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THE DESIGN AND OPERATION OF THE TRANSFER CASE
AND RELATED EQUIPMENT IN THE TRANSURANIUM PROCESSING PLANT

C. A. Hahs

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THE DESIGN AND OPERATION OF THE TRANSFER CASE
AND RELATED EQUIPMENT IN THE TRANSURANIUM PROCESSING PLANT

Abstract

A transfer case has been designed to handle highly radioactive cargo within the limited access area of the Transuranium Processing Plant at the Oak Ridge National Laboratory. This case and its related equipment were developed to make alpha-confined transfers of equipment and material at nine cell cubicles in the cell bank, the decontamination glove box, and the solid waste disposal station. Perhaps the most unique feature of this transfer system is the interchangeability of the large door in the bottom of the transfer case with the mating doors at the 11 transfer stations while using the same method of sealing for all of these doors. The design problems associated with the transfer case and its related equipment, the final design, and the methods of operation devised for this transfer system are described in this report.

1. INTRODUCTION

Target material is irradiated in the High Flux Isotope Reactor at Oak Ridge National Laboratory (ORNL) to produce target rods containing transuranium elements, including ^{252}Cf . All of these elements are highly radioactive and require special handling. These target rods containing the transuranium elements are processed in the Transuranium Processing Plant at ORNL, which was designed specifically for this purpose. The maintenance philosophy at the Transuranium Processing Plant stipulates that all material transfers to or from the primary line of containment are to be accomplished within the secondary containment for protection of the areas surrounding the facility.

A partial horizontal section through the limited access area of the Transuranium Processing Plant is shown in Fig. 1. As may be seen in this section, there are 12 stations that require a means of material transfer within this area. These are the nine cell cubicles in the

Fig. 1. Partial Horizontal Section Through the Limited Access Area of the Transuranium Processing Plant.

cell bank, the solid waste disposal station, the decontamination glove box, and the clean bag-in station.

It was decided that a transfer case would provide the best means of ensuring alpha-confined transfers of material and equipment within the limited access area of the Transuranium Processing Plant. This case would have to be capable of serving all 11 of the transfer stations as well as the clean bag-in station. The design problems associated with the transfer case and its related equipment, the final design, and the methods of operation devised for this transfer system are discussed in this report.

2. DESIGN SUMMARY

The design for the transfer case is basically founded on an approach proposed by Klima¹ for handling material and equipment within the limited access area of the Transuranium Processing Plant where sealing of alpha contamination within a containment envelop is the principal consideration. Our design effort reported here was directed toward refining the many mechanical features of the transfer case and its related components to assure its capability for handling a variety of relatively cumbersome pieces of equipment and its capabilities as a reliable transfer mechanism with essentially foolproof sealing methods.

The sealing requirement presented perhaps the most complicated problem encountered in the development of the design for the transfer case. The door in the bottom of the case had to lock and seal with 11 installed cubicle doors and several spare ones, each accommodating an opening 18 in. wide by 36 in. long. The sealing arrangement used had to ensure that the area between the bottom of the transfer-case door and the top of the cubicle door would be kept free of contamination when the doors were separated from their respective ports, and it also had to provide each door with the capability of sealing its own contained volume. A method for making such a sealing arrangement had already been demonstrated in the "double cover" technique pioneered by Wilson and Thorn² of the Los Alamos Scientific Laboratory.

The success of the entire containment scheme hinged upon the sealing arrangement selected for the doors. However, the interchangeability feature of the doors in this application would require very rigorous dimensional tolerances unless a soft and flexible seal could be devised. Soft

¹B. B. Klima, "Transuranium Development Facility," pp. 27-34 in Proceedings of the Ninth Conference on Hot Laboratories and Equipment, The Hot Laboratory Division of the American Nuclear Society, November 7-9, 1961.

²M. Wilson and L. Thorn, "Alpha-Gamma Transfer System," pp. 344-350 in Proceedings of the Ninth Conference on Hot Laboratories and Equipment, The Hot Laboratory Division of the American Nuclear Society, November 7-9, 1961.

seals are usually made from organic polymer materials, but these materials have a poor resistance to radiation, and the seals on the cell-cubicle doors would be exposed to an average gamma radiation dose rate of 100 r/hr. Dimensional tolerances of $\pm 1/64$ in. were established as the desired basis for the design and fabrication of the doors, and these tolerances would not permit the use of a hard sealing medium. A 40-durometer neoprene seal with a saw-tooth configuration was chosen for use on the doors. This configuration would permit a maximum area of sealing with a minimum amount of pressure applied over the gasketed area. This sealing arrangement offered relatively good resistance to radiation while allowing the desired dimensional tolerances to be met.

However, to ensure the continued reliability of the seals on the cubicle doors, a method had to be devised to allow routine replacement of the seals without loss of the operational utility of the cubicles. This problem was overcome by providing a spare pair of doors within the transfer case that could be used to replace the existing doors during routine transfer operations.

As well as making alpha-contained transfers of contaminated equipment between the cell cubicles, the decontamination glove box, and the solid-waste disposal station, the transfer case was also to be used to introduce clean equipment into the cubicles. Since the interior of the transfer case will always be considered contaminated, a method had to be devised to introduce the clean equipment into the transfer case without spreading its contamination into the limited access area. A clean equipment bag-in station was designed for this purpose, and at this station, the clean equipment is bagged into the case within the containment provided by a plastic bag.

A final design requirement for the transfer case was that its inside surfaces be capable of withstanding severe decontamination treatments, which would include nitric-acid washdowns. This unusual service condition further implied that no lubrication could be used on any of the moving parts within the case. To meet the decontamination requirement, all of the interior surfaces of the case, including the hoist and all other mechanical parts, were fabricated from stainless steel. The door-lift drive mechanisms, the hoist motor, and all electrical connections were

located on the exterior surfaces of the transfer case so that they would not have to be subjected to these decontamination treatments.

The final design developed for the transfer case and its related components meets the desired service requirements. The efficiency of the case in making alpha-contained transfers at the 12 transfer stations has been demonstrated by the increasing frequency of its use over the past six months that the case has been in operation in the Transuranium Processing Plant.

3. DESIGN AND OPERATION OF THE TRANSFER CASE

A detailed description of the design for the transfer case and the methods by which the design requirements were met may be more readily understood if a brief description is first given of the general operations required to make a material or equipment transfer at one of the cubicles in the cell bank. The transfer case is illustrated in Fig. 2, located at the back of your report, and examination of this illustration in conjunction with the following discussion may help clarify the approach taken in the design for the case.

Typical Transfer Operation

When material or equipment must be brought into or out of one of the cell cubicles, the transfer case is transported to the top of the designated cell, the 4-ft-thick concrete shielding plug over the cubicle door is removed from its cavity in the top of the cell bank, and the transfer case is lowered with a wire rope through the cavity. The door in the bottom of the transfer case is mechanically positioned to align within a few thousandths of an inch with the door on top of the cell cubicle. The doors are then locked and sealed together, and the locked pair of doors is pulled up into the side of the transfer case. The doors located in the top of the cubicles have no hinges and are dependent upon the equipment in the transfer case to provide the power and mechanism required to lock and manipulate them.

A hoist with a 1000-lb capacity is contained within the transfer case to raise and lower the equipment to be transferred. After the transfer of the equipment has been made, the locked pair of doors is lowered back into the original position and unlocked. When the transfer case is removed from over the door in the top of the cubicle, both the top surface of the cubicle door and the bottom surface of the transfer-case door will be free of contamination because these surfaces have been protected by the mating seals during the transfer operation. This

procedure minimizes cross contamination of the cubicles and provides an airtight transfer of all equipment moved within the limited access area of the Transuranium Processing Plant.

Design of the Transfer Case

The transfer case is approximately 46 in. wide, 26 in. deep, and 9 ft high. As may be seen in Fig. 2, glove ports and viewing windows are provided in the front and back of the case to give access to both the front and back of all equipment that will be lifted into it. Access ports are also provided in the top of the case to permit adjustment of the door drive mechanisms. No adjustment will be necessary under normal operating conditions, but because of the requirement that no lubrication be used, some adjustment to compensate for wear may be required.

Decontamination and Maintenance Features

Because of the design requirement stipulating that the interior of the transfer case be capable of withstanding decontamination treatments that include acid washdowns, all electrical equipment is located on the exterior of the case. The door-lift drive mechanisms and the hoist motor with its electrical connector are located on the top plate of the transfer case, as shown in Fig. 3.

This 3/4-in.-thick plate comprising the top of the transfer case is sealed to the box structure of the case with an O-ring that is compressed by bolts around the perimeter of the plate. This arrangement allows complete removal of the top of the case as one piece to facilitate maintenance of the mechanisms secured to it. The connections to the side plates of the inner assembly and the drive shafts for the door locking and lifting mechanisms may also be removed easily.

The hoist motor and its electrical connector are secured to an individual plate that is bolted to the top plate. The hoist mechanism inside the transfer case is secured to the underside of this same plate

Fig. 3. Side View of the Top Plate on the Transfer Case.

to which the motor is attached. The hoist motor may be removed from the top of the case by unbolting three bolts and unplugging the electrical connection, or the entire motor and hoist mechanism may be bagged out as a unit for remote decontamination and repair by unbolting the plate securing the assembly to the top of the transfer case.

The inside surfaces and all of the mechanical parts within the transfer case are of stainless steel to allow washdown with acid when it is necessary to decontaminate the interior of the case. Like all other mechanisms within the case, the hoist shown in Fig. 4 is fabricated from stainless steel. Figure 4 is a photograph taken from the floor looking up at the hoist and underside of the top plate on the transfer case. The hoist drum has a capacity of approximately 22 ft of stainless steel wire rope with a diameter of 1/4 in. Notice that the cable from the hoist drum travels across the case and back to the pulley that positions it on the center line of the case.

Fig. 4. Hoist Drum and Underside of the Top Plate of Transfer Case.

One of the few design changes made on the transfer case after it was mocked up was to increase the load rating of the hoist from 500 to 1000 lb. To keep down the height of the motor normally required for a hoist of this capacity, the small high-speed motor shown in Fig. 3 was used. The drive ratio for the hoist is approximately 10,000 to 1, and to save space, the planetary gear system was located within the hoist drum. The hoist limit switches are located outside the hoist structure and are thus sealed from the interior of the transfer case. If for any reason the hoist should become inoperative during a transfer operation, the access ports in the top of the case may be removed to allow the entrance of a hand tool or emergency hook.

Door Locking and Sealing Mechanisms

The success of the transfer operations effected with the case hinge upon the containment provided by the sealing arrangement selected for the doors. The door in the bottom of the transfer case was designed to lock and seal with the 11 installed cubicle doors and several spare ones. This interchangeability feature of the doors was assured by the manufacturing techniques used. The basic machine tolerance was held to $\pm 1/64$ in., and the doors were made to match by using a master fixture to locate the holes in the transfer-case and cubicle doors. Incidentally, this technique made a great savings in fabrication cost possible.

A breach-type locking arrangement was used to secure the door in the bottom of the transfer case to the cubicle door. The cubicle doors have neither hinges nor lock actuating devices. They are locked and sealed to their respective frames or unlocked and removed from them by means of an actuating device contained within the transfer case. A mechanical indicator is used to ensure the proper positioning of the actuator, and the device is remotely operated from above the case. A side elevation of the bottom portion of the transfer case with the door in place is shown in Fig. 5. The remotely operated door lock actuator may be seen in this view.

Fig. 5. Side Elevation of the Bottom Portion of the Transfer Case Showing the Door and the Lock Actuator.

To effect a transfer of equipment or material to or from a cubicle, the door in the bottom of the transfer case is positioned over the door in the cubicle. The top of a cell cubicle without the concrete is shown in Fig. 6. In this view, the cubicle door frame without the door is shown in its position relative to the cell. A typical cubicle door and frame assembly is shown in Fig. 7. The corner brackets used to guide the transfer case into position may be seen in this picture. Figure 8 is a picture of the bottom of the transfer case door in position over the cubical door frame with the door removed. The breach-type lock used to lock the transfer-case door to the cubicle door may be seen in this view.

Fig. 6. Top of Cell Cubicle and Door Frame.

ORNL Photo 82259

Fig. 7. Typical Cubicle Door and Frame Assembly.

ORNL Photo 82260

Fig. 8. Bottom of Transfer-Case Door.

When the door in the bottom of the transfer case has been positioned over the door in the top of the cubicle, a manual drive operated with a crank above the case is used to simultaneously unlock the transfer-case and cubicle doors from their respective frames and lock and seal these two doors to each other. Perhaps one of the most unique sealing arrangements ever used on two doors of this type was developed to provide an effective means of sealing the numerous interchangeable doors. This arrangement is illustrated in the two sectional views shown in Fig. 9.

ORNL Dwg 66-6115

Fig. 9. Sectional Views of Door Sealing Arrangement.

To allow the dimensional tolerances on the doors to be met and to provide an effective seal with relatively good resistance to radiation, a 40-durometer neoprene gasket with a saw-tooth configuration was chosen for use on the doors. This heavy serrated gasket around the perimeter of the transfer-case door frame and around the perimeter of the cubicle door may be seen in Fig. 9.

In the top portion of the upper section in Fig. 9, the transfer-case door is shown locked and sealed in place in the bottom of the case. In the lower portion of the upper section, the cubicle door is shown locked and sealed to its frame. The balanced door-locking condition may be noted in the lower portion of the upper section. In the lower section of Fig. 9, the transfer-case door is shown locked and sealed to the cubicle door with the seal between the two doors being made by the two offset serrated neoprene gaskets. This sealing arrangement ensures that the exterior surface of the transfer-case door and the exterior surface of the cubicle door will remain uncontaminated when the doors are removed from their respective frames.

When the transfer-case and cubicle doors have been locked and sealed together, a second manual device is used to elevate the two interlocked doors into the transfer case. The cubicle door is shown locked to the transfer-case door in Fig. 10. We are looking at the underside of the cubicle door in this view. The cubicle-door lock is designed to balance the load on each side of the lock and therefore balance the load on the breach lock between the two doors.

Fig. 10. Cubicle Door Locked to Transfer-Case Door.

Maintenance of Seal Integrity

One of the requirements confronting the designers was that of ensuring the reliability of the seals on the cubicle doors. To meet this requirement, a spare pair of locked doors, a transfer-case door locked to a cubicle door, is carried in the transfer case. The seals on the cubicle doors are visually inspected during the transfer operation, and any cubicle door with defective parts or seals may be replaced by using this spare pair of doors to close the cubicle after the transfer operation has been completed. The relative location of this pair of doors within the case is illustrated in Fig. 11. The ball-screw mechanism that is used to actuate the door-locking device on the transfer-case door may also be seen in this picture.

ORNL Photo 61245

Fig. 11. Relative Location of the Spare Pair of Locked Doors Within the Transfer Case.

The tracks in which the doors travel within the transfer case are shown in Fig. 12. Notice that the automatic switch makes it possible for either pair of doors to be positioned in the bottom of the case. This design feature required a great deal of thought because both pairs of doors must be aligned with the center line of the bottom of the case to within ± 0.005 in. to ensure that the case can be rotated 180° at any of the transfer ports.

Fig. 12. Interior View of One Side of the Transfer Case Showing the Tracks in Which the Doors Travel.

Accommodation of Large Equipment

All of the material and equipment to be transferred must pass through the free opening 18 in. wide by 36 in. long between the transfer case and the cubicle that is provided when the two interlocked doors are pulled up inside the case. All large process equipment that will be transferred from the cubicles into the case is mounted on standard equipment racks, and during the development of the design for the transfer case, full-scale mockups were made of all the equipment to be transferred. The mockup of a typical equipment rack in position inside a cubicle is shown in Fig. 13.

Fig. 13. Mockup of a Typical Equipment Rack in a Cell Cubicle.

Each of these equipment racks is provided with a guiding system to guide it from its position on the wall of the cubicle into the transfer case. An equipment rack that is being elevated from its position in a cell cubicle through the transfer port into the case is shown in Fig. 14. The guide arm that guides the rack into the case is shown in this picture, and the guide for the rack inside the transfer case may be seen in Fig. 12. The largest piece of cell equipment that will be transferred from a cubicle into the transfer case is an equipment mounting frame in Cell Cubicle 1. This frame is not provided with guides, but it was designed to be removed from the cubicle through the diagonal width of the transfer port. The filter housings may also be removed in the transfer case without a guiding system.

Fig. 14. Equipment Rack Being Elevated Through A Cell Cubicle Transfer Port Into the Transfer Case.

Additional Shielding for the Transfer Case

Another unusual feature of the design for the transfer case is the provision for additional shielding. Under normal equipment transfer conditions, the equipment being removed from the cubicles will be clean enough to require only the alpha containment provided by the transfer case. However, should more than alpha containment be required, this additional shielding can be provided by pulling the transfer case up into a 16-ton concrete shielding cask through shutter doors in the bottom of this cask.

The 12-in.-thick walls of the shielding cask are of limonite concrete, and all the interior and exterior surfaces of the cask are covered with stainless steel. A view of the front of this almost 11-ft-high cask is shown in Fig. 15. The port visible in this picture is for the sealed-beam light mounted in front of a shield plug. This light is used to illuminate the transfer case so that its interior may be viewed during transfer operations. A side view of the shielding cask is shown in Fig. 16. The port visible in this picture is for the shield plug housing the off-gas connection for the transfer case.

Fig. 15. Front of Shielding Cask.

Fig. 16. Side of Shielding Cask.

The top of the shielding cask is shown in Fig. 17. The large port in the top of the cask is also for a sealed-beam light. A 4-in.-thick lead-glass viewing window in the top of the cask in line with the window in the transfer case permits viewing of the interior of the illuminated transfer case. The smaller ports in the top of the cask are for the insertion of the various extension tools required for remote operation of the transfer case within the shielding cask.

Fig. 17. Top of Shielding Cask.

The shielding cask containing the transfer case may be moved to the top of a cell cubicle or to the solid waste disposal station to effect a transfer of material or equipment. The cask and case assembly is positioned over the shielding plug cavity in the top of the designated cell, the shutter doors in the bottom of the cask are opened, and the transfer case is lowered through the cavity and mechanically positioned over the cubicle door in the usual manner. The doors are locked together, the cubicle is opened, and the transfer operation is performed with the required additional shielding in place. This is perhaps the first approach to a shielded mechanical bagging technique.

4. DISPOSAL, BAG-IN, AND DECONTAMINATION TRANSFERS

Other problems confronting the designers during the development of the equipment handling and transfer systems for the Transuranium Processing Plant were related to the transfer procedures that would be used at the solid-waste disposal station, the clean equipment bag-in station, and the decontamination glove box.

Solid-Waste Disposal Station

Solid waste must be removed from the cell cubicles periodically. The intercell conveyor located underneath the cell cubicles, as shown in Fig. 1, is used to transport the solid waste from the cell cubicles to the transfer-area cubicle in the west end of the cell bank. Basically, this intercell conveyor system consists of a conveyor housing that supports track upon which a dolly is run. This dolly carries a sealed canister that can transport items 8 in. long with a diameter of 8 in. The conveyor canister is raised and lowered at the designated cell cubicle, and the double-cover technique is used to seal the canister to a port in the cubicle floor where the transfer into or out of the cubicle is made by using standard hot-cell manipulators. Solid waste deposited in the conveyor canister is then transported to the transfer-area cubicle where it is transferred from the conveyor canister into a disposable plastic canister.

When a disposable plastic canister is filled with solid waste, it is transferred to the solid-waste disposal station by means of the carrier charging system. A shielded carrier is positioned flush with the penetration through the west wall of the transfer-area cubicle, the cover of the plastic canister is heat sealed, the canister is transferred into the carrier, and the carrier is transported through the limited access area to the solid-waste disposal station.

During the conceptual stages of the design for the solid-waste disposal station, a simple hooded pit in the floor with a removable plug

was thought to be sufficient for disposing of the solid waste that would be removed from the Transuranium Processing Plant. However, the final design that evolved is somewhat different, and it provides for the disposal of solid waste in a modified piece of standard concrete pipe with an inside diameter of 42 in. A sectional view of the solid-waste disposal station is shown in Fig. 18.

ORNL Dwg 66-5571

Fig. 18. Sectional View of the Solid-Waste Disposal Station.

The concrete-pipe disposal cask is manually lowered into the solid-waste disposal station with the overhead crane and positioned on the turntable on the floor of the station, as shown in Fig. 18. The removable concrete shielding plug in the roof of the station has three shielding plugs within it. By rotating the disposal cask and removing the appropriate shielding plug, the plastic disposal canisters can be loaded symmetrically inside the disposal cask. Such an operation is illustrated

in Fig. 18. In this illustration, the waste carrier has been lifted off its trailer and placed over one of the shield-plug openings, and a disposable plastic canister is being lowered into the concrete cask with a canister handling tool. By rotating the cask and stacking the plastic canisters, 42 canisters can be loaded into the cask before it must be removed.

A 10-mil-thick polyethylene bag is attached to the bottom of the removable concrete plug in the top of the solid-waste disposal station, and this bag envelopes the concrete disposal cask. When the cask is to be removed from the disposal station, a concrete lid is placed on the cask and sealed with tar. The cask is then rotated to twist the polyethylene bag, a plastic band is clamped around the twisted section of the bag, and it is heat sealed with a hot knife that cuts the bag. The cask within its sealed polyethylene bag may then be removed from the disposal station with the overhead crane and transported to the burial grounds.

When contaminated equipment larger than that which can be contained within the plastic disposal canisters must be removed from the Transuranium Processing Plant, the transfer case within its shielding cask is used to transfer this equipment to the solid-waste disposal station. Such a transfer operation is illustrated in Fig. 19. In this illustration, the removable concrete plug normally in place over the solid-waste disposal station has been replaced with one containing a cubicle door. This concrete plug is normally positioned over the clean equipment bag-in station, but for the transfer of large contaminated equipment into the disposal station with the transfer case, the two concrete plugs are switched. In Fig. 19, the shutter doors in the bottom of the transfer-case shield have been previously opened and the transfer-case door is positioned over the cubicle door in the concrete plug. After the two doors have been locked and sealed together and lifted up into the transfer case, the contaminated equipment is transferred with the transfer-case hoist into the disposal cask inside the station. The large equipment may then be transported to the burial grounds in the concrete disposal cask.

Fig. 19. The Solid-Waste Disposal Station and the Clean Equipment Bag-In Station.

Bag-In Station

The bag-in station adjacent to the solid-waste disposal station is shown in Fig. 19. New or decontaminated equipment to be used inside the cell cubicles must be bagged into the transfer case because the interior of this case is always assumed to be contaminated. As previously mentioned, the removable concrete plug with the cubicle door in it is normally positioned over the bag-in station. A bag ring is attached to the bottom surface of the receptacle for this plug, and the top of the polyethylene bag enveloping the clean equipment is attached to this ring.

The transfer case is then positioned over the cubicle door in the concrete plug, and the transfer of the clean equipment into the case is effected within the containment provided by the plastic bag.

Decontamination Glove Box

When the first decontamination-room criteria were established, it was assumed that the transfer-area cubicle would be serviced by the transfer case. This would have allowed the large equipment to be decontaminated in the cubicle after having been removed from one of the nine cell cubicles. However, to reduce the size and cost of the building, the decontamination room was located over the transfer-area cubicle. This eliminated access to the transfer-area cubicle with the transfer case, and it was then assumed that the beta-gamma contamination could be reduced within each cubicle to a level where direct decontamination and maintenance procedures could be performed in a glove box designed for alpha containment only. This decontamination glove box is illustrated in Fig. 20. Transfers into and out of this glove box can be made with the transfer case when it is positioned over the cubicle door in the top of the box as shown in Fig. 20. The glove box is mounted on wheels so that it may be moved under the bridge crane outside the decontamination room.

The decontamination glove box is large enough to contain an equipment rack from one of the cell cubicles. There are movable tracks on the floor of the glove box that permit the racks to be moved to any side of the box, and a hydraulic hoist is provided in the top of the glove box to rotate the equipment racks within the box. The many glove ports mounted in viewing windows at different levels ensure that all parts of the racks are accessible. Since the glove box is so tall, work platforms are provided outside the box for the operators to stand on.

Small equipment, such as pumps and valves, may be removed from an equipment rack inside the glove box, decontaminated, repaired, returned to the rack, or transferred outside the glove box through the small bag-in port or in a plastic canister. A motor-driven platform is provided

Fig. 20. Decontamination Glove Box With Transfer Case Positioned Over Cubicle Door.

inside the glove box to move the small parts from one elevation to another or into the small glove box. The port closure is located in the small glove box, and it is equipped with a hydraulic lifting cylinder that elevates a plastic canister until it is sealed with the port. The double-cover technique is also used to transfer material into or out of the glove box with the plastic canisters.

Spray nozzles for both acids and water are piped into the interior of the glove box, and a hot drain is provided in the bottom of the box to ensure that all contaminants may be flushed from its interior. The off-gas connection in the top portion of the transfer case, as shown in Fig. 20, may be used during transfer operations to ensure that any air leak would be flowing into the containment provided by the glove box and the transfer case. An absolute filter is installed on both the glove box and the transfer case.

5. CONCLUSIONS

The transfer case and its related equipment were necessary to the successful operation of the Transuranium Processing Plant. During the conceptual developmental stages of the design for the handling systems, it was thought that it would be necessary to use the transfer case only about 4 or 5 times a month. However, during the approximately 6 months that the Transuranium Processing Plant has been in operation, the transfer case has been used much more often and is now used on an average of 15 times a month. Thus, the transfer case may justly be called the workhorse of the Transuranium Processing Plant as it efficiently fulfills its intended purpose of making alpha-contained transfers at the 12 transfer stations within the limited access area with an increasing frequency.

A measure of the effectiveness of the transfer case in making the alpha-contained transfers may be judged by the readings taken. After contaminated equipment was removed from one of the cell cubicles, a reading of 2000 dis/min was recorded on the bottom of the transfer case. However, a smear taken outside the seal area indicated a count of only 188 dis/min. The hoist hook within the transfer case was then checked, and a reading of approximately 10,000 dis/min indicated that the interior of the case was grossly contaminated. Therefore, it may be assumed that the sealing method used for the many interchangeable doors is a very effective one.

The importance of the fully developed conceptual design for the equipment handling systems that were to be used in the Transuranium Processing Plant cannot be overemphasized. Many of the early ideas required separate pieces of equipment for each task that was to be performed. However, during the development of the conceptual design, every effort was made to standardize the handling equipment to serve as many functions as possible. Thus, the solid-waste disposal station was designed to be served by both the transfer case and the shielded carrier, making it possible to dispose of both large and small contaminated items. Similarly, the transfer case was designed to serve all 12 transfer stations through the use of interchangeable doors. The mass-production

method used to fabricate these doors proved very satisfactory and decreased the cost of the doors considerably. Full-scale mockups were made of the equipment, and this procedure was very effective in directing attention to the design problems that were encountered.

Fig. 2. Transfer Case for Transuranium Processing Plant.

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