ATTACHMENT M2

GEOLOGIC REPOSITORY

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M2-1 Description of the Geologic Repository

The Disposal Phase will consist of receiving contact-handled (**CH**) and remote-handled (**RH**) TRU mixed waste shipping containers, unloading and transporting the waste containers to the Underground HWDUs, emplacing the waste in the Underground HWDUs, and subsequently achieving closure of the Underground HWDUs in compliance with applicable State and Federal regulations.

During the ten (10) year period of this Permit, the volume of RH TRU mixed waste emplaced in the repository will not exceed 123,585 ft^3 (3,500 m^3). For the purposes of this Permit, disposal of containers of CH TRU mixed waste will occur only in the three HWDUs designated as Panels 1-3 (See Figure M2-1). RH-TRU mixed waste disposal may begin in Panel 3. In the future, the Permittees may request a Permit to dispose of containers of CH and RH TRU mixed waste in ~~five (5)~~ additional panels that meet the definition of the HWDU in Permit Module IV. These future potential HWDUs have been designated as Panels 4 through 8. In addition the Permittees may also a request in the future a Permit to allow disposal of containers of TRU mixed waste in the north-south entries marked as E-300, E-140, W-30, and W-170, between S-1600 and S-3650. These areas are referred to as the disposal area access drifts and have been designated as Panels 9 and 10 in Figure M2-1. In addition to authorizing the excavation of Panels 2 and 3 and the disposal of waste in Panels 1, 2, and 3 this permit authorizes the excavation of Panels 4, 9, and 10.

Panels 1 through 3 will consist of seven rooms and two access drifts each.

The HWDUs identified as Panels 1 through 3 (Figure M2-1) provide room for 1,908,000 cubic feet (ft^3) (54,000 meters (m^3)) of CH TRU mixed waste. The CH TRU mixed waste containers (typically, 7-packs and standard waste boxes (**SWBs**)) may be stacked three-high across the width of the room. RH TRU mixed waste may be disposed of with up to 730 RH TRU mixed waste canisters emplaced in each panel. The initial waste emplacement activity in rooms where RH TRU mixed waste will be disposed is the placement of canisters in predrilled holes in the ribs.

M2-2a(3) Subsurface Structures Underground Ventilation System Description

At any given time during waste emplacement activities, there will be a significant level of activity ~~multiple~~ in three rooms. ~~one room that will be receiving CH waste containers~~. One room will be receiving CH TRU mixed waste containers (e.g., Room No. 7) and while the next room will be receiving RH TRU mixed waste (e.g., Room No. 6). RH TRU mixed waste emplacement boreholes will be drilled in the third room (e.g., Room No. 5). The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room when workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the

area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute as specified in the WIPP Ventilation Plan. The remainder of the air is needed in order to account for air leakage through inactive rooms.

M2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table M2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure M2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the facility cask is loaded, the Facility Cask Transfer Car moves onto the waste hoist conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste hoist conveyance to provide forklift access to the facility cask.

Horizontal Emplacement and Retrieval Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) (Figure M2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

M2-2b Geologic Repository Process Description

A forklift in the HWDU near the waste stack will be used to removed the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment. The CH TRU mixed waste will be emplaced room by room in Panels 1 through 3.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste hoist and is lowered to the waste shaft station underground. At the waste shaft station underground, the facility cask is moved from the waste hoist by the Facility Cask Transfer Car (Figure M2-16). A forklift is used to remove the facility cask from the Facility Cask Transfer Car and to transport the facility cask to the Underground HWDU. There, the facility cask is placed on the HERE (Figure M2-17), which has been previously aligned with a horizontal hole bored into the room wall. The facility cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear facility cask shield valve. The shield valves on the facility cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the facility cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the facility cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure M2-18). The transfer mechanism is retracted, the shield valves close on the facility cask, and the facility cask is removed from the HERE.

Shield plugs (29 in. (73 cm) in diameter) are inserted into the borehole (30 in. (75 cm) in diameter) after emplacement of the canister (approximately 26 in. (65 cm) in diameter). They provide the necessary shielding for the exposed end of the borehole, limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr.

The amount of RH TRU mixed waste disposal in each panel is 730 canisters based on thermal and geomechanical considerations. RH TRU mixed waste canisters will be placed into boreholes in each panel.

Figures M1-26 and M1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and 10-160B casks, respectively.

The following assumptions are made in estimating the time to fill each HWMU:

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

CH TRU mixed waste containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers (e.g., TRUPACT-IIs or HalfPACTs), at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping containers will be stored temporarily at the Parking Area Container Staging Area until the waste verification and examination requirements of Permit Attachment B7 are met ~~Storage Unit (Parking Area Unit)~~. A forklift will remove the Contact Handled Packages from the transport trailers and will transport them into the Waste Handling Building ~~Container Storage Unit~~

TRUDOCK Staging Area for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, or four 85-gal (321 L) drums. An overhead bridge crane will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, or two TDOPs. After approval of the waste verification and examination each ~~Each~~ stack of waste containers will be secured prior to transport underground (see Figure M2-3). A forklift will transport the loaded facility pallet to the conveyance loading car inside the conveyance loading room adjacent to the Waste Shaft. The conveyance loading car will be driven onto the waste hoist deck, where the loaded facility pallet will be transferred to the waste hoist, and the loading car will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (321 L) drums, 100-gal (379 L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste hoist will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste hoist cage, and the facility pallet will be transferred from the waste hoist onto the transporter (see Figure M2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment. The waste will be emplaced room by room in Panels 1 through 3. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

The emplacement of CH TRU mixed waste into the HWDUs will typically be in the order received and unloaded from the Contact Handled Packaging. There is no specification for the

amount of space to be maintained between the waste containers themselves, or between the waste containers and the walls. Containers will be stacked in the best manner to provide stability for the stack (which is up to three containers high) and to make best use of available space. It is anticipated that the space between the wall and the container could be from 8 to 18 in. (20 to 46 cm). This space is a function of disposal room wall irregularities, container type, and sequence of emplacement. Bags of backfill will occupy some of this space. Space is required over the stacks of containers to assure adequate ventilation for waste handling operations. A minimum of 16 in. (41 cm) was specified in the Final Design Validation Report (Appendix D1, Chapter 12 of the WIPP RCRA Part B Permit Application (DOE, 1997)) to maintain air flow. Typically, the space above a stack of containers will be 36 to 48 in. (90 to 122 cm). However 18 in. (0.45 m) will contain backfill material consisting of bags of Magnesium Oxide (MgO). Figure M2-8 shows a typical container configuration, although this figure does not mix containers on any row. Such mixing, while inefficient, will be allowed to assure timely movement of waste into the underground. No aisle space will be maintained for personnel access to emplaced waste containers. No roof maintenance behind stacks of waste is planned.

The anticipated schedule for the filling of each of the Underground HWDUs known as Panels 1 through 3 is as follows. The following assumptions are made in estimating the time to fill each HWMU:

- Throughput for CH waste is 784 drums per week (7 pallets per day, 4 days per week, 28 drums per pallet)
- The capacity of a panel is 81,000 drums
- RH TRU mixed waste emplacement does not impede CH TRU mixed waste throughput

Under these assumptions, a minimum of 104 weeks is needed to emplace the waste. Allowing a 25 percent contingency for maintenance delays and time to transition from one room to another, it is estimated that a panel will be filled 2.5 years after emplacement is initiated. Panel closure in accordance with the Closure Plan in Permit Attachment I and Permit Attachment I1 is estimated to require an additional 150 days.

TABLE M2-3
RH TRU MIXED WASTE HANDLING EQUIPMENT CAPACITIES

CAPACITIES FOR EQUIPMENT	
41-Ton Forklift	82,000 lbs
MAXIMUM GROSS WEIGHTS OF RH TRU CONTAINERS	

RH TRU Facility Canister	10,000 lbs
55-Gallon Drum	1,000 lbs
RH TRU Canister	8,000 lbs
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
Facility Cask	67,700 lbs

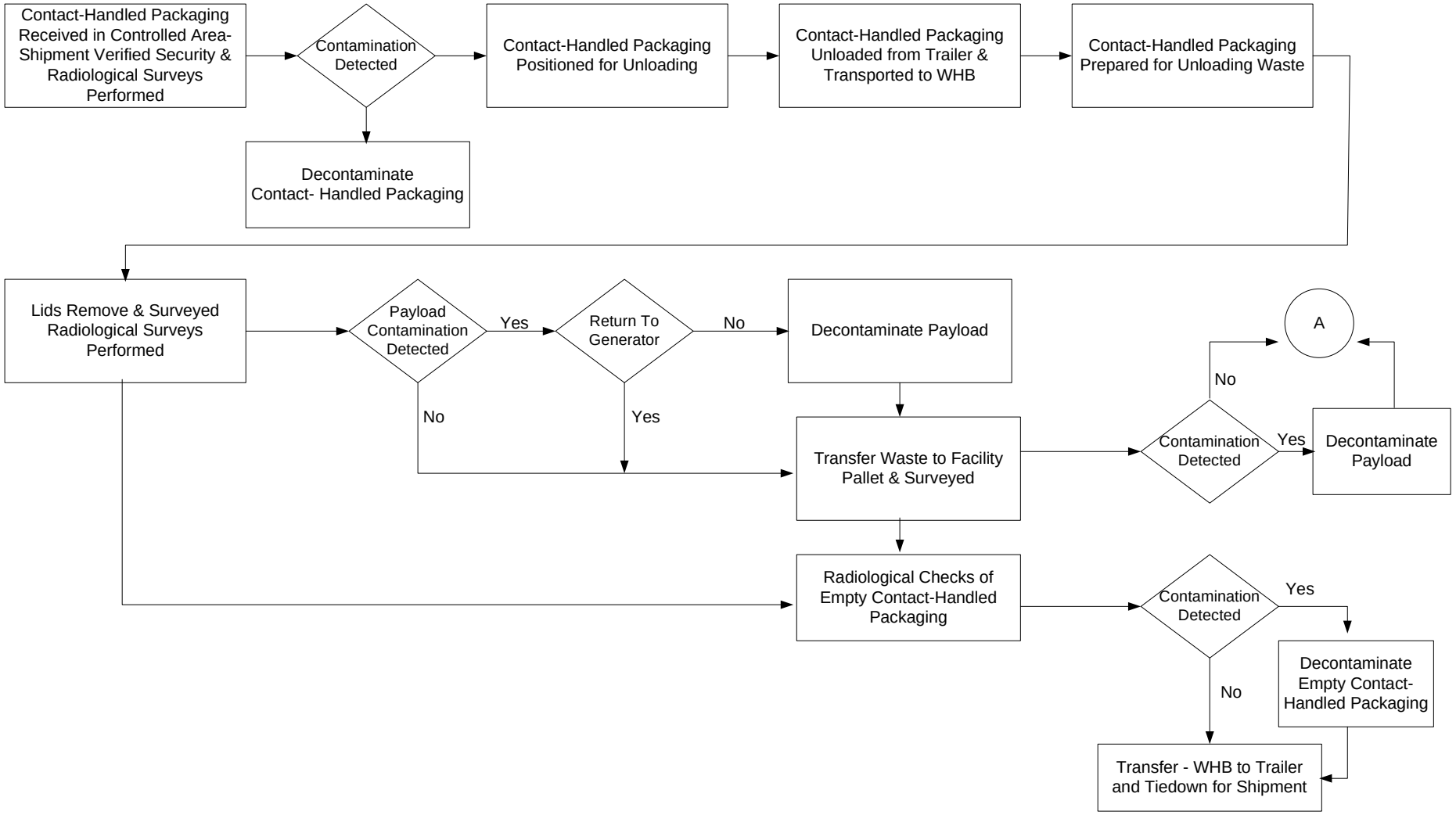

Figure M2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow

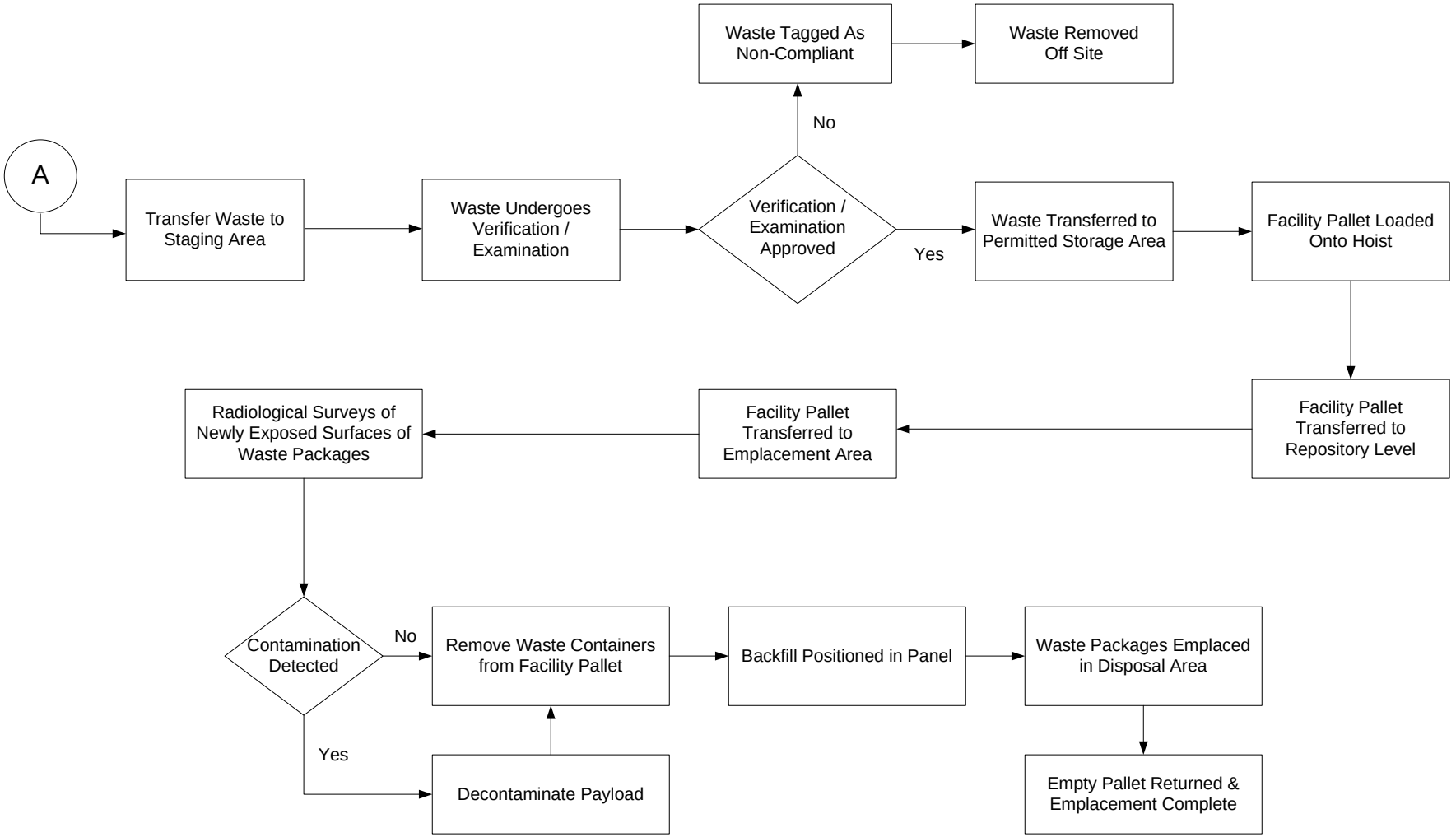

Figure M2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow (continued)

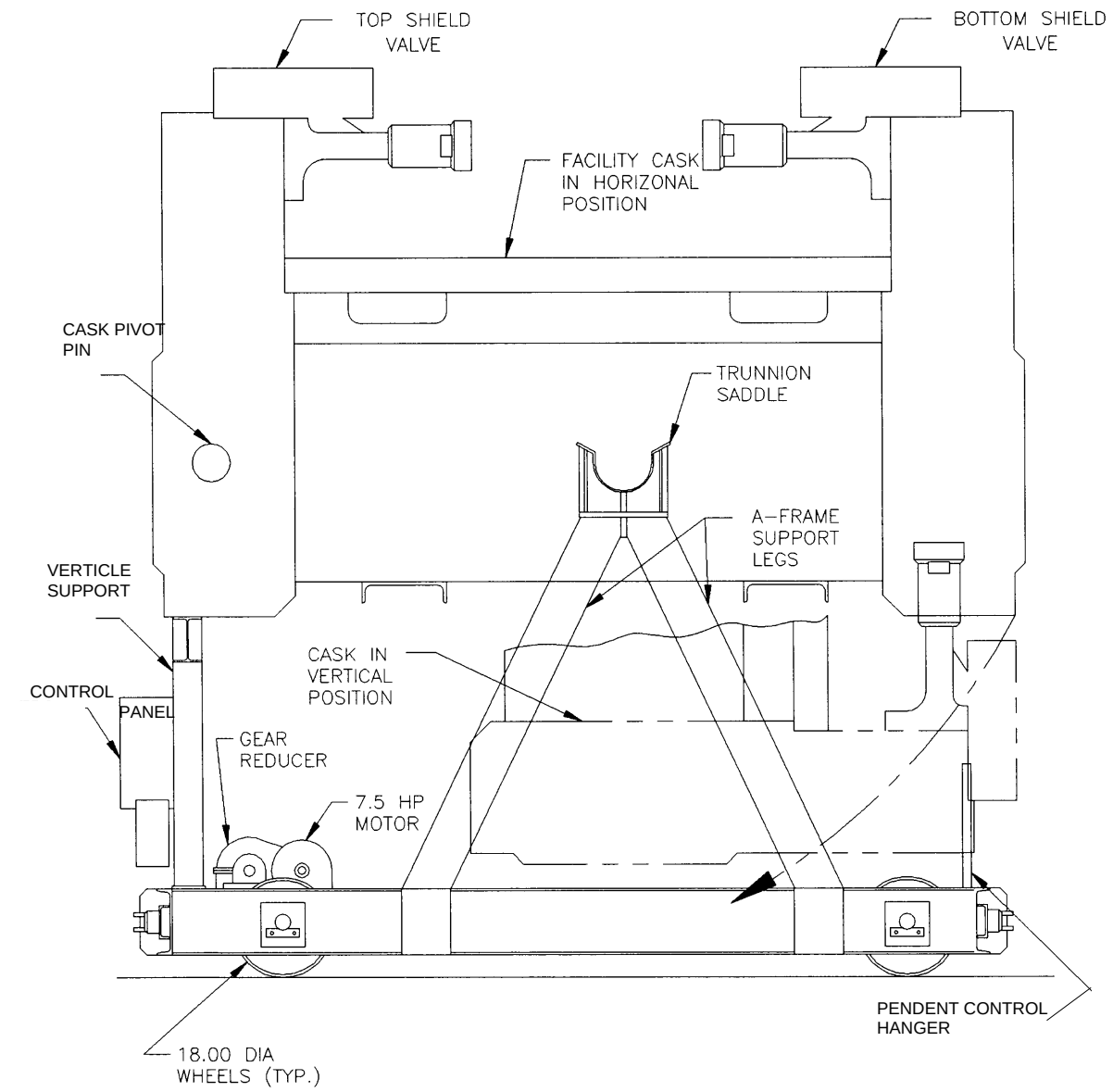

Figure M2-14
Facility Cask Transfer Car (Side View)

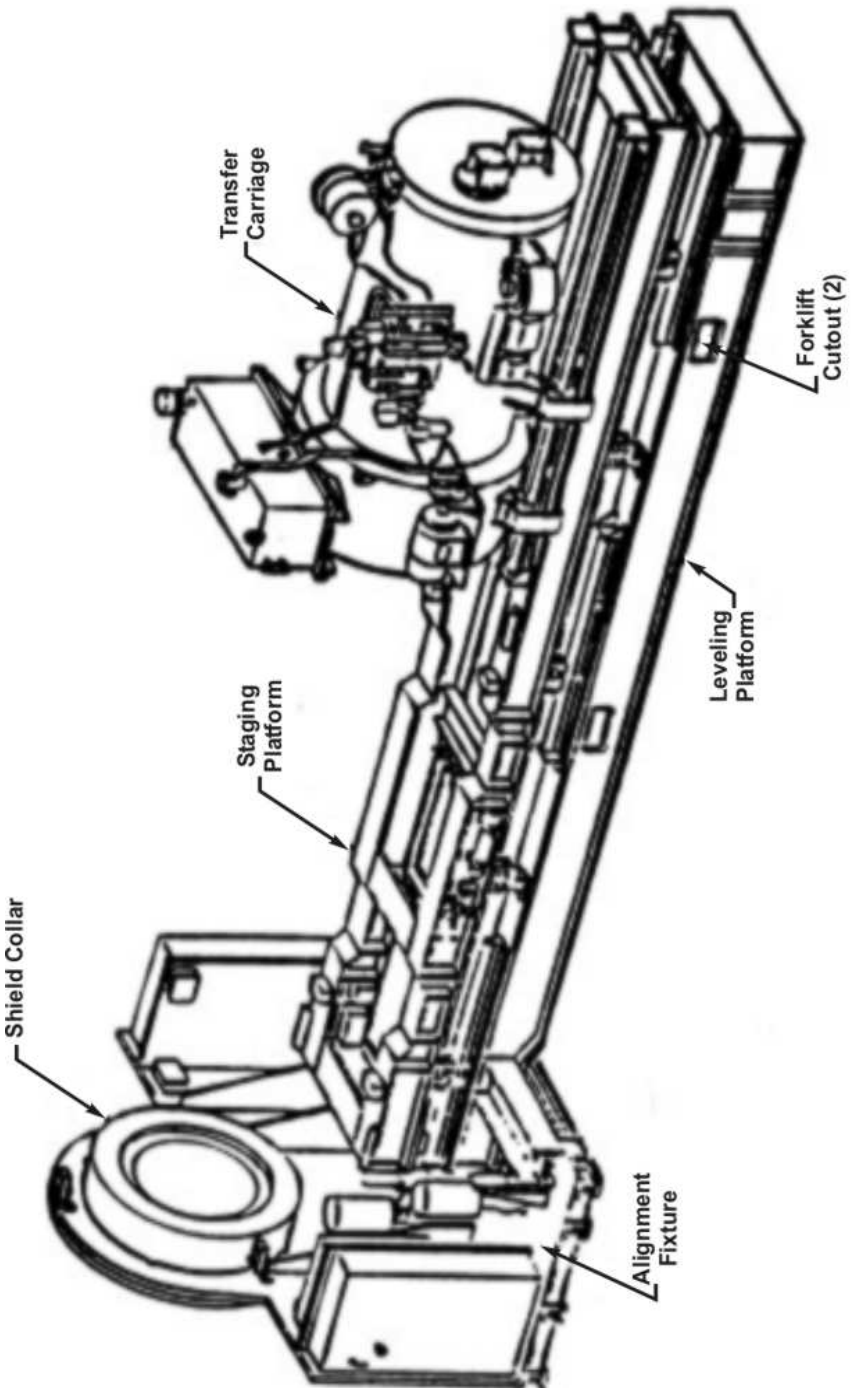

Figure M2-15
Horizontal Emplacement and Retrieval Equipment

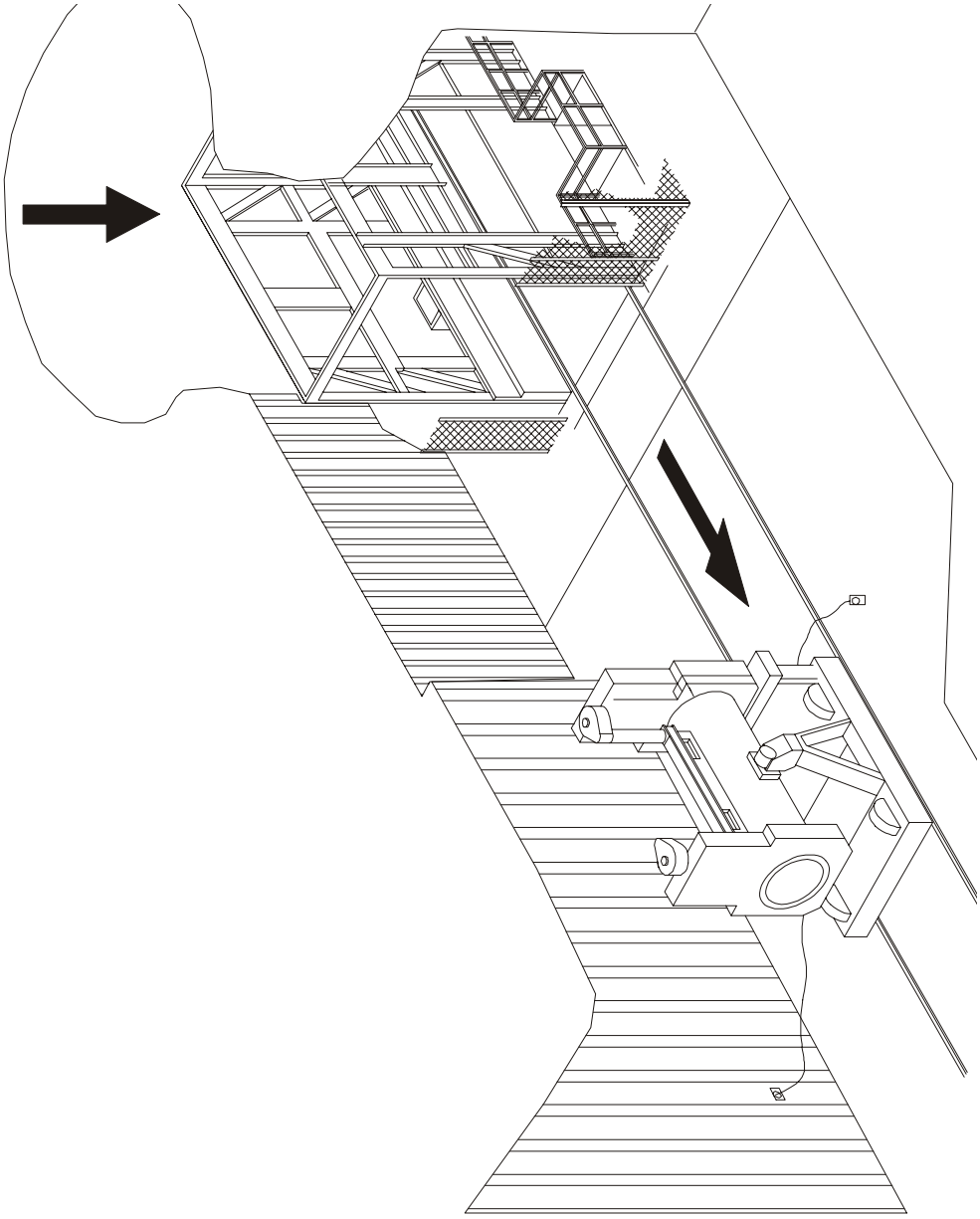

Figure M2-16
RH TRU Waste Facility Cask Unloading from Waste Hoist

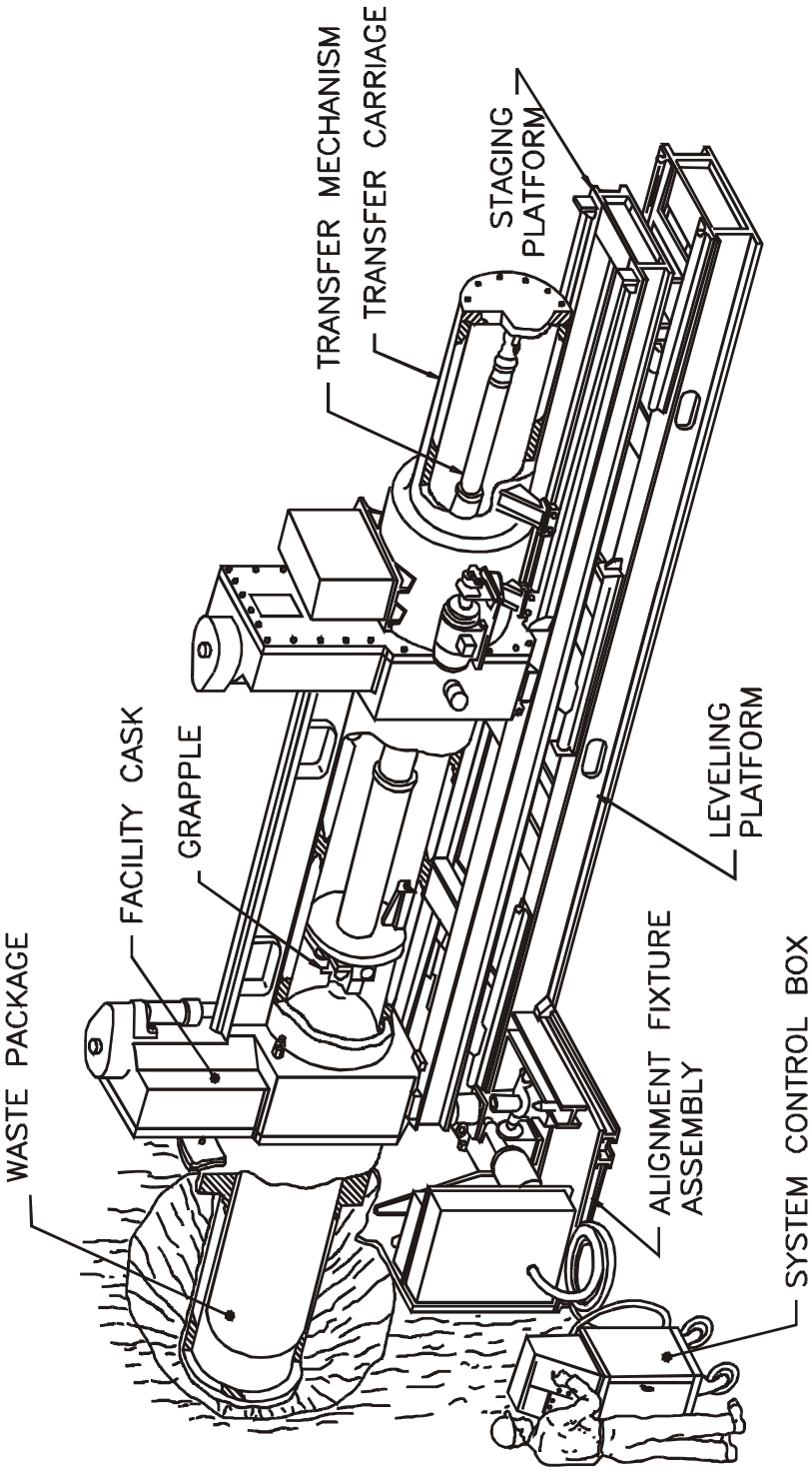

Figure M2-17
Facility Cask Installed on the Horizontal Emplacement Retrieval Equipment

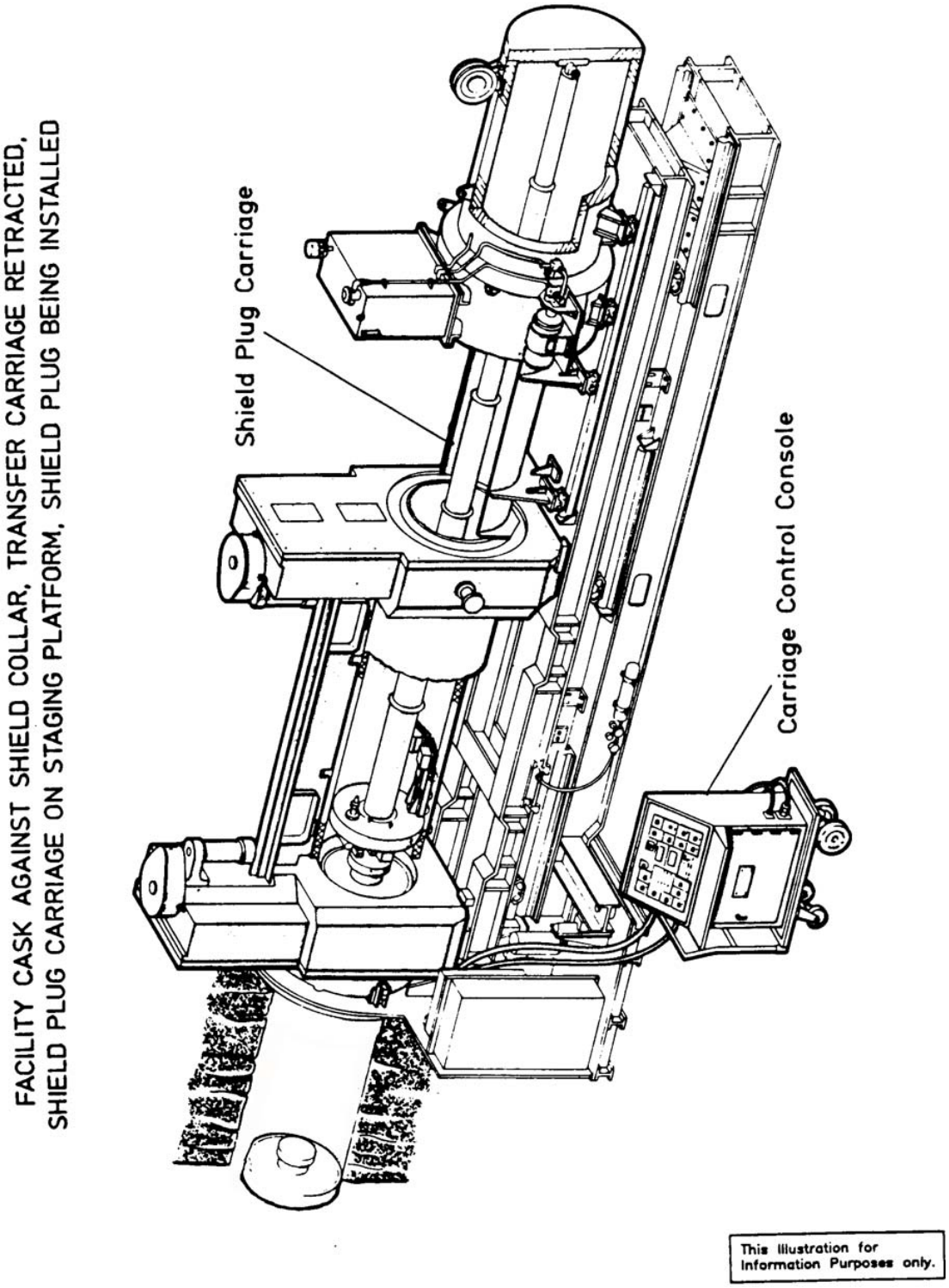

Figure M2-18
Installing Shield Plug