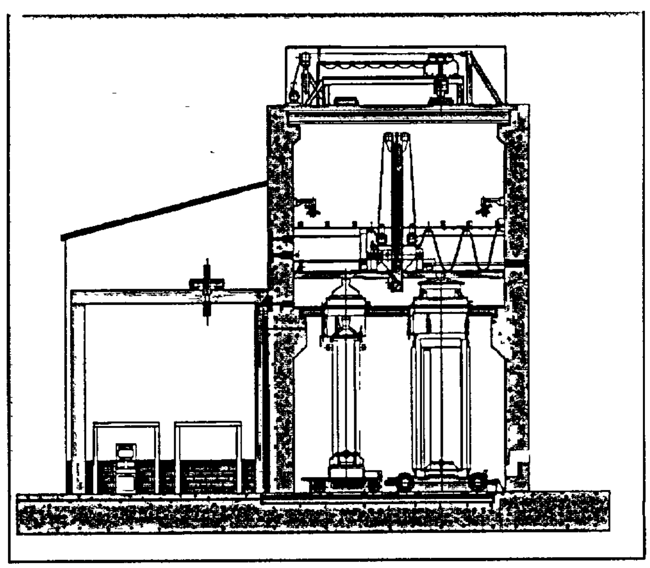
Dry Transfer System

Revision 1

Topical Safety Analysis Report

Volume I



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

TRANSNUCLEAR

DRY TRANSFER SYSTEM
TOPICAL SAFETY ANALYSIS REPORT
RECORD OF REVIEW
Rev. 1

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Errata Sheet for Dry Transfer System Topical Safety Analysis Report
Revision 1, September 2002

Volume I

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Chapter 2, Page ii, 2.5: Change "Surface Hydrology" tp "Subsurface Hydrology"

List of Tables
Chapter 5, Page xxix, 5.2-3: Change "CaskMating" to "Cask Mating"

Chapter 5, Appendix 5A,Page xxix, 5A-17: Change "Valadation" to "Validation"

Chapter 7, Page xxx, 7.3-3: Change "aaround" to "around"

Chapter 8, Page xxxii, 8.2-10a: Change "DoseEquivalent" to Dose Equivalent"
Chapter 8, Appendix 8A.1-29, Page xxxii: Change "ResultsSummary" to "Results Summary"

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Chapter 8, Appendix 8A.5, Page xxxii, 8A.5-18: Change "Strresses" to "Stresses

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CHAPTER 1

INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION

In the management of spent nuclear fuel both at utility sites and possibly other locations, there is a need to perform certain fuel transfer and packaging operations apart from the conventional pool. Facilities with weight or dimensional access limitations find the pool loading of large multi-element canisters for storage and/or transportation not feasible. A method has been developed whereby a large canister can be loaded in a dry facility external to the reactor or fuel building through the repeated use of a small transfer facility external to the reactor or fuel building through the repeated use of a small transfer cask carrying a small number of spent fuel assemblies. This topical report addresses the safety evaluation of the Dry Transfer System (DTS). The format follows the guidance provided in NRC Regulatory Guide 3.48(1). (Throughout this report, superscripted numbers in parentheses refer to reference numbers for the Section.) The report is intended for review by the NRC under 10CFR72(2). Although technically not an Independent Spent Fuel Storage Installation (ISFSI), the Dry Transfer System (DTS) is designed to meet the requirements of 10CFR72 as described herein.

The Dry Transfer System was developed by Transnuclear, Inc. under the direction of the Electric Power Research Institute (EPRI) and the Department of Energy (DOE). The DTS provides particulate confinement, shielding, and heat removal during fuel transfer in conjunction with a 30 ton transfer cask and a 125 ton transport or storage cask. Only single fuel assemblies are transferred, so the criticality control is maintained by the two casks.

The DTS is designed for the on-site transfer of a single bare spent fuel assembly from a top-loading source cask with a maximum capacity of 4 PWR assemblies to a top-loading receiving cask with a maximum capacity of 21 PWR assemblies. The design of the DTS has been selected to enable handling of other fuel and interface with other casks with minor design modifications.

This topical report analyzes the safety related aspects of dry transfer within the DTS. It does not address loading of the source cask in the spent fuel pool, removal of contamination due to immersion of the cask(s) in the spent fuel pool, or preparation or loading of the source cask. It also does not address handling of the source or receiving cask other than the handling required to directly interface with the DTS. These requirements would be covered in specific cask licensing applications.

Some sections of this report identify information that can only be supplied by the applicant for a site-specific license. However, where possible, typical or bounding values for the installation or site-specific information are supplied in this report so that review of the DTS and facility interfaces is facilitated.

1.1 Introduction

The DTS is designed to allow dry transfer of fuel from one cask (taken to be a small transfer or transport cask) to a larger storage or high capacity transport cask. The DTS allows utilities, which have handling restrictions, to take advantage of the economic benefits of high capacity storage and transport casks. It also provides a means for the utilities to unload storage casks without returning the fuel to the spent fuel pool.

The design of the DTS was performed in accordance with Transnuclear's Quality Assurance (QA) Program, that has been established in conformance with the requirements of 10CFR72 Subpart G. The QA Program is included as Appendix 11A. Likewise, the organizations that select the site, construct the facility, fabricate and install the equipment, test the systems, operate the systems, and decommission the facility and the site, shall have a QA Program appropriate to these activities. The QA programs shall be implemented for all the activities that are important to safety, including those that are subcontracted for this program.

The DTS consists of three areas - the Preparation Area, the Lower Access Area, and the Transfer Confinement Area (TCA). A general description of the three areas is provided below and a conceptual sketch of the DTS is provided in Figure 1.1-1. The DTS design is shown in Drawing No. 3039-1.

1.1.1 Preparation Area

The Preparation Area is where the receiving cask (which is to be loaded with fuel within the DTS) and the source cask (which will be unloaded within the DTS) enter, are prepared for fuel transfer and later for cask removal, and exit from the DTS. The Preparation Area is a weather resistant Butler-type building at the ground elevation of the transfer facility. Two entrances/exits exist to the Preparation Area. One is a roll up door for the casks and the other is a personnel access door.

The receiving and source cask arrive outside of the Preparation Area where they are mounted and locked onto a trolley mounted on rails (the Receiving and Source Cask Transfer Subsystem). The receiving and source casks are brought into the Preparation Area.

Upon proper positioning in the Preparation Area, the following activities are performed on the Receiving cask:

- Locking of the trolley in place;
- removal and storage of receiving cask lid and canister lids (A shield plug remains on the canister);
- emplacement of lid lifting pintle onto the canister shield plug;
- decontamination and radiation survey of receiving cask, if required.

These operations are performed on an empty cask.

After the receiving cask is loaded within the DTS, the following operations are performed in the Preparation Area:

- The trolley is locked in place to prevent tipover or sliding;
- Removal of lid lifting pintle from the shield plug;
- placement and welding of canister lids and receiving cask lid;
- inerting of receiving cask cavity;
- inspection and leak testing of canister lid closure welds, and
- replacement, bolting, and re-torquing of receiving cask lid.

There is only one railway into the DTS. Therefore, the source cask must enter the DTS after the receiving cask, and be removed before the receiving cask. The receiving cask will be moved into the Lower Access Area prior to moving the source cask into the Preparation Area.

Upon proper positioning in the Preparation Area, the following activities are performed on the source cask:

- unbolting of source cask lid;
- emplacement of lid lifting pintle;
- venting of the source cask gas; and
- decontamination and survey of source cask.

After the source cask is emptied within the DTS, the following operations are performed in the Preparation Area:

- Decontamination and survey of external surfaces of cask;
- Removal of lid lifting pintle; and
- Bolting of the source cask lid.

Lighting and video cameras are located in the Preparation Area so that operations can be viewed from the Control Center. The Heating Ventilating and Air Conditioning System keeps the Preparation Area at a pressure less than the ambient external pressure so that air will flow into the Preparation Area from the outside. In the event of airborne contamination, air flow will be from the outside to the inside. Radiation monitors are located in the Preparation Area to ensure that all operations are performed under safe working conditions.

1.1.2 Lower Access Area

The Lower Access Area is next to the Preparation Area and directly below the Transfer Confinement Area (TCA). This area is located within the concrete and steel structure of the DTS. The Lower Access Area provides shielding, confinement and positioning for the open source and receiving casks during fuel transfer. One entrance/exit exists for this area, a 7 to 9 inch thick steel sliding door.

The Lower Access Area is where the casks are positioned for fuel transfer operations. The source and receiving casks enter the Lower Access Area from the Preparation Area on the Cask Transfer Subsystem rails. Each cask is locked to the floor in the Lower Access Area and is mated to an opening in the steel mezzanine floor of the TCA through the Cask Mating Subsystem which provides a confinement connection between the cask and the TCA mezzanine floor.

The Lower Access Area also houses the bulk of the HVAC equipment. Radiation Monitors are located in the Lower Access Area. Lighting and one camera are located in the Lower Access Area so that the mating of the cask can be verified from the Control Center.

Personnel are allowed access into the Lower Access Area only when the casks are closed. The source cask lid and the receiving cask shield plug are removed from the casks remotely through openings in the TCA mezzanine floor.

1.1.3 Transfer Confinement Area (TCA)

The TCA is the upper level of the transfer facility directly above the Lower Access Area. This area provides the physical confinement boundary and radiation shielding between the fuel assemblies and the environment. The TCA can only be entered through two covered openings in the roof or through two covered openings in the TCA mezzanine floor from the Lower Access Area.

The TCA is where the fuel assembly transfer from the source cask to the receiving cask occurs in the shielded structure. Removal and replacement of the receiving cask shield plug and the source cask lid are also performed (remotely) in this area.

On the roof of the TCA is the Roof Enclosure Area. This area is enclosed by a steel structure (the protective cover) which contains one personnel access door. The protective cover houses the upper crane which is used to lift and lower the receiving cask canister shield plug and source cask lid. Two openings in the roof plate directly above the source cask and receiving cask allow the upper crane access to the main region of the TCA and the casks. When the upper crane hoist is not in operation, the two openings are covered by shielded port covers. An air conditioner and heating unit are used to maintain temperature within acceptable limits in the Roof Enclosure Area.

The mezzanine floor and the cask mating system provide a confinement barrier between the Lower Access Area and the TCA. Only minimal shielding is provided between these areas, since no personnel are allowed access to the Lower Access Area during fuel transfer.

The TCA is the region where the potential for radioactive contamination is highest. It is maintained at a pressure slightly lower than atmospheric and also lower than the Preparation Area and Lower Access Area. Thus air will flow from regions of lowest potential contamination to regions of highest potential contamination.

1.1.4 Principle Features of DTS

The DTS is designed to enable loading of one receiving cask in ten 24-hour days, and a turnaround of one source cask in one 24-hour day. It is designed to be constructed at any reactor site or a new site where dry transfer is required. The system is designed such that the mechanical equipment can be transported to another site after completion of the fuel transfer campaign.

The principal design features that characterize the DTS are described below, and the list of Structures, Systems, and Components (SSCs), classified as 'Important to Safety' are listed in Table 3.4-1 (See Section 3.4).

- Bare spent fuel assemblies are handled vertically. The fuel assemblies are lifted into a transfer tube which prevents the fuel assembly from swinging during lateral transfer. Each fuel assembly is handled individually.

- Each component is designed to perform only one function, thereby enabling the use of standard equipment and minimizing complexity.

  Several design features are incorporated to ensure that spread of contamination is minimized. Examples of these features are, the crud catcher which covers the bottom of the fuel assembly during transfer; pressure differentials to ensure that air flow is from areas of lowest contamination potential to highest contamination potential; and the cask mating subsystem.

- The DTS provides confinement of radioactive contamination by the use of at least one physical barrier.

- All equipment, which is operated remotely, is backed up by a redundant system, which can perform the same function. This can either take the form of a completely separate independent system or by providing access for manual operation from a shielded area.

- The DTS is designed to allow maintenance and repair after routine decontamination.

- The fuel handling crane and the upper crane are designed as single-failure proof cranes.

- The DTS is designed with a heating, ventilating, and air conditioning system, which dissipate the decay heat load from the design basis fuel and maintains the fuel cladding temperatures as low as possible, for the site specific conditions.

- The building structure, together with the sliding door, roof plate and protective cover, provide sufficient shielding to ensure that the requirements of 10CFR20 and 10CFR72 are met.

- The building structure and the filtration system ensure confinement of radioactive particulate.

- Ventilation is provided to ensure that occupational radiation exposures will be ALARA.

- The design of the DTS, and its construction from steel and concrete, means there is no scope for the initiation and propagation of major fires. Minor local electrical fires or hydrocarbon fires, are dealt with by local extinguishers in the Preparation Area and a CO_2 fire suppression system, in the TCA.

- The design of the DTS is arranged to contain any potential contamination during operation and to facilitate its removal at the decommissioning stage. The mechanical and the electrical equipment are designed so that they can be decontaminated and dismantled.

- Radioactive wastes both of solid or liquid form are minimal with the DTS design.

All operations within the DTS are performed dry. Therefore there is no risk of a criticality accident unless water is able to enter the DTS in significant quantities. There are no sources of water within the DTS. The only potential source of water is rain or flooding. The DTS is required to be located at an elevation above the flood level. Even if water were to enter the DTS from the ground level due to flooding it could not get into the casks, since the only surfaces that are open are the top of the casks which are well above the ground level.

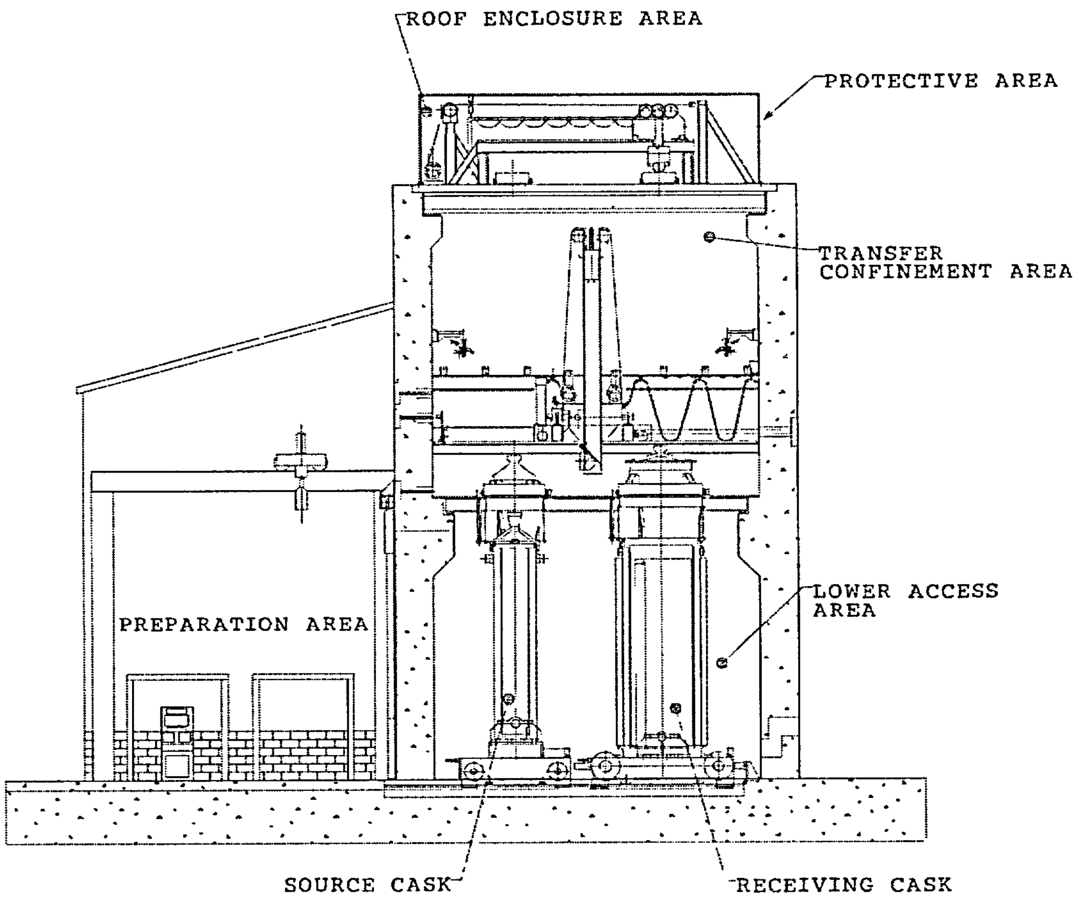
The rainwater is prevented from entering the DTS Transfer Confinement Area by the protective cover, which is made of 1.5 inch thick carbon steel. The protective cover is fully sealed, by a watertight sealing material such as a Viton gasket. The sealing material is used all around the bottom where the cover meets the TCA walls, as well as around any hatch doors provided for access into the TCA Roof Enclosure Area, to prevent rain water ingress.

In the Preparation Area, the lid is on the casks (or on the canister) at all times, except for a short period prior to the welding of the canister lid seal or when the canister is empty before loading, preventing water from entering the casks or canisters.

Therefore rainwater is precluded from the system, and there is no possibility of a criticality event.

Figure 1.1-1

Conceptual Sketch of DTS



1.2 General Description of Installation

1.2.1 Principal Design Criteria

This Topical Report addresses the generic DTS. This DTS is designed for transferring fuel from a 30 ton 4 assembly source cask to a 125 ton receiving cask. The receiving cask selected for the base design is a multipurpose canister, with two welded lids placed inside of a transport cask. The two casks were selected to determine the feasibility of the DTS design. The DTS can be adapted to be suitable for any two casks. The site specific applications which reference this Topical Report will address any differences from the base design casks and the selected source and receiving cask.

The DTS design is based on transferring B&W 15 x 15 PWR assemblies, with an initial enrichment of 3.75 weight percent U-235 and 40,000 MWd/MTU burnup. The shielding analysis is based on 5 year cooled fuel. However, the maximum design heat load of the fuel in the receiving cask is 15.5 kW (21 assemblies).

The waste products generated from the DTS are expected to be minimal, and is primarily from the crud levels on the fuel assemblies. Waste products will consist primarily of local decontamination materials, Pre-filters and HEPA filters.

The principal design criteria for the DTS are presented in Table 1.2-1. The DTS is designed to meet the design criteria of 10CFR72.

The DTS has been subdivided into several subsystems which are functionally defined below. The subsystems are classified into three categories: Major Structural Subsystems, Major Operations Subsystems and Major Support Subsystems.

Table 1.2-1

Principal Design Criteria of the DTS

Criteria or Parameter	
Tornado Requirements (Reg Guide 1.76 and NUREG-0800)	
Max. Wind Speed	360 mph
Rotational Speed	290 mph
Translational Speed	70 mph
Pressure Drop	3.0 psi at 2 psi/sec
Tornado Missiles (NUREG-0800)	Spectrum II, Region I
Snow and Ice Pressure(ANSI/ASCE 7-88)	100 psf
Seismic(Reg Guides 1.60 & 1.61 and 10CFR72.102)	0.25 g Horizontal 0.17 g Vertical
Flood	Site Specific Provision
Ambient Temperature	-20 to 115°F
Wind Velocity (ANSI/ASCE 7-95)	150 mph
Temperature Limits	
Fuel Cladding Limits	240°C in air for 2 week period 175°C in air for 2 year period
Concrete Limits	≤ 70° F across structure wall

1.2.2 Major Structural Subsystems

The major structural components provide: a physical confinement barrier during fuel transfer; radiation shielding of fuel assemblies during transfer and while in the source and receiving casks; the structural support of the Major Operations Subsystems within the DTS; and access to the source and receiving cask while in the Lower Access Area. The major structural components are described in more detail in Section 4.2.

The structural components of the DTS are listed below:

- A concrete base pad designed to withstand seismic loading;
- A concrete building structure which forms the Lower Access Area and TCA;
- A roof plate which provides shielding above the TCA;
- A mezzanine floor plate which separates the Lower Access Area and TCA;
- A Butler-type building which provides a weather protective structure around the Preparation Area;
- A Roof Enclosure Area which protects the upper crane from the weather and tornado missiles;
- A sliding door between the Lower Access Area and the Preparation Area which allows cask entry into the Lower Access Area, and
- A roll up door which provides cask entry into the Preparation Area.

Structural details are provided in Drawing Nos. 3039-15, and 3039-16.

1.2.3 Major Operations Subsystems

The Major Operations Subsystems are those subsystems which permit handling of the spent fuel, the receiving cask and the source cask. The locations of the subsystems are shown in Drawing No. 3039-1. The Major Operations Subsystems are described in detail in Section 5.2.

1.2.3.1 Receiving and Source Cask Transfer Subsystem

The Receiving and Source Cask Transfer Subsystem consists of two trolleys which are mounted on one set of rails. The rails run from the cask receipt and admittance area through the Preparation Area, and into the Lower Access Area. The casks are loaded onto the trolleys in the cask receipt and admittance area using a site specific cask transport and lifting subsystem. To minimize the size of the DTS, there is only one set of rails for the Receiving Cask Transfer Trolley and the Source Cask Transfer Trolley. Therefore, the receiving cask (the larger cask) must enter the DTS before the source cask. The Receiving Cask Transfer Subsystem is shown on Drawing No. 3039-2. The Source Cask Transfer Subsystem is shown on Drawing No. 3039-6. Each trolley is motor driven and operated using the local control panels outside and inside the Preparation Area and the Lower Access Area.

The Cask Transfer Subsystem supports the casks during all operations within the DTS, and prevents the casks from tipping over in a seismic event.

1.2.3.2 Receiving and Source Cask Mating Subsystem

The Receiving and Source Cask Mating Subsystem mates the casks with the floor of the TCA, providing a confinement barrier between the cask and the mezzanine floor. It works in conjunction with the HVAC Subsystem to prevent spread of contamination from the TCA to the Lower Access Area. There are two Cask Mating Subsystems, one for each cask, which are based on the same operating principles. These mating devices are shown on Drawing Nos. 3039-3, and 3039-7. Each Cask Mating Subsystem consists of an overlid with a gripping device, confinement bellows, and a motorized annular platform which supports the overlid. The overlid protects the upper surface of the cask lid from contamination. The gripping device is activated by a drive shaft which is driven by the motorized grapple of the upper crane. The confinement bellows, the annular platform and a static seal between the annular platform and the cask top surface provide the confinement barrier between the TCA and the Lower Access Area. Three electrical screw jacks enable platform lowering and lifting.

1.2.3.3 Receiving and Source Cask Transfer Confinement Port Cover Handling Subsystem

The TC port covers are used for storing the shield plug and source cask lid during fuel transfer. This was considered as a means to reduce the size of the DTS.

The TC (Transfer Confinement) port covers consist of rail mounted trolleys activated by electrical screw jacks. One port cover is positioned above each cask opening in the mezzanine floor plate. The openings allow access into the casks from the TCA for the lid and shield plug grapple and the fuel assembly grapple. The TC port covers are shown on Drawing No. 3039-8. The TC port covers are very similar to the upper shield port covers, but provide less shielding. A guidance device is mounted on each TC port cover, which allows the source cask lid (or MPC canister shield plug) to be accurately positioned on the port covers during fuel transfer operations.

1.2.3.4 Receiving Cask Shield Plug and Source Cask Lid Handling Subsystem

The Receiving Cask Shield Plug and Source Cask Lid Handling Subsystem is located in the Roof Enclosure Area of the DTS. This subsystem consists of two distinct portions. One portion is the Upper Crane which is used to remove the receiving cask shield plug and the source cask lid. The second portion is the upper shield port covers which are used to provide the upper crane access to the TCA and Lower Access Area for shield plug and lid removal and replacement.

The upper crane removes the shield plug from the empty receiving cask, places it in its storage position on the TC port cover and replaces it in the receiving cask upon completion of fuel transfer. The upper crane also removes the lid from the source cask, places it in storage, and installs it onto the source cask when unloading is completed.

The upper crane is shown on Drawing No. 3039-4. It consists of a motorized trolley suspended on rails, a hoist and a motorized grapple. The trolley moves between two fixed positions: directly above the source cask and directly above the receiving cask. The upper crane is housed within the Roof Enclosure Area. When the TC port cover and upper shield port cover are opened, the upper crane hoist lowers the grapple through the opening of the roof plate and the TC mezzanine floor. The grapple engages with a lifting pintle on the cask mating subsystem overlid (See Section 1.2.3.2). The gripping device of the overlid is also activated. The overlid and the lid (or shield plug) are then raised above the top of the TC port cover. While the overlid and lid (or shield plug) are suspended, the TC port cover is moved underneath the lid (or shield plug). The overlid and lid (or shield plug) are then lowered onto the TC port cover for temporary storage. Note that the upper crane is never moved laterally while under load.

During fuel transfer, the grapple is retracted into the Roof Enclosure Area, where it is shielded by the roof plate and upper shield port covers.

The upper shield port covers consist of rail-mounted trolleys activated by electrical screw jacks. They provide shielding over the openings in the roof plate. One port cover is positioned above each opening in the roof plate (above each cask). The openings allow access into the TCA from the Roof Enclosure Area for the lid and shield plug grapple. The upper shield port covers are shown on Drawing No. 3039-4.

1.2.3.5 Fuel Assembly Handling Subsystem

The Fuel Assembly Handling Subsystem is designed to engage a fuel assembly in the source cask by use of a conventional fuel grapple, lift it vertically (in the Z-direction) into the transfer tube, translate it laterally (in both the X and Y directions), and rotate the fuel tube containing the fuel assembly about the centerline to position it directly above the opening in the fuel assembly compartment of the receiving cask. The fuel assembly is then fully lowered into the cask and the fuel grapple is disengaged. Since the Subsystem has a full range of motion in the X, Y, Z and θ directions, it is adaptable to any source and/or receiving cask.

The Fuel Assembly Handling Subsystem consists of:

- A bridge supporting a trolley with two girders and end ties running on rails (X-direction),
- A motor driven trolley supporting a rotating platform and running on bridge girders (Y-Direction),
- A rotating platform supporting the Z-direction hoists and allowing correct orientation of the transfer tube above the cask basket cell (θ-Direction),
- A transfer tube which encloses and protects the fuel assembly during lateral movement,
- A spent fuel assembly grapple, and

- A crud catcher at the bottom of the fuel transfer tube which provides a confinement function for minimizing the potential spread of contamination from the spallation of crud from the fuel assembly in the TCA.

Two cameras and associated lighting are mounted at the base of the transfer tube. These cameras are used to verify identification of each fuel assembly and ensure that the fuel is properly lifted and lowered into the fuel assembly compartment of the source or receiving cask. The Fuel Assembly Handling Subsystem is shown in Drawing No. 3039-9.

1.2.3.6 Control Subsystem

The Control Subsystem controls and monitors system operations, including the Radiation Monitoring Subsystem and the HVAC Subsystem. The operations performed in the Preparation Area are locally controlled. The operations performed in the Lower Access Area and in the TCA are monitored and controlled remotely. The Control Subsystem is housed in a trailer, and can be disconnected and moved from one site to another. The Control Subsystem is described in detail in Section 5.5.

1.2.3.7 Closed Circuit Television Subsystem and Lighting Subsystem

The CCTV Subsystem provides viewing to align the casks with the Cask Mating Subsystem, to operate the Fuel Assembly Handling Subsystem, to operate the TC Port Cover, to remove and replace the receiving cask shield plug and the source cask lid, and monitor personnel operations. The CCTV Subsystem is also used for various inspection functions as well as the verification of the fuel assembly identification. There are six cameras in the TCA including two mounted on the fuel transfer tube, one camera in the Lower Access Area and one camera in the Preparation Area. The locations of each of the TV cameras within the DTS are shown on Drawing No. 3039-14.

This subsystem also provides lighting of the TCA to enable CCTV viewing of system component and operations. Additional general lighting will be provided in the TCA to ensure that operations can proceed and that will allow personnel access for maintenance and repair. This Subsystem provides lighting in the Preparation Area and Lower Access Area to enable the direct and/or CCTV viewing of the operation of the Cask Transfer Subsystem, the Canister Welding Subsystem, and the Cask Vacuum/Inerting/Leak Test Subsystem, and the Receiving Cask Lid Handling Subsystem.

1.2.4 Major Support Subsystems

The major support subsystems are the other systems which are not part of the structural nor directly a part of the major operation subsystems. These subsystems are described below.

1.2.4.1 HVAC Subsystem

The Heating, Ventilation and Air Conditioning (HVAC) Subsystem maintains negative pressure in the Preparation Area, the Lower Access Area, and the TCA relative to ambient and provides high efficiency filtration for particulate that may be released from assemblies. The HVAC Subsystem maintains air temperature at design levels for the design heat load to allow proper functioning of the operating equipment, monitors, cameras and lighting, as well as to ensure that the fuel clad temperature does not exceed specified levels. The HVAC subsystem is shown in Drawing Nos. 3039-12, and 3039-13. The HVAC Subsystem is described in detail in Section 5.3.

1.2.4.2 Radiation Monitoring Subsystem

The Radiation Monitoring Subsystem measures radiation and fixed and removable contamination levels in specified locations and on specified surfaces. It also measures airborne radioactive materials in specified locations. Measurements may be used for record and/or for notification of operating personnel of levels in occupied areas of the DTS or on specified surfaces. The Radiation Monitoring Subsystem also measures the effectiveness of the Decontamination Subsystem. The radiation monitors in the Lower Access Area are interlocked with the sliding door operation to ensure that the door cannot be opened unless the radiation level within the Lower Access Area is low enough to allow personnel entry. The Radiation Monitoring Subsystem is shown in Drawing No. 3039-10. The Radiation Monitoring Subsystem is described in detail in Section 7.3.1.

1.2.4.3 Receiving Cask Lid Handling Subsystem

The Receiving Cask Lid Handling Subsystem removes the lid from an empty receiving cask, stores it during cask loading, and replaces it when the cask is loaded. This subsystem also removes the two lids from the receiving cask canister, stored them during cask loading, and replaces them when the cask is loaded. This Subsystem is located in the Preparation Area and is shown on Drawing Nos. 3039-19, and 3039-20.

1.2.4.4 Decontamination Subsystem

This Subsystem is designed to collect and contain loose particulate contamination from the cask surfaces exposed to the interior of the TCA and equipment and surfaces in the DTS. This subsystem is discussed in more detail in Section 4.4.

1.2.4.5 Waste Products Generated During Operation

Chapter 6 describes the gaseous, the liquid and the solid radioactive wastes anticipated due to the operations of the Dry Transfer System (DTS).

The gaseous wastes are limited to the radioactive gases, that might be released from the fuel assemblies inside the source cask and then released inside the DTS upon opening of the source cask. Since the fuel assemblies are intact prior to the storage and transfer, and the storage environment is designed to minimize fuel rod rupture, little or no radioactive gases are expected. However, airborne radioactive contamination can result from the crud on the outside of fuel rods. Gaseous and aerosolized waste is processed, by a controlled airflow from areas of lowest to areas of highest contamination, and exhausted through the HEPA filters. A gas and aerosol sampling system monitors the radioactivity in the exhaust stack.

The only liquid waste generated during DTS operations will be the vacuum pump fluid, which will be solidified for disposal. There are neither potable nor sprinkler water supply lines to the DTS; so there is no source for water-based waste. All decontamination liquids will be from portable containers, and will be absorbed on wipes, for disposal as solid waste.

The solid radioactive wastes include protective clothing, cask and facility decontamination wastes (wipes and vacuum cleaner filters), HEPA filters, vacuum pump filters, and air handler filters. These will be processed by laundering or by compaction, and disposal as appropriate.

The only significant isotopes expected in the waste are Co60 and Mn54 from the crud. Monitoring of the locations where the contamination could accumulate (vacuum pump, HEPA and air handler filters, and vacuum cleaner) will be performed by periodic dose rate surveys which will indicate when the waste treatment is required.

Other than the HEPA filtration system, the DTS does not include any waste treatment facilities. Small amounts of waste, such as the wipes and the protective clothing, may be temporarily stored at the DTS. Waste treatment services will be provided by the facilities outside of the DTS.

1.2.5 Other Subsystems, not provided as Part of the DTS

This section describes systems which are not provided as part of the DTS, but may be needed by the utility or other user to properly make use of the DTS.

1.2.5.1 Cask Transport and Lifting Subsystem

A means for loading the receiving cask and source cask onto their respective trolleys outside of the Preparation Area is required. The equipment selected is required to be capable of lifting the loaded receiving cask, 125 tons, 26 inches (640 mm) above ground elevation and capable of lifting the loaded source cask, 30 tons, 46 inches (1170 mm) above ground elevation.

1.2.5.2 Cask Vacuum/Inerting/Leak Test System

This system evacuates, pressurizes with inert gas, and leak tests the receiving cask. The equipment designed for the receiving cask will be adopted for use in the DTS. These operations will be performed in the Preparation Area.

1.2.5.3 Canister Welding Subsystem

It is assumed that the receiving cask will have a welded canister. Therefore, a means to weld the canister lid(s) must be provided. The welding equipment which will be designed for the receiving cask will be adopted for use in the DTS. Welding will be performed in the Preparation Area.

1.2.5.4 DTS Power Subsystem

Primary and secondary electrical power as noted in this Topical Report will be provided by the collocated utility. The DTS Power Subsystem is described in Section 4.3.2.

1.2.5.5 Utilities and Services Provided by Co-located Utility

The DTS relies on the following common utilities and services associated with the co-located reactor site, or a potential new independent site:

Electrical power (480V and 220V 3 phase supply)
Access to Transportation
Security System
Waste Disposal System (DTS will store solid wastes in 55 gallon drums)
Health Physics Organization
Trained Operations Personnel

1.2.6 Master Drawing List

The DTS design drawings are provided as a part of this Section. A list of the design drawings are provided below.

Title	Drawing No.	Rev.
General Overview	3039-1	1
Receiving Cask Transfer Subsystem	3039-2	0
Receiving Cask Mating Subsystem	3039-3	1
Receiving Cask Shield Plug and Source Cask Lid Handling Subsystem	3039-4	0
Sliding Door	3039-5	0
Source Cask Transfer Subsystem	3039-6	0
Source Cask Mating Subsystem	3039-7	1
TC Port Cover Handling Subsystem	3039-8	1
Fuel Assembly Handling Subsystem	3039-9	1
Radiation Monitoring Subsystem	3039-10	1
Receiving Cask Shield Plug and Source Cask Lid Handling Subsystem	3039-11	0
HVAC Subsystem	3039-12	0
HVAC Subsystem Control Schematics	3039-13	0
Closed Circuit Television and Lighting Subsystem	3039-14	1
Structural Details	3039-15	1
Structural Details of Cast Items	3039-16	0
Roof Plate, Protective Cover and Mezzanine Details	3039-17	1
Penetration Details	3039-18	0
Preparation Area Details	3039-19	0
Preparation Area Details	3039-20	0
Fuel Assembly Transfer Tube	3039-21	0
Exhaust Fan & PLC Enclosure	3039-22	0

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO.	DATE	REVISIONS	DWN	CHK'D	M.D.		O/A	PROJ
1	9-11-02	SEE DCN 3039-1		JC	PS			

APPROVALS	DATE	
PROJ TJN	3 SEPT 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
O/A ED	3 SEPT. 96	DRY TRANSFER SYSTEM GENERAL OVERVIEW
MECH DES. PS	3 SEPT. 9	
CHK'D. BY AB	3 SEPT. 96	
DWN BY JTG	29 AUG 96	SCALE: NONE; SIZE: B; DWG. NO: 3039-1; REV: 1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO.	DATE	REVISIONS	DWN.	CHK'D	Q.A.		Q/A	PROJ

APPROVALS	DATE	
T.J.N. PROJ.	3/3/96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
E.B. Q/A	3/3/96	DRY TRANSFER SYSTEM RECEIVING CASK TRANSFER SUBSYSTEM
P.S. MECH. DES.	3/3/96	
A.B. CHK'D. BY	3/3/96	
J.T.G. DWN. BY.	2/29/96	NONE SCALE · B SIZE · 3039-2 DWG. NO · 0 REV.

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

1	[illegible]	SEE DCN 3039-2	[illegible]	[illegible]	PS	[illegible]	[illegible]
NO.	DATE	REVISIONS	DWN	CHK'D	MD	O/A	PROJ

APPROVALS	DATE
T.J.N PROJ	SEPT. 96
E.D. O/A	SEPT. 96
P.S. MECH. DES	SEPT 96
A.B. CHK'D BY	SEPT 96
J.T.G. DWN. BY	29 AUG. 96

TRANSNUCLEAR, INC.
HAWTHORNE, N.Y.

DRY TRANSFER SYSTEM
RECEIVING CASK
MATING SUBSYSTEM

SCALE	SIZE	DWG. NO	REV
NONE	B	3039-3	1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	MO		O/A	PROJ

APPROVALS	DATE	
PROJ TJN	9 3 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
O/A ED	9 3 96	DRY TRANSFER SYSTEM RECEIVING CASK SHIELD PLUG AND SOURCE CASK LID HANDLING SUBSYSTEM
MECH DES PS	9 3 96	
CHK'D BY AB	9 3 96	
DWN BY. JTG	8 29 96	NONE SCALE / B SIZE / 3039-4 DWG. NO / 0 REV.

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

TRANSNUCLEAR, INC.
HAWTHORNE, N.Y.

DRY TRANSFER SYSTEM

SLIDING DOOR

SCALE	SIZE	DWG NO.	REV
NONE	B	3039-5	0

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	MD.	O/A	PROJ

APPROVALS	DATE	
PROJ TJN		TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
O/A ED		DRY TRANSFER SYSTEM SOURCE CASK TRANSFER SUBSYSTEM
MECH DES PS		
CHK'D BY AB.		
DWN BY JTC		
NONE SCALE	B SIZE	3039-6 DWG NO. / 0 REV

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M D		Q/A	PROJ
1	[illegible]	SEE DCN 3039-3	[illegible]	[illegible]	PS		[illegible]	[illegible]

APPROVALS	DATE
PROJ T.J.N.	3 SEPT 96
Q/A E D	3 SEPT 96
MECH DES P S	3 SEPT 96
CHK'D BY A B	3 SEPT. 96
DWN. BY J T.G	29 AUG 96

TRANSNUCLEAR, INC.
HAWTHORNE, N.Y.

DRY TRANSFER SYSTEM
SOURCE CASK
MATING SUBSYSTEM

SCALE	SIZE	DWG NO	REV
NONE	B	3039-7	1

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M D		Q/A	PROJ
1	[illegible]	SEE DCN 3039-4	[illegible]	[illegible]	PS		[illegible]	[illegible]

APPROVALS	DATE	
PROJ TJN	3 SEPT 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A ED	3 SEPT 96	DRY TRANSFER SYSTEM TC PORT COVER HANDLING SUBSYSTEM
MECH DES P.S.	3 SEPT 96	
CHK'D BY AB	3 SEPT 96	
DWN BY J.T.G.	29 AUG. 96	SCALE: NONE · SIZE: B · DWG NO: 3039-8 · REV: 1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

1	9-11-98	SEE DCN 3039-5					
NO	DATE	REVISIONS	DWN	CHK'D	MD	O/A	PROJ

APPROVALS	DATE	
PROJ T.J.N	3 SEPT 98	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
O/A E.B.	3 SEPT 98	DRY TRANSFER SYSTEM FUEL ASSEMBLY HANDLING SUBSYSTEM
MECH DES. P.S.	3 SEPT 98	
CHK'D BY A.B.	3 SEPT 98	
DWN BY J.T.G	29 AUG 98	SCALE: NONE · SIZE: B · DWG NO: 3039-9 · REV: 1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M D		Q/A	PROJ
1	1-11-02	SEE DCN 3039-6	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

APPROVALS	DATE	
PROJ T J N	3 SEPT. 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A E D	3 SEPT 96	DRY TRANSFER SYSTEM RADIATION MONITORING SUBSYSTEM
MECH. DES. P.S.	3 SEPT 96	
CHK'D BY A B	3 SEPT 96	
DWN BY. J.T.G.	29 AUG 96	

SCALE	SIZE	DWG NO	REV
NONE	B	3039-10	1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO.	DATE	REVISIONS	DWN	CHK'D	M D		Q/A	PROJ

APPROVALS		DATE	
PROJ	TJN	3 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A	ED	3 96	DRY TRANSFER SYSTEM RECEIVING CASK SHIELD PLUG & SOURCE CASK LID HANDLING SUBSYSTEM UPPER CRANE DETAIL
MECH DES	PS	3 96	
CHK'D BY	AB	3 96	
DWN BY	JTC	8 29 96	NONE SCALE · B SIZE · 3039-11 DWG NO. · 0 REV

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	MD		Q/A	PROJ

APPROVALS	DATE	
PROJ. TJH	3 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A ED	3 96	DRY TRANSFER SYSTEM
		HVAC SUBSYSTEM
MECH DES. P.S	3 96	
CHK'D. BY AB	3 96	
DWN BY JTG	3 29 96	NONE SCALE · B SIZE · 3039-12 DWG. NO · 0 REV.

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

TRANSNUCLEAR, INC.
HAWTHORNE, NY

DRY TRANSFER SYSTEM
HVAC SUBSYSTEM
CONTROL SCHEMATICS

SCALE	SIZE	DWG NO	REV
NONE	B	3039-13	0

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M.D.		Q/A	PROJ
1		SEE DCN 3039-7						

APPROVALS	DATE	
PROJ T.J.N.	3 SEPT 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A ED	3 SEPT. 96	DRY TRANSFER SYSTEM CLOSED CIRCUIT TELEVISION AND LIGHTING SUBSYSTEMS
MECH. DES P.S.	3 SEPT. 96	
CHK'D BY A.B.	3 SEPT. 96	
DWN BY. J.T.G.	29 AUG 96	SCALE: NONE; SIZE: B; DWG NO: 3039-14; REV.: 1

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

1	9/3/98	SEE DCN 3039-9	9/3/98	JC	PS			
NO	DATE	REVISIONS	DWN	CHK'D	MD		Q/A	PROJ

APPROVALS	DATE	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
PROJ TJN		DRY TRANSFER SYSTEM STRUCTURAL DETAILS
Q/A ED	3/96	
MECH. DES PS		
CHK'D BY AB	3/96	
DWN BY. JTC	3/29/96	NONE SCALE | B SIZE | 3039-15 DWG. NO. | 1 REV.

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN.	CHK'D	M.D.		Q/A	PROJ

APPROVALS	DATE	
PROJ TJN		TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A ED		DRY TRANSFER SYSTEM STRUCTURAL DETAILS OF CAST ITEMS
MECH DES. PS		
CHK'D BY AB		
DWN BY JTC		SCALE: NONE · SIZE: B · DWG NO: 3039-16 · REV.: 0

Security-Related Information Figure Withheld Under 10 CFR 2.390.

1		SEE DCN 3039-8					
NO	DATE	REVISIONS	DWN	CHK'D	M.D.	O/A	PROJ

TRANSNUCLEAR, INC.
HAWTHORNE, N.Y.

DRY TRANSFER SYSTEM
ROOF PLATE,
PROTECTIVE COVER &
MEZZANINE DETAILS

APPROVALS		DATE
PROJ	T.J.N	SEPT. 96
O/A	E.D.	SEPT. 96
MECH DES	P.S.	SEPT. 96
CHK'D BY	A.B.	SEPT. 96
DWN BY	J.T.G	AUG 96

SCALE	SIZE	DWG NO.	REV
NONE	B	3039-17	1

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO.	DATE	REVISIONS	DWN.	CHK'D	M.D.		Q/A	PROJ

APPROVALS	DATE	
PROJ TJN		TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A E.D.		DRY TRANSFER SYSTEM PENETRATION DETAILS
MECH. DES PS		
CHK'D. BY AB		
DWN BY JTC		NONE SCALE | B SIZE | 3039-18 DWG. NO | 0 REV

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M.D.		Q/A	PROJ

APPROVALS	DATE	
TJM PROJ		TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
ED Q/A		DRY TRANSFER SYSTEM PREPARATION AREA DETAILS
PS MECH. DES		
AB CHK'D. BY		
JTG DWN BY		NONE SCALE / B SIZE / 3039-19 DWG. NO / 0 REV

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M.D.		Q/A	PROJ

APPROVALS	DATE	
PROJ TJN	9 3 96	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A ED	9 3 96	DRY TRANSFER SYSTEM PREPARATION AREA DETAILS
MECH DES P.S.	9 3 96	
CHK'D. BY AB	9 3 96	
DWN BY JTC	8 29 96	NONE SCALE · B SIZE · 3039-20 DWG. NO · 0 REV.

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

NO.	DATE	REVISIONS	DWN	CHK'D	M E		Q/A	PROJ

APPROVALS	DATE	
PROJ		TRANSNUCLEAR, INC. HAWTHORNE, N.Y.
Q/A		DRY TRANSFER SYSTEM FUEL ASSEMBLY TRANSFER TUBE
MECH ENG		
CHK'D BY		
DWN BY		NONE SCALE · B SIZE · 3039-21 DWG NO · 0 REV.

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NO	DATE	REVISIONS	DWN	CHK'D	M.D.		Q/A	PROJ

TRANSNUCLEAR, INC.
HAWTHORNE, N.Y.

DRY TRANSFER SYSTEM
EXHAUST FAN
& PLC ENCLOSURE

NONE SCALE | B SIZE | 3039-22 DWG NO | 0 REV

1.3 General Systems Description

The sequence of operations performed within the DTS can be divided into the following categories:

1) Receiving Cask Receipt, Preparation, Inspection, and Positioning (Fig. 1.3-1)
2) Source Cask Receipt, Preparation, Inspection, and Positioning (Fig. 1.3-2)
3) Source Cask Mating and Opening (Fig. 1.3-3)
4) Receiving Cask Mating and Opening (Fig. 1.3-3)
5) Fuel Transfer Operations (Fig. 1.3-4)
6) Source Cask Closing and Detachment (Fig. 1.3-5)
7) Receiving Cask Closing and Detachment (Fig. 1.3-5)
8) Source Cask Removal (Fig. 1.3-6)
9) Receiving Cask Removal (Fig. 1.3-7)

These operations are shown schematically in Figures 1.3-1 through 1.3-7.

Figure 1.3-1

Receiving Cask
Receipt, Preparation, Inspection and Positioning

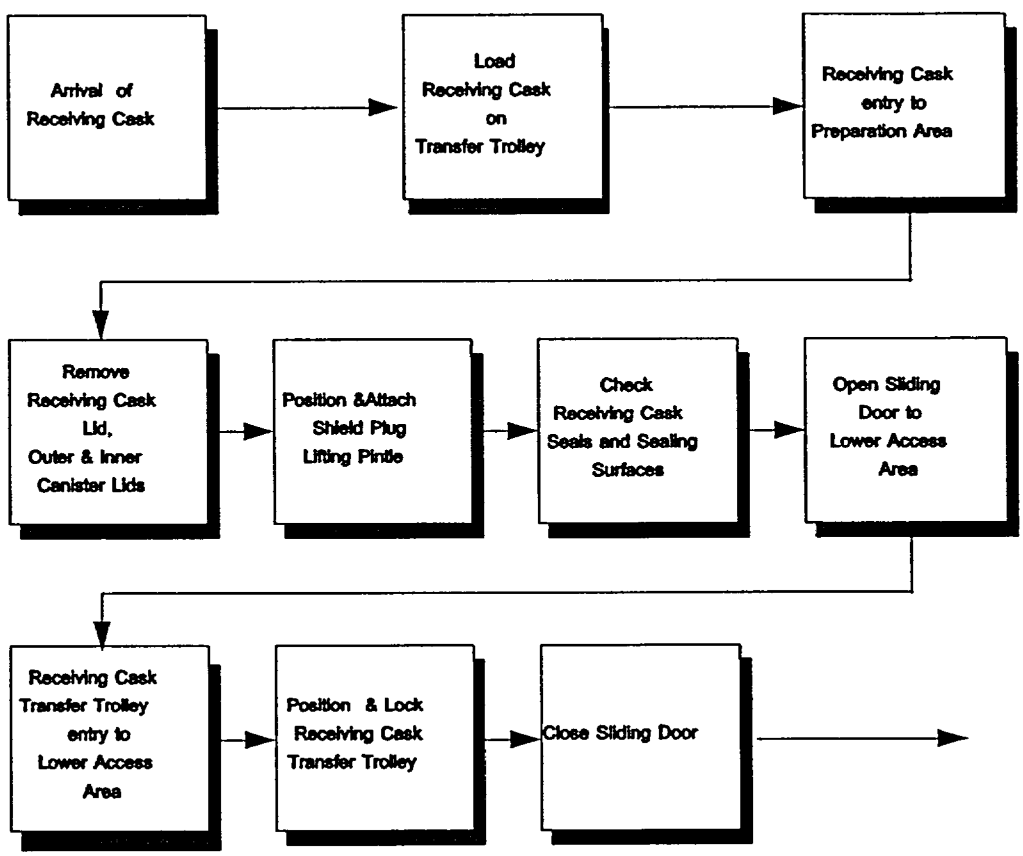


Figure 1.3-2

Source Cask
Receipt, Preparation, Inspection and Positioning

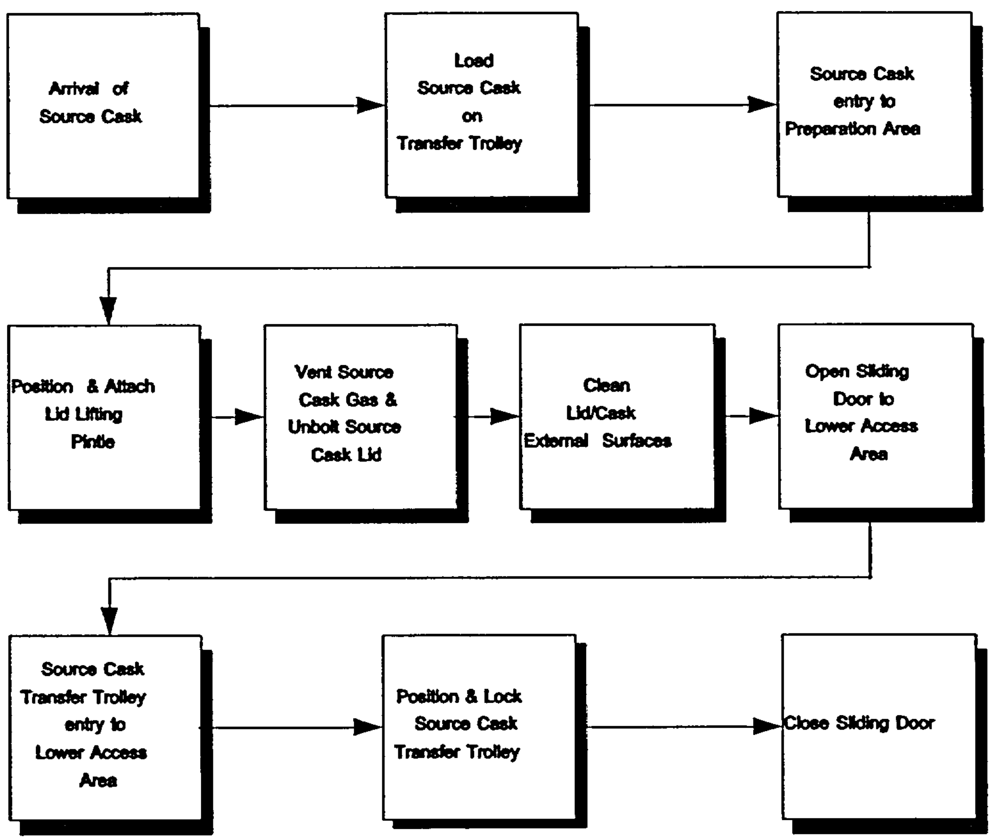
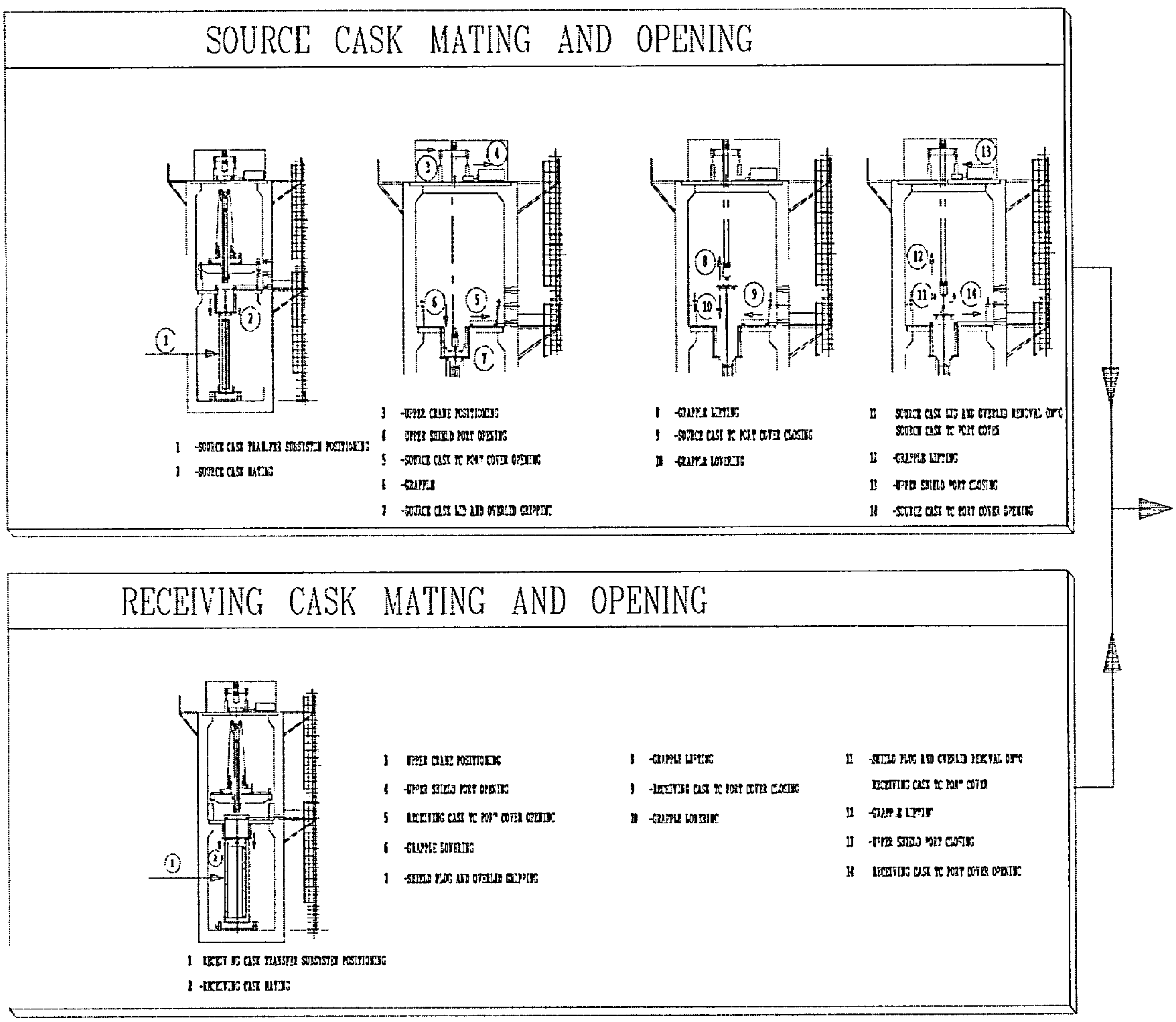


Figure 1.3-3

Source and Receiving Cask Mating and Opening



NOTES 1 - WHEN CASKS ARE MOVED BETWEEN THE PREPARATION AREA AND THE LOWER ACCESS AREA, THE SHIELD PLUG AND THE SOURCE CASK LID SHOULD BE ON THE RECEIVING CASK AND THE SOURCE CASK, RESPECTIVELY THE RECEIVING CASK LIDS ARE PLACED ON THE RECEIVING CASK IN THE PREPARATION AREA

Figure 1-4
Receiving and Source Cask Mating and Opening

Rev. 0 6,96

Figure 1.3-4

Fuel Transfer Operations

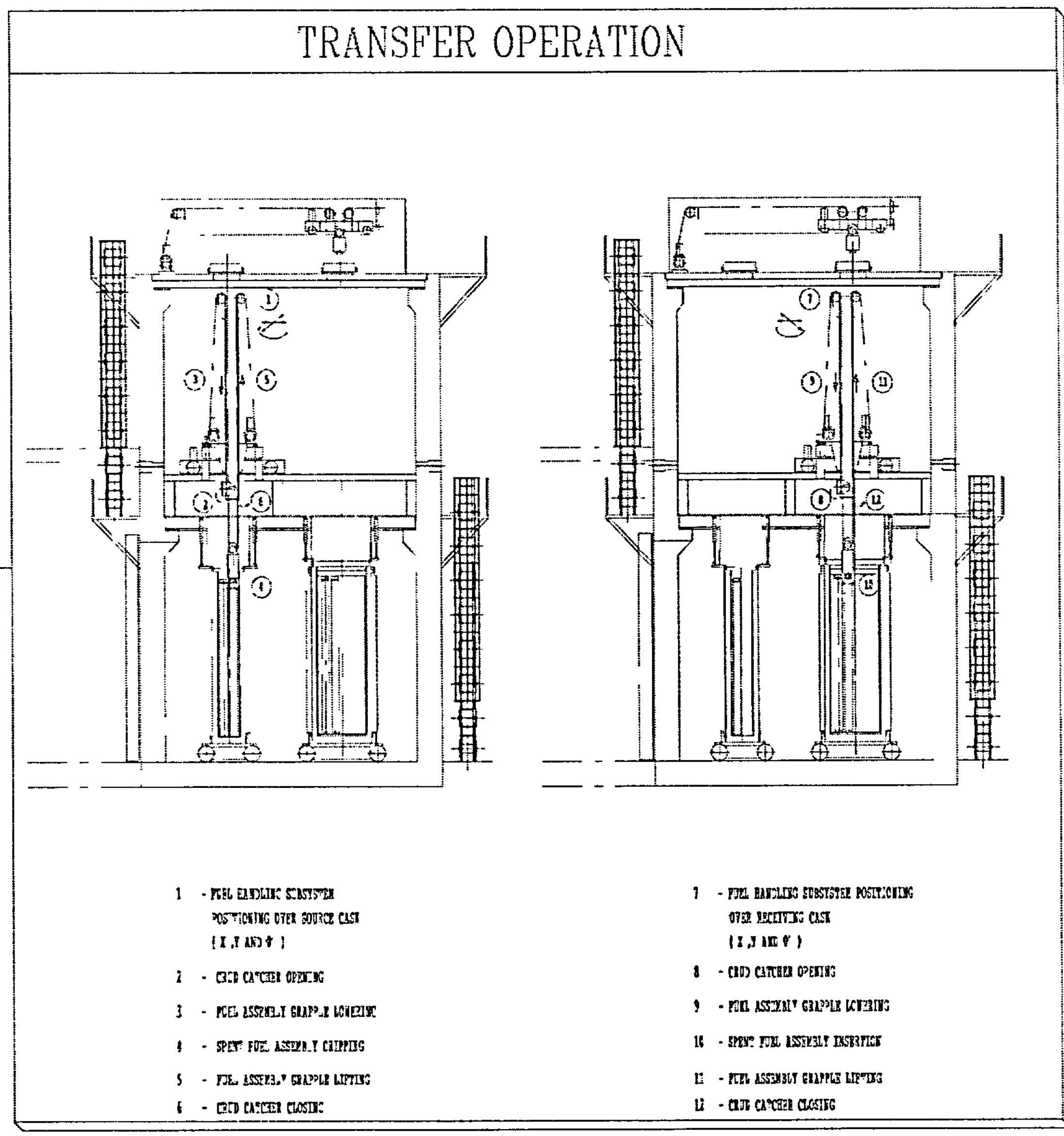


Figure 1-5
Transfer Operations
Rev. 0 6/96

Figure 1.3-5

Source Cask and Receiving Cask Closing and Detachment

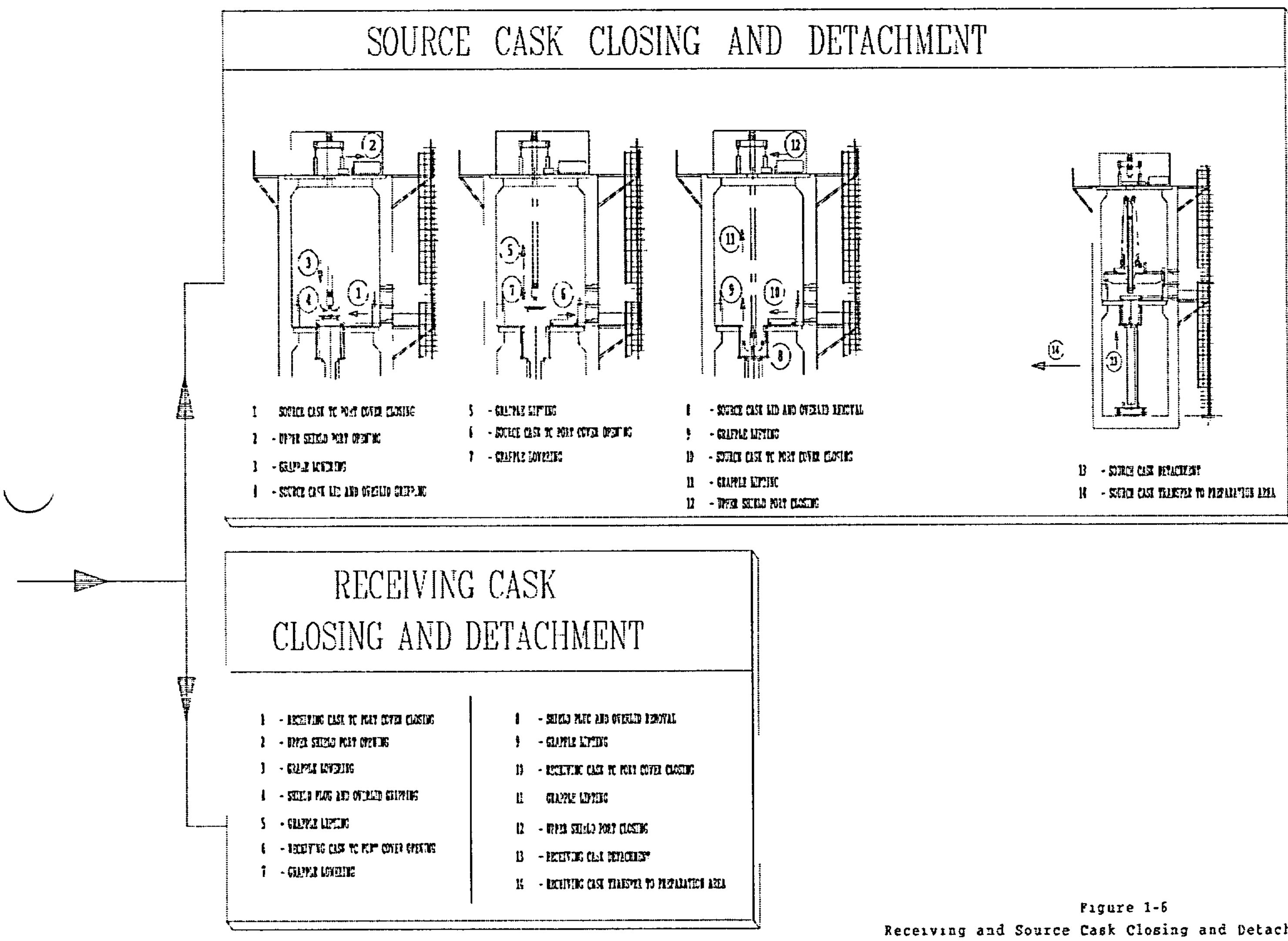


Figure 1-6
Receiving and Source Cask Closing and Detachment
Rev. 0 6/96

Figure 1.3-6

Source Cask Removal

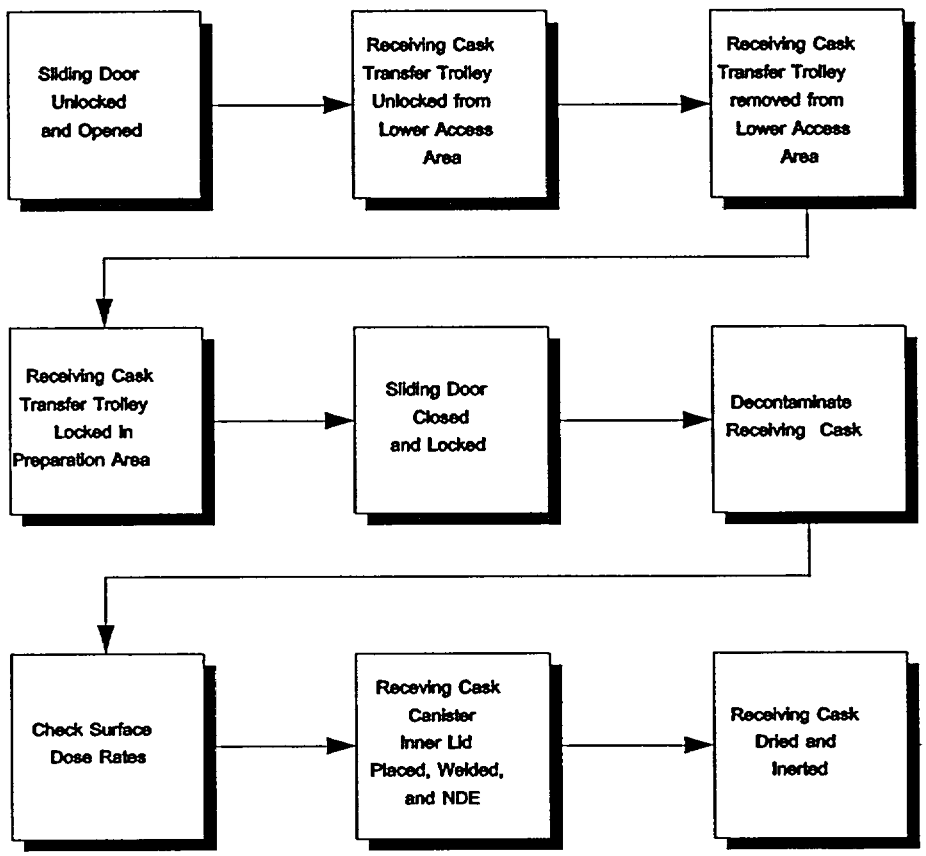
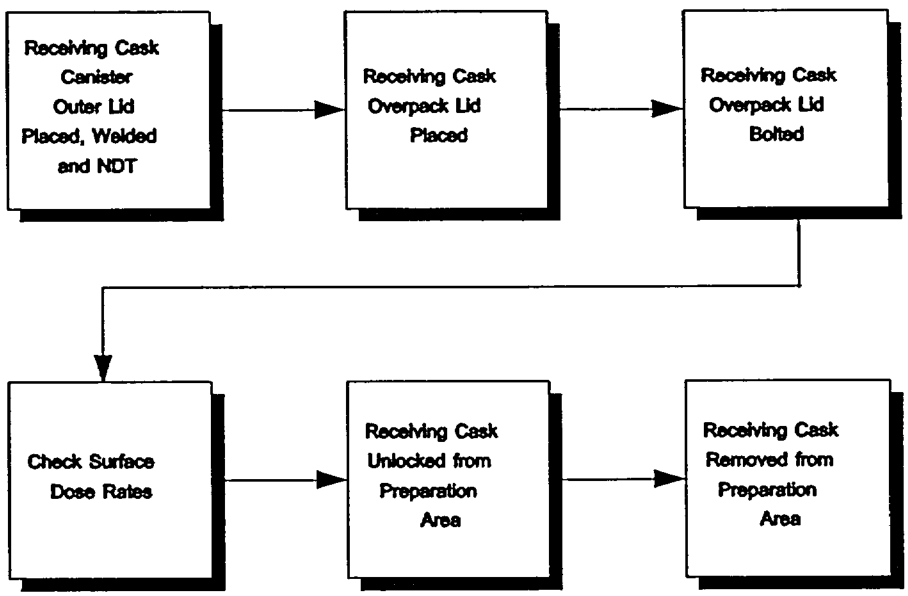


Figure 1.3-7

Receiving Cask Removal



1.4 Identification of Agents and Subcontractors

Transnuclear (TN), Inc. of Hawthorne, New York, was contracted by the Electric Power Research Institute (EPRI), Palo Alto, California to design the Dry Transfer System. The project was jointly funded by EPRI and the Department of Energy (DOE).

TN selected SGN Reseau Eurisys of France to perform the design and analysis of the mechanical equipment used for cask and fuel assembly handling. SGN has performed equipment and process design for the La Hague spent fuel reprocessing facility in France and brought that experience to this project.

TN selected Foster Wheeler Energy Company (FWEC) of Clinton, New Jersey to perform design and analysis of the building structure. FWEC subcontracted to GEC Alsthom for much of this work. FWEC and GEC are the designers of the Modular Vault Dry Store spent fuel storage system. This system has a reinforced concrete structure that is similar to the DTS structure.

TN selected National Technical Service (NTS) of Acton, Massachusetts to provide the design and analysis of the heating, ventilating, and air conditioning system. NTS subcontracted to the specialty HVAC design firm of Luchini, Milfort, Goodell and Associates, Inc. of Chelmsford, Massachusetts to conduct the technical work.

The contractors for the construction and operation of the installation will be addressed in the site specific applications.