheets are more detailed summaries. The first one is by DOE cost code and the second is by the project work breakdown structure.

Cask Maintenance Facility
Project Work Breakdown Structure

- 1.0 Cask Maintenance Facility
  - 1.1 Process Facility
    - 1.1.1 Process Area
      - 1.1.1.1 Building
      - 1.1.1.4 Process Pool
      - 1.1.1.5 Testing Station Equipment
      - 1.1.1.6 Maintenance Shop Area
      - 1.1.1.7 Yoke Maintenance & Storage
      - 1.1.1.8 Bridge Cranes
    - 1.1.2 Administration Building
      - 1.1.2.1 Building
      - 1.1.2.2 Data Processing Equipment
    - 1.1.3 Chemical Process
      - 1.1.3.1 Exterior Wash Recycle System
      - 1.1.3.2 Solidification System
      - 1.1.3.4 Interior Wash Recycle System
  - 1.2 Vehicle Maintenance Facility
    - 1.2.1 Vehicle Inspection
      - 1.2.1.1 Building
      - 1.2.1.3 Inspection Bay
    - 1.2.2 Bead Blast Facility
      - 1.2.2.1 Building
      - 1.2.2.2 Blast Equipment
  - 1.3 Entry & Exit Station
    - 1.3.1 Building
  - 1.4 Site Development
    - 1.4.1 Fencing & Security
    - 1.4.2 Utilities
    - 1.4.3 Roads & Parking
    - 1.4.4 Railroad
    - 1.4.5 Services to Site
    - 1.4.6 General Site Work
  - 1.5 Project Support
    - 1.5.1 Engineering
    - 1.5.2 Construction Management
    - 1.5.3 Project Support
    - 1.5.4 Land Costs

1-B-7 SUMMARY REPORT
CONSTANT FY 1989 DOLLARS

CASK MAINTENANCE FACILITY
WBS: 1

SCHEDULE 1-B-7a
CONSTANT DOLLARS

$1 = $1000

		Participants							
		OC	A-E	FPSC	CMC	DOE	OTHER		Total
I.	ENGINEERING:		6420						6420
II.	CONSTRUCTION:								
	LAND AND LAND RIGHTS					1000		1000	
	IMPROVEMENT TO LAND			4544				4544	
	NEW BLDG. & ADDITIONS			12794				12794	
	BLDG. MODIFICATIONS								
	OTHER STRUCTURES								
	SPECIAL FACILITIES			19786				19786	
	OUTSIDE UTILITIES			4169				4169	
	CONSTRUCTION MGMT.	4055		400	4280	1363		10098	
	TOTAL CONSTRUCTION	4055		41693	4280	2363			52391
III.	STANDARD EQUIPMENT:			1103					1103
	SUBTOTAL	4055	6420	42796	4280	2363			59914
IV.	CONTINGENCY	1014	1605	10699	1070	591			14979
	GRAND TOTAL	5069	8025	53495	5350	2954			74893

Engineering as a percent of Construction is: 12.25%

The overall distributed Contingency is : 25.00%

1-B-7 SUMMARY REPORT
ESCALATED DOLLARS
FY-96 START

CASK MAINTENANCE FACILITY
WBS: 1

SCHEDULE 1-8-7a
ESCALATED DOLLARS

$1 = $1000

	Participants							
	OC	A-E	FPSC	CMC	DOE	OTHER		Total
I. ENGINEERING:		10129						10129
II. CONSTRUCTION:								
LAND AND LAND RIGHTS					1728		1728	
IMPROVEMENT TO LAND			7387				7387	
NEW BLDG. & ADDITIONS			23736				23736	
BLDG. MODIFICATIONS								
OTHER STRUCTURES								
SPECIAL FACILITIES			36708				36708	
OUTSIDE UTILITIES			6777				6777	
CONSTRUCTION MGMT.	7007		650	7395	2354		17406	
TOTAL CONSTRUCTION	7007		75258	7395	4082			93742
III. STANDARD EQUIPMENT:			1993					1993
SUBTOTAL	7007	10129	77251	7395	4082			105864
IV. CONTINGENCY	1752	2532	19313	1849	1021			26467
GRAND TOTAL	8759	12661	96564	9244	5103			132331

Engineering as a percent of Construction is: 10.81%

The overall distributed Contingency is : 25.00%

CONSTANT FY 1989 AND ESCALATED COST SUMMARY REPORT
COST CODE BY WORK BREAKDOWN STRUCTURE BY BILL OF MATERIAL
FY-96 START

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: Cost Code / WBS / B/M Attribute

	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1000 Land and Land Rights						
1.5.4 WBS 1.5.4						
09.01 PURCHASE LAND	1000	0	1000	1728	0	1728
TOTAL Land and Land Rights	1000	0	1000	1728	0	1728
2000 Improvement to Land						
1.4.1 WBS 1.4.1						
C1.08 FENCING AND SECURITY	109	0	109	176	0	176
E3.19 FENCE GROUNDING	12	29	41	20	48	68
1.4.3 WBS 1.4.3						
C1.10 ROADS AND PARKING	1457	102	1559	2368	166	2534
1.4.6 WBS 1.4.6						
C1.06 SITE DEVELOPMENT	2680	154	2834	4358	251	4609
TOTAL Improvement to Land	4258	285	4543	6922	465	7387
3000 New Buildings and Additions						
1.1.1 WBS 1.1.1						
C1.02 CMF-PROCESS BUILDING	5009	1472	6481	9294	2730	12024
E3.02 RECEPTACLE SYSTEMS	15	22	37	28	41	69
E3.03 BUILDING GROUND SYSTEM	5	7	12	9	13	22
E3.04 LIGHTING SYSTEMS	89	67	156	165	124	289
E3.05 Power Distribution System	715	68	783	1326	125	1451
E3.06 EQPT. & CONNECTIONS TO MCC'S	91	77	168	169	143	312
H2.01 PROCESS BLDG HVAC EQUIP	660	187	847	1225	347	1572
H2.05 SHOP AREA HVAC	250	85	335	463	157	620
I4.06 BUILDING EQUIPMENT	542	57	599	1005	105	1110
P5.04 UTILITY PIPING FOR PROCESS	374	248	622	695	460	1155
P5.05 FIRE PROTECTION	86	46	132	159	85	244
1.1.2 WBS 1.1.2						
C1.04 ADMIN BLDG	203	75	278	377	139	516
E3.08 FIRE ALARM SYSTEM	24	16	40	44	30	74
E3.09 BUILDING COMMUNICATIONS	8	8	16	14	15	29
E3.10 POWER, LIGHTS, AND RECEPTACLES	19	17	36	35	32	67
H2.04 ADMINSTRATION AREA HVAC	67	59	126	125	110	235
I4.07 BUILDING EQUIPMENT	127	46	173	235	85	320

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: Cost Code / WBS / B/M Attribute

	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
3000 New Buildings and Additions						
1.1.2 WBS 1.1.2						
P5.07 CLEANING EQUIPMENT PIPING	52	23	75	96	43	139
1.2.1 WBS 1.2.1						
C1.01 CASK MAINT FAC-VEH CLEAN FAC	421	177	598	781	329	1110
E3.01 POWER, LIGHTS & RECEPTACLES	20	21	41	37	38	75
1.2.2 WBS 1.2.2						
C1.05 CMF-BEAD BLAST FACILITY	244	100	344	453	185	638
E3.11 RECEPTACLE SYSTEMS	3	6	9	6	11	17
E3.12 FIRE ALARM SYSTEM	9	4	13	17	7	24
E3.13 BUILDING COMMUNICATIONS	4	3	7	7	6	13
E3.14 LIGHTING SYSTEM	41	27	68	77	50	127
E3.15 POWER DISTRIBUTION SYSTEM	46	23	69	85	43	128
E3.16 BUILDING GROUND SYSTEM	2	3	5	4	5	9
E3.17 EQUIPMENT AND CONNECTIONS	8	14	22	15	26	41
H2.02 BEAD BLAST FACILITY HVAC	280	93	373	520	172	692
P5.02 UTILITY PIPING BEAD BLAST	57	68	125	105	126	231
P5.06 FIRE PROTECTION	21	14	35	40	26	66
1.3.1 WBS 1.3.1						
C1.03 ENTRY/EXIT STATION	74	37	111	138	69	207
E3.07 POWER, LIGHTS, AND RECEPTACLES	17	17	34	32	31	63
H2.03 GUARD PORTAL HVAC	5	1	6	9	1	10
I4.09 BUILDING EQUIPMENT	13	4	17	24	8	32
TOTAL New Buildings and Additions	9601	3192	12793	17814	5917	23731
6000 Special Facilities						
1.1.1 WBS 1.1.1						
C1.12 POOL LINNER	1560	381	1941	2894	706	3600
I4.05 TESTING STATION EQUIPMENT	347	60	407	643	112	755
M7.04 BASKET STORAGE CRANE	404	57	461	750	105	855
M7.05 PROCESS BRIDGE CRANE	2831	397	3228	5253	736	5989
M7.06 POOL MECHANICAL EQUIPMENT	2865	404	3269	5315	749	6064
M7.07 INSPECTION MECHANICAL EQUIPMEN	782	110	892	1451	203	1654
1.1.2 WBS 1.1.2						
I4.10 DATA BASE SYSTEM	1689	71	1760	3133	132	3265
1.1.3 WBS 1.1.3						
B6.01 Inter. Wash Process Equip.	494	66	560	917	123	1040

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: Cost Code / WBS / B/M Attribute

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
6000 Special Facilities						
1.1.3 WBS 1.1.3						
B6.02 Process Equipment	207	23	230	384	43	427
I4.01 SOLIDIFICATION SYSTEM	111	47	158	205	86	291
I4.02 INTERNAL RECYCLE SYSTEM	662	134	796	1228	249	1477
I4.03 EXTERNAL RECYCLE SYSTEM	332	104	436	616	192	808
P5.08 EXT WASH & RECYCLE PIPING	239	103	342	443	190	633
P5.09 SOLIDIFICATION SYSTEM PIPING	2840	516	3356	5269	958	6227
P5.10 INT. WSH & RECYCLE SYST PIPING	758	344	1102	1407	638	2045
1.2.1 WBS 1.2.1						
I4.04 INSPECTION BAY	77	6	83	144	10	154
1.2.2 WBS 1.2.2						
M7.08 BEAD BLAST EQUIP	674	95	769	1251	175	1426
TOTAL Special Facilities	16872	2918	19790	31303	5407	36710
7000 Utilities						
1.4.2 WBS 1.4.2						
C1.09 SITE UTILITIES	118	54	172	192	87	279
E3.18 AREA LIGHTING	237	68	305	385	111	496
E3.20 CATHODIC PROTECTION	11	11	22	18	19	37
E3.21 GENERAL TELEPHONE CABLING	674	0	674	1096	0	1096
E3.22 UNLEADED GASOLINE STATION	6	8	14	10	12	22
I4.08 SITE UTILITIES EQUIPMENT	23	31	54	38	50	88
P5.01 DIESEL FUEL TANK FOR GENERATOR	12	8	20	19	14	33
P5.03 UNLEADED GASOLINE STATION	18	12	30	30	19	49
P5.12 SITE WATER DISTRIBUTION	164	45	209	266	73	339
P5.13 UNDERGROUND FIRE WATER TANK	327	10	337	531	17	548
P5.14 NATURAL GAS LINE	8	10	18	13	16	29
1.4.4 WBS 1.4.4						
C1.11 RAILROAD	860	156	1016	1399	253	1652
1.4.5 WBS 1.4.5						
C1.07 UTILITY SERVICES TO SITE	598	111	709	972	181	1153
E3.23 UTILITIES TO SITE	35	46	81	57	74	131
P5.11 UTILITY SERVICES TO SITE	289	219	508	470	356	826
TOTAL Utilities	3380	789	4169	5496	1282	6778

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: Cost Code / WBS / B/M Attribute

	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
8000 Standard Equipment						
1.1.1 WBS 1.1.1						
M7.01 SHOP TOOLS	403	53	456	747	98	845
1.2.1 WBS 1.2.1						
M7.02 YARD TRUCK TRACTOR	162	9	171	300	17	317
1.4.4 WBS 1.4.4						
M7.03 YARD ENGINE	202	28	230	329	46	375
1.5.3 WBS 1.5.3						
09.02 PLANT VECHICLES	216	30	246	400	56	456
TOTAL Standard Equipment	983	120	1103	1776	217	1993
9000 Construction Mgmt.						
1.5.2 WBS 1.5.2						
X8.02 CONSTURCTION MANAGEMENT	4280	0	4280	7395	0	7395
1.5.3 WBS 1.5.3						
09.03 PLANT SECURITY	46	1285	1331	79	2220	2299
09.04 TEMPORARY FACILITIES	400	0	400	650	0	650
X8.03 PROJECT SUPPORT	2725	0	2725	4709	0	4709
X8.04 DOE'S PROJECT SUPPORT	1363	0	1363	2354	0	2354
TOTAL Construction Mgmt.	8814	1285	10099	15187	2220	17407
9999 Engineering						
1.5.1 WBS 1.5.1						
X8.1 DESIGN ENGINEERING	6420	0	6420	10129	0	10129
TOTAL Engineering	6420	0	6420	10129	0	10129
SUB - TOTAL	51328	8589	59917	90355	15508	105863
CONTINGENCY	12832	2146	14978	22589	3878	26467
GRAND TOTAL	64160	10735	74895	112944	19386	132330

CONSTANT FY 1989 AND ESCALATED COST SUMMARY REPORT
WORK BREAKDOWN STRUCTURE BY COST CODE BY BILL OF MATERIAL
FY-96 START

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: WBS / Cost Code / B/M Attribute

	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1.1.1 WBS 1.1.1						
3000 New Buildings and Additions						
C1.02 CNF-PROCESS BUILDING	5009	1472	6481	9294	2730	12024
E3.02 RECEPTACLE SYSTEMS	15	22	37	28	41	69
E3.03 BUILDING GROUND SYSTEM	5	7	12	9	13	22
E3.04 LIGHTING SYSTEMS	89	67	156	165	124	289
E3.05 Power Distribution System	715	68	783	1326	125	1451
E3.06 EQPT. & CONNECTIONS TO MCC'S	91	77	168	169	143	312
H2.01 PROCESS BLDG HVAC EQUIP	660	187	847	1225	347	1572
H2.05 SHOP AREA HVAC	250	85	335	463	157	620
I4.06 BUILDING EQUIPMENT	542	57	599	1005	105	1110
P5.04 UTILITY PIPING FOR PROCESS	374	248	622	695	460	1155
P5.05 FIRE PROTECTION	86	46	132	159	85	244
6000 Special Facilities						
C1.12 POOL LINNER	1560	381	1941	2894	706	3600
I4.05 TESTING STATION EQUIPMENT	347	60	407	643	112	755
M7.04 BASKET STORAGE CRANE	404	57	461	750	105	855
M7.05 PROCESS BRIDGE CRANE	2831	397	3228	5253	736	5989
M7.06 POOL MECHANICAL EQUIPMENT	2865	404	3269	5315	749	6064
M7.07 INSPECTION MECHANICAL EQUIPMEN	782	110	892	1451	203	1654
8000 Standard Equipment						
M7.01 SHOP TOOLS	403	53	456	747	98	845
TOTAL WBS 1.1.1	17028	3798	20826	31591	7039	38630
1.1.2 WBS 1.1.2						
3000 New Buildings and Additions						
C1.04 ADMIN BLDG	203	75	278	377	139	516
E3.08 FIRE ALARM SYSTEM	24	16	40	44	30	74
E3.09 BUILDING COMMUNICATIONS	8	8	16	14	15	29
E3.10 POWER, LIGHTS, AND RECEPTACLES	19	17	36	35	32	67
H2.04 ADMINSTRATION AREA HVAC	67	59	126	125	110	235
I4.07 BUILDING EQUIPMENT	127	46	173	235	85	320
P5.07 CLEANING EQUIPMENT PIPING	52	23	75	96	43	139
6000 Special Facilities						
I4.10 DATA BASE SYSTEM	1689	71	1760	3133	132	3265
TOTAL WBS 1.1.2	2189	315	2504	4059	586	4645

CASK MAINTENANCE FACILITY

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	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1.1.3 WBS 1.1.3						
6000 Special Facilities						
B6.01 Inter. Wash Process Equip.	494	66	560	917	123	1040
B6.02 Process Equipment	207	23	230	384	43	427
I4.01 SOLIDIFICATION SYSTEM	111	47	158	205	86	291
I4.02 INTERNAL RECYCLE SYSTEM	662	134	796	1228	249	1477
I4.03 EXTERNAL RECYCLE SYSTEM	332	104	436	616	192	808
P5.08 EXT WASH & RECYCLE PIPING	239	103	342	443	190	633
P5.09 SOLIDIFICATION SYSTEM PIPING	2840	516	3356	5269	958	6227
P5.10 INT. WSH & RECYCLE SYST PIPING	758	344	1102	1407	638	2045
TOTAL WBS 1.1.3	5643	1337	6980	10469	2479	12948
1.2.1 WBS 1.2.1						
3000 New Buildings and Additions						
C1.01 CASK MAINT FAC-VEH CLEAN FAC	421	177	598	781	329	1110
E3.01 POWER, LIGHTS & RECEPTACLES	20	21	41	37	38	75
6000 Special Facilities						
I4.04 INSPECTION BAY	77	6	83	144	10	154
8000 Standard Equipment						
M7.02 YARD TRUCK TRACTOR	162	9	171	300	17	317
TOTAL WBS 1.2.1	680	213	893	1262	394	1656
1.2.2 WBS 1.2.2						
3000 New Buildings and Additions						
C1.05 CMF-BEAD BLAST FACILITY	244	100	344	453	185	638
E3.11 RECEPTACLE SYSTEMS	3	6	9	6	11	17
E3.12 FIRE ALARM SYSTEM	9	4	13	17	7	24
E3.13 BUILDING COMMUNICATIONS	4	3	7	7	6	13
E3.14 LIGHTING SYSTEM	41	27	68	77	50	127
E3.15 POWER DISTRIBUTION SYSTEM	46	23	69	85	43	128
E3.16 BUILDING GROUND SYSTEM	2	3	5	4	5	9
E3.17 EQUIPMENT AND CONNECTIONS	8	14	22	15	26	41
H2.02 BEAD BLAST FACILITY HVAC	280	93	373	520	172	692
P5.02 UTILITY PIPING BEAD BLAST	57	68	125	105	126	231
P5.06 FIRE PROTECTION	21	14	35	40	26	66
6000 Special Facilities						

CASK MAINTENANCE FACILITY

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	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1.2.2 WBS 1.2.2						
6000 Special Facilities						
M7.08 BEAD BLAST EQUIP	674	95	769	1251	175	1426
TOTAL WBS 1.2.2	1389	450	1839	2580	832	3412
1.3.1 WBS 1.3.1						
3000 New Buildings and Additions						
C1.03 ENTRY/EXIT STATION	74	37	111	138	69	207
E3.07 POWER, LIGHTS, AND RECEPTACLES	17	17	34	32	31	63
H2.03 GUARD PORTAL HVAC	5	1	6	9	1	10
I4.09 BUILDING EQUIPMENT	13	4	17	24	8	32
TOTAL WBS 1.3.1	109	59	168	203	109	312
1.4.1 WBS 1.4.1						
2000 Improvement to Land						
C1.08 FENCING AND SECURITY	109	0	109	176	0	176
E3.19 FENCE GROUNDING	12	29	41	20	48	68
TOTAL WBS 1.4.1	121	29	150	196	48	244
1.4.2 WBS 1.4.2						
7000 Utilities						
C1.09 SITE UTILITIES	118	54	172	192	87	279
E3.18 AREA LIGHTING	237	68	305	385	111	496
E3.20 CATHODIC PROTECTION	11	11	22	18	19	37
E3.21 GENERAL TELEPHONE CABLING	674	0	674	1096	0	1096
E3.22 UNLEADED GASOLINE STATION	6	8	14	10	12	22
I4.08 SITE UTILITIES EQUIPMENT	23	31	54	38	50	88
P5.01 DIESEL FUEL TANK FOR GENERATOR	12	8	20	19	14	33
P5.03 UNLEADED GASOLINE STATION	18	12	30	30	19	49
P5.12 SITE WATER DISTRIBUTION	164	45	209	266	73	339
P5.13 UNDERGROUND FIRE WATER TANK	327	10	337	531	17	548
P5.14 NATURAL GAS LINE	8	10	18	13	16	29
TOTAL WBS 1.4.2	1598	257	1855	2598	418	3016

CASK MAINTENANCE FACILITY

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	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1.4.3 WBS 1.4.3						
2000 Improvement to Land						
C1.10 ROADS AND PARKING	1457	102	1559	2368	166	2534
TOTAL WBS 1.4.3	1457	102	1559	2368	166	2534
1.4.4 WBS 1.4.4						
7000 Utilities						
C1.11 RAILROAD	860	156	1016	1399	253	1652
8000 Standard Equipment						
M7.03 YARD ENGINE	202	28	230	329	46	375
TOTAL WBS 1.4.4	1062	184	1246	1728	299	2027
1.4.5 WBS 1.4.5						
7000 Utilities						
C1.07 UTILITY SERVICES TO SITE	598	111	709	972	181	1153
E3.23 UTILITIES TO SITE	35	46	81	57	74	131
P5.11 UTILITY SERVICES TO SITE	289	219	508	470	356	826
TOTAL WBS 1.4.5	922	376	1298	1499	611	2110
1.4.6 WBS 1.4.6						
2000 Improvement to Land						
C1.06 SITE DEVELOPMENT	2680	154	2834	4358	251	4609
TOTAL WBS 1.4.6	2680	154	2834	4358	251	4609
1.5.1 WBS 1.5.1						
9999 Engineering						
X8.1 DESIGN ENGINEERING	6420	0	6420	10129	0	10129
TOTAL WBS 1.5.1	6420	0	6420	10129	0	10129
1.5.2 WBS 1.5.2						
9000 Construction Mgmt.						
X8.02 CONSTURCTION MANAGEMENT	4280	0	4280	7395	0	7395
TOTAL WBS 1.5.2	4280	0	4280	7395	0	7395

CASK MAINTENANCE FACILITY

SUMMARY REPORT
$1 = $1000

02/17/89

Arranged By: WBS / Cost Code / B/M Attribute

	Unescalated Material $	Unescalated Labor $	Unescalated Total $	Escalated Material $	Escalated Labor $	Escalated Total $
1.5.3 WBS 1.5.3						
8000 Standard Equipment						
09.02 PLANT VECHICLES	216	30	246	400	56	456
9000 Construction Mgmt.						
09.03 PLANT SECURITY	46	1285	1331	79	2220	2299
09.04 TEMPORARY FACILITIES	400	0	400	650	0	650
X8.03 PROJECT SUPPORT	2725	0	2725	4709	0	4709
X8.04 DOE'S PROJECT SUPPORT	1363	0	1363	2354	0	2354
TOTAL WBS 1.5.3	4750	1315	6065	8192	2276	10468
1.5.4 WBS 1.5.4						
1000 Land and Land Rights						
09.01 PURCHASE LAND	1000	0	1000	1728	0	1728
TOTAL WBS 1.5.4	1000	0	1000	1728	0	1728
SUB - TOTAL	51328	8589	59917	90355	15508	105863
CONTINGENCY	12832	2146	14978	22589	3878	26467
GRAND TOTAL	64160	10735	74895	112944	19386	132330

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